

23.07.2018

To
The Director,
IA-III Division,
Ministry of Environment Forests and Climate Change, (IA-III Division)
Indira Paryavaran Bhawan,
Jor Bagh Road,
New Delhi - 110 003

Subject : Submission of Reply to the Compliance raised by Hon'ble EAC during 187th Meeting on 12th April, 2018 as Sr.No. 3.2 Integrated Industrial Township at Pen, Raigad by Karanja Infrastructure Pvt. Ltd now named as Orange Smart City Infrastructure Pvt. Ltd. – Environment Clearance [IA/MH/MIS/73042/2015] [F.No.21-130/2015-IA.III]

Ref : 187th EAC meeting MoM

Dear Sir,

With reference to 187th EAC meeting Minutes of Meeting displayed on Environment Department website for Environmental Clearance for Integrated Industrial Township at Pen, Raigad being developed by **Orange Smart City Infrastructure Pvt. Ltd.** [IA/MH/MIS/73042/2015] [F.No.21-130/2015-IA.III], we are hereby submitting the compliance of queries addressed during meeting.

Thanking you,

Yours Faithfully,

For Orange Smart City Infrastructure Pvt. Ltd.



Authorized Signatory

Encl. Mentioned as above



S.N.	Compliance Points	Reply
Queries raised during 187 th Meeting of EAC (Infrastructure-1) on 12 th April, 2018		
1.	PP is required to revise the EIA/EMP with layout plan including A category industry for proposed Industrial Township project as per prescribed ToR issued by the Ministry. Layout plan should cover area under each category of industries including utilities and other amenities.	The EIA/EMP report has been revised taking into the account the EAC's recommendation along with layout plan including category 'A' industries per prescribed ToR issued by the Ministry. The layout plan also covers the area under each category of industries including utilities and other amenities. The EIA/EMP report has been enclosed herewith for your kind perusal.

Environmental Impact Assessment Report
for
Proposed Integrated Industrial Township
“Orange Smart City”, Taluka Pen, District Raigad

Submitted to
Expert Appraisal Committee (EAC)

July 2018

Environmental consultant:



Building Environment (India) Pvt. Ltd

Proponent:



**M/s. Orange Smart City
Infrastructure Pvt. Ltd. (OSCIPL)**



Undertaking by the Project Proponent

M/s. Orange Smart City Infrastructure Pvt. Ltd. is willing to submit this undertaking with respect to the Terms of Reference (ToR) prescribed by Expert Appraisal Committee of Ministry of Environment, Forest & Climate Change (MoEF&CC), Government of India (GoI), vide letter F. No. 21-130/2015-IA.III dated 23rd November 2015 for the proposed Orange Smart City project in Taluka Pen, District Raigad of Maharashtra.

The data information submitted herein are correct to the best of our knowledge.



Authorized Signatory

A handwritten signature in blue ink, appearing to read 'Phintan'.

M/s. Orange Smart City Infrastructure Pvt. Ltd.

ENVIRONMENTAL IMPACT ASSESSMENT**FOR**

Proposed Integrated Industrial Township titled “Orange Smart City”

in Taluka Pen, District Raigad, Maharashtra

Project Proponent: M/s. Orange Smart City Infrastructure Pvt. Ltd.

For and on behalf of : Building Environment India Pvt. Ltd.

Approved by : Mr. Hrushikesh Kolatkar

Position : EIA Coordinator

Date : February 2018

M/s. Orange Smart City Infrastructure Pvt. Ltd. (OSCIPL) appointed M/s. Building Environment India Pvt. Ltd. (BEIPL) to conduct the Environment Impact Assessment (EIA) study as per Terms of Reference (ToR) prescribed by Expert Appraisal Committee of Ministry of Environment, Forest and Climate Change, Government of India, vide letter F. No. 21-130/2015-IA.III dated 23rd November 2015 for the proposed Orange Smart City project in Taluka Pen, District Raigad of Maharashtra.

Building Environment India Pvt. Ltd. has complied with ToR as well as other relevant norms applicable to EIA study and has exercised reasonable skill, care and diligence while preparing this report.

The responsibility of Building Environment India Pvt. Ltd. to the client and others is limited to the scope and terms of the contract with the client and as per the disclosure provided in Chapter 10 of this report.

Tel.: 022-2757 8554 / 4123 7072 / 40231980 / Web: www.beipl.co.in / Email: info@beipl.co.in

**buildingenvironment (India) Pvt. Ltd.** 000419

Dakshina Building, 401, 4th Floor, Plot No. 2, Sector - 11, Near Raigad Bypass, C.B.D Belapur, Navi Mumbai - 400614.

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For Building Environment (India) Pvt. Ltd.

Hrushikesh Kolatkar

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List of Abbreviations

AAS/ICP	Atomic Absorption Spectroscopy/ Inductively Coupled Plasma
ALARP	As Low As Reasonably Practicable
AMI	Advanced Metering Infrastructure
APHA	American Public Health Association
AQM	Air Quality Monitoring
ARAI	Automobile Research Association Of India
BDL	Below Detection Limit
BEIPL	Building Environment India Pvt Ltd.
BIS	Bureau Of Indian Standards
BOD	Biochemical Oxygen Demand
BT	Bio Terrorism
BW	Biological Warfare
CCT	Continuous Contour Trenching
CETP	Common Effluent Treatment Plant
CFC	Chloro Fluoro Carbon
CFL	Compact Fluorescent Lamp
CGWB	Central Ground Water Board
CHP	Combined Heat And Power
CIDCO	City And Industrial Development Corporation Of Maharashtra
CLO	Community Liaison Officer
COD	Chemical Oxygen Demand
CPCB	Central Pollution Control Board
CPHEEO	Central Public Health And Environmental Engineering Organisation
CPTED	Crime Prevention Through Environmental Design
CSR	Corporate Social Responsibility
DCP	District Cooling Plants
DCR	Development Control Regulations
DCS	Distributed Control System
DDMA	District Disaster Management Authority
DFO	Divisional Forest Officer
DG	Diesel Generator
DMIC	Delhi Mumbai Industrial Corridor
DMP	Disaster Management Plan
DO	Dissolved Oxygen
F&E	Fire & Explosion
DSS	Distribution Substation
EC	Environmental Clearance
ED-XRF	Energy Dispersive X-Ray Fluorescence
EHS	Environmental Health & Safety
EIA	Environmental Impact Assessment
EMC	Environment Management Committee
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
EPZ	Export Processing Zones

ERDAS	Earth Resources Data Analysis System
ERP	Enterprise Resource Planning
ESIA	Environmental And Social Impact Assessment
ETP	Effluent Treatment Plant
FCC	False Colour Composite
FDIR	Advanced Metering Infrastructure
FSI	Floor Space Index
GC/HPLC	Gas Chromatography /High-Performance Liquid Chromatography
GCP	Ground Control Point
GDCR	General Development Control Regulations
GIS	Advanced Metering Infrastructure
GoI	Government Of India
GoM	Government Of Maharashtra
GW	Ground Water
HC	Hydrocarbon
HCV	High Commercial Vehicles
HH	Household
HIG	Light Commercial Vehicle
HOV	High Occupancy Vehicle
HVAC	Heating, Ventilation, And Air Conditioning
IBMS	Intelligent Building Management System
ICT	Information And Communication Technology
IIA	Integrated Industrial Areas
IMD	India Meteorological Department
IT	Information Technology
JLL	M/S Jones Lang Lasalle
JNPT	Jawaharlal Nehru Port
LCA	Life Cycle Assessment
LCV	Light Commercial Vehicle
LCV	Light Commercial Vehicle
LDAR	Leak Detection And Repair
LED	Light Emitting Diode
LIG	Low Income Group
LPG	Liquefied Petroleum Gas
LU/LC	Land Use/Land Cover
MAH	Major Accident Hazard
MCC	Maximum Credible Accident
MCGM	Municipal Corporation Of Greater Mumbai
MIDC	Maharashtra Industrial Development Corporation
MIG	Middle Income Group
MINAS	Minimum National Standards
MMR	Mumbai Metropolitan Region
MMRDA	Mumbai Metropolitan Region Development Authority
MoEF&CC	Ministry Of Environment And Forests And Climate Change Govt. Of India
MPCB	Maharashtra Pollution Control Board
MRSS	Main Receiving Substation

MSDS	Material Safety Data Sheet
MSEDCL	Maharashtra State Electricity Distribution Company Ltd.
MSL	Mean Sea Level
MSRTC	Maharashtra State Road Transport Corporation
MSW	Municipal Solid Waste
MTHL	Mumbai Trans-Harbour Link
NAAQS	National Ambient Air Quality Standards
NABL	National Accreditation Board For Testing And Calibration Laboratories
NBC	National Bureau Of Standards
NBSS & LUP	National Bureau Of Soil Survey And Land Use Planning
NDIR	Non Dispersive Infra-Red
NGO	Non-Governmental Organization
NMIA	Navi Mumbai International Airport
OBC	Other Backward Class
OM	Organic Matter
OMS	Advanced Metering Infrastructure
OSC	Orange Smart City
OSCIPL	Orange Smart City Infrastructure Pvt. Ltd.
PCU	Passenger Car Unit
PHA	Preliminary Hazard Analysis
PM	Particulate Matter
PPE	Personal Protective Equipment
PSIMS	Physical Security Information Management System
PTFE	Polytetrafluoroethylene
PV	Photovoltaic
PWD	Public Works Department
QRA	Quality Risk Assessment
RDMC	Regional Disaster Management Centre
ROW	Right Of Way
RWH	Rain Water Harvesting
SCADA	Supervisory Control And Data Acquisition Systems
SDI	Spatial Data Infrastructure
SEIAA	State Environment Impact Assessment Authority
SEZ	Special Economic Zones
SLDC	State Load Dispatch Centre
SOP	Standard Operating Procedures
SPL	Sound Pressure Level
SC / ST	Scheduled Caste/ Scheduled Tribe
STP	Sewage Treatment Plant
SW	Surface Water
SWM	Solid Waste Management
TDS	Total Dissolved Solids
TOD	Transit-Oriented Development
TOEM	PM Instrument
ToR	Terms Of Reference
TSS	Total Suspended Solids

UMIG	Upper Middle Income Group
URDPFI	Urban And Regional Development Plans Formulation And Implementation
VEC	Value Ecosystem Components
VKT	Vehicle Kilometers Travelled
VOC	Volatile Organic Chemical
VOC	Volatile Organic Chemical
WPR	Workforce participation Ratio
WTP	Water Treatment Plant

LIST OF ANNEXURES

Sr. No.	Annexure
I.	ToR issued by MoEF
II.	Certificate of Incorporation and name change
III.	Consent to establish under RED category from MPCB
IV.	NOC for location clearance from Water Resources Department
V.	Archaeological NOC
VI.	Letter for consideration of water demand from Hetawne Medium Project Division
VII.	In principle approval from MSEDCL
VIII.	Borgaon NOC
IX.	Letter of consent from MWML
X.	Cost of noise mitigation measures during construction and operational phase
XI.	Environmental monitoring reports
XII.	Bore hole details
XIII.	Different Ecosystems observed in the buffer zone
XIV.	List of trees reported at Karnala WLS
XV.	List of Shrubs, Herbs, Climbers & Grasses reported at Karnala WLS
XVI.	Birds Reported In The Karnala Wild Life Sanctuary
XVII.	List of Flora & fauna from the working plan of the Raigad Dist.
XVIII.	Public hearing and its minutes
XIX.	Risk assessment and Disaster Management plan
XX.	Distance of the buffer zone of the Karnala Bird Sanctuary from T3 land parcel
XXI.	Tree census details
XXII.	Approved layout plan

ToR compliance

Sr. No	ToR condition	Section where complied
1.	Reasons for selecting the site with details of alternate sites examined/rejected/ selected on merit with comparative statement and reason/basis for selection. The examination should justify site suitability in terms of environmental damage, resources sustainability associated with selected site as compared to rejected sites. The analysis should include parameters considered along with weightage criteria for short-listing selected site.	Refer Chapter -5 titled “ Analysis of Alternatives”
2.	Submit the details of the land use break-up for the proposed project. Details of land use around 10 km radius of the project site. Analysis should be made based on latest satellite imagery for land use with raw images. Check on flood plain of any river.	For existing land use Refer Table-2.2 titled “Land Profile of Proposed Orange Smart City Project For details of the 10km radius of the project site using the satellite imagery please refer Table-3.5 “ Land Use/Land Cover statistics of 15 km Radius Area”
3.	Submit details of environmentally sensitive places, land acquisition status, rehabilitation of communities/ villages and present status of such activities.	The land is already in possession of the proponent. Hence the land acquisition and the R&R is not applicable.
4.	Examine the impact of proposed project on the nearest settlements.	Refer Section 4.3.6 titled Socio –Economic Environment” under the Section Impacts and Mitigations Construction Phase.
5.	Examine baseline environmental quality along with projected incremental load due to the	Refer chapter -3 “ Description of the Environment”

Sr. No	ToR condition	Section where complied
	project taking into account of the existing developments nearby.	
6.	Environmental data to be considered in relation to the project development would be (a) land, (b) groundwater, (c) surface water, (d) air, (e) bio-diversity, (f) noise and vibrations, (g) socio economic and health.	Refer Chapter 3 “Description of the Environment”
7.	Submit a copy of the contour plan with slopes, drainage pattern of the site and surrounding area, and any obstruction of the same by the project.	Refer Section-2-7 titled “Site Description” in Chapter-2
8.	Details regarding project boundary passing through any eco- sensitive area and within 10 km from eco- sensitive area.	Karanala bird sanctuary is located at a distance of 6.7 km from the buffer zone of Karnala Bird Sanctuary. Refer Annexure- XXI
9.	Green buffer in the form of green belt to a width of 15 meters should be provided all along the periphery of the industrial area. The individual units should keep 33% of the allotted area as a green area.	Refer Section -9.6 in the Chapter-9 titled “Environmental Management Plan”
10.	Submit the details of the trees to be felled for the project.	Refer the Tree Census Report attached as Annexure-XXII. There are a total of 1692 trees at the site. Efforts will be made to protect the trees and incorporate them as a part of design. Areas with maximum tree density are designated as green areas in the master plan.
11.	Submit the details of the infrastructure to be developed.	Refer Section 2.23 to 2.38
12.	Submit the present land use and permission required for any conversion such as forest, agriculture etc.	For existing land use Refer Table-2-2. titled “ Land Profile of Proposed Integrated Industrial Township Project”

Sr. No	ToR condition	Section where complied
		The land is already in possession of the proponent. Land conversion is subsumed in the permission accorded as per the IIA Policy
13.	Submit details regarding R&R involved in the project	The land is already in possession. Hence R&R is not applicable
14	Zoning of the area in terms of type of industries' coming-up in the industrial area based on the resource requirement along with likely pollutants with the quantity from the various industries.	Category A and Life sciences, Engineering, Agro/Food Processing, Logistic, Research & Development, Gems & Jewellery, and Electronics & Semi-conductors industries are proposed in the project The zoning has been done as per the prevailing rules and regulations. Resource requirement during the construction phase is given in Section: 2.21 and the same during the operation phase is given in Section- 2.22 (Water requirement, Section-2.25 (Power Infrastructure) As the project is an industrial integrated Township capacities of the individual industries in not known at this point of time as the project is in planning stage.
15.	The project boundary area and study area for which the base line data is generated should be indicated through a suitable map. Justification of the parameters, frequency and locations shall be discussed in the EIA.	The following maps can be referred for the baseline environmental components : Figure-3-23 (Map for AAQM locations) Figure-3-31 (Map for ground water quality monitoring locations) Figure- 3-32 (Map for surface water monitoring locations) Figure-3-28 (Map for noise quality monitoring stations) Figure-3-33 (Map for soil quality monitoring locations)

Sr. No	ToR condition	Section where complied
16	Submit Legal frame work for the implementation of Environmental Clearance conditions - to be clearly spelt out in the EIA report.	Refer Section - 9.3 titled “ Applicable Environment and Social Legislations
17.	Site justification of the identified industry sectors from environmental angle and the details of the studies conducted if any.	Category A and Life sciences, Engineering, Agro/Food Processing, Logistic, Research & Development, Gems & Jewellery, and Electronics & Semi-conductors industries are proposed in the project and the layout has been prepared keeping in view the prevailing meteorological conditions. Refer – Section-3.6 “Climate and Meteorology” for detailed analysis of meteorological conditions”
18.	Ground water classification as per the Central Ground Water Authority.	As per CGWA the Pen Taluka comes under the list of “List of Non-notified Areas of the States / UTs where CGWA regulate and control ground water management & development.” No ground water will be abstracted for the proposed project either in construction phase or in operation phase.
19.	Submit the source of water, requirement vis-a-vis waste water to be generated along with treatment facilities, use of treated waste water along with water balance chart taking into account all forms of water use and management.	The source of the water is from the Hetwane Dam. The water balance is depicted in the Figure- 2.26 titled “ Water Balance Diagram”
20	Rain water harvesting proposals should be made with due safeguards for ground water quality. Maximize recycling of water and utilization of rain water. Examine details.	Refer Section 2.24 titled “Storm Water Drainage System, rainwater harvesting and storage facilities” The rain water harvesting will be done through the holding ponds catering to the run-off and the it will be made mandatory for all the individual plot owners to implement rainwater harvesting at the plot level

Sr. No	ToR condition	Section where complied
21	Examine soil characteristics and depth of ground water table for rainwater harvesting.	The soil characteristics are given in Table:-3.20 while the ground water levels are given in Section - 3.10.4. Detailed borehole investigations are given in Annexure-XIII.
22.	Examine details of solid waste generation treatment and its disposal.	Refer section-2.29 titled “ Solid waste handling system and the landfill details”
23	Examine and submit details of use of solar energy and alternative source of energy to reduce the fossil energy consumption.	Refer Section -2.41 for the details of the proposed Solar PV installation.
24	In case DG sets are likely to be used during construction and operational phase of the project, emissions from DG sets must be taken into consideration while estimating the impacts on air environment. Examine and submit details.	The details of the air quality modelling during the construction phase and the operation phase are covered in Section-4.3.1 and 4.4.1 respectively
25.	Examine road/rail connectivity to the project site and impact on the traffic due to the proposed project. Present and future traffic and transport facilities for the region should be analysed with measures for preventing traffic congestion and providing faster trouble free system to reach different destinations in the city.	Refer Section-3.33 titled “ Traffic and Transportation Plan”
26	A detailed traffic and transportation study should be made for existing and projected passenger and cargo traffic.	Refer Section-2.36 titled “ Traffic and Transportation Plan”
27.	Examine the details of transport of materials for construction which should include source and availability.	Refer Section-2.21 titled “Resource Requirements- Construction Phase. The materials for the construction will be sourced from local approved quarries”

Sr. No	ToR condition	Section where complied
28	Examine the details of National Highways/State Highways/Expressways falling along the corridor and the impact of the development on them.	Refer section 4.4.1 Impact of the project traffic on the surrounding roads
29	Examine noise levels - present and future with noise abatement measures.	Refer Section-3.8 Ambient Noise Quality for the baseline noise levels Refer section 4.3.5 for noise modelling during the construction phase and mitigation measures Refer section 4.4.5 titled “Impact on noise environment during the operation phase” noise modelling during the operation phase and mitigation measures
30	Identify, predict and assess the environmental and sociological impacts on account of the project. A detailed description with costs estimates of CSR should be incorporated in the EIA / EMP report.	Orange Smart City is willing to spend CSR money in providing skill development, clean and safe drinking water, sanitation facility, primary health care support in the near by villages. ☐ ☐ Orange Smart City will provide housing to approx 1,50,000 people which will include social housing.
31	Examine separately the details for construction and operation phases both for Environmental Management Plan and Environmental Monitoring Plan with cost and parameters.	Refer Chapter-6 titled “ Environmental Monitoring Plan and Chapter-9 “Environmental Management Plan”
32	Submit details of a comprehensive Disaster Management Plan including emergency evacuation during natural and man-made disaster.	Refer Annexure-XIX titled ‘Risk Assessment and Disaster Management Plan’

Sr. No	ToR condition	Section where complied
33	Any further clarification on carrying out the above studies including anticipated impacts due to the project and mitigative measure, project proponent can refer to the model ToR available on Ministry website " http://www.moe.gov.in/Manual/IndustrialEstate ".	Noted

1. INTRODUCTION

1.1 Purpose of the Report

Environmental Impact assessment (EIA) is a process of identifying, predicting, evaluating the impact of the implementation of project and working out the mitigation measures required to counter the probable adverse impact if any on the biophysical, social and other relevant aspects of developmental proposals prior to major decisions being taken. EIA provides general information pertaining to purpose of the report, identification of project and project proponent. It also includes scope of study as well as regulatory scoping and organization of the report. The objective of this EIA is to foresee the potential environmental problems that would arise out of a proposed development and address them in the project's planning and implementation stage. The EIA process shall then allow for the communication of this information to:

- The project proponent
- The regulatory agencies
- All stakeholders and interest groups.

1.2 Identification of project

Orange Smart City Infrastructure Pvt. Ltd. (OSCIPL) has planned to develop a Smart Integrated Township at Taluka Pen, Dist Raigad, Maharashtra. Although it is not part of Government of India's 100 Smart City Mission, but it has been planned along the lines of Smart City Guidelines of Government of India (GoI). This is the first green field smart city planned in Maharashtra.

The proposal for development of the Smart Integrated Township at Taluka Pen, District Raigad is the culmination of an elaborate study of various factors, potential of the project area with reference to industrial and infrastructure development scenario in the Mumbai Metropolitan Region (MMR) and Raigad region.

Maharashtra has been a pioneer in many of the policy initiatives that support manufacturing in industrial sector and the State Government recognizes that manufacturing is a key driver of state's economic growth. In view of the above, Government of Maharashtra (GoM) as per Industrial Policy, 2013-2018 allows creation of integrated industrial areas / IIAs to promote integrated development primarily with industrial and all allied activities including residential, commercial, etc.

With the current policy of economic liberalization and stress on privatization and reacting to urban development problems like increasing urban population, urban sprawl, traffic congestion, water shortages, and air and water pollution. OSCIPL advocates the use of urban-led strategies to proactively spark economic and social development.

Orange Smart City (OSC) is to adapt the most advanced technical know-how to start smart facilities systems such as

- Smart Energy
- Smart Mobility

- Smart Water
- Smart Public services
- Smart Buildings and Homes

OSC is a planned urban development having more open space which encourages walk to work communities. It is planned Transit Oriented Development (ToD), which reduces use of fuel with emphasis on walk-ability and pedestrian comfortable environment. The activities on different sites had been planned as per their significance to the functions/uses/business of the OSC. The location of these activities is encapsulated as cluster with the proximity to transport and facilities. OSC Development plan facilitates development of following industries:

- Category A and Life Sciences: Pharmaceutical, Bulk drugs and Intermediates
- Engineering: Automotive industries preferably one anchor unit and others will be tier-2 and tier-3 category.
- Food Processing: Fish poultry and Meat processing, Food processing and packaging, Sorting, grading and cold storage.
- IT/ITES
- Logistics
- KPO/BPO
- Other related industrial, commercial (offices) as per the predominant land use.

OSC is planned with mix use development with predominant industrial use. To support the industrial and other economic uses, Residential and commercial is also proposed with all required infrastructural utilities and allied facilities. The OSC is planned to address Industrial demand and new emerging housing need including affordable housing by creating infrastructure and a globally competitive environment that attracts investment and promotes sustainable development.

The project site spread across over 1042.51 acres of land, is closely clustered at four locations. The site parcels are located in close proximity to India's financial capital, Mumbai. The site cluster is well connected and is in close proximity of the Jawaharlal Nehru Port (JNPT), the well-developed urban center of Navi Mumbai, the proposed Mumbai Trans-Harbor Link (MTHL) and the proposed Navi Mumbai International Airport (NMIA).

OSC is within the influence zone of India's most ambitious infrastructure project – the Delhi Mumbai Industrial Corridor (DMIC) and is in vicinity of the terminal point of the Western Dedicated Freight Corridor (DFC). The NH-66 and the suburban railway network presently connect OSC to the major urban centres of the Mumbai Metropolitan Region (MMR).

The objective of OSC is to develop Green Sustainable Smart City to cater the industrial demand, create employment opportunities and provide sustainable smart housing with provision of adequate

infrastructure and public services assurance of environmental justice and healthful living environment and achievement of the vision for a more livable city.

The project proposes to have sustainable economic base primarily driven by manufacturing product mix along with institutional, residential and commercial supporting activities. The township proposes to provide trunk infrastructure facilities including supporting social and physical infrastructure to boost the sustainable economy in combination of Industrial Parks, IT/BT Parks and Logistics, Warehousing and Financial Centers.

1.3 Identification of Project Proponent

OSCIPL is a newly formed SPV solely to establish OSC. The board of directors comprises eminent and experienced persons on the subject of urban development and industrial township projects of large size.

Promoters role in this project :- the promoters seeks to create the sustainable smart city under the Govt of Maharashtra's industrial policy for which basic role would be to create common and city level infrastructure only, Market the plots on predefined land use basis, The promoter has also initiated this report based on the development mix planned in the development plan proposed here which presents a comprehensive overall picture of environmental impact assessment if whole township is built in time frame of 10 to 12 years and the mitigation measures required if any adverse impact is noticed. The environmental clearance for each of the industrial units and other supporting projects is proposed to be taken independently.

Promoter shall also discharge the partial municipal functions (only maintenance of infrastructure) as per Maharashtra Municipal councils, Nagar Panchayats and Industrial Townships act 1965 till government declares the new municipal body and takes over such functions.

1.4 Brief of the Project

1.4.1 Nature, Size, Location of the Project

The project boundary is linear irregular shaped clustered around four land parcels i.e T1, T2, T3 and T4 that fall within the Delhi Mumbai Industrial Corridor (DMIC) influence zone. The site cluster is well connected and is in proximity of the Jawaharlal Nehru Port (JNPT), the well-developed urban center of Navi Mumbai, the proposed Mumbai Trans-Harbour Link (MTHL) and the proposed Navi Mumbai International Airport (NMIA).

The site falls within two planning areas namely Raigad Regional Plan (approximately 900 acres) and Mumbai Metropolitan Region (MMR) Development Authority (approximately 100 acres) limits. The Project will comprise of residential, industrial commercial land use, green and open spaces with basic provisions of city infrastructures viz; roads, amenities, bridges, water supply infrastructure, wastewater infrastructure etc. All the four land parcels have moderate vegetative growth or are devoid of manmade structures. The details of the parcel-wise land-use is shown in Table 1-1 below and Location of the project site is depicted in Figure 1-1.

Table 1-1 : Details of land-use parcel-wise

Sr. No	Land Use Zone	Physiography	Type of Proposed Use	Total site area in Acres
1.	T1	A South –North valley divides this Parcel in two hills. Side slopes of the valley are nearly 1v:2.5h. This valley has upstream maximum elevation of 220m and downstream minimum elevation of 26m where it meets the river, whereas ridge has highest elevation of 340m at top.	Predominantly Industrial with low Residential and Commercial Land Use	723.33
2.	T2	T2 Parcel has relatively flat ground. The ground elevation of this Parcel ranges from 80m to 55 and approximate slope of 1v:10h.	Predominantly Industrial with low Residential and Commercial Land Use	102.40
3.	T3	The site is generally flat at top having slope leading to the Balganga River. The ground elevation of this Parcel ranges from 40m to 80.	Predominantly Industrial followed by Residential and Commercial	83.59
4.	T4	The site boundary along the northern side has larger parcel of flat land, which is favourable for development. This Parcel is situated at base of major hills on West. T4 Parcel is made up of eighteen small land parcels and two major parcels. One of the major parcel have ground elevation ranges from 55m to 7m. And other major parcel is relatively hilly ground with elevations ranges from 86m to 12m.	Predominantly Residential followed by Commercial	133.19
Total project area				1042.51

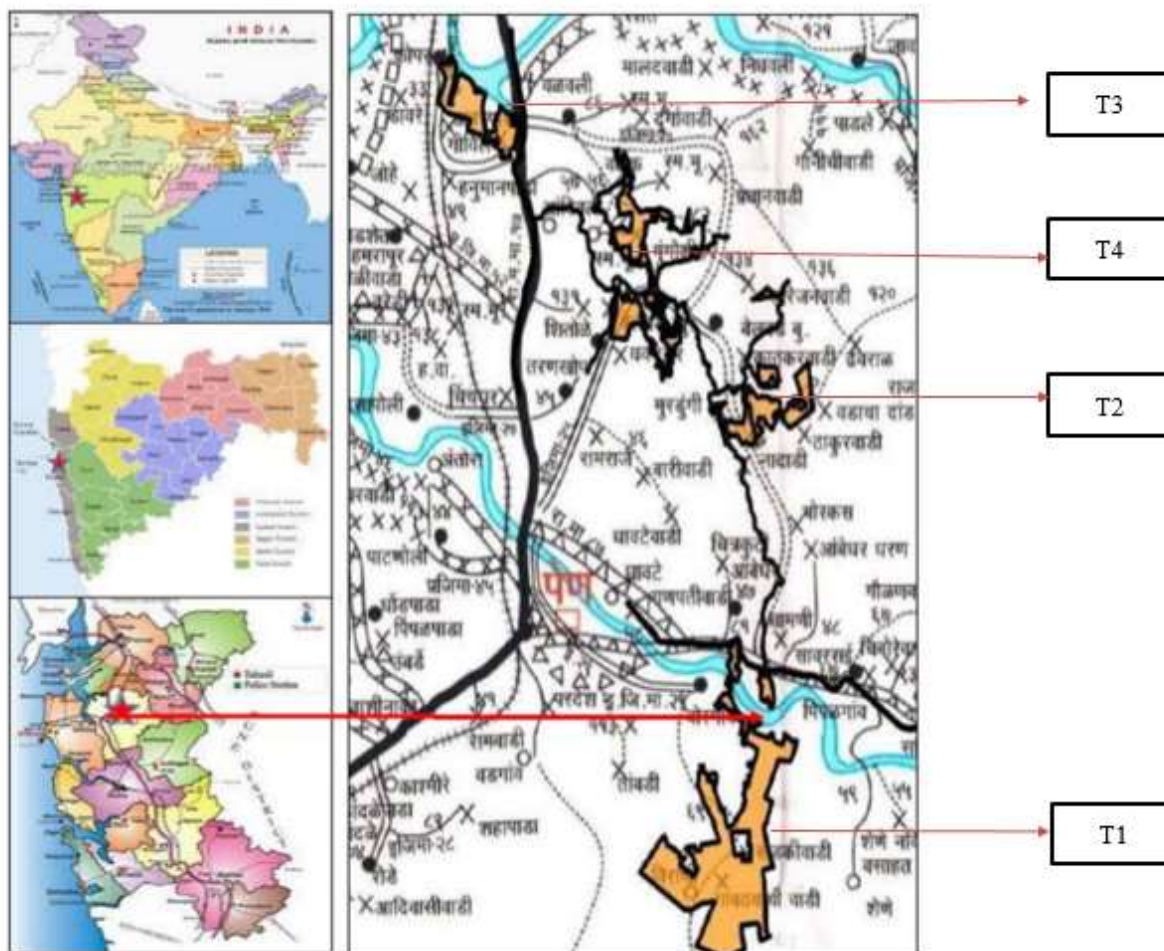


Figure 1-1-1: Location Map –Integrated Industrial Township

1.5 Litigation(S)/ Orders Passed by Any Court of Law/ Any Statutory Authority against the Project

As informed by OSCIPL, there is no pending litigation (s) against the project.

1.6 Scope of the EIA Study

1.6.1 Legal Requirement and Categorization of the Project

As per the EIA notification of the Ministry of Environment and Forests and Climate Change Govt. of India (MoEF), dated 14th September 2006 and its amendments, the project falls under activity 7(c) in Schedule of EIA notification and environmental clearance from MoEF&CC is to be obtained as it falls under Category A. Further to assess the impact on environment due to construction and operation of above mentioned units it is necessary to ascertain present environmental status prevailing at the project site. Further prediction of impacts is to be ascertained due to proposed construction and operation on the environment. Threshold Limit of Category 'A & B' projects as per MoEF&CC Notification is given in Table 1-2.

Table 1-2: Threshold Limit of Category 'A & B' projects as per MoEF&CC Notification

Project or Activity	Category with Threshold Limit	Applicability	Category with Threshold Limit	Applicability
	A		B	
7 C Industrial estates/ parks/ complexes/ areas, export processing Zones (EPZs), Special Economic Zones (SEZs), Biotech Parks, Leather Complexes	If at least one industry in the proposed industrial estate falls under the Category A, entire industrial area shall be treated as Category A, irrespective of the area.	Yes	Industrial estates housing at least one Category B industry and area <500 ha.	No
	Industrial estates with area greater than 500 ha and housing at least one Category B industry.	No	Industrial estates of area >500 ha. and not housing any industry belonging to Category A or B.	No

1.6.2 Objectives and Scope of work

- To undertake an Environment Impact Assessment (EIA) study as per the approved Terms of Reference (ToR) from MoEF&CC Delhi in 151st EAC meeting obtained vide letter dated 23rd Nov 2015 (Attached as Annexure I) and as per the suggestions by EAC committee provided in 187th Minutes of meeting held on 12th April 2018.
- To establish the baseline environmental and social scenario of the project surroundings
- To identify, predict and evaluate environmental and social impacts
- Recommend appropriate preventive and mitigation measures to eliminate or minimize pollution, environmental & social disturbances during the life-cycle of the project, ensuring compliance with environmental laws and regulation applicable
- Formulate an Environmental Management Plan (EMP) that they can be implemented, monitored and suitable corrective action can be taken in case of deviations
- Conduct a Risk Analysis Study and identify the major hazards
- Recommend measures to eliminate / minimize hazard levels and develop a Disaster Management Plan (DMP)
- To conduct public hearing under State Pollution Control Board (SPCB) in accordance with the requirements of EIA Notification, 2006 and amendments.
- Final EIA Report Submission to EAC, MoEF&CC Delhi for Prior Environmental Clearance (EC)

2. PROJECT DESCRIPTION

2.1 Type of the Project

Orange Smart City is proposed be a Integrated Industrial township spread over on four land parcels, namely, T1, T2, T3 & T4 admeasuring total plot area of 1042.51 acres. OSC comprises of Industrial (various sectors), Residential & Commercial components. The project sites are irregular in shape and overlook the river Bhogeshwari & Balganga.

The proposed project components are as given below:

- Residential Area
- Commercial Area
- Industrial Area (Including Category A : Synthetic Organic Chemicals)
- Internal Roads including the Storm Water Disposal System
- Water supply infrastructure
- Wastewater Treatment infrastructure
- Power supply infrastructure
- Solid waste management infrastructure
- ICT Infrastructure
- Traffic and transport infrastructure
- HVAC Infrastructure
- IT and telecommunication
- Telephone and Internet / Optical Fibre Network

The key details are as in Table 2-1: Key Details of the project

Table 2-1: Key Details of the project

Sr. No	Item	Details
1.	Name of the project	Orange Smart City (OSC)
2.	Project Type	Integrated Industrial Township
3.	Location	Pen, Raigad
4.	Name of the villages coming under project area	T1: Boregaon, Shene, Ambeghar & Virani T2: Belawade Budruk T3: Balawali, Govirle, Kopar, Ambiwali & Hamrapur

Sr. No	Item	Details
		T4: Mungoshi, Walak, Belawade Khurd, Padale and Belawade Budruk
5.	Project Connectivity	NH 66 & SH 88
6.	Total site area	1042.51 acres
7.	Built Up Space	5.01 million sq.m
8.	Industrial Built Up Area	3075720 sq.m
9.	Commercial Built Up Area	710896 sq.m
10.	Residential Area	1100784 sq.m
11.	Green Area and Open spaces	1031746 sq.m
12.	Amenities / Utilities	23307 sq.m
13.	Estimated Population	73068
14.	Estimated Employment Opportunities	150000 (approx)
15.	Project Cost	Rs 2032 Crores (+Rs. 2000 crores land cost)
16.	Project Start Year	FY 2019
17.	Start of Operations	FY 2029
18.	Horizon Years of development	10 Years
19.	Project Land Use Components	Includes industrial commercial residential and institutional developments as well as open and green spaces, industries such as Synthetic Organic Chemicals Logistics, Engineering, Agro, Electronics and Semi-Conductor, Life Sciences, Information technology, Gems and Jewellery, & Research and Development.
20.	<u>Power requirement</u>	Construction Phase: 5 MVA Operation Phase: 142.18 MVA
21.	Source of Power	Maharashtra State Electricity Distribution Company Ltd. (MSEDCL)
22.	<u>Water requirement</u>	Construction Phase: 320 m ³ /day Operation Phase: 38.60 MLD
23.	Source of water	Hetwane Dam
24.	<u>Waste water Generated</u>	Construction Phase: 256 m ³ /day Operation Phase: 21.56 MLD
25.	<u>Solid Waste Generation</u> Solid waste from residential areas Solid waste from industrial areas Solid waste from commercial areas	29.2 Tonnes (At 400 gms/capita/day) 13.1 Tonnes (At 150 gms/capita/day) 9.2 tonnes (At 9.22 gms/capita/day)

Sr. No	Item	Details
26.	Project Status	Detailed Project Report has been completed. The land is privately owned by company Detailed Master Plan has been approved by MIDC Public hearing has been held.

2.2 Land Area Details

The project will be built on 1042.51 acres. The land has been purchased from private owners on the willing buyer and seller basis. Following Table 2-2 illustrates the land profile of Orange Smart City project as per information obtained from Orange Smart City Infrastructure Pvt. Ltd. The entire land shown is under possession of OSCIPL.

Table 2-2: Land Profile of Proposed Orange Smart City Project

Site	Name of Village	Area in Acres
T1	Boregaon, Shene, Ambeghar and Virani	723.33
T2	Belawade Budruk	102.40
T3	Balawali, Govirle, Kopar, Ambiwali and Hamrapur	83.59
T4	Mungoshi, Walak, , Belawade Khurd, Padale and Belawade Budruk	133.19
Total		1042.51

2.3 Demand Assessment

The demand assessment for the industrial use has been carried out by M/s Jones Lang LaSalle (JLL) which has vast experience in market assessment. The assessment was carried out assuming production / export trend for the industry. JLL study recommended development mix for the project based on their demand analysis, for industrial commercial and residential development in the region taking into account the infrastructure projects coming up in the region including NMIA, MTHL, JNPT expansion, etc. and the same is as under. The summary of the recommended development mix assessment is given Table 1-1 : Details of land-use parcel-wise below:

Table 2-3: Summary of the industrial demand assessment

Industry Type	Area demand in the region (Acres)
Logistic	114.93
Engineering	118.42
Agro	74.88
Electronics & Semi-conductor	19.71
Life Sciences	21.29
Information Technology	22.06
Gems & Jewellery	5.22
Research & Development	3.49
TOTAL	380.00

Based on the above assessment, modest refinements to future land use designations related to industrial uses could be accommodated by OSCIPL without jeopardizing the overall industrial market in the Region and industrial demand in OSC. Presently OSCIPL proposes to provide about 380 acres of land for industrial use in the Orange Smart City and balance for supporting activities. Figure 2-1 shows distribution of Industrial Demand Assessment

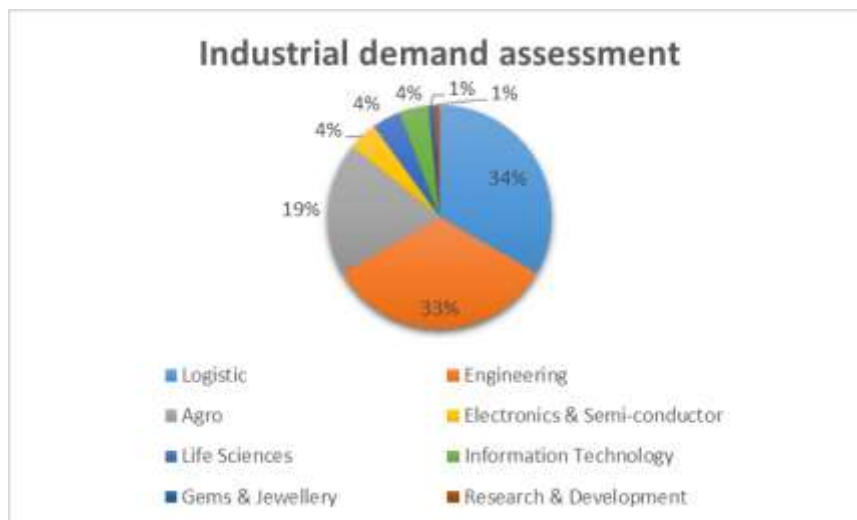


Figure 2-1: Distribution of Industrial Demand Assessment

2.4 Product Mix Assessment

Based on the industrial demand assessment, the product mix for the development of OSC is worked out considering to create Balanced & efficient land-use patterns, Mixed and complementary land uses (i.e. Industrial, Residential, Commercial, Retail, Recreation).

The recommended land use mix at OSC is inclusive of all required land area provisions for recreational green and open space, social infrastructure, utility, road and parking at detailed layout level. is as follows: The OSC land use mix assessment is given in Table 2-4 below:

Table 2-4: Land-use mix assessment

Land-use	Total (Acres)	Percentage (%)
Industrial	380.00	36.45
Commercial Area	87.83	8.42
Residential Area	136.00	13.05
Major Roads	126.14	12.10
Undevelopable/Green/Open	254.95	24.46
Amenities/Utilities	57.59	5.52
Total	1042.51	100

2.5 Site Description

2.5.1 Site Location

The delineated Proposed Project is located in Pen Tehsil of Raigad district of Maharashtra State. It partly falls in MMR & majorly in Raigad RP boundary. Project is scattered on four parcels, namely, T1, T2, T3 & T4 in villages as mentioned in Table 2-2. The distance between these parcels varies from 2 to 3 km. Project is located geographically between 18°42'14.11" N, 73°08'37.90" E and 18°46'53.73" N, 73°07'28.52" E at an average altitude of 225 m from the sea level. The general location of the project is shown in **Error! Reference source not found.** and the geographical coordinates for the delineated area boundary for selected locations have been presented in Figure 2-2 below.

The proposed smart and sustainable OSC project site is located amidst scenic hills, rivers and pastoral lands. It is located at the very foothills of the Western Ghats as they descend to the Arabian Sea.



Figure 2-2: Location on google map

Table 2-5: Geographical Coordinates for the Delineated Area Boundary

Land Parcels	Geographical Coordinates
T1	Latitude: 18°42'14.11" N Longitude: 73°08'37.90" E
T2	Latitude: 18°46'23.80" N Longitude: 73°07'17.44" E
T3	Latitude: 18°46'53.73" N Longitude: 73°07'28.52" E
T4	Latitude: 18°47'26.51" N Longitude: 73°05'27.74" E

2.6 Site Settings and Analysis

The sites are irregular in shape and located in four parcels and overlook the River Bogeshwari, & Balganga. The T1 site is contoured and has a rocky terrain, with a little vegetation cover.

The proposed sites are open on all sides, connected by access to SH 88 and NH 66. The site is well connected by Pen, Jite and Hamrapur railway routes. It has good proximity to JNPT and MTHL at about 20.8 and 15 kms distance respectively. The infrastructure along proposed site and general site environmental settings are presented in Table 2-6 and Table 2-7 respectively.

Table 2-6: Infrastructure along proposed Project Site

Sr. No.	Feature	Details
1	Nearest Highway	NH 66 & SH 88 (Now notified as NH) Proposed MTHL-15 km from north end (T3) (Aerial distance)
2	Nearest Airport	Chhatrapati Shivaji International Airport (40 km- Aerial distance) from T3 land parcel Proposed Navi Mumbai International Airport (from the funnel zone): 19.83 km distance from northern edge of T3 land parcel
3	Nearest Railway Station	Pen on Konkan Railway Route (4.7 km from T-1 Land parcel), Hamrapur on Panvel –Roha railway route (1.14 km from T3 land parcel) (All aerial distances)
4	Nearest Town	Pen (5 km) from T1 –Land parcel (Aerial distance)
5	Sea Port	JNPT: 20.8 km from north end (T3) (Aerial distance)

Table 2-7: Salient features along proposed Project Site

Sr. No.	Feature	Details
1	Altitude MSL	Approximately 225 m
2	Climatic Condition	Average Annual Temperature -28°C, Dominant Wind Direction– SW and Speed 14 km/h, Relative Humidity 82%, Average Annual rainfall – 3000 mm
3	Topography	Elevation range of T1 land parcel: 26 to 340 m Elevation range of T2 land parcel: 40 to 80 m Elevation range of T3 land parcel: 40 to 80 m Elevation range of T4 land parcel: 7 to 55 m
4	Protected Forest/ Reserve Forest	Nil
5	Archaeological Monuments/ Religious Historic Places	Karnala Fort (Approximately 16.5 km away from the project site)
6	Water bodies (River/ Lake/ Natural Streams/Reservoir)	Hetavane Dam, Ambeghar Dam, Bhogeshwari River & Balganga River
7	Defense Installations	None
8	Seismic Zone	Zone - IV

Sr. No.	Feature	Details
9	Reserved and Protected Forest / Nearest National Park / Wildlife Sanctuary	Buffer Zone of Karnala Bird Sanctuary is approx. 6.7 km away from T3 Land Parcel.

2.7 Site Description

The proposed Orange Smart City is spread over four land parcels, namely, T1, T2, T3 & T4 admeasuring total plot area of 1042.51 acres.

2.7.1 T1 Parcel

The T1 site is located at latitude: 18°43'33.99"N, longitude: 73° 7'44.05"E around the villages of Boregaon, Shene, Virani and Ambegarh of Pen Taluka, Maharashtra. The northern part of the site has a frontage to the State Highway-88 i.e. Pen-Khopoli Road connecting it to the National Highway-66 in the Western side and the Mumbai-Pune Expressway in the eastern side.

This Parcel is situated at southern catchment of Hetavane (Bhogishwari) river. A South –North valley divides this Parcel in two hills. Side slopes of the valley are nearly 1v:2.5h. This valley has upstream maximum elevation of 220m and downstream minimum elevation of 26m where it meets the river, whereas ridge has highest elevation of 340m at top. An irrigation canal from Hetavane dam also runs at base of this Parcel.

The terrain of this land parcel contributes to moderately steeper slopes requiring mitigation for smooth future vehicular and pedestrian movements. The terrain at the top is flatter, thereby creating future opportunities for development. Presently western side of the site is accessed through a ODR linking the site directly to State Highway-88. Figure 2-3 shows elevations and slopes at T1

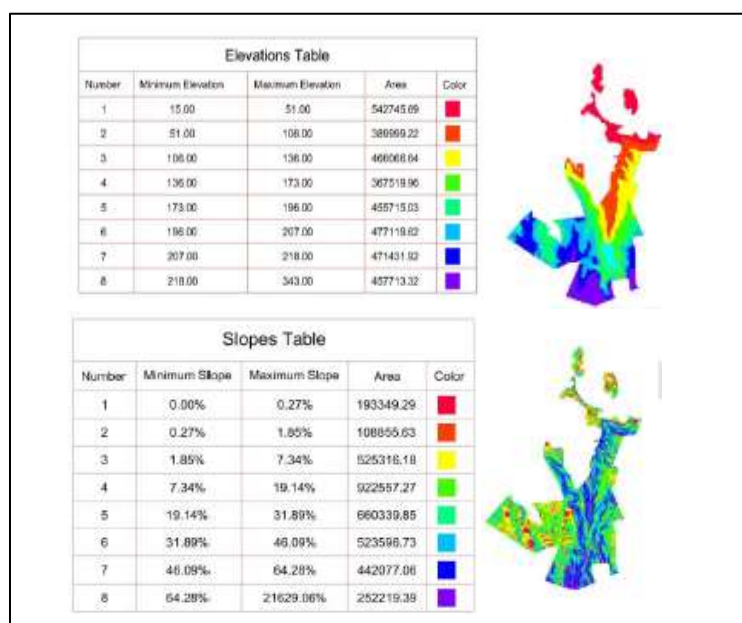


Figure 2-3: Elevations and Slopes at T1

2.7.2 T2 Parcel

T2 Parcel has relatively flat ground. The ground elevation of this Parcel ranges from 80m to 55 and approximate slope of 1v:10h. The T2 site is located at latitude: 18°45'42.65"N, longitude: 73° 7'30.76"E around the villages of Belawade and Budruk of Pen Taluka, Maharashtra.

Site accessibility is through the Other District Road (ODR) linking the site to NH 66 on the Northern side and SH 88 (Pen Khopoli Road) on the Southern side, creating opportunities to develop feature ingress/ egress points for the subject development. Figure 2-4 shows elevations and slopes at T2

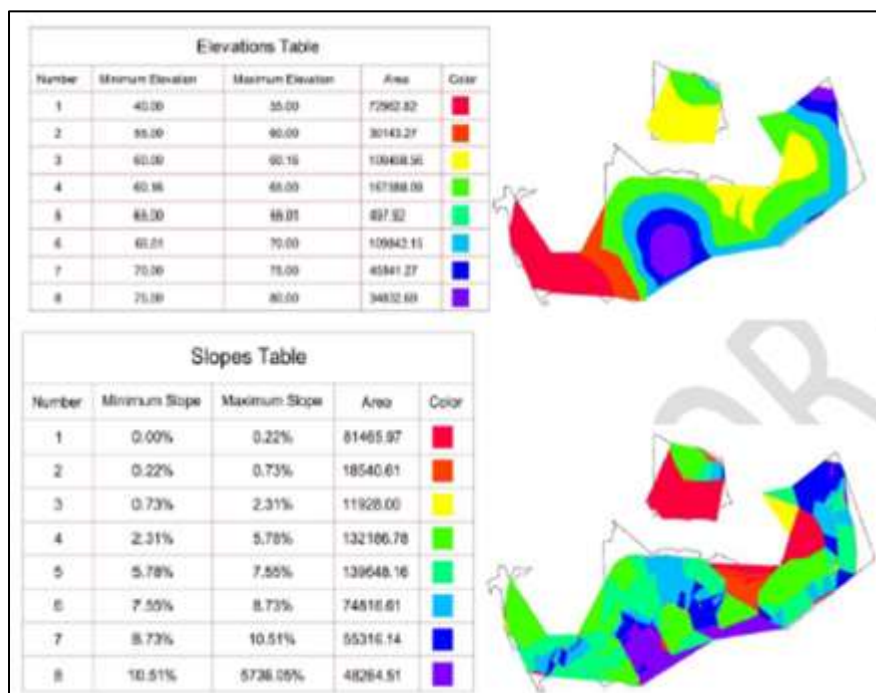


Figure 2-4: Elevations and Slopes at T2

2.7.3 T3 Parcel

The T3 site is located at latitude: 18°47'48.27"N, longitude: 73° 5'11.37"E around the villages of Govirle and Dawre of Pen Taluka, Maharashtra. The subject development is directly accessible from the National Highway-66 (Mumbai-Goa Highway) to the East, which is connecting the site to Panvel, Mumbai, Navi-Mumbai, JNPT and Karanja Port to the North-West and Alibag and Dharmatar Port to the South-West. The Northern part of the site has a visibility and frontage to the National Highway-66 and thus provides an opportunity to be one of the major ingress / egress points to site.

The site is generally flat at top having slope leading to the Balganga River having potentials of enhancing the site with a natural frontage. This land parcel is divided by downstream river of Govirle dam. The drainage channel passes through the T3 Site connecting to Balganaga River. Site T3 has proximal frontage to CRZ-III category of the riverbed of Balganga River. The site is in close proximity of the Konkon Railway and close next to the Hamrapur Railway Station in between Pen and Panvel. Figure 2-5 shows elevations and slopes at T3

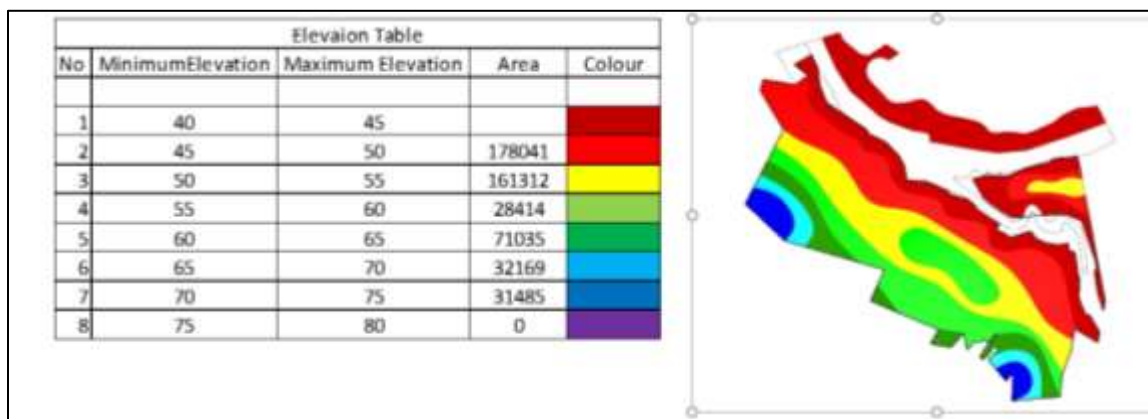


Figure 2-5: Elevations and Slopes at T3

2.7.4 T4 Parcel

The T4 site is located at latitude: 18°46'42.20"N, longitude: 73° 6'50.02"E around the villages of Valak, Mungeshi, Belwade and Khurd of Pen Taluka, Maharashtra. Present ODR (Other District Road) connecting the site to NH-66. The ingress and egress points are presently narrow and widening of approach road would be necessary.

The site boundary along the northern side has larger parcel of flat land, which is favourable for development. This Parcel is situated at base of major hills on West. T4 Parcel is made up of eighteen small land parcels and two major parcels. One of the major parcel have ground elevation ranges from 55m to 7m. And other major parcel is relatively hilly ground with elevations ranges from 86m to 12m. Figure 2-6 shows elevations and slopes at T4

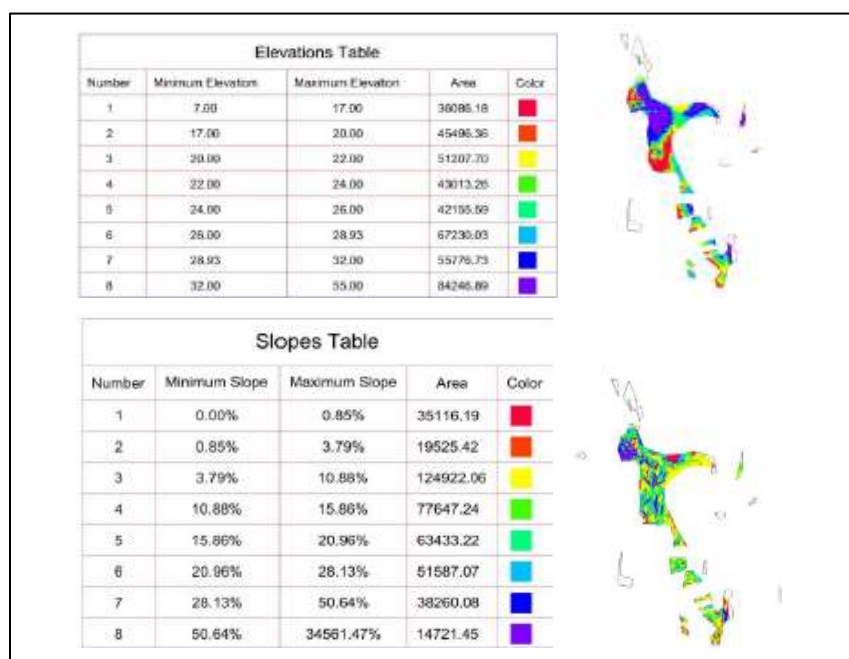


Figure 2-6: Elevations and Slopes at T4

Site photographs are presented in figure 2-7

T1 Land Parcel



T2 Land Parcel



T3 Land Parcel**T4 Land Parcel**

Figure 2-7: Site Photograph

2.8 Site Connectivity**2.8.1 Accessibility to site by Road**

Site (T3) is readily accessible through the National Highway 66. The site (T1) is adjacent to SH 88 (Pen - Khopoli Highway) through the proposed access via 18-metre wide road, apart from this, the subject-site region (T2 & T4) is also connected by about 6 km. of road length fall under major district roads and other district roads which are maintained by PWD and Zilla Parishad. Figure2-8 and Figure 2-9 shows site connectivity and Road network in site region respectively

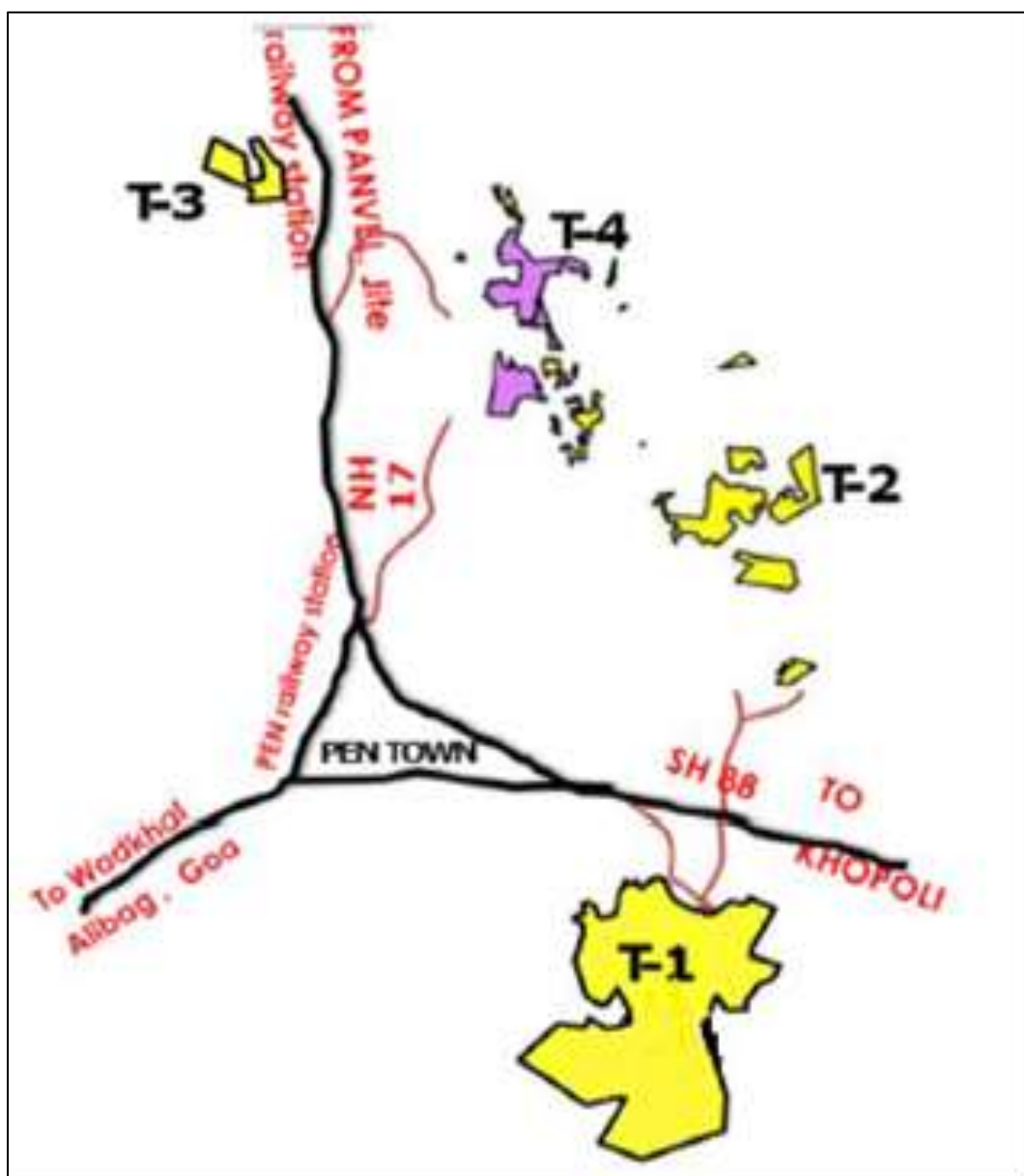


Figure 2-8: Site Connectivity

The major National, State Highways, Railways and expressway in vicinity to the subject site are provided in the following tables 2-8 and 2-9:

Table 2-8: National Highways and Expressway in site surroundings

Sr. No.	Name of Road	From - To
1	Mumbai Pune Expressway	Kalamboli (Navi Mumbai) to Pune
2	NH 4	Mumbai to Pune further down to Bangalore
3	NH 4 B	Panvel to JNPT
4	NH 3	Mumbai to Nashik further down to Agra
5	NH 8	Mumbai to Ahmedabad

Sr. No.	Name of Road	From - To
6	NH 17	Mumbai to Goa

Table 2-9: The Major State Highways in the immediate surroundings

Sr. No.	Name of Road	From - To
1	SH 88	Pen Khopoli
2	SH 85	Khopta - Sai
4	SH 81	Ghavan Phata to SH 85
5	SH 54	Uran to Panvel

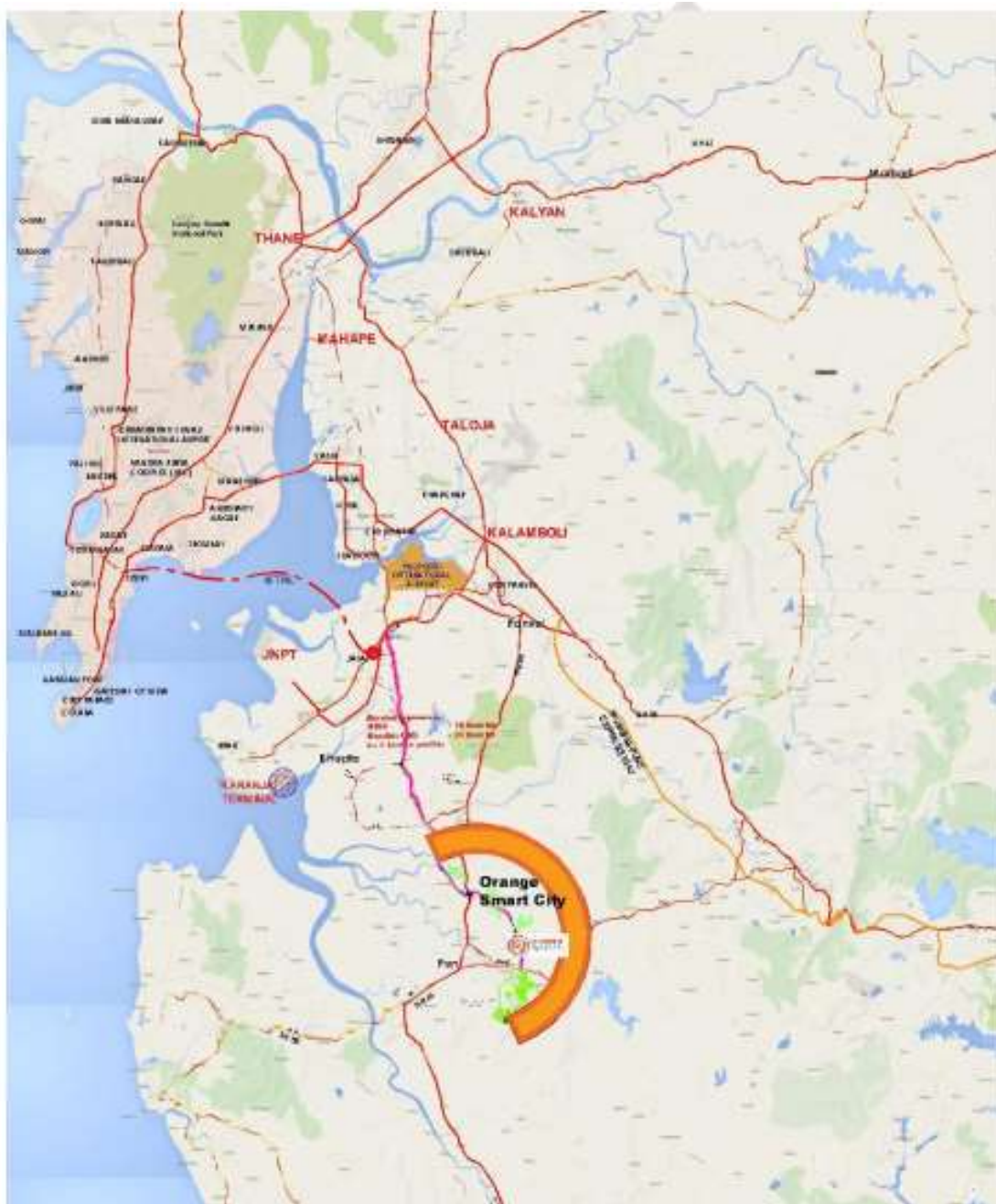


Figure 2-9: Road network in site region

Source: Revised draft DPR (June 2018)

2.8.2 Accessibility to Site by Railway

Pen Railway Station is one of the major rail terminus. It is situated on the Panvel - Roha route of Central Railway. It is at a distance of 103.59 km from Chhatrapati Shivaji Terminus via Diva junction. Its station code is PEN. It belongs to the Mumbai division of Central Railway. Hamarapur Railway Station is also one of the railway stations on the Panvel-Roha route of Central Railway abutting Orange Smart City. It is situated between Jite and Pen railway stations.

Konkan railway line runs parallel to project region along NH-66. The railway stations within the project region are Hamarapur and Pen along NH-66. Pen Railway Station is a major rail terminus. Panvel-Hamarapur-Pen konkan railway line connects the OSC project region with 30 km and 36km distance from Panvel respectively. Passenger train connectivity is available at the Pen station for local commute as well as for select long distance trains. Figure2-10 shows Mumbai suburban rail network. Rail Cargo access points are available at the JNPT terminal of the Dedicated freight corridor about 45km away for access to the Northern markets on the DMIC line as well as the Southern Markets on the BMIC line. In addition to this at Nagothane, which is about 30 km away, a Roll-on Roll-off facility for trucks plying to the Konkan belt is available. The facility provides significant timesaving for cargo by limiting the road travel on hilly terrain through the Western Ghats.

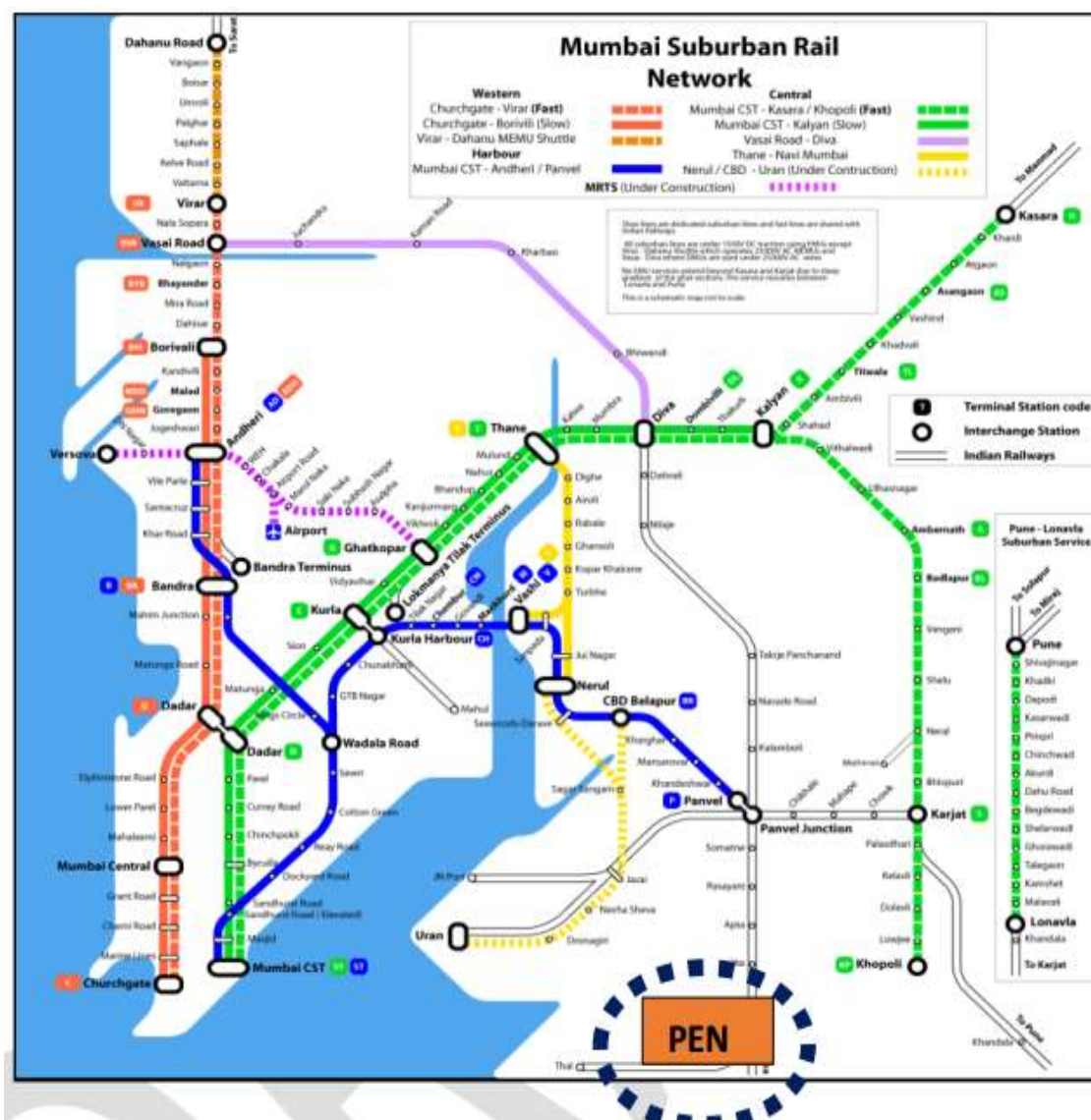


Figure 2-10: Figure showing Mumbai Suburban Rail Network

Source: Revised draft DPR (June 2018)

2.8.3 Accessibility to Site by Air

Proposed Navi Mumbai international airport: Proposed Navi Mumbai international airport is about 26 km from the project site along NH - 66 and also connectivity will be further enhanced through the development of proposed elevated corridor.

Mumbai international airport (Chhatrapati Shivaji International Airport): The Mumbai international airport is about 85 Kms from the project site and has undergone sea change and capacity expansion many times over. The city has been well served by the airport, but it is becoming increasingly difficult to keep up with the exponentially growing demand of the Indian aviation industry.

Pune airport: Pune also has an international airport approximately 120 km from the site, making it a viable alternative to Mumbai given the travel times in question. The airport is well connected to the domestic market and has limited international connectivity as well. Figure 2-11 shows nearby airport connectivity from the site

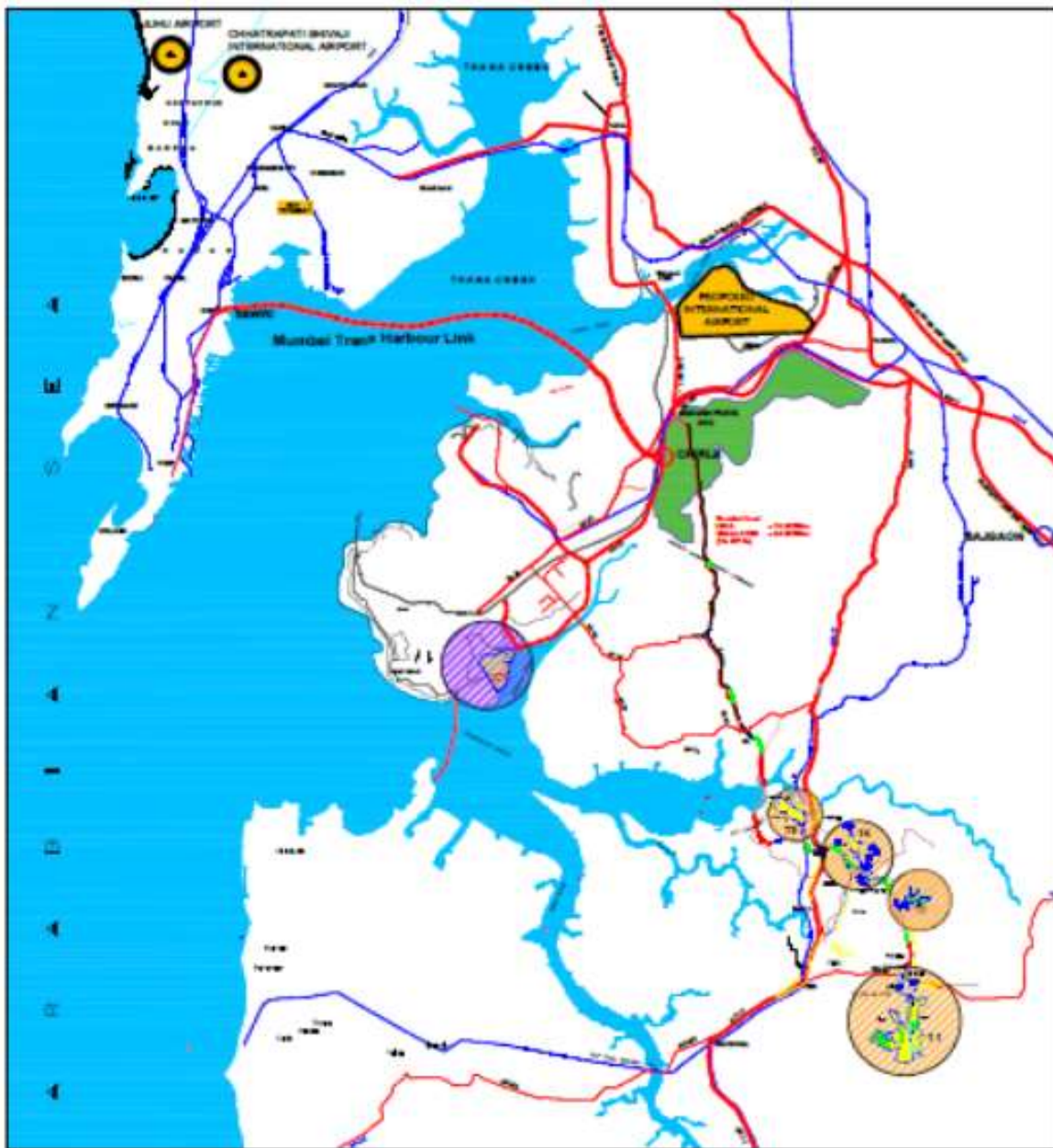


Figure 2-11: Map showing nearby air connectivity from site

Source: Revised draft DPR (June 2018)

2.8.4 Accessibility to Site by Sea Port

Jawaharlal Nehru Port Trust, India's largest & most modern sea port that provides cargo linkages to all the international markets, is located at a distance of about 20.8 km (aerial distance). It is connected to this site by Land Parcel T3. Proximity to Mumbai Port and proposed Rewas Port, another major port in India. The connectivity network around JNPT is proposed to be upgraded as it is the terminal point of the DMIC corridor.

Karanja Port is located in Uran, Raigad district in close proximity to OSC. The site's prime location will be key to the facility's success, given its proximity to Mumbai and the fact that the surrounding area is expected to undergo substantial regeneration including the construction of the proposed Mumbai-Trans Harbour Link bridge, the Dedicated Freight Corridor, expansion of JNPT and the proposed new international airport, all of which will significantly improve transportation links and access to and from the facility.

JSW Dharamtar Port, at Dolvi in Raigad District, is an existing port and terminal facility, located in Amba river about 23 nautical miles away from Mumbai Harbour by sea route. This upgradation will ensure faster connectivity to the Proposed Project. Figure 2-12 shows nearby ports.

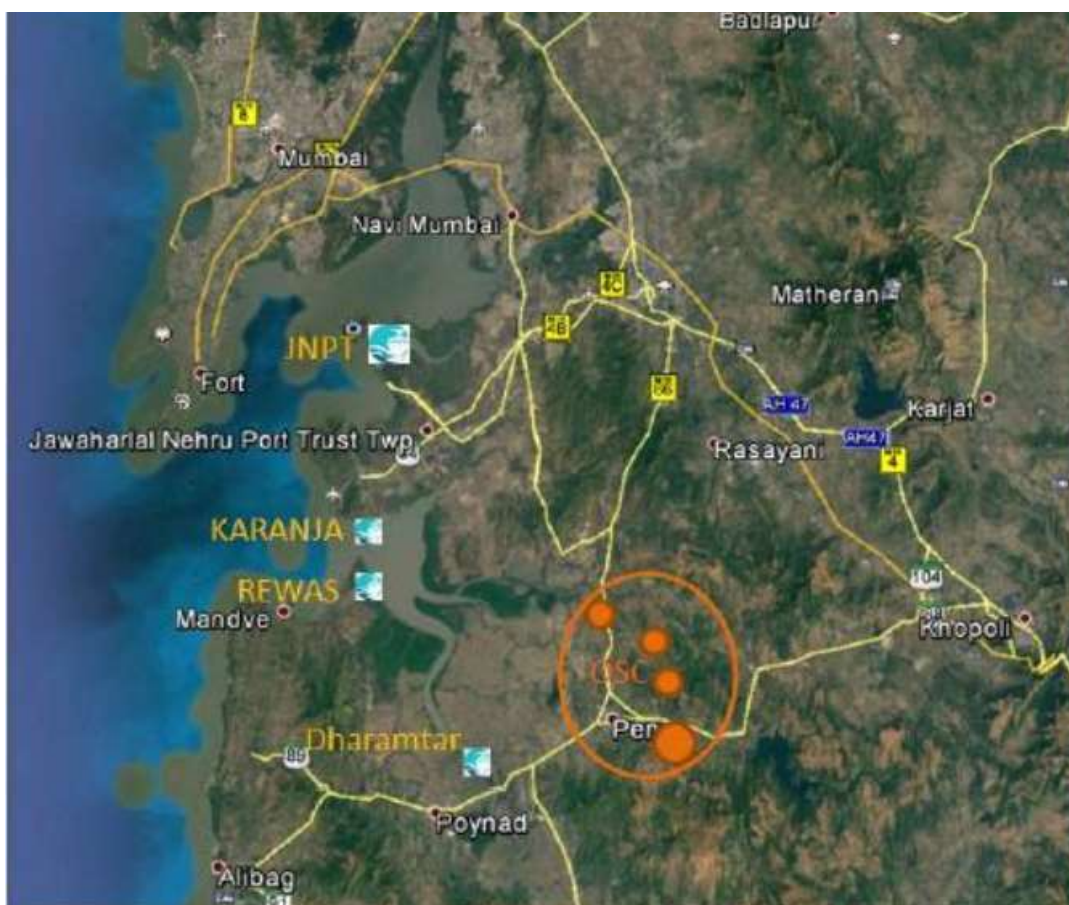


Figure 2-12: Map showing nearby ports from site

Source: Revised draft DPR (June 2018)

2.9 Traffic Analysis & Forecast

The major roads present close to the different parcels are NH 66, SH 88 and Balavali road. Apart from this there are a number of government schemes proposed in the future that shall improve the future traffic infrastructure which includes the following:

The project is connected to the major road network via NH 66 road and SH 88. Apart from that, there is also a Hamrapur-Pen railway line moving close to the project boundary. The two major roads mentioned above serve as the pathway for traffic movement from and towards the project. The current condition of the access road network is shown in the below in Figure 2-133.



Figure 2-13: Images showing the current scenario of the road network of NH 66 and SH 88 respectively

The traffic volume contribution in the current year would be mostly due to the NH 66 and SH 88 road only as they are the major carriers of the traffic through and toward the project location. NH 66 and SH 88 comes in the category of arterial road and is a 4-lane two-way road. The Table 2-9 shows the traffic scenario on the aforesaid three roads in 2018.

Table 2-8: Current Traffic projections in vehicles / hr (2018)

	Balavali	NH 66	SH 88
	2018	2018	2018
Two W	75	646	192
Three Wheeler	19	83	25
Four W	1	1266	376
LCV	0	56	17
Bus	4	49	15
Truck	0	111	33
Total	99	2211	657

The above table reflects that the category of car, van and jeep had major contribution to the traffic at each of the roads. The other major categories contributing to the traffic were 4 wheelers, 3 wheelers.

2.10 Project Overview

The proposed project is an Integrated Industrial Township and has been planned as a mixed-use development comprising of residential, industrial and commercial land uses. The following sections provide brief description of the project.

2.11 Development Concept

Rapid Urbanization is posing infrastructural challenges to governments & municipalities. As cities grow and expand their services, management and governance become increasingly complex. The proposed Orange Smart City project will provide infrastructure for industries, academic

institutions, students & faculty housing and support social & physical infrastructure. It is intended to have sustainable economic base around industries and educational, institutional activities for technical & professional skill development. The proposed Orange Smart City Project of 1042.51 acres is divided into 4 land parcels inclusive of the Main trunk road and the Arterial roads. A smarter, efficient city that would encompass aspects of intelligent transportation, security, energy management. Table 2-9 presents principles for development of concept master plan.

Development concept will implement Integrated IT and telecommunication network for data, voice, video and internet with uninterruptible power supply, smart meters, power system automation, traffic management system, Surveillance CCTV's, Access control system etc. The Orange Smart City will foster learning, earning and living. It aims to take advantage of the synergistic relationship that can be established between centers of learning and working. The proposed project aims to create such a center near Pen. Co-location of educational institutions in the industrial township makes collaboration between academia and industry more efficient and effective. Presence of industries in the same township not only will have an impact on the course-curriculum and vice-versa, it could also improve employment opportunities for graduates of these institutes, and a ready talent pool for industries to recruit from.

Table 2-9: Key Guiding Principles for Development of Concept Master Plan

Design Principle	Strategy
Sustainable Development	Right balance of jobs to resident population to be economically self-sufficient and self-supporting. About 15% land within the townships to be set aside for clean and green industry to provide employment opportunities for the residents living there especially the female workers. Modular township development of about 1042.51 acres for ease of implementation and of sufficient critical mass
Optimum and Effective Land Utilization	Integration with development of infrastructure within the proposed development. Provision of high density development along major transportation network to promote Transit Oriented Development (TOD) The Non-buildable area can entirely be utilized for creation of green area by undertaking afforestation on the hill slopes
Maximum Efficiency & Network Regional Connectivity	Provision of good infrastructure and utilities including a comprehensive transportation system that will satisfy the needs of residents and workers. Ensuring good accessibility with efficient road system with linkages to main landmarks like MTHL, JNPT, Airport, NH and SH along with DMIC zone. Provision of a hierarchy of roads and standardization of road widths for ease of implementation and to match with city level network. All-inclusive planning strategy for the entire region and regional connectivity.

Design Principle	Strategy
Best Deal with Social & Environment Issues/ Concerns	Juxtaposition of industrial clusters based on pollution standards with adequate separation buffers between the industrial and residential areas. Cleaner industries located within new towns. This is to provide employment opportunities for residents and curb inter- region traffic flow. Conservation of natural features. Provision of a high quality environmental living with green vistas, good landscape, range of leisure and recreation facilities. A full range of social community and institution facilities to support different income groups within the target population of Investment Region.
Barrier Free Infrastructure	Proposed project will create vital infrastructure of roads, communication networks, commercial facilities and certain common infrastructure that will benefit the local population as well as improve the region's perception for real estate developments Design to include pedestrian walkways and green connectors at accessible locations to make the townships more walk able with convenient access to amenities.
Appealing Urban Form/ Visual Aesthetics	Introduce linear greens into the residential and industrial township Provide conducive environment by water collection / retention ponds / reservoir. Tree planting strips and buffers along major roads and arterials/ sub-arterials for visual relief and green vistas.
Education and Employment	Human capital will be created through educational institutes of the Proposed Orange Smart City project and contribute to the overall growth of the community, region, and of nation. Industrial city will provide employment opportunities for individuals of diverse capabilities ranging from unskilled and semi-skilled to skilled professionals and managers
Innovation & Entrepreneurship Intellectual Property	Proposed Project will be able to incubate innovative business ideas by providing guidance, and other support. Businesses thus launched will be able to further strengthen the virtuous cycle of education and employment Proposed Industrial development along with other companies will generate valuable intellectual property

2.12 Proposed Concept Master Plan and basis for the location of the land parcels

The concept master plan for the delineated 'Proposed Integrated Township Project' has been designed considering the existing MMR, Raigad and DMIC Influence zone as the growth centre. The proposed Logistic hubs, warehousing and freight terminals and proximity of JNPT & MTHL will be serving as strategic inland port and primary discharge point for transportation of goods. This has been considered as the focal point for developing the master plan for the Proposed Orange

Smart City project. The proposed concept master plan for the region has been provided as Figure 2-14.

Due to geographical profile of Proposed Project Site, the entire area has been divided into four planning zones. Each zone is identified based on actual profile of project site boundary, physical distribution of hubs in Land use linked by main trunk road and ease of implementation. Proposed zones are shown in the map given below in Figure 2-15 to Figure 2-18.

Based on above maps it can be observed that all planning zones basically consist of industrial establishment along with initial supporting residential, commercial facilities and social infrastructure. The quality of life in any town depends upon the availability of and accessibility to quality facilities indicated in the Master Plan and Community Facilities, which are indicated at the layout plan level in various zones. Together, these include facilities pertaining to health, education, sports and socio-cultural facilities. Apart from these basic utilities like water supply and sewerage system, pumping stations, service reservoirs and related infrastructure, electrical substations and power distribution, fire station, information and communication system etc. are planned to cater industrial and residential establishments along with all facilities.

The basis for locating the land parcels is given below:

The total land of OSC is divided into 4 parcels, T1, T2, T3 and T4. T1 is the largest land parcel, located in the hilly region close to the city of Pen. The rest of the parcels i.e. T2, T3, & T4 are smaller and are located towards the north along the proposed Elevated Freeway and parallel to Nh17, which will allow better connectivity to them in future. Amongst all T3 is located on the northern most part having access from the sea creek.

The total area of OSC is segregated in two types, the Undevelopable and developable land. This division of land gives us open areas which act as buffer zones between the industrial and support / residential. All the developable land except for T4 is further divided into Industrial (60%) and Support (40%). The detailed review is as below

T1:T1 is the largest Parcel with a North-south valley that divides the parcel in two hills. The terrain of the valley is steep and undevelopable. The undevelopable land acts as a natural barrier and buffer zone between Industrial and Residential areas. All the proposed Residential areas are placed on the Eastern side of the valley and industrial areas on the west whereas the Industrial areas have been proposed to be located in the areas of moderate slopes. T1 has direct connectivity from SH88 and hence, the commercial areas are provided on the northern most part of the parcel having better access.

T2:T2 has moderate slope. It is further sub-divided into three parts, Industrial, residential and commercial. The layout of these areas has been done such that we get a buffer zone between the Industrial and Residential. The Industrial zone is placed in the largest sub-parcel so as the industries can have larger plots. The residential areas are placed away from the entry and the highways. This reduces the impact of Noise and Air pollution from the highways. T2 has a flatter topography and more usable areas.

T3:T3 is the smallest parcel of all. It has direct connectivity from NH 17. Hence, maximum areas have been provided for Industries and the commercial areas are placed on plots having access from the Highway. T3 has a flatter topography and more usable areas. The Types of Industries have been decided depending on the proximity to NH 17 and CRZ area.

T4:T4 has moderate slopes and has sub-parcels connected by district roads. These parcels have smaller individual areas to place any industries. Hence, the entire T4 parcel is kept for Residential and commercial areas.

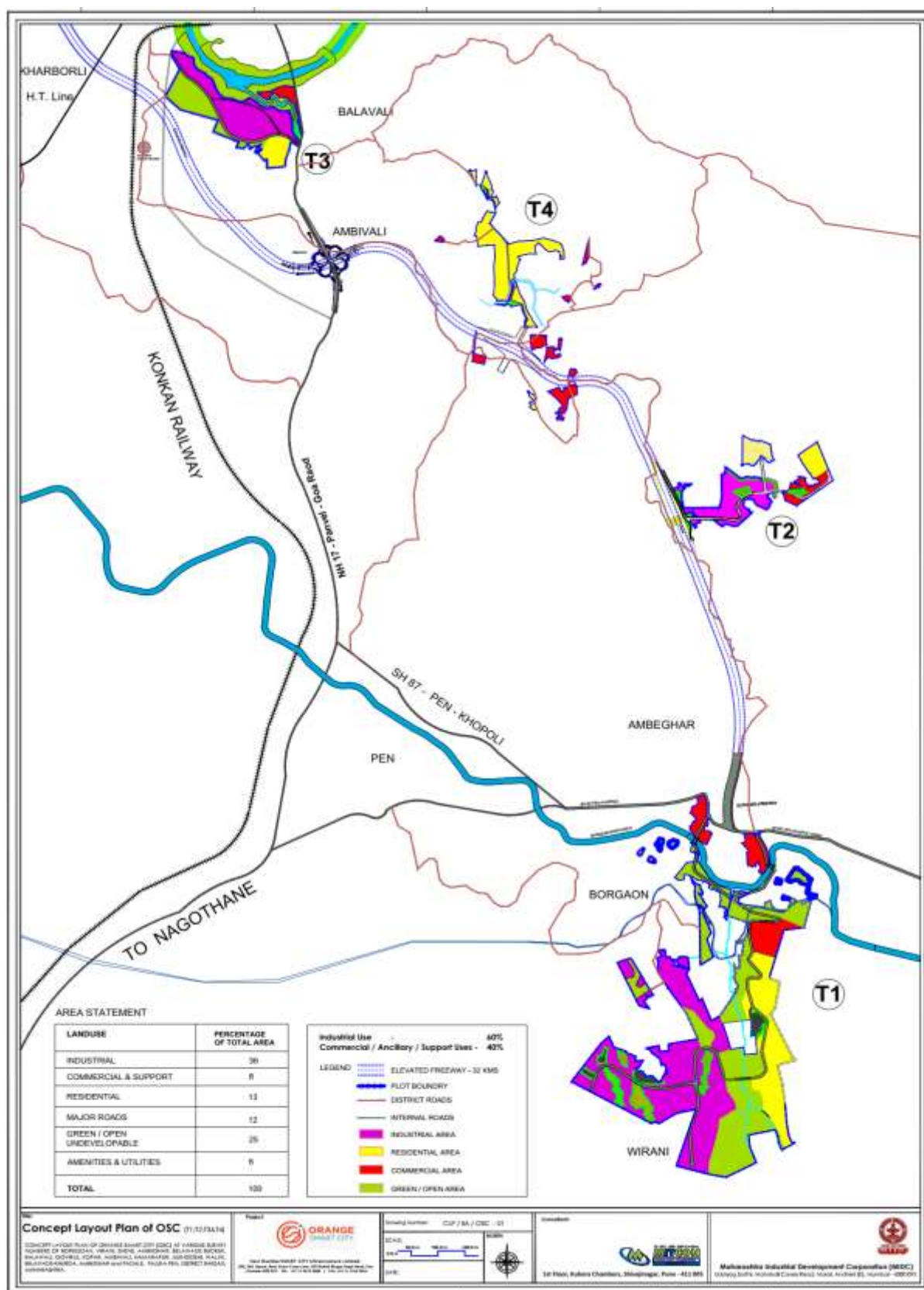


Figure 2-14: Concept Master Plan and Zoning

2.13 Area and the population details

The land use details of all the parcels are given in Table: 2-10.

Table 2-10: Land use details of all the parcels

Land use	Land Use in Acres					
	T1	T2	T3	T4	Total	%
Industrial	282.00	58.00	40.00	0.00	380.00	36.45
Commercial	38.33	7.87	2.40	39.23	87.83	8.42
Residential	58.00	8.00	8.00	62.00	136.00	13.05
Major Roads	87.00	12.29	10.87	15.98	126.14	12.10
Undevelopable / Green / Open Space	220.00	10.24	16.72	7.99	254.95	24.46
Amenities / Utilities / Facilities	38.00	6.00	5.60	7.99	57.59	5.52
Total	723.33	102.40	83.59	133.19	1042.51	100

Note: All dimensions in Acre except percentage

The Table 2-10 reflects that the total areas of T1, T2, T3, and T4 are 723.33, 102.40, 83.59 and 133.19 acres. The major component of the land use is industrial land use amounting to a percentage of 36%. Followed by undevelopable/ green/open area amounting to 25%. The other significant areas are residential area (13%) and major roads (12%).

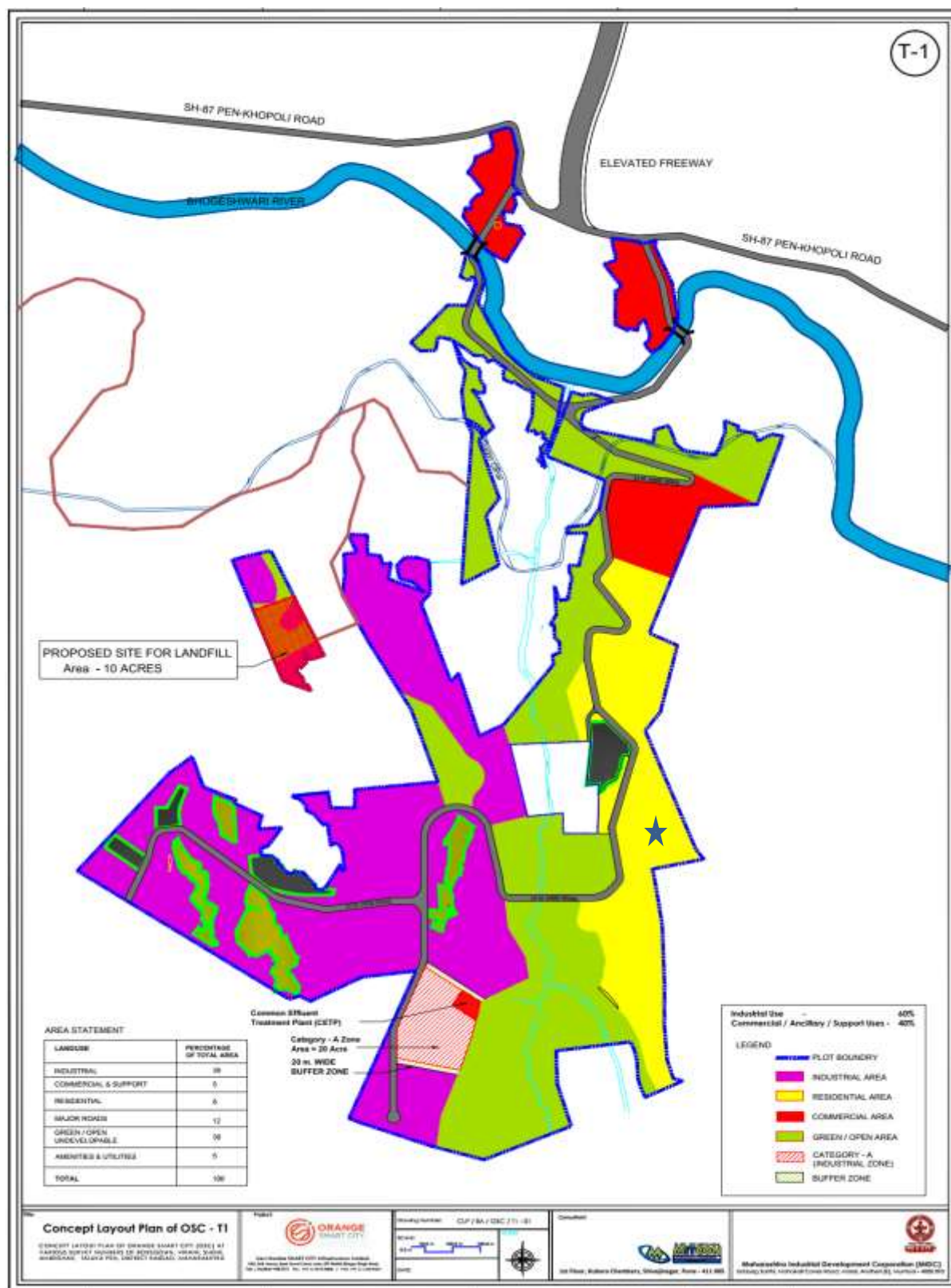


Figure 2-15: Layout plans for T1 land parcel

★ Labour camp for 200 workers (space requirement -620 sq.m)

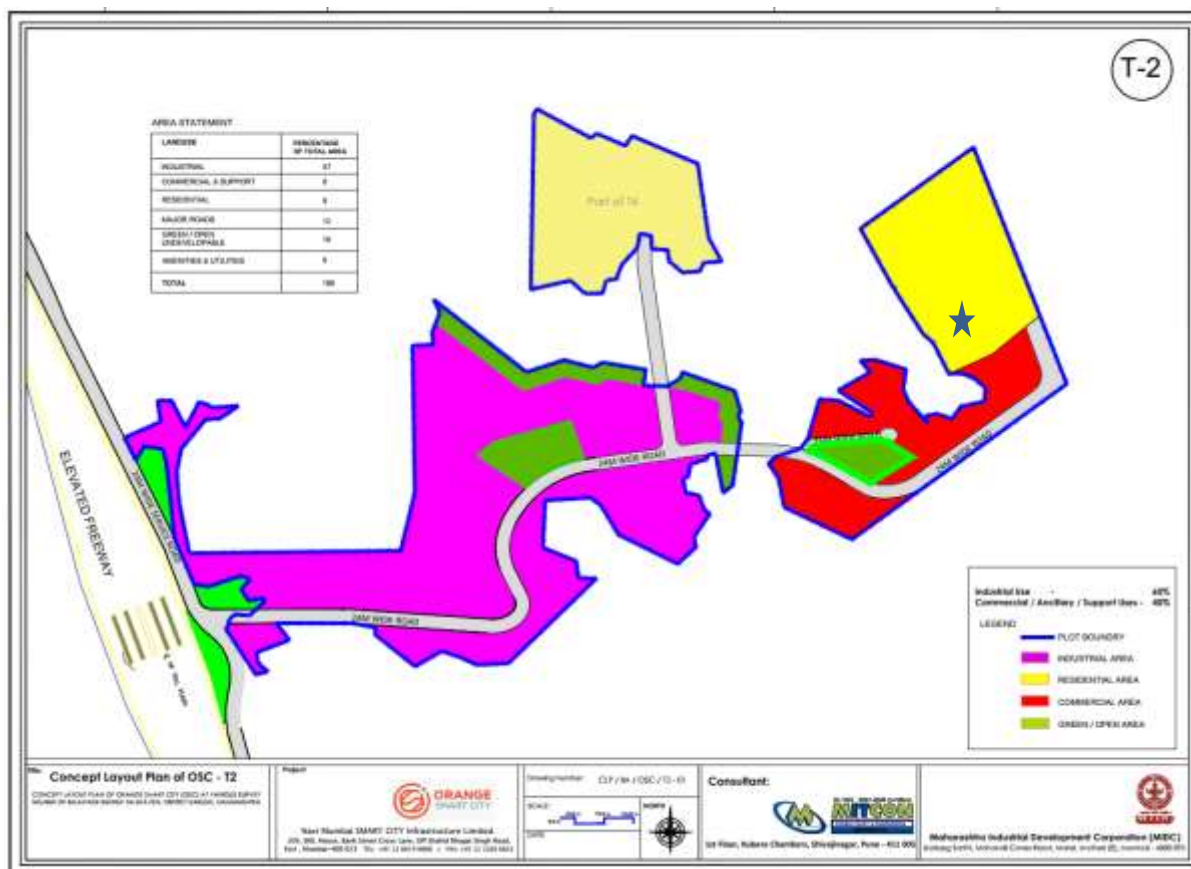


Figure 2-16: Layout plans for T2 land parcel

★ Labour camp location for 100 workers (space requirement – 310 sq.m)

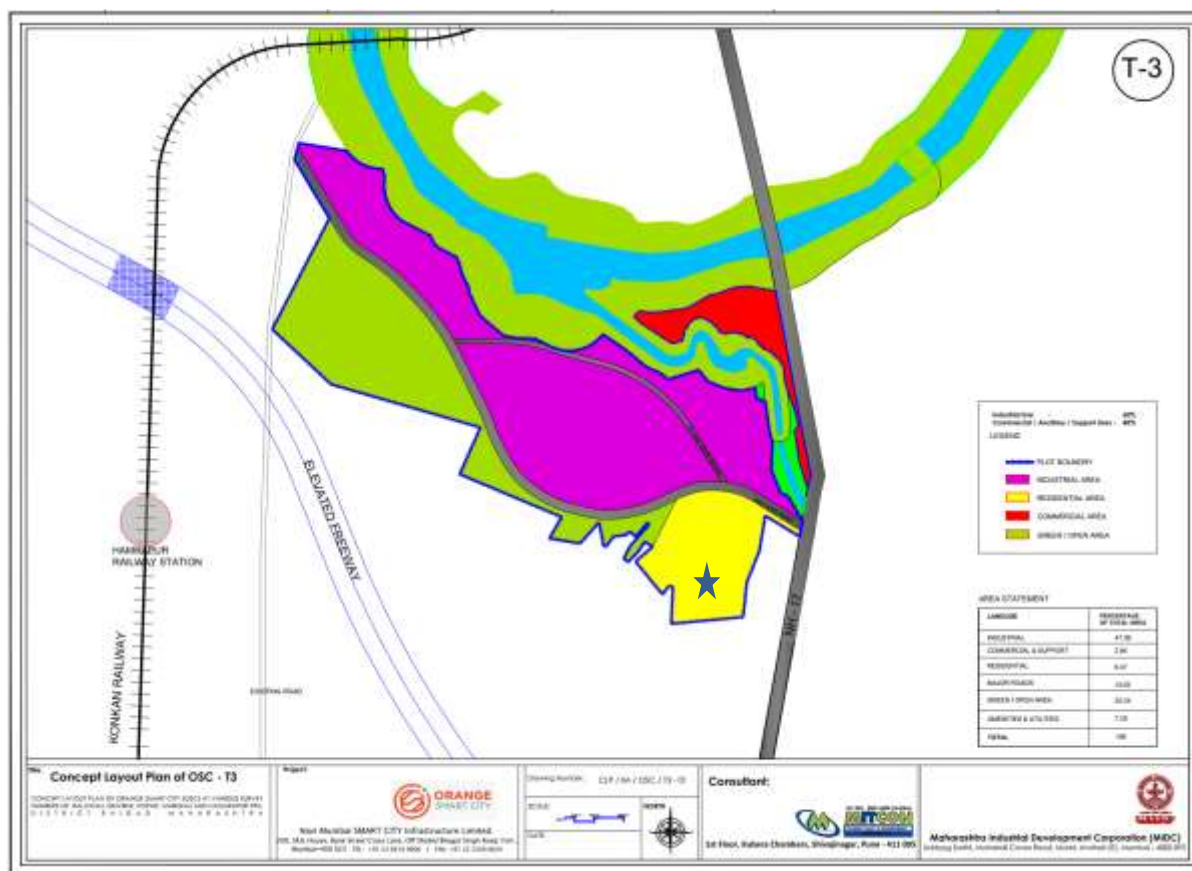


Figure 2-17: Layout plans for T3 land parcel

- ★ Space for labour camp of about 100 workers (space requirement – 310 sq.m)

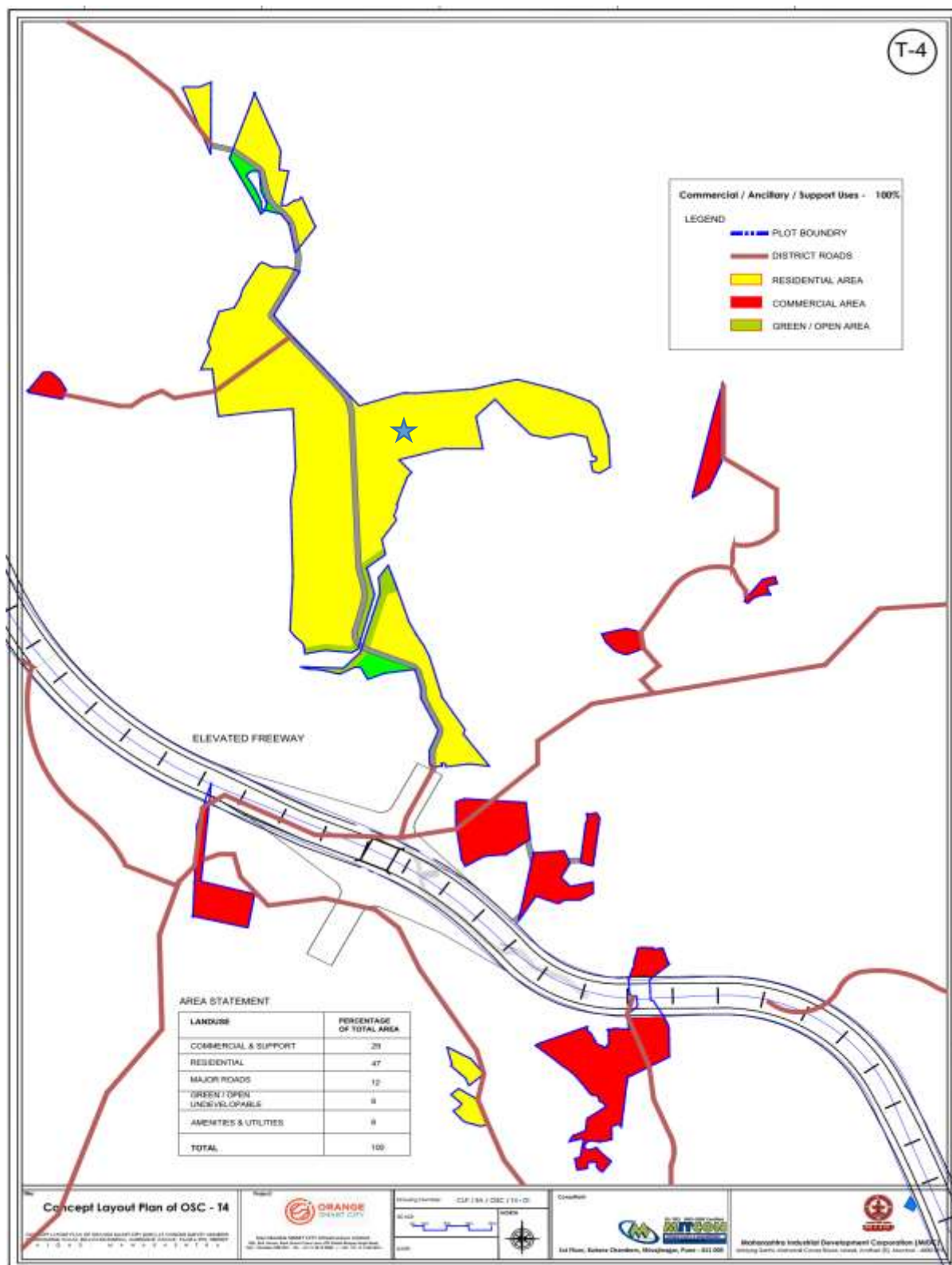


Figure 2-18: Layout plans for T4 land parcel

- ★ Labour camp of 100 workers (space requirement of about 310 sq.m)

The Land-use allocation and break-up formulated are presented from Table 2-10 till Table 2-133.

Table 2-10: Land use break up of land parcel –T1

	Area (Acres)	Area (m ²)	Area (Sq.Ft)	FSI considered	Built-Up Area (m ²)	Built-Up Area (MSM)	Land Distribution (%)
Industrial	282.00	1141254	12284458	2.00	2282508	2.28	39
Commercial Area	38.33	155122	1669728	2.00	310243	0.31	5
Residential Area	58.00	234726	2526591	2.00	469452	0.47	8
Major Roads	87.00	352089	3789886	-	0	-	12
Undevelopable/ Green/Open	220.00	890340	9583620	0.10	89034	0.09	30
Amenities/ Utilities	38.00	153786	1655353	0.10	15379	0.02	5
Total	723.33	2927317	31509635	-	3166616	3.17	100

Note: MSM: Million Square meter and sq.ft.: square feet

Table 2-11: Land use break up of land parcel –T2

	Area (Acres)	Area (m ²)	Area (Sq.Ft)	FSI considered	Built-Up Area (m ²)	Built-Up Area (MSM)	Land Distribution (%)
Industrial	58.00	234726	2526591	2.00	469452	0.47	57
Commercial Area	7.87	31850	342832	2.00	63700	0.06	8
Residential Area	8.00	32376	348495	2.00	64752	0.06	8
Major Roads	12.29	49738	535376	-	0	-	12
Undevelopable/ Green/Open	10.24	41441	446074	0.10	4144	0.00	10
Amenities/Utilit ies	6.00	24282	261371	0.10	2428	0.00	6
Total	102.40	414413	4460739	-	604476	0.60	100

Note: MSM: Million Square meter and sq.ft.: square feet

Table 2-12 : Land use break up of parcel –T3

	Area (Acres)	Area (m ²)	Area (Sq.Ft)	FSI considered	Built-Up Area (m ²)	Built-Up Area (MSM)	Land Distribution (%)
Industrial	40.00	161880	1742476	2.00	323760	0.32	48
Commercial Area	2.40	9713	104549	2.00	19426	0.02	3
Residential Area	8.00	32376	348495	2.00	64752	0.06	10
Major Roads	10.87	43999	473605	-	-	-	13
Undevelopable/ Green/Open	16.72	67658	728268	0.10	72827	0.07	20
Amenities/ Utilities	5.60	22663	243947	0.10	24395	0.02	7
Total	83.59	338289	3641340	-	505159	0.51	100

Note: MSM: Million Square meter and sq.ft.: square feet

Table 2-13 : Land use break up of parcel –T4

	Area (Acres)	Area (m ²)	Area (Sq.Ft)	FSI considered	Built-Up Area (m ²)	Built-Up Area (MSM)	Land Distribution (%)
Industrial	0.00	0	0	0.00	-	-	0
Commercial Area	39.23	158764	1708934	2.00	317528	0.32	29
Residential Area	62.00	250914	2700838	2.00	501828	0.50	47
Major Roads	15.98	64671	696119	-	0	-	12
Undevelopable/ Green/Open	7.99	32336	348060	0.10	3234	0.00	6
Amenities/ Utilities	7.99	32336	348060	0.10	3234	0.00	6
Total	133.19	539020	5802011	-	825823	0.83	100

Note: MSM: Million Square meter and sq.ft.: square feet

The summary of proposed built up area in million sq.m is given in Table 2-14 below:

Table 2-14: The summary of proposed built up area in million sq.m

Landuse	T1 (MSM)	T2 (MSM)	T3 (MSM)	T4 (MSM)	Total (MSM)
Industrial	2.28	0.47	0.32	0.00	3.08
Commercial Area	0.31	0.06	0.02	0.32	0.71
Residential Area	0.47	0.06	0.06	0.50	1.10
Major Roads	-	-	-	-	0.00
Undevelopable/ Green/ Open	0.09	0.00	0.07	0.00	0.17
Amenities/Utilities	0.02	0.00	0.02	0.00	0.05
Total	3.17	0.60	0.51	0.83	5.10

The Total Proposed Built-up area in Orange Smart City is 5.10 MSM and this area is spread over the four land parcels.

Note– The FSI figures considered for the calculations are considering upcoming major development projects viz elevated freeway, Navi Mumbai International Airport etc.

However, it should be noted that the maximum permissible FSI for residential and commercial in Mumbai region is 1.33 which can be increased upto 4 on payment of premium/ TDR, and the same is applicable for industrial areas.

2.14 Population projection and Employment Generation

The Proposed project comprises of 4 land parcels admeasuring 1042.51 Acres. The land parcels T1, T2, T3 and T4 are located in the vicinity and have good connectivity from existing road network and transit facilities. The details regarding the estimated population projection and employment generation calculated on the basis of land use proposed in the project has been explained in the subsequent sections.

2.14.1 Resident Population Estimates

The estimates for resident population in OSC has been calculated on the basis of the total proposed built-up area in all four land parcels T1, T2, T3 and T4. The built-up area for each individual land parcel has been bifurcated into housing typologies based on the types of units and the area of each single unit. The housing typologies include dwellings for following user groups:

- Lower Income Group Middle Income Group
- Upper Middle-Income Group
- Higher Income Group

Standard areas have been designated to each of these housing typologies and number of units for each type has been calculated. The total number of residents has been calculated by assuming

average household size of 4 persons per Household. The Table 2-155 states the calculations for all four land parcels:

Table 2-15: Residential Population Estimates

Land Parcel	Total Plot Area (Acres)	Net Residential Area (Acres)	Residential Built-up Area (m ²)	Estimated Resident Population
T1	723.33	58	469452	31161
T2	102.40	8	64752	4298
T3	83.59	8	64752	4298
T4	133.19	62	501828	33310
Total	1042.51	136	1100784	73068

2.14.2 Working Population Estimates

The estimates for working population in OSC has been calculated on the basis of the total proposed built-up area in all four land parcels T1, T2, T3 and T4. The calculations are based on the type of industries proposed in each of the land parcel as per JLL study and the areas allotted for each type of industry as per the proposed land use plan. The number of employees per acre has been calculated as per standard assumptions. Also, the same methodology has been adopted while calculating the worker population in commercial and institutional areas. Floating population for each land parcel has been calculated as per 40% of the direct employees. The description of all these calculations is in the Table 2-166

Table 2-16: Working Population Estimates

Land Parcel	Industrial Built Up Area (m ²)	Commercial Built Up Area (m ²)	Industrial Employment	Commercial Employment	Indirect/ Floating Employment	Total Employment
T1	2282508	310243	35746	19165	21964	76876
T2	469452	63700	13910	3935	7138	24982
T3	323760	19426	12859	1200	5624	19683
T4	0	317528	0	19615	7846	27461
Total	3075720	710896	62515	43915	42572	149002

So, a conclusion of all the above table states that the entire project site will generate roughly 2.22 lakh people out of which it is expected that 33% population will be residing in OSC.

2.15 Proposed Industrial Area

The total land allocation for industrial development in Orange Smart City is 380 acres which amounts to 36.45% of the total land available. The proposed industrial area has been allocated in T1, T2 and T3 parcels and shown in Table 2-177 and

8.

Table 2-17: Type of Industries and Parcel-wise Land Allocation

Type of Industry	T1 (Acres)	T2 (Acres)	T3 (Acres)	T4 (Acres)
Engineering	104.4	13.98	-	-
IT	-	9.08	12.97	-
Agro	67.9	6.99	-	-
Life Sciences	-	10.48	10.81	-
Logistic	104.4	10.48	-	-
Research & Development	-	3.49	-	-
Gems & Jewellery	5.2	-	-	-
Electronics & Semi-conductor	-	3.49	16.22	-
Total	282	58	40	-

Note- area allocation for Category ‘A’ industries and its required CETP & MEE facility will be considered under total industrial area allocation of 282 acres of T1.

Table 2-18: Land Parcel wise Type of Industry with Tentative Built-up Areas

Type of Industry	FSI Considered	T1 (sq ft)	T2 (sq ft)	T3 (sq ft)	T4 (sq ft)	Total
Engineering	2	9099599	1217634	-	-	10317233
IT	2	-	791462	1130255	-	1921717
Agro	2	5914739	608817	-	-	6523556
Life Sciences	2	-	913226	941879	-	1855105
Logistic	2	9099599	913226	-	-	10012824
Research & Development	2	-	304409	-	-	304409
Gems & Jewellery	2	454980	-	-	-	454980
Electronics & Semi-conductor	2	-	304409	1412819	-	1717227
Total		24568916	5053181	3484953	-	33107050

Types of industries in T1, T2 and T3 land parcels are shown in figure 2-19, figure 2-20 and figure 2-21, respectively and Table2-17.

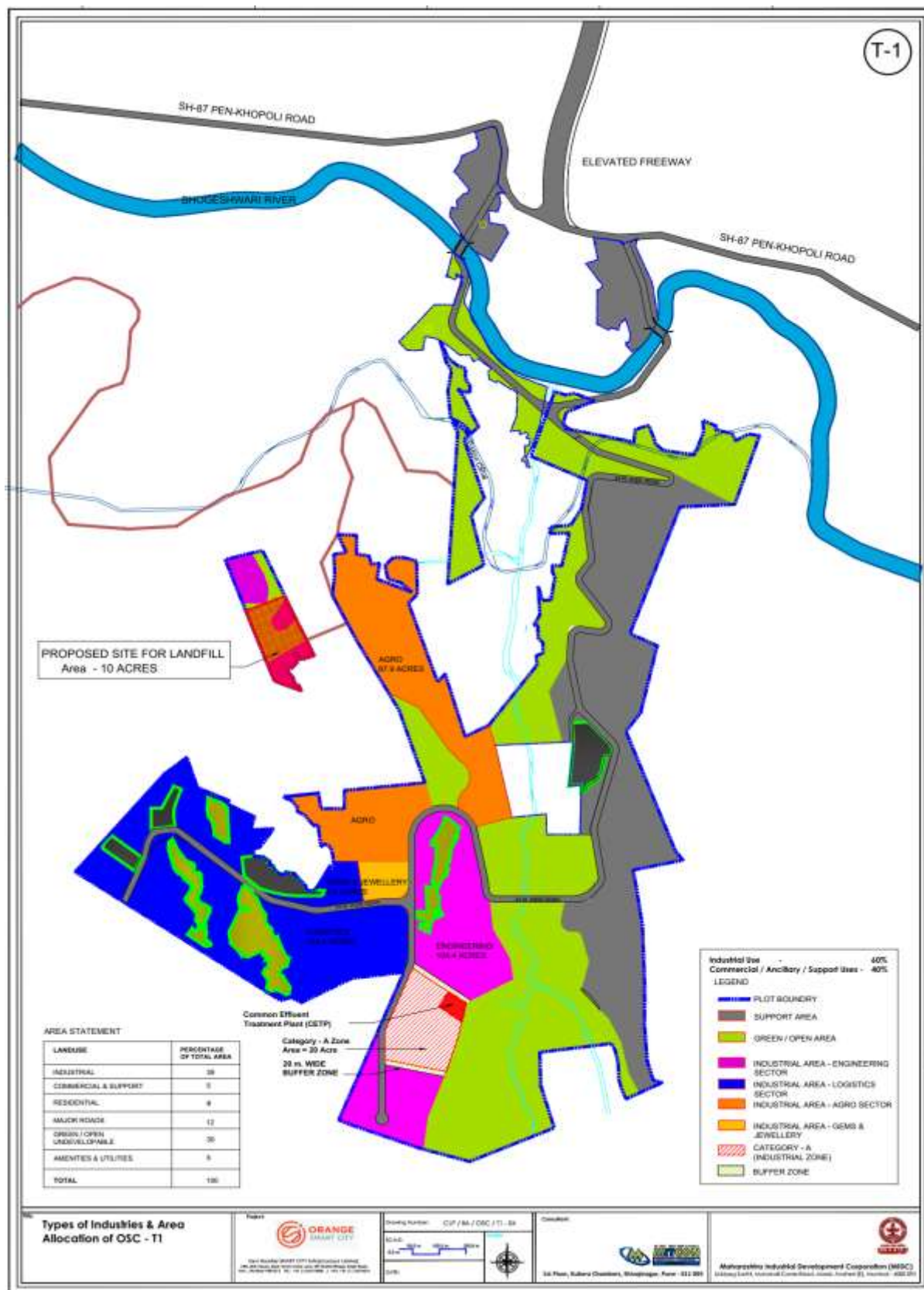


Figure 2-19: Type of industries in T1

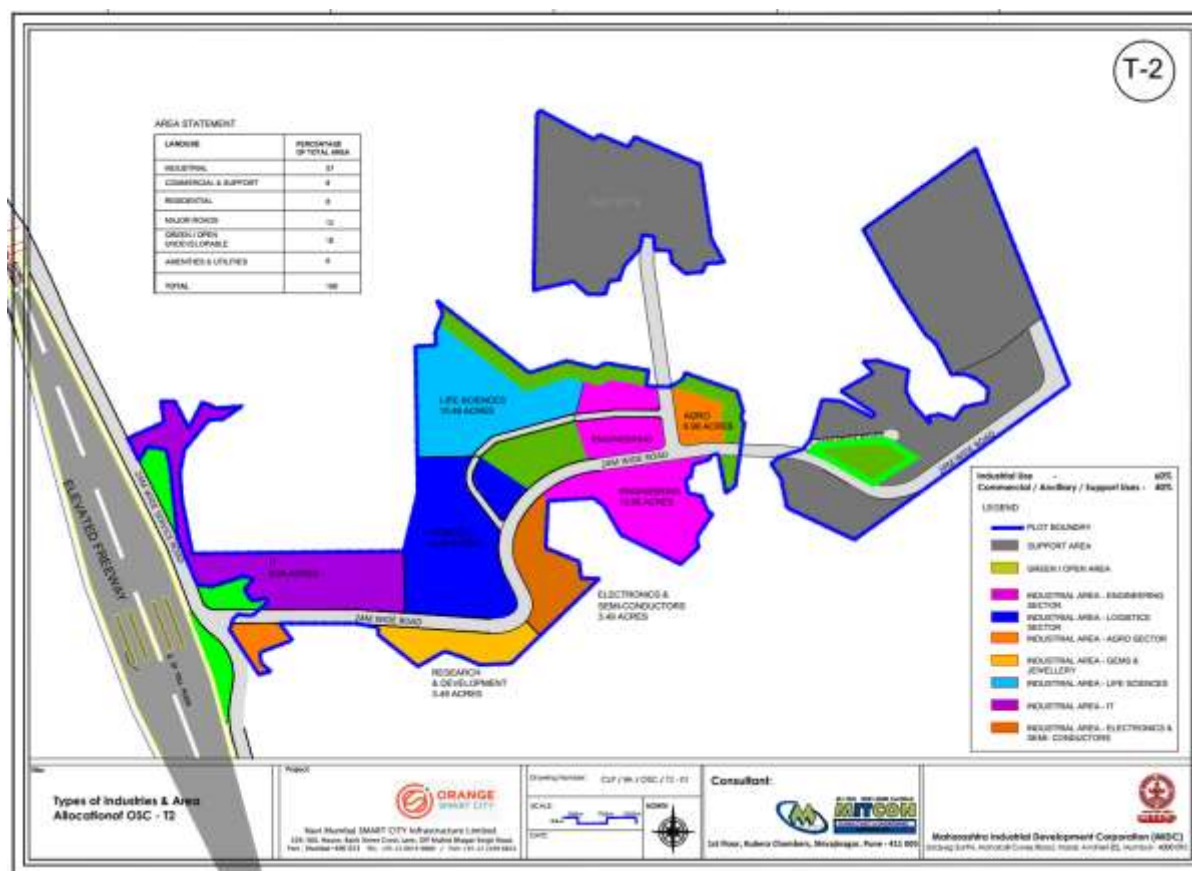


Figure 2-20: Types of industries in T2

Table 2-19: Type of industries in each category

Category	Type of industry
Category A and Life sciences	Pharmaceutical Bulk drugs and intermediates
Engineering	Automotive industries preferably One anchor unit and others will be Tier 2 and 3 Category
Agro/Food Processing	Fish, Poultry and Meat processing Food processing and packaging Sorting grading and cold storage
Logistic	Temperature controlled storage, CFS, warehousing etc.
Research & Development	R&D for manufacturing and biotech etc.
Gems & Jewellery	Diamond processing and Jewellery making
Electronics & Semi-conductor	Manufacture of domestic electric appliances

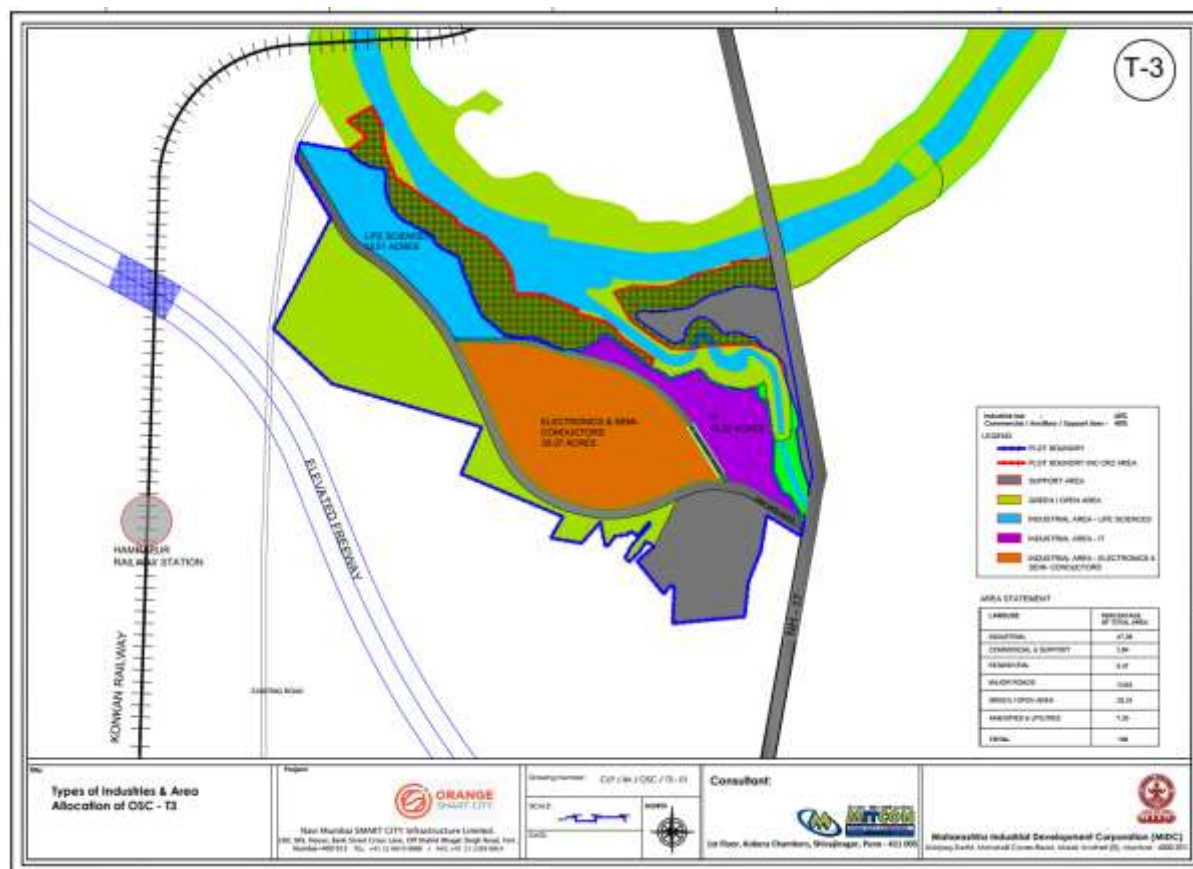


Figure 2-21: Type of industries in T3

2.16 Proposed Commercial Area

The total land allocation for Commercial development in Orange Smart City is 87 acres which amounts to 8.3% of the total land available. The proposed commercial area has been allocated in all four land parcels. These commercial areas will include convenience shopping areas, neighborhood retail outlets, stores for personal care, recreational areas, hospitality and health care facilities, etc. The details are depicted above. Table 2-20 shows parcel-wise land allocation

Table 2-20: Parcel-wise land allocation & built-up areas for Commercial areas

Land Parcel	Commercial Area (Acres)	Commercial Area (m ²)
T1	38	310243
T2	8	63700
T3	2	19426
T4	39	317528
Total	87	710896

2.17 Proposed Residential Area

The total land allocation for Residential development in Orange Smart City is 136 acres which amounts to 13.04% of the total land available. The proposed residential area has been allocated in all four land parcels. The details are presented below.

The built-up area for each individual land parcel has been bifurcated into housing typologies based on the types of units and the area of each single unit. The housing typologies include dwellings for LIG, MIG, Upper MIG and HIG user groups. In total 18267 dwelling units are proposed in Orange Smart City. Table 2-21: Total land allocation

Table 2-21: Total land allocation

Land Parcel	Residential Area (Acres)	Residential (m ²)	Total No. of Dwellings
T1	58	469452	7790
T2	8	64752	1075
T3	8	64752	1075
T4	62	501828	8328
Total	136	1100784	18267

2.18 Proposed Amenities & Utilities

Amenities and Utilities in OSC have been proposed in all four land parcels on 57.59 acres of land which makes up 6% of the total site area. The proposed amenities and utilities have been planned aiming to make OSC a self-sufficient development project.

Some major proposed utilities are as below:

- Central Effluent Treatment Plant (CETP) & Multi Effect Evaporator (MEE): Considering the inclusion of Category A industries and other water polluting industries, a CETP along with MEE is considered. An area of 3 acres is allotted for the same excluding buffer areas. Proposed CETP site is shown in Figure 2-22: Proposed CETP site

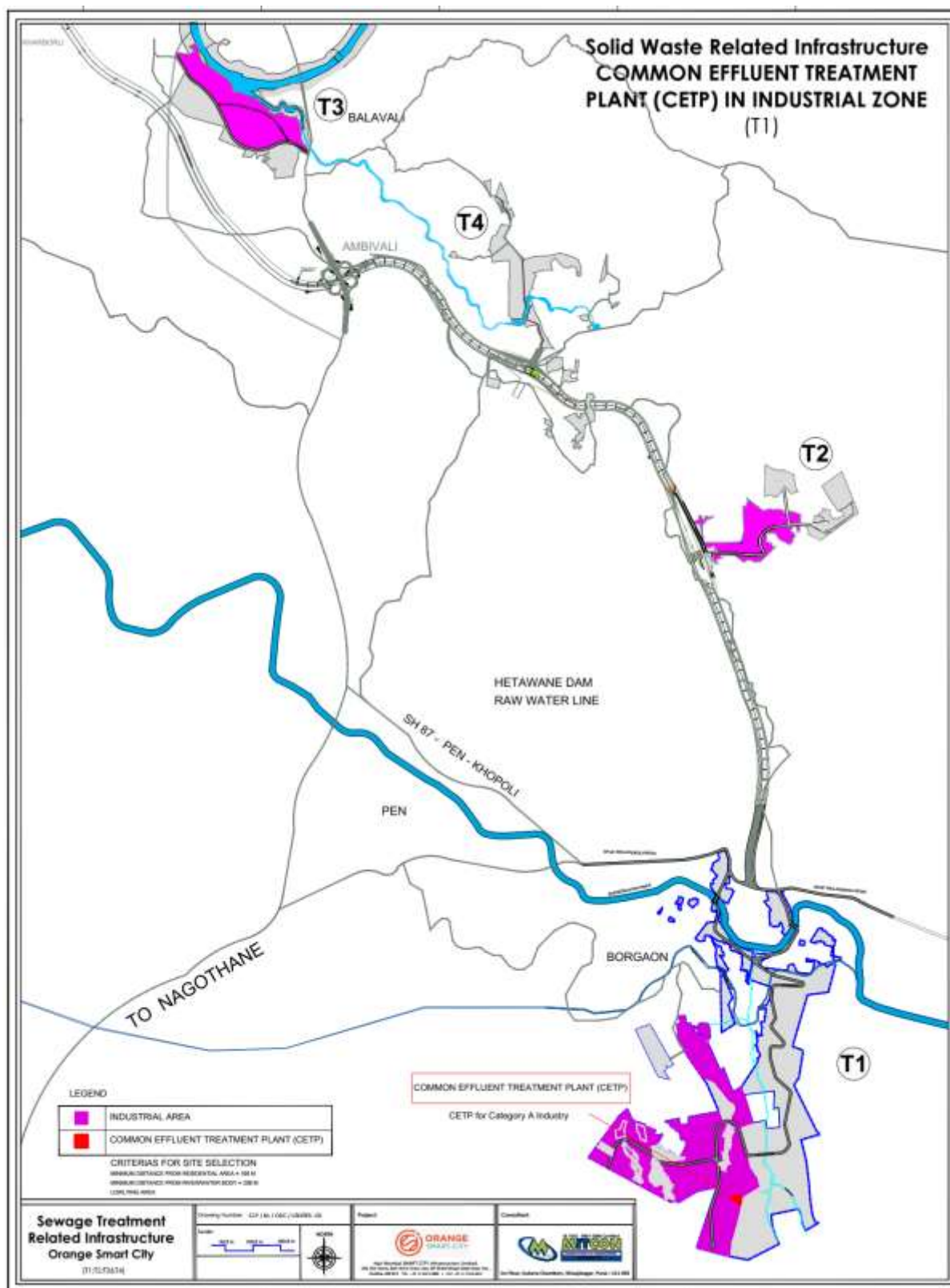


Figure 2-22: Proposed CETP site

- Landfill: A provision of landfill along with ancillary infrastructure is also considered and shown in the plan, with total area of about 10 acres. Location of landfill is shown in Figure 2-23: Proposed land fill location.

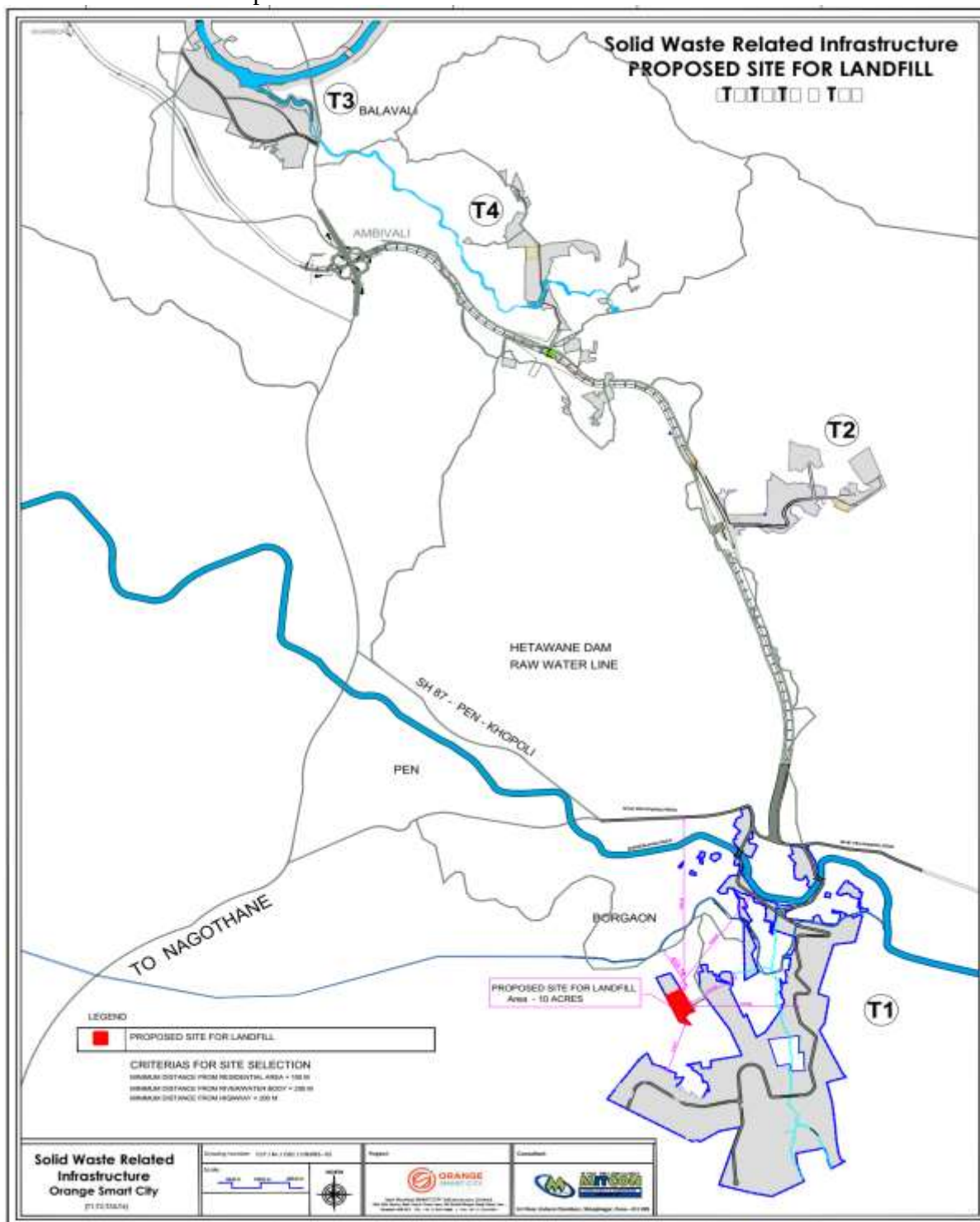


Figure 2-23: Proposed land fill location

2.18.1 Landscape, Green and Open Space Development

OSC has been planned with an objective to enhance the vegetation cover, develop green envelope and natural environment, by creation of a range of landscaped open spaces. The total green area proposed shall be approx. 254.95 acres which accounts for 24.46% of the total OSC Site area. The landscaping will be integral part of the development and shall be driven by emerging trends and the rising popularity of garden outdoor spaces as an extension of built environment.

The green space proposed will accommodate a variety of recreational and adventure need while integrating parks into a functioning urban environment. Each type of park provides a distinct range of opportunities. Green spaces proposed at OSC shall exist in a great variety of shapes, forms and types within the OSC urban fabric. The successful creation and development of the spaces are one of the key elements required to achieve sustainable urban development.

The proposed green areas shall have plantation of local species. The landscape, green and open space details are presented in Table 2-2222.

Table 2-22: Landscape, Green & Open Space Details

Sr. No.	Particulars	Acres	% of OSC land
1.	Open/Green Valley	208.50	20%
2.	Parks and landscaped areas	46.45	4.46%
TOTAL		254.95	24.46%

2.18.2 Central Green / Valley

A large central green area, measuring approx. 208.50 Acres is planned and developed which will act as a lung of the OSC. This green area is proposed for dense plantation of various types of local species detailed out in the Green Development Plan in Chapter-9.

The vastness of this green area along with its central location makes it a major environmental feature of proposed OSC development. This landscape area shall serve as Central Leisure Area for all the users of OSC, as well as people of adjoining area. The said central green area shall have dense plantation of trees & vegetation up to 8-10 m height. A pond/small lake shall be developed as part of this central green to harvest rainwater from the catchment of OSC. The water body & green vegetation, together shall lead to creation of pleasant, aesthetic and sustainable green development.

2.19 Parks and landscaped areas

Apart from the aforesaid two categories of green developments, several large parks and landscape areas are proposed as part of OSC Master Plan. The total area under this category of green development is approx. 54 acres. These green areas are planned across various parcels of OSC, and they shall provide dense green cover, accessible green space for OSC users at walking distance of their work and living areas. Small ponds and water bodies shall be part of this category of green areas, providing rain water harvesting, water for landscape and other non-potable uses. In addition to above, trees and dense vegetation shall be planted along all major roads, offering green cover

and shade to road users and also assisting in encouraging pedestrian movement within OSC site area.

2.20 Proposed Common use buildings in OSC

OSC shall provide plots for construction of following common use buildings as part of City Area development, as part of OSC Master Plan: Some of these buildings shall be on standalone like common facility block or training and management school. The common use buildings with built-up areas is given in Table 2-233.

Table 2-23: Common use buildings with Built-up areas

Sr. No.	Buildings / Facilities	Built-Up Area (In sqm)
1	OSC Management Office	35,000
2	OSC Administration	1,00,080
3	MLCP (2 no's)	2,10,000
4	Hospital - 200 Bed	25,000
5	Police Station, Police posts, security offices	2,900/1000
6	Utility Plant - STP (24.50 MLD)	48,000
7	Utility Plant - WTP & Storage Tank	22,800
8	Bus Stop, Bus Terminal, Bus Parking, Taxi Parking	1,000
9	Common Service Block - Facilities	25,000
10	Common Service Block - Retail & Offices	25,000
11	Training Center	10,000
12	Training & Management School	50,000
13	Common Services Block - Recreation, Entertainment	20,000
14	Sports Club	10,000
15	Conference / Convention Center	50,000
16	Service Apartments	25,000
17	Temporary Warehouse, Site Offices	4,500
18	Exhibition Facility	10,000
19	Common Service Block - Art & Museum	10,000
20	Solid Waste Collection Center	10,800
	Total	322,100

2.21 Resource requirements – Construction phase

2.21.1 Labor

It is estimated that the number of labourers for the T1, are 200nos. and 100 each for T2, T3 and T4. The space requirement for labour camps assuming that 100 sq.ft (9.2 sq.m) space will be required for 3 labourers – the space requirement for the labourer camps for T1,T2,T3 and T4 will be 6666 sq.ft (620 sq.m) and 3333 sq.ft (310 sq.m) each for T2,T3 and T4 respectively.

The construction phase will include hiring of local laborer but considering the magnitude of development, a temporary influx of population from outside areas is expected. The labour facilities will be established and will be provided with water and power supply and sanitation facilities including toilet facilities along with septic tanks.

2.21.2 Construction Material

The proposed project will involve large scale construction activities and will involve large quantities of construction materials. The construction materials will be sourced only from authorized quarries and local sources in and around the region.

2.21.3 Power Requirement

Power demand during initial period mainly will be for construction power which will be in the range of 5 MVA. This will be made available by taking 22 kV supply from MSEDCL Raigad. The ultimate power requirement for the development will be made available by taking 22/33 kV supply from Pen substation. To fulfil the power requirement during outages, DG sets shall be utilized the details of which have been discussed in the air quality impacts of the project.

2.21.4 Water Requirements

The water requirement for the construction phase will include water for construction activities such as curing and formation of concrete mixtures and water for domestic consumption. Considering the number of workers required for the development during construction as per NBC norms, water demand for domestic consumption has been estimated to be about 80 m³/day which may go up to 320 m³/ day at the peak construction period. Proponent will make adequate allocations for providing piped water supply to the labour colonies. For construction activities, tankers will be provided and adequate water allocations will be made by the contractor.

2.21.5 Wastewater Generation

The estimated quantity of sewage likely to be generated during each phase of construction is about 36 m³/day. The labour camps will be provided with adequate number of soak pits and septic tanks for disposal of sewage. After completion of construction work, compact STPs would be properly cleared and demolished.

2.21.6 Solid Waste Generation

The waste generation during construction phase will include construction waste and residential waste from labour facilities. The construction waste will largely comprise of excavated earth and debris which can be used as a fill material for low lying areas and for construction of roads. The residential waste generated during the construction period from labour facilities would be collected and transported to an interim transfer station where it will be treated (composting) by modular composter. Only residual waste will be transported to proposed landfill facility for disposal.

The construction activities will also entail generation of hazardous wastes such as waste oil. Proponent, through contractual obligations, will specify disposal of hazardous waste by the contractor to authorized recyclers/agencies.

2.22 Resource requirements – Operation Phase

2.22.1 Water requirement

The proposed development mix at city side of OSC includes various facilities including Industrial, logistics and freight, transport facilities, commercial / office spaces, Residential, retail and F&B, entertainment, educational / institutional, cultural and event spaces, health care, etc. As OSC being mix land use development having various water demands including drinking, flushing, horticulture, industrial process, HVAC etc.

Detailed water demand assessment has been carried out for proposed facilities as above for the ultimate stage year. Water demand of Horticulture, industrial, flushing and HVAC is proposed to be sourced by recycled water. Site wise water demand is worked out as per NBC. The treated water from STP's is proposed to be utilized for various non-potable water demands. The calculations are based on prevalent standards as per URDPFI and CPHEEO standards.

Table 2-24: Potable water demand assessment

Particulars	T1	T2	T3	T4	Total
Potable Water Requirements (MLD)					
Industrial (at 30 KLD/Ha)	4.23	0.70	0.49	0.00	5.42
Residential (at 105 lpcd)	3.27	0.45	0.45	3.50	7.67
Industrial & Commercial Workers (at 50 lpcd)	3.84	1.25	0.98	1.37	7.45

The Table 2-24: Potable water demand assessment reflects that the total potable water demand for the industrial area, residential area and industrial and commercial workers is 5.42, 7.67 and 7.45 MLD respectively.

Table 2-25: Non-potable water demand assessment

Particulars	T1	T2	T3	T4	Total
Non-Potable Water Requirements (MLD)					
Industrial & Commercial Workers (at 30 lpcd)	2.31	0.75	0.59	0.82	4.47
Residential (at 45 lpcd)	1.40	0.19	0.19	1.50	3.29
HVAC	7.18	1.48	0.97	0.68	10.30

The Table 2-255 reflects that the total non-potable demand for the industrial and commercial workers, residential workers and HVAC requirement is 4.47, 3.29 and 10.30 MLD.

The water demands as arrived for potable water and non-potable water for Industrial, Commercial and Residential are totaled to arrive at the total water requirement for all the developments planned at OSC. The total Water Demand includes water supply requirements for Residential, Industrial and Commercial areas proposed in the four land parcels – T1, T2, T3 and T4. This will provide the total water requirement for the OSC for the future years.

The summary of water demand assessment is given below in Table 2-266 below:

Table 2-26 : Summary of water demand assessment

Land Parcel	Total Potable Water (MLD)	Total Non-Potable Water (MLD)	Total Water Demand (MLD)
T1	11.34	10.89	22.23
T2	2.40	2.42	4.82
T3	1.92	1.75	3.67
T4	4.87	3.01	7.88
Total	20.54	18.06	38.60

The total water demand is 38.60 MLD which includes potable water demand of 20.54 MLD and non-potable demand of about 18.60 MLD.

2.23 Available Infrastructure and Proposed Infrastructure

Available Infrastructure

Hetawane Dam

Hetawane reservoir on the upstream of medium size earthen dam about 6.00 km from T1 parcel of OSC, is the potential water source for the proposed development. The dam project was completed in year 2000, by the water resources department, Konkan region. The project falls under the purview of North Konkan Irrigation Project Circle. The usable storage capacity of the Dam is about 145million meter cube. Currently water is supplied for irrigation and about 150 MLD to CIDCO Navi Mumbai. A 2 MW hydro-electric plant is also currently operational at dam site.

CIDCO 150 MLD raw water supply line (1500 & 1200 mm diameter) runs partly along Sh-88 that is Pen-Khopoli road. The water drawn from Hetawane dam is treated at the Water Treatment Plant of capacity 150 MLD located near Jite and then the treated water is supplied to Navi-Mumbai.

Balganga Dam

Balganga dam is under construction, approx. 4 km north of parcel T4. The project is likely to be completed by 2026. The dam will have the capacity to supply water at 350 MLD.

Proposed Infrastructure

2.23.1 Water supply Infrastructure

The primary water source for Orange Smart City is the Hetawane reservoir. Facilities for each land parcel are proposed separately/ decentralized system. A dedicated water supply line from Hetawane reservoir to the T1 Site of OSC site is being proposed along the existing alignment. A dedicated conveyance system has been considered from Hetawane Dam to T1 Site.

Water Transmission from CIDCO pipe line to WTP at T1 of about 750 diameter pipe with tapping length of about 3000 m is proposed. Water Treatment Plant (total 20 MLD) including SCADA system is proposed at T1 Site. Clear water reservoir (GSR) and Clear water pumping station from WTP with intermediate pumping stations is also proposed to ensure continuous supply of water without any disturbance. Water Distribution is planned through gravity from individual GSR to respective parcel. Smart metering system for the entire project site is also planned.

The JITE WTP is near to T3; T4 & T2 Site of OSC. Also, a new supply line is planned to be laid upto Jite WTP from Hetawane Dam. For external water supply to these 3 sites of OSC, it is proposed to lay a separate water supply line from Jite Water Treatment Plant following the existing road alignment. The 500 mm diameter pipe with tapping length of about 5500 m is proposed to be laid along the existing road alignment / elevated corridor alignment.

Water Treatment Plant is proposed on each respective site (T2; T3 & T4) including SCADA system for the total demand. It will also house Clear water reservoir (GSR) and Clear water pumping station having intermediate pumping stations. Water Distribution from individual GSR to respective parcel is proposed through gravity system. The entire system is planned with smart metering. The distribution system would cater gross water demand required during regular operation and critical demand during maintenance period. The water supply infrastructure is given in Table 2-277 below:

Table 2-27: Water supply infrastructure

Land Parcel	No. of WTP's	Area of WTP (sq mtr)
T1	1	10000
T2	1	2500
T3	1	2500
T4	1	2500
Total	4	17500

The water supply infrastructure is given below in Figure 2-24.

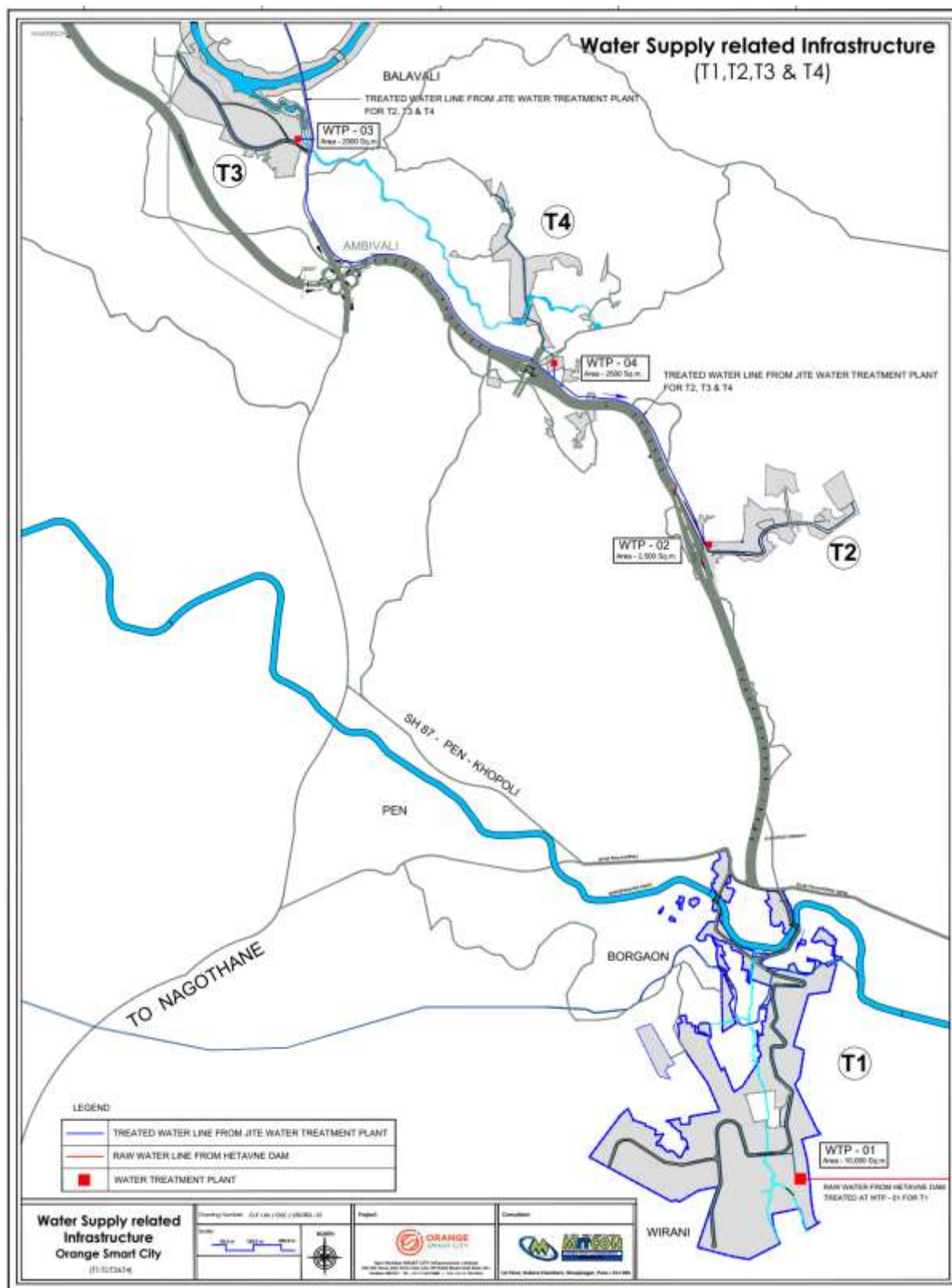


Figure 2-24: Water supply infrastructure

2.23.2 Wastewater Infrastructure

The wastewater system will consist of collection, treatment, and reuse of wastewater for OSC requirement. Wastewater will be collected and conveyed to the Sewage Treatment Plant (STP). The treated water would be used for Flushing, Landscaping and as Make-up Water for District Cooling Towers.

The waste water generated from within OSC will be treated as per international standards and local pollution control board's norms. This recycled water can be used for flushing, gardening and other non-potable water demands. As prescribed in CPHEEO manual, it is assumed that 80% of water actually supplied at consumer end for domestic use and 60% of water supplied to industries shall be generated as waste water. As OSC is a green field development project there is no existing Sewage Treatment Facility available within OSC Site.

Estimation of Sewage Flow

The Waste Water Generation for OSC project has been calculated on the basis of the proposed land use in all four parcels – T1, T2, T3 and T4. The calculations are based on prevalent standards as per URDPFI and CPHEEO standards. The Waste Water Generation for Industrial areas is as follows. Table 2-28: Waste Water Generation from Industrial Processing

Table 2-28: Waste Water Generation from Industrial Processing

Land Parcel	Total Plot Area (In Acres)	Net Industrial Area (In Acres)	Total Water Demand (MLD) (At 30KLD/ Ha)	Sewage Generation (60% of Water Demand) (MLD)
T1	723.33	282.00	4.23	2.54
T2	102.40	58.00	0.70	0.42
T3	83.59	40.00	0.49	0.29
T4	133.19	0.00	0.00	0.00
Total	1042.51	380.00	5.42	3.25

Table 2-29: Waste water generation from Commercial worker usage

Land Parcel	Total Plot Area (In Acres)	Commercial Area (In Acres)	Estimated Working Population	Total Water Demand (MLD)	Sewage Generation (80% of Water Demand) (MLD)
T1	723.33	38	26831	2.15	1.72
T2	102.40	8	5509	0.44	0.35
T3	83.59	2	1680	0.13	0.11
T4	133.19	39	27461	2.20	1.76
Total	1042.51	88	61481	4.92	3.93

The waste water generation from the residential areas is presented below:

Table 2-30: Waste water generation from residential areas

Land Parcel	Total Plot Area (In Acres)	Residential Area (In Acres)	Estimated Resident Population	Total Water Demand (MLD)	Sewage Generation (80% of Water Demand) (MLD)
T1	723.33	58	31161	4.67	3.74
T2	102.40	8	4298	0.64	0.52
T3	83.59	8	4298	0.64	0.52
T4	133.19	62	33310	5.00	4.00
Total	1042.51	136	73068	10.96	8.77

The total waste water generation from residential area is 8.77 MLD.

The Table 2-31 reflects that the Total Waste Water Generation for the OSC project is approximately 21.56 MLD. The total Waste Water Generation includes waste water generated from Residential, Industrial and commercial areas proposed in the four land parcels – T1, T2, T3 and T4.

Table 2-31: Summary of Total Sewage Generation

Land Parcel	Total Water Demand (MLD)	Total Sewage Generation (MLD)
T1	22.23	11.20
T2	4.82	2.54
T3	3.67	2.07
T4	7.88	5.75
Total	38.60	21.56

Wastewater Treatment Facilities

The amount of waste water generated in the four land parcels has been calculated on the basis of the prevalent CPHEEO norms and other relevant guidelines and by-laws. Looking at the geographical conditions and expanse of the four land parcels, the topography will play a crucial role in the working of the entire waste water management system. Focus is on optimizing the use of the topographical conditions. The waste water conveyance system is mostly planned on the gravitational flow and attempts to reduce the number of pumping stations in the overall project. The waste water conveyance facilities, waste water collection and treatment facilities are proposed in a decentralized manner limiting to each individual site of OSC.

Sewage treatment Plant including SCADA system is planned in each site of OSC with well-planned sewerage network. Intermediate sewage pumping stations are also proposed at suitable location. All the individual sites are planned with treated water tank and treated water pumping station next to STP's.

Waste water will be treated in STPs and recycled for non-potable water demands like flushing, gardening, HVAC etc. Total treated water supply will be around 35 MLD. The infrastructure related to the sewage management is given in Table 2-32.

Table 2-32: Proposed STP details

Land Parcel	Underground Drains (In kms)	No. of STP's (Area of 3600 m² each)
T1	4.9	1
T2	2.2	1
T3	2.65	1
T4	1.8	1
Total	11.55	4

At present the industries proposed in OSC all are less-polluting. No proposed industry is in red category. Hence, it is assumed that effluent generated is very less and individual ETP at each industry level is proposed which will implement zero effluent discharge norms. The map depicting sewage treatment infrastructure is given below in Figure 2-25.

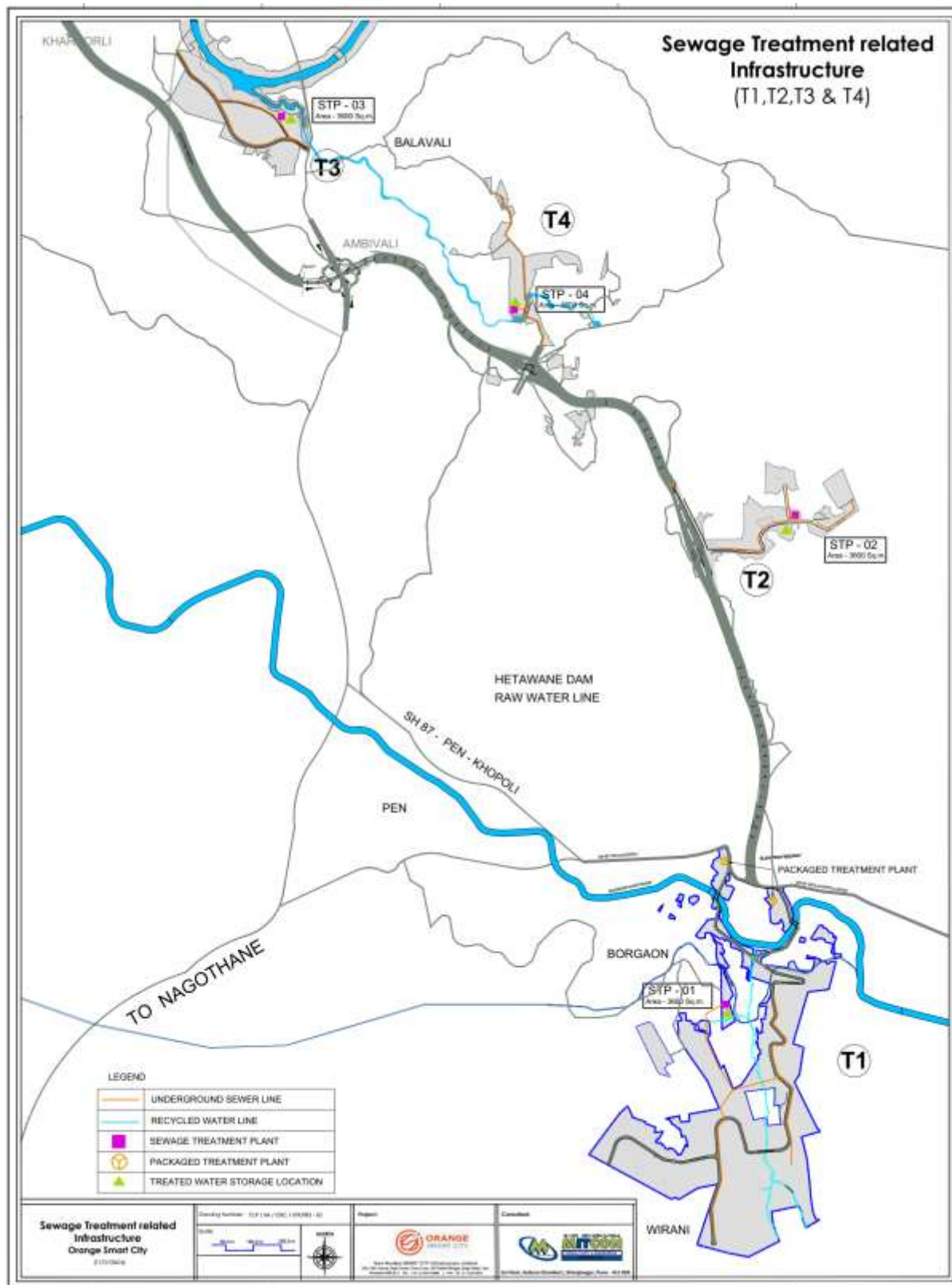


Figure 2-25: Sewage treatment infrastructure details

Water Balance Diagram

The water balance diagram is given below in Figure 2-26.

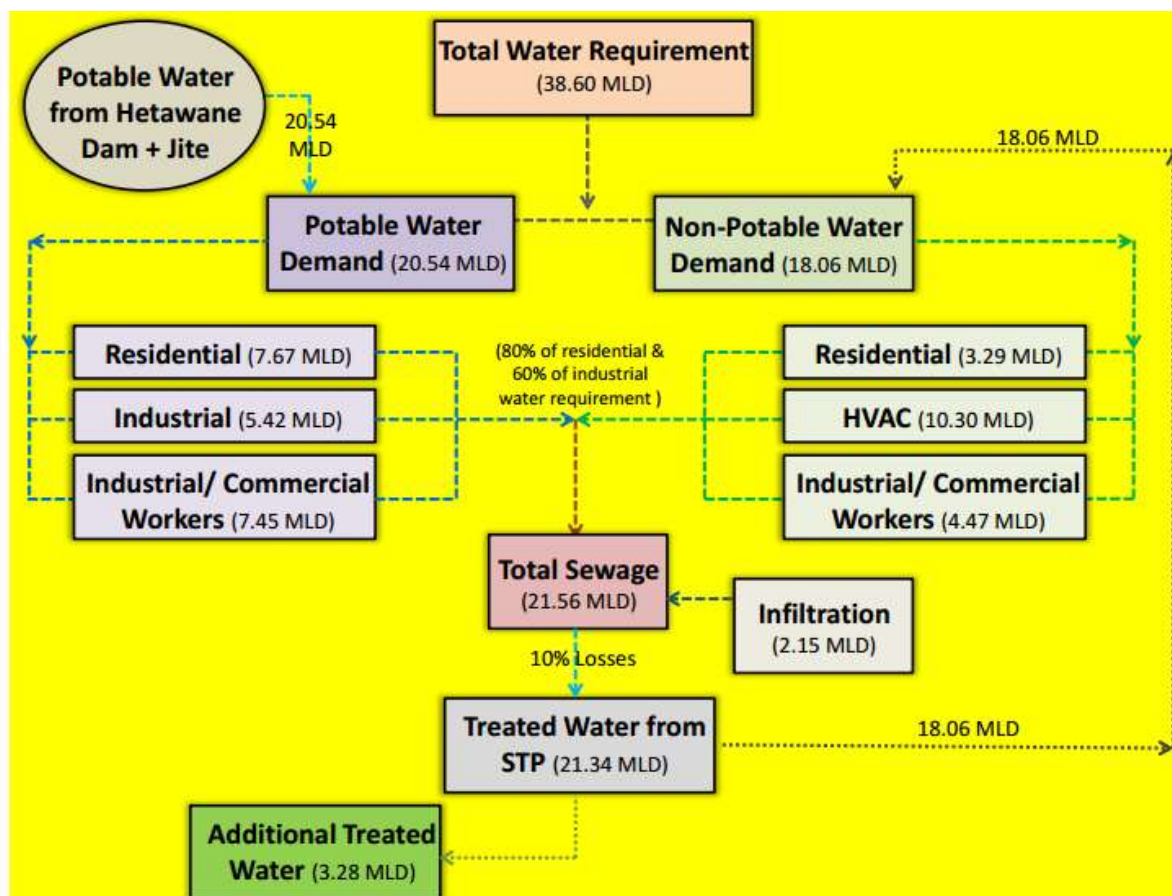


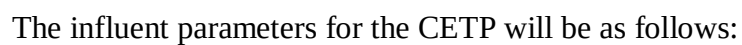
Figure 2-26: Water balance diagram

It is proposed that the water treated from the STP's will be used for all non-potable water uses such as HVAC, horticulture, flushing, etc. minimizing the need for treated potable water. The water balance diagram suggests that additional treated water of 3.28 MLD will be generated.

2.23.3 Common Effluent Treatment Plant

A CETP of capacity 2 MLD along with Multieffect evaporator is proposed for treatment of effluents from category 'A' industries for the project of Orange Smart City in an area of 3 acres excluding the buffer zone.

The map depicting the location of the CETP in the T1 land parcel is shown below:



Sr. No	Parameters	Standards considered for the design of CETP
		Limiting concentration in mg/lit except for pH and temperature
1	pH	7-8
2	Total dissolved solids	2100
3	Suspended solids	600
4	COD	1000
5	BOD	700
6	Total Nitrogen	80
7	Total Phosphorus	10
8	Chlorides	600
9	Sulphate	1000
10	Total Oil (free + emulsified)	350 ppm
11	(a) Free Oil	100 ppm
12	(b) Emulsified Oil	250 ppm
13	Iron	5
14	Arsenic	0.5
15	Cadmium	0.5
16	Lead	1
17	Copper	3
18	Zinc	15
19	Nickel	3
20	Mercury	0.02
21	Selenium	0.1

Sr. No	Parameters	Standards considered for the design of CETP
		Limiting concentration in mg/lit except for pH and temperature
22	Chromium	1
23	Hexavalent Chromium	0.1
24	Cyanide	0.1

The treated effluent parameters for the CETP to be maintained by operator will confirm to the CPCB norms as mentioned in section below:

CPCB Norms for discharge of the treated effluent from CETP

		Max. permissible values (in milligram/litre except for pH and Temperature)		
Sr.No	General Parameters	Into inland surface water	On land for irrigation	Into sea
1	pH	6-9	6-9	6-9
2	Biological Oxygen Demand, BOD ₃ , 27 o C	30	100	100
3	Chemical Oxygen Demand (COD)	250	250	250 *
4	Total Suspended Solids (TSS)	100	100	100
5	Fixed Dissolved Solids (FDS)	2100**	2100**	NS
6	Temperature, o C	Shall not exceed more than 5oC above ambient water temperature	Shall not exceed more than 5oC above ambient water temperature	Shall not exceed more than 5oC above ambient water temperature
7	Oil & Grease	10	10	10
8	Ammonical –Nitrogen	50	NS	50

Sr.No	General Parameters	Max. permissible values (in milligram/litre except for pH and Temperature)		
		Into inland surface water	On land for irrigation	Into sea
9	Total Kjeldahl Nitrogen (TKN)	50	NS	50
10	Nitrate- Nitrogen	10	NS	50
11	Phosphates, as P	5	NS	NS
12	Chlorides	1000	1000	NS
13	Sulphates, as SO ₄	1000	1000	NS
14	Flouride	2	2	15
15	Sulphides, as S	2	2	5
16	Phenolic compounds (as C ₆ H ₅ OH)	1	1	5
17	Total Res. Chlorine	1	1	1
18	Zinc	5	15	15
19	Iron	3	3	3
20	Copper	3	3	3
21	Trivalent Chromium	2	2	2
22	Manganese	2	NS	2
23	Nickel	3	NS	3
24	Arsenic	0.2	NS	0.2
25	Cyanide as CN	0.2	NS	0.2
26	Vanadium	0.2	NS	0.2
27	Lead	0.1	NS	0.1
28	Hexavalent Chromium	0.1	NS	0.1

		Max. permissible values (in milligram/litre except for pH and Temperature)		
Sr.No	General Parameters	Into inland surface water	On land for irrigation	Into sea
29	Selenium	0.05	NS	0.05
30	Cadmium	0.05	NS	0.05
31	Mercury	0.01	NS	0.01
32	Bioassay test	As per industry specific standards	As per industry specific standards	As per industry specific standards

Notes : NS – Not specified

*Discharge of treated effluent into sea shall be through proper marine outfall. The existing shore discharges shall be converted to marine outfalls. In cases where the marine outfall provides a minimum initial dilution of 150 times at the point of discharge and a minimum dilution of 1500 times at a point 100 m away from discharge point, then, the State Board may relax the Chemical Oxygen Demand (COD) limit: Provided that the maximum permissible value for Chemical Oxygen Demand (COD) in treated effluent shall be 500 milligram/litre

**Maximum permissible Fixed Dissolved Solids (FDS) contribution by constituent units of a Common Effluent Treatment Plant (CETP) shall be 1000 milligram/litre. In cases where Fixed Dissolved Solids (FDS) concentration in raw water used by the constituent units is already high (i.e. it is more than 1100 milligram/litre) then the maximum permissible value for Fixed Dissolved Solids (FDS) in treated effluent shall be accordingly modified by the State Board.

In case of discharge of treated effluent on land for irrigation, the impact on soil and groundwater quality shall be monitored twice a year (pre- and post-monsoon) by Common Effluent Treatment Plants (CETP) management. For combined discharge of treated effluent and sewage on land for irrigation, the mixing ratio with sewage shall be prescribed by State Board.

Cost of the CETP

The bifurcation of the capital cost of CETP is presented in section below:

Sr. No	Item	Capital cost Cost (Rs. Crore)
1.	For the 2MLD CETP	2
2.	Additional Cost for CETP (10%)	0.2
3	ZLD cost	3

	Total	5.2

Operation and Maintenance cost for the CETP : Rs. 6 lakhs per annum

Mandatory permissions for setting up the CETP : The operator of the CETP will seek separate environmental clearance for establishing the CETP as per the EIA Notification 2006 and its amendments thereof.

2.24 Storm water drainage system, rain water harvesting and storage facilities

The four land parcels in the project have a unique topography. The land parcel T1 has the most promising topography. Relatively the land parcels T2, T3 and T4 are flat plain lands. The T1 site has natural drains which will drain the rainfall received to the adjoining Bhogeshwari River.

The conveyance facilities for the storm water is designed to avoid instances of water logging, preserve water, and conserve soil. The rainfall data for past couple of decades has been considered for working out storm water drainage details. Rainwater harvesting is proposed and judiciously planned in all parcels of OSC.

The proposed development at OSC ensures that no disturbances will be caused to the existing natural drainage system, hence for crossings over these drains is made by box culverts, pipe culverts and bridges depending upon flow and topography.

As per IMD, the average annual rainfall for the Raigad district as a whole is 3,028.9 mm. The suggested maximum rainfall in 24 hours for 100 years return period comes as 878.1 mm. So, the critical intensity of rainfall as per IMD recommendations is $= 0.16 \times 878.1 = 140.49$ mm per hour.

The co-efficient of runoff is the portion of precipitation that makes its way to the drain. Its value depends upon, permeability of the surface, type of ground cover, shape and size of catchment area, the topography and geology. As per recommendation of IRC-SP-50, the following values have to be adopted for the design of storm water drains.

- Residential Area: 0.60
- Industrial Area: 0.55
- Open / Parks: 0.15
- Roads: 0.90

In general, the drainage of the area is from South East (where high hills are seen) towards the North Western side.

The Storm water drainage system is provided to drain the rain water within the project area. Due care has to be taken during designing of the drainage system, that the drains flow along the natural slope of ground, to avoid unwanted earth work during construction. The map depicting the storm water channels is given in

Figure 2-27. The rain water harvesting will be done through the detention ponds catering to 1 day run-off and then it will be made mandatory for all the individual plot owners to implement rainwater harvesting at the plot level.

The post project run off calculations are given in the section below :

	Area (Sq.Mtr)	Rainfall (m)	Runoff Co-Eff	Total Yearly Rainfall (Cu.Mtr)
T1	1053055	3.492	0.9	3309540
T2	202021	3.492	0.9	634912
T3	141645	3.492	0.9	445162
T4	276258	3.492	0.9	868225
Total	1672979	3.492	0.9	5257839

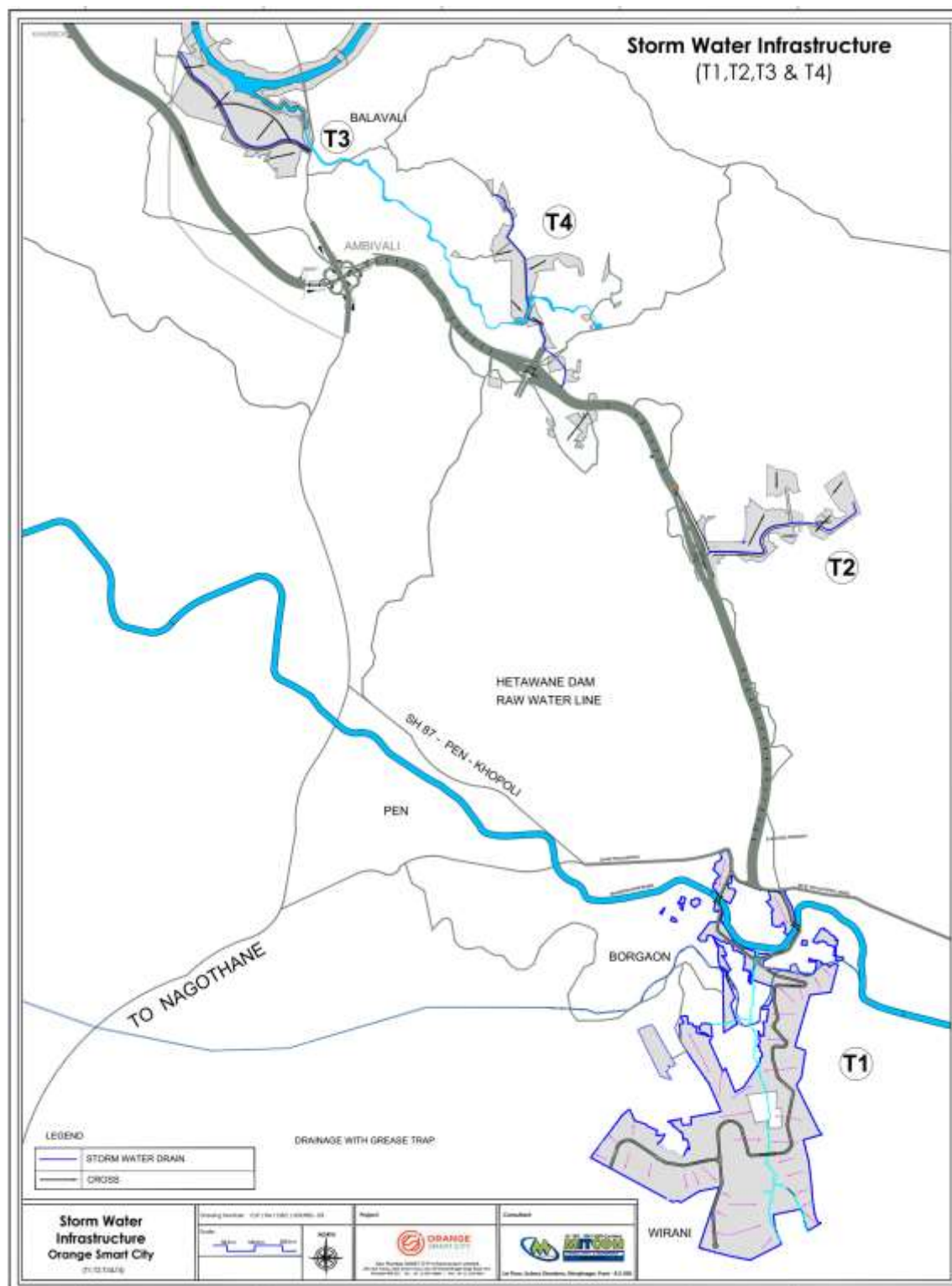


Figure 2-27: Storm water channels

2.25 Power Infrastructure

Estimated Electricity Requirements:

The Electricity Demand Assessment for OSC project has been calculated on the basis of the proposed land use in all four parcels – T1, T2, T3 and T4. The calculations are based on prevalent standards as per MSEDCL and MIDC standards. The Electricity Demand Assessment for Industrial, Commercial, Residential, amenities and Recreational areas is presented in Tables 2-33 to Table 2-36 below.

Table 2-33 : Electricity Requirements for Industrial Areas

Land Parcel	Total Plot Area (Acres)	Built Up Area (m ²)	Load Density (45W/m ²)	Diversity factor (0.35 for Industrial)	Electricity Demand (Watts)	Electricity Demand (MVA)
T1	723.33	2282508	102712860	0.35	35949501	39.90
T2	102.40	469452	21125340	0.35	7393869	8.21
T3	83.59	323760	14569200	0.35	5099220	5.66
T4	133.19	0	0	0.35	0	0.00
Total	1042.51	3075720	138407400		48442590	53.77

Total Electricity Requirement in Industrial Areas is 53.77 MVA.

Table 2-34 : Electricity requirements for commercial areas

Land Parcel	Total Plot Area (Acres)	Built Up Area (m ²)	Load Density (100W/m ²)	Diversity Factor (0.65 for Commercial)	Electricity Demand (Watts)	Electricity Demand (MVA)
T1	723.33	310243	31024302	0.65	20165796	22.38
T2	102.40	63700	6369978	0.65	4140486	4.60
T3	83.59	19426	1942560	0.65	1262664	1.40
T4	133.19	317528	31752762	0.65	20639295	22.91
Total	1042.51	710896	71089602		46208241	51.29

Total Electricity Requirement in Commercial Areas is 51.29 MVA.

Table 2-35 : Electricity requirements for residential areas

Land Parcel	Total Plot Area (Acres)	Built Up Area (m ²)	Load Density (75W/ m ²)	Diversity Factor (0.4 for Residential)	Electricity Demand (Watts)	Electricity Demand (MVA)
T1	723.33	469452	35208900	0.4	14083560	15.63
T2	102.40	64752	4856400	0.4	1942560	2.16

T3	83.59	64752	4856400	0.4	1942560	2.16
T4	133.19	501828	37637100	0.4	15054840	16.71
Total	1042.51	1100784.00	82558800		33023520	36.66

Total Electricity Requirement in Residential Areas is 36.6 MVA.

Table 2-36: Electricity requirements for amenity and utilities areas

Land Parcel	Total Plot Area (Acres)	Built Up Area (m²)	Load Density (45W/ m²)	Diversity Factor (0.40 for Amenities)	Electricity Demand (Watts)	Electricity Demand (MVA)
T1	723.33	15379	692037	0.40	276815	0.31
T2	102.40	2428	109269	0.40	43708	0.05
T3	83.59	2266	101984	0.40	40794	0.05
T4	133.19	3234	145510	0.40	58204	0.06
Total	1042.51	23307	1048800		419520	0.47

Total Electricity Requirement in Amenity + Utility Areas is 0.47 MVA.

The total Electricity Requirement for the OSC project is approximately 142 MVA. The total electricity requirements include electricity demand for Residential, Industrial and commercial areas proposed in the four sites of OSC i.e. T1, T2, T3 and T4.

2.25.1 Proposed Electrical Infrastructure

It is proposed to have two feeders of 100 kV to ensure more reliable supply from NAMCO substation to the T1 Site. The Power supply at T1 parcel will be provided through different level by stepping down the incoming voltage, the various levels are:

- Main receiving substation (MRSS)
- Distribution substation (DSS)

The power supply at 100kV voltage level from NAMCO substation will be stepped down to 22kV at MRSS which is located at T1 parcel through Power transformer. As per M/S MSEDCL Circular CE (Dist)/D-III /Req. of level of land/28792 dated 17.07.2015, at 22kV voltage level the maximum load allowed is 20 MVA.

Considering the total demand of T1 Site 2 No's of DSS are proposed. At DSS level 22kV voltage will be stepped down to 11kV. Further the voltage level from 11kV will be stepped down to 0.415kV at cluster level substation, the cluster level substation will have Ring main unit of 3 MVA load at 11kV voltage level.

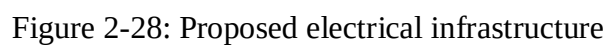
The Power connectivity between MRSS to DSS at T1 Parcel will be done through underground cable and overhead line as per requirements and site condition. And the Power connectivity between DSS to each parcel level substation will be done through underground cable. Also, the backup power shall be provided by using DG sets in case of power outages.

Considering the total power requirement for T2, T3 & T4 sites, a substation is proposed on each site having connection from existing Receiving station at JITE. It is proposed to have two feeders of 22kV lines for each DSS for reliable supply through overhead lines and further the distribution inside the sites will be carried out underground cable. At Sub Station level 22kV voltage will be step down to 11kV. The area requirements for the Substation in each parcel are shown in Table 2-37.

Table 2-37 : Parcel wise sub-stations with Area requirements

Parcel	Substation	Area (m²)
T1	MRSS	8000
T1	DSS 1	1500
T1	DSS 2	1500
T2	Sub Station	1500
T3	Sub Station	1500
T4	Sub Station	1500

The map depicting proposed electrical infrastructure is given in Figure 2-28: Proposed electrical infrastructure.



2.26 Street Lighting system

LED luminaries of various ratings are proposed for the street lighting to have energy efficient system. The lux level has been considered as per IS1944. The street lights shall be controlled from outdoor street light DB with 4Pole RCBO incomer, LT Tariff meter, power contactor for switching ON/ OFF the lights and MCB outgoings for distribution.

A Centralized Smart Street lighting control system is proposed for monitoring and control of the street lights throughout the project area. The centralized lighting management system is a complete web-based solution with advanced communication facilitating remote control and monitoring of the entire street lighting system. The system shall be modular and easily scalable. The centralized solution shall provide on/off control for burn hour optimization; to simplify maintenance and remote operation. Programming shall be enabled remotely and can be changed at any time. The ON / OFF times shall be optimized for the different daylight hours every day for energy optimization based on the sunrise and sunset times.

The Centralized Lighting management system shall consist of a RF capable nodal device to be installed on each pole and a Gateway device with microcontroller that has both RF and GPRS capability installed in the Street light Feeder Pillars which can control no. of luminaries. The Feeder Pillar monitoring configurations shall be enabled remotely and can be changed at any time. Power supply voltage input to Feeder Pillars shall be made available from the CSS LT panels/ LT Feeder Pillars as the case may be. All alarm/fault detection events shall be logged and available for reporting and analysis.

2.27 Smart Initiatives

Smart initiatives in urban areas with the help of information and communication technologies help solve specific problems and support sustainable development in social, economic and / or environmental terms. Smart initiatives enhance quality, performance and interactivity of urban services, reduce costs and resource consumption.

- Few initiatives which can be taken in the power supply system are:
- Implementation of SMART GRID feature for better power management
- Generation of power through sustainable means from renewable sources

2.28 Smart Grid

A smart grid is an electrical grid which includes a variety of operational and energy measures including smart meters, smart appliances and energy efficiency resources. The traditional electric grid will need to build additional layers of automation, communication and IT systems to transform it to a smarter grid. Some of the applications or building blocks of a smart grid include:

- Advanced Metering Infrastructure (AMI) with two-way communication and Meter Data Management Systems,
- Distribution Management Systems (DMS),
- Fault Detection, Isolation & Restoration (FDIR) System.
- Outage Management Systems (OMS),
- Geographical Information Systems (GIS) – mapping of electrical network assets and consumers on geospatial maps,

- Automation of the substations with modern switchgear and numerical relays,
- Substation Automation System - Supervisory Control and Data Acquisition Systems (SCADA)
- Enterprise IT network covering all substations and field offices with reliable communication systems,
- Electronic billing systems and customer care systems,
- Mobile Crew Management Systems,
- Wide Area Measurement and Control Systems,
- Enterprise Resource Planning (ERP)/Asset Management Systems,
- Enterprise Application Integration; and
- Analytics.

The above list is focused on applications and systems, i.e., enablers. From a functionality point of view, one might aim for variable or dynamic tariffs, renewable integration, etc.

2.28.1 Smart Grid system shall include the following;

Connectivity with the State Load Dispatch Centre (SLDC) for the exchange of information regarding Load Management & Forecast, AT&C losses, Outages etc. for township/ city. The system shall be compatible with the existing IT/ ERP systems of the Utility Supply Company.

The proposed system shall be capable of Data acquisition, validation, processing, and data archiving/ storage of the electrical network within city in order to control and manage the Load including forecasting and outages, billing, and interface with end consumers through various portals.

The system shall be capable to interface with the Substation Automation system appropriately for On-line monitoring, controlling and operation of the network elements and parameters to achieve optimal results and fulfilment of the scope objective.

2.29 Solid waste handling system

The objective of solid waste management or handling for the development is to manage waste generation, storage, collection, transportation, treatment and disposal of solid waste in a manner that is in accordance with the best principles of public health, economics, engineering, aesthetics, and other environmental considerations. The sources of solid waste are residential units, industrial units, offices, and commercial establishment, parks and logistics areas. Solid waste generated from these sources will be collected and handled as per the CPHEEO norms.

As OSC is a green field development project there are no existing Solid Waste Treatment Facilities available on the proposed land parcel.

The proposed solid waste management system is derived on the basis of analysis of different functions of waste management system and aimed to improve the value of the project through adaptation of an advanced system. The value improvements for the proposed system includes minimizing human intervention in the process, reduce adverse environmental & health impacts, reduce traffic inconvenience, improving the aesthetic value, cost economics in the long run.

2.29.1 Solid waste management planned

The waste generation units envisaged for OSC includes, Industrial, commercial and residential development and its associated facilities. The waste generated from the above facility sectors/sources are broadly categorized as follows;

- Biodegradable Waste: Food and kitchen waste, green waste (vegetables, flowers, leaves, fruits), paper (can also be recycled).
- Recyclable Material: Paper, glass, bottles, cans, metals, certain plastics, tyres, tubes etc.
- Inert Waste: Construction and demolition waste, dirt, rocks, debris.
- Composite Wastes: waste clothing, tetra packs, waste plastics such as toys.
- Domestic Hazardous Waste (also called “Household Hazardous Waste”) & Toxic Waste: Medications, e-waste, paints, chemicals, light bulbs, fluorescent tubes, spray cans, fertilizer and pesticide containers, batteries, shoe polish.

In the present initiative, it is proposed to have the waste segregation process at source, provide separate colour bins / drop boxes to facilitate the users, collect and segregate in scientific manner, adopt 3R approach in waste management process. Based on the Land use planning; it is proposed to have decentralized waste collection centres to have effective solid waste management system.

2.29.2 Estimation of solid waste quantity for future years

Based on the data of solid waste generation from proposed land uses, detailed estimation has been carried out for solid waste generation quantity from different facilities i.e. industrial, commercial / Office Spaces, Residential, Retail and F&B, Entertainment, Health Care and Educational Institutions, Cultural & Event Spaces, Pedestrian Plaza, Transport Facilities. Industrial process waste has also been projected as per CPHEEO norms. Solid Waste Generation norms are given in the Table 2-38 below:

Table 2-38 : Solid Waste Generation Norms considered

Sr. No.	Source Type	Generation (Kg/Capita/Day)
1	Residential Population	0.4
2	Industrial Population	0.15

The Solid Waste Generation for OSC project has been calculated on the basis of the proposed land use in all four parcels – T1, T2, T3 and T4. The calculations are based on prevalent standards as per URDPFI and CPHEEO standards. The Solid Waste Generation in different areas are presented in Table 2-39 to Table 2-41.

Table 2-39: Solid Waste Generation in Industrial Areas

Land Parcel	Total Plot Area (In Acres)	Industrial Area (In Acres)	Estimated Working Population	Total Waste Generation (Tonnes) (At 150 gms/capita/day)
T1	723.33	282	50045	7.51
T2	102.40	58	19473	2.92
T3	83.59	40	18003	2.70
T4	133.19	0	0	0.00
Total	1042.51	380	87521	13.13

Total Solid Waste Generation in Industrial Areas is 13.3 Tonnes per Day.

Similarly, the Solid Waste Generation in Residential Areas has been calculated in the Table 2-40.

Table 2-40 : Solid Waste Generation in residential areas

Land Parcel	Total Plot Area (In Acres)	Residential Area (In Acres)	Estimated Resident Population	Total Waste Generation (Tonnes) (At 400 gms/capita/day)
T1	723.33	58	31161	12.46
T2	102.40	8	4298	1.72
T3	83.59	8	4298	1.72
T4	133.19	62	33310	13.32
Total	1042.51	136	73068	29.23

Total Solid Waste Generation in Residential Areas is 29.23 Tonnes per Day.

Table 2-41: Solid Waste Generation in commercial areas

Land Parcel	Total Plot Area (In Acres)	Commercial Area (In Acres)	Estimated Working Population	Total Waste Generation (Tonnes) (At 150 gms/capita/day)
T1	723.33	38.33	26831	4.02
T2	102.40	7.87	5509	0.83
T3	83.59	2.40	1680	0.25
T4	133.19	39.23	27461	4.12
Total	1042.51	87.83	61481	9.22

Total Solid Waste Generation in Commercial Areas is 9.22 Tonnes per Day

Total Solid Waste Generation for the OSC project is approximately 51.58 Tonnes/Day. The total Solid Waste Generation includes solid waste generated from Residential, Industrial and commercial areas proposed in the four land parcels – T1, T2, T3 and T4.

2.29.3 Methodology for solid waste management

The general methodology for Solid Waste Management is as follows.

Identification of Waste Generation Sources and Collection & review of existing data available with the project proponent and other concerned departments about the inventory of:

- Type and size wise Industrial establishments in OSC
- Type and number of households and residential development planned
- Category and size wise commercial, recreational and institutional establishments and major centres.
- Type and size wise commercial establishments / markets
- Intensity and location of construction activities
- Hospital, clinics and other health care facilities
- Open spaces and parks
- Hierarchy and inventory of road.

Waste Quantification and characterization

Estimation of quantum of solid waste generated and its characteristics assume great significance for identifying the most suitable collection, conveyance, treatment and disposal options. To assess the waste generation, a comprehensive desk research will be undertaken to develop key indicators of various types of waste sources such as, residential, commercial and institutional, recreational, roads, construction and other utilities etc. The following tasks would be performed to ascertain the same:

- Assess the present MSW quantities and characteristics based on primary field assessments and validation with data available from secondary sources (CPHEEO manual, etc.);
- Estimate different categories of waste and assessment of total quantum of waste generated category wise.
- The construction and demolition waste, street sweeping, waste from parks etc. shall also be assessed using suitable quantification techniques.
- The hazardous waste and e-waste shall be quantified based on population estimation in OSC.
- Characterization and categorization – biodegradable, recyclable, inert, and domestic hazardous
- Establish future generation trends by projecting the population and per capita generation rate for the reference year.

Solid Waste Management Conceptual Plan

- Based on the outputs derived from various tasks discussed above, a solid waste management plan has been prepared. The management plan essentially consists of specific proposals for improving various facets of solid waste management, phased implementation schedule and cost estimates for the proposed measures. The following tasks shall be undertaken:
 - Review of the environmental, physical, social and economic conditions of all the sites of OSC.

- Integrate the Industrial solid waste with the Commercial and Residential waste management system.
- Technical viability of the different technologies of solid waste management considering the existing Waste Quantity & Quality, requirement for waste segregation, primary and secondary storage and collection and waste treatment as described below.

Waste Segregation & Storage

The segregated waste is packed perfectly before transporting for recycling to avoid any spillage and other inconveniences. The waste is weighed and transported to the statutory authorized recycling agency for complete recycling of waste generated. The complete recycling of waste is continuously monitored and recycled up to end products production like bio fertilizers, construction blocks and raw bituminous for construction of roads. The following tasks would be performed to ascertain the same:

- Modalities of storing waste at source & plan for source segregation
- Develop waste minimization & recycling strategy including implementation options.

Primary Collection

All bins with nomenclature have been provided to ease the user to drop the waste into suitable bins. The filled bins are collected in scientific manner and transferred to solid waste collection centre for further segregation and packing after weighing. The color codes and nomenclature represented shown in the Figure 2-29 below have been used in OSC. The following tasks would be performed to ascertain the same.



Figure 2-29: Primary waste collection bins and codes

Secondary Storage / Collection

- Planning and design of transfer stations / collection points for secondary/intermediate storage
- Develop efficient collection and transportation of waste
- Identification of vehicles for collection of different categorization of waste
- Design of vehicle routing and collection schedule.

Waste Collection Centre

- The waste collection centre is constructed to handle the waste generated in OSC by means of scientific method of segregation and recycling. The waste collection centre is constructed in environment friendly manner as listed below:
- The roof top of the waste collection centre is fixed with transparent roof for natural light illumination due to which the activities at waste collection centre takes place without light during day time. The main idea of this structure is to save power.
- The activities at waste collection centre are planned in day time only.
- The exhaust to clear off all the waste smell elimination in the waste collection centre is of natural wind operational type exhaust fan where the power is not require running the exhaust. The exhaust fans runs on wind energy.
- The platform of the waste collection centre is raised by 10 ft. from ground level in order to avoid any rain water entry or animals.



Figure 2-30 : Waste Processing Centre

Waste Processing, Treatment and Disposal of Waste

The completely segregated and packed solid waste transferred by good transport vehicle to statutory authorized agency for complete recycling after the quantity measurement. The complete scientific method of recycling is ensured and continuously monitored. The plastic waste is recycled for production of bituminous, the paper and other waste are recycled as bio fertilizer and wet waste is recycled as bio gas generation.

The end products like bio fertilizers and concrete blocks from OSC solid waste is again utilized by OSC on agreed terms and conditions with the agency in various field like irrigation and construction works. The sludge generated in OSC STP is also used as fertilizer for landscaping after de-composting in earth pits.

Disposal of solid waste shall be made at the designated site prescribed by Pollution Control Board.

The map depicting solid waste infrastructure is given in Figure 2-31: Map depicting solid waste infrastructure

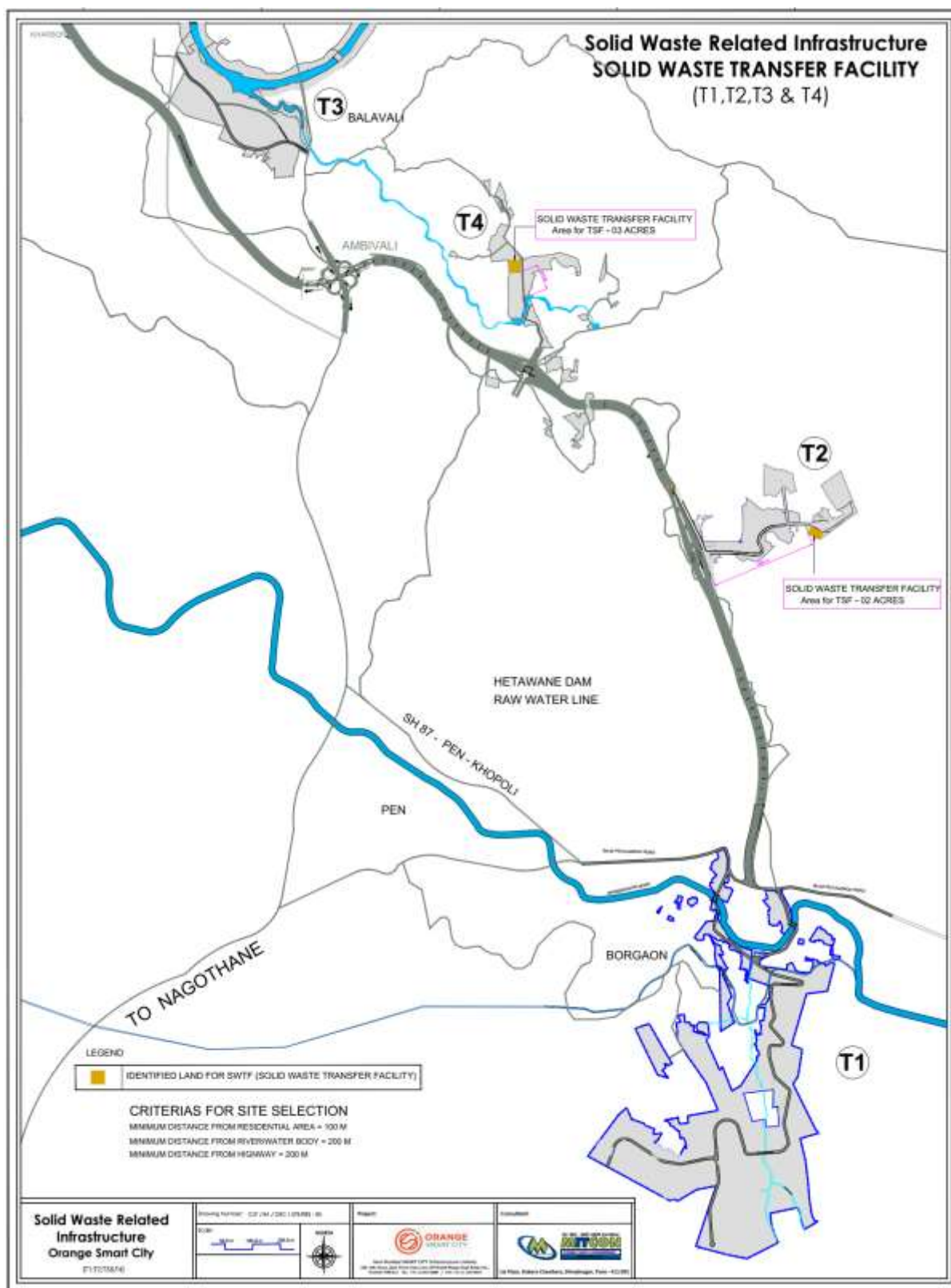


Figure 2-31: Map depicting solid waste infrastructure

2.29.3 Landfill site

The landfill site for the Orange Smart City has been proposed in the T1 land parcel amounting to total area of 10 acres including the ancillary infrastructure.

The compliance against the CPHEEO criteria for selecting the site for the landfill is mentioned below :

Sr.No	Criteria	Minimum siting distance	Site selected	Remark
1	Coastal regulation, wetland, critical habitat areas, sensitive eco-fragile areas, and flood plains as recorded for last 100 years	Not permitted within these areas	Not Applicable	
2	Rivers	100 metres from flood plain		Closest distance is 1200 metres from the river in T1
3	Ponds, lakes, water bodies	200m	Not Applicable	
4	Non- meandering water channel (canal, drainage, etc.)	30m		500 metres from the natural drain in T1, 530 metres from the irrigation canal
5	Highway or railway line, water supply wells	500m from centre line		1800 metres from Pen - Khopoli highway
6	Habitation	500m from such areas		510 metres from nearby existing settlements, 970 metres from proposed residential area

7	Earthquake zone	500m from fault line fracture	Not Applicable	
8	Flood Prone area	Not permitted within these areas	Not Applicable	
9	Water table (highest level)	Bottom liner atleast 2m above highest water table		Average ground water table is more than 5 metres in the selected area
10	Airport	20 km		45 kms from CSIA & 30 kms aerial distance from Proposed Navi Mumbai Airport

The operator should comply with the following requirements for the landfill site confirming to the SWM Rules 2016 as under:

Criteria for development of facilities at the sanitary landfills.-

1. Landfill site shall be fenced or hedged and provided with proper gate to monitor incoming vehicles, to prevent entry of unauthorised persons and stray animals
2. The approach and / internal roads shall be concreted or paved so as to avoid generation of dust particles due to vehicular movement and shall be so designed to ensure free movement of vehicles and other machinery.
3. The landfill site shall have waste inspection facility to monitor waste brought in for landfilling h, office facility for record keeping and shelter for keeping equipment and machinery including pollution monitoring equipment. The operator of the facility shall maintain record of waste received, processed and disposed.
4. Utilities such as drinking water and sanitary facilities (preferably washing/bathing facilities for workers) and lighting arrangements for easy landfill operations during night hours shall be provided
5. Safety provisions including health inspections of workers at landfill sites shall be carried out made.
6. Provisions for parking, cleaning, washing of transport vehicles carrying solid waste shall be provided. The wastewater so generated shall be treated to meet the prescribed standards.

Criteria for specifications for land filling operations and closure on completion of land filling.-

1. Waste for land filling shall be compacted in thin layers using heavy compactors to achieve high density of the waste. In high rainfall areas where heavy compactors cannot be used, alternative measures shall be adopted.
2. Till the time waste processing facilities for composting or recycling or energy recovery are set up, the waste shall be sent to the sanitary landfill. The landfill cell shall be covered at the end of each working day with minimum 10 cm of soil, inert debris or construction material..
3. Prior to the commencement of monsoon season, an intermediate cover of 40-65 cm thickness of soil shall be placed on the landfill with proper compaction and grading to prevent infiltration during monsoon. Proper drainage shall be constructed to divert run-off away from the active cell of the landfill.

After completion of landfill, a final cover shall be designed to minimise infiltration and erosion. The final cover shall meet the following specifications, namely :--

- The final cover shall have a barrier soil layer comprising of 60 cm of clay or amended soil with permeability coefficient less than 1×10^{-7} cm/sec.
- On top of the barrier soil layer, there shall be a drainage layer of 15 cm.
- On top of the drainage layer, there shall be a vegetative layer of 45 cm to support natural plant growth and to minimise erosion.

(D) Criteria for pollution prevention.-In order to prevent pollution from landfill operations, the following provisions shall be made, namely:-

(i) The storm water drain shall be designed and constructed in such a way that the surface runoff water is diverted from the landfilling site and leachates from solid waste locations do not get mixed with the surface runoff water. Provisions for diversion of storm water discharge drains shall be made to minimise leachate generation and prevent pollution of surface water and also for avoiding flooding and creation of marshy conditions.

(ii) Non-permeable lining system at the base and walls of waste disposal area. For landfill receiving residues of waste processing facilities or mixed waste or waste having contamination of hazardous materials (such as aerosols, bleaches, polishes, batteries, waste oils, paint products and pesticides) shall have liner of composite barrier of 1.5 mm thick high density polyethylene (HDPE) geo-membrane or geo-synthetic liners, or equivalent, overlying 90 cm of soil (clay or amended soil) having permeability coefficient not greater than 1×10^{-7} cm/sec. The highest level of water table shall be at least two meter below the base of clay or amended soil barrier layer provided at the bottom of landfills.

(iii) Provisions for management of leachates including its collection and treatment shall be made. The treated leachate shall be recycled or utilized as permitted, otherwise shall be released into the sewerage line, after meeting the standards specified in Schedule- II.. In no case, leachate shall be released into open environment.

(iv) Arrangement shall be made to prevent leachate runoff from landfill area entering any drain, stream, river, lake or pond. In case of mixing of runoff water with leachate or solid waste, the entire mixed water shall be treated by the concern authority.

Criteria for water quality monitoring.-

Before establishing any landfill site, baseline data of ground water quality in the area shall be collected and kept in record for future reference. The ground water quality within 50 meter of the periphery of landfill site shall be periodically monitored covering different seasons in a year that is, summer, monsoon and post-monsoon period to ensure that the ground water is not contaminated.

Usage of groundwater in and around landfill sites for any purpose (including drinking and irrigation) shall be considered only after ensuring its quality. The following specifications for drinking water quality shall apply for monitoring purpose, namely:-

S. No.	Parameters	IS 10500:2012, Edition 2.2(2003-09) Desirable limit (mg/l except for pH)
(1)	(2)	(3)
	Arsenic	0.01
	Cadmium	0.01
	Chromium(as Cr^{6+})	0.05
	Copper	0.05
	Cyanide	0.05
	Lead	0.05
	Mercury	0.001
	Nickel	-
	Nitrate as NO_3	45.0
	pH	6.5-8.5
	Iron	0.3
	Total hardness (as CaCO_3)	300.0
	Chlorides	250
	Dissolved solids	500
	Phenolic compounds (as $\text{C}_6\text{H}_5\text{OH}$)	0.001
	Zinc	5.0
	Sulphate (as SO_4)	200

Criteria for the ambient air quality monitoring

1. Landfill gas control system including gas collection system shall be installed at landfill site to minimize odour, prevent off-site migration of gases, to protect vegetation planted on the rehabilitated landfill surface. For enhancing landfill gas recovery, use of geomembranes in cover systems along with gas collection wells should be considered.
2. The concentration of methane gas generated at landfill site shall not exceed 25 per cent of the lower explosive limit (LEL).
3. The landfill gas from the collection facility at a landfill site shall be utilized for either direct thermal applications or power generation, as per viability. Otherwise, landfill gas shall be burnt (flared) and shall not be allowed to escape directly to the atmosphere or for illegal tapping. Passive venting shall be allowed in case if its utilisation or flaring is not possible.
4. Ambient air quality at the landfill site and at the vicinity shall be regularly monitored. Ambient air quality shall meet the standards prescribed by the Central Pollution Control Board for Industrial area.

Criteria for plantation at landfill Site.-

A vegetative cover shall be provided over the completed site in accordance with the following specifications, namely:-

1. Locally adopted non-edible perennial plants that are resistant to drought and extreme temperatures shall be planted;
2. The selection of plants should be of such variety that their roots do not penetrate more than 30 cms. This condition shall apply till the landfill is stabilized;
3. Selected plants shall have ability to thrive on low-nutrient soil with minimum nutrient addition;
4. Plantation to be made in sufficient density to minimise soil erosion.
5. Green belts shall be developed all around the boundary of the landfill in consultation with State Pollution Control Boards or Pollution Control Committees.

Criteria for post-care of landfill site.-

(1) The post-closure care of landfill site shall be conducted for at least fifteen years and long term monitoring or care plan shall consist of the following, namely :-‘

- (a) Maintaining the integrity and effectiveness of final cover, making repairs and preventing run-on and run-off from eroding or otherwise damaging the final cover;
- (b) Monitoring leachate collection system in accordance with the requirement;
- (c) Monitoring of ground water in and around landfill;
- (d) Maintaining and operating the landfill gas collection system to meet the standards.

(2) Use of closed landfill sites after fifteen years of post-closure monitoring can be considered for human settlement or otherwise only after ensuring that gaseous emission and leachate quality analysis complies with the specified standards and the soil stability is ensured.

Requirement of seeking environmental clearance: The operator of the Common Waste Management Facility will seek environmental clearance as per EIA notification 2006 and its amendments thereof.

2.30 HVAC Infrastructure/District Cooling System

It is proposed to provide air-conditioning and ventilation system for Orange Smart City. District Cooling Plants (DCP) would be provided to meet the requirements placed in a modular form. The efficiencies gained by central chilled water facilities result in lower overall energy consumption, increased reliability, increased diversification of cooling load, and reduced environmental impact.

2.30.1 Proposed HVAC System

It is proposed to have centralized water-cooled system for the industrial and Hospitality Sector while air-cooled units are proposed for the Commercial, Neighborhood and Residential areas at all the four sites of OSC.

2.30.2 Strategy & Phasing of Implementation

For Industrial and Hospitality Sector, the cooling load and plant capacity will be depending on the area development strategy and the phasing. The chilled water piping buried or in trenches up to individual building location will be developed by Developer. Further the individual building owner or developer has to connect and extend the network at desired locations inside the building.

For Commercial, Neighborhood and Residential areas, the building owner/ developer will design, plan, procure, execute and meet his building air-conditioning and ventilation requirement. In future, looking at the feasibility and requirements proposed HVAC system and DCS options will be implemented.

2.31 IT & telecommunication

ICT Plan for Orange Smart City consists of the smart Infrastructure within the City for providing the communication system such as telephone & Internet, monitoring of the city services, planning and controlling the City Infrastructure, provide communication medium for Systems, People and effectively manage the resources. In order to meet the growing needs and the opportunities associated with an increasing urban population, cities require innovative approaches to achieve sustainable development, which are crucial to ensure more inclusive development pathways and a higher quality of life (QoL) for its inhabitants. This will enable an Orange Smart City to become an efficient urban center of the future, safe, secure, green and sustainable with a well-balanced relationship between city and government managers, business and industry, research and academia and the citizens. Information & Communication Technology (ICT) acts as a key enabler for the achievement of these goals, there is an increasing need to better understand and foster the use of new technologies, particularly of rapidly diffusing Information and Communication Technologies (ICTs). Following ICT Systems are planned for the Orange Smart City:

- Trunk infrastructure for Telephone & Internet Connectivity
- Safety and Security System
- Command Centre & Emergency Response System
- Utility Monitoring and Management

2.32 Telephone and Internet / Optical Fiber Network

Telephone and Broadband access is an essential part of our daily needs and also an economy. To create jobs and grow wages at home, and to compete in the global information economy, the

delivery of fast, affordable and reliable broadband service to all corners is must. The build-out of broadband infrastructure itself is a major driver of investment and job creation, but even more significant are the ways that connectivity is transforming a range of industries, education, entertainment, agriculture, business, and many more.

To fulfill the requirement of communication systems of telephone and Internet services for residential, Industrial and commercial user's Broadband network has to be planned for its trunk infrastructure. The provision for the trunk infrastructure for communication is made in the initial phase of the project planning to lay down the Optical Fiber network for using telephone, internet and entertainment services. Provision of Ducts for laying the telephone and Broadband cables is planned. Ducts and street furniture is planned along both sides of the Arterial Roads and Internal roads. The Internet Service Providers / Telecom service Providers will lay down their optical fiber cable in the duct to provide the telecom and internet services to the residents.

T2, T3 and T4 Sites of OSC will be connected on lease lines for centralized monitoring of the utilities and facility management. Facility management and central monitoring will be done from T1 Land parcel and other land parcels will have secondary monitoring Stations.

2.32.1 Safety, security and Surveillance system

The Aim of the Safety, Security and Surveillance is to provide safe and secure environment to the residents, Maintain Law and Order, Crime Control and traffic control and management. Video Surveillance System will be implemented at junctions, common area and market places for monitoring the movement of the people, Vehicles, etc. This system will also integrate with other stakeholder's surveillance System to provide the holistic and integrated video surveillance System. Command and control system will also be integrated with Emergency Response System Mechanism to provide the quick response. A mix of High definition IP based Fixed; ANPR and PTZ cameras will be used for the purpose.

2.32.2 Command Centre and Emergency Response System

Centralized command centre will be established at T1 parcel for monitoring and control of following Systems:

- City / Township wide Video Surveillance System
- SCADA System for Water & Waste Water
- Solid waste Management System (GPS & RFID based)
- Remote monitoring & Control of Electricity
- Utility and Facility Management and Billing System
- Emergency Response System
- Call Centre for Residents

Emergency response System and Facility management System is provided to the residents by providing Helpline number. Helpline number shall be displayed at prominent public places and Panic/ Emergency call points are installed throughout the city. Citizen can call to Emergency response call centre by means of mobile, landline, installed emergency call point and established two way audio communications with Emergency Response Team. Helpline Call Center from Command and control centre will receive call and providing response mechanism for safety, security, utility management, facility management and Emergency response. Well trained

operators will provide the response solution based on the type of call / emergency. Response team such as police help, fire help, medical help, etc. shall be integrated to Emergency Response System.

2.33 Proposed ICT Infrastructure

Proposed Infrastructure will provide the compliance to the following Smart and Sustainable City Guidelines of the MoUD:

- Safety and Security of the residents including women and children
- 100% coverage for providing High speed internet connectivity to the Dwellers
- 100% coverage for telephone and mobile phone connectivity
- 100% metering for utilities such as Water, Energy and other utilities
- Quality of life for the people with clean and safe environment
- Smart Solutions such as remote monitoring and management of the Utilities, Automated billing System, Video Surveillance

2.34 Other proposed smart Infrastructure

Domestic Gas

An integrated approach for Orange Smart City consists of the smart Infrastructure within the City for providing better facilities to the residents and the working population. Such facilities include a centralized gas supply system for the entire project area. Such facilities will enable the project to become an efficient urban center of the future, safe, secure, green and sustainable with a well-balanced relationship between the citizens.

Nowadays, a reticulated LPG Piped Gas System has been adopted in the Orange Smart City. The system includes underground piped LPG distribution system, bulk installations as per requirements, valve stations, and gas banks to the entire project area. This is a sustainable, safe and secure approach for providing piped gas. It also includes an independent gas usage monitory system with smart meters for increasing the collections of charges as per usage and reducing leakages, losses and unaccounted gas proportions.

Benefits of a Centralized Gas Supply System proposed at OSC is that No storage of LPG is required, hence valuable Space Saving, Uninterrupted supply of LPG as there is a standby cylinder bank with automatic changeover when the main cylinder bank becomes empty, Enhanced safety and Value Addition to the projects with Cutting Edge modern technology.

2.34.1 Intelligent Building Management System

The buildings in OSC shall be equipped with IBMS and same shall be connected to central control and command center to provide interface between user and utility service providers.

2.34.2 Fire Fighting System

For the building level firefighting, the water supply would be from Fire Water Storage Tanks. In all buildings, arrangement or occupancy for firefighting will be provided with warning to occupants, automatic fire detecting and alarm facilities, for the escape of occupants, or to facilitate the orderly conduct of fire exit drills.

2.34.3 Utility Infrastructure Areas

- The utility infrastructure plants for various services such as water, sewerage, solid waste collection and treatment, district cooling system, power are located so as to meet the requirements of the proposed development optimally.
- These infrastructure facilities are planned to be modular in nature. The distribution of these infrastructure services would underground / at grade / overhead as per requirement and feasibility. These utilities would be integrated with the overall OSC infrastructure.

2.35 Summary of Utilities

The Table 2-42 summarizes the Water Supply requirements, Waste Water Generation, Solid Waste Generation and Electricity Requirements for the OSC Project on the basis of proposed land use in four parcels – T1, T2, T3 and T4.

Table 2-42: Summary of Utilities

Land Parcel	Total Plot Area (In Acres)	Water Supply Requirements (MLD)	Sewage Generation Requirements (MLD)	Solid Waste Generation (Tonnes/Day)	Electricity Requirements (MVA)	Effluent Generation (MLD)
T1	723.33	22.23	11.20	24.00	78.23	1.18
T2	102.40	4.82	2.54	5.47	15.01	0.00
T3	83.59	3.67	2.07	4.67	9.26	0.00
T4	133.19	7.88	5.75	17.44	39.69	0.00
Total	1042.51	38.60	21.56	51.58	142.18	1.18

2.36 Traffic and Transportation Plan

The Proposed project comprises of 4 land parcels admeasuring 1042.51 Acres. The land parcels T1, T2, T3 and T4 are located in the vicinity and have good connectivity from National highways, State highways and from existing road network and regional transit facilities. The following section details out the existing and proposed transportation facilities in the project. The regional connectivity details are given in Table 2-43: Regional Connectivity Details

Table 2-43: Regional Connectivity Details

Sr. No.	Particulars	Connecting Places
1	Mumbai – Pune Expressway	Navi Mumbai to Pune
2	NH 4	Mumbai – Pune-Bangalore
3	NH 4B	Panvel to JNPT
4	NH 3	Mumbai to Nashik
5	SH 88	Pen to Khopoli
6	SH 85	Khopla to Sai

Sr. No.	Particulars	Connecting Places
7	SH 54	Uran to Panvel

2.37 Connectivity to Orange Smart City (Existing)

The proposed project site is centered at a strategic location and has good connectivity from major urban centres, towns and upcoming areas. The Table 2-44 explains the approximate distances from nearby urban centres and major landmarks.

Table 2-44: Approximate distances from nearby landmarks

Areas	Approximate Aerial Distance (km)
Mumbai City (Fort)	30
Pen Town	02
Navi Mumbai SEZ	08
Panvel	24
Alibaug	30
Khopoli	26
Chhatrapati Shivaji International Airport	85
Proposed Navi Mumbai International Airport	25
Pen railway station	03

2.37.1 Proposed Transport Infrastructure for OSC in the Horizon Year

The transport infrastructure has been proposed on the basis of proposed land use in the four land parcels T1, T2, T3 and T4 as per OSC development plan. On the basis of percentage distribution of the land use in each parcel of OSC and norms formulated by MMRDA, MCGM, MIDC, GDCR and IIA policy have been taken into consideration for calculating the number of four wheelers and two wheelers on the basis of proposed built up area and the housing typologies.

Table 2-45: Number of Vehicles in Industrial areas

Land Parcel	Total Plot Area (In Acres)	Industrial Area (m ²)	Total 4 Wheelers (1Cars/200 m ²)	Visitor 4 Wheelers (10% Addn)	Total 4 Wheelers	Total 2 Wheelers	Truck (1 per 1000 m ²)
T1	723	2282508	11413	1141	12554	34238	2283
T2	102	469452	2347	235	2582	7042	469
T3	84	323760	1619	162	1781	4856	324
T4	133	0	0	0	0	0	0
Total	1043	3075720	15379	1538	16916	46136	3076

Table 2-46: Number of Vehicles in Commercial and Recreational areas

Land Parcel	Total Plot Area (Acres)	Commercial Area (m ²)	Total 4 Wheelers (2Cars/100 m ²)	Visitor 4 Wheelers (10% Addn)	Total 4 Wheelers	Total 2 Wheelers (3TW/100 m ²)
T1	723	310243	6205	620	6825	9307
T2	102	63700	1274	127	1401	1911
T3	84	19426	389	39	427	583
T4	133	317528	6351	635	6986	9526
Total	1043	710896	14218	1422	15640	21327

Table 2-47: Number of Vehicles in Residential areas

Land Parcel	Total Plot Area (Acres)	Net Residential Area (Acres)	Built Up Area (m ²)	Resident 4 Wheelers (1/flat below 100 m ² & 2/flat above 100 m ²)	Visitor 4 Wheelers (10% Addn)	Total 4 Wheelers	Total 2 Wheelers (2/tenement)
T1	723	58	469452	9896	990	10885	15581
T2	102	8	64752	1365	136	1501	2149
T3	84	8	64752	1365	136	1501	2149
T4	133	62	501828	10578	1058	11636	16655
Total	1043	136	1100784	23204	2320	25524	36534

Table 2-48: Total Number of vehicles in OSC

Land Parcel	4 Wheelers	2 Wheelers	Trucks	Buses (1/2000 persons)
T1	30265	59126	2283	16
T2	5485	11102	469	2
T3	3709	7588	324	2
T4	18622	26181	0	17
Total	58081	103997	3076	37

The above Tables 2-45 to 2-48 include calculated number of vehicles on the basis of norms, standards with respect to the projected areas as per various land use.

2.38 Parking Proposals

All the proposed residential, commercial and industrial development in the proposed project has incorporated parking facilities for the workers, cargo and residents respectively inside the dedicated site areas. Apart from these, dedicated road side parking facilities for the tourists and other floating population commuting inside OSC have been proposed. Similar facilities for cargo trucks, commuter buses have been provided at identified locations in the four land parcels.

2.38.1 Proposed Roadways and Kerb Side Facilities

Detailed road network for the entire project site has been worked out on the basis of the contour survey drawings and from the proposed land use plans. The road widths have been allocated as per the location of various industrial, residential and commercial plot sizes with appropriate road sections and street furniture incorporated (footpaths, cycle tracks, ROW's, etc.)

2.38.2 Proposed Public Transport Facilities

Bus Transit System

A commuter bus service is a fixed-route bus characterized by service predominantly in one direction during peak periods, limited stops, use of multi-ride tickets and routes of extended length, usually between the central business district and outlying suburbs. Commuter bus services also include other services, characterized by a limited route structure, limited stops and a coordinated relationship with another mode of transportation. Such transit system has been proposed in the OSC project keeping in mind the total area of the township as well as the frequency of other modes of transport available for the commuters. Proposing such services in the project will not only help reduce personal transport but help improve environmental conditions.



Figure 2-32: Bus Transit Services

Rent-a-Cycle System

A bicycle-sharing system is a service in which bicycles are made available for shared use to individuals on a very short-term basis. Bike share schemes allow people to borrow a bike from point A and return it at point B. The service is mostly free or with a nominal charge. It helps in promoting non-motorized approach and is a very sustainable way for local commute. Incorporating such transportation concepts will add value to the project. Such smart non-motorized transit facilities have been included in OSC project.



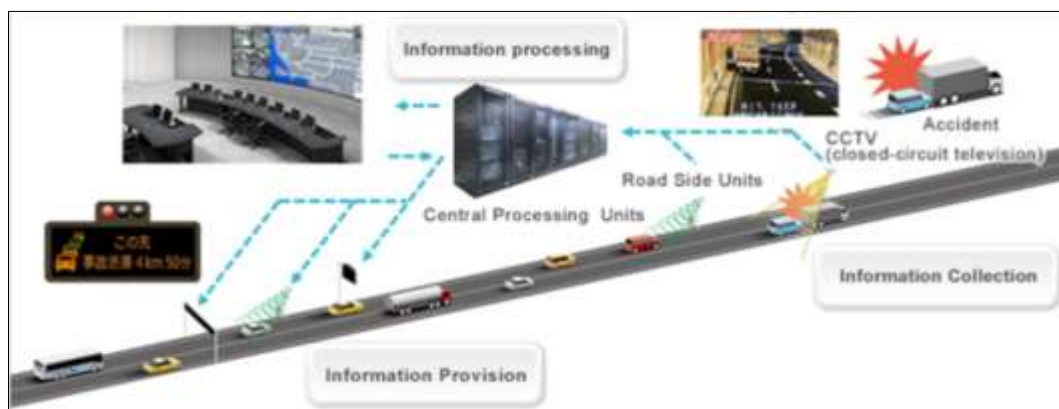
Figure 2-33: Bicycle Sharing Services

Proposed Pedestrian Facilities

As the main vision of this project is to incorporate smart concepts into conventional integrated township planning techniques, a stress will be given on promoting non-motorized facilities and creating a pedestrian friendly environment in the entire township. Adequate importance has been given to proposing vehicle-free zones, walking plazas, pedestrian zones, walkways, etc. in the project. This will not only improve the quality of life of the users and residents but also help achieve an eco-friendly environment in the township.

Traffic Management System

The Advanced Traffic Management System is a top-down management perspective that integrates technology primarily to improve the flow of vehicle traffic and improve safety. The primary approach of this system is increase transportation system efficiency, enhance mobility, improve safety, reduce fuel consumption and environmental cost and increase economic productivity. Such systems will be incorporated in the project.



Proposed Road Network

The Road Network proposed in all four land parcels has been worked out on basis of the proposed land-use and the topographical conditions. The placement of roads has been worked out on the detailed slope analysis and study of the natural drains and gradients. At present 24-meter-wide roads have been proposed with bridges at relevant locations. The following table explains the proposed facilities:

Table 2-49: Infrastructure related to Road

Land Parcel	Road (km)	Bridges (Nos.)
T1	8.4	3
T2	2.2	-
T3	1.8 (24 m) & 0.8 (12 m)	-
T4	1.7 (12 m)	-

The road network related infrastructure is shown below.

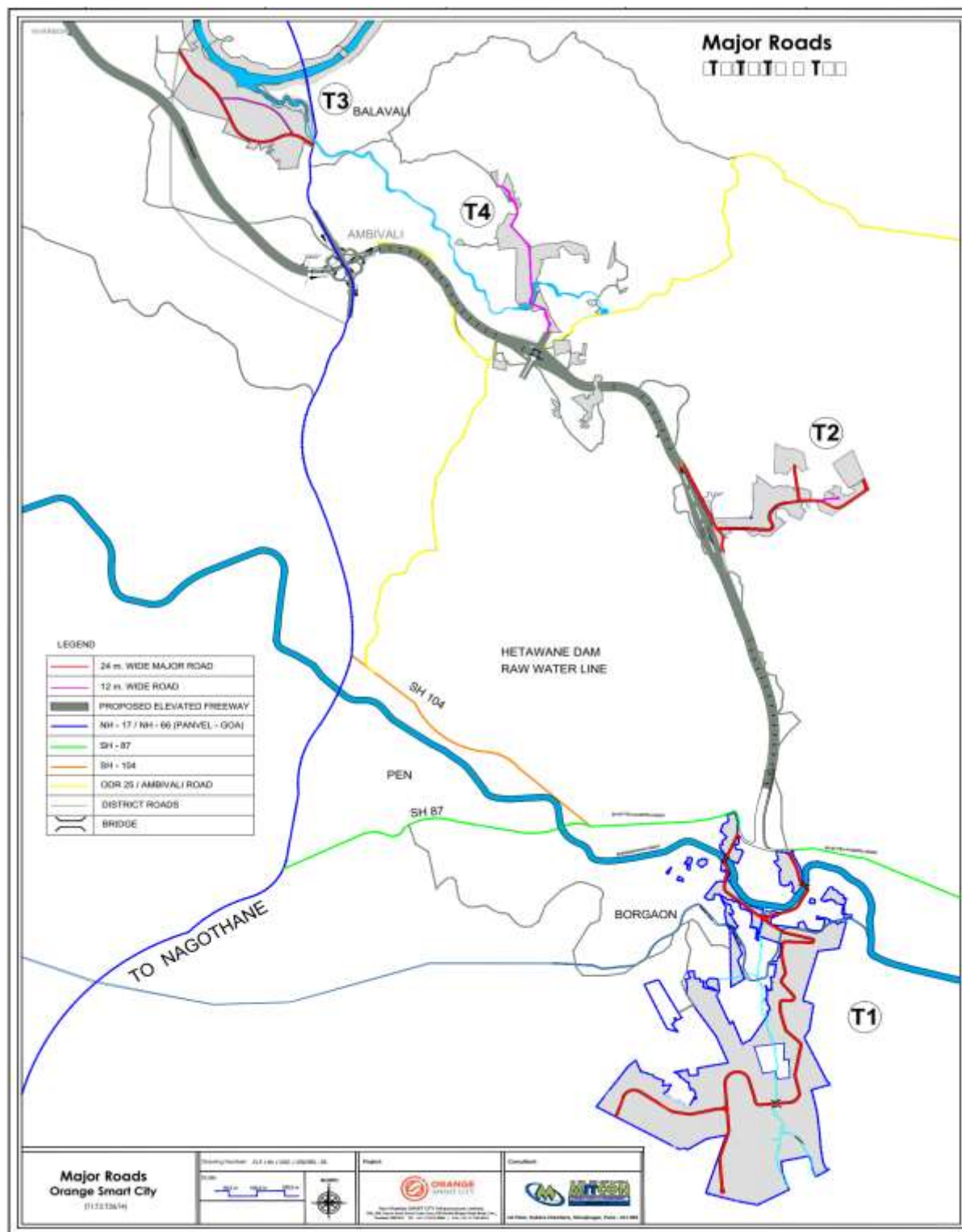


Figure 2-34: Map depicting road network related infrastructure

2.39 Project Implementation and Scheduling

Orange Smart City Infrastructure Pvt. Ltd. (OSCIPL), as the Project Proponent has the overall responsibility for the planning, design, construction and operation of the Orange Smart City (OSC). Proposed Master Plan of OSC is an orderly series of development intended to provide physically balanced distribution of land uses that contributes towards and facilitates the long-term fiscal and economic viability and a safe, efficient, attractive and smart infrastructure facility providing flexibility to meet the short and long-range needs of the OSC in a timely manner.

OSC Master Plan provides a strategic approach for construction work in Phases. The scheduling of projects within the master plan has been prioritized to permit construction work in a coordinated approach.

The Phasing has been planned considering required OSC demand at each stage, optimum utilization of the available OSC land resources, minimum impact on existing and adjoining development, safeguarding future unconstrained development by means of a coherent and comprehensive phasing strategy. As per OSC proposed Master Plan, the development is proposed to balance the overall demand and capacity in each stage of development.

As the development at OSC is spread over 4 sites within 10 Km of Radius. The development at all the Sites will start concurrently to meet the growing demand in the region.

The proposed infrastructure development and supporting facilities including STP, ETP, WTP, Sub Stations, Parking facilities, administrative buildings, etc. will be developed in 2 Phases. The details of Phasing are as given in Table 2-50.

Table 2-50: Details of phasing

Phase	Timeframe
Phase I	2019 – 2023
Phase II	2024 - 2029

The implementation plans have been prepared considering overall development of OSC and covers the entire 7-year master planning horizon, ending at Phase II (2024 - 29). The implementation plan is driven primarily to provide entire Infrastructure Facility. The infrastructure shall be completed by developing infrastructure required to make the OSC operational like internal roads, all the utilities, Fire Station, Parking facilities, Administrative Buildings, required fencing / boundary wall, etc.

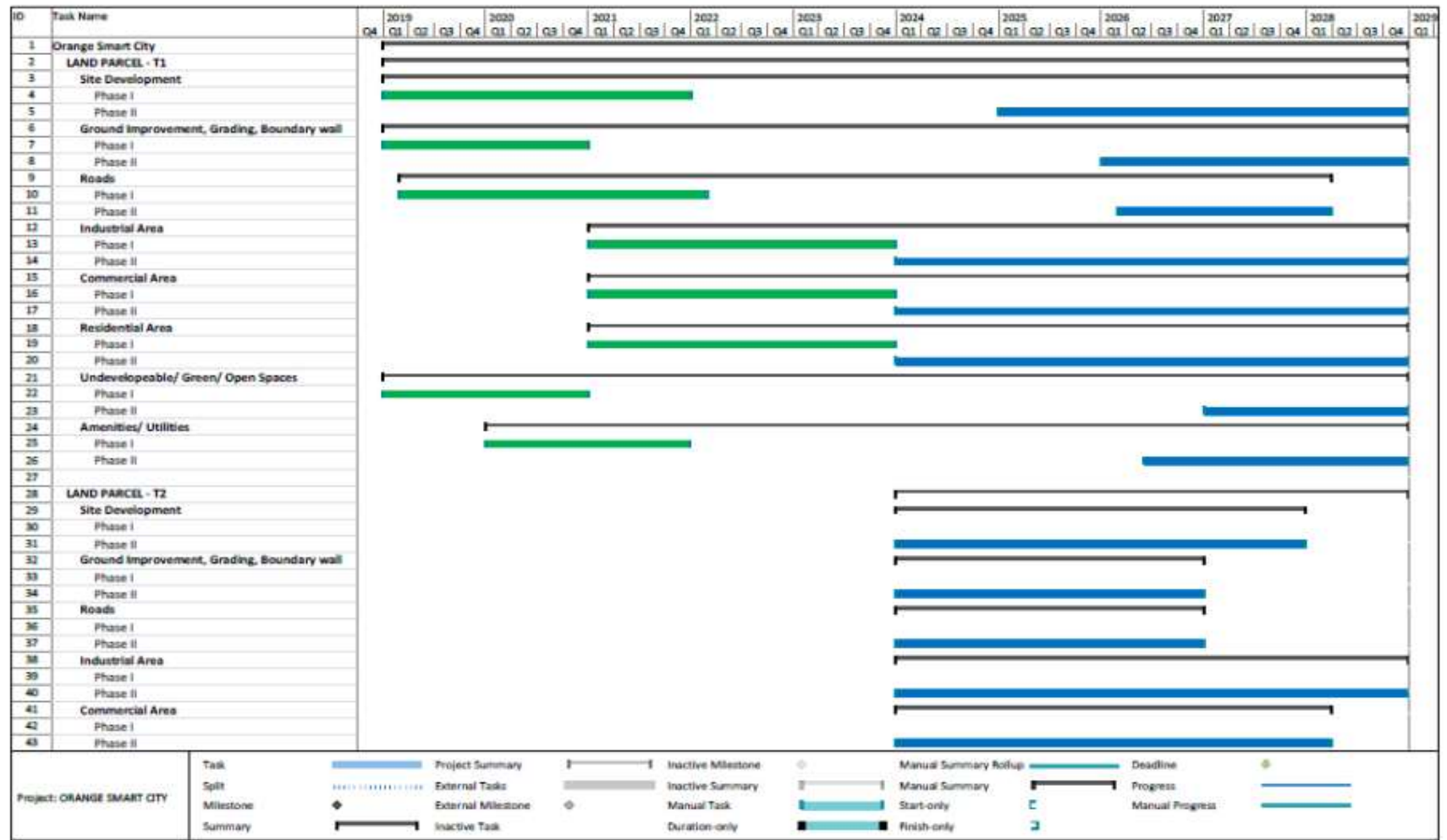
The earth work for the entire OSC area is planned to be completed in the Phase I over the entire site. The earthwork boundaries include undeveloped site required for the development of the infrastructure including roads and services. This provides the platform for utilities corridors and road pavements and structures, and the building foundations for essential buildings to make OSC Operational.

Gross area of approx. 600 acres shall be developed in Phase I (2019 – 2023) including OSC management and administration offices, facilities like police station, required utilities, healthcare facilities, Traffic and Transportation facilities, Training Center & School, facilities for entertainment & recreation, conference & exhibition facilities, etc.

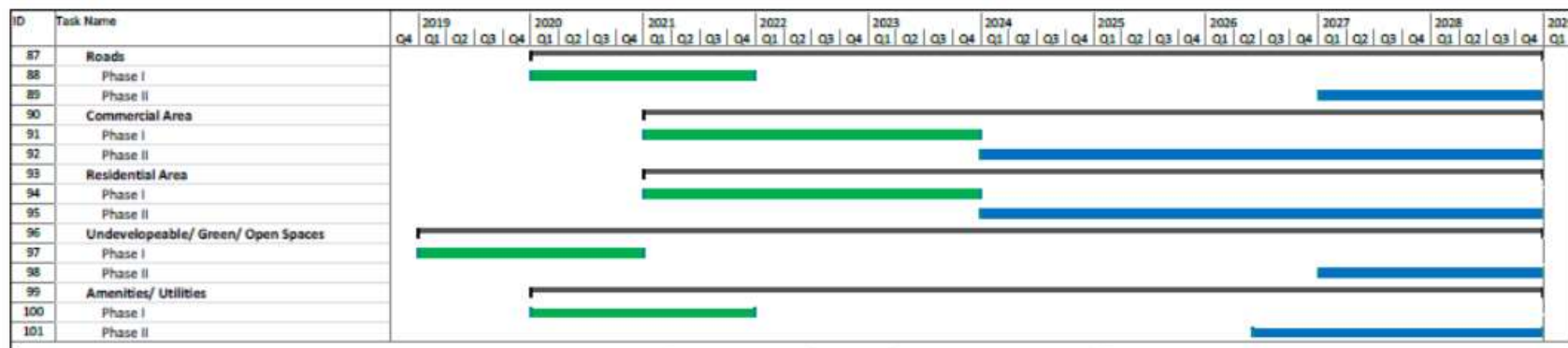
The section below shows proposed OSC development of BIA, in phase I & II development programme through 2019 – 2029. This staged development of projects will enable the OSC to get operational and fulfill the demand and support the development in the region.

Sr. No.	Project Description	Implementation (Phase)
1	Ground Improvement, Grading, Boundary Wall as per Master Plan	Phase I & Phase II
2	Roads	Phase I & Phase II
3	Storm Water	Phase I & Phase II
4	Skywalk / Underpass (Pedestrian & Vehicular / Bridges)	Phase I & Phase II
5	Water Supply	Phase I & Phase II
6	Sewage Management	Phase I & Phase II
7	Rain Water Harvesting	Phase I & Phase II
8	Recycle Water	Phase I & Phase II
9	Power & Electricity	Phase I & Phase II
10	IT & Security	Phase I & Phase II
11	Gas Supply	Phase I & Phase II
12	Fire Station	Phase I & Phase II
13	Solid waste Disposal System including collection	Phase I & Phase II
14	Site Development	Phase I
15	Parking Facility	Phase I & Phase II
16	Landscape / Parks / Open Space Development	Phase I & Phase II
17	All other essential Infrastructure, Utilities and Services	Phase II
18	Entrance Gates	Phase I & Phase II
19	Essential Buildings including OSC Management Building, Administrative Building, Training Center, Hospital, Police Station, Police posts, security offices, Common Service Blocks, Sports Club, etc.	Phase I & Phase II

Long-term Implementation Plan







2.40 Safety and Security Plan of Orange Smart City

Safety and Security becomes critical today as the nature of threat and risk in today's world is multifaceted and multi-channelled and therefore, OSC Master Plan considers every aspect and worked on holistic approach to safety and security with overall development at OSC.

OSC being Greenfield smart city is planned with a holistic approach which enables the entire infrastructure and people living in OSC to support the others which creates an environment where people can live without worrying about safety. OSC is planned with an integrated approach and created incredible places which allow strong, integrated communities to flourish in an environmentally safe and secure space.

As safety & security becomes more critical, OSC is planned on principles of Crime prevention through environmental design (CPTED), which shapes the Built Environment of OSC, encourages legitimate use and discourage the illegitimate use within OSC. OSC has also planned to standardized the CPTED working processes.

The physical built environment in OSC is planned with multidisciplinary approach having maximum open space which discourages crime and minimize the opportunities for such events. The built environment is designed to reduce crime opportunity and fear of crime through natural, mechanical, and practical means. The OSC is designed with more open environment, greater permeability which enable pedestrian and vehicle permissive with soft controls. OSC master plan provides natural surveillance, visibility, accessibility, and shall be attractive and robust.

OSC is planned with integrated approach including infrastructure facilities which improves system performance by leveraging synergies between multiple infrastructure systems.

The working population and residents of the OSC will be trained / reinforced with notions of a “sense of ownership”. OSC will have its own natural and technical Surveillance, Access control Situational Awareness and Incident Response system and shall ensure that the physical environment transmits positive signals to all users, which leads to a reduction in the fear and incidence of crime, and an improvement in the quality of life.

OSC is also proposed to use Information and Communications Technology (ICT) to manage its critical functions (infrastructure and social systems) in smarter and more integrated ways, which will benefit OSC in its overall development including increased efficiency, resiliency, sustainability, economic growth and citizen quality of life.

OSC is planned with Central Control and Command Center (C4) at each site integrated with entire infrastructure system, buildings, utilities, etc. The integrated system enforces standard operating procedures (SOPs) and provides greater of all security activity in real-time single view and helps OSC Authorities to implement and enforce rules and regulations. It also enables situational awareness throughout its infrastructure and buildings by creating a unified and interactive intelligence image, drawing data from all sensors, showing the details of incident and provide video from different sources. The combined image is constantly updated and will be shared with the concern, thereby serving as a uniform basis for operational planning and management and allocation of tasks.

OSC is also planned with Physical Security Information Management System (PSIMs), which operates as part of an overall incident cycle that integrates all the security action together. It is based on Plan, detect, react and analyze principles. The planned system through C4 at OSC will enable Multi-Agency Collaboration, Situational Awareness, Video & Data Analytics and Automated Processes.

C4 at OSC is planned to regulate various services and provide security and assistance in disaster management and emergency situations. The main aim of C4 at OSC is as follows:

- Ensuring Safety and Security;
- Disaster Management & Emergency Services;
- Ensuring efficient services to the Users;
- Co-ordination and Integration among various service providers & Users and
- Record keeping / documentation.

Also as part of overall development of OSC, the buildings in OSC shall be equipped with intelligent building management system (IBMS) and same shall be connected to central control and command center to provide interface between user and utility service providers.

In all buildings, arrangement or occupancy for firefighting will be provided with warning to occupants, automatic fire detecting and alarm facilities, for the escape of occupants, or to facilitate the orderly conduct of fire exit drills.

In addition to above, OSC is planned with an integrated technology that is embedded in city infrastructure, such as integrated traffic management systems and public transport control systems, weather intelligence, which is unified to facilitate crime prevention and to enable emergency access or citizen evacuation in the event of a crisis.

Apart from making OSC safer in planning and design, it is also proposed to ensure that a rigorous system is in place with clear processes and procedures and shall be rigorously rehearsed.

Most of the natural calamities occur quite suddenly without any forewarning. OSC is in district Raigad, Maharashtra, falls in seismic Zone IV. All the building and structures including infrastructure and utility shall be earthquake resistant and shall be designed in compliance with the codes of seismic Zone IV.

Further, the C4 at OSC will also be integrated with the government authorities including District Disaster Management Authority (DDMA) and Regional Disaster Management Centre (RDMC) at Alibaugh and Mumbai. Warning / Alert shall be issued at time of any disaster after confirmation and proper integrated evacuation system shall be planned for safe evacuation of the residents and employees of the OSC.

OSC shall also design an effective Crisis Management Plan including establishing a framework that best suits the needs of the built environment of OSC. A practical framework will be prepared to ensure the unexpected does happen and the OSC authority shall be prepared to respond flexibly within established processes to tackle the challenge.

OSC shall also have provision of periodical audit for Safety and security of the overall development at OSC including Buildings, Infrastructure, Utility, Fire, etc.

OSC is environmentally safe and resilient future Smart City as it is cost effective and ensures that there is no duplication of effort in trying to mitigate risks from a physical and technological perspective. OSC ensures that security is coherent and non-obtrusive by designing security in to infrastructure and services it becomes part of daily life and doesn't become a burden on the citizen of OSC.

2.41 Solar PV installation

As developers of OSCIL we aim to make maximum usage and reliance on sustainable energy resources. We are committed to install solar PV cells on all the buildings owned and operated by the developer. As per calculations the total surface area we are aiming in the proposed amenities and facilities amounts to around 23.60 Acres of land available for Solar PV installations.

- Total Area allocated for Solar Roof-Top PV Installations: 23.60 Acres
(40% ground coverage considered on the total proposed Amenity Space of 59 Acres)
- Total electricity generation from proposed Solar PV Installation: 23 MW
(Area requirement: 1Acre per 1 MW & Solar PV Panel efficiency of 15% considered)
- Contribution of electricity generated from Solar PV Installations: 6.68% of total electricity requirement (1 MVA = 1 MW (if power factor is "1"))

The total contribution of electricity generated from Solar PV Installations on buildings owned and operated by the Developer accounts to 6.68% of the total Project electricity requirements. Apart from this the developers will urge all the individual project proponents (industrial, commercial and residential establishments) to maximize Solar PV installations in their individual premises.

3. DESCRIPTION OF THE ENVIRONMENT

The baseline has been carried out at different locations along the alignment considering different environmental aspects like topography, drainage, meteorology, biological environment, socio-economic status etc. The data generation included site visits, primary environmental monitoring, ecological surveys, social surveys and interviews, processing of satellite imagery, etc.

3.1 Study area and period

As a primary requirement of EIA process, the baseline data for ambient air quality, water quality, soil quality, noise levels and meteorology were collected within the study area and area extending up to 10 km beyond the site boundary, as specifically mentioned at Para 9(iii) of Form I of EIA Notification 2006 amended hitherto. The baseline study was conducted during the pre-monsoon season from March 2015 to May 2015 by Avanira Labs (MoEF&CC recognized and NABL Accredited) as per the Terms of Reference (ToR) approved by the EAC CRZ and Miscellaneous Committee, Ministry of Environment and Forests & Climate Change (MoEF&CC).

3.2 Methodology

The guiding factors for the present baseline study are the MoEF&CC's requirements for the Environmental Impact Assessment notification. The various environmental attributes were divided into primary and secondary studies. Primary attributes such as air environment, water, soil, biological environment was assessed by conducting field studies, on-site monitoring.

Secondary attributes such as land use studies, geology, physiological characteristics, and socio-economic status have been assessed by literature review of previous studies conducted by various government publications. The scoping and the extent of data generation were formulated with interdisciplinary team discussions, criteria questions and professional judgment. The baseline studies started with site visits and reconnaissance survey in the study area for fixing the monitoring locations for the primary data. As a secondary data source, various government agencies were approached for getting information and relevant data.

3.3 Establishment of Baseline for Valued Environmental Components

The primary baseline environmental data are those which need to be collected on the field to define the status of environment (like air quality data, water quality data, noise quality etc.).

The secondary data are those data which have been collected over the years by some recognized agencies. (Such as IMD data for micrometeorological data rainfall, humidity and Census data for Socio Economic, Geological data to understand geological formation of the area etc.,) and is used to understand the existing environmental scenario of the study area. The Environmental Impact Assessment (EIA) studies are conducted over a short period of time and therefore understanding of environmental trends based on few months of primary data has its own limitations. Ideally, the primary data has to be considered along with the secondary data for complete understanding of the existing environmental status of the area.

In order to identify the existing environmental and social conditions, following attributes were considered: Table 3-1.

Table 3-1: Methodology of Baseline Data collection

ATTRIBUTE	PARAMETERS	FREQUENCY OF MONITORING
Meteorology	Wind Speed, Wind Direction, Temperature, Relative Humidity, Rainfall, Visibility	Microprocessor based Weather Monitoring Station Continuous hourly recording for 10 Days
Ambient Air Quality	SO ₂ , NO _x , PM ₁₀ , PM _{2.5} , CO	14 Locations 24 hourly samples Twice a week 3 months
Noise Level	Noise Level in dB(A)	8 Locations Continuously over 24 hours period Once in season
Vehicular Traffic	No. of vehicles	At major junctions
Water Quality	Physical, Chemical and Biological Parameters	Once in season 14 Locations- (8 Surface water + 6 Ground water)
Ecology	Existing terrestrial and Aquatic flora and fauna	General in 10 km study area and data collected around the project site through field visits
Land Environment	Land use	Land use for different Categories
	Soil Characteristics	8 Locations Soil type & texture, Physico-chemical properties, NPK
Socio-economic Aspects	Socio-Economic Assessment	General in 10 km study area through Census of India, 2011

3.4 Physical Environment

3.4.1 Physiography

The project area is divided in four patches and these patches occupy diverse topography from a steeply sloping hilly terrain situated at higher elevations to almost plain topography along lower contours.

The T1 parcel is situated at southern catchment of Hetavane (Bhogeshwari) river. A South–North valley divides this parcel in two hills. This valley has upstream maximum elevation of 220 m and downstream minimum elevation of 26 m where it meets the river, whereas ridge has highest elevation of 340 m at top. The terrain of this land parcel has moderately steeper slopes but at the top it is flatter. T2 Parcel has relatively flat ground. The ground elevation of this Parcel ranges from 80 m to 55 m. The T3 land parcel is generally flat at top having slope leading to the Balganga River having potentials of enhancing the site with a natural frontage. This land parcel is divided by downstream river of Govirle dam. The drainage channel passes through the T3 Site connecting to Balganaga River. For T3, elevation ranges from 80m to 40m. The T4 parcel is situated at base of major hills on West. T4 Parcel is made up of eighteen small land parcels and two major parcels. One of the major parcel have ground elevation ranges from 55m

to 7m. And other major parcel is relatively hilly ground with elevations ranges from 86m to 12m.

3.4.2 Drainage

The proposed Integrated Industry Hub Project area is divided in four patches i.e. T1, T2, T3, and T4. Bhogeshwari River forms Northern boundary of T1 patch and this area comes under the Bhogeshwari River catchment. Balganga river forms Northern boundary of T3 patch and this area comes under Balganga River catchment. These two rivers meet Arabian Sea. Whereas patch T2 & T4 are situated on water divide of these two rivers.

3.4.3 Geology

Deccan Trap Basalt of upper Cretaceous to lower Eocene period is the sole rock formation in this area. This rock occupies considerable portion of the Central India, covering significant portion in states of Maharashtra, Madhya Pradesh, Gujarat, Andhra Pradesh, Chhattisgarh and Karnataka. Nearly 82% of geographical area of Maharashtra state alone is made up of this rock. This rock is formed due to solidification of lava flows owing their origin to volcanic eruption. In the study area too, two layers of this rock, separated from each other by an intervening layer of soft, weathered rock and red soil are observed. The thickness of the individual layers is generally 12 m to 30 m.

3.4.4 Hydrogeological Survey

The proposed project shall occupy more than 1000 acres land. Therefore, in order to understand the groundwater regime in the project as well as surrounding area in a proper way to assess the probable impacts of the proposed activity on the geology, groundwater and surface water of this neighborhood and to design appropriate Rainwater Harvesting Scheme suitable for proposed project site for conservation of this precious natural resource, systematic Hydrogeological study was carried out in and around project area. This assignment was handled by M/s Sujalam Consultants, Nagpur. Name of Mr. S. A. Kothe – Head Sujalam Consultants is approved by QCI NABET (accredited vide Accreditation Committee Meeting for Surveillance Assessment held on May 12, 2017) as empaneled functional area expert for Hydrology and Groundwater and Geology.

1.1.1.1 Methodology

Methodology used for survey is given as follows:

- Reconnaissance visit to assess Geology, Soil, Topography, and drainage within study area.
- To understand the hydrogeological regime within study area along with groundwater bearing structures and their performance.
- To assess water level fluctuation in study area.
- To assess probable impacts of the proposed activity on the Surface and Groundwater regime in the study area.
- Baseline data & Quality Control.

1.1.1.2 Hydrogeological Observations

Groundwater Occurrence: The groundwater formation depends upon the topography as well as the subsurface geology in the area of interest. In the case of OSC project, the topography, as

well as the subsurface rock are obstructing to the groundwater formation in this locale. However, the groundwater is not intensively used in this area.

The project area occupies a steeply sloping, highly undulating land occupying the highly placed plateau and hill slope portions. It is comprised of Deccan trap basaltic rock. Primarily, this rock has low porosity and permeability and hence, is considered as “Hard” from groundwater occurrence point of view. These factors are found to play vital role in poor groundwater occurrence in the study area. The hydrogeological map sourced from District brochure of Raigad district (Published by CGWB) is shown as Figure 3-1: Hydrogeology, Raigad district, Maharashtra (Source: CGWB report, Raigad District).

In the project area, the groundwater occurs both- under phreatic i.e. water table condition, providing water to open dug wells and semi-confined condition tapped by means of bore wells.

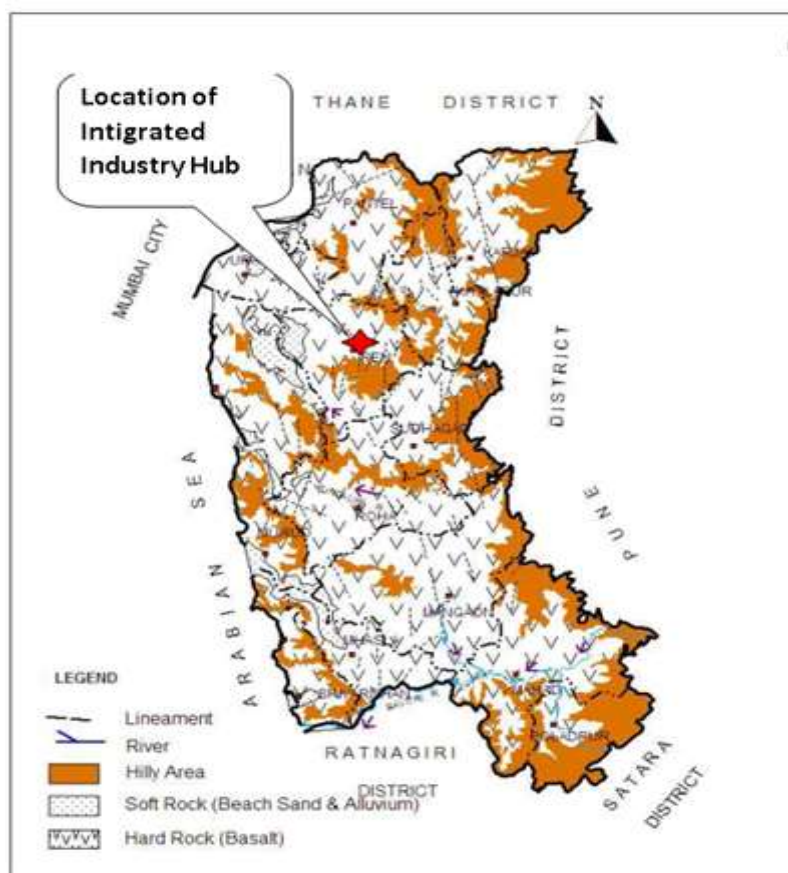


Figure 3-1: Hydrogeology, Raigad district, Maharashtra (Source: CGWB report, Raigad District)

Dug wells:

The dug wells in study and surrounding area are found to be located particularly in the ravines and low-lying gully portions and along the surface water courses (Plate 1). They are found 8 to 10 m in depth bgl. The static water level (pre-monsoon) in this region is reported to be ranging from 8.5 to 9.0 m bgl, while the same (post monsoon) is observed to be almost at par with the Ground level. These structures are largely found to be used as domestic water source with irrigation on insignificant extent.

Bore wells: The study and surrounding area hosts few bore wells. These are observed along the lower reaches. They are found to tap the semi confined and confined aquifer in this area. They are reported to be 90 to 100 m in depth bgl. Majority of bore wells are fitted with hand pump while few are installed with low capacity pumps as per requirement.

The proposed project will not utilize the ground water. It is planned to take water from nearby Hetawane dam. However, this area is categorized as “SAFE” for further groundwater utilization by Central Groundwater Board (Ministry of Water Resources, Government of India).



Plate 1: Dug well adjacent to streamlet

3.5 Land-use

3.5.1 Methodology

Remote Sensing data is a classic source of information on natural resources for a region and provides a record of the continuum of resource status because of its repetitive coverage. It is a powerful and accurate means of collecting data. The study of satellite imagery gives an excellent opportunity to monitor the quantitative extent of vegetation cover as well as qualitative changes due to changes in environment. This aspect is very significant in understanding the dynamics of the earth surface features and phenomenon such as various ecosystems.

3.5.2 Data Base

1.1.1.3 Satellite Data

IRS Resourcesat-2 L4FMX multispectral satellite data of 29th December 2014 was utilized for the present study and shown in Table 3-2: Details of Satellite Data. The rectification of imagery was carried out on to bring the digital data on the earth coordinate system by means of ground control point (GCP) assignments from SOI toposheets. The spectral bands of IRS Resourcesat-2 data are furnished in Table 3-3: Characteristics of IRS Resourcesat-2 Data and Table 3-4: IRS Resourcesat-2 L4FMX, Satellite Spectral Bands and their Principal Applications and image of study area in Figure 3-2: IRS Resourcesat-2 L4FMX Image of the Study Area

Table 3-2: Details of Satellite Data

S.No.	Satellite	Sensor	Scale	Path & Row	SOI Toposheet No.	Date of Pass
1	IRS Resourcesat-2	L4FMX	1:50,000	94 & 59 B & D	E43H01, E43H02, E43H05 & E43H06 (OSM Series)	29.12.2014

Table 3-3: Characteristics of IRS Resourcesat-2 Data

Type of the Satellite	Multi Spectral Bands	Bandwidth / wave length in microns	Spectral resolution (m)	Product type	Format / scale
1	IRS Resourcesat-2	L4FMX	1:50,000	94 & 59 B & D	E43H01, E43H02, E43H05 & E43H06 (OSM Series)

Table 3-4: IRS Resourcesat-2 L4FMX, Satellite Spectral Bands and their Principal Applications

Band	Wave Length (microns)	Application
2	0.52 - 0.59	Soil/vegetation differentiations, coniferous/deciduous flora discrimination, vegetation vigour assessment, rock/soil boundary differentiation, turbidity and bathymetry in shallow water.
3	0.62 - 0.68	Strong chlorophyll absorption leading to discrimination of vegetation types mining area, mapping of settlements and transport network.
4	0.76 - 0.86	Delineation of surface water features, land forms / rock types, mining area, mapping of settlements and transport network.

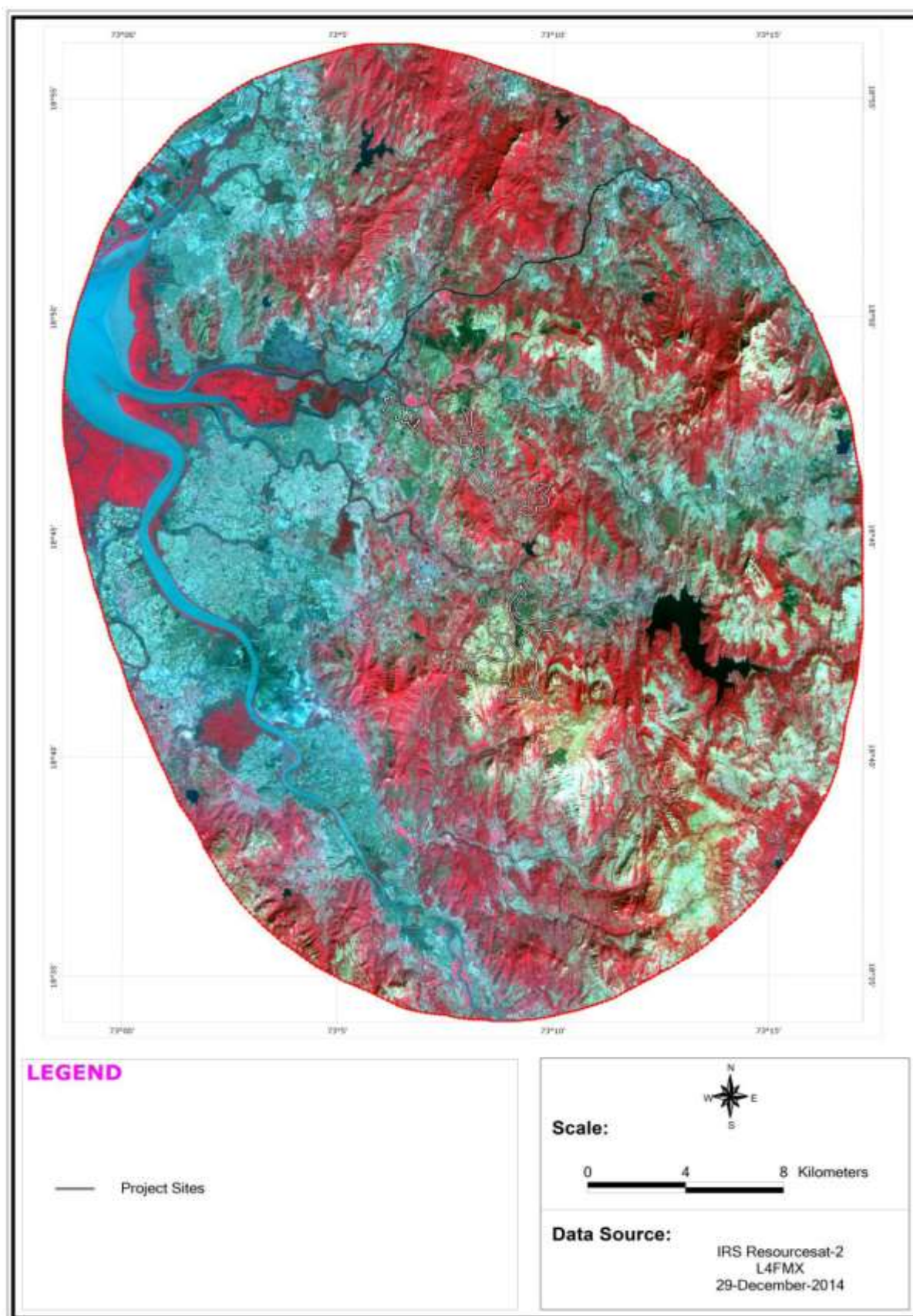


Figure 3-2: IRS Resourcesat-2 L4FMX Image of the Study Area

1.1.1.4 Scale of Mapping

Satellite data interpretation was done at 1:50,000 scale, which indicates that one unit of distance on the map, corresponds to 50,000 of the same units on the ground. Thus, one centimeter on the map refers to 50,000 cms (500m) on the ground.

1.1.1.5 Approach

The land use/land cover map is prepared by adopting the interpretation techniques of the image in conjunction with collateral data such as topographical maps and census records. For the present study, ERDAS and ArcView Software has been used for pre-processing, rectification, enhancements and classifying the satellite data for preparation of land use land cover map and assessing land use land cover and land developmental activities.

The imagery is interpreted initially based on the secondary data available and image characteristics. Thorough ground verification is done by BEIPL team to check each class of land use/ land cover spread over the entire study area and final land use/ land cover analysis is made after necessary corrections. The flowchart showing the methodology adopted is presented in Figure 3-3: Flowchart of simplified methodology.

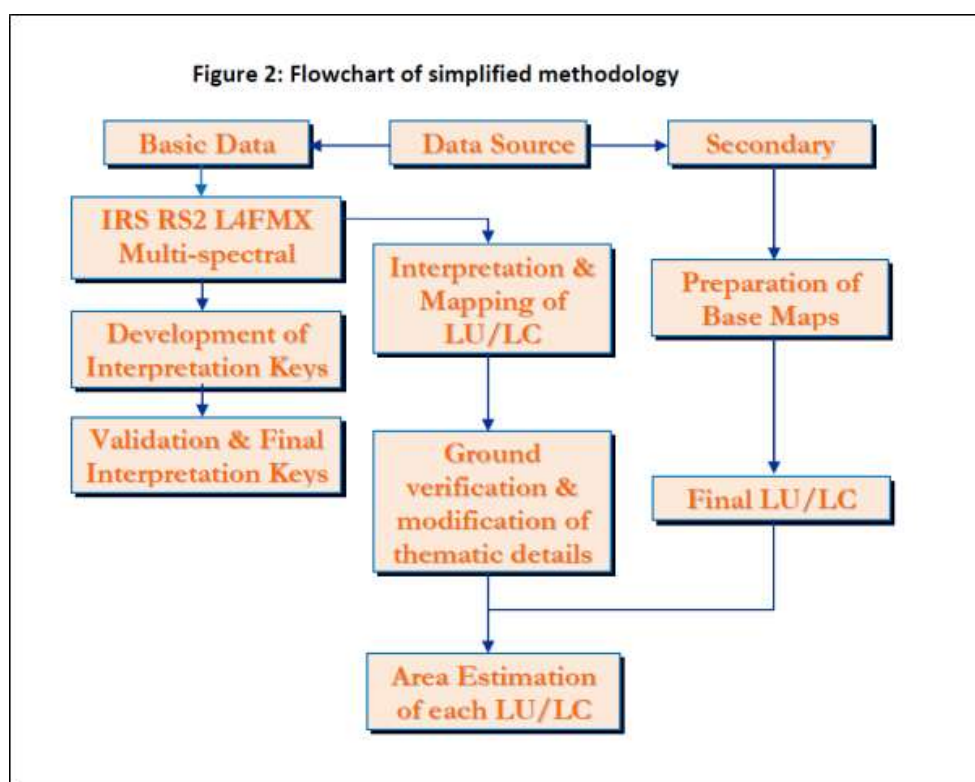


Figure 3-3: Flowchart of simplified methodology

1.1.1.6 Results of Land Use/Land Cover Mapping

Using the standard land use classification system proposed by NRSA, seven classes of level I, twenty-one of level II land use/land cover classes were identified and mapped using satellite data in the present study. Subsequently land use/land cover map of the study area (Figure 3-4) was digitally composed in ArcView module and the final area statistics was worked out and presented in Table 3-5, Distribution of land use/land cover in the study area is depicted in the

form of a bar chart in Figure 3-5. The results depict that the predominant land use is land with / without scrub (31.04%), followed by other agricultural (19.02%), dense open vegetation (18.89%). The other land uses along with respective percentages are given in Table 3-5.

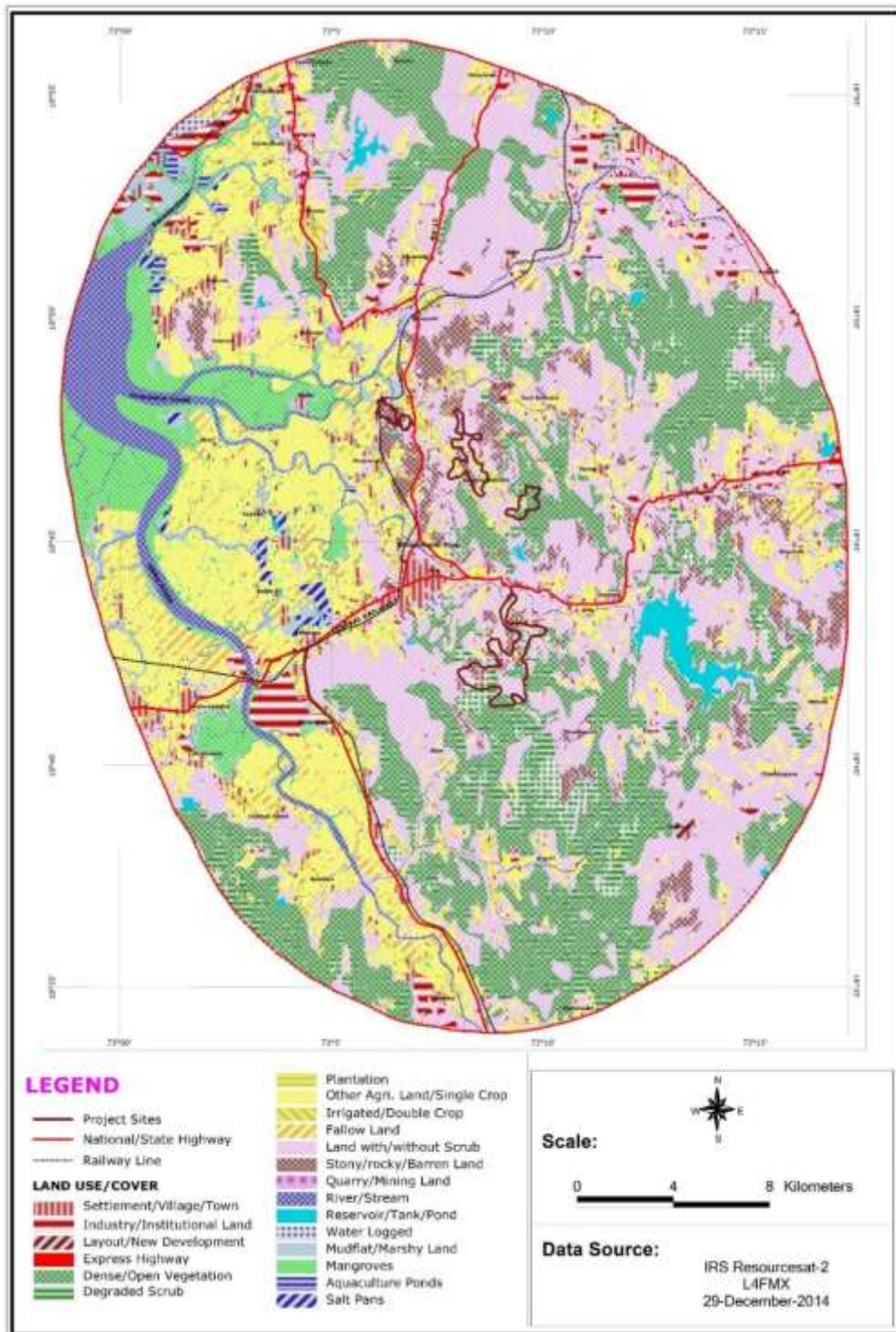


Figure 3-4: land use/land cover map of the study area

Table 3-5: Land Use/Land Cover statistics of 15 km Radius Area

S. No	Land Use	Area (Hectares)	Area (%)
1.	Settlement	3172.7	3.04
2	Industry	2504.7	2.40
3	Layout	41.7	0.04
4	Expressway	10.4	0.01
5	Dense / Open Vegetation	19714.4	18.89
6	Degraded Scrub	4623.3	4.43
7	Plantation	219.2	0.21
8	Irrigated	1565.5	1.50
9	Other agricultural	19850.0	19.02
10	Fallow Land	3266.6	3.13
11	Land with / without scrub	32394.6	31.04
12	Rocky / Barren	3861.5	3.70
13	Quarry Mining Land	135.7	0.13
14	Stream /River /Canal	4654.6	4.46
15	Reservoir /Tank / Pond	1429.8	1.37
16	Water Logged	114.8	0.11
17	Mudflats / Marshy Land	1722.0	1.65
18	Mangroves	4445.9	4.26
19	Aquaculture Ponds	250.5	0.24
20	Salt Pans	386.1	0.37
Total		104364	100.00

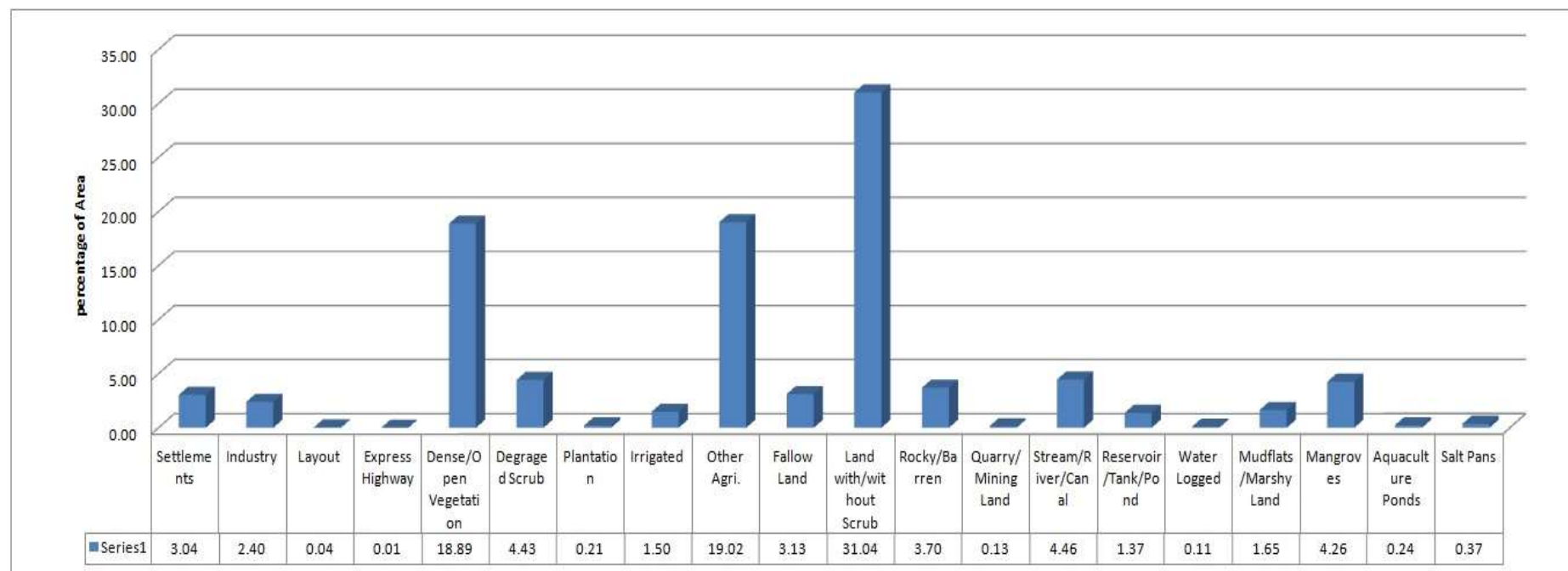


Figure 3-5: Distribution of LU/LC in 15 Km Radius Area

3.6 Climate and Meteorology

3.6.1 Primary Data

On site monitoring was undertaken for various meteorological variables in order to generate the site-specific data. The data generated has been compared with meteorological data generated by nearest observatory at Murud.

An automatic weather monitoring station was installed at a height of 10 meters from the ground level at proposed site to monitor parameters of wind speed and wind direction, temperature, & relative humidity. The 24 hourly meteorological data were collected for the study period from March 2015- May 2015. The data is recorded as the maximum, minimum, instantaneous value, and average value of all the readings collected during the proceeding hour. Monitoring was done as per IS: 8829: Micro-meteorological Techniques in Air Pollution. The details of parameters monitored, equipment used and the frequency of monitoring are given in Table 3-6.

Table 3-6: Meteorological Parameters Monitored at site

Sr. No	Parameters	Instruments	Frequency
1.	Wind speed	Counter Cup Anemometer	Hourly /Continuous
2.	Wind direction	Wind vane	Hourly /Continuous
3.	Temperature	Thermo sensor	Hourly /Continuous
4.	Relative humidity	Thermo –hydro sensor	Hourly /Continuous

3.6.2 Secondary Data

The secondary data for meteorological variables such as wind speed, wind direction and temperature for the period March -2014 to May 2014 was collected from the nearest IMD station Murud.

The secondary data of Murud IMD station were analyzed w.r.t wind pattern and temperature. The seasonal and month –wise interpretation of the secondary data is presented below:

1.1.1.7 Seasonal (March 2014 – May 2014) – Secondary Data

Wind pattern: The seasonal wind pattern is presented in the form of wind rose from the month of March -2014 – May 2014 (Refer Figure 3-6). The wind rose reflects that the predominant wind direction is from the W-NW quadrant followed by the East direction. The wind speed varied from 0 m/s to 4.6 m/s, while the average was computed to be 1.37 m/s. The wind speed frequency distribution chart for the period from March – 2014 to May -2014 is presented in **Error! Reference source not found.** and reflects that the wind speed class - 0.5 m/s to 2.1 m/s was found to be predominant (about 70.8%) most of the time during the season (March 2014 – May 2014). The frequency of calm period prevailed for 1.5% during the season (March 2014 – May 2014).

Temperature: The temperature varied from 17.8°C to 38.6°C with the average being 28.1°C during the season. (March 2014 – May 2014).

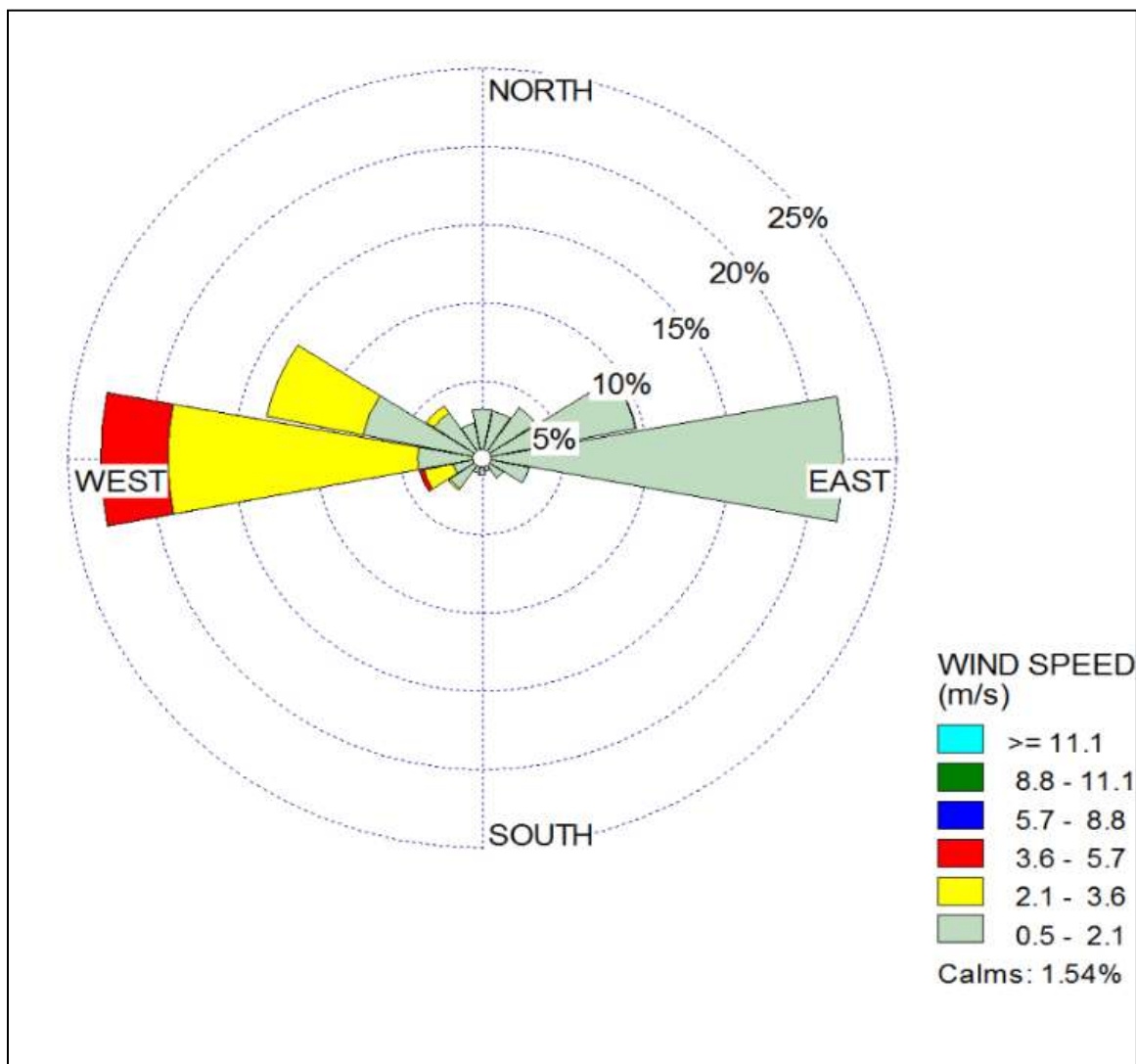


Figure 3-6: Wind rose for the period March -2014 to May-2014 –IMD Murud

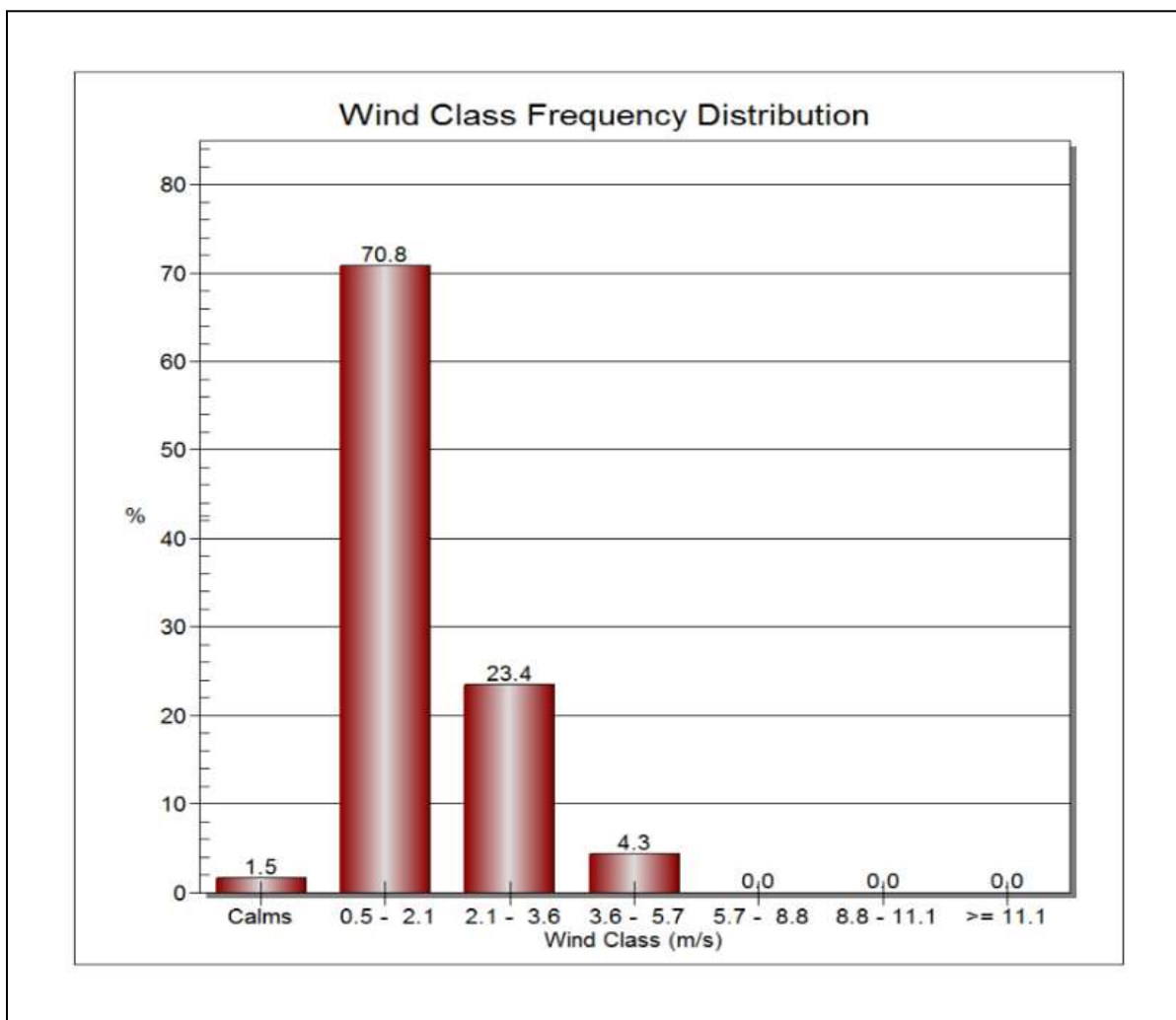


Figure 3-7: Wind rose for the period March -2014 to May-2014 –IMD Murud

1.1.1.8 Monthly pattern

March -2014

Wind pattern: The wind pattern is presented in the form of wind rose for the month of March - 2014 (Figure 3-8). The wind rose reflects that the predominant wind direction is from East followed by the W-NW quadrant. The wind speed varied from 0 m/s to 4.1 m/s, while the average was computed to be 1.2 m/s. The wind speed frequency distribution chart for the month of March-2014 is presented in Figure 3-9: Wind class frequency distribution chart of IMD Murud (March-2014) and reflects that the wind speed class - 0.5m/s to 2.1 m/s was found to be predominant (about 79.7%) most of the time during the month of March 2014. The frequency of calm period prevailed for 1.9% of during the month.

Temperature: The temperature varied from 17.8°C to 38.6°C with the average being 27°C.

April 2014

Wind pattern: The wind pattern is presented in the form of wind rose for the month of April -2014 (Refer **Error! Reference source not found.**). The wind rose reflects that the predominant wind direction is from the W-NW quadrant followed by the East direction. The wind speed varied from 0 m/s to 3.9 m/s, while the average was computed to be 1.4 m/s. The wind speed frequency distribution chart for the month of April 2014 is presented in **Error! Reference source not found.** and reflects that the wind speed class - 0.5m/s to 2.1 m/s was found to be predominant (about 69.3%) most of the time during the month of April - 2014. The frequency of calm period prevailed for 1.3% during the month.

Temperature: The temperature varied from 19.2°C to 36.6°C with an average being 27.7°C during the month of April-2014.

May 2014

Wind pattern: The wind pattern is presented in the form of wind rose for the month of May -2014 (Refer **Error! Reference source not found.**). The wind rose reflects that the predominant wind direction is from the W direction followed by the East direction. The wind speed varied from 0 m/s to 4.6 m/s, while the average was computed to be 1.5 m/s. The wind speed frequency distribution chart for the month of May - 2014 is presented in **Error! Reference source not found.** and reflects that the wind speed class - 0.5m/s to 2.1 m/s was found to be predominant (about 63.3%) most of the time during the month of May - 2014. The frequency of calm period prevailed for 1.5% during the month. Temperature: The temperature varied from 23.8°C to 34.3°C with the average being 29.6°C during the month of May-2014.

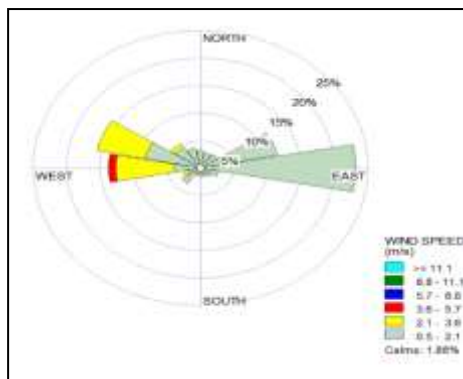


Figure 3-8: Wind rose for the month of March 2014 (IMD station–Murud)

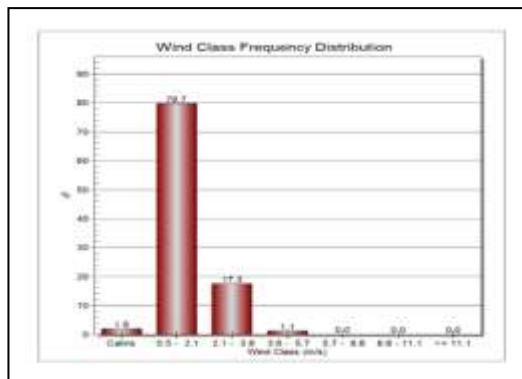


Figure 3-9: Wind class frequency distribution chart of IMD Murud (March-2014)

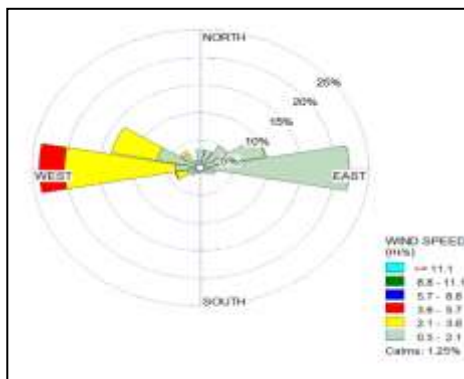


Figure 3-10: Wind rose for the month of April -2014 (IMD Murud)

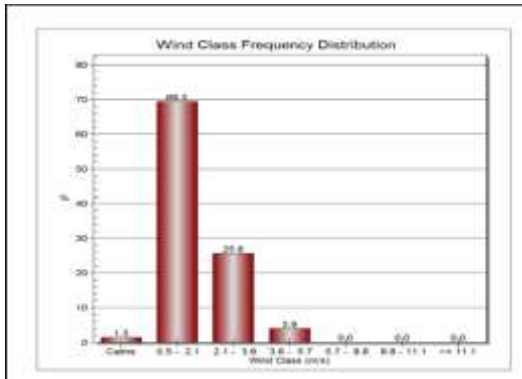


Figure 3-11: Wind class frequency distribution chart of IMD Murud (April-2014)

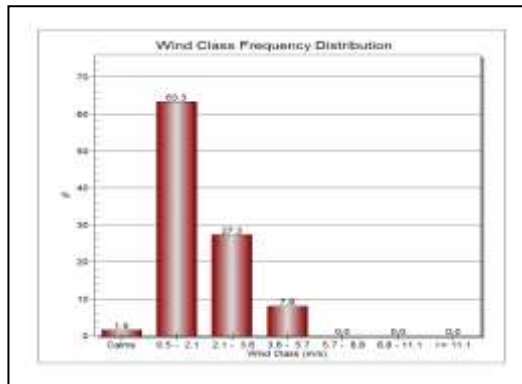
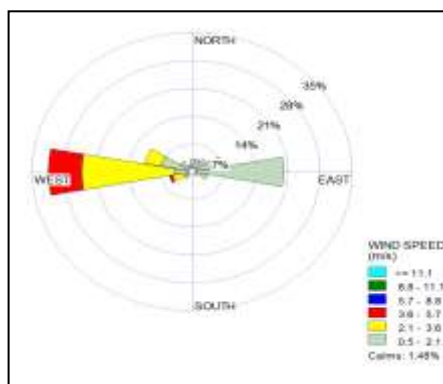


Figure 3-12: Wind rose for the month of May 2014 (IMD station –Murud)

Figure 3-13: Wind class frequency distribution chart IMD Murud (May -2014)

The synopsis of data collected from the nearest IMD station Murud is presented in Table 3-7:

Table 3-7: Synopsis of site specific meteorological data (March 2014 – May 2014)

Month	Wind speed (m/s)			Temperature (°C)		
	Max	Min	Avg	Max	Min	Avg
March -2014	4.1	0	1.2	38.6	17.8	27
April-2014	3.9	0	1.4	36.6	19.2	27.7
May -2014	4.6	0	1.5	34.3	23.8	29.6

1.1.1.9 Seasonal (March 2015 – May 2015) – Primary Data

The seasonal wind pattern is presented in the form of wind rose from the month of March -2015– May 2015 (Refer Figure 3-14: Seasonal wind pattern (March 2015 – May 2015)). The wind rose reflects that the predominant wind direction is from the W-NW quadrant followed by the East direction. The wind speed varied from 0 m/s to 6.0 m/s, while the average was computed to be 1.48 m/s. The wind class frequency distribution chart for the period from March–2015 to May-2015 is presented in Figure 3-15: Wind class frequency distribution (March 2015 – May 2015) and reflects that the wind speed fraction in the range of 0.5 m/s to 2.1 m/s was found to be predominant (about 67.5%) most of the time during the season (March 2015–May 2015). The frequency of calm period prevailed for 2.4% during the season.

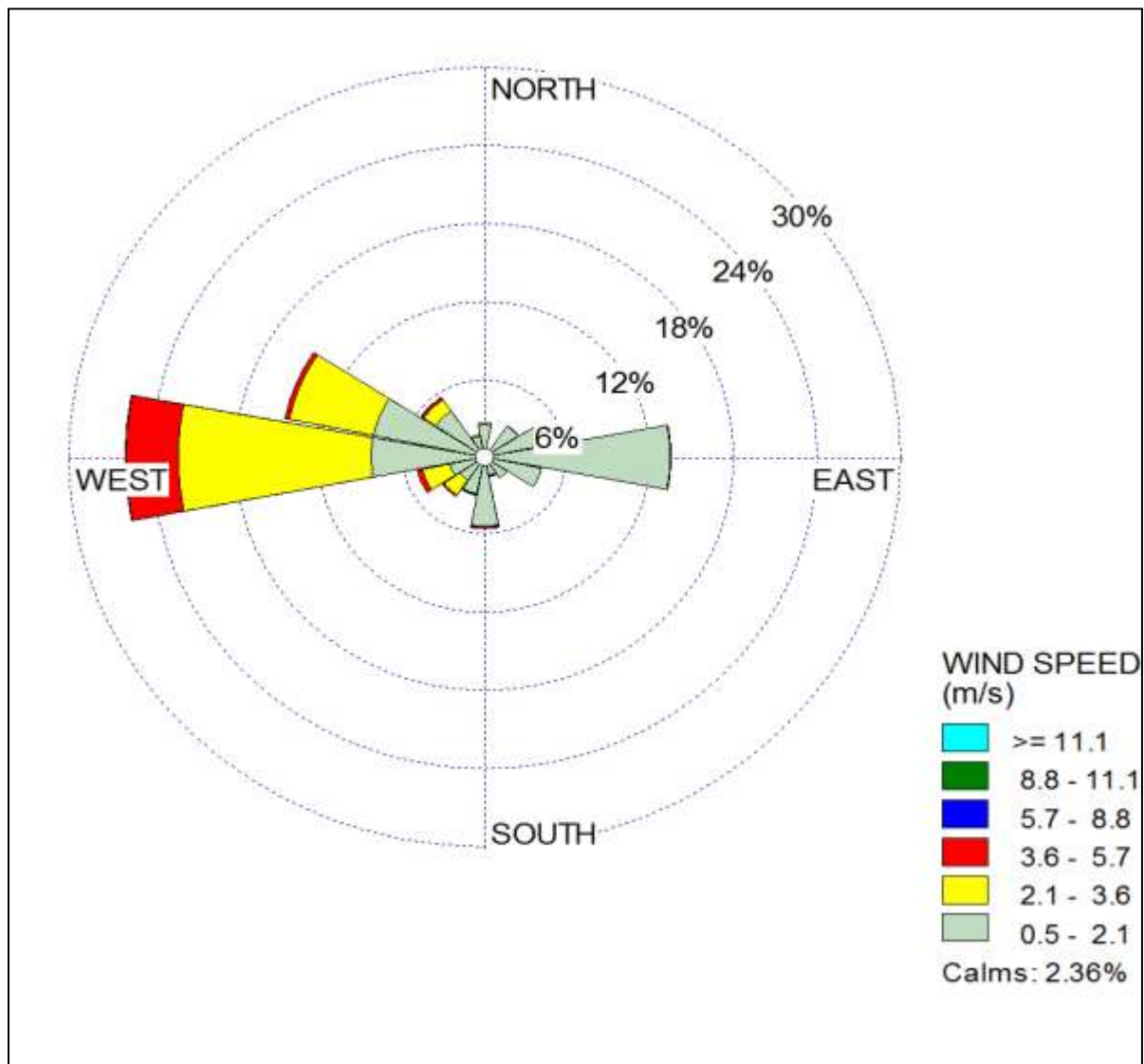


Figure 3-14: Seasonal wind pattern (March 2015 – May 2015)

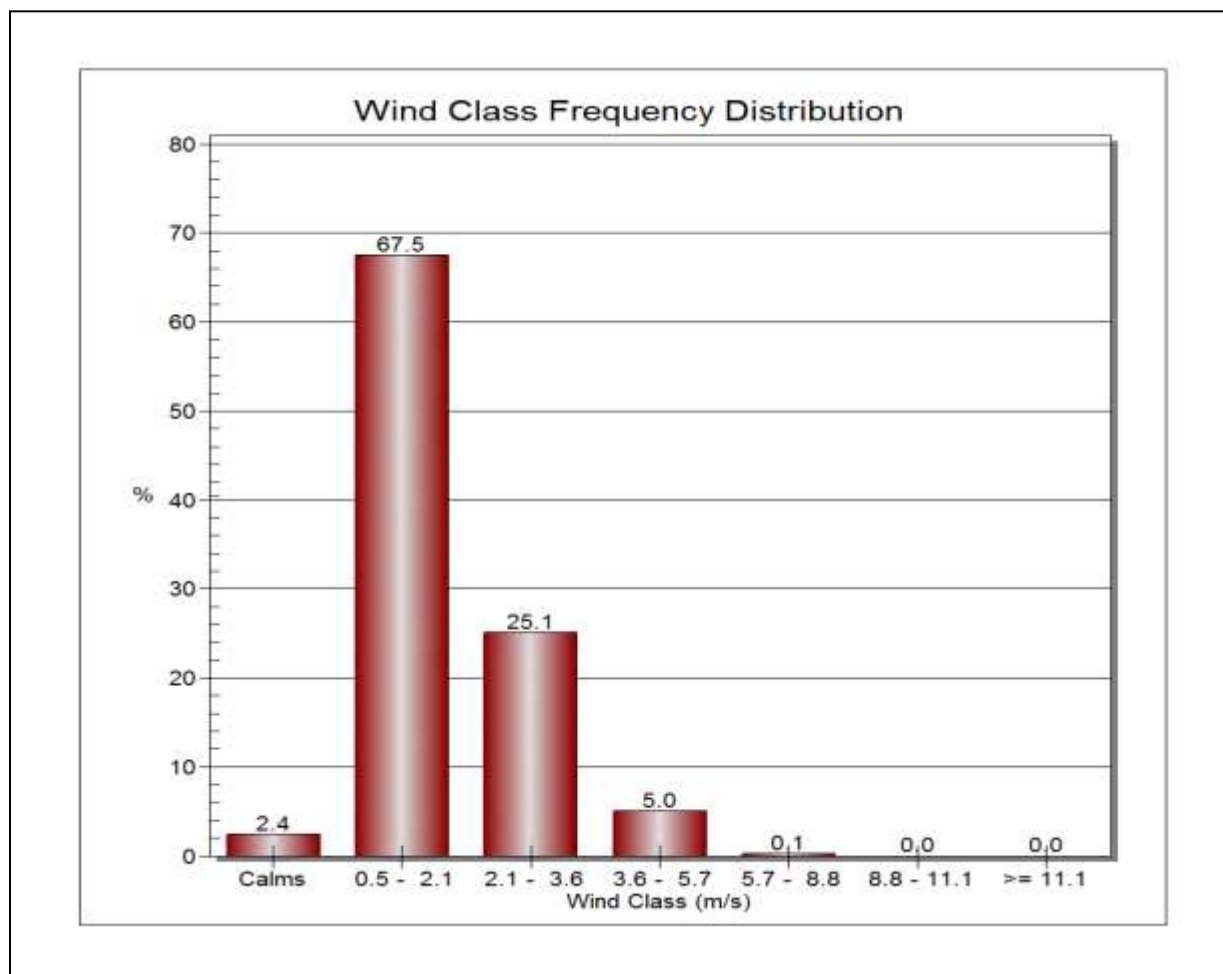


Figure 3-15: Wind class frequency distribution (March 2015 – May 2015)

1.1.1.10 Monthly pattern

March 2015

Wind pattern: The wind pattern is presented in the form of wind rose for the month of March - 2015 (Refer Figure 3-16). The wind rose reflects that the predominant wind direction is from W-NW quadrant followed by the East direction. The wind speed varied from 0 m/s to 5.5 m/s, while the average was computed to be 1.25 m/s. The wind speed frequency distribution chart for the month of March-2015 is presented in Figure 3-17: Wind class frequency distribution (March - 2015) and reflects that the wind speed fraction in the range of 0.5m/s to 2.1 m/s was found to be predominant (about 75%) most of the time during the month of March 2015. The frequency of calm period prevailed for 4.2% during the month.

Temperature: The temperature varied from 18°C to 39.1°C with the average being 26.8°C during the month of March-2015.

April 2015

Wind pattern: The wind pattern is presented in the form of wind rose for the month of April -2015 (Refer Figure 3-18: Site specific wind rose (April 2015)). The wind rose reflects that the predominant wind direction is from W-NW quadrant followed by the East direction. The wind speed varied from 0 m/s to 6.0 m/s, while the average was computed to be 1.61 m/s. The wind speed frequency distribution chart for the month of April- 2015 is presented in Figure 3-19: Wind class frequency distribution (April -2015) and reflects that the wind speed fraction in the range of 0.5m/s to 2.1 m/s was found to be predominant (about 65%) most of the time during the month of April 2015. The frequency of calm period prevailed for 1.5% during the month.

Temperature: The temperature varied from 20.9°C to 36°C with the average being 27.7°C during the month of April- 2015

May 2015

Wind Pattern: The wind pattern is presented in the form of wind rose for the month of May-2015 (Refer Figure 3-20: Site specific wind rose (May 2015)). The wind rose reflects that the predominant wind direction is from W direction followed by the East direction. The wind speed varied from 0 m/s to 4.6 m/s, while the average was computed to be 1.57 m/s. The wind speed frequency distribution chart for the month of May -2015 is presented in Figure 3-21: Wind class frequency distribution

(May 2015) and reflects that the wind speed fraction in the range of 0.5m/s to 2.1 m/s was found to be predominant (about 62.4%) most of the time during the month of May 2015. The frequency of calm period prevailed for 1.3% during the month.

Temperature: The temperature varied from 23.4°C to 34°C with the average being 29.4°C during the month of May-2015.

Primary site specific meteorological data: The primary site specific meteorological parameters viz., wind speed, wind direction and temperature were recorded for the period from March 2015 – May 2015 were recorded by installing onsite meteorological weather station on the site at an anemometric height of 10m above the ground level. The synopsis of the findings is presented in Table 3-8: Synopsis of site specific meteorological data (March 2015 – May 2015) below.

Table 3-8: Synopsis of site specific meteorological data (March 2015 – May 2015)

Month	Wind speed (m/s)			Temperature (°C)		
	Max	Min	Avg	Max	Min	Avg
March -2015	5.5	0	1.25	39.1	18	26.8
April-2015	6	0	1.6	36	20.9	27.7
May -2015	4.6	0	1.57	34	23.4	29.4

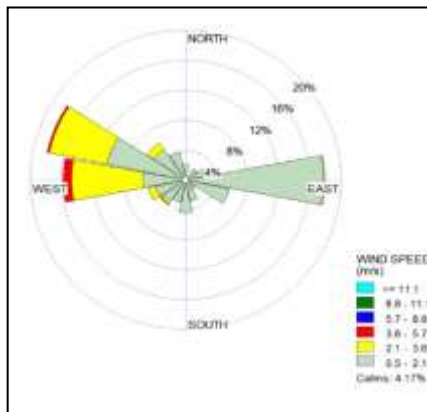


Figure 3-16: Site specific wind rose (March 2015)

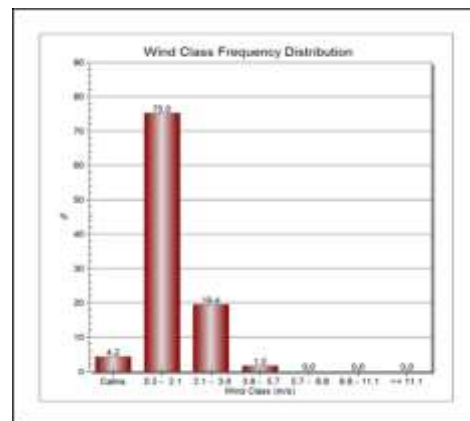


Figure 3-17: Wind class frequency distribution (March -2015)

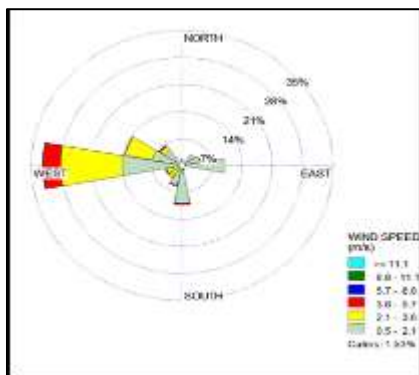


Figure 3-18: Site specific wind rose (April 2015)

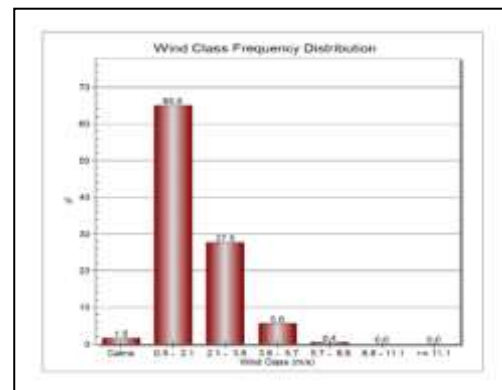


Figure 3-19: Wind class frequency distribution (April -2015)

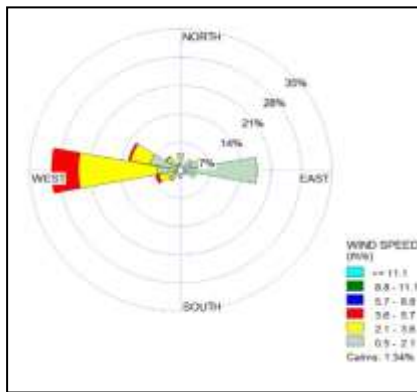


Figure 3-20: Site specific wind rose (May 2015)

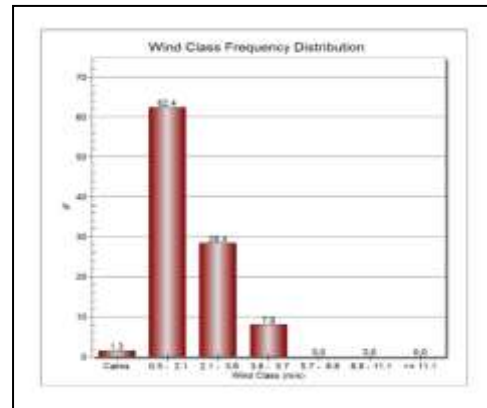


Figure 3-21: Wind class frequency distribution

1.1.1.11 Total monthly rainfall

The total monthly rainfall was collated for the IMD station from IMD publication “Climatological Normals 1981-2010” and is presented in the Figure 3-22: Total monthly rainfall for IMD station Alibag

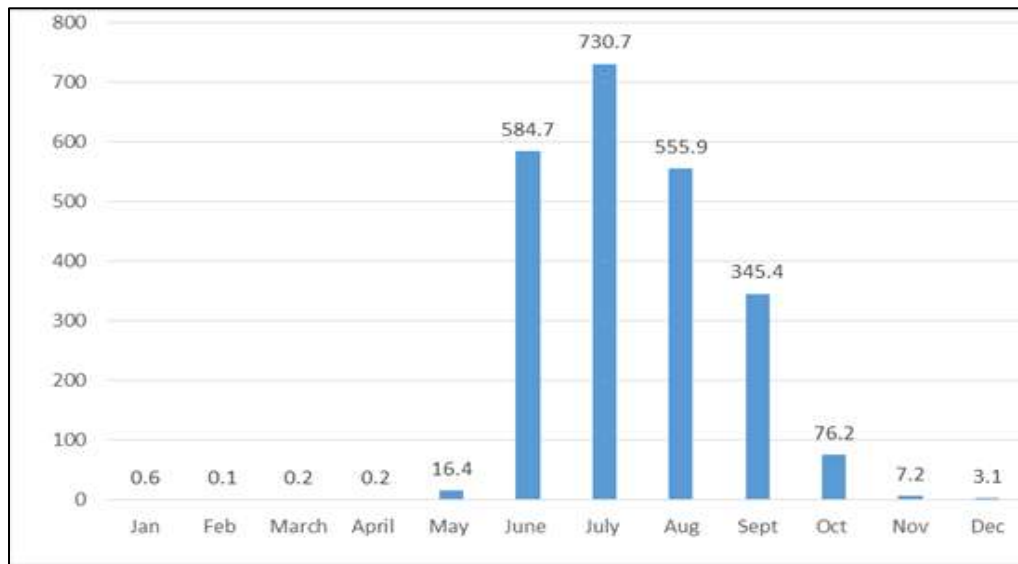


Figure 3-22: Total monthly rainfall for IMD station Alibag

The chart reflects that the lowest total monthly rainfall was for the month of February (0.1 mm) and highest for the month of July (730.7 mm)

3.7 Ambient Air Quality

The existing ambient air quality of the study area provides an assessment of pollution load and assimilative capacity of region and forms an important tool for planning further development in the area. The main sources of air pollution in the study area include industrial emissions from vehicular traffic and from domestic burning of fuel. The air quality was studied to assess the current status of the same and to check the air quality status of the region vis-à-vis the air quality standards prescribed by the Central Pollution Control Board. The ambient air quality monitoring was conducted at 14 locations considering the sensitive receptors w.r.t. the proposed project site. The monitoring locations have been selected primarily based on the predominant wind direction. The details are given in Table 3-9. The other factors considered while selection of the monitoring stations includes topography, representative nature of the sample, accessibility, location of receptors and availability of power.

Table 3-9: Monitoring Stations for Air Quality Assessment

Sr. No.	Location	Sample Code	Distance from the boundary of nearest land parcel (km)	Geographical Location	Direction from the boundary of the nearest land parcel
1	Onsite of T3 Land Parcel	AQ1	2.98 w.r.t T4	18°48'21.68"N; 73° 4'54.59"E	NW
2	Downwind of T3 at Rave village	AQ2	4.52 w.r.t T4	18°48'53.77"N; 73° 4'8.77"E	NW
3	Upwind of T-3 at Kharoshi Padale Village	AQ3	1.50 w.r.t T4	18°48'36.59"N; 73° 6'2.84"E	NW
4	Onsite T-4 Land Parcel	AQ4	Project site at T4	18°46'39.19"N; 73° 6'51.91"E	---
5	Downwind of T-4 at Balavali Village	AQ5	1.23 km w.r.t T4	18°47'39.15"N; 73° 5'54.32"E	NW
6	Upwind of T-4 at Nidhavali Village	AQ6	1.3 km w.r.t T4	18°47'19.72"N; 73° 7'30.23"E	NE
7	Onsite T-2 Land Parcel	AQ7	Project site T2	18°45'48.89"N; 73° 8'14.23"E	---
8	Downwind of T-2 at South of Belawade Budruk	AQ8	0.44 w.r.t T2	18°45'22.82"N; 73° 7'38.90"E	SW
9	Upwind of T-2 at base of Hills	AQ9	3.64 w.r.t T2	18°45'54.28"N; 73°10'34.16"E	E
10	Onsite T-1 Land Parcel	AQ10	Project site T1	18°42'32.00"N; 73° 8'4.01"E	---
11	Downwind of T-1 at Wirani Village	AQ11	1.02 w.r.t T1	18°43'1.00"N; 73° 9'16.66"E	E
12	Upwind of T-1 at Talavali Village	AQ12	0.27 w.r.t T1	18°42'32.77"N; 73° 7'11.64"E	W
13	Crosswind in North of the Project area at Village Jui Khur	AQ13	1.74 w.r.t T4	18°48'52.88"N; 73° 6'18.50"E	NNW
14	Crosswind in South of the Project area at Village Shene	AQ14	2.82 w.r.t T1	18°40'20.62"N; 73° 6'1.37"E	SW

3.7.1 Sampling Period, Frequency and Parameters

During the period from March 2015 to May -2015. 24-hourly samples were collected twice a week from each location. The following air pollution parameters were measured by sampling during the sampling period. Map of monitoring locations in Figure 3-23: Map depicting the ambient air quality monitoring locations Particulate Matter less than 10µm (PM₁₀)

- Particulate Matter less than 2.5µm (PM_{2.5})
- Sulphur dioxide (SO₂)
- Oxides of nitrogen (NO₂)
- Carbon monoxide (CO)
- Hydrocarbon (HC)

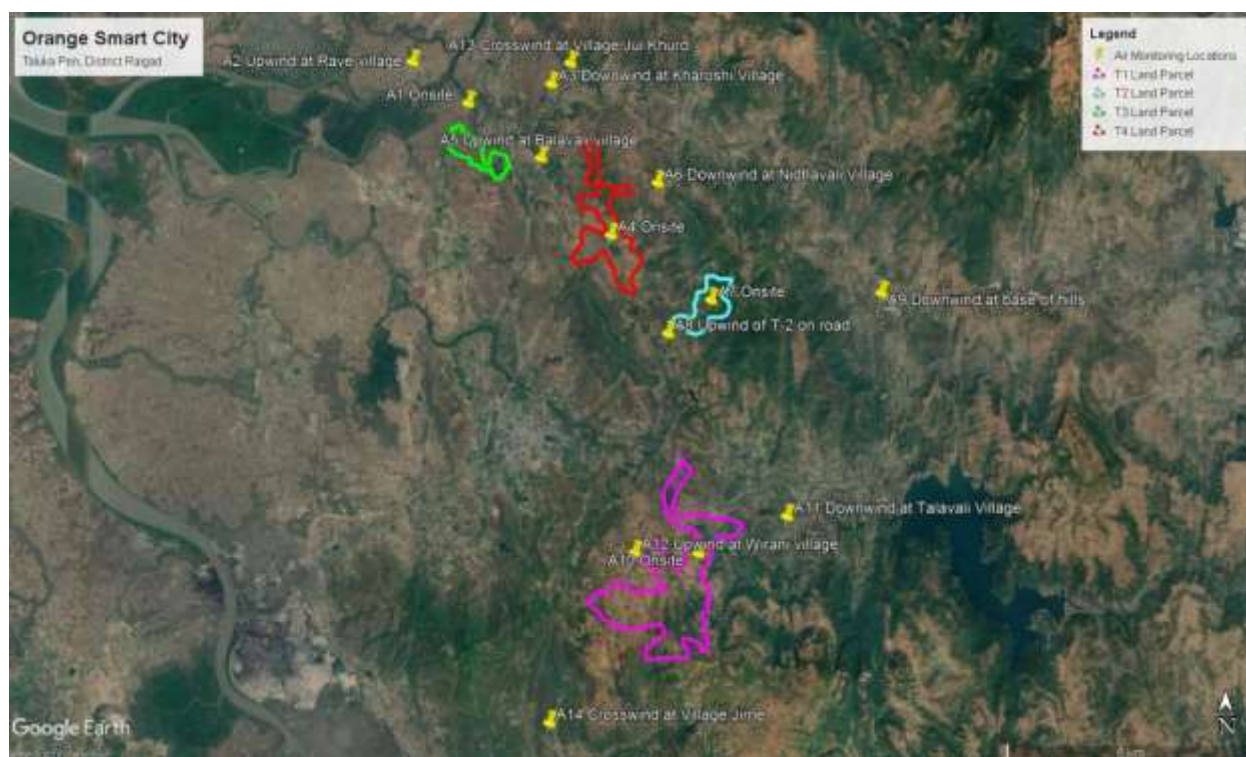


Figure 3-23: Map depicting the ambient air quality monitoring locations

3.7.2 Sampling and Analytical Procedure

A brief description of the sampling and analytical procedures followed during the ambient air quality survey is as follows:

PM₁₀: The sampling of ambient air for evaluating PM₁₀ levels were performed with a Fine Dust Sampler NPM-FDS 2.5 A without PM_{2.5} Inlet. The PM₁₀ concentrations were evaluated gravimetrically and computed from the average air flow rate, sampling Period and the mass of particulate matter collected over the filter paper.

PM_{2.5}: Ambient air enters the NPM-FDS 2.5 A with impactor through an inlet designed to provide a clean aerodynamic cut-point for particles greater than 10 microns. Particles in the air stream less than 10 microns proceed to a “WINS” impactor that has an aerodynamic cut point at 2.5 microns. The air sample and fine particulates exiting from the PM_{2.5} impactor is passed through a 47mm diameter filter membrane that retains the Fine Particulate Matter. The PM_{2.5} concentrations are evaluated gravimetrically and computed from the mass of PM_{2.5} collected on filter paper and total volume of air sampled.

Sulphur Dioxide: The sampling of ambient air for evaluating the gaseous pollutants was performed with a Multi-gas Sampler, using the vacuum created by the sampler for drawing the air samples through the impingers. For SO₂, air was drawn at a measured and controlled rate of 400 to 500 ml/min through a solution of potassium tetrachloro mercurate. After completion of the sampling, the used absorbing reagent was treated with dilute solutions of sulfamic acid, formaldehyde and para-rosaniline hydrochloride. The absorbance of the intensely colored para-rosaniline methyl sulphononic acid was measured and the amount of SO₂ in the sample was computed. The ambient SO₂ concentrations were computed from the amount of SO₂ collected and the volume of air sampled.

Oxides of Nitrogen: Air was drawn at a measured and controlled rate of about 500 ml/min through an orifice-tipped impinger containing solutions of sodium hydroxide and sodium arsenite. After completion of the sampling, an aliquot of the used absorbing solution was treated with solutions of H₂O₂, sulphanilamide and NEDA. The nitrite ion present in the Impinger was calculated from the absorbance of the resulting solution. The ambient NO_x concentrations were computed from the total nitrite ion present in the impingers, overall efficiency of the Impinger and the procedure, and the volume of air sampled.

Hydrocarbon: Rubber Bladder and Aspirators have been used to collect the samples for hydrocarbon. The HC levels were analyzed through Gas Chromatography.

Carbon Monoxide: Rubber Bladder and Aspirators have been used to collect the samples for carbon monoxide. The CO levels were analyzed by NDIR Technology.

1.1.1.12 Techniques for Measurement

The techniques used for measurement of pollutants may be summarized in Table 3-10: Measurement Techniques. The ambient air quality monitoring was undertaken twice a week for a period of twelve weeks. One set of 24-hour average samples were collected continuously. Analytical results of the air monitoring are presented in Table 3-11: AAQ Monitoring Results below. The results of the CO monitored are presented in Table 3-12: .

Table 3-10: Measurement Techniques

S.N.	Pollutant	Code of Practice	Methods of Measurement
1	Particulate Matter (size less than 10 µm) or PM ₁₀	IS-5182 (PART-23):2006 & CPCB Guidelines	Gravimetric
2	Particulate Matter (size less than 2.5 µm) or PM _{2.5}		

3	Sulphur Dioxide (SO ₂)	IS-5182 (Part-II):2001 & CPCB Guidelines	Improved West and Geake
4	Nitrogen Dioxide (NO ₂)	IS-5182 (Part-VI): 2006 & CPCB Guidelines	Modified Jacob & Hochheiser (Na-Arsenite)
5	Hydrocarbon (HC)	NIOSH 1500	Gas Chromatography
6	Carbon Monoxide (CO)	IS: 5182 (Part-X) & CPCB Guidelines	Non Dispersive Infra-Red (NDIR) spectroscopy
7	Volatile Organic Compounds (VOC)	NIOSH 2549	Gas Chromatography

Table 3-11: AAQ Monitoring Results in $\mu\text{g}/\text{m}^3$

Location code	Pollutant															
	SO ₂				NO _x				PM ₁₀				PM _{2.5}			
	Min	Max	Average	98th %tile	Min	Max	Average	98th %tile	Min	Max	Average	98th %tile	Min	Max	Average	98th %tile
AQ1	11.74	22.75	19.09	22.33	34.25	51.64	42.62	50.23	48.16	64.46	54.36	50.23	24.42	38.42	27.48	35.18
AQ2	9.05	12.65	11.06	12.48	17.28	22.52	20.7	22.37	47.68	54.28	50.84	53.43	20.21	27.49	24.36	27.09
AQ3	8.15	12.95	10.3	12.72	47.68	54.28	50.84	23.12	36.19	50.33	41.87	49.32	17.21	25.56	20.66	24.63
AQ4	9.58	15.02	12.79	14.91	19.15	29.15	24.44	28.23	47.02	61.25	56.41	60.81	23.27	31.78	27.94	31.36
AQ5	12.79	15.02	9.58	10.94	12.58	23.25	17.99	22.23	35.1	43.2	38.74	42.73	15.77	20.65	17.76	20.53
AQ6	8.75	10.44	6.5	10.35	12.21	20.42	17.35	20.3	36.02	43.38	38.73	43.11	16.76	21.31	18.95	20.96
AQ7	13.55	17.41	15.47	17.28	22.45	29.15	25.35	29.12	43.45	58.67	50.96	56.59	21.14	29.79	24.55	29.017
AQ8	6.65	10.44	8.54	9.98	13.15	20.34	17.41	20.2	34.85	40.18	37.96	40.03	15.82	20.28	18.2	20.25
AQ9	7.27	11.35	8.82	10.78	12.62	23.3	18.05	22.35	35.08	41.5	38.46	41.1	17.06	20.85	18.82	20.62
AQ10	14.1	18.63	16.1	18.51	20.22	28.95	25.43	28.84	54.2	64.12	59.53	64.11	19.06	22.85	20.81	22.62
AQ11	7.27	11.35	8.82	10.77	12.62	23.3	18.05	22.35	35.08	41.5	38.46	41.09	17.06	20.85	18.81	20.62
AQ12	9.42	14.62	11.9	14.48	18.3	23.65	21.13	23.46	40.65	53.02	46.94	52.95	19.87	26.77	23.32	26.56
AQ13	9.88	15.11	12.31	14.79	19.24	25.1	21.26	24.54	47.17	52.45	49.52	52.19	17.21	26.33	23.48	26
AQ14	8.93	14.65	11.45	14.63	14.3	23.66	19.3	23.43	35.77	49.32	42.7	49.3	17.2	21.65	19.2	21.61
CPCB limits	80				80				100				60			

Table 3-12: AAQ Monitoring Results in mg/m³ for CO

Location code	Pollutant			
	CO			
	Min	Max	Avg	98th %tile
A1	0.2	0.7	0.37	0.65
A2	BDL	BDL	BDL	BDL
A3	BDL	BDL	BDL	BDL
A4	0.1	0.6	0.38	0.6
A5	BDL	BDL	BDL	BDL
A6	BDL	BDL	BDL	BDL
A7	0.1	0.4	0.26	0.4
A8	BDL	BDL	BDL	BDL
A9	BDL	BDL	BDL	BDL
A10	0.2	0.8	0.4	0.76
A11	BDL	BDL	BDL	BDL
A12	BDL	BDL	BDL	BDL
A13	BDL	BDL	BDL	BDL
A14	BDL	BDL	BDL	BDL

3.7.3 Inferences

1.1.1.13 Particulate Matter – PM₁₀

The average PM₁₀ concentration recorded at all the sampling locations are well below the prescribed CPCB limits of 100µg/m³. The minimum value recorded was 34.85 µg/m³ at downwind of T-2 at South of Belawade Budruk (AQ8). The maximum value recorded was 64.46 µg/m³ at onsite of T3 land parcel (AQ-1). The 98 percentile values ranged from 20.2 µg/m³ to 50.23 µg/m³. The high values of PM₁₀ can be attributed to the terrain and sandy soil type of the region. The average values varied from 17.35 µg/m³ to 50.84 µg/m³. The graphical representation is provided in Figure 3-24: Graphical representation of the maximum values of PM₁₀

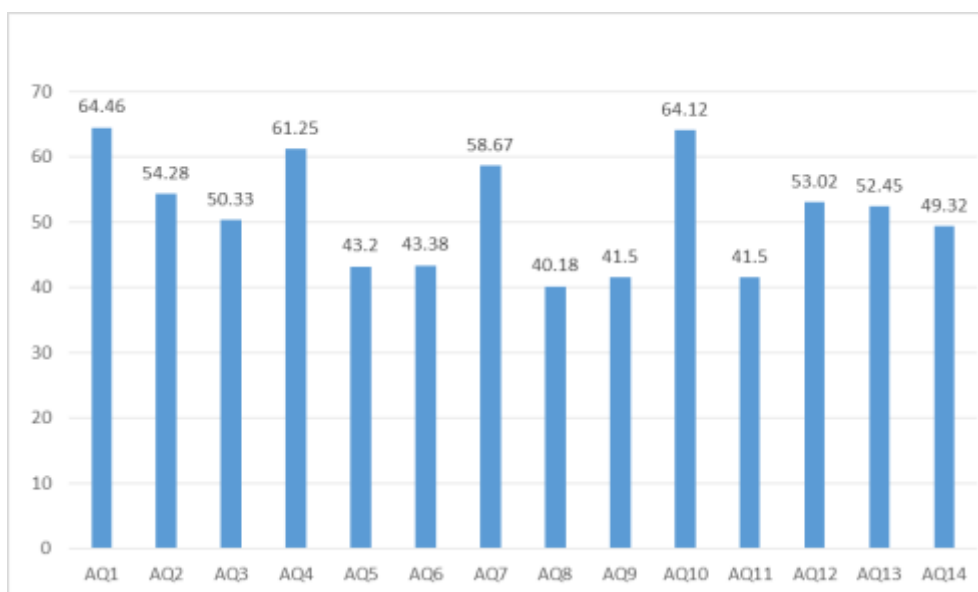
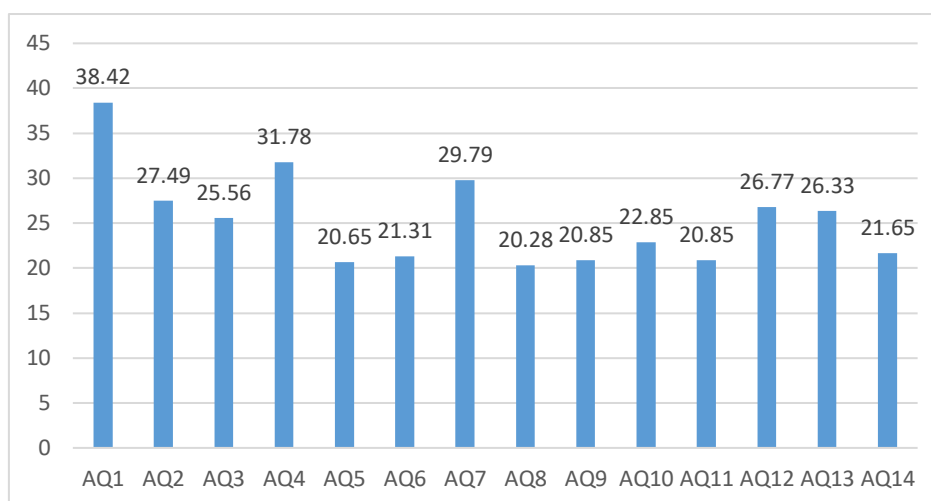


Figure 3-24: Graphical representation of the maximum values of PM₁₀

Note: All figures in µg/m³

1.1.1.14 Particulate Matter – PM_{2.5}

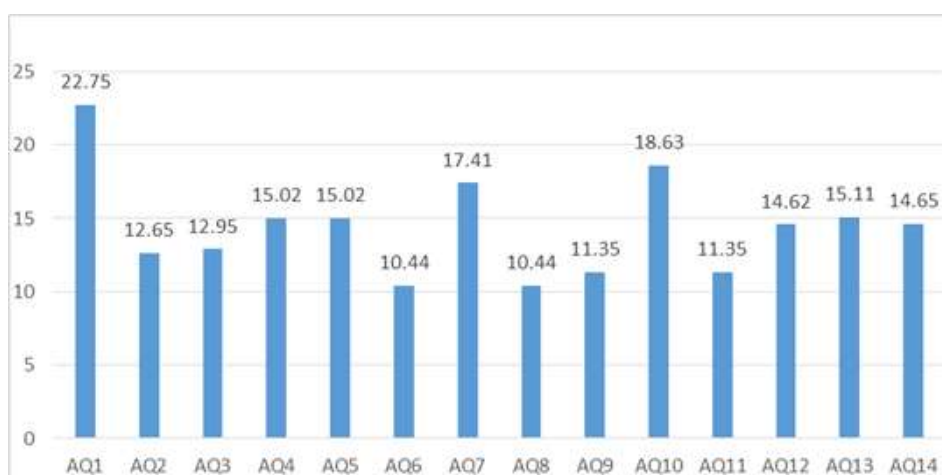
The average PM_{2.5} concentration recorded at all the sampling locations are well below the prescribed CPCB limits of 60 µg/m³. The minimum value recorded was 15.77 µg/m³ at downwind of T-4 at Balavali village (AQ5). The maximum value recorded was 38.42 µg/m³ at onsite of T3 land parcel (AQ-1). The 98 percentile values ranged from 20.25 µg/m³ to 35.18 µg/m³. The high values of PM_{2.5} can be attributed to the terrain and sandy soil type of the region. The average values varied from 17.76 µg/m³ to 27.94 µg/m³. The graphical representation is provided in Figure 3-25: Graphical representation of maximum values of PM_{2.5}

Figure 3-25: Graphical representation of maximum values of PM_{2.5}

Note: All values in µg/m³

1.1.1.15 Sulphur Dioxide (SO₂)

The average concentrations of SO₂ were found to well within the prescribed CPCB limit of 80 µg/ m³. The concentrations of sulphur dioxide in the region are observed to be in the range of 6.65 to 22.75 µg/m³. The maximum values of SO₂ were recorded at Onsite of T3 land parcel (AQ-1). The average values ranged from 6.5 µg/ m³ to 19.09 µg/m³ and 98 percentile values varied from 9.98 µg/ m³ to 22.33 µg/m³. The graphical representation of observations is presented in

Figure 3-26: Graphical representation of maximum values of SO₂Figure 3-26: Graphical representation of maximum values of SO₂

Note: All values in µg/m³

1.1.1.16 Oxides of Nitrogen

The minimum NO_x concentration was observed to be 12.21 µg/m³ at Upwind of T-4 at Nidhawali Village, (AQ6). The maximum NO_x concentration observed is 54.28 µg/m³ at Upwind of T-3 at Kharoshi Padale Village (AQ-3). The 98 percentile values measured were in the range of 20.2 µg/m³ and 50.23 µg/m³. The average values ranged from 17.35 µg/m³ to 50.84 µg/m³. The NO_x concentrations were within the prescribed norms of 80 µg/m³ as per

NAAQS guidelines. The observations of NO_x are presented graphically in Figure 3-27: Graphical representation of maximum values of NO_x.

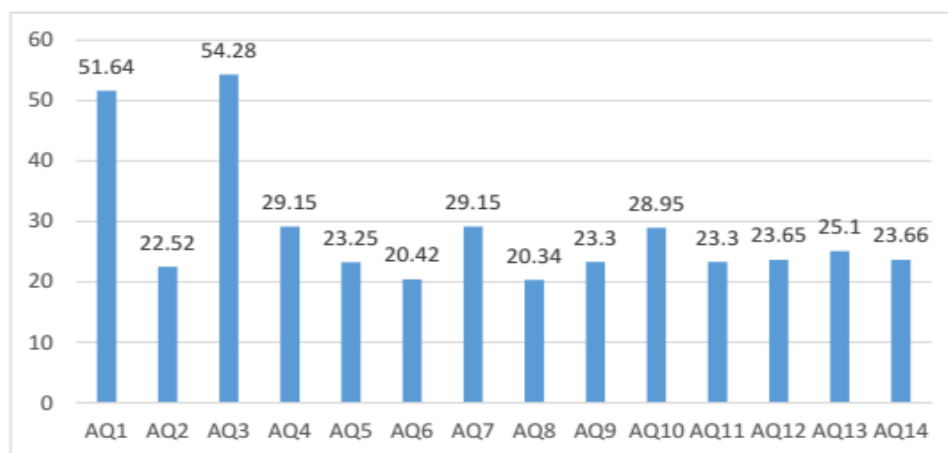


Figure 3-27: Graphical representation of maximum values of NO_x

1.1.1.17 CO results

The average CO concentration recorded at all the sampling locations are well below the prescribed CPCB limits of 2 mg/m³. The minimum value recorded was 0.1 mg/m³ at onsite T-4 land parcel (AQ4). The maximum value recorded was 0.2 mg/m³ at onsite of T3 land parcel (AQ-1). The 98 percentile values ranged from 0.4 mg/m³ to 0.76 mg/m³. The average values varied from 0.26 mg/m³ to 0.4 mg/m³.

1.1.1.18 Hydrocarbons (HCs) and Volatile Organic Compounds (VOCs)

The HCs and the VOCs were found to be below detectable limit throughout the study period at all the locations.

3.8 Ambient Noise Quality

Ambient noise levels were monitored at 8 locations within the study area, identified during preliminary baseline survey. Noise levels were measured by Integrating Sound Level Meter manufactured by Rion (model no. NL – 20) continuously over 24 hours period. The details of sampling stations are depicted in Table 3-13: Details of Ambient Noise Locations. Sampling locations are shown in Figure 3-28: Noise monitoring locations marked on Google Earth. The day noise level has been monitored during 6 am to 10 pm and night levels during 10 pm to 6 am at all ambient locations.

Table 3-13: Details of Ambient Noise Locations

Station code	Station Name	Geographical Co-ordinates	Distance w.r.t nearest land parcel site (km)	Direction w.r.t nearest land parcel site	Zone as per CPCB
N1	Onsite of T-3 Land Parcel	18°48'24.78" N 73° 4'51.41" E	Project site T3	---	Residential

Station code	Station Name	Geographical Co-ordinates	Distance w.r.t nearest land parcel site (km)	Direction w.r.t nearest land parcel site	Zone as per CPCB
N2	Crosswind of T-3 at Kopar village	18°48'27.79" N 73° 5'20.20" E	0.84 w.r.t T3	E	Residential
N3	Downwind of T-3 at Jite village	18°48'10.80" N 73° 4'49.67" E	0.43 w.r.t T3	S	Residential
N4	Onsite of T-4 Land Parcel	18°47'11.59" N 73° 6'23.85" E	0.14 w.r.t T4	W	Residential
N5	Downwind of T-4 at Mungoshi Village	18°46'44.35" N 73° 7'11.77" E	0.03 w.r.t T4	W	Residential
N6	Upwind of T-4 at Ambivali village	18°46'24.77" N 73° 7'14.47" E	Project site T4	---	Residential
N7	Upwind of T-2 at Belvade village	18°45'46.36" N 73° 8'2.96" E	Project site T2	---	Residential
N8	Downwind of T-1 within Land Parcel	18°42'6.04" N 73° 8'15.52" E	0.02 w.r.t T1	E	Residential
N9	Upwind of T-1 Wirani Village	18°41'29.51" N 73° 8'4.06" E	0.06 w.r.t T1	SW	Residential
N10	Crosswind of T-1 abutting Plot Boundary	18°42'31.76" N 73° 7'15.48" E	0.18 km w.r.t T1	SW	Residential
N11	Crosswind of T-1 within land parcel	18°43'7.17"N 73° 8'9.76" E	Project site T1	---	Residential

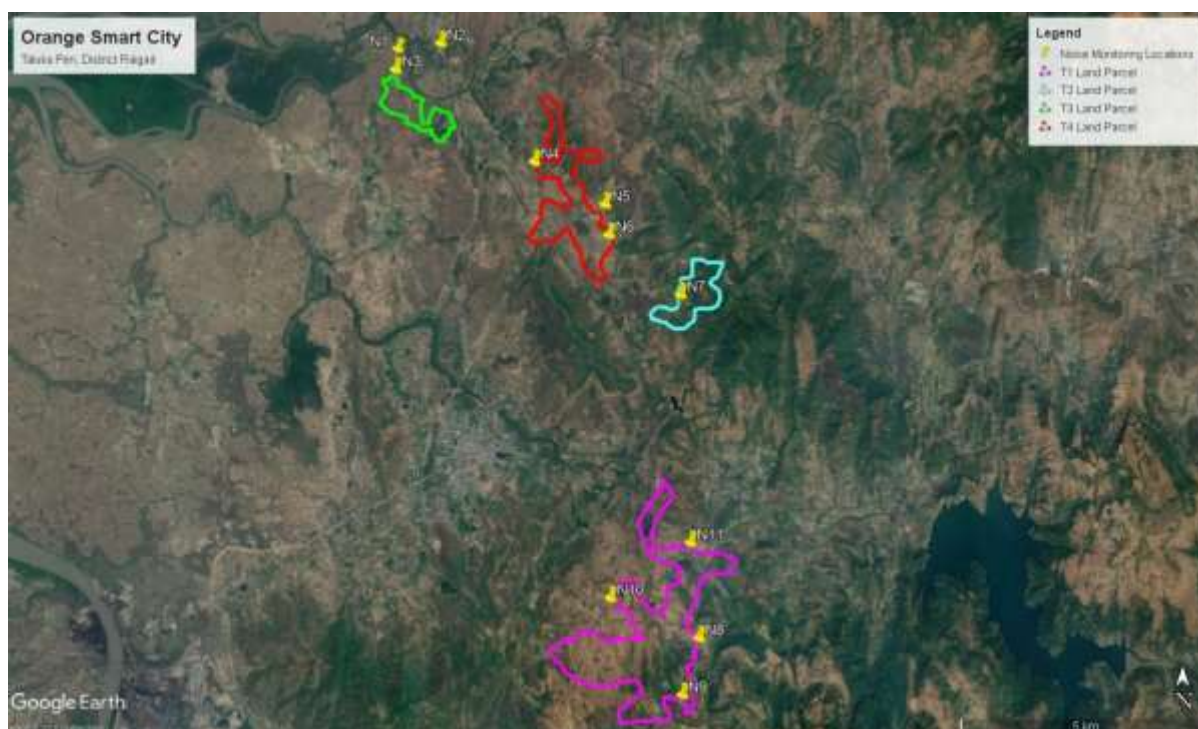


Figure 3-28: Noise monitoring locations marked on Google Earth

3.8.1 Parameters measured during monitoring

Equivalent sound Pressure Level (Leq):

The Leq is the equivalent continuous sound level which is equivalent to the same sound energy as the actual fluctuating sound measured in the same period. This is necessary because sound from noise source often fluctuates widely during a given period of time.

The instrument internally performs the statistics of frequency distribution for the set time period (in this case one-hour) and hourly Leq are obtained at each location. These hourly Leq is added logarithmically to obtain 24 hours Leq as well as Lday and Lnight levels. Lday is defined as the equivalent noise level measured over a period of time during day (10 am to 6 pm). The Leq value measured for each individual hour and then averaged for 10 am to 6 pm and is known as Lday.

Lnight is defined as the equivalent noise level measured over a period of time during night (10 pm to 6 am). The Leq value measured for each individual hour and then averaged for 10 pm to 6 am and is known as Lnight.

Further the noise rating developed by EPA for specification of community noise from all sources is the day night sound level, Ldn. It is similar to a 24 hour equivalent sound level except that during the night period, which extends from 10.00 p.m. to 6.00 a.m. A 10 Dba weighing penalty is added to the account for the fact that noise at night when people are trying to sleep is judged more annoying than the same noise during the day time.

3.8.2 Result and Discussion

The equivalent noise levels viz. Leq (24hrly), Lday, Lnight at ambient locations for summer season are presented in Table 3-14: Noise quality monitoring results.

Table 3-14: Noise quality monitoring results

Location code	Location name	Lday (day)	Lnight (night)
N1	Onsite of T-3 Land Parcel	42.8	32.5
N2	Crosswind of T-3 at Kopar village	42.5	33.1
N3	Downwind of T-3 at Jite village	42.6	33.8
N4	Onsite of T-4 Land Parcel	42.2	34.9
N5	Downwind of T-4 at Mungoshi Village	43.5	32.5
N6	Upwind of T-4 at Ambivali village	43.3	34.2
N7	Upwind of T-2 at Belvade village	42.9	32.9
N8	Downwind of T-1 within Land Parcel	42.9	32.9
N9	Upwind of T-1 Wirani Village	43.9	33.7
N10	Crosswind of T-1 abutting Plot Boundary	42.9	32.8
N11	Crosswind of T-1 within land parcel	43.1	32.9
CPCB standards			
Sr. No	Land use	Day Time	Night time
1.	Industrial	75	70
2.	Commercial	65	45
3.	Residential	55	45
4.	Silence Zone	50	40

Note: All figures in dB(A)

The variation of the Leq (day) and Leq (night) are diagrammatically represented in the Figure 3-29: Variation in Leq (day) during the study period (March 2016 to May -2016) and Figure 3-30: Variation in Leq (night) during the study period (March -2016 to May -2016)

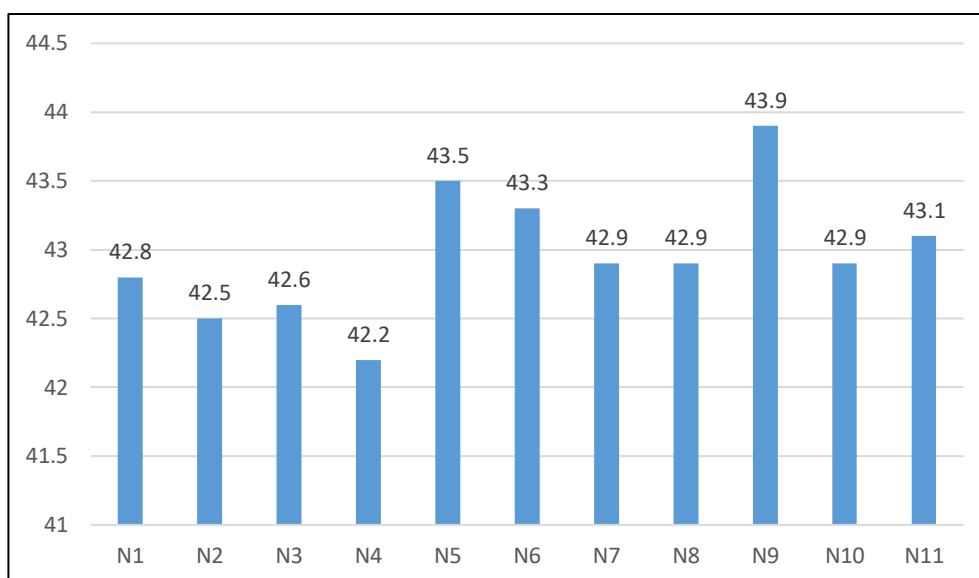


Figure 3-29: Variation in Leq (day) during the study period (March 2016 to May -2016)

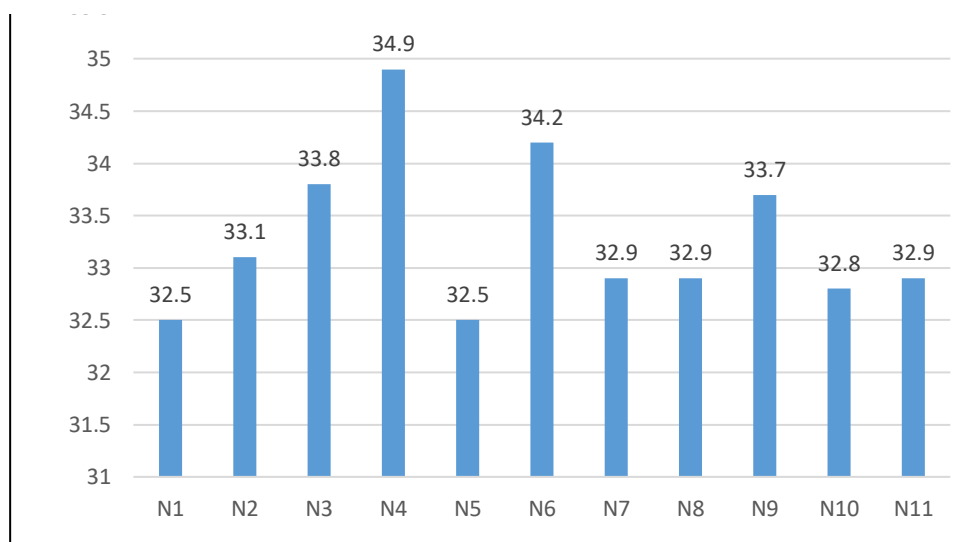


Figure 3-30: Variation in Leq (night) during the study period (March -2016 to May -2016)

Residential Zone: Noise levels (Leq) observed during daytime in this zone is in the range of 42.2 (Onsite of T4 Land parcel) to 43.9 dB (A) (Upwind of T-1 Wirani Village) while during nighttime it is 32.5 (Downwind of T-4 at Mungoshi Village) to 34.9 dB (A) (Onsite of T4 Land Parcel). The Leq during day and night is within the prescribed CPCB limits for residential zone.

3.9 Water quality

Sampling was carried out in the month of March 2015 – May 2015. 6 groundwater sampling stations and 8 surface water sampling station were selected depending upon the location and usage of resource. The details of sampling stations are depicted in Table 3-15: Monitoring Stations for Ground water Quality Assessment and Table 3-16: Monitoring Stations for Surface water Quality Assessment. The ground water sampling locations are shown in Figure 3-31: Map depicting ground water quality locations and surface water and in Figure 3-32: Map depicting surface water quality locations.

3.9.1 Monitoring locations

Ground water Sampling was carried out by APHA 1060 B & C Method. The ground water samples were analyzed for parameters as per IS: 10500 standards and the analysis were undertaken as per IS: 3025 and relevant APHA (American Public Health Association) standard methods.

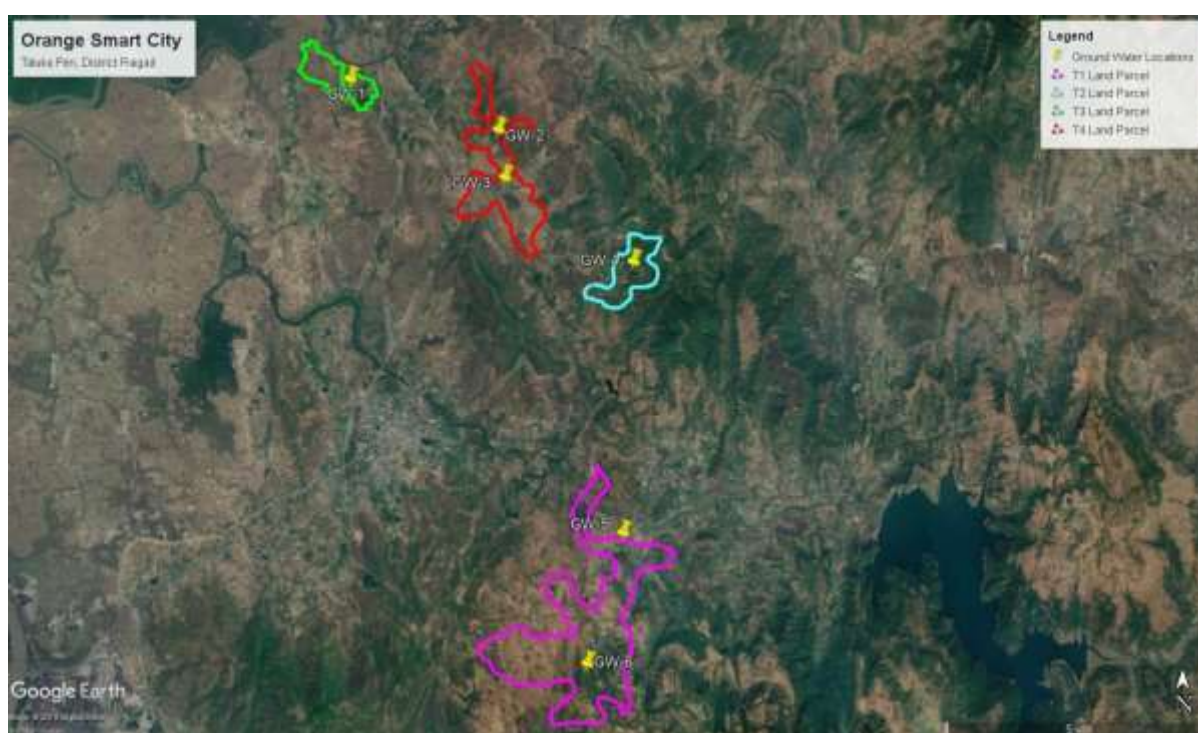


Figure 3-31: Map depicting ground water quality locations

Table 3-15: Monitoring Stations for Ground water Quality Assessment

Sr. No.	Location	Sample Code	Distance from the boundary of site	Geographical Location	Direction from the center of site
1	T-3 Land Parcel	GW1	----	18°47'44.35"N 73° 5'12.22"E	---
2	T-4 Land Parcel	GW2	----	18°47'13.50"N 73° 6'47.63"E	----

Sr. No.	Location	Sample Code	Distance from the boundary of site	Geographical Location	Direction from the center of site
3	T-4 Land Parcel	GW3	----	18°46'44.55"N 73° 6'51.75"E	----
4	T-2 Land Parcel	GW4	----	18°45'53.24"N 73° 8'14.15"E	---
5	T-1 Land Parcel	GW5	-----	18°43'8.67"N 73° 8'7.63"E	----
6	T-1 Land Parcel	GW6	----	18°41'49.35"N 73° 7'44.60"E	----

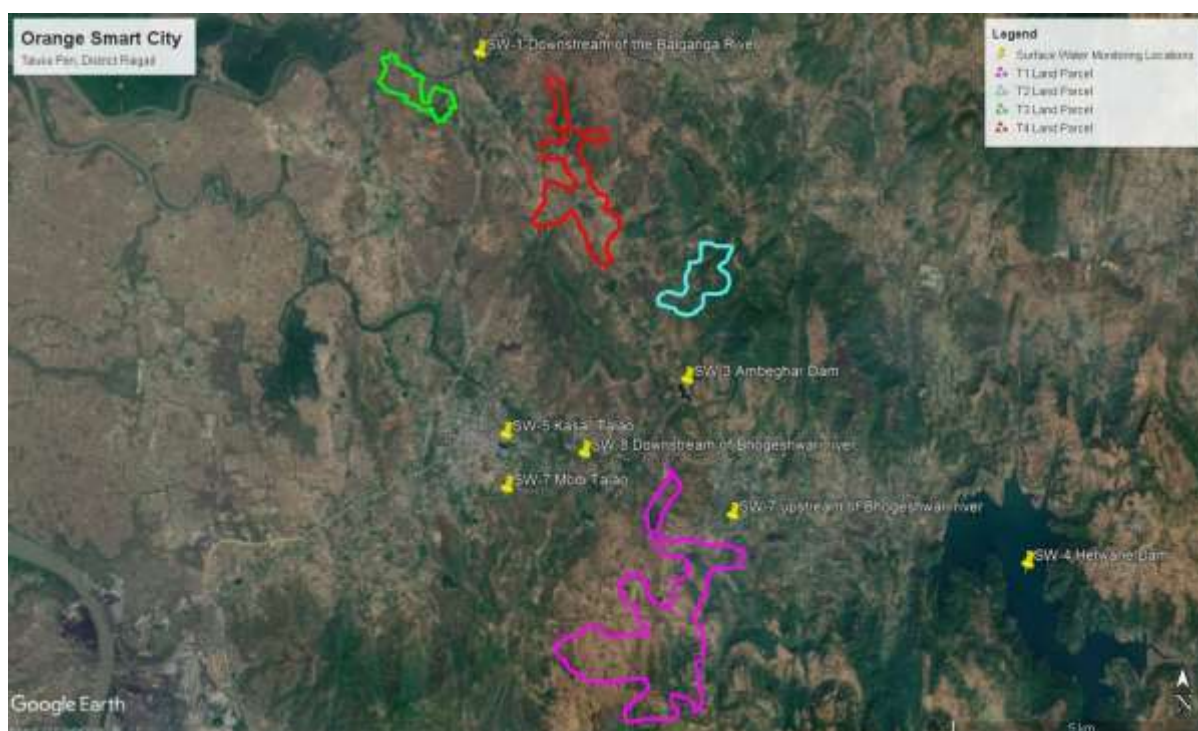


Figure 3-32: Map depicting surface water quality locations

Table 3-16: Monitoring Stations for Surface water Quality Assessment

Sr. No.	Location	Sample Code	Distance from the boundary of site	Geographical Location	Direction from the center of site
1.	Upstream of the Balganga River	SW1	3.05	18°49'45.23"N 73° 5'15.47"E	N
2.	Downstream of Balganga River	SW2	1.3	18°48'7.62"N 73° 5'45.50"E	E
3.	Ambhegar Dam	SW3	1.3	18°44'44.45"N 73° 8'2.26"E	S

Sr. No.	Location	Sample Code	Distance from the boundary of site	Geographical Location	Direction from the center of site
4.	Hetwane Dam	SW4	5.4	18°42'49.86"N 73°11'46.36"E	E
5.	Kasar Talao	SW5	3.2	18°44'10.30"N 73° 6'2.82"E	NNW
6.	Modi Dam	SW6	2.7	18°43'36.83"N 73° 6'3.41"E	SW
7.	Upstream of the Bhogeshwari River	SW7	1.1	18°43'20.18"N 73° 8'32.06"E	SE
8.	Downstream of Bhogeshwari River	SW8	1.7	18°43'58.65"N 73° 6'54.48"E	NNW

3.9.2 Water Quality Inference

1.1.1.19 Ground Water Quality:

The ground water quality was analyzed at 6 different locations (GW1 to GW6) within the study area. GW samples analysis revealed excess of Calcium and Iron at GW6 as per the limit prescribed in IS-10500 -2012. The levels of lead were high at GW2. The coliform content and Residual chlorine level were high in all samples collected during the study period. As per IS10500-2012, the samples collected from all the aquifers will require suitable treatment for before the usage. However, the groundwater will not be used in the proposed project. The ground water quality results have been depicted in Table 3-17.

1.1.1.20 Surface water quality:

The surface water quality was analyzed at 8 locations within the study area once during the study period (March-2015 to May-2015). The surface water quality parameters when compared with IS 2296 class-C reflects that the water shows non-conformance for chemical and bacteriological parameters at three locations (SW3, SW4 and SW5). The surface water quality results have been depicted in Table 3-18.

3.9.3 Results

Table 3-17: Ground Water Quality results

Sr. No	Parameter	Unit	GW1	GW2	GW3	GW4	GW5	GW6	IS 10500 Limits
Physical Parameter									
1	Turbidity	NTU	0.6	1	1	1.9	1	0.6	<1.0
2	TDS	mg/l	293	298	289	285	286	304	<500
Chemical Parameter									
1	pH	--	6.6	6.94	6.67	6.6	7.1	6.61	6.5-8.5
2	E. Conductivity	µS/cm	521.1	425	510	510	490.2	515.69	N.S
3	Total Hardness as CaCO ₃	mg/l	127.45	128.36	155.56	140.52	145.75	199.35	<200
4	Total Alkalinity as CaCO ₃	mg/l	115.79	112.63	96.15	107.89	114.21	117.89	<200
5	Chloride as Cl	mg/l	12.25	11.76	17.15	12.74	18.88	48.02	<250
6	Sulphate as SO ₄	mg/l	3.69	8.38	26.96	28.38	23.27	22.57	<200
7	Fluoride as F	mg/l	0.41	0.83	0.01	0.53	0.69	0.14	<1.0
8	Residual chlorine	mg/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	>0.2
9	Nitrate as NO ₃	mg/l	0.01	0.49	0.5	0.01	0.01	1.73	<45
Elemental Testing									
1	Calcium as Ca	mg/l	30.11	28.15	29.08	27.9	10.05	76.09	<75
2	Magnesium as Mg	mg/l	12.9	14.46	15.25	19.89	3.605	14.88	<30
3	Iron as Fe	mg/l	0.25	0.13	0.06	0.145	0.07	1.74	<0.3
4	Copper as Cu	mg/l	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.05
5	Cadmium as Cd	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.003
6	Chromium as Cr	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.05

Sr. No	Parameter	Unit	GW1	GW2	GW3	GW4	GW5	GW6	IS 10500 Limits
7	Lead as Pb	mg/l	0.01	0.03	0.01	0.01	<0.01	0.01	<0.01
8	Selenium as Se	mg/l	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01
9	Manganese as Mn	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1
10	Zinc as Zn	mg/l	0.01	0.02	<0.01	0.065	<0.01	0.02	<5.0
11	Sodium as Na	mg/l	1.3	1.3	1.9	1.09	1.12	1.17	N.S
12	Potassium As K	mg/l	0.21	0.35	0.3	0.32	0.42	0.4	NS
Microbiological Parameter									
1	Total Coliform	MPN/100ml	1600	1600	220	<2	1600	2	Absent
2	Fecal Coliform	MPN/100ml	27	900	2	<2	350	<2	Absent

Table 3-18: Surface water quality results

Sr. No	Parameter Name	Unit	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	As per IS: 2296 Class C (Clause 3.3)
Physical Parameters											
1	Turbidity	NTU	0.9	0.97	0.6	0.63	2.1	0.83	0.92	0.22	NS
2	TDS	mg/l	412	350	63	61	193	70	255	222	<1500
Chemical Parameters											
1	pH	--	7.09	6.85	7.25	7.33	6.71	7.29	7.35	7.25	6.5-8.5
2	E. Conductivity	µS/cm	690.2	490.2	190.2	490.2	289.46	240.2	359.85	390.2	NS
3	Total Hardness as CaCO ₃	mg/l	155.1	123.96	42.48	41.2	81.96	43.6	129.5	115	NS
4	Total Alkalinity as CaCO ₃	mg/l	82.63	65.96	39.47	37.6	43.68	39.2	53.1	59	NS

Sr. No	Parameter Name	Unit	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	As per IS: 2296 Class C (Clause 3.3)
5	Chloride as Cl	mg/l	105.64	106.56	7.84	7.65	18.62	7.82	94.48	72.38	<600
6	Sulphate as SO ₄	mg/l	80.29	49.12	4.69	4.56	17.52	4.66	42.85	22.21	<400
7	Fluoride as F	mg/l	0.25	0.33	0.19	0.17	0.46	0.17	2.1	1.07	<1.5
8	Residual chlorine	mg/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	NS
9	Nitrate as NO ₃	mg/l	0.72	0.77	0.05	0.03	0.06	0.03	0.68	0.66	<50
Elemental Testing											
1	Calcium as Ca	mg/l	56.9	58.3	9.72	8.63	15.94	7.42	49.3	29.44	NS
2	Magnesium as Mg	mg/l	39.6	37.5	3.645	2.43	6.265	3.43	20.3	17.12	NS
3	Iron as Fe	mg/l	0.05	0.05	0.06	0.05	0.03	0.05	0.04	0.04	<50
4	Copper as Cu	mg/l	0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01	<1.5
5	Cadmium as Cd	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
6	Chromium as Cr	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.05
7	Lead as Pb	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1
8	Selenium as Se	mg/l	0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01	<0.05
9	Manganese as Mn	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NS
10	Zinc as Zn	mg/l	0.02	0.02	0.02	0.01	<0.01	0.01	0.01	0.01	<15
11	Sodium as Na	mg/l	1.12	1.09	0.89	1.09	0.76	0.69	1	0.56	NS
12	Potassium As K	mg/l	0.38	0.32	0.22	0.32	0.49	0.12	0.22	0.02	NS
Microbiological Parameters											
1	Total Coliform	CFU/100ml	240	252	300	266	1600	273	233	233	5000
2	Faecal Coliform	MPN/100ml	130	133	17	15	34	18	111	129	Absent

3.10 Soil quality

3.10.1 Introduction

The soils of the district are formed from the Deccan trap. The study region has many areas where green vegetation can be seen indicating that for trees and shrubs and Shallow to Medium Deep soil is identified in study region. This soil is composed of various disintegrated rocks of the overlying trap formation, with a varying proportion of calcareous substances. It is reddish, light brown in color. Rice is a major crop commonly observed in study area followed by Pulses, oil seeds and vegetables.

The sampling locations have been finalized with the following objectives:

- To determine the baseline soil characteristics of the study area; and
- To determine the impact on agricultural productivity of soil due to the proposed industrial estate.

3.10.2 Monitoring and analysis

Soil sampling locations were chosen based on a reconnaissance survey of the area and prevailing activities within the 10 km study area. Samples were collected by hand sampling augurs from surface region. All the soil samples were taken at depth of 60 cm. Samples were homogenized before testing. The samples were packed in dependable, waterproof containers and analyzed as per APHA, C.A. Black (Soil Chemical Analysis) and IS: 2720 (Physical Parameters). The soil sampling locations are depicted in Figure 3-33: Map depicting the soil sampling locations and details of the same are tabulated in Table 3-19: Details of soil sampling locations. The sampled soil quality results are presented in Table 3-20: and are described in the further subsections.

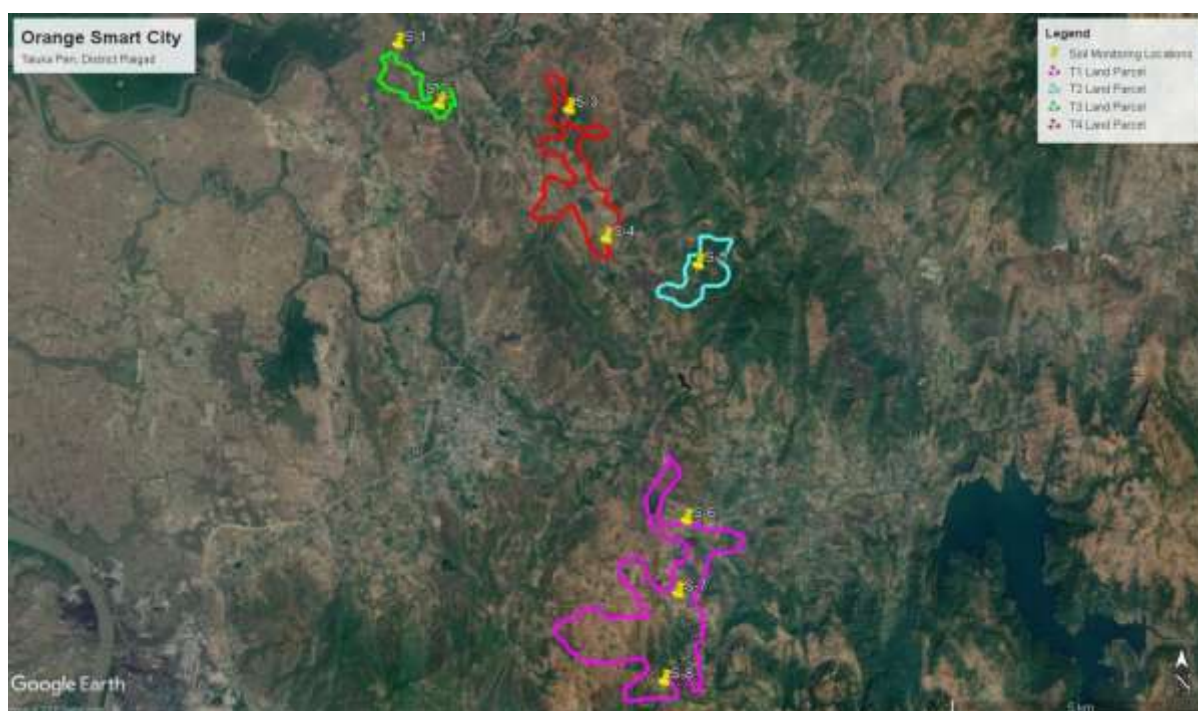


Figure 3-33: Map depicting the soil sampling locations

Table 3-19: Details of soil sampling locations

Sr. No	Location code	Sampling location name	Geographical Co-ordinates	Direction w.r.t project site	Description of the location
1	S1	Onsite of T-3 Land Parcel on North	18°48'12.10"N 73° 4'51.71"E	N	Barren Land
2	S2	Onsite of T-3 Land Parcel on South	18°47'33.25"N 73° 5'18.87"E	S	Mild vegetation
3	S3	Onsite of T-4 Land Parcel on North	18°47'30.27"N 73° 6'44.40"E	N	Hilly terrain
4	S4	Onsite of T4 Land Parcel on South	18°46'7.53"N 73° 7'9.01"E	S	Agricultural field
5	S5	Onsite of T-2 land parcel	18°45'50.98"N 73° 8'9.71"E	--	Agricultural field
6	S6	Onsite of T-1 land parcel on North	18°43'7.29"N 73° 8'1.93"E	N	Barren Land
7	S7	Onsite of T-1 land parcel in Centre	18°42'20.42"N 73° 7'56.32"E	---	Barren land
8	S8	Onsite of T-1 land parcel on South	18°41'24.20"N 73° 7'47.28"E	S	Hilly terrain

Table 3-20: Soil Analysis Results

Sr. No	Parameter	Unit	S1	S2	S3	S4	S5	S6	S7	S8
Physical Parameter										
1	Salinity	%	0.02	0.004	0.02	0.01	0.01	0.01	0.03	0.05
2	Water Holding Capacity	%	50	55	60	55	60	65	68	75
3	Soil texture	--	Clay Loam	Clay	Clay	Clay Loam	Clay Loam	Clay Loam	Clay Loam	Clay
Chemical Parameter										
1	pH	--	5.99	6.46	6.06	6.36	6.44	6.34	6.49	6.82
2	Electrical Conductivity	µS/cm	476	78	339	265	225	190.1	201.4	308.1
3	Total Organic Matter	%	3.15	3.22	9.91	4.35	3.54	3.26	3.63	5.66
4	Total Nitrogen	mg/kg	1120	910	2380	2170	1890	1750	1863	1533
5	Sodium Absorption Ratio	--	2.85	0.96	1.42	1.39	2.02	8.97	9.39	9.2
Elemental Testing										

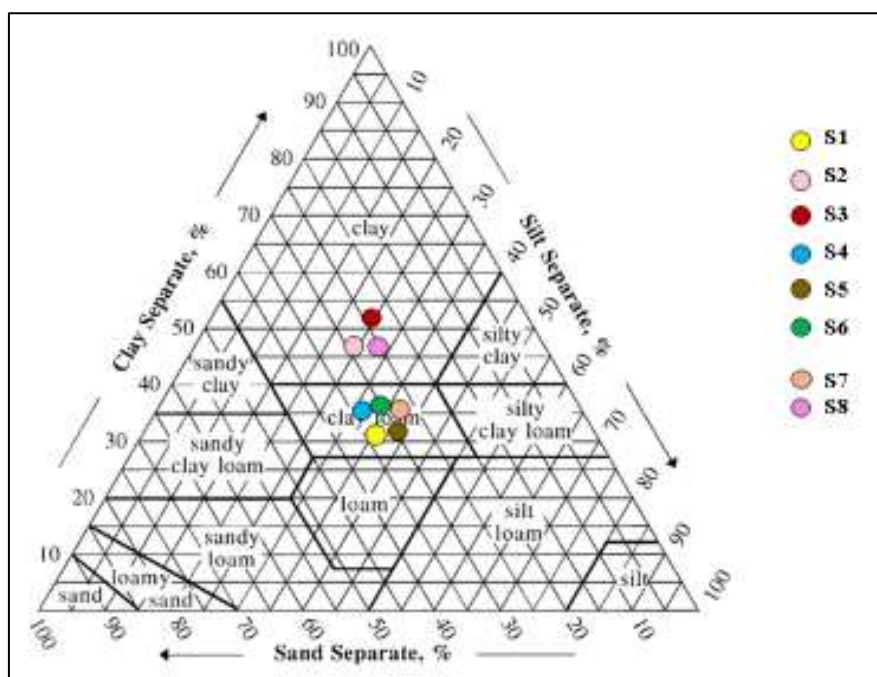
Sr. No	Parameter	Unit	S1	S2	S3	S4	S5	S6	S7	S8
1	Potassium as K	mg/kg	493.4	242.6	383.1	62.4	333.8	876.5	892.2	882.5
2	Phosphorous as P	mg/kg	1054	2575	2601	999	1738	1592	1660	1663
3	Sodium as Na	mg/kg	513	100.4	178.7	166.8	401.5	1467	1556	1557
4	Calcium as Ca	mg/kg	5965	1193	1793	1399	4460	7385	7860	7651
5	Magnesium as Mg	mg/kg	2825	1476	2052	2003	5137	7388	7581	7755
6	Iron as Fe	mg/kg	28810	22570	47300	16070	49760	48230	47361	44662
7	Copper as Cu	mg/kg	121.3	294.3	654.8	251.1	470.6	298.87	305.26	310.25
8	Manganese as Mn	mg/kg	1848	3622	6157	3894	6338	5870	5982	5525
9	Zinc as Zn	mg/kg	117.2	193.2	327.7	128.8	240.2	204.8	222.3	211.07
10	Nickel as Ni	mg/kg	64.78	97.97	163.7	87.43	167.8	179.6	186.5	186.4

3.10.3 Results and discussion

The soil samples were analyzed for all the important parameters like pH, electrical conductance, calcium, magnesium, nitrogen, phosphorus, potassium, etc. The NPK represents the nutrients available in the soil, which directly indicates the soil fertility. The range of variation of different parameters found in the study area is explained briefly below.

Soil Texture Classification

The soil texture for all the locations was observed to be Clay and Clay loam. The soil texture classification for the eight soil samples is depicted below:



pH

The pH of the all samples collected were in the range of 5.99 to 6.82 i.e. moderately acidic to slightly acidic as per the ranges and classification of pH given by Department of Agriculture. (Source: Method Manual, Soil Testing in India, 2011). It is a very important property of soil as it determines the availability of nutrients, microbial activity and physical condition of soil.

Electrical Conductivity

Electrical conductivity expresses ion contents of solution which determine the current carrying capacity thus giving a clear idea of the soluble salts present in the soil. The Collected Soil samples was highly saline. Electrical Conductivity value ranges from 78 $\mu\text{S}/\text{cm}$ to 476 $\mu\text{S}/\text{cm}$.

Water Holding Capacity

Water holding capacity as the amount of water held in the soil. Soil structure influences the extent of pore space in the soil, water holding capacity, aeration, root movement and the nutrient availability. The better and more stable soil aggregates are considered as a desirable soil property with regard to plant growth. Water holding capacity of Collected Soil samples ranges from 50 to 75 %.

Calcium and Magnesium

The important cations present in soil are calcium and magnesium. It is observed that both calcium and magnesium concentrations are in the range of 1193 to 7860 mg/kg and 1476 to 7755 mg/kg respectively whereas sodium and potassium are in the range of 100.4 to 1557 mg/kg and 62.4 to 892.2 mg/kg respectively.

Micronutrients

The concentration of micronutrient in the soil was observed in the ranges of 16070 to 49760 mg/kg for iron, 1848 to 6338 mg/kg for manganese, 117.2 to 327.7 mg/kg for zinc, 121.3 to 654.8 mg/kg for copper and 64.78 to 186.5 mg/kg for nickel. Thus it was observed that the soils from the study area are enriched in micronutrients like Zn, Mn, Cu, and Fe although they show varying range.

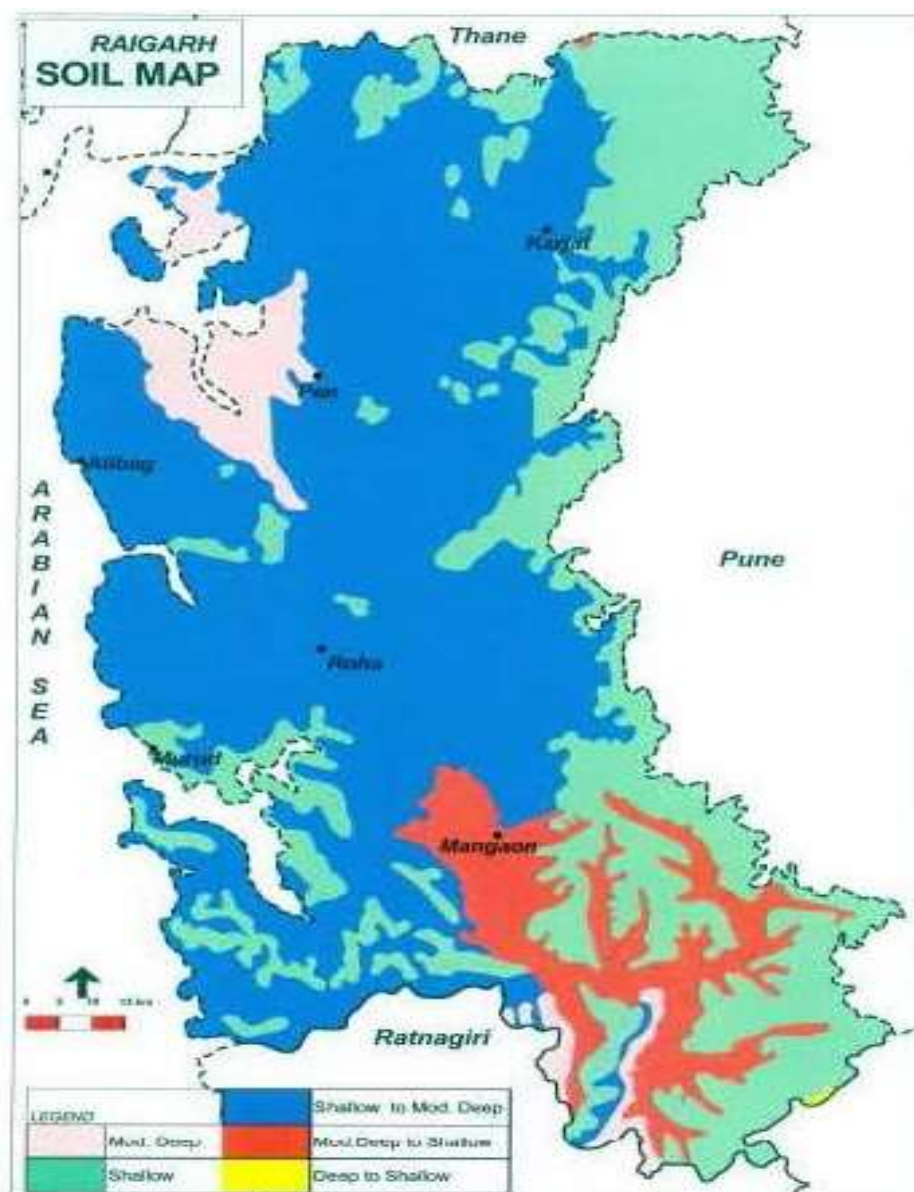
Macronutrients

The important cations present in soil are calcium and magnesium. It is observed that both calcium and magnesium concentrations are in the range of 1193 to 7860 mg/kg and 1476 to 7755 mg/kg respectively whereas sodium and potassium are in the range of 100.4 to 1557 mg/kg and 62.4 to 892.2 mg/kg respectively.

Organic matter present in soil influences its physical and chemical properties of soil. Soil OM is important to a wide variety of soil's chemical, physical, and biological properties. As soil OM increases, so does CEC, soil total N content, and other soil properties such as water holding capacity and microbiological activity. Organic matter, total nitrogen and phosphorous are found to be in the range of 3.15 to 9.91%, 910 to 2380 mg/kg and 999 to 2601 mg/kg respectively. These soils are having high range of organic matter content and total nitrogen content in the soil. Also having high range of Phosphorus and Potassium content thus shows good fertility level and fulfil the minimum nutrient requirement for plants.

Soil Type in the Study area

Based on Soil map of Raigad district (Source - NBSS & LUP, Nagpur), soil of the study area is classified as shallow to moderate deep. The soil map of the area is shown in section below.



3.10.4 Ground water levels

As per the geo-technical investigation conducted by the proponent the ground water levels are tabulated below :

BoreHole – No.	Location	Depth of GWT (bgl)	Depth of Borehole below existing GL (m)
BH-01	Dhamani Naka (T1)	2.0	13.5

BH-02	Belwade Gaon(T2)	6.0	13.5
BH-03	Boregaon (Virani)(T1)	5.5	15
BH-04	Olakh (T4)	7.5	13.5

The representative borelog is shown below and the borehole logs are enclosed in Annexure-XXX :

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %
				DEPTH (m)	TYPE	15	15	15	15			
0.00				0.00	DS1							
0.50				0.50								
1.00											13	NIL
1.50				1.50	Rock							
2.00												
2.50											19	NIL
3.00			Brownish Highly weathered ROCK	3.00	Rock							
3.50												
4.00											16	NIL
4.50				4.50	Rock							
5.00											33	32
5.50												
6.00			Brownish Highly weathered BASALT	6.00	Rock							
6.50												
7.00											37	36
7.50				7.50	Rock							
8.00											06	NIL
8.50												
9.00	N X		Brownish Completely weathered Rock	9.00	Rock						08	NIL
9.50												
10.00												

3.10.5 Interpretation

The construction activities will result in loss of vegetation which along with digging and excavations in the project area would make the land susceptible to erosion during rainy season. The top soil removed will be reused for proposed landscaping purpose. The project would involve compaction of soil due to construction activities and landscaping towards the later part which would reduce the chance of subsidence. The photographs of soil from tree plantation within the Plot and agricultural fields in surrounding area are shown in Figure 3-34.



Figure 3-34: The photographs of soil from tree plantation within the Plot and agricultural fields around surrounding area

3.11 Ecology and biodiversity

The purpose of this study is to characterize and describe the terrestrial environment, habitats and species present at the site and provide an assessment of the likely impacts of developing a township at Pen.

The broad terms of reference for the assessment include the following:

- Assess and detail the potential impacts of the proposed development on both vegetation and fauna at the site
- Outline possible mitigation measures, rehabilitation procedures and or vegetation removal procedures that would reduce the potential impacts of the development.
- Identify and rate the significance of potential impacts and outline additional management guidelines.

The detailed terms of reference for the study are described below.

3.11.1 Scope of Study

1.1.1.21 Vegetation Study

- Carrying out fieldwork to locate and describe the current status of vegetation in the study area.
- Determine the forest type as per Champion & Seth guidelines, enumerating species present in the study areas
- A description of different micro-habitats, and the species associated with those habitats.
- Disclose any gaps in information or assumptions made.

- Recommendations for migratory measures to minimize impacts identified.
- An outline of additional management guidelines.
- Provide monitoring requirements, mitigation measures and recommendations in a table format as input into the Environmental Management Plan (EMP), as well as generic rehabilitation and re-vegetation guidelines.

Faunal Study

- Carrying out fieldwork to locate and describe the current status of faunal species in the study area.
- Conduct a faunal assessment that can be integrated into the ecological study.
- Describe the existing impacts of current land use as they affect the fauna.
- Describe the different micro-habitats, and the species associated with those habitats.
- Describe the potential direct, indirect and cumulative negative and positive impacts of the proposed activity on inhabitant and reliant faunal species.
- Provide a detailed fauna sensitivity map of the site, including mapping of faunal community disturbance, transformation and potential “no-go” areas on site.
- Clarify species of special concern (SSC) as per Wildlife (Protection) Act, 1972 Schedule & IUCN Red Data list and that are known to be:
 - endemic to the region;
 - that are considered to be of conservational concern;
 - that are in commercial trade (CITES listed species);
 - Or, are of cultural significance.
- A description of species composition and conservation status in terms of protected, endangered or vulnerable faunal species.

3.11.2 Regulatory and legislative overview

A summary of the relevant portions of the Acts which govern the activities and potential impacts to the environment associated with the development are listed below. Provided that standard mitigation and impact avoidance measures are implemented, not all the activities listed in the Acts below would actually be triggered.

Environment (Protection) Act of 1986

- The Act is an “umbrella” for legislations designed to provide a framework for Central Government, coordination of the activities of various central and state authorities established under previous Acts, such as the Water Act and the Air Act.
- The purpose of the Act is to implement the decisions of the United Nations Conference on the Human Environment of 1972, in so far as they relate to the protection and improvement of the human environment and the prevention of hazards to human beings, other living creatures, plants and property.

- In this Act, main emphasis is given to “Environment”, defined to include water, air and land and the inter-relationships which exist among water, air and land and human beings and other living creatures, plants, micro-organisms and property.
- “Environmental pollution” is the presence of pollutant, defined as any solid, liquid or gaseous substance present in such a concentration as may be or may tend to be injurious to the environment.
- “Hazardous substances” include any substance or preparation, which may cause harm to human beings, other living creatures, plants, microorganisms, property or the environment.

Wild Life (Protection) Act of 1972 and Amendment, 1982

- The Wild Life Act provides for
 - state wildlife advisory boards,
 - regulations for hunting wild animals and birds,
 - establishment of sanctuaries and national parks,
 - regulations for trade in wild animals, animal products and trophies, and
 - Judicially imposed penalties for violating the Act.
- Harming endangered species listed in Schedule 1 of the Act is prohibited throughout India.
- Hunting species, like those requiring special protection (Schedule II), big game (Schedule III), and small game (Schedule IV), is regulated through licensing.
- An amendment to the Act in 1982, introduced a provision permitting the capture and transportation of wild animals for the scientific management of animal population.

Forest (Conservation) Act of 1980

- Forest Conservation Act was enacted to consolidate the law related to forest, the transit of forest produce and the duty livable on timber and other forest produce.
- Under the provisions of this Act, prior approval of the Central Government is required for diversion of forestlands for non-forest purposes.
- An Advisory Committee constituted under the Act advises the Centre on these approvals.
- The Act deals with the four categories of the forests, namely reserved forests, village forests, protected forests and private forests.
 - Reserved forest:
- A state may declare forestlands or waste lands as reserved forest and may sell the produce from these forests.
- Any unauthorized felling of trees quarrying, grazing and hunting in reserved forests is punishable with a fine or imprisonment, or both
 - Village forests:
- Reserved forests assigned to a village community are called village forests.
 - Protected forests:
- The state governments are empowered to designate protected forests and may prohibit the felling of trees, quarrying and the removal of forest produce from these forests.

- The preservation of protected forests is enforced through rules, licenses and criminal prosecutions.

Biodiversity Act 2000

The legislation aims at regulating access to biological resources so as to ensure equitable sharing of benefits arising from their use.

- Salient features of the biodiversity legislation
 - The main intent of this legislation is to protect India's rich biodiversity and associated knowledge against their use by foreign individuals and organizations without sharing the benefits arising out of such use, and to check bio-piracy
 - This bill seeks to check bio-piracy, protect biological diversity and local growers through a three-tier structure of central and state boards and local committees.
 - Collaborative research projects and exchange of knowledge and resources are exempted provided they are drawn as per the policy guidelines of the Central Government.

3.11.3 Methodology

Data review & sourcing

The data sources consulted and used where necessary in the study includes the following:

Flora & Ecosystem

- Vegetation types for the area were extracted from Report of the Committee to Formulate Objective Parameters for Identification of Inviolable Forest Areas, July 2012. Identification of species was done according to the ENVIS publication of plant species & their importance; published in November 2016.
- The IUCN conservation status (Table 1) of the species in the list was also extracted from the database and is based on the Threatened Species Programme.
- Freshwater and wetland information was extracted from the National Wetland Conservation Programme (NWCP) and The List of Wetlands of International Importance Published 6 July 2018 as published on the Ramsar website.

Fauna

- Lists of mammals, reptiles and amphibians which are likely to occur at the site were derived based on distribution records from the literature and various databases
- Bird data for the site was extracted from the Ebird listing for the region and Birds of the Indian Subcontinent by Richard Grimmett, Carol Inskipp, Tim Inskipp was used during site visit for the identification of species and Birdlife India's Important Bird Areas was also referred to ascertain if the site falls within the range of any range-restricted or globally threatened species.
- The faunal species lists provided are based on species which are known to occur in the broad geographical area, as well as a preliminary assessment of the availability and quality of suitable habitat at the site. For each species, the likelihood that it occurs at the site was rated according to the following scale:

- **Low:** The available habitat does not appear to be suitable for the species and it is unlikely that the species occurs at the site.
- **Medium:** The habitat is broadly suitable or marginal and the species may occur at the site.
- **High:** There is an abundance of suitable habitat at the site and it is highly probable that the species occurs there.
- **Definite:** Species that were directly or indirectly (scat, characteristic diggings, burrows etc.) observed at the site. No species are characterized as definitely present without a site visit.

General

The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria version 3.1 (2012) and where species have not been assessed under these criteria, the CITES status is reported where possible. These lists are adequate for mammals and amphibians, the majority of which have been assessed, however the majority of reptiles have not been assessed and therefore, it is not adequate to assess the potential impact of the development on reptiles, based on those with a listed conservation status alone. In order to address this shortcoming, the distribution of reptiles was also taken into account such that any narrow endemics or species with highly specialized habitat requirements occurring at the site were noted. The IUCN Red List Categories for fauna and flora. Species which fall within the categories in red and orange below, are of conservation concern.

IUCN Red List Category
Critically Endangered (CR)
Endangered (EN)
Vulnerable (VU)
Near Threatened (NT)
Critically Rare
Rare
Declining
Data Deficient - Insufficient Information (DDD)
Data Deficient - Taxonomically Problematic (DDT)
Least Concern

3.11.4 Sampling limitations and assumptions

Three site visits were carried out during the study period. The list of plant species obtained for the site is therefore likely to be highly representative and it is not likely that there are any significant features of the site that were not observed. The list of plant species was however complemented by a list of any red-data species which are known from other studies to occur in the general vicinity of the site. The lists of amphibians, reptiles and mammals for the site are based on those observed at the site as well as those likely to occur in the area based on their distribution and habitat preferences. This represents a sufficiently conservative and cautious approach which takes account of the study limitations.

During the main site visit, the different biodiversity features, habitat, vegetation and landscape units present at the site were identified and mapped in the field. Walk-through-surveys were conducted across the site and all plant and animal species observed were recorded. Searches

for listed and protected plant species at the site were conducted and the location of all listed plant species observed was recorded. Active searches for reptiles and amphibians were also conducted within habitats likely to harbor or be important for such species. The presence of sensitive habitats such as mangroves especially in case of parcel T3 were noted in the field and recorded.

3.11.5 Ecological Settings

The project is situated in the hilly region of North Konkan, though the proposed activities are mainly in plain and rolling areas. The Forested hills in the surrounding area has moist evergreen forests that are mixed with deciduous varieties. Some of the Forests are Bombax dominant forests. The forest vegetation is interspersed with fruit trees like Mango, Cashew, Chickoo, Jackfruit, etc.

There are number of hills within 15 km boundary of project site that have reserved forest. The nearest Protected forest is Karnala Wildlife Sanctuary. The hillslopes are largely cultivated with millets whereas foothills are cultivated with Paddy. Many hillslopes are cultivated for Cucumber and other vegetables during the Monsoon. The entire area has low to moderate wildlife value and fauna is significantly dominated by fringe species that are usually associated with rural settings

Western Ghat

Western Ghats is one of the eight "hottest hot-spots" of biological diversity in the world. The range runs north to south along the western edge of the Deccan Plateau, and separates the plateau from a narrow coastal plain, called Konkan, along the Arabian Sea. A total of national parks, wildlife sanctuaries and reserve forests were designated as world heritage sites - four in Maharashtra. The area is one of the world's ten "Hottest biodiversity hotspots" and has over 7,402 species of flowering plants, 1,814 species of non-flowering plants, 139 mammal species, 508 bird species, 179 amphibian species, 6,000 insects species and 290 freshwater fish species; it is likely that many undiscovered species live in the Western Ghats. At least 325 globally threatened species occur in the Western Ghats.

The Western Ghats form one of the four watersheds of India, feeding the perennial rivers of India. The major river systems originating in the Western Ghats include Godavari, Kaveri, Krishna, Thamiraparani and Tungabhadra.

3.11.6 Terrestrial Ecological Status: Primary Survey

Eleven locations were selected to conduct a detailed study within in the study area. Of the total locations studied eight are in the core zone and eight in the buffer zone. The locations are given in **Table 3-21**.

Table 3-21 : Details of terrestrial ecology sampling locations

Code	Name of the location	Direction from Project Site	Distance from Project Site (km)
EB-1	Kalambusare : 18°51'30.44"N	NE	6.2
		SE	7.8

	73° 03'30.18"E		
EB-2	Chirner 18°50'51.44"N 73° 02'56.24"E	NE SE	3.4 6.5
EB-3	Vadgaon 18°51'13.45"N 73° 12'00.62"E	NE S	5.4 11.3
EB-4	Jambhulpada 18°55'40.49"N 73° 02'30.64"E	NW S	7.2 12.8
EB-5	Poynad 18°40'40.76"N 73° 00'27.22"E	S SW	12.8 22.6
EB-6	Bense 18°35'04.39"N 73° 05'23.86"E	S S	13.6 30.6
EB-7	Palas 18°34'26.62"N 73° 07'44.13"E	S S	12.96 31.63
EB-8	Ransai 18°46'25.71"N 73° 12'32.82"E	E NE	7.51 9.3

The sampling locations in the core zone and the buffer zone are shown in the section below:

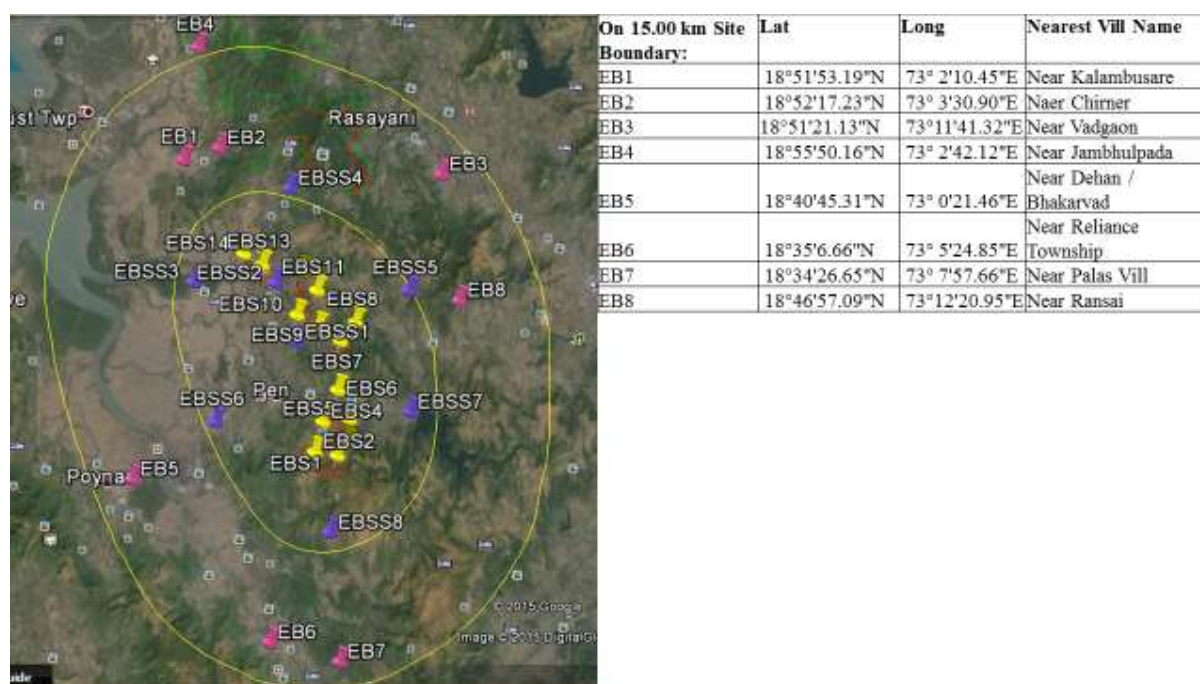


Figure 3-35: Map depicting sampling locations in the buffer zone

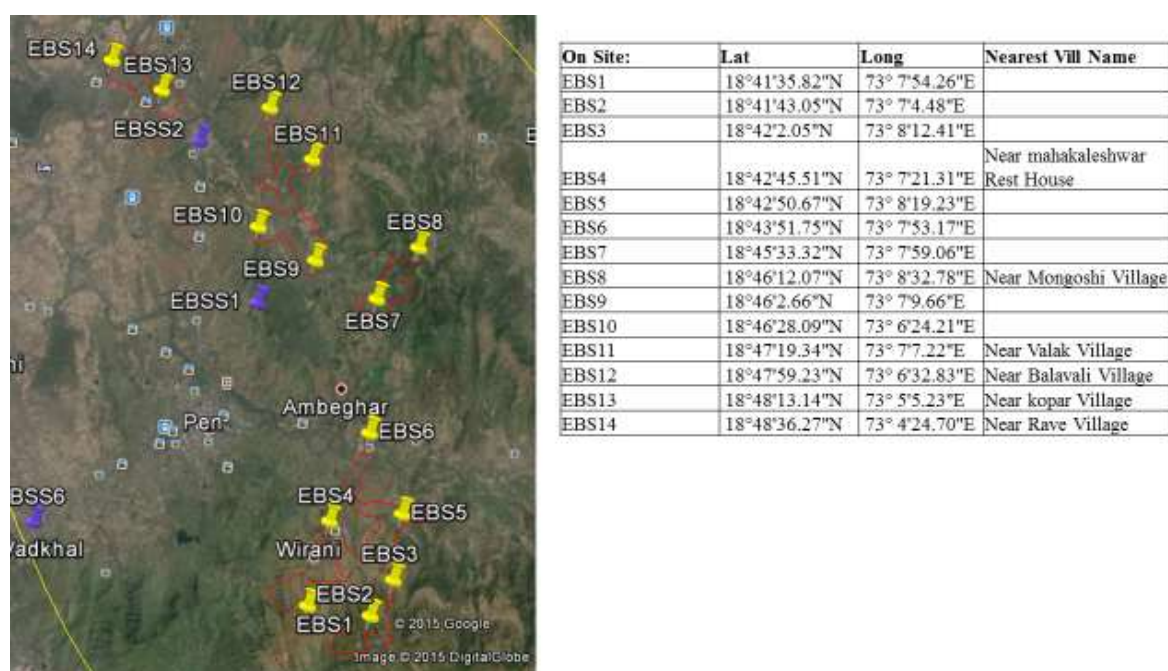


Figure 3-36: Map depicting the sampling locations at the site

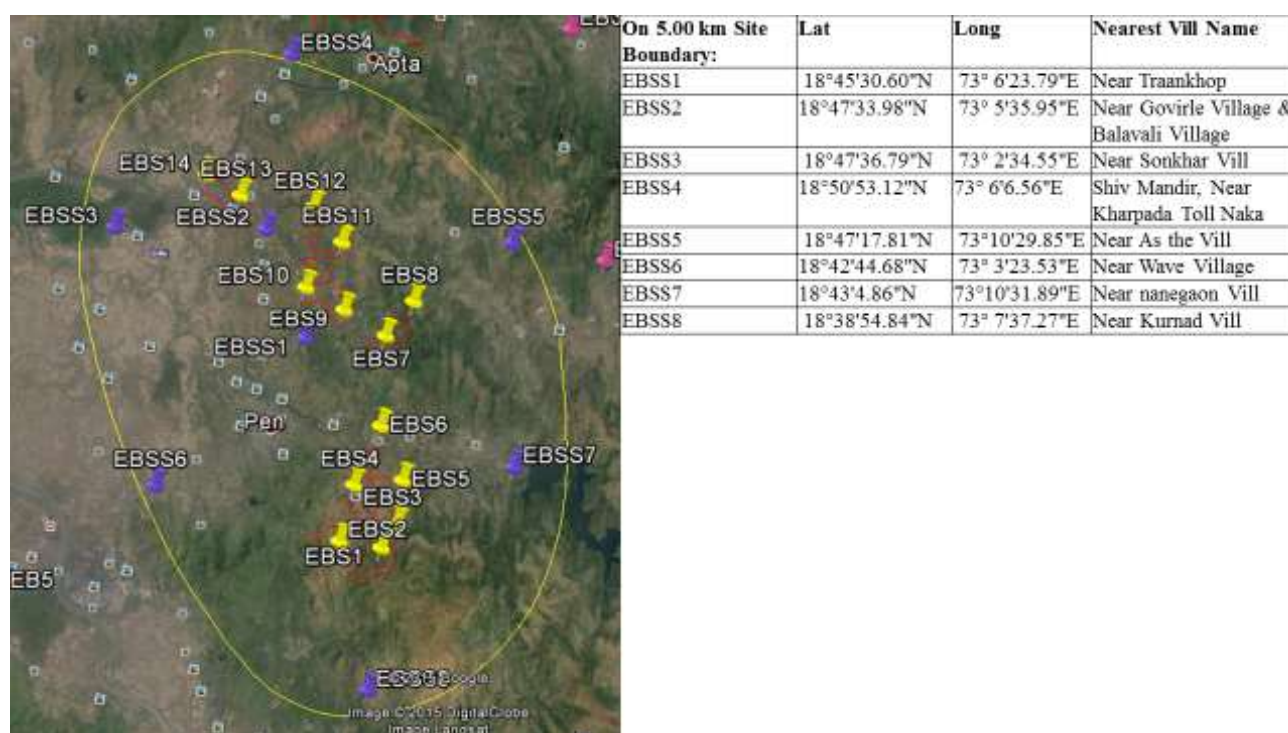


Figure 3-37: Map depicting the ecological sampling locations within 5km of the project boundary

3.11.7 Ecological Sampling

Generally, the duration of an ecological baseline survey should be commensurate with the scale of the proposed development at hand, and the duration of sampling conducted for the proposed project is regarded as the minimum requirement.

The duration of this ecological baseline survey was dependent on the following factors:

- The geographical coverage of the study area
- The diversity of habitats within the study area
- The diversity of flora and fauna within the study area
- Presence of ecologically important species or habitats which exhibit distinct seasonal patterns (e.g. migratory animals, seasonal wetlands)
- Ecological information of the study area available

Vegetation Survey

The region of the proposed project supports diverse habitats and thus the entire sampling was based on random sampling through "Plot Quadrature Method".

Plot Quadrature Method

- This technique is used only when a part of a much large area is sampled, on the basis of which, the total population of species in the larger area can be estimated.

- The shape and sizes of the quadrates were selected, based on previous experiences in undertaking similar studies. The plot quadrate method was adopted to evaluate phyto-sociological parameters like density, diversity and the frequency of the plant species. The sizes of the quadrate were selected on the basis of species area curve' and also based on the past experience of undertaking such studies.

For the present vegetation survey

- Quadrates of size 10 m x 10 m were selected for studying the trees and shrubs and a 1m x1m quadrate was selected for studying the ground cover dominantly the herbaceous vegetation.
- About 3-4 quadrates were studied at each location depending upon the vegetation cover and species diversity.
- A quadrant of 1 m² area was sited at the center of each sample plot for the ground cover sampling.
- Species composition was expressed in terms of frequency of occurrence, the most frequent species indicated as common and the least frequent as rare.
- The photographs showing Vegetation in the Study Area are shown as Annexure-XIII

Wildlife Survey

- The plant species were identified with standard field keys. Unidentified plant specimens were photographed & tagged, and/or collected & tagged. These tagged specimens were identified with various available species photographs in and around the study areas and later counter-checked and confirmed with the reference material available in the reference keys.
- In addition, the Red Data Book Plants of India (Nayar & Sastry 1987-88 & <http://www.bsienviis.nic.in/RET/maharashtra> was referred for the rare, endangered or threatened species.
- All the data was corroborated with the available floral and faunal list by the Forest Dept. of Raigad.

Ecological Settings

- Natural ecological features and wild life can be seen in forests of hilly tracts but these are restricted to ranges of Sahayadris that are at considerable distance from the study area.
- There are some reserved forest areas in the North East and South West of the site. The project site is irregular in shape and overlooks the River Bhogeshwari & Balganga.

Habitats in the Study Area

Considering the location and topography of the study area, distinct habitats can be demarcated. The study area can be divided into terrestrial, aquatic (freshwater bodies-lotic and lentic), estuarine (marshland, mudflats and mangroves), and estuarine subtidal habitats. There are some more pockets of habitat that are formed in the study area due to anthropogenic interventions like the, agricultural land, settlements, industries and salt pans and aquaculture farms. The region within 15 km radius where the present project is located has a total area of 104364 hectares out of which, approximately 25% of the area is covered by forests. The dense/open forest acquires 18.6% of the total area and degraded scrub forests covers 5% of the study area. Total agricultural land is about 21 % of the area with a small percentage of 0.2% plantation and 1.5 % irrigated crop whereas other agriculture land comprises approx.19%.

The existing project area primarily comprises of barren land Part of the T3 land parcel comes under CRZ limit (CRZ-III).

Floristic Composition- Primary Survey

The forests of this region have features, which are very similar to tropical rain forests although much of the Western Ghats in the northern sector is drier as compared to those regions further South in Goa, Karnataka, Tamil Nadu and Kerala. Because of general differences in the ecological patterns, the floral and faunal communities of the Western Ghats in the northern sector differ from the biological communities from the southern part of Western Ghats.

The study area considered for the proposed Orange Smart City has within its area several trees. Some of the landscape elements, which occur at the project site, include the following:

- Shrub covered hill tops and plateaus,
- Rivers adjacent to the project site
- Creek
- Rocky slopes
- Some cultivation is seen in the surroundings and the environs of the villages present around the site.
- During the surveys of all the villages, cultivation of paddy and Nachni in some places (*Eleusine coracana*) were noticed.

Floristic Diversity

During the field survey, a total number of 279 plant species (except algae, fungi and bryophytes) were recorded from the study area which are given in Table 3-22. The floral data collected for the baseline study was verified with the "List of Flora from the Working Plan of Raigad District" and the species recorded in the baseline study are very much comparable with the forest department list.

Table 3-22: Floristic composition in the study area

Sr. No.	Scientific Name	Common Name	Family
I Agricultural crops			
1	<i>Oryza sativa</i>	Rice sp	Poaceae
2	<i>Eleusine coracana</i>	Millet sp	Eleusine
3			
II Commercial crops (Including Vegetables)			
4	<i>Amorphophallus paeoniifolius</i>	Elephnat Foot Yam	
5	<i>Abelmoschus indicus</i>	Hibiscus	Malvaceae

Sr. No.	Scientific Name	Common Name	Family
6	<i>Allium cepa</i>	Onion	Liliaceae
7	<i>Allium sativum</i>	Garlic	Liliaceae
8	<i>Annona squamosa</i>	Custard Apple	Annonaceae
9	<i>Arachis hypogea</i>	Peanuts	Fabaceae
10	<i>Artocarpus heterophyllus</i>	Jackfruit	Artocarpus
11	<i>Cajanus cajan</i>	Pigeon Pea	Fabaceae
12	<i>Carica papaya</i>	Papaya	Caricaceae
13	<i>Citrus lemon</i>	Lemon	Ruataceae
14	<i>Colacasia esculenta</i>	Colocasia	Areaceae
15	<i>Ipomoea batatas</i>	Sweet Potato	Umbelliferae
16	<i>Lycopersicum esculentus</i>	Tomato	Solanaceae
17	<i>Mangifera indica</i>	Mango	Anacardiaceae
18	<i>Memordia charantia</i>	Bitter gourd	Cucurbitaceae
19	<i>Psidium guava</i>	Guava	Myrtaceae
20	<i>Raphanus sativa</i>	Raddish	Cruciferae
21	<i>Solanum tuberosum</i>	Potato	Solanaceae
22	<i>Vigna radiata</i>	Moong	
III Plantations			
23	<i>Acacia nilotica</i>		Mimosaceae
24	<i>Albizia lebbeck</i>		Mimosaceae
25	<i>Albizia odorattissima</i>		Mimosaceae
26	<i>Albizia procera</i>		Mimosaceae
27	<i>Azadirachta indica</i>		Meliaceae
28	<i>Bauhinia variegata</i>		Caesalpinaceae

Sr. No.	Scientific Name	Common Name	Family
29	<i>Bauhinia purpuria</i>		Caesalpinaceae
30	<i>Bambusa arundanaceae</i>		Poaceae
31	<i>Blumea sp.</i>		
32	<i>Butea superba</i>		Caesalpinaceae
33	<i>Butea frondosa</i>		Caesalpinaceae
34	<i>Cocos nucifera</i>		
35	<i>Eucalyptus sp</i>		Myrtaceae
36	<i>Delonix regia</i>		Caesalpinaceae
37	<i>Leucena leucophloe</i>		Caesalpinaceae
IV Natural Vegetation			
38	<i>Abelmoschus esculentus</i>	Orka	
39	<i>Abrus precatorius</i>	Crab's eye	Fabaceae
40	<i>Abutilon indicum</i>	Indian Mallow	Malvaceae
41	<i>Acacia Arabica</i>	Acacia spp	Mimosaceae
42	<i>Acacia auriculiformis</i>	Acacia spp	Mimosaceae
43	<i>Acacia leucophloe</i>	Acacia spp	Mimosaceae
44	<i>Achras sapota</i>	Chikoo	Sapotaceae
45	<i>Acalypha hispida</i>	Fox tail	Mimosaceae
46	<i>Acanthospermum hispidum</i>	Goat's head	Compositae
47	<i>Achyranthes aspera</i>	Prickly Chaff Flower	Amaranthaceae
48	<i>Adathoda vasica</i>	Adulsa	
49	<i>Adiantum philippense</i>	Fern	
50	<i>Adenanthera pavonina</i>	Ratan Gunj	
51	<i>Aegle marmelos</i>	Indian Bel	Rutaceae

Sr. No.	Scientific Name	Common Name	Family
52	<i>Aegeratum conyzoides</i>		
53	<i>Ageratum conyzoides</i>		Compositae
54	<i>Ailanthus excelsa</i>		Simaroubaceae
55	<i>Albizia odoratissima</i>		Caesalpinaceae
56	<i>Albizia procera</i>		Caesalpinaceae
57	<i>Aloe barbadensis</i>		Agavaceae
58	<i>Allophylus cobbe</i>		
59	<i>Alternanthera sessilis</i>		Amaranthaceae
60	<i>Alysicarpus hamosus</i>		Fabaceae
61	<i>Alysicarpus monilifer</i>		Fabaceae
62	<i>Argyreia elliptica</i>		Convolvaceae
63	<i>Argemone mexicana</i>		Papaveraceae
64	<i>Asparagus racemosus</i>		Liliaceae
65	<i>Atalantia monophylla</i>		Rutaceae
66	<i>Azadirachta indica</i>		Meliaceae
67	<i>Barleria cuspidata</i>		
68	<i>Bauhinia racemosa</i>		
69	<i>Bridelia retusa</i>		
70	<i>Blepharis asperima</i>		Acanthaceae
71	<i>Blumea lacera</i>		Compositae
72	<i>Bombax ceiba</i>		Bombacaceae
73	<i>Borreria stricta</i>		Rubiaceae
74	<i>Bridelia retusa</i>		Euphorbiaceae
75	<i>Buchanania lanzan</i>		

Sr. No.	Scientific Name	Common Name	Family
76	<i>Butea monosperma</i>		
77	<i>Caesalpina pulcherima</i>		Caesalpinaceae
78	<i>Calotropis procera</i>		Asclpiadaceae
79	<i>Canna indicda</i>		Cannaceae
80	<i>Calycotropis floribunda</i>		
81	<i>Careya arborea</i>		Palmae
82	<i>Carissa carandus</i>		Apocyanaceae
83	<i>Carissa spinarium</i>		Apocyanaceae
84	<i>Carvia callosa</i>		
85	<i>Casearia tomentosa</i>		
86	<i>Cassia auriculata</i>		Caesalpinaceae
87	<i>Cassia obtuse</i>		Caesalpinaceae
88	<i>Cassia occidentalis</i>		Caesalpinaceae
89	<i>Cassia tora</i>		Caesalpinaceae
90	<i>Cassia fistula</i>		
91	<i>Catunaregam spinosa</i>		
92	<i>Calycotropis floribunda</i>		
93	<i>Ceiba pentandra</i>		Bombacaceae
94	<i>Celosia argentea</i>		
95	<i>Cestrum noctrunum</i>		Rubiaceae
96	<i>Chromalaena odorata</i>		
97	<i>Chrysanthemum sp</i>		Compositae
98	<i>Cissus quadrangularis</i>		Vitaceae
99	<i>Citrus media</i>		Rutaceae

Sr. No.	Scientific Name	Common Name	Family
100	<i>Cleome viscosa</i>		Capparidaceae
101	<i>Clematis triloba</i>		
102	<i>Cocculus villosa</i>		Cucurbiataceae
103	<i>Cocos nucifera</i>		Palmae
104	<i>Combretum ovalifolium</i>		Rubiaceae
105	<i>Commelina benghalensis</i>		Commelinaceae
106	<i>Cordia dichotoma</i>		Rubiaceae
107	<i>Cordia rothri</i>		Rubiaceae
108	<i>Crotalaria pallida</i>		Fabaceae
109	<i>Crotalaria sp. 2</i>		Fabaceae
110	<i>Croton bonplandinum</i>		Amoryllidaceae
111	<i>Cryptostegia grandiflora</i>		Orchidaceae
112	<i>Curcuma aromatica</i>		
113	<i>Cuscuta reflexa</i>		Cuscutaceae
114	<i>Dalbergia lanceolata</i>		
115	<i>Dalbergia sisoo</i>		
116	<i>Datura alba</i>		Solanaceae
117	<i>Dendrophthe falcate</i>		Loranthaceae
118	<i>Desmodium gangeticum</i>		Asclepiadaceae
119	<i>Desmodium triflorum</i>		Asclepiadaceae
120	<i>Diploclisia glaucescens</i>		
121	<i>Echinops echinatus</i>		Compositae
122	<i>Eclipta alba</i>		Compositae
123	<i>Eclipta prostrate</i>		Compositae

Sr. No.	Scientific Name	Common Name	Family
124	<i>Eichhornia crassipes</i>		Pontederiaceae
125	<i>Emblica officinalis</i>		Euphorbiaceae
126	<i>Entada pursaetha</i>		
127	<i>Erythrina indica</i>		Papilionaceae
128	<i>Eupatorium glandulosum</i>		
129	<i>Euphorbia nerifolia</i>		Euphorbiaceae
130	<i>Euphorbia neruri</i>		Euphorbiaceae
131	<i>Euphorbia nivula</i>		Euphorbiaceae
132	<i>Ficus asperrima</i>		
133	<i>Ficus benghalensis</i>		Moraceae
134	<i>Ficus glomerata</i>		Moraceae
135	<i>Ficus hispida</i>		Moraceae
136	<i>Ficus microcarpa</i>		
137	<i>Ficus racemosus</i>		Moraceae
138	<i>Ficus religiosa</i>		Moraceae
139	<i>Flacourtia indica</i>		Flacourtiaceae
140	<i>Flacourtia latifolia</i>		Flacourtiaceae
141	<i>Gardenia latifolia</i>		Rubiaceae
142	<i>Garuga pinnata</i>		Burseraceae
143	<i>Garcinia indica</i>		
144	<i>Gloriosa superba</i>		
145	<i>Gossypium herbaceum</i>		Malvaceae
146	<i>Grewia abutifolia</i>		Tiliaceae
147	<i>Grewia asiatica</i>		Tiliaceae

Sr. No.	Scientific Name	Common Name	Family
148	<i>Grewia subinaqualis</i>		Tiliaceae
149	<i>Helictis isora</i>		Rubiaceae
150	<i>Heliotropium indicum</i>		Rubiaceae
151	<i>Heliotropium ovalifolium</i>		Rubiaceae
152	<i>Heterophragma quadriculare</i>		
153	<i>Hemidesmus indicus</i>		Asclepiadaceae
154	<i>Hibiscus micronthus</i>		Malvaceae
155	<i>Hibiscus ovalifolia</i>		Malvaceae
156	<i>Hibiscus rosa-cianensis</i>		Malvaceae
157	<i>Holarrhena antidysentrica</i>		
158	<i>Hygrophylla auriculata</i>		Acanthaceae
159	<i>Hymenodictyon excelsum</i>		
160	<i>Hyptis suaveolens</i>		Labiatae
161	<i>Ipomea sp.</i>		Convolvulaceae
162	<i>Ixora parviflora</i>		Rubiaceae
163	<i>Ixora coccinea</i>		
164	<i>Jasminum malbarichum</i>		
165	<i>Jatropha gossypifolia</i>		Euphorbiaceae
166	<i>Justicia carnea</i>		Acanthaceae
167	<i>Justicia procumbens</i>		Acanthaceae
168	<i>Lantana camara</i>		Verbinaceae
169	<i>Lathyrus sativus</i>		Papilionaceae
170	<i>Lawsonia inermis</i>		Lythraceae
171	<i>Largestromia lanceolata</i>		

Sr. No.	Scientific Name	Common Name	Family
172	<i>Leea microphylla</i>		
173	<i>Lepisanthes tetraphylla</i>		
174	<i>Leucas aspera</i>		Labiatae
175	<i>Leucas stelligera</i>		Labiatae
176	<i>Loranthus sp</i>		Loranthaceae
177	<i>Mancranga peltata</i>		
178	<i>Mangifera indica</i>		Anacardiaceae
179	<i>Melia azadirachta</i>		Meliaceae
180	<i>Merremia umbellata</i>		Convolvulaceae
181	<i>Merremia vitifolia</i>		Convolvulaceae
182	<i>Mimosa pudica</i>		Mimosaceae
183	<i>Mitrgyna parviflora</i>		Rubiaceae
184	<i>Moullava spicata</i>		
185	<i>Mollugo hirta</i>		Aizoaceae
186	<i>Moringa oleifera</i>		Moringaceae
187	<i>Mucuna pruriens</i>		
188	<i>Murraya koenigii</i>		Rutaceae
189	<i>Musa paradisica</i>		Musaceae
190	<i>Nerium indicum</i>		Apocyanaceae
191	<i>Ocimum americanum</i>		Labiatae
192	<i>Ocimum basillum</i>		Labiatae
193	<i>Ocimum sanctum</i>		
194	<i>Operculina turpethum</i>		
195	<i>Opuntia dillinii</i>		Opuntiaceae

Sr. No.	Scientific Name	Common Name	Family
196	<i>Opuntia elator</i>		Cacataceae
197	<i>Oxalis corniculata</i>		Oxalidaceae
198	<i>Panicum notatum</i>		Poaceae
199	<i>Parthenium hysterophorus</i>		Compositae
200	<i>Passiflora foetida</i>		Passifloraceae
201	<i>Pavonia zeylanica</i>		Malvaceae
202	<i>Peltophorum ferrugineum</i>		Caesalpinaceae
203	<i>Peristrophe bicalculata</i>		Acanthaceae
204	<i>Phoenix aculis</i>		Palmae
205	<i>Phyllanthus emblica</i>		Euphorbiaceae
206	<i>Phyllanthus niruri</i>		Euphorbiaceae
207	<i>Physalis minima</i>		Solanaceae
208	<i>Pithocolobium dulce</i>		Mimosaceae
209	<i>Polyalthia longifolia</i>		Annonaceae
210	<i>Pongamia glabra</i>		
211	<i>Pongamia pinnata</i>		Fabaceae
212	<i>Portulaca oleracea</i>		Portulaccaceae
213	<i>Psidium guava</i>		Myrtaceae
214	<i>Pteris sp</i>		
215	<i>Punica granatum</i>		Puniaceae
216	<i>Rhus mysoorensis</i>		Rosaceae
217	<i>Samanea saman</i>		
218	<i>Sapindus emarginatus</i>		Sapindaceae
219	<i>Schleichera oleosa</i>		

Sr. No.	Scientific Name	Common Name	Family
220	<i>Sida acuta</i>		
221	<i>Sida cordifolia</i>		Malvaceae
222	<i>Sida rhombifolia</i>		Malvaceae
223	<i>Smilax zeylanica</i>		
224	<i>Solanum nigrum</i>		Solanaceae
225	<i>Solanum xanthocarpum</i>		Solanaceae
226	<i>Spondias pinnata</i>		
227	<i>Sterculia villosa</i>		Tiliaceae
228	<i>Strobilanthus callossus</i>		
229	<i>Sygygium cumini</i>		Myrtaceae
230	<i>Tabernaemontana pandacaqui</i>		
231	<i>Tagetes sp</i>		Compositae
232	<i>Tamarindus indica</i>		Caesalpinaceae
233	<i>Tectona grandis</i>		Verbinaceae
234	<i>Tephrosia purpuria</i>		Fabaceae
235	<i>Teramnus labialis</i>		
236	<i>Terminalia paniculata</i>		<i>Terminalia paniculata</i>
•	<i>Terminalia tomentosa</i>		<i>Terminalia tomentosa</i>
237	<i>Terminalia chebula</i>		
238	<i>Terminalia elliptica</i>		
239	<i>Tetrasigma sp.</i>		
240	<i>Thespesia populanea</i>		Malvaceae
241	<i>Thespesia lampas</i>		Malvaceae

Sr. No.	Scientific Name	Common Name	Family
242	<i>Thumbergia sp.</i>		
243	<i>Tinospora cordifolia</i>		Rhamnaceae
244	<i>Tragus biflorus</i>		Poaceae
245	<i>Trapa bispinosa</i>		Trapaceae
246	<i>Trapa natans</i>		Trapaceae
247	<i>Trema orientalis</i>		
248	<i>Tridax procumbens</i>		Compositae
249	<i>Triumferta pilosa</i>		Tiliaceae
250	<i>Urtica sp.</i>		
251	<i>Vanda sp.</i>		
252	<i>Vangueria spinosa</i>		
253	<i>Vanilla planifolia</i>		
254	<i>Vernonia cinera</i>		Compositae
255	<i>Vicoa indica</i>		Compositae
256	<i>Vitex negundo</i>		Verbinaceae
257	<i>Woodfordia fruticosa</i>		
258	<i>Wrightia tinctoria</i>		
259	<i>Wrightia tomentosa</i>		Apocyanaceae
260	<i>Xanthium strumarium</i>		Compositae
261	<i>Yucca gloriosa</i>		Agavaceae
262	<i>Zizyphus jujube</i>		Rhamnaceae
263	<i>Zizyphus mauritiana</i>		Rhamanaceae
264	<i>Zizyphus nummularis</i>		Rhamnaceae
265	<i>Zizyphus oenoplica</i>		Rhamnaceae

Sr. No.	Scientific Name	Common Name	Family
266	<i>Cenchrus ciliaris</i>		Poaceae
267	<i>Apluda mutica</i>		Poaceae
268	<i>Chloris dolichosta</i>		Poaceae
269	<i>Cyanodactylon sp</i>		Poaceae
270	<i>Dichanthium annulatum</i>		Poaceae
271	<i>Aristida adscensionsis</i>		Poaceae
V Grasses			
272	<i>Andropogon pumilis</i>		
273	<i>Andropogon pertusus</i>		
274	<i>Andropogon monticola</i>		
275	<i>Cenchrus setifera</i>		Poaceae
276	<i>Cyperus aristatus</i>		Cyperaceae
277	<i>Cyperus rotundus</i>		Cyperaceae
278	<i>Cynodon dactylum</i>		
279	<i>Digitaria bicornis</i>		Poaceae
280	<i>Digitaria Segetaria</i>		Poaceae
281	<i>Digitaria stricta</i>		Poaceae
282	<i>Eragrostis tenella</i>		Poaceae
283	<i>Fibrostylis dichotoma</i>		Poaceae
284	<i>Ischaemum pilosum</i>		
285	<i>Heteropogon contortus</i>		
VI Mangroves			
286	<i>Avicennia alba</i>		Verbenaceae
287	<i>Avicennia marina</i>		Verbenaceae

Sr. No.	Scientific Name	Common Name	Family
288	<i>Acanthus illicifolius</i>		Acanthaceae
289	<i>Derres heterophylla</i>		Fabaceae
290	<i>Salvadora persica</i>		Salvadoraceae
291	<i>Sonneratia apetala</i>		Sonneratiaceae

The percentage of the ground cover in the study area is depicted in **Figure 3-38**

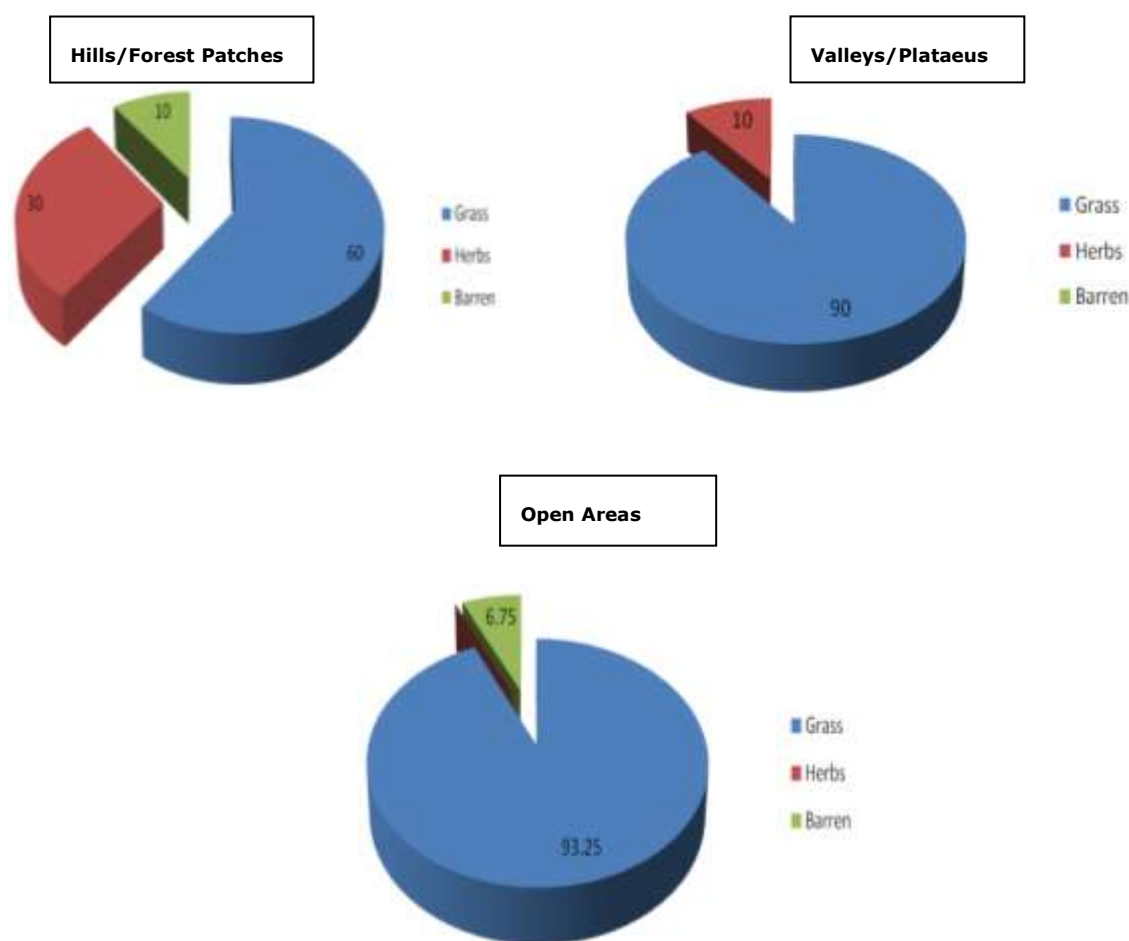


Figure 3-38 : Distribution of the ground cover in the study area

3.11.8 Observations and Discussion

Ecological Resources

The ecological studies at the above locations clearly indicate that the project area is inhabited by several plant and animal species that support a biological diversity of the project area. Local plant communities, which were recorded, include many evergreen species, like *Ficus racemosa*, and *Mangifera indica*. Deciduous elements are, however,

less in abundance in the area. The under storey development was observed to be moderate and the presence of bamboo patches were also a common feature. The local and tribal people in the region collect species like *Terminalia tomentosa*, *Terminalia chebula*, *Syzigium cumini*, *Pongamia pinnata*, *Garcinia indica* for their medicinal values. There are less number of big mammals and there are sporadic records of leopard, barking deer and jackals. Avifauna activity, which was recorded here during the short visit included Thrushes, Babbler, Shama, woodpeckers etc.

Common Floral Species

- As per primary survey conducted in post- monsoon 2015, predominant plant species observed in the study area were *Tectona grandis*, *Bombax ceiba*, *Erythrina indica*, *Grewia* spp., *Moullava spicata*, *Mucuna pruriens*, *Justicia* spp., *Chromolaena odorata*, *Cassia tora*, and *Macranga peltata*. Outside project site, in buffer zone, *Shirish* / *Albizia* spp., coconut plantation, banana, Drumstick plantation, Tamarind tree and paddy plantation is observed
- Scrub species that are commonly found in the region are *Ziziphus rugosa*, *Acacia concinna*, *Carissa congesta*.
- The species present in the region have further been depleted because of the human interventions and the associated exploitation of the forest resources due to cutting by the villagers and the tribal communities in the region. The floral communities of the site were observed to be fairly diverse except for plateau level habitats where there is poor diversity and abundance of flora, which was subsequently reflected in the faunal communities as well.
- Wild plants play a very important role in the livelihoods of the neighbouring villages and tribal communities as an integral part of the subsistence strategy of people in many forest regions.
- Food plants serve as one of the primary alternative sources of income for many resource poor communities, and the source of species for domestication.
- Some of the economically important forest vegetation that was recorded during the survey has been classified according to their resource use/value and are given in **Table 3-23**.

Table 3-23 : Classification of the commonly occurring plant species as per resource use/ value

Timber & other Economic Products	Edible Fruit	Medicinal Value	Ornamental Value
<i>Acacia concinna</i>	<i>Carissa congesta</i>	<i>Bauhinia purpurea</i>	<i>Bauhinia purpurea</i>
<i>Acacia catechu</i>	<i>Ficus racemosa</i>	<i>Dillenia indica</i>	<i>Bauhinia racemosa</i>
<i>Bauhinia purpurea</i>	<i>Mangifera indica</i>	<i>Erythrina</i> spp.	<i>Cassia fistula</i>
<i>Bombax insigne</i>	<i>Emblica officinalis</i>	<i>Euphorbia nerifolia</i>	<i>Erythrina</i> spp.
<i>Butea monosperma</i>	<i>Catunaregam Spinosa</i>	Ferns	<i>Jasminum malabaricum</i>

Timber & other Economic Products	Edible Fruit	Medicinal Value	Ornamental Value
<i>Careya arborea</i>	<i>Syzygium cumini</i>	<i>Ficus racemosa</i>	-
<i>Cassia fistula</i>	<i>Zyziphus mauritiana</i>	<i>Pongamia pinnata.</i>	-
<i>Dillenia indica</i>	<i>Zyziphus rugosa</i>	<i>Emblica officinalis</i>	-
<i>Ficus racemosa</i>	<i>Syzygium cumini</i>	<i>Syzygium cumini</i>	-
<i>Pongamia pinnata .</i>	<i>Meyna laxiflora</i>	<i>Terminalia chebula</i>	-
<i>Catunaregam spinosa</i>	<i>Phyllanthus emblica</i>	<i>Garcinia indica</i>	-
<i>Carvia callosa</i>	<i>Emblica officinalis</i>	-	-
<i>Syzygium cumini</i>	<i>Tamarindus indica</i>	-	-
<i>Terminalia chebula</i>	<i>Garcinia indica</i>	-	-
<i>Terminalia crenulata</i>	<i>Syzygium caryophyllatum</i>	-	-
<i>Terminalia tomentosa</i>	<i>Buchanania lanzan</i>	-	-
<i>Dalbergia latifolia</i>	-	-	-
<i>Trema orientalis</i>	-	-	-

The most common floral species observed are given in **Table 3-24**.

Table 3-24: Most common floral species observed in the study area

Sl. No.	Scientific name	Local name
1.	<i>Carissa congesta</i>	Karvanda
2.	<i>Erythrina sp.</i>	Pangar
3.	<i>Euphorbia neriifolia</i>	
4.	<i>Ficus racemose</i>	Umbar
5.	<i>Moullava spictata</i>	

Sl. No.	Scientific name	Local name
6.	<i>Mucuna pruriens</i>	Khazkhuzli
7.	<i>Chromolaena odorata</i>	
8.	<i>Tectona grandis</i>	Sagvan
9.	<i>Syzygium cumini</i>	Jambhul
10.	<i>Terminalia crenulata</i>	
11.	<i>Terminalia tomentosa</i>	Ain
12.	<i>Macranga peltata</i>	Chanda
13.	<i>Zyziphus rugosa</i>	Toran
14.	<i>Careya arborea</i>	Kumbhi
15.	<i>Emblica officinalis</i>	Anvala
16.	<i>Acacia concinna</i>	Shikakai
17.	<i>Mangifera indica</i>	Amba
18.	<i>Bombax ceiba</i>	Kante Savar
19.	<i>Albizia spp.</i>	Siris
20.	<i>Dalbergia latifolia</i>	Shisham

Ground Cover

Almost the entire region of the study area ground cover was majorly contributed by grass and few herbs which grow in the monsoon season. Since the sampling was done in the non-monsoon period, almost all ground vegetation was dried, although some places still retained the remnants of monsoon grown live herbs. The actual project site being an open area, more than 93% of the groundcover was by dry grass and remaining area was barren land.

Observation on fauna:

Domestic Animals: The domestic animals in the study area mostly comprise of goat, buffalo, rat, dog, cow. The survey revealed that cow constituted the most abundant species, followed by buffalo and goat.

Wild Animals: The diversity of fauna basically depends upon density and diversity of flora. The study area do not support the presence of wild mammals. Further, besides avifauna, which has been addressed separately, species of amphibians, reptiles and butterflies were recorded

(Table 3.41 & Figure 3.27). Amongst them, butterflies like Glassy Tiger, Plain Tiger, common grass yellow, Common Jay, blue mormon, common leopard, golden angle etc. were found. Butterfly diversity and community composition are dependent on plants, as their caterpillars are highly specific to host plants, on which they feed and metamorphose into the adults. Therefore, richness of host plant diversity contributes to butterfly diversity. As the butterfly population increases, a variety of organisms including preying mantis, spiders, lizards and birds also colonise the area leading to a stabilization of habitats and better functioning of ecosystem. Bufo, Frog, blind snakes were found during the survey. Availability of fauna in the vicinity of the sites is presented in None of these animals are endangered as per Wildlife (Protection) Act 1972.

Table 3-25 : Fauna recorded in the study area upto 5 km radius

Sr. No.	Common Name	Scientific Name
Amphibians		
1	Common toad	<i>Bufo melanostictus</i>
2	Indian bullfrog	<i>Rana tigrina</i>
3	Dumeril	<i>Microhyla ornate</i>
Reptiles		
1	Lizard	<i>Psmmophilus blanfordanus</i>
2	House gecko	<i>Hemidactylus brooki</i>
3	Indian chameleon	<i>Chamaeleon zeylanicus</i>
4	Blind snake	<i>Rhamphot ylops</i>
Butterfly		
1	Glossy tiger	<i>Parantica aplea</i>
2	Plain Tiger	<i>Danaus chrysippus</i>
3	Common grass yellow	<i>Eurema hecabe</i>
4	Common Jay	<i>Graphium doson</i>
5	Blue mormon	<i>Papilio polymnestor</i>
6	Common leopard	<i>Phalanta phalantha</i>
7	Golden angle	<i>Caprona ransonnetti</i>
Mammals		
1.	Squirrel	<i>Funambulus palmarum</i>

Sr. No.	Common Name	Scientific Name
2.	Jackal	<i>Canis aureus</i>
3.	Cow	
4.	Domestic Buffalo	
5.	Goat	
6.	Common dog	
7.	Common cat	
Avifauna		
1.	House sparrow	<i>Passer domesticus</i>
2.	Black drongo	<i>Dicrusus adsimilis</i>
3.	Kingfisher	<i>Alcedo atthis</i>
4.	Bulbul	<i>Pycnonotus jacous</i>
5.	Fantail flycatcher	<i>Rhipidura sp..</i>
6.	Common myna	<i>Acridotheres tristis</i>
7.	Cuckoo	<i>Cuculus canorus</i>
8.	Parakeets	<i>Psittacula sp.</i>

Source: Field Observation and discussion with local people

***Barring Indian Chameleon (Sch II), no other animals are enlisted in Schedules I through V under Wild Life (Protection) Act 1972**



Rhamphotyplops



Bufomelanostictus



Psammophilusblanfordanus



Chamaeleonzeilanicus

Figure 3-39 : Select common animals in the study area



Paranticaaglea



Euremahecabe



Papiliopolymnestor



Graphiumdoson

Figure 3-40 : Select common butterfly in the study area

FIGURE 3.29: SELECT COMMON AVIFAUNA OBSERVED IN THE STUDY AREA

Passer domesticus



Dicrususadsimilis



Psittacula sp.



Alcedoatthis

Figure 3-41 : Select common avifauna observed in the study area

3.1.1 Sanctuaries within the study area

Karnala Bird Sanctuary:

The project site is in the vicinity of Karnala Bird Sanctuary. In addition to the available secondary data, the sanctuary was also part of the field survey as one of the EB survey location. Findings are provided in Annexure-XIV to Annexure-XVI. Karnala Bird Sanctuary is at Karnala in Panvel and Uran Tahsil of Raigad District. Total area of the sanctuary is 12.154 Sq.Km. Consisting of 6.562sq.Km. Reserve forest, 5.547Sq. Km. Acquired forest and 0.045 sq.km. Private land.

The place along the Mumbai Goa NH 66, the road passes through sanctuary is about 1.5 km. Karnala Bird Sanctuary, there is fort called Karnala fort which has very interesting history. In spite of being a small pocket it holds a rich diversity of wood land vegetation & wood land bird species. It also forms a catchment area of Patalganga River. The Sanctuary is an important green oasis surrounded by industrial areas of Panvel, Khopoli & Patalganga. Hilly terrain consist of nallas on eastern and western slopes which drains in Patalganga River. Mean max.temp.: 34.25°C while Mean min.temp.: 24.82° C while average annual rainfall is 2404.45mm.

Prior to 31st March, 1994 the area of this sanctuary was under administrative control of Alibag Forest Division. Henceforth, the area is transferred to Wild Life Division, Thane. Area 4.27

Sq.Km. of reserve forest was earlier declared as Karnala Fort sanctuary in the year 1968 under “Bombay Wild Animal And Wild Bird Act,1951”. In 1986, as per the provision of Wild life Protection Act,1972 of Section 18, the area 12.11 Sq.Km. was notified for Karnala Bird Sanctuary . The rights and privileges were settle down.In 2003, an area of 12.109Sq.km. of reserve and acquired forest including earlier declared area was notified as Karnala Bird Sanctuary under sec. 26(a) of Wild Life Protection Act,1972. In 2003, subsequently a private cultivation area 0.045Sq.Km. Added by declaration as Karnala Bird Sanctuary. Thus today the total area of the sanctuary is 12.154Sq.Km.

The total length of external boundary is 29.56 km. The sanctuary area is divided in compartments hence the internal boundary is16.50 km. At the bottom of the funnel hill of the fort there are 12 water storage dug out tanks in impermeable basalt rock that retain stagnated rain water all around the year.23 cement water dishes kept at strategic places to provide water to animals and birds.

Flora and Fauna within the Sanctuary

FLORA

3B/C1b – Southern Teak Bearing Forest

2B/C2 – Southern Moist Mixed Deciduous

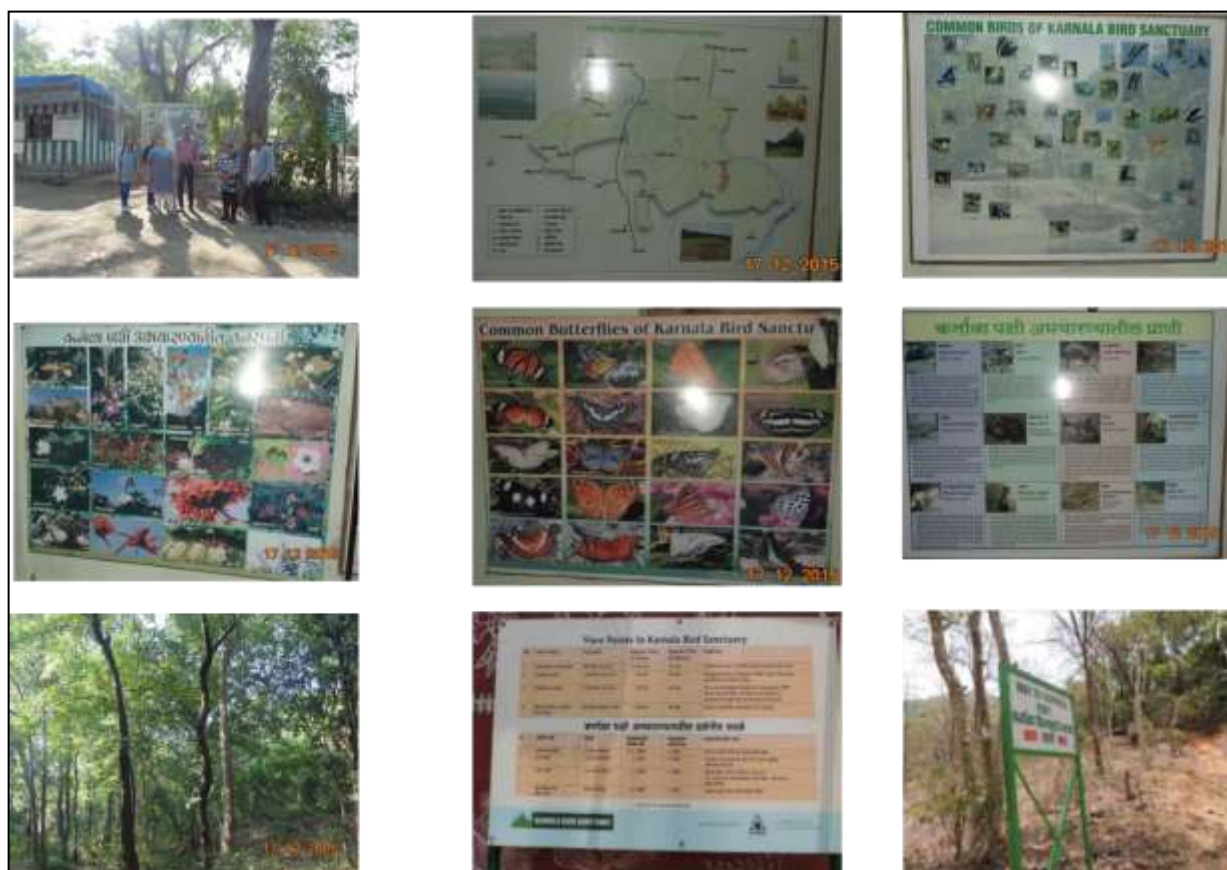
4E/RS1 – Tropical reparine Fringe Forest

- The Sanctuary area is covered with mixed forest. In Southern teak bearing forest, the teak dominance seen in Karnala Sanctuary.
- With teak, top canopy consists of Ain, Amba, Behada, Hed, Kusum, Sawar, Dhavada, middle canopy Alu, Bahawa, Dhaman, Dikamali, Asana, Apta, Palas, Lokhnadi, Kuda. herbs, shrubs and grasses like atrun, Karvand, Kusali and Marvel.
- The moist mixed deciduous forest are similar with Southern Teak bearing Forest except that percentage of Kinjal, Nana, amba and Behda are more than Teak.
- The density of the forest is between 0.6 to 0.8.
- The Riparian Fringing Forest occur along the nala bank consists of top canopy with Umbar, Jambhul, Karanj Amba. Middle canopy with Alu, Bahava, Dhaman, Dikemali, Lokhandi, Palas, Kumbhi.
- In 1980, Botonical Survey of India Pune carried out the survey of this area and found out about 642 species.

FAUNA

- The topographical features and ecological conditions are favourable for boarding large variety of birds and small animals like wild pig, barking deer, porcupine, mongoose, jungle cat, monitor lizard, squirrels, hyena and monkey.
 - As many as 132 bird spp. have been listed in the sanctuary. Of these 92 spp. are resident and 40 spp. are migratory.
 - Globally threatened and endemic birds like Long Billed Vultures, Malbar Gray Hornbill, Small Sun Bird and Shahin Falcon birds spp. are found in Karnala Bird Sanctuary.
- Around 11 spp. of reptiles are found in sanctuary area like Cobra, Krait, Viper, Python, Rat snake etc.

(Source: <http://www.thanewildlife.org/Sanctuaries/karnala-wildlife-sanctuary>)



Agriculture

The common crops in the study area are *Oryza sativa* and *Eleusine coracana* which mainly depend on rainwater and irrigation in non-monsoon season. Apart from that commercial crops like Mangoes, Cashews, Suran and vegetables such as Onions, Sweet potatoes, Chilies, Brinjal, Ladyfinger and leafy vegetables are common. A sizable land in the study area was also under farms for cultivation of fish and prawn. Most of the farms cultivate prawns and this in semi-intensive farming wherein mostly fresh water and some places brackish water is used. Some farms use it for both paddy and sometimes prawn/fish farming depending on the season and availability of water.

Estuaries and Mangroves

- The intertidal area on the landward side is actually a broad area inundated by tidal flooding daily twice and thus muddy. This forms an intertidal estuarine habitat which are capable of growing the mangroves. Mangroves are found at the fringe and interior as well, and at some places they are dense.
- Mangrove species were observed along the shores of Balganga and estuarine creek near Sonkar village. Except for these creeks and its shore, no other area within 15 km radius of project location harbours mangroves. Large stretches of associated species of *Derres heterophylla* and *Acanthus ilicifolius* were observed in this area. The predominant mangrove species were *Sonneratia apetala* as dominant species and *Avicennia marina* and *A. alba* were present but very sparse with few nos. All the mangroves together showed a height range of 2-10 ft. The mangroves observed in this location have healthy luxuriant growth. These mangroves have been classified by the Wildlife Department as “Marine Protected Areas of India” as listed by the Wildlife of India, 1999 and “Mangrove Wetlands of India” as per records of the State Forest Department. Natural mangrove vegetation in the project area is primarily limited to a layer of a single predominantly less salt tolerant species, with much of the area devoid of other species.
- The species in the marshy areas alongside the creeks were represented by *Suaeda nudiflora* and *Sesuvium portulacastrum*. The other species which also occur in these marshes were *Asparagus racemosus*, and *Casuarina* sp.
- Some of the areas which do not have frequent tidal flushing were intruded by *Thespesia populnae* but in other estuarine areas it was absent possibly due to daily inundation.
- In some water-logged areas aquatic species like *Trapa* sp., *Salvinia* sp., *Eichornia* sp., *Nymphaea* sp. and submerged vegetation like *Hydrilla* sp. was observed

Aquatic Ecosystem

Unpolluted fresh water is amongst the most endangered of our natural resources, basically fragile communities that supports may similarly be under threat. With increased understanding of the process that operates in these dynamic assemblages of species, attention has been directed towards the effect exerted by different groups of the substances such as heavy metals and organic substances on the aquatic plant and animal communities. An attempt has been made to generate baseline data of the water bodies in study area to know the existing biological spectrum. This information will give a clear picture of current load of pollution or inflows coming from surrounding areas to the aquatic bodies.

Phytoplankton: forms the basis of food chain in any aquatic water body. The diversity and abundance of phytoplankton mainly depends on the region, type of water body, either lentic or lotic, the nutrient flux in the system and the sunlight available for photosynthesis. These factors together form the dynamics of phytoplankton productivity over the seasons. The phytoplankton of given water body determines the zooplankton populations and the fish productivity of the ecosystem

Zooplankton: The zooplankton of the aquatic water body are the primary consumers and also in cases secondary produces which play an important role for the fisheries of that system. The diversity and abundance of zooplankton also depends on whether the water body is eutrophic or oligotrophic. They also are good representation of the ecosystem health. The amount and type of pollutants in the water body determine the type of zooplankton species. Species of copepod will usually dominate in the tropical region while more eutrophicated waters with high nutrient or organic loads will harbour high number of crustaceans and arthropods. The less polluted waters will have more of cladocerans and rotifers

Benthos: Benthic fauna inhabiting the coastal water bodies have importance in the context of assessing the brackish water and estuarine production. The estuarine bottom and the extensive mudflats with their diverse littoral mangrove swamps are known to contribute significantly to the total productivity by harbouring a great variety of organisms, by producing a large amount of detritus and providing food to demersal fishery. Hence any alteration in benthic community would affect the productivity and the demersal fishery.

Methodology Adopted for the Aquatic Ecological Studies

This aquatic ecology study was carried out in different water bodies such as the Bhogawati river, Balganga River, Hetavne dam within the study area. Ponds present in the study area were not sampled as they had almost dried up. Three sampling locations were selected for analyzing different parameters of water as required for aquatic ecology survey. The aquatic ecology survey was carried out along with the terrestrial ecology survey.

Two water samples for plankton study were collected from each lentic ecosystem. The samples were collected 0.3 m from surface of the water. The details of the sampling locations are presented in Table 3-26

Table 3-26 : Details of aquatic sampling locations

Code	Name of Sampling Location	Distance w.r.t Project Site (Km)	Direction
AE-1	Hetwane Dam	5	Downstream
AE-2	Balganga	1.3	Downstream
AE-3	Bhogeshwari	1.7	Downstream

The samples were collected in one-liter capacity polyethylene cans and the samples were fixed with 4% buffered formaline solution. For the measurement of frequencies of various forms of phyto-plankton and zoo-plankton, one drop of the sedimented plankton was mounted on a microslide and as many as 10 different microscope fields situated at more or less even distances

from each other were examined (**Lackey Method, 17th edition, APHA, AWWA 1992**). The plankton forms were identified upto species level and Shannon Weaver's index was calculated.

Shannon Wiener s Diversity Index

Diversity of plankton depends on physico-chemical characteristics of water especially on trophic levels in oligotrophic waters. With increasing levels of pollution such as mesotrophic or eutrophic conditions, diversity of plankton decreases. Shannon-weaver's index is a measure of diversity of plankton, which takes into account the total and important species count in a water sample. It should be noted that diversity is also susceptible to other parameters such as turbidity, colour and nutrients. A widely accepted ecological concept is that community with larger number of species i.e with high diversity that can resist adverse environmental factors. The maximum value of Shannon weaver index of phytoplankton for clear water has been reported to be 6 though it may differ slightly in different locations. Decrease in the value index may thus be taken as indicator of pollution. The Shannon weavers index values there and above for zooplankton generally considered as indicator of healthy conditions of water bodies. The values between 1 and 3 and less than one are believed to be for mild and highly polluted conditions respectively.

Table 3-27 : List of fresh water plaktonic flora and fauna from the study area

Freshwater Phytoplankton	Freshwater Zooplankton
<i>Gyrosigma sp</i>	<i>Keratella monospina</i>
<i>Achananthes affinis</i>	<i>Brachirous caudatus</i>
<i>Gyrosigma accuminatus</i>	<i>Asplancha brighwell</i>
<i>Pandorina sp</i>	<i>Colpidium colpoda</i>
<i>Ankistrodesmus falcatus</i>	<i>Daphnia sp</i>
<i>Pediastrum boryanum</i>	<i>Ceriodaphnia reticulate</i>
<i>Scenedesmus bijuga</i>	<i>Mesocyclops leuckarti</i>
<i>Melosira granulate</i>	<i>Mesocyclops hyalinus</i>
<i>Cyclotella meneghiana</i>	<i>Coleps hirsutus</i>
<i>Microcystis sp</i>	<i>Arcella sp</i>
<i>Navicula gracilis</i>	<i>Actinophyros sp</i>
<i>Nitzschia gracilis</i>	<i>Asplancha sp</i>
<i>Chroococcus minutes</i>	<i>Ceriodaphnia sp</i>
<i>Spirulina princeps</i>	<i>Mesocyclops sp</i>

Freshwater Phytoplankton	Freshwater Zooplankton
<i>Pinnularia braunii</i>	-
<i>Synedra tabulate</i>	-
<i>Ophora sp</i>	-
<i>Cymbella sp</i>	-
<i>Navicula radiosa</i>	-

Table 3-28 : Shannon Weaver's Diversity Index of Plankton

Sampling Location	Phyto-Plankton	Zoo-Plankton
Bhogavati River	2.68	2.25
Balganga River	2.54	2.37
Hetavne dam	2.76	2.31

Observations and Discussion of Aquatic Ecosystem

Phytoplankton & Zooplankton

Dominance of chlorophyceae followed by bacillariophyceae was observed at sampling location (AE-1 & AE-2) and rest was dominated by chlorophycean and cyanophycean members. Cladoceran members were dominant at sampling location (AE-1) and rotifers were dominant at sampling location (AE-3).

The results of phyto and zooplanktons are presented in

Table 3-29. It may be observed from the

Table 3-29 that the population of phytoplankton and zooplankton is satisfactory in both the both the rivers and the Hetavne dam. The moderately high value of algal biomass and chlorophyll indicates that the river water is favorable for the growth aquatic species. occurrence of higher amount of macrophytes (aquatic plants and algae), which is related to the primary production of organic carbon in rivers shows these ecosystems to be conducive for the normal growth and population of aquatic animals.

Occurrence of *Osciplaria sp.*, *Euglena sp.* and *Paramecium sp.* etc. in the Bhogavati River indicates presence of bio degradable matter, which acts as food for fishes in in this River aquatic eco-system.

Systematic ecological monitoring of population dynamics and composition of relevant parts of the water bodies was carried out to generate the baseline data. The Shannon weaver's index for

phytoplankton varies in between 2.68 to 2.76 and the same for zooplankton varies in between 2.45 to 2.37 indicating that these water bodies were enriched with nutrients and free from any sort of anthropogenic pollution loads.

The species diversity index value for the phytoplankton and zooplankton in the studied water bodies indicates that the system is moderately favorable for the growth of phytoplankton and zooplankton community. The value of chlorophyll also supports the presence of observed population of aquatic community.

Therefore, the values of phyto and zooplankton community in these three water bodies are almost satisfactory in terms of taxonomic diversity. The obtained value of different parameters indicates that the existence of balanced eco system in the rivers and dam water for phytoplankton and zooplankton community.

Marine Plankton & Benthos Study

The marine biodiversity studies conducted during post-monsoon season i.e Jan 2016.

a) Sampling procedure:

Polyethylene bucket and Niskin sampler respectively, were used for sampling surface and bottom waters for the estimation of phytoplankton pigments and population. Sample for phytoplankton cell count was fixed in Lugol's iodine and a few drops of 3% buffered formaldehyde.

Zooplankton were collected by oblique hauls using a Heron Tranter net (Mesh size 0.33 mm, mouth area 0.25 m²) with an attached calibrated digital flow meter (General Oceanic). All collections were of 5 min duration. Samples were preserved in 5% buffered formaldehyde.

Sediment samples for macro benthos were collected using a van-Veen grab of 0.04 m² area. Intertidal collections between the HTL and the LTL were done with quadrants. Samples were preserved in 5% buffered formaldehyde - Rose Bengal.

b) Methods of analysis:

i) Phytoplankton:

The cells in the sample preserved with Lugol's solution were allowed to settle and transferred into a Sedgwick Rafter slide. Enumeration and identification of phytoplankton were done under a microscope.

ii) Zooplankton:

Volume (biomass) was obtained by displacement method. A portion of the sample (25-50%) was analysed under a microscope for faunal composition and population count.

iii) Macrobenthos:

Sediment was sieved through a 0.5 mm mesh sieve and animals retained were preserved in 5% buffered Rose Bengal formaldehyde. Total population was estimated as number of animals in 1 m² area and biomass was determined on wet weight basis (g/m²).

Table 3-29 : Marine Plankton species recorded from the study area

Phytoplankton Group	Marine Phytoplankton	Zooplankton Group	Marine Zooplankton
<i>Diatoms</i>	<i>Gyrosigma</i> sp	<i>Copepods</i>	<i>Canthocalanus</i> sp.
	<i>Asterionella</i> sp.		<i>Eucalanus</i> sp.
	<i>Bacillaria</i> sp.		<i>Bestiolina</i> sp.
	<i>Odontella sinensis</i>		<i>Acrocalanus</i> sp.
	<i>Odontella</i> sp.		<i>Paracalanus</i> sp.
	<i>Chaetoceros affinis</i>		<i>Euchaeta</i> sp.
	<i>Chaetoceros</i> sp.		<i>Centropages</i> sp.
	<i>Coscinodiscus centralis</i>		<i>Temora</i> sp.
	<i>Coscinodiscus gigas</i>		<i>Candacia</i> sp.
	<i>Coscinodiscus radiatus</i>		<i>Labidocera</i> sp.
	<i>Cyclotella striata</i>		<i>Pontella</i> sp.
	<i>Ditylum</i> sp.		<i>Acartia</i> sp.
	<i>Gyrosigma</i> sp.		<i>Oithona</i> sp.
	<i>Navicula henneydii</i>		<i>Corycaeus</i> sp.
	<i>Navicula</i> sp.		<i>Heliodyptomus</i> sp.
	<i>Netrium digitus</i>		<i>Pseudodiptomus</i> sp.
	<i>Pleurosigma angulatum</i>		
	<i>Rhizosolenia robusta</i>	<i>Decapods</i>	<i>Acetes</i> sp.
	<i>Rhizosolenia</i> sp.		<i>Lucifer hansenii</i>
	<i>Skeletonema</i>		<i>Zoea larvae</i>

	<i>Thalassiosira subtilis</i>		<i>Megalopa larvae</i>
	<i>Planktoniella</i> sp.	<i>Branchopoda</i>	<i>Evadne tergestina</i>
	<i>Triceratium favus</i>	<i>Hydroids/Medusae</i>	<i>Globigerina bulloides</i>
<i>Dinoflagellates</i>	<i>Amphisolenia bidentata</i>		<i>Globigerina</i> sp.
	<i>Ceratium furca</i>		<i>Eirene viridula</i>
	<i>Ceratium</i> sp.	<i>Spirotrichea</i>	<i>Tintinnopsis butschii</i>
	<i>Ceratium macroceros</i>		<i>Tintinnopsis mortensenii</i>
	<i>Dinophysis</i> sp.	<i>Appendicularia</i>	<i>Oikopleura dioica</i>
	<i>Noctiluca scintillans</i>		<i>Sagittoidea</i>
	<i>Pyrophacus</i> sp.		<i>Sagitta elegans</i>
<i>Blue-green alagae</i>	<i>Anabena</i> sp.		<i>Sagitta bedoti</i>
	<i>Microcystis</i> sp.	<i>Mongononta</i>	<i>Brachionus plicatilis</i>
	<i>Nostac</i> sp.		<i>Brachionus calyciflorus</i>
	<i>OSCIPLlatoria</i> sp.		<i>Monostyla lunaris</i>
	<i>Spirulina major</i>	-	-
	<i>Chlorella</i> sp.	-	-
	<i>Spirogyra</i> sp.	-	-
	<i>Volvox</i> sp.	-	-

Table 3-30 : Benthic species recorded from the study area

Mieobenthic Group	Macrobenthic Group	Macrobenthos Species
Nematodes	Bivalves	<i>Glucocom acerca</i>
Copepods		<i>Brachyodontes</i> sp.
Polychaetes		<i>Katelsia marmorata</i>
Turbellarians		<i>Cardium asiaticum</i>

Mieobenthic Group	Macrobenthic Group	Macrobenthos Species
Nemertins		<i>Katelysia opima</i>
Foraminifera		<i>Dosinia</i> sp.
Kinorynchs	Cnidarian	
Halacarids		<i>Pelocoetes</i> sp.
Others		<i>Stephensonactis</i> sp.
--		
	Crustaceans	<i>Sesarma</i> sp.
		<i>Varuna</i> sp.
		<i>Uca</i> sp
		<i>Hermit carb</i>
		<i>Uca annulipes</i>
	Polychaetes	<i>Lycastis</i> sp.
		<i>Nereis</i> sp.
		<i>Dendronereis</i> sp.
		<i>Glycera alba</i>
		<i>Prinospio pinnata</i>
		<i>Perinereis cultrifera</i>
	Gastropods	<i>Cerethedea</i> sp.
		<i>Melampus</i> sp.
		<i>Onchidium</i> sp.
		<i>Nassarius</i> sp.
		<i>Auricula</i> sp.
<i>Littorina</i> sp.		

Fishes

The data for fishes in the study area was collected through actual visits to the mudflats, mangroves, surveys of local fishes in the nearby markets, observations from the fish catch by locals' fishermen in the vicinity of water bodies. The list of the fishes in the study area is given in **Table 3-31**.

Table 3-31 : List of the fishes in the study area

Sr. No.	Scientific Name	Local Name
	Freshwater Fishes	
1	<i>Catla catla</i>	catfish
2	<i>Channa striatus</i>	
3	<i>Clarius batrachus</i>	
4	<i>Mystus singhala</i>	
5	<i>Labeo bata</i>	
6	<i>Puntius sarana</i>	
7	<i>Wallago atta</i>	
	Marine/Estuarine Fishes	
8	<i>Mugil Cephalus</i>	Mullet
9	<i>Boleophthalmus dussimerii</i>	Mudskipper
10	<i>Boleophthalmus boddarti</i>	
	Decapods (Prawns/Shrimps)	
11	<i>Penaeus monodon</i>	
12	<i>Squilla mantis</i>	
13	<i>Metapeneaus affinis</i>	
14	<i>Acetes indicus</i>	
15	<i>Panularius polyphagus</i>	

	Crabs	
16	<i>Uca sps.</i>	
17	<i>Scylla serrata</i>	
18	<i>Leptodius exaratus</i>	
19	<i>Portunus spp.</i>	
21	<i>Charybdis sp.</i>	

3.11.9 Conclusions

The project area is outside any recorded forest area. In the project site, no formal logging of wood and other such activities were observed, the exploitation of the forest resources by the nearby villagers and the local communities was evident in the surroundings of the project site. The marks of forests fire were also visible near two locations viz. Chirner and Palas village.

Flora

By and large the habitat is dominated by evergreen and deciduous foliage. Amongst the locations surveyed, it was seen that many of the sites have localized biological diversity with a great variety of evergreen tree species as well as shrub layer. The development activities may result in clearing of many plant species mostly grasses and shrubs which are not unique or rare species because of their abundant occurrence in other areas. Thus, the loss of these species would have no serious ecological consequences.

Fauna

The project area could be home to general avifaunal species which are widespread and therefore any loss of habitat in this area is not expected to lead to any major loss in species numbers or diversity. Generally the concerns of non- recorded species do exist although it may be on smaller scale owing to their non-sighting in the three day sampling period between Dec 16-18, 2015.

3.12 Socio-Economy

The proposed “OSC” Project by M/S. OSCIPL is located in Raigad District of the state of Maharashtra. The project shall occupy more than 1000 acres land and is planned to develop the Township in four patches namely T1 covering the villages Boregaon, Ambeghar, Shene & Virani, T2 & T4 by villages Belawade Budruk, Belawade Khurd, Padale, Walak & Mugoshi and T3 by Govirle, Kopar, Ambiwali, Balawali & Hamrapur villages in Pen (Tehsil) of Raigad District, Maharashtra. The following section describes the socio-economic baseline of the Project site and its surrounding area. For this purpose, 25 urban areas, 247 rural villages and 14 project affected villages were studied.

3.12.1 Methodology

Socio-Economic baseline data was collected through primary survey as well as secondary sources. Primary survey involved visiting project site, discussion with the local population including project affected, local elected representatives such as panchayats and local administrative units of government. Secondary data collection involved collecting existing Census data, published documents on various aspects such as land use, demography, literacy, employment, social structure of society, and socio-cultural aspects from different institutions, government offices, literature etc. and discussions with the concerned departments/agencies.

Raigad District

Raigad is located in the Konkan region bound by Mumbai Harbor to the northwest, Thane District to the north, Pune District to the east, Ratnagiri district to the south, and the Arabian Sea to the west. It includes the large natural harbor of Pen-Mandwa, which is immediately south of Mumbai harbor, forming a single landform with it. The northern part of the district is included in the planned metropolis of Navi Mumbai, and its port, the Jawaharlal Nehru Port. The district includes towns/cities of Panvel, Alibag, Mangaon, Roha, Pen, Khopoli, Kharghar, Taloja, Khalapur, Uran, Patalganga, Rasayani, Nagothana, Poladpur, Alibag, Karjat and Mahad. The largest city both in area and population is Panvel. The district also includes the isle of Gharapuri or Elephanta, located in Uran which has ancient Hindu and Buddhist caves.

Comparative data for population, sex ratio & Literacy rates in Affected Villages, Pen Tehsil, Raigad District and entire Maharashtra State is given in the Table 3-32.

Table 3-32: Comparative data for population, sex ratio, & Literacy rates in affected villages

Demographic features	Affected Villages (14 no.)	Pen	Raigad	Maharashtra state
Total Population	11,187	37,852	2,634,200	11.24 crores
Sex Ratio Per 1000 males	493	966	955	929
Literacy rate	63.53%	91.40%	83.89%	82.34%

3.12.2 Socio-Economic Profile – Secondary Data

As per the EIA notification 2006, socio-economic impact can be seen on villages and urban centers lying within the 15-km radius of the project area. For the purpose of this assessment, the study area has been divided into following:

- Villages within the 15-km radius of the project area: 247 rural villages & 25 urban areas
- Villages within project site on the basis of willing seller willing buyer basis: 14 villages
- Total study area covering 285 villages

The names of the villages within the project study area and their categorization are given in the Table 3-33 below:

Table 3-33: Names of the villages and categorization

Category	Name of village	Type of village
Villages within project site	Virani, Mungoshi, Boregaon, Ambeghar, Shene, Belwade Khurd, Belvade Budruk, Walak, Padale, Hamrapur, Balawali, Govirle, Ambiwali .and Kopar	Rural
Villages within 15 km of the project area	Sonkhar, Sawarsai, Sapoli, Pimpalgaon, Dhamni, Uchede, Odhangi, Johe, Kalave, MotheVadhav, Kane, Borze, Dhondpada, Antore, Washi, Jirne Kurnad, MahalmiryaDongar, Nidhawali, Shitole, Chinchghar, Davansar, Ramraj, Kandlepada, Kashmire, Kandale, Melegghar, Tarankhop, Pen Rural, Patnoli, Urnilee, KharDutarfaBorli, Jite, Dushmi, Koproli, Panchgani, Kurnad, Karav, Rode, Kurmurli, Nanegaon, Hetavane, Ashte, Warsai, Tarankhop, Mangrul, MohiliKhalsa, Sai, Kasar Bhat, Dolghar, Padale, Niphad, Balawali, KharBorli, Kopar, Davre, Hanumanpada, Warawane, Paned, Gagode Bk, Washiwali, Gagode Khurd, Umbarde, Turkhul, Waredi KharBorli, Kopar, Davre, Hanumanpada, Warawane, Paned, Gagode Bk, Washiwali, Gagode Khurd, Umbarde, Turkhul, Waredi Jui Khurd, Melegghar, Kalad Kharpale, Odhangi, Koproli, Davansar Shetpalas, Koleti, Kondgaon, Karli, Warap, Talekhar, Kalai, Chole, Gandhe, KharOvali, KharKoleti, Tarshet, JambhulTep., Atiwali, Amtem, Benase, Bidwagale, Kasurghuntwadi, PataniPandapur, Dhaulpada, Burdi, Kasu, Salinde, Mhaisbad, Kharpada, Usar, Nigade, Kasurghuntwadi, Dhaulpada, Revoli, Pabal, Kondhavi, Uddhar, Chandragaoon, Mahagaon, Tadeagaon, Padsare, Kavele, Palas, Dhamni, Hatond, Wakraul, Aghai, JambhivalitarChhattishi, Gothivali, Gorthan BK., Wanvate, Gorthan Khurd, Ransai, Tondali, Uaroli, Dhamni, Nandanpada, Narangi, Swali, Kharivali, Gohe, Karambeli, Apati, Ajivali(N.V.), Horale, Parkhande, Vavoshi, Mohinlam, Ghote, AmbivaliT. Wankhal, Wadgaon, Talavali, Isambe, Vayal, Vat , Kaire, Borivali, Vanivali, Kambe, Kasap, Lodivali, Chambharli, Parade, Gulsunde, Karade Khurd, Posari, Dapiwali, Vaveghar, Turade, Nanoshi, Kalhe, Karnala, Barapada, Kasar Bhat, Dolghar, Koral, Sarsai, Kaliwali , Chawane , KauliBelodakhar, Jambhivali, Veshvi, Belondakhar, Chirle, Paundkhar, Dhutum, Muthekar, Shematikhar, Waltikhar, Dighode, Kanthavali, Pahi, Ransai, Vindhane, Taki, HArishchandraPimpale, Bori Bk., BorichaKotha, Dhasakhosi, Jui, chikhalibhom, Bhom, Chirner, Kalamusare, Pirkon, Waltikhar, Muthekar, Sangapalekhar, Govathane, Pale, Sarde, Vasheni, Punade, MotheBhal, Vitthalwadi, Kanhoba, Kaleshriwadi, Lakhola, Benavale, Bahiramwatak, Narwel, Wadhav, Div, Umbarde, Shirki, ShirkiChawl No.1, Masad Bk, MasadBeli (N.V.) , MasadKhurd, Borwe, Urnilee, KharDutarfaBorli, DolviDababa, Johe, Tambadshet, Govirle, Nidhawali, Jawali, Karodi, Dherand,	Rural

Category	Name of village	Type of village
	Shahapur, Ramkotha, Bahirichapada, Beneghat, Sarebhag, Kurdus, Hemnagar, Kolghar, DalaviKharoshi, Ravet, Shihu, Poynad, Chikhali	
Urban villages within 15 km of project area	Dadar (CT) Dadar (CT) WARD NO.-0001 Mohpada Alias Wasambe (CT) Mohpada Alias Wasambe (CT) WARD NO.-0001 Zotirpada (CT), Zotirpada (CT) WARD NO.-0001 Pen (M Cl), Pen (M Cl) WARD NO.-0001 to 0018	Urban

Source: Census of India; 2011

Table 3-34: Demographic details of the study area

Project Study Area	Number of Households (HHs)	Number of HHs %	Total Population	Total population %	Population in the age group 0-6	% of population in the age group 0-6 %
Demographic details of villages affected by land purchase	2544	3	11187	3	1370	3
Demographic details of Villages within the study area (minus the affected villages)	54863	65	241080	66	27629	67
Demographic details of Urban areas within the study area	26938	32	112648	31	12098	29
Demographic details of Total Study Area	84345	100	364915	100	41097	100

Source: Census 2011

According to the 2011 Census data, population in the total study area was 364915 living in 84345 households project site was whereas the affected villages population was 11187 persons that is about 3% of the total study area population and the population of all the rural villages within the 15 km radius of the study area (Refer Table 3-34: Demographic details of the study area).

Social Groups

The proportion of Scheduled Castes (SCs) and Scheduled Tribes (STs) population within the project study area is on an average 3.0% and 15.3% respectively. The proportion of SC population in affected villages is merely 0.8% found only in 14 villages, which is less than other rural villages (2.2%) and urban centers (4.9%) in the study area. Whereas the proportions of ST population for affected villages is (43.9%), which together constitutes to 44.7% which is much higher than the other rural villages (21.9%) & urban areas (18.3%) (Refer Table 3-35: SC and ST populations in the Project Study Area).

Table 3-35: SC and ST populations in the Project Study Area

SC and ST populations in Project Study Area	Proportion of SC population %	Proportion of ST population %
SC and ST population in villages affected by land purchase	93 (0.8%)	4906 (43.9%)
SC and ST population in Villages within the study area (minus the affected villages)	5310 (2.2%)	47441(19.7%)
SC and ST population in Urban areas within the study area	5540 (4.9%)	3314 (2.9%)
SC and ST population in Total Study Area	10943 (3.0%)	95661 (15.3%)

Source: Census 2011

Gender

Table 3-36: Sex Ratio and Literacy rate in the Project Study Area

Sex Ratio and Literacy rate in Project Study Area	Sex Ratio per 1000 male	Literacy Rate % (Male)	Literacy Rate % (Female)
Sex Ratio and Literacy rate in villages affected by land purchase	972	57%	43
Sex Ratio and Literacy rate in Villages within the study area (minus the affected villages)	957	56%	44
Sex Ratio and Literacy rate in Urban areas within the study area	943	53%	47
Sex Ratio and Literacy rate in Total Study Area	953	55%	45

Source: Census 2011

According to 2011 census, sex ratio in the total study area was found to be 953 while in the affected villages was found to be 972. The sex ratio in the villages other than the affected villages was found to be 957. It is important to note that, literacy rate for male and female in project affected villages is 57% and 43% respectively which indicates that the literate male population is more than the female literate population. (Refer Table 3-36: Sex Ratio and Literacy rate in the Project Study Area).

Vulnerability

As regards vulnerability, poverty is actually a reason for making any section of a population vulnerable. The data for families below poverty line for the all the villages in study area is not available. However, based on the studies in other areas of Maharashtra, most of the SC and ST families can be considered as the vulnerable group which constitutes about 45% of the total population in the project affected villages in addition to any other BPL families in the region.

Occupational Pattern

Table 3-37: Workforce participation Ratio (WPR) in the Project Study Area

Workforce participation in Project Study Area	Total WPR %	Male WPR%	Female WPR %	Main Workers	Marginal Workers	Non-Workers
Workforce participation in villages affected by project	48%	69%	31%	3478	1840	5869
Workforce participation in Villages within the study area (minus the affected villages)	43%	73%	27%	73892	29382	137806
Workforce participation in Urban areas within the study area	35%	79%	21%	34740	5142	72766
Workforce participation in Total Study Area	41%	76%	24%	112110	36364	216441

Source: Census 2011

It can be seen from Table 3-37: Workforce participation Ratio (WPR) in the Project Study Area that the workforce participation ratio (WPR) in the study area as a whole is about 41%, and the same for project affected villages is 43%. Of the total WPR, the female workforce participation ratio is 24% and the same for project affected villages is 31% and other rural villages is 27%. The higher participation of female in project affected villages and other villages in the study area is the reflection of role of women in household's economic contribution. Higher participation of women in economic contribution in rural areas is mainly due to their involvement in agriculture and other activities such as dairy, wage labors, etc. The data also reveals that the female participation ratio in workforce in urban areas of study area is only 21%, which is lower than the rural areas of the study area.

Table 3-38: Occupational profile of the villages in the Project Study Area

Occupational profile of the main workers in Project Study Area	% of Male & Female as, Main Workers		Occupation Type (%)			
	Male	Female	Cultivator	Agri. Laborers	HH industry	Others
Occupational profile of the Main Workers in villages affected by land purchase	69	31	19	45	4	32
Occupational profile of the main workers in Villages within the study area (minus the affected villages)	73	23	30	21	3	46
Occupational profile of the Main workers in Urban areas within the study area	79	21	1	1	5	93
Occupational profile of the main workers in Total Study Area	74	26	21	16	3	60
Occupational profile of the marginal workers in Project Study Area	% of Male & Female as Marginal Workers		Occupation Type (%)			
	Male	Female	Cultivator	Agro. Laborers	HH industry	Others
Occupational profile of the marginal workers in villages affected by land purchase	49	51	13	73	2	12
Occupational profile of the marginal workers in Villages within the study area (minus the affected villages)	53	47	24	44	6	26
Occupational profile of the marginal workers in Urban areas within the study area	68	32	2	20	6	72
Occupational profile of the marginal workers in Total Study Area	55	45	21	42	6	31

Source: Census 2011

From the Table 3-38 it is observed that in case of Main Workers, the contribution of females is low compared to the males which is about 2-3 times high as main workers in the overall study area. Nevertheless, the contribution of females as main workers is much higher and that of males in the project affected areas than the other rural villages & urban areas. The main occupation type of the main workers in the project affected villages is Agro-laborers (45%) followed by Others (32%) and HH industry (4%) as the least but in the other rural villages, the main occupation type is Cultivators with a similar trend as others & HH industry. Similarly, in case of Marginal Workers also the contribution of females is low compared to the males in the overall study area but the contribution of females as marginal workers also is much higher and that of males in the project affected areas than the other rural villages & urban areas.

The main occupation type of the marginal workers in the overall study area is agro-laborers followed by Cultivators with the highest percentage (73%) of Agro-laborers in the project affected villages and Cultivators in the other rural villages.

3.12.3 Socio-Economic Profile – Primary Data

Socio-Economic survey was conducted in all the villages affected by land purchase for the project. In all 2544 households (Sample size) were surveyed and the village wise sample size is shown in Table 3-39. Out of the total surveyed population, about 47% or 1653 did not respond to the survey questions.

Family size

The respondents, 47% or 1653 people did not respond to the questions and the highest number of families (31%) which responded to the survey consisted of 3 to 5-person size and 14% of families were with 6 to 9-person size and only 8% of the families comprised of 2 persons.

Table 3-39: Family Size of Surveyed Respondents

Name of village	Sample size	% of Sample size	Not responders (NR)	% NR	Family Size					
					2	%	3 to 5	%	6 to 9	%
Virani	143	5.6	44	3	27	13.8	54	6.9	18	6
Mungoshi	105	4.1	5	0	16	8.2	55	7.0	29	9
Boregaon	248	9.7	147	9	15	7.7	64	8.1	22	7
Ambeghar	427	16.8	327	20	18	9.2	60	7.6	22	7
Shene	236	9.3	136	8	16	8.2	51	6.5	33	10
Belwade Khurd	24	0.9	77	5	12	6.1	77	9.8	12	4
Belvade Budruk	304	11.9	205	12	21	10.7	52	6.6	26	8
Walak	52	2.0	50	3	12	6.1	60	7.6	30	9
Padale	59	2.3	41	2	9	4.6	58	7.4	33	10
Hamrapur	418	16.4	317	19	14	7.1	64	8.1	23	7
Balawali	346	13.6	246	15	16	8.2	65	8.3	19	6
Govirle	62	2.4	38	2	12	6.1	61	7.8	27	8
Ambiwali	120	4.7	20	1	8	4.1	66	8.4	26	8
Kopar										
Total	2544	100.0	1653	100	196	100	787	100	320	100
	100%		47%		8%		31%		14%	

Source: Primary Survey

Social Groups

Social group classification of respondents reflects all strata and groups in the collected data. In the affected villages, the lowest percentage is of the SC group which is only 0.8% of the total population compared to the General and OBC together which is 55.3% and 43.9% of ST category (Refer Table 3-40: Social classification of respondents).

Table 3-40: Social classification of respondents

Name of village	Social classification					
	SC	% of SC	ST	% of ST	others (OBC and General)	% of others (OBC and General)
Virani	1	1.1	566	11.5	0	0.0
Mungoshi	0	0.0	228	4.6	258	4.2
Boregaon	0	0.0	618	12.6	475	7.7
Ambeghar	6	6.5	673	13.7	1081	17.5
Shene	2	2.2	1092	22.3	18	0.3
Belwade Khurd	0	0.0	3	0.1	107	1.7
Belwade Budruk	0	0.0	996	20.3	313	5.1
Walak	0	0.0	1	0.0	225	3.6
Padale	0	0.0	165	3.4	123	2.0
Hamrapur	74	79.6	16	0.3	1730	28.0
Balawali	4	4.3	456	9.3	1047	16.9
Govirle	0	0.0	0	0.0	316	5.1
Ambiwali	6	6.5	92	1.9	495	8.0
Kopar						
Total	93	100	4906	100.0	6188	100.0
Percentage %	0.8		43.9		55.3	

Source: Primary Survey

Literacy

Villages of Raigad district have 1368 government and private schools. In the affected villages, the males are more literate than the females. The literacy rate for females range between 43%-47% with the lowest rate in the affected villages and highest in the urban areas. In males the literacy rate range from 53%-57% with lowest in Urban areas and highest in the affected villages.

Overall literacy rate of the region stands at 55% and 45% for male and female respectively. In Pen region government has established total 132 primary and secondary school which might have also improved from 2011 census figure. Nevertheless, the proposed OSC project has provision of establishing educational institutions within the project boundary and this would improve the education infrastructure of the region significantly.

Table 3-41: Literacy Rate in the project study area

Literacy Rate in Project Study Area	Literacy Rate % (Male)	Literacy Rate % (Female)

Literacy Rate in villages affected by land purchase	57%	43%
Literacy Rate in Villages within the study area (minus the affected villages)	56%	44%
Literacy Rate in Urban areas within the study area	53%	47%
Literacy Rate in Total Study Area	55%	45%

Table 3-42: Distribution of primary schools by management

Distribution of primary school by management	No.
Government and Government Aided Schools	5
District School Board	1,283
Municipal School Board	--
Schools Aided by-	--
(1) District School Board	75
(2) Municipal School Board	--
Unaided Schools	5
Total	1,368

Source: Kulaba Gazetteer Department

Income

In the project affected villages, the average monthly income based on the respondent data, of the families range from rupees 3000 or less per month to more than 20,000 per month. The highest percentage (56.3%) of surveyed families earned up to rupees 3000 or less per month and only about 1.4% of the families earn rupees more than 20000 income per month. Another 19.7% of families are earning between rupees 3001 to 5000 per month. The rupees 3000 or less & 3001 to 5000 per month categories of families put together constitutes 76.0% of total sample size and, thus revealing that the families in general are poor or marginally above poverty level and the OSC project in these villages would create opportunities for betterment.

Table 3-43: Average monthly income of families

Name of village	Monthly Family Income in Rs.					
	NA	3000 or less	3001 to 5000	5001 to 10000	10001 to 20000	>20001
Virani	1	8	2		1	
Mungoshi	1	7	2			1

Boregaon	1	6	3	1		
Ambeghar	1	9	4	1	2	
Shene	1	6	2		1	
BelwadeKhurd	3	4				
Belwade Budruk	1	7	3	1		
Walak	4	3	1			
Padale	2	4	1			
Hamrapur	1	9	4	1	2	
Balawali	1	8	3	1		
Govirle	2	4	1			
Ambiwali	2	5	2			1
Kopar						
Total	21	80	28	5	6	2
	14.7%	56.3%	19.7%	3.5%	4.2%	1.4%

Source: Primary source

Occupation

The data in the Table 3-44 below depicts that 33.9% of respondents in the affected villages are engaged in farming as their primary occupation for livelihood. This is somewhat in line with the census data of 2011 where in 21% of the main workers are engaged as cultivators. Occupation like business and other work (jobs and professionals) constitutes 13.7% of total surveyed population.

Table 3-44: Primary Occupation of Families

Name of village	Primary occupation of HoH				
	NA	Farming	Business	Other work	House wife
Wirani	114	237	0	21	195
Mungoshi	101	217	1	78	89
Boregaon	216	458	3	88	328
Ambeghar	319	499	60	357	525
Shene	243	452	9	94	314
Belwade Khurd	24	32	0	16	38
Belwade Budruk	270	760	0	29	250
Walak	45	110	3	16	52
Padale	71	144	0	5	68
Hamrapur	447	189	61	402	721

Name of village	Primary occupation of HoH				
	NA	Farming	Business	Other work	House wife
Balawali	318	584	24	84	497
Govirle	77	22	14	58	145
Ambiwali	132	86	10	95	270
Kopar					
total no. affected of villages affected	2377	3790	185	1343	3492
	21.2%	33.9%	1.7%	12.0%	31.2%

Source: Census 2011

3.12.4 Asset ownership

Ownership of various asset class at household level gives an insight into the economic wellbeing of the family and a general affluence level of the area. Therefore, the asset base of the respondent households was also surveyed. The asset ownership information has been collected for electronic appliances like television, refrigerator etc. and vehicles owned. Of the total assets, the electronic appliances contribute to 87% and about 13% was from vehicles. Among the electronics, 38% is from the Television and about 28% is from Telephone/Mobiles. In terms of vehicles, about 11.55 was from Scooter/motorcycle and Car/Van/Jeep is only 1.3%. Overall, of all the assets refrigerator was lowest with only 1.1% (Refer Table 3-45).

Table 3-45: Asset ownership

Assets ownership in surveyed HH	Name of village (insert Kopar village)														
	Virani	Mungoshi	Boregaon	Ambeghar	Shene	Belwade Khurd	Belwade Budruk	Walak	Padale	Hamrapur	Balawali	Govirle	Ambiwali	Total	%
Radio/ Transistor	24	22	9	11	8	43	0	4	100	13	5	2	14	255	16.2
Television	6	36	36	44	24	65	16	33	100	69	45	84	50	608	38.5
Computer/ Laptop	1	2	2	5	4	16	1	4	2	5	3	3	2	50	3.2
Telephone/ Mobile Phone	4	36	26	20	16	54	10	35	82	42	24	53	42	444	28.1
Refrigerator	0	0	1.2	1.7	0	7.7	0	2	0	2.9	0.3	1.6	0	17.4	1.1
Scooter/ Motorcycle	4	16	18	17	3	19	4	14	2	22	10	31	22	182	11.5
Car/ Jeep/ Van	0	4	1	3	0	0	0	0	0	2	0	9	2	21	1.3
Total	39	116	93.2	101.7	55	204.7	31	92	286	155.9	87.3	183.6	132	1577.4	100

3.12.5 Public Consultation and Discussion

Stakeholder consultations were carried out in the surrounding villages viz., BelawadeKhurd, Ambeghar, Kopar to appraise the locals about the proposed project and to understand their expectations and concerns about the project. A survey was carried out in the villages to supplement the consultation process. The details of discussion are presented in Table 3-46.

Table 3-46: Consultation at Villages

Date of Visit	20/10/2015		
Venue :	Project Site		
Client	BEIPL : Mr. Hrushikesh Kolatkar Client : Representative from Client		
Village Name	Kopar village	Belawade village	Ambeghar village
Discussion Points:			
Key points of the meeting were	The village has school only for Primary level and for Middle and high school students have to go to Jambhul tep, Pen. There is no primary health center facility. For critical health related matters, Pen is the nearest place. Rain water and Dug-well are the main sources of irrigation. For domestic use, Dug-well and Hand pumps are the sources. Most of the people in the village are engaged in agriculture, dairy. Rice and seasonal vegetables are cultivated by the people. Most of the seasonal vegetables grown are sold at Pen and Navi Mumbai. Almost each family has cows or buffaloes to supplement their income by selling milk. There are also people is	The village has a total of 328 houses The school in the village is only up to eight standards. For studies after eight, students have to go to Pen. There is a private clinic of a Physician in the village. The nearest government primary health center is at Pen village. Most of the village land is rain fed for agriculture purpose. For the domestic use well and hand pumps are the sources. People of the village in general are engaged in agriculture, dairy and wage labour. Rice and seasonal vegetables are cultivated by the people. Seasonal vegetable grown are	The village Ambeghar has 427 houses. The village has relatively large population. It can be seen that the village is well connected by road. The village has Government school up to 8th standard. For studies after eight, students have to go to Pen. There is a private doctor in the village. The nearest government primary health center is at Pen. Most of the village land is irrigated through dug-wells and tube wells. For domestic use, dug-wells and hand pumps are the sources of water for villagers. People of the village in general are engaged in agriculture, dairy and wage labour. Main crops are paddy and seasonal vegetables Some families are dependent on small vegetable cultivation for

	engaged in wage labor in agriculture and construction activity in nearby urban areas. Women in general support the family by engaging in agriculture and dairy activity & household chores.	sold in nearby urban areas. Almost each family has cows or buffaloes to supplement their income. About half the male population of village is engaged in construction activity in nearby urban areas. The education level is generally low among the villagers Women in general support the family with household chores. In addition, women are also involved in agriculture and dairy activity of family.	lack of any other source of income. In addition to agriculture, the other two main occupation for earning for the locals is dairy and wage labour. Almost each family has cows or buffaloes to supplement their income. Most of the male population of villages is engaged in construction and factories in Pen as wage labor. The education level is generally low among the villagers. Women in general support the family with household chores. In addition, women are also involved in agriculture and dairy activity of family.
Key observations and issues:	People are aware about the project and have a very positive opinion on the project. People expect the project would bring development in their villages and would open up opportunity of employment and other business avenues People were keen to know when the project would start and what kind of factories will come up. People also expect the project to give preference to local in employment Unemployment and lack of opportunity is evident in the village.	People are aware about the project and have a very positive opinion on the project. People expect the project would bring development in their villages and would open up opportunity of employment and other business avenues People were keen to know when the project would start and what kind of factories will come up People also expect the project to give preference to local in employment People also expect the project to give preference to local in employment	People are aware about the project and have a very positive opinion on the project. People expect the project would bring development in their villages and would open up opportunity of employment and other business avenues People were keen to know when the project would start and what kind of factories will come up People also expect the project to give preference to local in employment In project construction phase the locals can be good source of construction labour as they are already in to that activities currently.

		With respect to compensation, people are somewhat unhappy about the amount of compensation. They feel that the market rate is higher than what they have received from the government. In project construction phase the locals can be good source of construction labour as they are already in to that activities currently.	There is large scale unemployment reported during the survey

4. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

This chapter describes potential social and environmental impacts for construction and operation phases of the proposed project in line with the description of project presented in Chapter 2 of this report. The impact assessment is done in two steps: Identification of Impacts and Evaluation of Impacts. The impacts have been identified taking into account the nature of the project and the project components including the trunk infrastructure being proposed, size and magnitude of the project activities, sub activities, and prevailing baseline environmental conditions in the study area. In the subsequent stage the evaluation of the impacts has been carried out with the standard impact assessment matrix. Additionally, available project documents; discussions with the local community; the project proponents and BEIPL's previous project experience in similar assignments is also considered. Based on the significance of impact, the specific mitigation measures are also suggested with a management plan.

4.1 Identification of Impacts

The impact identification has been presented in the form of interactive matrix between the various project activities and the environmental attributes. The identification of impacts is done based on the proposed project components both for construction and operations phase and various activities involved which may potentially have impacts on the environment. The project phases, timelines, proposed design, main activities, sub-activities, resource requirements, and baseline environmental settings are considered in this exercise. The identification of impacts is done separately for construction and operation phase as presented in the following sections.

4.1.1 Construction Phase

The project activities comprise principally the construction of trunk infrastructure components such as water supply system, road infrastructure, wastewater management system, solid waste management system, ICT system, power supply system, storm water management system, common utility buildings and other ancillary / support infrastructure. The construction phase will span from 2019-2029. The potential impacts identified for pre-construction and construction phase of the proposed project is presented in Table 4-1. At the end of construction phase, there would be some demobilization activities which also are covered in this matrix, however, since the nature of these activities is similar to the construction phase activities, these are not considered separately for evaluation of impacts in Section 4.2 of this report.

Table 4-1: Identification of Potential Impacts: Pre-Construction and Construction Phase

S. N.	Main Activities	Potential Impacts											
		Change in land use	Change in Topography	Ecology	Water Quality (Surface/ground)	Water Resources (Surface/Ground)	Ambient Air Quality	Soil (Erosion, Contamination)	Noise	Socio-economics	Traffic & Transport	Livelihood	Occupational Health & Safety
A	Site Preparation												
1	Site Clearing, Grading	√	√	√	√	√	√	√	√		√	√	√

S. N.	Main Activities	Potential Impacts											
		Change in land use	Change in Topography	Ecology	Water Quality (Surface/ground)	Water Resources (Surface/Ground)	Ambient Air Quality	Soil (Erosion, Contamination)	Noise	Socio-economics	Traffic & Transport	Livelihood	Occupational Health & Safety
2	Excavation / Cut and Fill activity		√	√	√	√	√	√	√		√	√	√
3	Stacking of Excavated top soil			√		√	√	√					√
4	Access Road / Pavement works			√		√	√	√	√		√		√
5	Use of Construction Equipment and Machinery				√		√	√	√		√		√
6	Burning of wastes, refuse and cleared vegetation			√			√						
B Labour Engagement													
1	Construction of labour facility				√	√	√		√		√		√
2	Waste from labour facility				√	√		√					
3	Sewage disposal				√	√		√					
4	Water Requirement					√							
5	Influx of construction laborers					√				√		√	√
C Material Handling & Storage													
1	Transportation & Unloading of construction material				√		√	√	√		√		√
2	Storage & Handling of construction wastes				√			√					√
3	Storage & Handling of Hazardous material (chemicals/flammables)				√			√					√
D Construction activities													
1	Preparation/Mixing of construction material				√	√	√	√	√				√

S. N.	Main Activities	Potential Impacts											
		Change in land use	Change in Topography	Ecology	Water Quality (Surface/ground)	Water Resources (Surface/Ground)	Ambient Air Quality	Soil (Erosion, Contamination)	Noise	Socio-economics	Traffic & Transport	Livelihood	Occupational Health & Safety
2	Operation of construction machinery						√	√	√		√		
3	Handling and Disposal of construction wastes				√			√	√		√		√
4	Construction of Boundary Wall / Separation between zones within Industrial township						√	√	√				√
5	Development of plots, site zoning						√	√	√				
6	Laying of roads		√	√	√		√	√	√				√
7	Water Supply & Pipelines, Overhead tanks, etc		√			√							
9	Storm water and Drainage Network		√			√	√	√	√				√
10	Laying of treated water disposal Pipe Lines		√			√	√	√	√				√
11	Power connection and laying of transmission lines		√			√	√	√	√				√
12	Laying of Telecom lines		√			√	√	√	√				√
13	Laying of Gas Distribution lines		√			√	√	√	√				√
14	Earth moving operations					√	√	√	√		√		√
15	Construction of building including temporary structures and common facilities					√	√	√	√				√
16	Heavy Equipment operations						√	√	√		√		√
17	Disposal of construction wastes					√		√					√

S. N.	Main Activities	Potential Impacts											
		Change in land use	Change in Topography	Ecology	Water Quality (Surface/ground)	Water Resources (Surface/Ground)	Ambient Air Quality	Soil (Erosion, Contamination)	Noise	Socio-economics	Traffic & Transport	Livelihood	Occupational Health & Safety
18	Vehicular traffic						√		√		√		√
20	DG set operations						√		√				√
21	Laying of pipeline for collection of Wastewater from individual industries leading to CETP & also for recycling/disposal of treated wastewater		√			√	√	√	√				√
E	Demobilization at the end of construction phase												
1	Demobilization of construction Equipment						√		√		√		√
2	Dismantling of temporary support construction structures/ equipment						√	√	√		√		√
3	Transportation and disposal of Construction/De molition wastes					√	√		√		√		√
4	Vehicular traffic						√		√		√		√

4.1.2 Operations Phase

The operations phase mainly includes the operation of individual components (residential, commercial establishments and industries such as manufacturing of synthetic organic chemicals, engineering, roads, agro based industries, IT industry, Gems and Jewelry etc.). Also, the operation phase activities include the operation and maintenance of trunk infrastructure components such as water supply system, road infrastructure, wastewater management system, solid waste management system, ICT system, power supply system, storm water management system, common utility buildings and other ancillary / support infrastructure. Based on the activities involved, an impact interaction matrix for operation phase has been prepared for the project. The potential impacts identified for operation phase of the proposed project is presented in Table 4-2.

Table 4-2: Identification of Potential Impacts in Operations Phase

S.N	Main Activities	Potential Impacts									
		Ecology	Water Quality (Surface/ground)	Water Resources (Surface/Ground)	Ambient Air Quality	Soil (Erosion, Contamination)	Noise	Socio-economic	Traffic &Transport	Cultural Values	Occupational Health & Safety
A	Residential and Commercial Establishments										
1	Influx of population							√		√	
2	Water Consumption			√							
3	Wastewater generation		√			√					
4	Power back up				√		√				√
5	Waste generation		√			√					
6	Vehicular movement				√		√		√		
B	Industrial Establishments										
1	Effluent Generation	√	√			√					
2	Combustion of fuel	√			√		√				
3	Waste generation and storage	√	√	√	√	√					√
4	Industrial processes and operations		√	√	√	√	√				√
5	Vehicular traffic				√		√		√		
6	Water Consumption			√							
7	Raw materials handling and storage, access, parking, and loading/ unloading arrangements				√		√		√		√
8	Waste management – liquid and solid waste	√	√			√			√		√
9	Influx of population		√	√				√	√		
10	Storage of chemicals/ flammables/hazardous materials		√		√	√					√
C	Utilities (Power, Water, and Other support services)										

S.N	Main Activities	Potential Impacts									
		Ecology	Water Quality (Surface/ground)	Water Resources (Surface/Ground)	Ambient Air Quality	Soil (Erosion, Contamination)	Noise	Socio-economic	Traffic & Transport	Cultural Values	Occupational Health & Safety
1	Operation		√	√	√		√				√
2	Maintenance						√				
3	Structural failure										√
D	Waste Management Facilities										
1	Waste transportation		√		√	√	√		√		√
2	Waste treatment/processing		√		√	√	√	√			√
3	Handling and Storage of wastes		√			√			√		√
4	Landfilling		√		√	√	√				√
5	DG set operation				√		√				
E	CETP & STP										
1	Wastewater collection (Tankers/ Pipelines)	√	√			√	√	√	√	√	√
2	Treatment & other operations	√	√		√	√	√				√
3	Disposal	√	√	√	√	√		√		√	√
4	DG set operations				√		√				

4.2 Evaluation of Impact

The impact evaluation is done based on Severity, Extent and Duration of the impact. The resultant of the impact evaluation is represented by the Significance of the impact which is basically the multiplication of these three parameters as shown in Table 4-3. Based on standard environmental assessment methodologies, three key elements are considered for this analysis.

4.2.1 Severity of Impact:

The degree of damage that may be caused to the environmental components concerned. This will be decided by the standards available for the parameter. To decide severity a scale is essential. This scale is assumed to be percentage value of the parameter with respect to the existing standard. The 0 reading would be considered as 0 % and the standards valued will be considered as 100%. For example, SO_x standard is 80 microgram/ m³. In this case if a project depicts baseline or prediction value as 80 microgram/ m³ then the value in terms of scale is

considered as 100%. If a project depicts baseline or predicted value as 72 microgram/ m³ then the value is 90%. Based on this scale three levels of severity are considered which are defined below.

Severity 1 (Low)	The baseline and / or predicted value is less than 90% /or if the activity is intermittent
Severity 2 (Moderate)	The baseline and / or predicted value is between 90% to 110% or the activity is continuous
Severity 3 (High)	The baseline and / or predicted value is more than 110%

4.2.2 Extent of Impact:

The geographical spread of the impact around project location and corridors of activities. Extent of the project impact is based on the impacts extent beyond the project boundary. As per the Standard ToR for Industrial Estates issued by MoEF (2010) the primary impact zone is 10 km from the project boundary. Based on this data the scale of extent of impact is defined as below.

Extent 1 (Low)	The extent of the impact is within the project boundary.
Extent 2 (Moderate)	The extent of the impact is within 10km. from the project boundary.
Extent 3 (High)	The extent of the impact is beyond 10km from the project boundary.

4.2.3 Duration of Impact:

The time for which the impact lasts taking into account the project lifecycle. The duration impact for said project has been bifurcated in to Construction and Operation Phase especially. For Construction Phase the following criteria are used to decide intensity of the duration.

Cont. Duration 1 (Low)	Impacts those are instantaneous. (e.g. Noise)
Cont. Duration 2 (Moderate)	Impacts those last during the entire construction phase.
Cont. Duration 3 (High)	Impacts those last after the construction phase.

Any impact that is going to happen because of the operation of the project will continue throughout the life of the project. Hence these impacts are categorized based on their likely occurrence or frequency. These are defined in the following manner.

Operation Duration 1 (Low)	Rare (e.g. D. G. set operation)
Operation Duration 2 (Moderate)	Periodic
Operation Duration 3 (High)	Regular (e.g. traffic generated by the project occupants)

A positive or beneficial impact that may result from this project is not ranked and is depicted in the form of ++.

4.2.4 Impact Significance:

The significance of the impact is adjudged based on a multiplicative factor of the three element rankings mentioned above. The **Error! Reference source not found.** below assigns impact significance in the scale of Low-Medium-High and will be used for delineation of preventive actions, if any, and management plans for mitigation of the impacts.

The impact significance is determined taking into account the measures which are factored at the design and planning phase of the project. Legal issues are taken into account in the criteria sets, wherever appropriate, to aid in OSCIPL effort to comply with all relevant legislations. Additionally, the results of quantitative impact prediction exercise, wherever undertaken, are also fed into the process. It is also to be noted that the estimation of significance is done based on the experience and judgment of the respective functional area expert and the EIA coordinator where the quantitative assessment is not possible.

Table 4-3: Criteria based significance of Impact

Severity of Impact (A)	Extent of Impact (B)	Duration of Impact (C)	Impact Significance (A X B X C)	
1	1	1	1	LOW
1	1	2	2	
1	2	1	2	
2	1	1	2	
2	1	2	4	
1	2	2	4	
3	1	2	6	MEDIUM/ MODERATE
1	3	2	6	
2	2	2	8	
3	2	2	12	
2	3	2	12	
2	2	3	12	
3	3	2	18	HIGH
3	2	3	18	
2	3	3	18	
3	3	3	27	
- Impact is Beneficial -			++	POSITIVE

To assist in determining and presenting the significance of an impact, an impact evaluation matrix was developed. The significance of the impact is depicted using colour codes for easy understanding. In the case that an environmental component might be impacted by more than one project activity the higher impact significance ranking is taken as the significance ranking for the subject receptor. Impacts that are determined to have high significance ranking of “>12” are considered to be significant and hence require examination in terms of preventive actions and/or required additional mitigation to reduce the level of the potential impact.

4.3 Impacts and Mitigations – Construction Phase

The impact during pre-construction and construction phase are primarily from site preparation activities, construction activities, transportation, combustion of fuel, operation of heavy equipment and machinery and vehicular traffic. The assessment of impacts on various environmental components and the respective mitigation measures are discussed in the following sections.

4.3.1 Ambient Air Quality

The initial construction year 2019 has been considered for the air quality modelling purposes during the construction phase. The major sources of air pollution during the construction phase are D.G sets and the traffic plying on the following roads which include the project traffic:

- Balavali Road
- NH-66
- SH-88

The map depicting the roads is shown in Figure-1.1



Figure 4-1 : Map depicting the road network in the vicinity of the project site

The emission inventory considered for the air quality modelling is depicted in Table- 1-1. The major sources of emission as mentioned earlier are D.G sets and the traffic on the roads. The details are presented in Table 4-4 and Table-1.2. Each D.G set is assumed to operate for one hour daily for the entire year only for the back-up supply purposes.

Table 4-4 : Emissions from the D.G set ¹

Parcel	Configuration of the D.G sets (Nos x KVA rating)	Emissions per D.G set (g/sec)		
		CO (g/sec)	NOx (g/sec)	PM10 (g/sec)
T1	9 x 2000	1.49	3.51	0.19
T1	1x 3500	2.60	6.15	0.33
T2	5 x 1000	0.74	1.76	0.09
T2	1x 550	0.41	0.97	0.05
T3	8 x 500	0.37	0.88	0.05
T3	1x 700	0.52	1.23	0.07
T4	4 x 1000	0.74	1.76	0.09
T4	5 x 500	0.37	0.88	0.05 ²

The traffic plying on the roads mentioned above which includes the contribution from the project traffic is presented in Table 4-5 along with the emission rates from the traffic on the roads (considered as area sources for the purpose of modelling exercise). The Euro –III & Euro IV emission factors have been considered for estimating the emission from the traffic.

Table 4-5 : Emission due to the projected traffic in 2019

Sr No	Road	No of vehicles (vehicles/Hour)							Emission Factor (g/s/sq.m)		
		2W	3W	4W	LCV	Bus	Truck	Total	CO	Nox	PM10
1	Balavali Road	79	20	1	0	4	0	104	1.01E-05	2.07E-06	6.01E-07
2	NH66	680	87	1333	59	51.5	116.5	2327	6.51E-05	2.89E-05	6.63E-06
3	SH88	202	26	396	17.5	15.5	34.5	692	1.937E-05	8.60E-06	1.97E-06

Methodology for dispersion modelling and scenario analysis

Industrial Source Complex Short Term Model (ISCST3) model is based on Gaussian plume dispersion model, which is the simplified form of the three-dimensional transmission-distribution equation. The Short-Term model incorporates the COMPLEX1 screening model dispersion algorithms for receptors in complex terrain. ISCST3 model is capable of handling multiple sources, including point, volume, area and open pit source types. To run the model, the main model input files include: input run-stream file and meteorological data file. Run-stream setup file contains modelling options, source information, receptor locations, meteorological data file specifications and output options. However, meteorological data file contains all the required meteorological data on hourly basis. ISCST3 Gaussian plume model for predicting downwind pollutant concentrations from line sources. In the present study ISCST3 model has been used to predict the dispersion of pollutants over the study area to predict pollutant concentrations near highways or roads by approximating them as area sources. The D.G sets have been assumed as point sources for the modeling purposes.

Model Inputs

¹AP-42 : Gaseous Emission Factors For Large Stationary Diesel Engines - Diesel Fuel ((Source Classification Code) SCC 2-02-004-01)

The data base included in model are meteorological data, traffic emissions data and ambient air quality data. Background concentrations were calculated using monitored values from sites.

Model Used	ISCST3 for Area Source
Source Type	Area Source: for vehicle tail pipe emissions Point Source : D.G sets
Modelling Grid	1 Cartesian Grid , 17 km x 17 km
Emission Factor	Emission rates in g/s.m ² based on total traffic estimates based on ARAI emission factors Emission rates in g/sec for the D.G sets based on the AP-42 emission factors
Met File (ISC Ready)	Dec 2016- Nov 2017, Anemometer Height: 10 m
Prediction Years	2019, 2029, 2035
Receptors	GLC at 14 receptors as per baseline monitoring program.

Scenario Analysis for the construction phase (2019)

a) CO

The resultant concentrations for the pollutants CO at the AAQM locations are presented in Table 4-6

Table 4-6 : Resultant concentrations of CO at AAQM locations

Receptor	Baseline	Predicted	Total
AQ1	650	43.938	693.9
AQ2	0	20.853	20.85
AQ3	0	52.09	52.09
AQ4	600	38.161	638.2
AQ5	0	135.639	135.6
AQ6	0	31.721	31.72
AQ7	400	41.061	441.1
AQ8	0	56.485	56.49
AQ9	0	24.787	24.79
AQ10	400	22.03	422
AQ11	0	25.185	25.19
AQ12	0	21.913	21.91
AQ13	0	42.387	42.39
NAAQS standard	2000 µg/m ³		

Note : - All values in µg/m³

The Table 4-6 reflects that the minimum resultant CO concentrations was at the location AQ12 (21.91 µg/m³) while the maximum resultant concentration was at AQ5 (135.639 µg/m³). The

maximum resultant concentration of CO was found to be within the NAAQS limit for CO (2000 $\mu\text{g}/\text{m}^3$).

The isopleths of CO for the year 2019 is depicted in Figure 4-2

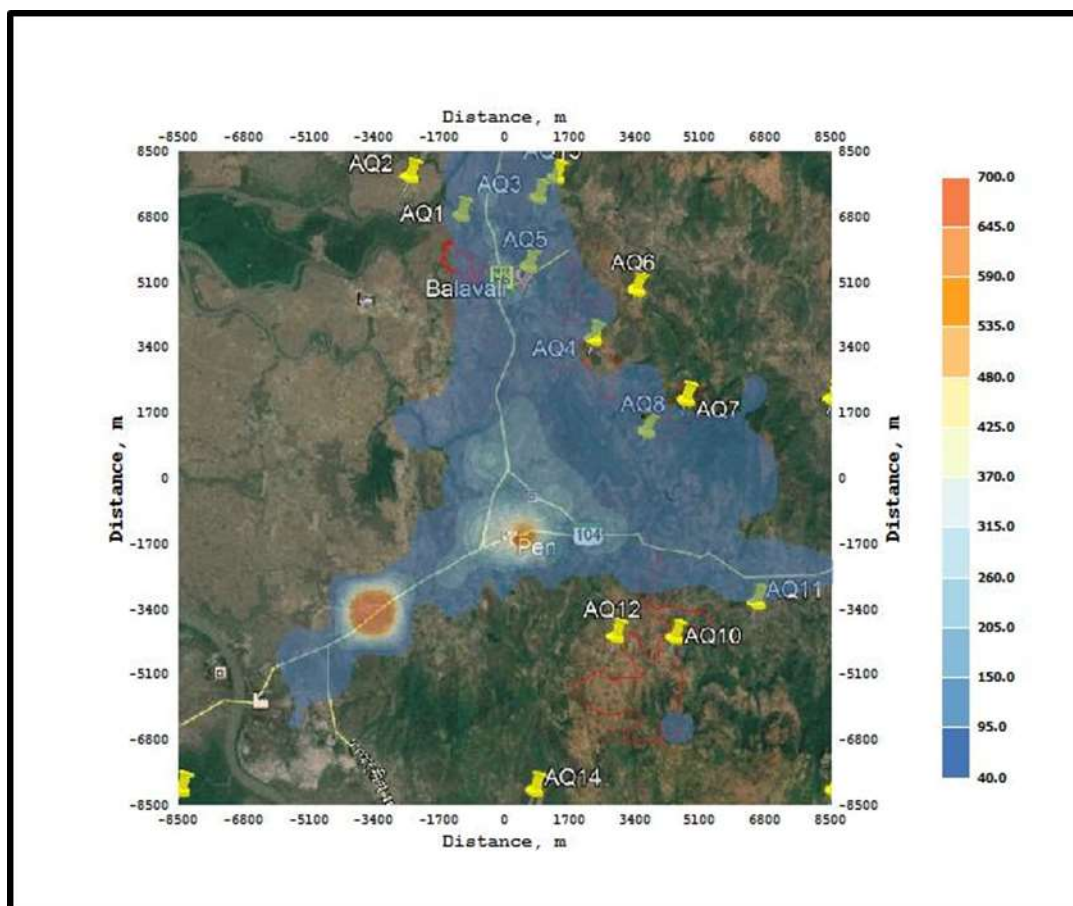


Figure 4-2 : Isopleths depicting the resultant concentrations of CO due to combined operations of the D.G sets and traffic -2019

b) NO_x

The resultant concentrations for the pollutants NO_x at the AAQM locations are presented in Table 4-7

Table 4-7 : Resultant concentrations of NO_x at AAQM locations

AAQM location code	Baseline ($\mu\text{g}/\text{m}^3$)	Predicted ($\mu\text{g}/\text{m}^3$)	Total ($\mu\text{g}/\text{m}^3$)
AQ1	50.23	12.063	62.3
AQ2	22.37	6.806	29.2
AQ3	23.12	14.77	37.9
AQ4	28.23	12.439	40.7
AQ5	22.23	80.274	103
AQ6	20.3	7.861	28.2
AQ7	29.12	23.374	52.5
AQ8	20.2	16.512	36.7
AQ9	22.35	7.453	29.8
AQ10	28.84	19.964	48.8

AQ11	22.35	9.78	32.1
AQ12	23.46	8.831	32.3
AQ13	24.54	11.681	36.2
AQ14	23.43	3.165	26.6
NAAQS	80 µg/m ³		

The Table 4-7 reflects that the minimum resultant NO_x concentration was at the location AQ14 (26.6 µg/m³) while the maximum resultant concentration was at AQ5 (103 µg/m³). The maximum resultant concentration of NO_x was found to exceed the NAAQS limit for NO_x (80 µg/m³).

The isopleths of NO_x for the year 2019 is depicted in Figure 4-3.

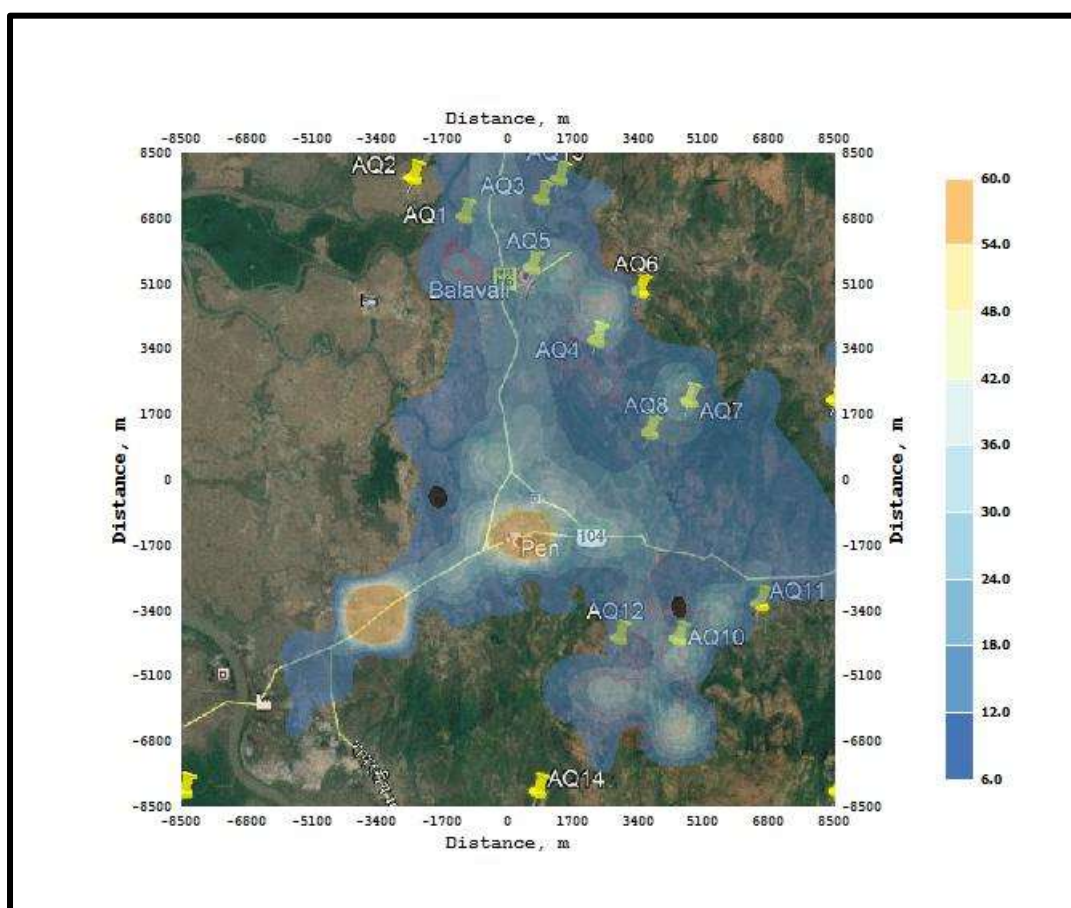


Figure 4-3 : : Isopleths depicting the resultant concentrations of NO_x due to combined operations of the D.G sets and traffic -2019

c) PM10

The resultant concentrations for the pollutants PM10 at the AAQM locations are presented in Table 4-8

Table 4-8 : Resultant concentrations of PM10 at AAQM locations

Station Code	Baseline (µg/m ³)	Predicted (µg/m ³)	Total (µg/m ³)
AQ1	50.23	1.306	51.5
AQ2	53.43	0.679	54.1

AQ3	49.32	2.142	51.5
AQ4	60.81	1.509	62.3
AQ5	42.73	3.481	46.2
AQ6	43.11	1.086	44.2
AQ7	56.59	1.853	58.4
AQ8	40.03	1.881	41.9
AQ9	41.1	1.008	42.1
AQ10	64.11	1.062	65.2
AQ11	41.09	0.961	42.1
AQ12	52.95	0.704	53.7
AQ13	52.19	1.68	53.9
AQ14	49.3	0.278	49.6
NAAQS	100 µg/m ³		

The Table 4-8 reflects that the minimum resultant PM10 concentration was at the location AQ8 (41.9 µg/m³) while the maximum resultant concentration was at AQ10 (65.2 µg/m³). The maximum resultant concentration of PM10 was found to be within the NAAQS limit for PM10 (100 µg/m³).

The isopleths of PM10 for the year 2019 is depicted in Figure 4-4.

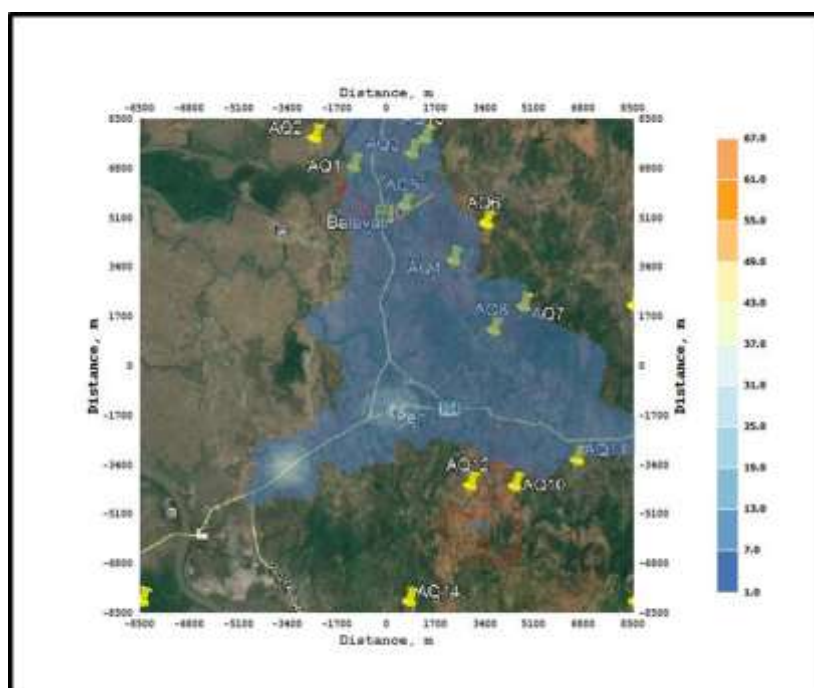


Figure 4-4 : Isopleths depicting the resultant concentrations of PM10 due to combined operations of the D.G sets and traffic -2019

Significance of Impact

As per the modelling results, the resultant concentrations of NO_x are exceeding the NAAQS standard during the construction phase the severity of the impact is High (3), also as the extent

of the impact is within the 10 km of the project boundary the extent is categorized as Moderate (2) and as the duration of the impact is for the entire construction period, the duration of the impact is categorized as moderate (2) and subsequently the impact has been ranked as 'Medium'.

Severity of Impact	3	Extent of Impact	2	Duration of Impact	2
Impact Significance = 12 i.e. Moderate					

4.1.1.2 Mitigation measures

- Material Handling

The transport of materials such as concrete and asphalt to construction sites generate significant amounts of road dust, especially for sites that are relatively far from material manufacturers. Setting up temporary portable concrete plants and/or asphalt plants at construction sites can eliminate haulage of materials.

- Idling Time Reduction

The traffic management plan to be prepared and implemented to reduce the idling time and adequate parking space for construction vehicles.

- Improved Maintenance

Recognizing that significant emission reductions can be achieved through regular equipment maintenance, contractors will be asked to provide maintenance records for their fleet as part of the contract bid and at regular intervals throughout the life of the contract.

- Reduction of On-site Construction Time

Rapid on-site construction would reduce the duration of traffic interference and therefore, reduce emission from traffic delay. Off-site fabrication of structural components can also enhance the quality of work, as the production takes place in controlled settings and external factors such as weather and traffic do not interfere.

- Other pollution control measures:
 - Emission Control System at Stone Crushers & Batching Plants.
 - Dust suppression on construction sites.
 - The excavation debris shall be kept at one place and covered with grass turf to reduce runoff during monsoon season.

4.3.2 Water

Water Usage

The construction activities that will have potential impact on water resources (surface and ground) are site preparation, labour engagement and various construction activities as detailed in Table-1.1 above. The construction activities will require setting up of 3 - 4 construction labour facilities for each phase of project with a capacity to accommodate a peak labour of 100 - 200 at each labour facility and an average labour of around 500. The labour facilities will require water for domestic consumption of workers as well as for the construction activities such as brickwork, concreting and plastering, curing, domestic purpose, housekeeping, RMC plant, truck washing, dust suppression, for checking/reporting/repairing leaks etc. It is estimated that domestic water requirement of about 59 KLD and 320 KLD of water for construction activities would be required. The water will be sourced by contractor from authorized sources/approved agencies for the construction phase.

Significance of the Impact

The severity is categorized as ‘Moderate’ (2) due to continuous burden on the existing water resources in the area. The extent of the impact is not restricted within the project boundary (water will be sourced from outside the project boundary), the same is classified as ‘Moderate’ (2) and as the duration of the impact will last during the entire construction period, it has been categorized Moderate (2) and accordingly the impact has been ranked as Moderate (8).

Severity of Impact	2	Extent of Impact	2	Duration of Impact	2
Impact Significance = 8 i.e. Moderate					

Suggested Mitigation Measures

- Water for the construction phase will be sourced through authorized tanker supply. The contractor shall ensure that supply is from approved water sources;
- The construction campsites will put in place optimal water consumption measures along with adequate awareness measures for the laborer;

Water Quality

The major activities that may contribute to the degradation of water quality are site preparation, labour engagement, material handling and storage and various construction activities as detailed in Table 4-1. It is expected that during construction phase, there will be generation of sewage from labor facilities and minor quantity of rejected water from testing of utility tanks and pipelines. About 57 KLD of sewage is expected to be generated from labour facility. There is a potential for contamination of surface and groundwater resources resulting from improper management of sewage.

Significance of the impact

Significant water quality impact will occur, if the sewage is disposed without any prior treatment. The sewage disposal from the labour facility will be to the tune of maximum upto 57 KLD and will be continuous, the severity has been categorized as ‘Medium’ (2), also as the adequate number of toilets (at least 8 toilets per 100 labour) will be provided on site along with packaged STP, the extent of the impact is restricted within the project boundary, the extent is classified as ‘Low’ (1) and as the duration of the impact is during the entire construction period i.e., ‘Medium’ (2) the impact has been ranked as ‘Low’.

Severity of Impact	2	Extent of Impact	1	Duration of Impact	2
Impact Significance = 4 i.e. Low					

4.1.1.3 Mitigation Measures

Onsite Packaged STP will be provided for treating the sewage from the labour facility. The treated water from the packaged STP will be used for non-potable uses such as dust suppression, green belt development, etc. Training programs and awareness camps will be conducted for workers to educate them about the indiscriminate disposal of untreated sewage, open defecation etc.

4.3.3 Land use, Landscape and Topography

Impact on Land Use

The study area occupies a highly undulating terrain in T1 Parcel. The land use at the land parcels is a mix of land with / without scrub, dense open vegetation, Stony /rocky/barren land as per the land use /land cover statistics derived from the classified satellite image and will change to mixed land use comprising predominantly industrial, commercial and residential components. The land use change will be permanent which will be for beneficial purposes and the impact will be positive.

Impact significance
Impact is positive ++

Impact on topography

The change in topography will be mostly at the micro-level due to leveling of area or modification of terrain. The construction activities such as site clearing, gradation, cut fill, excavation works for foundations of various project-components, development of drains, providing proper slopes across the area, erection of the associated structures and buildings will change the topography of the area.

Significance of the impact

As the topography is undulating especially in T1 land parcel, the severity has been classified as moderate (2), also as the extent of the impact will be within the project site, the extent has been classified as Low (1) and as the duration of the impact last during the entire construction phase, the duration has been classified as Moderate (2), the impact on the topography and the landscape has been accordingly ranked as 'Low'(4).

Severity of Impact	2	Extent of Impact	1	Duration of Impact	2
Impact Significance = 4 i.e. Low					

4.1.1.4 Mitigation measures

For topography

- The land clearance shall be kept to a minimum. Clearing of areas with highly erodible soils and steep slopes which are prone to water and wind erosion shall be avoided.
- The roads are advised to be carefully constructed for; there will be multiple patches where the soil shall be exposed. The soil being loose and fast draining, has tendency to wash out during heavy rainfall and result in landslides. Hence, the road sections adjacent to such soil patches should have retention walls to avoid mishaps.
- The earth material that will be excavated at the time of construction should be properly stacked, covered with grass and suitable plant species and utilized for developing landscapes in respective areas.
- Rainwater harvesting shall be carried out in the entire industrial and residential, commercial areas. This will minimize the surface run off and thereby impact of rainwater on the structures in lower reaches of site. This will also save the natural resource in the form of soil and rainwater from going waste;
- No extra soil shall be brought into the site from outside the project boundary for the construction activity. All excavated soil to be used in land levelling;

- Road corridor to be provided with adequate cross drainage.

For landscape

- The green area (254.95 acres) will be developed in the beginning of construction phase to the extent possible;
- The construction contractors shall be instructed not to cut any tree. Wherever possible avoid disturbance to existing ecology to improve the landscape of the project site;
- Diversion dykes would be constructed to channel runoff around the excavated site to avoid surface runoff of excavated material.

4.3.4 Soil Quality

4.1.1.5 Soil Erosion:

The project activities will include site preparation which further involves the activities of grading, excavation, which will result in top soil removal and will disturb the soil surfaces. And may lead to soil erosion. Soil erosion may be caused by exposure of soil surfaces to rain and wind during site clearing, grading, excavation, cut and fill activities. The mobilization and transport of soil particles may result in sedimentation of surface drainage networks. However, such impacts will be primarily confined to the project site during initial construction period.

Significance of Impact

Due to the undulating terrain in T1 land parcel as compared to the other parcels (T2, T3 and T4), there may be considerable localized cut and fill activity confined to the project site during initial construction period, hence the severity of the impact has been classified as Moderate (2), the extent of the impact will be restricted to the project boundary, the same has been classified as Low (1) and as the duration of the impact will last during the entire construction period, the duration has been ranked as moderate (2), accordingly the impact has been ranked as 'Low' (4).

The significance of the impact is presented below:

Severity of Impact	2	Extent of Impact	1	Duration of Impact	2
Impact Significance = 4 i.e. Low					

4.1.1.6 Mitigation Measures

- Immediate management measures using extensive high-density plantation, slope stabilization, metal mesh netting, etc.
- Management of loose soil in the impact zones of construction using a combination of ecological resistance mechanism, using landscaping for flat & gentle slopes whereas coir netting for medium / moderate slopes and gabion wall for steep slopes.
- Major activities pertaining to site grading and excavation for foundation and backfilling will be avoided during monsoons and shall be planned for dry season;
- Surface runoff from the construction site and exposed areas will be diverted to drainage swales or ditches. The method of choice will depend on the size of the drainage area and the steepness of the slope;

- Retention wall or bund shall be provided around the storage areas for excavated soil and other construction material to check the flow of sediments with storm water in case of rain;

4.1.1.7 Top Soil Management:

As mentioned earlier, due to the undulating terrain in T1 land parcel as compared to the other parcels (T2, T3 and T4), there may be considerable localized cut and fill activity, site grading, excavation confined to the project site during initial construction period which may, hence the severity of the impact has been classified as Moderate (2), the extent of the impact will be restricted to the project boundary, the same has been classified as Low (1) and as the duration of the impact will last during the entire construction period, the duration has been ranked as moderate (2), accordingly the impact has been ranked as 'Low' (4).

The significance of the impact is presented below:

Significance of Impact

Severity of Impact	2	Extent of Impact	1	Duration of Impact	2
Impact Significance = 4 i.e. Low					

Mitigation Measures

- Excavated soil shall be used/transported at the earliest for filling low lying areas at the site for raising of level as planned;
- Proper routing and adequate capacity of the storm water run-offs drains with catch pits shall be provided at all construction sites;
- Completed earthworks will be sealed and/ or re-vegetated as soon as reasonably practicable with the help of landscape expert;
- The excavated soil material shall be stacked in earmarked areas. It is advised to be dumped properly and stabilized with grass and trees or utilized for green area development to avoid its washing due to rains;
- Moreover, the washed soil will also be arrested by creating garland drains, leading to settling pond/s to allow its settling and avoid its mixing with surface water and result in their silting.
- The Top soil will be lost due to the site clearing, grading, excavation / cut and fill activity, construction of the access road/ pavement works in the proposed development within project site.

4.1.1.8 Soil contamination

The soil contamination can occur due to the labour engagement (Waste from labour facility Sewage disposal), Material Handling and Storage (Transportation & Unloading of construction material, Storage & Handling of construction wastes and Storage & Handling of Hazardous material (chemicals/ flammables). The tentative quantification of the construction debris generated from the project is given in Table 4-9.

Table 4-9: Construction Waste Debris

Sr. No	Particulars	Quantity in Tonnes	Management
1	PCC Waste	2005.55	Will be used for Site filling
2	Concrete Waste	34846.49	Will be used for Site filling

3	Reinforcement steel scrap	7019.44	To be sold to vendors
4	Brick Debris	13286.79	Will be used for Site filling
5	RCC	46879.82	Will be handed over to recyclers
6	Tiles Waste	120834.61	To be sold to vendors
7	Glass Waste	12785.40	To be sold to vendors
8	Paint Cans	10027.77	To be taken by Contractor
9	Wood Waste	3008.33	To be taken by Contractor
Total		250694.21	
Total Construction debris generated: 250694.21 T			

Table 4-10: Waste from Labor facility

No. of Workers	Solid Waste Generation Kg/capital/day	Dry waste (Kg/day)	Wet waste (Kg/day)	Total waste (kg/day)
500	0.25	38	88	125

Significance of Impact

Construction wastes from site such as metal cuttings, reinforced steel scrap, tiles waste, glass waste, debris, plastic packing material, wooden logs etc. will be segregated and will be kept in specially identified waste bins. All metal scrap, reinforced steel scrap, tiles waste, glass waste will be sold to local vendors; concrete waste, PCC waste, brick debris will be used for site levelling; paint cans, oil cans, plastic and cardboard packing material will be taken by contractors and other inert materials like rubber, tyres etc will be disposed off to authorized agency. Since most of the waste generated will be segregated, sold to local vendors and construction waste generated will be off to local vendors, contractors and reused on site, the severity has been classified as low (2), also as the extent of the impact will be within the project site, the extent has been classified as Low (1) and as the duration of the impact last during the entire construction phase, the duration has been classified as Moderate (2), the impact on the soil has been accordingly ranked as 'Low'(4).

Impact significance

Severity of Impact	1	Extent of Impact	1	Duration of Impact	2
Impact Significance =2 i.e. Low					

Mitigation Measures

- Storage facilities will be designed within paved surface, provided with covered shed and adequate containment facility at the construction site to prevent contamination of soil due to accidental spills of lubricating oil, fuel oil, paints, thinner, varnishes, chemicals etc.;

- Storage of machine oil, used oil and grease will be provided with adequate secondary containment to avoid any soil contamination;
- Adequate hazardous waste collection and storage facilities shall be provided in a designated place away from storm water drains or watercourses with proper access control and proper labeling;
- All the hazardous waste containers will be properly labeled with the waste being stored and the date of generation;
- The hazardous waste shall not be stored for more than 90 days at the site and will be sold to authorized recyclers;
- An inventory of the hazardous waste generated, stored and sold to recyclers shall be maintained by the contractors;
- A spill contingency plan shall be delineated by the contractor. A portable spill containment and cleanup equipment will be available at site and training in the equipment deployment will be imparted to the contractors;
- Covered garbage bins shall be provided for the construction labour facilities and will be collected and transferred to the proposed waste management facilities within site;
- The construction waste shall be used as a fill material for the low-lying areas and for construction of roads;
- Empty containers, which may contain some toxic substances such as paints, solvents, adhesives, chemicals and sealants shall be returned to the manufacturers or disposed appropriately as the case may be;
- Waste generated will be segregated into biodegradable and non-biodegradable contents. All biodegradable wastes from canteens to be collected and disposed of in humus pits generated onsite for subsequent use as manure;
- Construction wastes from site such as metal cuttings, reinforced steel scrap, tiles waste, glass waste, debris, plastic packing material, wooden logs etc. will be segregated and kept in specially identified waste bins. All metal scrap, reinforced steel scrap, tiles waste, glass waste will be sold to local vendors; concrete waste, PCC waste, brick debris will be used for site levelling; Paint cans, Oil cans, plastic and cardboard packing material will be taken by contractors and other inert materials like rubber, tyres etc. will be disposed off to authorized agency;
- Hazardous wastes including used oil, waste oil and residue containing oil or other hazardous substances will be stored at a designated place at all construction sites for disposal through authorized vendors;
- Paintbrushes and equipment for water and oil-based paints shall be cleaned within a contained area and shall not be allowed to contaminate site soils, watercourses, or drainage systems;
- All oil handling will be done in an area underlined by gravel and PCC to avoid soil contamination.

- Segregation of potentially hazardous waste from non-hazardous construction site debris;
- The contractor shall educate the workers and subcontractors about hazardous waste storage and disposal procedures.

4.3.5 Ambient Noise Quality

OSC is a new construction project for with industrial, residential, commercial components proposed in this facility. Being a construction project, majority of the machinery are only going to be present at the project site during the construction phase only. Following are the identified major sound sources from the list of machinery with their respective Sound Pressure Levels.

- Concrete Mixer (2 Nos) – 90~100 dB
- Submersible pumps – 80~85 dB
- Grinding Machines (Multiple) – 95 dB
- Concrete Batching Plant – 100 dB
- Bar cutting and bending machines - <80~85 dB
- Chipping Machine - < 85~95 dB
- Electric Drill machines - 10 Nos. – < 80 dB
- Dumpers / Trucks – 80~85 dB
- JCB / Excavators / Breakers / Earth Moving Machinery (Multiple) – 85~90 dB

DG Sets (Multiple Numbers) – As per the CPCB norms, the DG sets are supposed to have <75 dBA of SPL when measured in anechoic conditions, but in real conditions, the noise level actually observed is usually higher. Additionally, due to multiple DG sets being kept at the same location, it increases the overall SPL due to logarithmic addition of sound pressure levels of each of the individual DG Sets.

It can be observed that extremely low noise levels are observed at all of the locations as per the baseline noise levels recorded, which are in the range of 42 to 44 dB during the day time as well. During the site visit, it was noted that there was no nearby construction activity or vehicular movement or any other activity which can potentially raise the baseline noise levels, due to which low baseline noise levels are recorded as above.

Noise modelling predictive analysis was conducted to predict the potential increase in the Leq-Day Sound Pressure Levels at the nearby areas surrounding the construction activity. Noise modelling analysis assumes that the construction activity is conducted right near the project boundary and calculates the potential increase in noise levels in surrounding villages with the consideration of the attenuation achieved due to green-belt and mitigations implemented as per the suggestions of this report. In real conditions, the construction activity would in fact be conducted well within the project boundary, and hence the actual noise levels noted during the construction activity would be lesser than what is mentioned in this report. This analysis is conducted for the worse-case scenario, in which case the construction is done right near the project boundary.

Villages which are within a distance of 50 to 200 meters were chosen for the noise modeling study from the available data of 10 Noise monitoring locations. The results predicted are based on distance from the project boundary or from construction activity. Similar results would be observed at villages located at same distance from the project boundary or the construction activity.

The noise modeling results are given below in Table 4-11:

Table 4-11: Noise Modeling results in the construction phase

Long Duration Noise Sources					Anticipated Noise level (dBA)				
S.N o.	Noise Generating areas	Noise level at source (dBA)			N7 : Belawade Village	N5 : Mungoshi Village	N4 : Ambivali Village	N3 : Kopar Village	N10 : Wirant Village
		(at 1 meter dist)	Distance from project site (m)		50	100	150	200	200
1	Excavator-Loader /CBI/ Breaker/Construction Activity	90			56.0	50.0	46.5	44.0	44.0
2	Concrete Batching plant	100			66.0	60.0	56.5	54.0	54.0
3	Concrete Mixers	95			61.0	55.0	51.5	49.0	49.0
	Cumulative Noise Levels				67.5	61.5	58.0	55.5	55.5
	Attenuation due to Green Belt and acoustic enclosure				20.0	20.0	20.0	20.0	20.0
	Existing Noise Levels (day-time)				42.8	43.7	43.4	42.6	42.7
	Cumulative Noise Levels (DAY)				48.8	45.8	44.5	43.4	43.5

The inferences from the noise modeling results are given below:

- The highest increase was predicted at the village Belawade which is located at 50 meters distance upwind of T2, with an increase over the baseline noise levels of 6 dB.
- At Mungoshi Village, which is located at 100 meters downwind of T4, increase of 2.1 dB was predicted which is very minor, considering that the minimum change in Sound Pressure Level detectable by a human ear is measured at 0.5 dB.
- At Ambivali Village which is located at 150 meters from project boundary, upwind of T4, increase of 1.1 dB was predicted, which is again negligible.
- At Kopar Village and Wirant Village, which are located at 200 meters away from the project boundary, increase over the baseline noise levels of 0.8 dB each is predicted, which is very negligible.

The results of the noise modeling indicate that the predicted values are less than the 90% of the existing standards, the severity is classified as 'Low' (1), the extent of the impact will be within the 10 km boundary of the project site, the same is classified as 'Moderate' (2) and as the duration of the impact will last during the entire construction phase, the duration has been classified as Moderate (2), accordingly the impact has been ranked as 'Low'.

Severity of Impact	1	Extent of Impact	2	Duration of Impact	2
Impact Significance = 4 i.e. Low					

4.1.1.9 Mitigation Measures

During the construction phase, Noise Reflective Corrugated Roof-sheets to be temporarily installed as "Noise Reflective Barriers" which are effective in reducing the noise levels by up to 5 dB. Upon implementation, the SPL measured at approx. 150 meters distance should be equal to the background noise level measured in absence of these noise sources.

Batching Plant:

The batching plant contains several different sources, the collective noise level of which may rise to 100 dB. Following are the several different sources present in a batching plant.

- Truck and front-end loader engine noise
- Hydraulic pumps
- Conveyor belts
- Air valves
- Filters
- Alarms
- Compressors
- Swinging, scrapping and loading devices

The contractor should carefully choose the above equipment in order to meet with the CPCB Norms.

Hydraulic pumps and compressors should be covered with Acoustical Enclosures with 20 dB Transmission Loss Rating in order to reduce the noise.

Valves should be covered with Removable Acoustical Blankets.

The contractor should choose controlled operating hours for noisy activities such as delivery, loading unloading etc.

Vehicular Movement:

There would be increased activity of vehicular movement during the construction phase of the project. Dumpers/Trucks with sound Pressure Levels of 80~85 dB would be moving around the project sites on the available roads. The increased vehicular movement is likely to affect the houses abutting the roads that lead to the construction sites, but the impact and increase over the baseline noise levels is going to be momentary and only during the truck/dumpers pass the certain houses.

- Well maintained vehicles to be chosen for the project so that the sound generated by the vehicles is as low as possible.
- It is recommended that vehicular movement to be avoided during the night time, and most of the material movement to be conducted during the day time to avoid disturbance to surrounding villages.
- These calculations are done using theoretical formulation, which assumes that there are no reflective surfaces or no other surfaces which may lead to attenuation of the sound. But in actual conditions, the project site being located in a densely populated area, or an urban area, there will be several tall buildings, walls or trees which will lead to attenuation of the Sound, and thus the sound will not affect any project beyond 150 meters radius outside the boundary walls.
- This analysis is done assuming that the Noise level of the mentioned sources is going to be 85~100 dB at the Boundary of the project site, where as in actual, the machinery will be installed well within the boundary of the Plot, and other sound sources e.g. Compressors, Dewatering Pumps, Cranes, JCBs etc. are going to be located well within the plot boundary, because of which there will additional attenuation and hence the SPL measured at the boundary of the project because of the machinery involved in this project is going to be much lower than what is considered in this report. This Analysis is done for the absolute worst-case scenario for the Noise Environment.

4.3.6 Socio-Economic Environment

The establishment of proposed the proposed Integrated Industrial Township at Pen, Raigad, is likely to generate a range of permanent and temporary social impacts. These impacts will also be both positive and negative in nature. The positive impacts include increase in employment opportunities, improvement in infrastructure facility in the project site and business opportunities for the local people, increase in real estate value in surrounding area etc. The potential negative impacts of the project changes in land-use, changes in the traffic pattern and related impacts. The entire range of impacts can be broadly categorized as:

- Direct impacts on the prevailing natural and social systems;
- Indirect impacts that may be secondary impacts, derived from the existing natural and social systems; and

All impacts have been identified through consultation with the Project proponent, with government officials, elected representatives at village and consultation with various stakeholders including the people living in villages affected by the project.

The actual impacts are documented from the examination of available data, socio-economic survey and feedback received from the stakeholder consultations.

The pre-construction and construction phase impacts on socio-economic conditions of the Project area are discussed in the following sub-sections.

4.1.1.10 Land Related Impact

Impact of Loss of land

The land required for project has been purchased on willing buyer –willing seller basis from 15 affected villages. The land use at the land parcels is a mix of land with / without scrub, dense open vegetation, Stony /rocky/barren land as per the land use /land cover statistics derived from the classified satellite image. As the land at the project site is predominantly non-agricultural land, subsequently there is no loss of productive agricultural land.

As the land is predominantly non-agricultural land the severity of the impact has been classified as ‘Low’ (1), the extent of the impact is restricted to be project site the same has been classified as ‘Low’ (1) and as the duration of the impact will last after the construction phase the same has been classified as ‘High (3)’ accordingly the impact related to the loss of land has been ranked as ‘Low’(3).

Severity of Impact	1	Extent of Impact	1	Duration of Impact	3
Impact Significance = 3 i.e.Low					

Extent of loss of agricultural land

In terms of extent of land loss, in all approx. 1042.51 acres land has been purchased on the willing buyer –willing seller basis from 14 village’s viz., Boregaon, Virani, Shene, Ambeghar, Belawade Khurd, Belawade Budruk, Mungoshi, Padale, Walak, Govirle, Hamrapur, Ambiwali, Balawali and Kopar.

A study of OSC sites reflects that the loss of agricultural land is minimal and the conversion of this mixed land into industrial, residential and commercial use will have positive socio –

economic impact in the surrounding region. The project will have 25% of green and open space which will have positive impact on the environment. . (Impact is beneficial and is positive)

Impact is beneficial ++

Land use planning

The proposed 'OSC project' will comprise of industries of various sectors, commercial & residential buildings. The proposed land use pattern will be under mixed-use category.

4.1.1.11 Impact on Livelihood

The Land was purchased on willing buyer - willing seller basis & is in control/possession of the Group. No rehabilitation and resettlement is required. However the villagers were of the opinion that as the project is expected to generate employment opportunities which will be beneficial for them. The villagers also had expectations of benefitting from CSR activities associated with the project. Hence the overall impact on the livelihoods will be positive.

Impact is beneficial ++

4.1.1.12 Impact on utilities

There is no utility present within the project site. Hence there is no impact on the utility infrastructure in the area.

4.1.1.13 Impact on Livelihood Opportunities

The impact will be beneficial on account of the following reasons

Job Opportunities

The proposed project will create new jobs in skilled, semi-skilled, unskilled, managerial and technical level. This along with other project related requirements like security, housekeeping, gardening etc. will create a constant requirement for labor, for the entire operation phase of the project life. In addition, the manufacturing units in the project will create number of job opportunities & also other proposed facilities such as commercial, recreational, hospital, education, logistic, etc. It is also envisaged that a number of jobs will be created outside the project boundary by various ancillary units catering to the needs of primary manufacturing units in the project. However, the benefit of project will trickle down to the local communities if adequate measures are taken in a planned way.

The project would spur the employment opportunity 1,50,000 no.s at local and regional level. In order to benefit the local population from the implementation of the project the following measures should be adopted:

Dissemination of information to the local youths about various types of jobs opportunities likely to be generated by the project;

Under CSR program companies should identify local youths and extend necessary skill development trainings leading to linkages to job;

The coordination between industry and community should start well in advance so that both can benefit from it;

As there will be generation of the employment due to the creation of the job opportunities, the impact on the livelihood opportunities will be beneficial.

Impact is beneficial ++

4.1.1.14 Impact on the Infrastructure / Institutional Development

Currently there is paucity of the infrastructure such as schools, colleges and sanitation facilities in the nearby villages. Due to the establishing of the OSC there will be upgradation of the surrounding infrastructure indirectly. Hence the impact will be positive and beneficial. With the development of project activities, the locals expressed that infrastructural development in their villages such as access roads, water supply. Also the schools and college facilities should be provided so that the education will be available in the village. Due to the infrastructure / institutional development the impact will be beneficial

Impact is beneficial ++

Additional Benefits of the Community Development Activities

Once the proposed projects established, the continued sustenance of community relations will require the project proponents to engage in community development initiatives as per needs and priorities. The project proponent has identified focal areas of CSR activity such a women empowerment, skill development etc. The project development will generate direct and indirect employment, will improve infrastructure in the region which will socio-economically transform the region. The impact due to the above will be beneficial.

4.1.1.15 Impact on the Utilities & Resources

Another key impact that the project will bring about in the betterment of the public is the increase in utilities and resources. Presently, the villages are dependent on nearest urban centers namely Kopar, Belawade, Govirle, Ambeghar and Pen for facilities like higher education, medical, recreation etc. Improved facilities in project will significantly benefit the local community in terms of access to public utilities and in supporting overall social development. Hence the impact will be beneficial and positive.

Better value for Local Products

Development of project will create a market in itself for local products such as vegetables, dairy, poultry etc. Presently nearest urban center is the primary market for the villagers and mostly sales their product through middleman. With the development of residential and market in the project will give the villagers to sale their product directly to the consumers at a market rate, thus making more profit. The project may also encourage the villagers to take up cultivation of vegetables seriously and diversify to meet the growing demand from the project residents.

Improvement in women's socio-economic conditions

Enhanced facilities such as schools, health, recreation in vicinity has direct linkages to the improvement in women's social- economic condition. This is especially true for the women living in surrounding villages of project area. Furthermore, local educated women will have opportunity to work in the manufacturing units and other facilities are will be established in the project. Additionally, there would be opportunity to work as domestic help in the residence colony in the project. The project will surely enhance the situation of women.

Access of the facilities to the poor segment

With the implementation of the project, poorer section of society living around the project area would be benefited from access to employment, education, medical and other utilities. This section of the population would also have access to market and many other unskilled jobs for the entire operation period of the project.

Increase in surrounding land value

The value of land around project has already increased significantly with the announcement of the project. It is expected that the value of surrounding land will further enhance once the implementation of project starts. Villagers around the project site will reap the benefit of enhanced value of the land. The project will also bring in many workers of different categories who will be looking for accommodation outside the project boundary. Local people will have continuous source of earning by letting out their house for accommodation to these families.

Impact is beneficial ++

4.3.7 Ecology

4.1.1.16 Ecological Parameters

The project will comprise of residential area, commercial, industrial area, open and green area. The Site is situated close to many water bodies particularly the Hetawane Dam is situated at a distance of approx. 5km from the T1 site. The project site is irregular in shape and overlooks the River Bhogeshwari & Balganga. The site has rocky terrain, with a little vegetation cover. After the Hetawane dam, the downstream portion of Bhogeshwari river runs to the North of the T1 site in a East to West direction. The existing irrigation channel originating from the Hetawane dam passes next to T1 site and as the contour of T1 are much higher than the water level in the channel.

The major components and the allied infrastructure and facilities of proposed project: residential area, industrial area and economic zone will be setup in land parcels which are non-fertile/low fertility and non-irrigated with no major vegetation. Hence it is envisaged that there will not be significant impact on ecology due to development works for proposed project within site as the forest land is

4.1.1.17 Major Impacts

In general, the potential impacts associated with the construction phase of the development can be summarized under the following areas of impact:

➤ Air Pollution: Effects on Fauna and Flora

Damage to Fauna – Air pollution harms animals and wildlife in many ways. The increased ozone level in atmosphere damages the lung tissues in animals. Air pollution also produces acid rain that results in leaching of aluminum from the soil, thus, killing the fish. The harmful particulate particles suspended in the air affects the respiratory, circulatory and nervous system of the animals. Even the migration cycle of birds and animals get disturbed due to air pollution as smog creates confused vision for them.

Damage to Flora – Trees may also get affected from air pollution through different ways including eutrophication. While acid rain makes the soil poisonous and adversely affects the growth and survival of plants, the ground level ozone causes respiratory problems in plants by blocking the stomata in plants.

Adverse effects on flowering quality of plants – Air pollution may also affect the flowering quality of plants. Due to cement dust and other pollutants in the air, crusts are formed on the flowers, giving them a poor quality and look. Moreover, the plants do not get to grow well in excessive air pollution and give poor flowering results.

➤ Water pollution on aquatic habitat

Due to increased construction activities, there could be direct impact on the aquatic habitat in case of land parcel T3 which is close to the creek. Dust and smoke from the construction activities can affect the growth of the mangroves.

➤ Habitat fragmentation

Habitat fragmentation affects the wildlife movement and presence of microhabitats.

➤ Existing fields in the vicinity of the project site

Increased levels of chlorine, ammonia, ethylene, carbon monoxide, and other harmful gases are putting food crops in danger. The decreased food crop and poor quality of crop are also results of air pollution. The harmful effects of air pollution can be observed on the leaves, roots, flowers and fruits of plants.

The potential impact on ecology during the construction phase will be primarily due to the following activities:

- Site clearance,
- Excavations,
- Site formation,
- Filling of habitats with spoil
- Waste disposal

The construction activities will entail site clearance and development activities which will lead to loss of vegetation and tree felling within the delineated area for the development of the various projects. The loss of vegetation will result in destruction of habitats for small mammals and birds. The project related construction activities involving noise and vibrations, construction vehicle movement, illumination at the project site will have adverse impacts on flora and fauna. Use of wood as fuel by cutting trees in the nearby area by construction labour may also result as a threat to the ecology of the area.

Unplanned storage of construction raw material and indiscrete disposal of construction debris can result in contamination of soil and water bodies in the proximity, which may also lead to increase in turbidity of water and increase siltation towards mouth of river. High turbidity and presence of construction debris can result in damage to aquatic habitats.

Impact on Flora:

The major impact on flora associated with the development will occur during the construction phase of the project. The major impacts at this stage will be the loss of natural vegetation and transformation and disturbance of natural ecosystems at the site.

Varying degrees of risks are also anticipated in view of the presence of a sizeable construction workforce and the operation and presence of construction machinery at the site.

In general, the major impacts associated with the construction phase of the development can be:

- Destruction and loss of habitat & deposition of dust

➤ Impact on plant / trees due to uprooting / cutting / trimming

The selection of development site and the master plan for OSC is planned in a manner so as to maintain maximum existing flora and fauna, minimum interference with existing vegetation.

During site preparation only, some vegetation mostly comprising wild shrubs, grasses and herbs and some will be removed. Although mangroves are present adjacent to the project boundary in one of the land parcel, any disturbance or impact to them during construction is ruled out as they are more than 500m from the project boundary. Construction phase would require proper monitoring of movement of workers, Vehicles etc. to restrict any movement in mangrove area.

Agriculture activities practiced in the close vicinity of the development may be impacted to some extent due to dust generation but mitigative measures such as regular water sprinkling on active areas for example hole roads, dumpsites should be strictly followed so that impact is minimized.

Impacts on fauna

The development of the site would directly impact the fauna of the site in several different ways. Firstly, the loss of vegetation or habitat will lead to death or moving of the fauna from the project site. The anticipated noise pollution and disturbance associated with the construction phase including equipment noise. This would frighten many of the larger mammals away from the area and would probably cause increased pressures and survival fight among these individuals as they would have to move into sub-optimal habitat or compete with other individuals for new territories.

There are no major faunal species observed within the project area. All the aquatic and marine fauna is outside the actual project site. Therefore, other than small invertebrates, no major loss of faunal biomass is envisaged. Moreover, the core does not have much of the wildlife, but however the increased noise level during construction phase can disturb the resident bird population. This disturbance is temporary & potential noise impacts would be restricted within the site.

The effect due to noise pollution and disturbance associated with construction would be transient and affected species would be able to return once construction has been completed. However, the presence of the newly developed structures & population may deter sensitive species from returning or would require some time for them to become habituated to their presence. Secondly, the transformation of intact vegetation would constitute habitat loss and fragmentation for fauna.

Apart from the direct loss of vegetation, this will also render the disturbed areas vulnerable to erosion. The extent of the impact will be limited to the development footprint and near surroundings. Erosion may however also affect adjacent and downstream areas but proper measures are incorporated to protect the top soil layer & erosion control and for use later. Green belt development on cleared areas will alleviate the erosion problem.

No protected / rare or endangered plant species were observed within the development footprint indicating that there will not be any impact on the protected species. The project area does not encroach into any wildlife sanctuary or any other type of protected area.

Before the publication of the Karnala Eco-sensitive Zone notification no. S.O.230 (E) dated 22nd January 2016, the distance of the project site was around approx. 16.5 kms from the Karnala Bird sanctuary, but after the promulgation of the aforesaid notification, the distance of

the nearest land parcel T3 is approximately 6.7 km from the buffer zone of Karnala Bird Sanctuary and therefore no significant impact is envisaged.

Broad Principles for Identification of Pristine Areas

The pristine areas are sites of significance for conservation of biodiversity (floral and faunal) and forest types that are unique and ecologically important. Besides these, the forested areas having high density coverage that are important for rendering invaluable ecological services, also need protection and conservation for sustainability of these services through the generations. Similarly the identification of the areas was carried out depending upon the secondary data & primary data.

- **Forest Type:**

Of the 178 forest types identified in the country's forests as per 'Champion and Seth' classification (1968), many of them are unique (and therefore irreplaceable) to a particular site while some of these forest types, such as Tropical Wet Evergreen forests, are ecologically sensitive as they harbor a wide range of species diversity. Likewise, there are several forest types (e.g. Myristica swamp forest, reed breaks, desert dunes scrub etc.) which are either very small in extent and are found in one or few localities in the entire country and are hence irreplaceable. Based on the principles of their comparative ecological significance, extent and range, uniqueness etc. an attempt has been made to score these types on a scale of 1-100.

- **Forest Cover:**

Forest cover density is an important parameter for assessing the health of a forest ecosystem. Biennial estimates of forest cover in country are made by Forest Survey of India and presented in India State of Forest Report (ISFR). As per ISFR 2011, very dense forests (having crown density more than 70 %) constitute only 2.54% of the geographical area, while moderately dense forest (having crown density from 40 % to 70 %) and open forest (having crown density from 10 % to 40 %) are 9.76% and 8.75% respectively.

- **Landscape Integrity**

Integrity of landscape is an important factor to ensure integration of various elements of habitats, thereby fulfilling the requirement of connectivity, livelihoods and contiguity among them, besides lending aesthetic values. The world over, landscape approach is being adopted in land resources management and conservation. From biodiversity prospective also, it provides necessary gradients for species movement and their dispersion, thus ensuring their sustainability. Based on the land-use pattern and vegetation, some areas representing integrity of landscape, therefore, need to be protected for aforesaid reasons.

- **Hydrological Value:**

Forests play important role in maintenance of hydrological cycle. Water is regarded as one of the important products of the forests. Maintenance of forest cover in catchment area of first order perennial streams is important for survival of these streams.

- **Wildlife Value:**

The country has a network of protected areas (PAN) in its forests. Although, global average for PAN coverage is 12%, India has only 4.9% of its geographical area under PAN comprising notified sanctuaries and national parks. These areas enjoy legal protection under Wild Life (Protection) Act, 1972 and specific provisions thereto, prohibit diversion of these areas for activities which are ecologically incompatible and may adversely affect their integrity. These PAs should therefore, be treated as inviolate. However, besides the protected areas, there are

corridors that connect these and special wildlife habitat such as Nvetlands, breeding sites of important bird species, congregation sites which also need to be conserved and preserved for the persiStence of biodiversity. Based on these considerations, scoring criteria have been developed for assigning wildlife values to a site.

Assigning Score for Each Parameter

Forest Cover

1. The FSI estimates forest cover of the country at an interval of every two years and publishes it in the form of State of Forest Reports.
2. Score for forest cover will be average of the gross forest cover and weighted forest cover, both expressed as fraction of the total area, multiplied by one hundred.
3. Gross forest cover will be the sum-total of the area of the open forest, moderately dense forests and the very dense forests³.
4. Based on the functional value and abundance/rarity, each forest type has been assigned a score on 0 to 100 scale.
5. This region comes under Southern Dry Mixed Deciduous Forest and is scored at 40 as the area mainly consists of dry shrubs & grasses along with very little canopy.

Forest Type

1. FSI has prepared forest type map by mapping of 178 forest types (of natural origin) and plantations/ trees outside forests available in the country.
2. Based on the functional value and abundance/rarity, each forest type has been assigned a score on 0 to 100 scale.
3. This region comes under Southern Dry Mixed Deciduous Forest and is scored at 40 as the area mainly consists of dry shrubs & grasses along with very little canopy.

Wildlife Value

1. All protected areas notified under Wild Life (Protection) Act, 1972 would automatically be categorised as inviolate. However, the score for wildlife value of areas falling outside PAN would be based on its intrinsic value as wildlife habitat.
2. This areas is located outside the protected area network but having presence of more than 5 Schedule-I wildlife species and hence the total score of this area is 60.

Landscape Integrity

1. Depending on the level of fragmentation, size and distance from boundary of the un-fragmented landscapes in which these areas are located, a score of 0 to 100 scale will be assigned.
2. As this area is located in the totally fragmented landscapes having not a single un-fragmented patch of size more than 5.00 hectare within and 2 km distance from boundary of the cell, the score is 0.

Hydrological Value

1. The score for hydrological value of an area will be based on utility of area as catchment for a perennial/seasonal stream/river, economic importance of the river/ streams fed by the catchment and distance from river/stream/wetland bank etc.
2. As this area is located in catchment area of perennial rivers having no hydro power/ irrigation/multi-purpose projects on them and also not being a part of the catchment area of a first order perennial stream the score is 55.

Cumulative Value:

Averaging the score of forest cover (40), forest type (40), wildlife value (60), landscape integrity (0) & hydrological value (55), the total score of the area is 39.

4.1.1.18 Mitigation

The mitigation measures shall be implemented by each individual project based on its applicability to the activities and processes. The project authorities set shall supervise and monitor the performance of all project contractors during construction.

Tree Felling

All projects envisaged in future (Industrial and/or Residential) shall ensure that no felling of trees is taken up unless necessary, however the wherever possible trees shall be transplanted the construction contractors shall be instructed to avoid tree cutting and avoid disturbance to ecology to the extent possible;

Emphasis will be on growing nesting and birds, butterflies, insect and other fauna attracting trees while development of green belt

In addition, the awareness program will be conducted for site incharge, labours, drivers & local community about the ecology & biodiversity so as to minimize any potential impacts due to their unawareness

No hunting activity shall be permitted within and around the delineated area and strict guidelines will be given to contractors to ensure that such activities are not allowed;

All project proponents shall ensure implementation of measures to control silt/sediments during construction phase and special attention should be given to containment systems in project-related dumping-sites to prevent leaching of foreign materials into the surrounding environment;

The project activities shall ensure that storage of raw material and debris are kept away from water bodies, streams and run off areas to avoid any increase in turbidity or sedimentation in the key rivers of the area.

The impact of the construction activities on the existing fields in the vicinity of the project site will be pronounced in the form of dust generation from the various activities such as excavation, site levelling etc. Various measures such as use of water sprinklers for dust suppression and the wetting of the stockpile have been suggested to minimize the impact due to the dust generation from the various activities during the construction phase.

Disturbance due to Noise and Visual Intrusions

Minimum levels of noise during construction activities shall be maintained, illumination and night operations will be restricted;

Ensure measures as suggested for ambient air quality and traffic and transport of material to minimize impacts on existing ecology at the site and its surroundings.

Significance of Impact

As the project site doesn't harbor endangered/threatened flora and fauna as per the Red Book and the Wildlife Protection Act 1972, the severity of the impact is 'Low' (1), the extent of the impact is within the project boundary the same is categorized as 'Low' (1) and as the duration of the impact is during the entire construction phase the same is categorized as 'Medium' (2), resulting in the overall significance of the impact being 'Low'.

Similarly, the cumulative score according to the broad principles used for identifying pristine areas, the score totals to 39. This indicates that the total impact on the area is low.

Severity of Impact	1	Extent of Impact	1	Duration of Impact	2
Impact Significance = 2 i.e. Low					

4.3.8 Cultural Heritage

There is one dargah titled 'Hazrat Syed Badruddin Hussaini Dargah' which is located at 1 km outside from the boundary of the T4 parcel. The said dargah / religious structure is not a notified structure by Archaeological Survey of India. Extensive due diligence has been accorded while purchasing the land for the project site which excludes the said Dargah. As said dargah / religious structure is not a notified structure by Archaeological Survey of India, the severity of the impact has been classified as 'Low'(1), Also the overall impact is low.

4.4 Impacts and Mitigations – Operations Phase

4.4.1 Impact of the project traffic on the surrounding roads

The major surrounding roads in the vicinity of the project site which will be affected due to the project traffic are tabulated in the section below:

Affected Road	Existing Peak Hour Vol in 2018 (PCU/h)	Existing Peak Hour Vol projected to 2029 (PCU/h)	Generated Traffic due to proposed development (PCU/h)	Total Peak Hour Vol post development 2029 (PCU/h)	Total Peak Hour Vol after 5 years (PCU/h)	Total Peak Hour Vol after 10 years (PCU/h)	Total Peak Hour Vol after 15 years (PCU/h)	% Impact due to development
Pen - Khopoli WB / SH-88	1486	3292	853	3719	5680	8239	11829	23%
Pen - Khopoli EB / Dhamani Rd	1486	3292	832	3708	5656	8203	11777	22%
SH 104 Pen Bypass	1486	3292	831	3708	5656	8202	11776	22%
NH-66 NB (Two way)	5000	11078	882	11519	16890	24336	34937	8%
NH-66 SB (Two way)	5000	11078	821	11488	16821	24231	34787	7%

Ambivali Road / Balavali Road	149	329	492	575	1023	1518	2179	86%
Davansar Road	149	329	391	525	910	1345	1931	75%
Mumbai-Pune Expressway	6534	14477	40	14497	20828	29906	42934	0.3%
Old NH-4	3442	7626	9	7630	10958	15732	22586	0.1%

The tabulated data reflects that the major affected roads are Pen-Khopoli WB/ SH-88, Pen Khopoli EB/Dhamani road, SH 104 Pen Bypass. The percentage impact due to development of the Orange Smart City on the SH-88, Dhamani road and SH-104 is 23%, 22% and 22% respectively. The capacity analysis of the surrounding roads was also conducted with the level of the service of the roads keeping in view the project traffic due to the Orange Smart City. The capacity analysis of the adjoining roads is tabulated in the section below:

Road	Base Capacity (PCU/h)	Adjustment factor for c/w (f_w)	Adjustment factor for paved shoulder (f_{ps})	Adjustment factor for directional split (f_{ds})	Adjustment factor for road geometry (f_{ds})	Capacity, C (PCU/h)	Existing Vol Estimate, V (PCU/h)	V / C	Existing LOS
Pen - Khopoli WB /SH-88	1754	0.95	1.22	1	1	2033	1486	0.73	D
Pen - Khopoli EB / Dhamani Rd	1754	0.95	1.22	1	1	2033	1486	0.73	D
SH 104 Pen Bypass	1754	0.8	1.2	1	1	1684	1486	0.88	E
NH-66	2434	1.14	1.55	1	1	4301	5000	1.16	F
Mumbai-Pune Expressway (Pune to Mumbai)	7370	1	1	1	1	7370	3267	0.44	B
Mumbai-Pune Expressway (Mumbai to Pune)	5245	1	1	1	1	5245	3267	0.62	C
Old NH-4 (Pune to Mumbai)	3636	1	1	1	1	3636	1721	0.47	C
Old NH-4 (Mumbai to Pune)	3632	1	1	1	1	3632	1721	0.47	C

The tabulated data reflects that the existing level of service for adjoining roads varies from B to F wherein LOS 'B' to LOS 'F' represents the best to the worst conditions in terms of catering to the traffic. In this context the Mumbai - Pune Express way has the LOS 'B' representing the best roads conditions w.r.t catering to the traffic volume while NH-66 has the relatively difficult conditions w.r.t catering to the traffic volume.

4.4.2 Ambient Air Quality

Though the project operations commence from the year 2029, 2035 also has been considered for the purposes of air quality modelling exercise. The major source of air pollution during the operation phase is the traffic plying on the roads which include the project traffic. Also, the

D.G sets used as the back up power source will also contribute to the air emissions. The traffic on following roads is considered for impact assessment:

- Balavali Road
- NH-66
- SH-88

The following table presents the emission rates from the traffic movement on these roads including the project traffic. The Euro IV emission factors have been considered for estimating the emission from the traffic.

Table 4-12 : Emission due to the projected traffic in 2029 and 2035

Sr No	Year	Road	No of vehicles (vehicles/Hour)							Emission Factor (g/s/sq.m)		
			2-W	3-W	4-W	LCV	Bus	Truck	Total	CO	Nox	PM10
1	2029	Balavali Road	983	246	249	0	62	0	1540	1.30E-04	2.48E-05	2.46E-06
2	2029	NH66	2136.5	363	2968	195	156	320.5	6139	1.57E-04	5.62E-05	1.09E-05
3	2029	SH88	1127	231	1029.5	107	79	199.5	2773	7.97E-05	3.10E-05	6.33E-06
4	2035	Balavali Road	1111	278	298	0	72	0	1759	1.35E-04	2.84E-05	2.83E-06
5	2035	NH66	3929.5	718	4770	365	282	564.5	10629	2.68E-04	1.01E-04	1.94E-05
6	2035	SH88	2351	509	1772.5	227	163	298	5320	1.53E-04	5.62E-05	1.04E-05

4.1.1.19 Prediction for Year 2029

The resultant concentrations of CO, NOx and PM10 are presented in Table 4-13.

Table 4-13 : Resultant concentrations of CO, NOx and PM₁₀ (Year 2029)

Emission Prediction for 2029									
	CO µg/m3			NOx, µg/m3			PM10, µg/m3		
Receptor	Baseline	Predicted	Total	Baseline	Predicted	Total	Baseline	Predicted	Total
AQ1	650	106.252	756.25	50.23	12.074	62.3	50.23	2.312	52.54
AQ2	0	55.912	55.91	22.37	6.803	29.17	53.43	1.251	54.68
AQ3	0	131.229	131.23	23.12	14.685	37.81	49.32	3.621	52.94
AQ4	600	95.265	695.27	28.23	12.454	40.68	60.81	2.405	63.22
AQ5	0	1224.204	1224.2	22.23	80.268	102.5	42.73	11.242	53.97
AQ6	0	77.182	77.18	20.3	7.757	28.06	43.11	1.852	44.96
AQ7	400	98.126	498.13	29.12	23.415	52.54	56.59	2.704	59.29
AQ8	0	134.7	134.7	20.2	16.586	36.79	40.03	3.132	43.16
AQ9	0	60.176	60.18	22.35	7.473	29.82	41.1	1.793	42.89
AQ10	400	44.153	444.15	28.84	19.968	48.81	64.11	1.407	65.52
AQ11	0	61.029	61.03	22.35	9.792	32.14	41.09	1.984	43.07
AQ12	0	52.726	52.73	23.46	8.831	32.29	52.95	1.228	54.18

AQ13	0	111.675	111.68	24.54	11.72	36.26	52.19	2.811	55
AQ14	0	16.271	16.27	23.43	3.165	26.6	49.3	0.539	49.84
NAAQS	2000 $\mu\text{g}/\text{m}^3$			80 $\mu\text{g}/\text{m}^3$			100 $\mu\text{g}/\text{m}^3$		

Results and discussion

a) CO

The Table 4-13 reflects that the minimum resultant CO concentrations was at the location AQ14 ($16.27 \mu\text{g}/\text{m}^3$) while the maximum resultant concentration was at AQ5 ($1224 \mu\text{g}/\text{m}^3$). The maximum resultant concentration of CO was found to be within the NAAQS limit for CO ($2000 \mu\text{g}/\text{m}^3$) for the year 2029.

The isopleths of CO for the year 2029 are depicted in Figure 4-5.

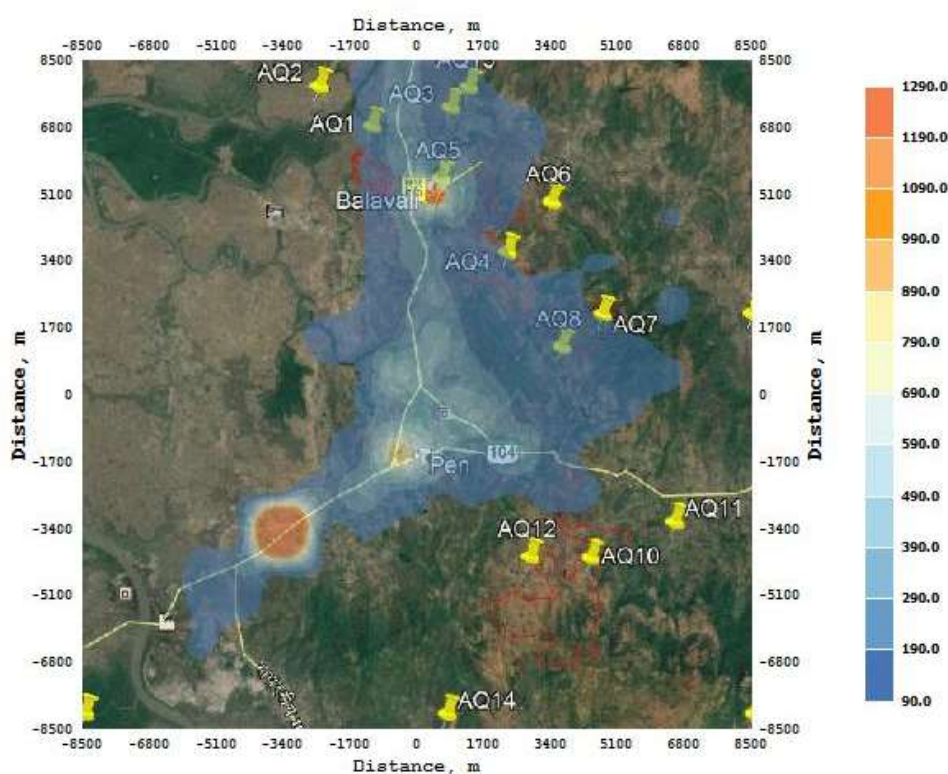


Figure 4-5 : Isopleths depicting the resultant concentrations of CO due to combined operations of the D.G sets and traffic -2029

b) NOx

The Table 4-13 reflects that the minimum resultant NOx concentrations was at the location AQ14 ($26.6 \mu\text{g}/\text{m}^3$) while the maximum resultant concentration was at AQ5 ($102.5 \mu\text{g}/\text{m}^3$). The maximum resultant concentration of NOx was found to be exceeding the NAAQS limit. ($80 \mu\text{g}/\text{m}^3$) for the year 2029.

The isopleths of NOx for the year 2029 are depicted in Figure 4-6.

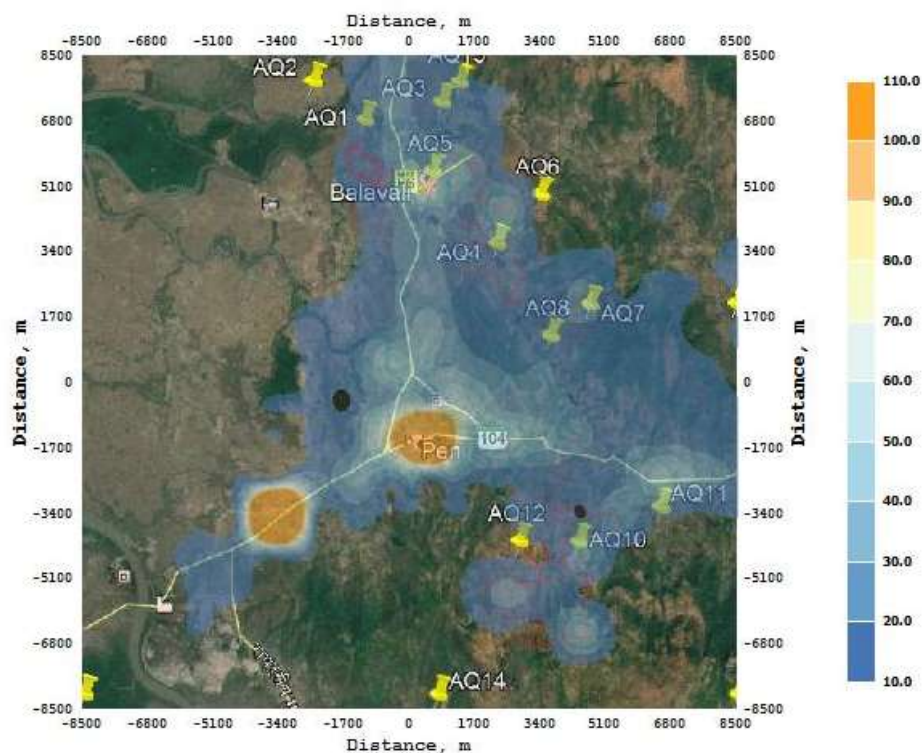


Figure 4-6 : Isopleths depicting the resultant concentrations of NO_x due to combined operations of the D.G sets and traffic in 2029

c) PM₁₀

The Table 4-13 reflects that the minimum resultant PM₁₀ concentrations was at the location AQ9 (42.89 $\mu\text{g}/\text{m}^3$) while the maximum resultant concentration was at AQ10 (65.52 $\mu\text{g}/\text{m}^3$). The maximum resultant concentration of NO_x was found to be within the NAAQS limit. (100 $\mu\text{g}/\text{m}^3$) for the year 2029.

The isopleths of PM₁₀ for the year 2029 are depicted in Figure 4-7.

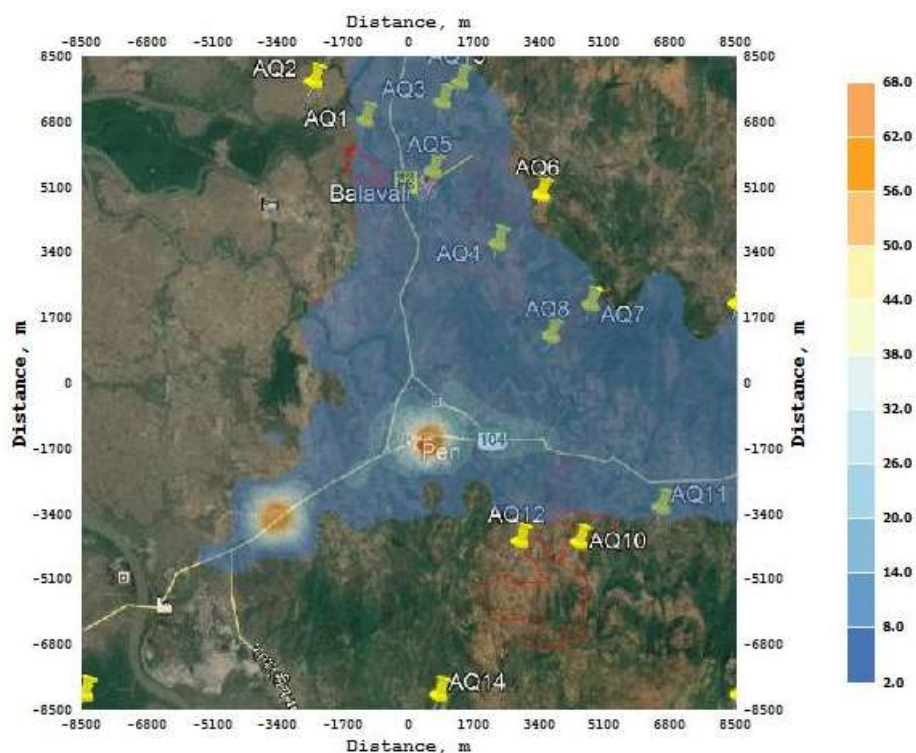


Figure 4-7 : Isopleths depicting the resultant concentrations of PM₁₀ due to combined operations of the D.G sets and traffic in 2029

4.1.1.20 Prediction for Year 2035

The resultant concentrations of CO, NO_x and PM₁₀ for the year 2035 are presented in Table 4-14.

Table 4-14 : Resultant concentrations of CO, NO_x and PM₁₀ (Year 2035)

Emission Prediction for 2035									
	CO $\mu\text{g}/\text{m}^3$			NO _x , $\mu\text{g}/\text{m}^3$			PM ₁₀ , $\mu\text{g}/\text{m}^3$		
Receptor	Baseline	Predicted	Total	Baseline	Predicted	Total	Baseline	Predicted	Total
AQ1	650	196.224	846.22	50.23	21.156	71.39	50.23	4	54.23
AQ2	0	102.772	102.77	22.37	11.854	34.22	53.43	2.105	55.54
AQ3	0	221.46	221.46	23.12	26.247	49.37	49.32	6.265	55.59
AQ4	600	169.53	769.53	28.23	20.537	48.77	60.81	4.193	65
AQ5	0	1357.852	1357.85	22.23	103.03	125.26	42.73	15.335	58.07
AQ6	0	131.578	131.58	20.3	14.208	34.51	43.11	3.252	46.36
AQ7	400	172.573	572.57	29.12	32.38	61.5	56.59	4.299	60.89
AQ8	0	244.98	244.98	20.2	29.549	49.75	40.03	5.792	45.82
AQ9	0	115.281	115.28	22.35	13.347	35.7	41.1	3.238	44.34
AQ10	400	90.532	490.53	28.84	22.035	50.88	64.11	2.357	66.47
AQ11	0	138.303	138.3	22.35	17.638	39.99	41.09	3.403	44.49
AQ12	0	103.475	103.48	23.46	13.999	37.46	52.95	2.12	55.07

Emission Prediction for 2035									
	CO $\mu\text{g}/\text{m}^3$			NO _x , $\mu\text{g}/\text{m}^3$			PM ₁₀ , $\mu\text{g}/\text{m}^3$		
AQ13	0	185.695	185.7	24.54	20.867	45.41	52.19	4.98	57.17
AQ14	0	38.731	38.73	23.43	5.221	28.65	49.3	0.931	50.23
NAAQS	2000 $\mu\text{g}/\text{m}^3$			80 $\mu\text{g}/\text{m}^3$			100 $\mu\text{g}/\text{m}^3$		

Results and discussion

a) CO

The Table 4-14 reflects that the minimum resultant CO concentrations was at the location AQ14 ($38.73 \mu\text{g}/\text{m}^3$) while the maximum resultant concentration was at AQ5 ($1357 \mu\text{g}/\text{m}^3$). The maximum resultant concentration of CO was found to be within the NAAQS limit for CO ($2000 \mu\text{g}/\text{m}^3$) for the year 2035.

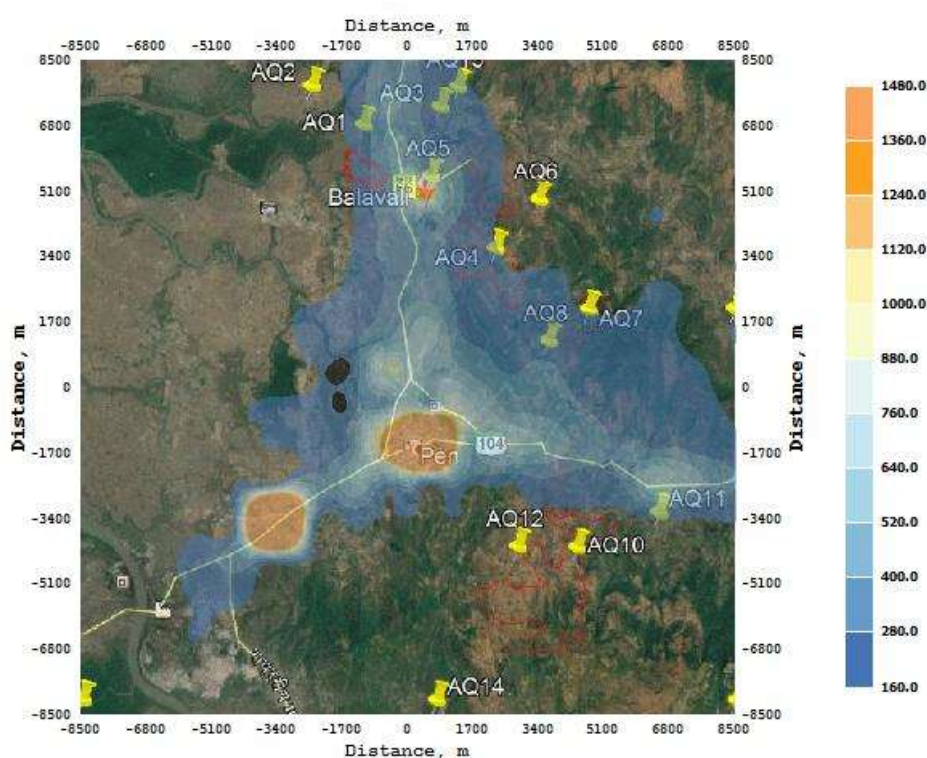


Figure 4-8 : Isopleths depicting the resultant concentrations of CO due to combined operations of the D.G sets and traffic in 2035

b) NO_x

The Table 4-14 reflects that the minimum resultant NO_x concentrations was at the location AQ14 ($28.65 \mu\text{g}/\text{m}^3$) while the maximum resultant concentration was at AQ5 ($125.26 \mu\text{g}/\text{m}^3$). The maximum resultant concentration of NO_x was found to exceed the NAAQS limit for NO_x ($80 \mu\text{g}/\text{m}^3$) for the year 2035.

The isopleths of NO_x for the year 2035 are depicted in Figure 4-9

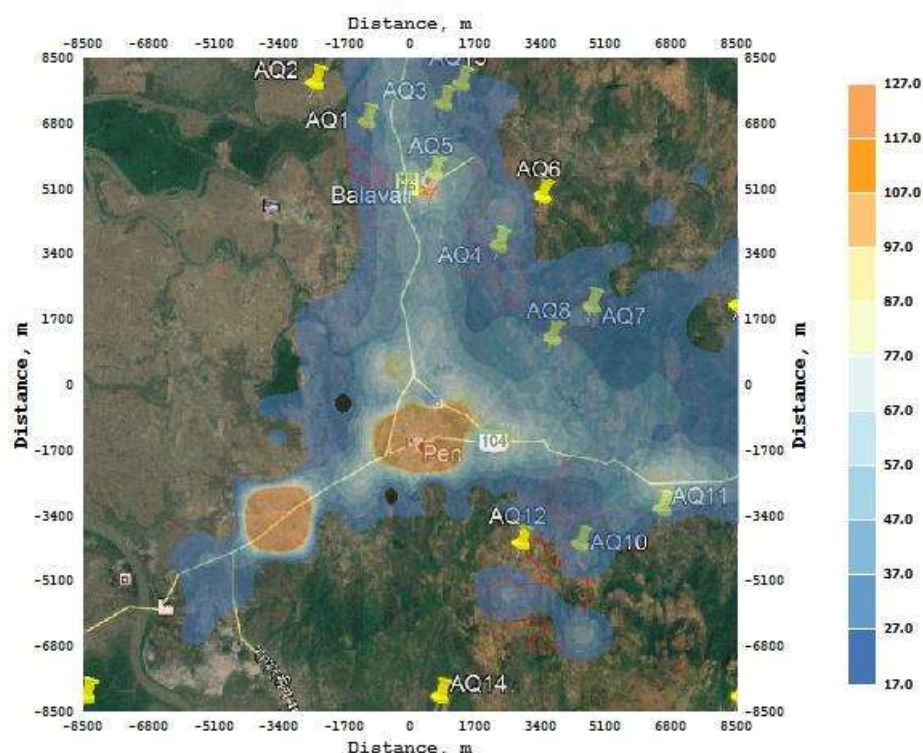


Figure 4-9 : Isopleths depicting the resultant concentrations of NO_x due to combined operations of the D.G sets and traffic in 2035

c) PM₁₀

The Table 4-14 reflects that the minimum resultant PM₁₀ concentrations was at the location AQ9 (44.34 $\mu\text{g}/\text{m}^3$) while the maximum resultant concentration was at AQ10 (66.47 $\mu\text{g}/\text{m}^3$). The maximum resultant concentration of PM₁₀ was within the NAAQS limit for PM₁₀ (100 $\mu\text{g}/\text{m}^3$) for the year 2035.

The isopleths of PM₁₀ for the year 2035 are depicted in Figure 4-10.

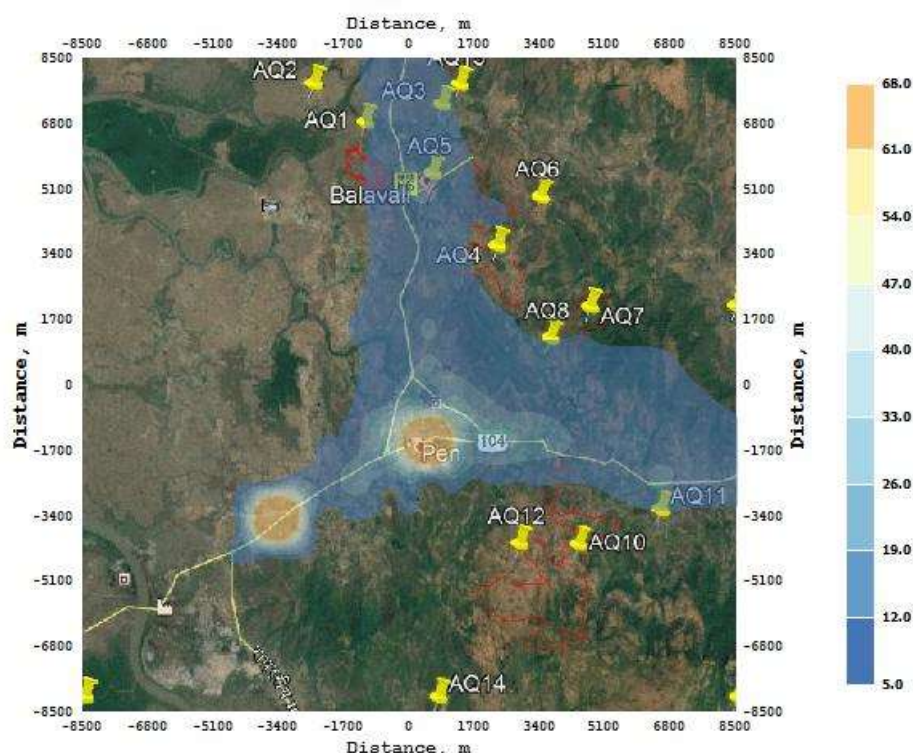


Figure 4-10 : Isopleths depicting the resultant concentrations of PM10 due to combined operations of the D.G sets and traffic in 2035

Significance of the Impact

As per the modelling results, the predicted concentrations of NO_x for year 2035 are not exceeding the NAAQS standard during the operation phase except at AQ5, therefore the severity of the impact is moderate (2), also as the extent of the impact is within the 10 km of the project boundary the extent is categorized as Moderate (2) and as the duration of the impact is regular, the same is categorized as high (3) and subsequently the impact has been ranked as 'Moderate'.

Severity of Impact	2	Extent of Impact	2	Duration of Impact	3
Impact Significance = 12 i.e. Moderate					

Mitigation Measures

- Comprehensive planning has been undertaken as a part of master plan development to mitigate impacts due to industries.
- Planning ensures that the proposed Industrial areas and existing residential are placed in such a way to avoid the impact of air pollution on people.
- Vehicular traffic management plan to be implemented so as to maintain the smooth traffic flow and avoid congestion during normal operations.
- Adequate buffer to be provided for Residential areas and industries.

- Individual industries will be required to obtain adequate approvals such as Consent to Establish / Consent to Operate or Environment Clearance from MPCB / SEIAA / MoEF.
- All emission sources to be provided with adequate stack height as per CPCB / MoEF norms.
- Low emission fuels to be used by industries.
- Air pollution control equipment to be deployed by industries.
- Good housekeeping to be practiced.
- PP to organize seminars and Capacity Building training programmes about the best practices in different industrial sectors.
- PP in association with the MPCB to regularly monitor the environmental performance of the industries.
- CETP – to be provided with adequate ventilation system to prevent emissions such as HAPs, Odour etc. The adequate management practices to be adopted to control and mitigate the air emissions during CETP operations;
- Waste Management Facility: Odour control measures to be adopted. The adequate management practices to be adopted to control and mitigate the air emissions during facility operations;
- All maintenance activities should ensure that the dust control measures are applied.
- It is seen from the results of the air quality modeling that NO_x is exceeding the prescribed NAAQS standards at some locations. The proponent has proposed the use of electric vehicles within the OSC with the charging points to mitigate the impact of NO_x.
- Under the National Electric Mobility Mission Plan (NEMP) the government is laying emphasis on the adoption of electrical vehicles which will reduce the emissions by indirectly lessening the pollution load on the environment.
- The BS VI emission standards are planned to be enforced by government by 2020 which will result in emission reduction significantly.
- The upcoming infrastructural facilities in the vicinity of the project site such as elevated free corridor will result in considerable reduction in the traffic on the adjoining roads which will further reduce the emissions to a large extent.

4.4.3 Water

The potential impact on the water resources and the water quality during the operation phase can arise from the following:

4.1.1.21 Water resources

The water resources can get impacted from the residential and commercial establishments (water consumption), industrial establishments (Waste generation and storage, Industrial processes and operations, Water Consumption, Storage of chemicals/ flammables/hazardous materials), operation of the utilities, disposal of the treated effluent from the CETP. The water consumption from each parcel is given in Table 4-15.

Table 4-15: The water consumption from each parcel

Land Parcel	Total Water Demand (MLD)
T1	22.23
T2	4.82
T3	3.67

T4	7.88
Total	38.60

As reflected from the Table 4-13 above, the fresh water requirement for the OSC is 38.60 MLD. The water will be met from the Hetavane Dam. The details of the water supply infrastructure (including dedicated water supply, Water Treatment Plant, Clear water reservoir (GSR) and Clear water pumping station from WTP, intermediate pumping stations etc.) are given in Section 2.23.1 titled “Water Supply Infrastructure”

Significance of the Impact

As the consumption of the water will be continuous in nature, the severity of the impact is classified as Moderate (2), the extent of the impact will be within the 10 km radius of the project boundary the same has been classified as ‘Moderate’ (2) and as the duration of the impact is regular the same has been classified as ‘High’ (3) and subsequently the impact significance has been ranked as Moderate (12).

Severity of Impact	2	Extent of Impact	2	Duration of Impact	3
Impact Significance = 12 i.e. Moderate					

Mitigation Measures

1. Monitoring of unaccounted water and detection of leakage shall be done by providing bulk water meters to measure water consumption, inspection of all consumer meters, fixing of new meters, testing of meters for accuracy, recording of consumptions on installed meters to measure water supplied to the consumers;
2. Leak detection and water auditing shall be done for assessing leaks and losses;

4.1.1.22 Water Quality

The water quality can get potentially deteriorate from the residential and commercial establishments (wastewater generation and waste generation), industrial establishments (effluent generation, waste generation and storage, industrial processes and operations, waste management – liquid and solid waste, influx of population, storage of chemicals/flammables/hazardous materials), operation of the utilities, waste management facilities (waste transportation, waste treatment/ processing, Handling and Storage of wastes, landfilling), CETP and STP.

Sewage:

The total sewage generated and the details of the underground drains and number of STP's per parcel is given in Table 4-14:

Table 4-16: The total sewage generated

Land Parcel	Total Sewage Generation (MLD)	Underground Drains	No of STPs (Area of 3600 m ² each)
T1	11.20	4.9	1
T2	2.54	2.2	1

T3	2.07	2.65	1
T4	5.75	1.8	1
Total	21.56	11.55	4

According to the water balance depicted in Figure -2-26, treated wastewater to the tune of 18.06 MLD from the total amount of 21.34 MLD will be recycled back into the system for non – potable uses such as such as HVAC, horticulture, flushing, etc. thereby minimizing the need for treated potable water. The balance 3.28 MLD of treated wastewater will be stored in holding ponds and given to nearby gram panchayat for use in agricultural fields / discharged in the inland surface water body confirming to the discharge norms of CPCB. OSCIPL will be solely responsible for the maintaining the quality of the treated sewage discharged as per the CPCB norms. The consent from the gram panchayat is given in Annexure-VIII.

Effluent:

The total effluent generation from the industries is given in Table 4-17.

Table 4-17: The total effluent generation from the industries³

Particulars	Category A industries - Effluent generation in MLD*	Agro & Food processing*** Effluent generation in MLD
Effluent Generations	0.43	1

Total Effluent treated	1.43 MLD
Proposed Capacity of CETP including MEE	2.0 MLD

Assumptions:

*Cat A industries - Bulk Drug and Drug Intermediate considered for the calculation

**Considered only Engg. Industries with allied Tier 1 and 2 Suppliers

Considered 2 plots of 5 Acres each for Poultry and Fish Processing wherein CETP is required

For the Electronics and Semiconductor industry offsite effluent take away and treatment is preferred hence not considered in CETP calculation

The total effluent amounting to 1.43 MLD will be generated from the category 'A' industries (Bulk Drug and Drug Intermediates) and Agro industries (Poultry and Fish Processing etc.), out of which 1.18 MLD will be treated in CETP which will be Zero Liquid discharge unit.

³ As per DPR of OSC prepared by MITCON

Significance of the impact

As the sewage and effluent generation will be continuous in nature, the severity of the impact is classified as Moderate (2), the extent of the impact will be within the 10 km radius from the project boundary the same has been classified as ‘Moderate’ (2) and as the duration of the impact is regular the same has been classified as ‘High’ (3) and subsequently the impact has been ranked as Moderate (12).

Severity of Impact	2	Extent of Impact	2	Duration of Impact	3
Impact Significance = 12 i.e. Moderate					

Mitigation Measures:

The following general mitigation measures are proposed for alleviating the impact of the sewage and effluent generation:

- Minimize flow variation from the mean flow
- Storing of oil wastes in lagoons should be minimized in order to avoid possible contamination of the ground water system.
- All effluents containing acid/alkali/organic/toxic wastes should be properly treated.
- Monitoring of ground water
- For wastes containing high TDS, treatment methods include removal of liquid and disposal of residue by controlled landfilling to avoid any possible leaching of the fills
- Neutralization and sedimentation of wastewaters, where applicable
- Dewatering of sludges and appropriate disposal of solids
- In case of oil waste, oil separation before treatment and discharge into the environment
- By controlling discharge of sanitary sewage and industrial waste into the environment.

For synthetic Organic chemicals industries:

- Develop spill prevention plans in case of chemical discharges and spills
- Develop traps and containment system and chemically treat discharges on site
- Treated wastewater (such as sewage, industrial wastes, or stored surface runoffs) can be used as cooling water makeup.

4.1.1.23 Impact due to the abstraction of ground water

OSC will not extract / abstract ground water for its routine operations and also make it binding on the individual industries, residential and commercial areas to discourage the use of ground water thereby minimizing the impact on the ground water. As the severity of the impact is ‘Low’, the extent is also Low and the duration is also ‘Low’, the overall impact rating is classified as ‘Low’

Severity of Impact	1	Extent of Impact	1	Duration of Impact	1
Impact Significance = 1 i.e. Low					

Additional measures

Adequate water supply shall be made available to individual projects to discourage the use of groundwater.

The proposed developments will result in increase in paved areas, thereby resulting in increased runoff. During planning stage, it has been suggested that the increased runoff shall be tapped for rainwater harvesting.

4.1.1.24 Impact due to the increased surface runoff

The development of the plot as Industrial Integrated Township will result in change in land use which thereby results in increased surface run off.

As the proposed run off will be intermittent only peaking during the rainy season, the severity has been categorized as 'Low' (1), the extent of the impact will be beyond the 10 km radius of the project site boundary, the extent has been categorized as 'High' (3) and as the duration will be periodic the same will be Moderate (2) resulting in the impact ranking as 'Low'.

Severity of Impact	1	Extent of Impact	3	Duration of Impact	2
Impact Significance = 6 i.e. Moderate					

Mitigation Measures:

There is a direct relationship between the velocity of water flowing over exposed soil and the rate of erosion. Installation of various artificial recharge structures on the site to retard the overland water flow is an effective measure to reduce erosion in areas where high water flows are expected. It is desirable to minimize continuous slopes where flowing water can scour the top soil and result in erosion.

Even though the proposed activity shall occupy 1042 acres of land, the covered area occupied by industrial sheds, residential quarters/ colonies is going to be less than 47%. The agriculture in this neighborhood is principally rain-fed single crop agriculture. Still, it is advised to develop a green belt within the project area.

The development of the plot shall result in increase in covered area thereby to boost surface run off; but it is also advised to be countered with rainwater harvesting within the project premises and surrounding area.

Working in Waterways, Floodplains and Creek: The site Govirle is located along bank of creek. Hence, it is necessary to adopt appropriate precautionary measures. It is advised to develop the low-lying plots as green belts so as to have minimal disturbance in case of any mishap.

Rainwater Harvesting Potential for Integrated Industry Hub

The run off calculations and the rainwater harvesting potential in the OSC is given in the section below:

	Area (Sq.Mtr)	Rainfall (m)	Runoff Co-Eff	Total Yearly Rainfall (Cu.Mtr)
T1	1053055	3.492	0.9	3309540
T2	202021	3.492	0.9	634912
T3	141645	3.492	0.9	445162
T4	276258	3.492	0.9	868225
Total	1672979	3.492	0.9	5257839

The tables in the above section reflect that the post project runoff from the various land uses in the OSC amounts to yearly total of 5257839 cu.m. Thus, the OSC project may attain self-sufficiency on water front if it adopts rainwater harvesting to maximum possible extent.

As the study area is occupying a steeply sloping, hilly terrain, it forms a prominent run off zone. Hence it is advised to recharge the groundwater artificially by nalla bunds, check dams, gabions, etc. so as to induce the recharge in open areas and to adopt rooftop rainwater harvesting in industrial and residential areas for artificial recharge.

Even though these structures will not harvest incident rainfall significantly, still they will help to improve the water balance in this region and also contribute in soil and water conservation.

Significance of Impact

Severity of Impact	2	Extent of Impact	2	Duration of Impact	2
Impact Significance = 6 i.e. Moderate					

4.4.4 Soil

The activities that can have potential impacts on the soil quality are residential and commercial establishments (waste water generation, waste generation), Industrial establishments (Effluent Generation, Waste generation and storage, Industrial processes and operations, Waste Management- Liquid and Solid Waste ,Storage of Chemicals/flammables/hazardous material), Waste Management facilities (Waste transportation, Waste treatment/processing, Handling and Storage of wastes , Landfilling), CETP /STP (Wastewater collection (Tankers/ Pipelines, Treatment & other operations, Disposal)

As the generation of the solid /industrial waste will be intermittent in nature, the severity has been classified as 'Low' (1) , the extent of the impact will be restricted to the project site the same has been categorized as 'Low' (1) and as the duration of the impact will be periodic, the same has been categorized as 'Moderate' (2) resulting in the impact ranking as 'Low'

Significance of Impact

Severity of Impact	1	Extent of Impact	1	Duration of Impact	2
Impact Significance = 2 i.e. Low					

4.1.1.25 Mitigation Measures

Individual industries will dispose of their hazardous waste through Mumbai Waste Management Ltd (MWML). The letter of intent from the MWML has been enclosed as Annexure-IX. The sewage from the OSC will be treated in four STPs and then used for non-potable uses such as horticulture, HVAC makeup, flushing.

The domestic solid waste from the OSC will be properly segregated at source into biodegradable, non-biodegradable, and inerts. The biodegradable waste will be composted, while inerts will be landfilled within OSC thereby minimizing the impact on the soil quality.

Individual IT industries will tie up with authorized e-waste recycler to dispose off the same.

The hazardous waste oil from the D.G. sets will be sent to MWML for disposal

4.4.5 Noise

During operational phase, the only sources going to be present at the project site are the DG Sets, the Sewage treatment plant which would have multiple Blowers, Pumps etc., the combined noise of which is assumed at 90 dB after installation of Acoustical Enclosures for Blowers and Pumps, and the vehicular movement, the noise contribution of which is minimal.

The impact of the noise environment from the above noise sources has been gauged through the noise modelling study results of which are presented in below Table 4-18.

Table 4-18: Results of noise modelling study (Operational Phase)

Operational Phase								
S.N o.	Noise Generating areas	Noise level at source (dBA)		Anticipated Noise level (dBA)				
				N7 : Belawade Village	N5 : Mungoshi Village	N4 : Ambivali Village	N3 : Kopar Village	N10 : Wirant Village
		(at 1 meter dist)	Distance from project site (m)	50	100	150	200	200
1	STP (Blowers, Pumps) with acoustical enclosures	90		56.0	50.0	46.5	44.0	44.0
2	DG Sets (Multiple)	85		51.0	45.0	41.5	39.0	39.0
3	Vehicular Movement	80		46.0	40.0	36.5	34.0	34.0
	Cumulative Noise Levels			57.5	51.5	48.0	45.5	45.5
	Attenuation due to Green Belt and acoustic enclosure			20.0	20.0	20.0	20.0	20.0
	Existing Noise Levels (day-time)			42.8	43.7	43.4	42.6	42.7
	Cumulative Noise Levels (DAY)			43.9	44.0	43.5	42.7	42.8

During the operational phase, increase of approximately 0.1 dB ~ 1.1 dB is predicted at the Noise monitoring locations, depending on their baseline noise levels. For the Belawade Village located at 50 meters from the project site, and allowable CPCB noise level of 55 dB, it is predicted that there would not be an increase beyond 1.1 dB for any distance beyond 50 meters from the project site, and the Sound Pressure Level even during the operational Phase would be within the allowable CPCB limit.

Contribution due to vehicular movement is likely to be even less than 80 dB, and it would be significant only during morning and evening peak hours, hence no mitigations are required for this source of noise.

During the operational phase, the impact on the noise environment is negligible (0.1~1.1 dB for distances of up to 200 meters from the project site).

Beyond a distance of 250 meters from the project site, there will not be any increase in the Sound Pressure Levels.

Increase of approximately 6 dB was predicted at Noise Monitoring locations located within 50 meters from the project boundary during the construction phase. Beyond 100 meters, the increase predicted is 2.1 dB at 100 meters, 1.1 dB at 150 meters and 0.8 dB beyond 200 meters distance from project boundary. This increase would be controlled by installing Sound-Reflective corrugated sheets as Noise reflective barriers around the project site boundary.

Significance of the Impact

As the predicted values of the noise levels are within the 90% of the existing standards, the severity of the impact has been categorized as 'Low' (1), the extent of the impact is within the 10 km radius of the project site hence, the same has been categorized as Moderate (2) and as the duration of the impact is regular the same has been categorized as 'High' (3) resulting in the impact ranking to be 'Medium' (6)

Severity of Impact	1	Extent of Impact	2	Duration of Impact	3
Impact Significance = 6 i.e. Moderate					

Mitigation Measures

The mitigation measures are tabulated below:

Table 4-19: Mitigation measures during operational phase

Sr.	Machinery / Equipment Description	Predicted SPL at 1 m distance	Mitigations Required
1.	DG Sets (Multiple Numbers)	<85 dB	Diesel Generator Sets are supposed to have Sound Pressure Levels of lesser than 75 dBA when measured at 1 meter distance. However, when multiple DG sets are supposed to be kept close to one another, a single Acoustical Enclosure combined for all the DG Sets is recommended with a minimum Transmission Loss Rating of 30 dBA.
2.	Submersible Pumps	80~85 dB	Submersible type de-watering pumps have lower Sound Pressure Levels than 80 or 85 dB, therefore no mitigations are necessary for this source of noise.
3.	Cranes / Hoists	< 80 dB.	Cranes usually are silent and have noise levels of less than 80 dB in case they are electrically driven and no mitigation is necessary for the same. In case the cranes are driven using an engine, in that case, Acoustical Enclosure with 20 dB Transmission Loss Rating is recommended for the engine and the driving mechanism.

Sr.	Machinery / Equipment Description	Predicted SPL at 1 m distance	Mitigations Required
4.	Sewage Treatment Plant	100 dB	1. STP consists of multiple of blowers and pumps, out of which blowers can generate noise levels exceeding 100 dB. Acoustical Enclosures for STP Blowers are strongly recommended, with 30 dB Transmission Loss Rating.
8.	Additional Mitigations / Care to take	N/A	Sound Reflective barriers to be installed at the boundary of the project site. All people working in the vicinity of the Equipment/Machinery with Sound Pressure Levels higher than 90 dB should wear protective ear plugs to avoid permanent hearing damage.

4.4.6 Ecology

The following section presents the impacts envisaged during the operation phase of the project. The OSC comprises of industrial and residential developments along with commercial, institutional landuses. About 390 acres of industrial area will be developed and will comprise of the following industry mix.

- Engineering
- IT
- Agro
- Life Sciences
- Logistics
- Research
- Development
- Gems and Jewelry
- Electronics and Semi-Conductor
- Services

In general, the major impacts associated with the Operation phase of the development can be summarized under the following areas of impact:

- Alteration of habitats and removal of available habitats by the development of project
- Use of fertilizers & pesticides for maintenance of Golf course grasses
- Operation of the industries, regular traffic residential areas, institutions with events, celebrations

Impact on Flora and Fauna:

The establishment of township project will require the destruction of vegetation project development footprint. Given the limited extent of transformation of the site and the limited land requirement of the development relative to the extent of available intact habitat, the direct loss of habitat would be minimal for most faunal species and there do not appear to be any species which would be significantly impacted by the direct loss of habitat especially in light of the green belt development on 254.95 acres.

Fragmentation poses a greater threat as some species may avoid open areas or become vulnerable to predation while traversing open ground

Regular events with loud music can negatively affect the birds and other animals found within the surrounding habitats. The project influence area is known to harbour a large number of birds including migratory species. However, considering the fact that beyond a distance of 250 meters from the project site, there will not be any increase in the Sound Pressure Levels no impact is envisaged.

The aquatic and marine fauna from the water bodies may be threatened by the water quality deterioration coming largely from industrial wastes if not managed properly

Mangroves found along the periphery of the project may be threatened from siltation and damage.

Significance of the Impact

The impact will be low considering the less polluting nature of the industries and the provision of the extensive green belt plan which will further offset the adverse impacts due to the operation of the OSC project.

Severity of Impact	-	Extent of Impact	-	Duration of Impact	-
Impact Significance = Low					

i. Mitigation Measures

Each individual project to be developed within the OSC will obtain environmental clearance and consents from regulatory authorities as per the relevant Acts and Notifications. Each individual project shall comply with the clearance/consent conditions. The mitigation measures provided shall be implemented by each individual project based on its applicability to the activities and processes.

Wherever the project development activity is in close proximity to forest area, utmost care will be taken that no forest area shall be disturbed while developing / construction & the same shall be kept untouched maintaining the biodiversity of the area maintaining minimum a buffer of atleast 20-100m wherever possible with ecological barriers

The mangrove vegetation fringing the project boundary in the T1 parcel will be protected from all damage following proper measures.

Proposed maintenance of existing ponds within the project site will help the wildlife and more specifically the birds to use the areas

The purpose of landscape planning is to protect the environment, as also to provide the much-needed aesthetic excellence. A diverse wildlife population can be achieved with an integrated landscape composed of lawns, tree, shrub and water features.

Green Belt Development

The proposed green belt development will aid the lost biomass and lead to sustainable development. The green belt will enrich soil organic matter thereby nitrogen. It will be developed to attain maximum attenuation of noise. Green belt will also control temperatures and keep the surroundings cool. It will attract avifauna and create suitable habitat to micro flora and fauna. The green belt will help as a sink to dust and gaseous pollutants. On the whole it will have a positive impact on the environment. In the proposed green belt development scheme mainly fruit bearing, ornamental, medicinal values trees will be planted; which results in enrichment of biodiversity & beautification of area.

The ecological survey has been done to establish the baseline ecological conditions in the project site in order to assess the potential ecological impacts and develop a suitable management plan to mitigate the impact due to the proposed project. This section of report presents the ecological baseline of the project site. There will be a positive impact on the ecology due to the upcoming proposed project.

Extensive plantation and green area development in the area of XXXXX m² is planned in the proposed project along with landscaping. This is hereby ensured that the mostly indigenous/ local plants will be planted all around the periphery of the project area and along the roadsides. Plantations would be of large leaf trees that provide adequate shade and are semi-evergreen to evergreen. The landscape plan showing green area, trees and table of tree species is enclosed. Various native and indigenous trees would be planted for mitigation purpose which includes

Sr. No.	Scientific Name
1	<i>Amorphophallus paeoniifolius</i>
2	<i>Abelmoschus indicus</i>
3	<i>Annona squamosa</i>
4	<i>Artocarpus heterophyllus</i>
5	<i>Carica papaya</i>
6	<i>Citrus lemon</i>
7	<i>Mangifera indica</i>
8	<i>Albizia odoratissima</i>
9	<i>Albizia procera</i>
10	<i>Azadirachta indica</i>
11	<i>Bauhinia variegata</i>
12	<i>Bauhinia purpuria</i>
13	<i>Bambusa arundanaceae</i>
14	<i>Blumea sp.</i>
15	<i>Butea superba</i>

Sr. No.	Scientific Name
16	<i>Butea frondosa</i>
17	<i>Cocos nucifera</i>
18	<i>Eucalyptus sp</i>
19	<i>Delonix regia</i>
20	<i>Leucena leucophloe</i>
21	<i>Abelmoschus esculentus</i>
22	<i>Abrus precatorius</i>
23	<i>Abutilon indicum</i>
24	<i>Acacia Arabica</i>
25	<i>Acacia auriculiformis</i>
26	<i>Acacia leucophloe</i>
27	<i>Achras sapota</i>
28	<i>Acalypha hispida</i>
29	<i>Acanthospermum hispidum</i>
30	<i>Achyranthes aspera</i>
31	<i>Adathoda vasica</i>
32	<i>Adiantum philippense</i>
33	<i>Adenanthera pavonina</i>
34	<i>Aegle marmelos</i>
35	<i>Aegeratum conyzoides</i>
36	<i>Ageratum conyzoides</i>
37	<i>Ailanthes excelsa</i>
38	<i>Albizia odoratissima</i>
39	<i>Albizia procera</i>
40	<i>Aloe barbedensis</i>
41	<i>Allophylus cobbe</i>

Sr. No.	Scientific Name
42	<i>Alternanthera sessilis</i>
43	<i>Alysicarpus hamosus</i>
44	<i>Alysicarpus monilifer</i>
45	<i>Argyreia elliptica</i>
46	<i>Argemone Mexicana</i>
47	<i>Asparagaus racemosus</i>
48	<i>Atalantia monophylla</i>
49	<i>Azadirachta indica</i>
50	<i>Barleria cuspidate</i>
51	<i>Bauhinia racemose</i>
52	<i>Bridelia retusa</i>
53	<i>Blepharis asperima</i>
54	<i>Blumea lacera</i>
55	<i>Bombax ceiba</i>
56	<i>Borreria stricta</i>
57	<i>Bridelia retusa</i>
58	<i>Buchanania lanzan</i>
59	<i>Butea monosperma</i>
60	<i>Caesalpina pulcherima</i>
61	<i>Calotropis procera</i>
62	<i>Canna indicda</i>
63	<i>Calycotropis floribunda</i>
64	<i>Careya arborea</i>
65	<i>Carissa carandus</i>
66	<i>Carissa spinarium</i>
67	<i>Carvia callosa</i>

Sr. No.	Scientific Name
68	<i>Casearia tomentosa</i>
69	<i>Cassia auriculata</i>
70	<i>Cassia obtuse</i>
71	<i>Cassia occidentalis</i>
72	<i>Cassia tora</i>
73	<i>Cassia fistula</i>
74	<i>Catunaregam spinose</i>
75	<i>Calycotropis floribunda</i>
76	<i>Ceiba pentandra</i>
77	<i>Celosia argentea</i>
78	<i>Cestrum noctrunum</i>
79	<i>Chromalaena odorata</i>
80	<i>Chrysanthemum sp</i>
81	<i>Cissus quadrangularis</i>
82	<i>Citrus media</i>
83	<i>Cleome viscose</i>
84	<i>Clematis triloba</i>
85	<i>Cocculus villosa</i>
86	<i>Cocos nucifera</i>
87	<i>Combretum ovalifolium</i>
88	<i>Commelina benghalensis</i>
89	<i>Cordia dichotoma</i>
90	<i>Cordia rothri</i>
91	<i>Crotalaria pallida</i>
92	<i>Crotalaria sp. 2</i>
93	<i>Croton bonplandinum</i>

Sr. No.	Scientific Name
94	<i>Cryptostegia grandiflora</i>
95	<i>Curcuma aromatic</i>
96	<i>Cuscuta reflexa</i>
97	<i>Dalbergia lanceolate</i>
98	<i>Dalbergia sisoo</i>
99	<i>Datura alba</i>
100	<i>Dendrophthe falcate</i>
101	<i>Desmodium gangeticum</i>
102	<i>Desmodium triflorum</i>
103	<i>Diploclisia glaucescens</i>
104	<i>Echinops echinatus</i>
105	<i>Eclipta alba</i>
106	<i>Eclipta prostrate</i>
107	<i>Eichhornia crassipes</i>
108	<i>Emblica officinalis</i>
109	<i>Entada pursaetha</i>
110	<i>Erythrina indica</i>
111	<i>Eupatorium glandulosum</i>
112	<i>Euphorbia nerifolia</i>
113	<i>Euphorbia neruri</i>
114	<i>Euphorbia nivula</i>
115	<i>Ficus asperrima</i>
116	<i>Ficus benghalensis</i>
117	<i>Ficus glomerata</i>
118	<i>Ficus hispida</i>
119	<i>Ficus microcarpa</i>

Sr. No.	Scientific Name
120	<i>Ficus racemosus</i>
121	<i>Ficus religiosa</i>
122	<i>Flacourtia indica</i>
123	<i>Flacourtia latifolia</i>
124	<i>Gardenia latifolia</i>
125	<i>Garuga pinnata</i>
126	<i>Garcinia indica</i>
127	<i>Gloriosa superba</i>
128	<i>Gossypium herbaceum</i>
129	<i>Grewia abatifolia</i>
130	<i>Grewia asiatica</i>
131	<i>Grewia subinaqualis</i>
132	<i>Helictis isora</i>
133	<i>Heliotropium indicum</i>
134	<i>Heliotropium ovalifolium</i>
135	<i>Heterophragma quadrifidum</i>
136	<i>Hemidesmus indicus</i>
137	<i>Hibiscus micronthus</i>
138	<i>Hibiscus ovalifolia</i>
139	<i>Hibiscus rosa-cianensis</i>
140	<i>Holarrhena antidysenterica</i>
141	<i>Hygrophylla auriculata</i>
142	<i>Hymenodictyon excelsum</i>
143	<i>Hyptis suaveolens</i>
144	<i>Ipomea sp.</i>
145	<i>Ixora parviflora</i>

Sr. No.	Scientific Name
146	<i>Ixora coccinea</i>
147	<i>Jasminum malbarichum</i>
148	<i>Jatropha gossypifolia</i>
149	<i>Justicia carnea</i>
150	<i>Justicia procumbens</i>
151	<i>Lantana camara</i>
152	<i>Lathyrus sativus</i>
153	<i>Lawsonia inermis</i>
154	<i>Largestromia lanceolate</i>
155	<i>Leea microphylla</i>
156	<i>Lepisanthes tetraphylla</i>
157	<i>Leucas aspera</i>
158	<i>Leucas stelligera</i>
159	<i>Loranthus sp</i>
160	<i>Mancranga peltata</i>
161	<i>Mangifera indica</i>
162	<i>Melia azadirachta</i>
163	<i>Merremia umbellate</i>
164	<i>Merremia vitifolia</i>
165	<i>Mimosa pudica</i>
166	<i>Mitrgyna parviflora</i>
167	<i>Moullava spicata</i>
168	<i>Mollugo hirta</i>
169	<i>Moringa oleifera</i>
170	<i>Mucuna pruriens</i>
171	<i>Murraya koenigii</i>

Sr. No.	Scientific Name
172	<i>Musa paradisiac</i>
173	<i>Nerium indicum</i>
174	<i>Ocimum americanum</i>
175	<i>Ocimum basillum</i>
176	<i>Ocimum sanctum</i>
177	<i>Operculina turpethum</i>
178	<i>Opuntia dillinii</i>
179	<i>Opuntia elator</i>
180	<i>Oxalis corniculata</i>
181	<i>Panicum notatum</i>
182	<i>Parthenium hysterophorus</i>
183	<i>Passiflora foetida</i>
184	<i>Pavonia zeylanica</i>
185	<i>Peltophorum ferrugineum</i>
186	<i>Peristrophe bicalculata</i>
187	<i>Phoenix aculis</i>
188	<i>Phyllanthes emblica</i>
189	<i>Phyllanthes nirurii</i>
190	<i>Physalis minima</i>
191	<i>Pithocolobium dulce</i>
192	<i>Polyalthia longifolia</i>
193	<i>Pongamia glabra</i>
194	<i>Pongamia pinnata</i>
195	<i>Portulaca oleracea</i>
196	<i>Psidium guava</i>
197	<i>Pteris sp</i>

Sr. No.	Scientific Name
198	<i>Punica granatum</i>
199	<i>Rhus mysoorensis</i>
200	<i>Samanea saman</i>
201	<i>Sapindus emarginatus</i>
202	<i>Schleichera oleosa</i>
203	<i>Sida acuta</i>
204	<i>Sida cordifolia</i>
205	<i>Sida rhombifolia</i>
206	<i>Smilax zeylanica</i>
207	<i>Solanum nigrum</i>
208	<i>Solanum xanthocarpum</i>
209	<i>Spondias pinnata</i>
210	<i>Sterculia villosa</i>
211	<i>Strobilanthus callosus</i>
212	<i>Syzygium cumini</i>
213	<i>Tabernaemontana pandacaqui</i>
214	<i>Tagetes sp</i>
215	<i>Tamarindus indica</i>
216	<i>Tectona grandis</i>
217	<i>Tephrosia purpuria</i>
218	<i>Teramnus labialis</i>
219	<i>Terminalia paniculata</i>
220	<i>Terminalia chebula</i>
221	<i>Terminalia elliptica</i>
222	<i>Tetrasigma sp.</i>
223	<i>Thespesia populanea</i>

Sr. No.	Scientific Name
224	<i>Thespesia lampas</i>
225	<i>Thumbergia sp.</i>
226	<i>Tinospora cordifolia</i>
227	<i>Tragus biflorus</i>
228	<i>Trapa bispinosa</i>
229	<i>Trapa natans</i>
230	<i>Trema orientalis</i>
231	<i>Tridax procumbens</i>
232	<i>Triumferta pilosa</i>
233	<i>Urtica sp.</i>
234	<i>Vanda sp.</i>
235	<i>Vangueria spinose</i>
236	<i>Vanilla planifolia</i>
237	<i>Vernonia cinera</i>
238	<i>Vicoa indica</i>
239	<i>Vitex negungo</i>
240	<i>Woodfordia fruticose</i>
241	<i>Wrightia tinctoria</i>
242	<i>Wrightia tomentosa</i>
243	<i>Xanthium strumarium</i>
244	<i>Yucca gloriosa</i>
245	<i>Zizyphus jujube</i>
246	<i>Zizyphus mauritiana</i>
247	<i>Zizyphus nummularis</i>
248	<i>Zizyphus oenoplica</i>
249	<i>Cenchurus ciliaris</i>

Sr. No.	Scientific Name
250	<i>Apluda mutica</i>
251	<i>Chloris dolichosta</i>
252	<i>Cyanodactylon sp</i>
253	<i>Dichanthium annulatum</i>
254	<i>Aristida adscensionsis</i>
255	<i>Andropogon pertusus</i>
256	<i>Andropogon monticola</i>
257	<i>Cenchrus setifera</i>
258	<i>Cyperus aristatus</i>
259	<i>Cyperus rotundus</i>
260	<i>Cynodon dactylum</i>
261	<i>Digetaria bicornis</i>
262	<i>Digetaria Segetaria</i>
263	<i>Digetaria stricta</i>
264	<i>Eragrostis tenella</i>
265	<i>Fibrostylis dichotoma</i>
266	<i>Ischaemum pilosum</i>
267	<i>Heteropogon contortus</i>

Plantation of these trees will not only ensure the presence of native species but will also help in creating corridors for thriving faunal activities.

4.4.7 Socio Economics

There will be impact on the socio-economic conditions in the study area in general due to influx of the external population which may put stress on the existing resources such as water and electricity. But the project proponent will not draw on these existing resources as it will take water from the sanctioned quota for industrial use from the Hetwane Dam and also electricity for which it has already secured permission from the competent authority after carefully calculating the requirements for the various uses in the OSC project without disturbing the existing resources in the surrounding area.

Also, the project will provide housing to the 73068 (Refer Table-4-15) people which includes provision of the social housing thereby reducing the stress on the local resources and the existing infrastructure.

Table 4-20: Estimated Population

Land Parcel	Total Plot Area (Acres)	Industrial Area (Acres)	Residential Area (Acres)	Estimated Resident Population
T1	723.33	282.00	58.00	31161
T2	102.40	58.00	8.00	4298
T3	83.59	40.00	8.00	4298
T4	133.19	0.00	62.00	33310
Total	1042.51	380.00	136.00	73068

There will be general improvement in the socio-economic conditions in the nearby villages due to establishment of the ancillary small scale petty shops and other small scale commercial establishments which will go a long way in contributing to the economic development in the vicinity of the project area such as which will be positive in nature due to general improvement in the socio-economic conditions in the study area and upliftment of the people. The land purchase has been done keeping in view the access roads to the project site and the village roads in the vicinity of the project site i.e, these will be left undisturbed by the project proponent wherein due diligence has been accorded while planning the project boundary. The access roads / village roads connecting the various residential areas outside the project boundary will be left undisturbed. As a result, the impact will be beneficial.

Provision of employment

There will be possibility of the employing a population of about 1,49,002 nos of people (Refer Table –4-17) in the operational phase of the project depending on the qualifications / credentials and the skill sets of the people. The split up of the working population estimates is presented below.

Table 4-21: Employment generation in OSC

Land Parcel	Total Plot Area (Acres)	Industrial Employment	Commercial Employment	Total Direct Employment	Indirect/Floating Employment	Total Employment
T1	723.33	35746	19165	54911	21964	76876
T2	102.40	13910	3935	17845	7138	24982
T3	83.59	12859	1200	14059	5624	19683
T4	133.19	0	19615	19615	7846	27461

Total	1042.51	62515	43915	106430	42572	149002

As a result of the employment opportunities the impact will be beneficial.

4.1.1.26 Impact on cultural heritage

While planning the land use within the T4 land parcel which predominantly consists of the residential and commercial area along with the green /open area which will not impact the said Dargah due to less polluting nature of the activities in the designated for these land uses.

Hence the impact will be low in nature in the operation phase.

Severity of Impact		Extent of Impact	-	Duration of Impact	-
Impact Significance = Low					

5. ANALYSIS OF ALTERNATIVES

This section of the report presents the justification for the project and the analysis of alternatives considered. The sections in this chapter are as under:

- Alternatives considered for selection of site;
- Alternative Site Assessment
- Suitability of Site for Proposed Industrial Township Development

5.1 Alternatives Considered for Selection of Site

Pen, sub region of MMR is the untapped area from development perspective in spite of the existing connectivity by National Highway, proximity to the Jawaharlal Nehru Port (JNPT) and proposed Navi Mumbai International Airport. It also falls on the proposed Multi-modal Corridor from Virar to Alibaug proposed by MMRDA and within the influenced zone of the proposed Delhi Mumbai Industrial Corridor (DMIC). Considering all the above OSCIPL has proposed to establish an IIA in the Pen Tehsil. In connection with the same the reconnaissance survey of the entire Pen Tehsil area was carried out to locate suitable parcels of land which were ideal for the development of an IIA without any detrimental influence on the surrounding environment. A total number of three sites were shortlisted for further study and finalization.

5.1.1 Sites Selected for Study

- Site 1 – Tarankhop Ramraj and Dhavate
- Site 2 – Meleggar & Kashmire
- Site 3 – Boregaon, Shene, Virani, Ambeghar Belawade Budruk, Belawade Khurd, Padale, Walak, Mungoshi, Govirle, Kopar, Ambiwali, Balawali & Hamrapur

5.1.2 Key Characteristics and Comparative Site Evaluation

For identification of the most suitable region for development of the proposed OSC project, assessment of the sub regions was carried out on the following aspects.

- Connectivity
- Terrain
- Land Availability
- Cost
- Water Availability
- Manpower Availability
- Proximity to JNPT

5.2 Description of each alternative

5.2.1 Site No.1: (Tarankhop Ramraj and Dhavate):

The site admeasures 480 Acres approximately. The same is located to the North of Pen-Khopoli by-pass road (SH -88). This site is situated directly on the NH 66 on the West side and the SH 88 towards the South and ODR 25 (Pen to Belawade-Khurd) of Pen Tehsil. The site has a gradual slope towards the West and South and appears flat and buildable.

The Hetawane canal passes along the eastern side of the site. Though the site appears to be strategically located, it is also inherent with the following drawbacks. Being adjacent to the irrigation canal it will fall under the command area of irrigation and therefore permission for

conversion from agricultural to other land uses will be difficult. Also, the land for lease will be difficult since only 60% to 70% of the land owners are willing to part with their land holdings. The existing settlement of Tarankhop village is situated between the site and the NH 17 and as such it is difficult to derive access from the same.

5.2.2 Site No.2: (Meleghar and Kashmire)

This site admeasures 633 Acres approximately. This site derives access from a narrow land parcel connecting to NH 66 and is situated to the South of Pen-Khopoli by-pass road (SH 88). The site is also separated from the NH 66 by the Konkan rail and can derive access from NH 66 only by means of a flyover. The site is also bounded to the East, West and the South by Hetawane canal. As such the accessibility of the site appears to be severely restricted. The land is relatively sloping from south east to north-west direction. The land is also divided by two village roads and as such the land parcel is split into three parcels which needs to be connected either by shifting the village roads or bridging the parcels by means of ROBs (Road over bridges). The entire parcel of land is irrigated land. Hence the same is costlier. Being adjacent to the irrigation canal it will fall under the command area of Irrigation and therefore permission for conversion from Agriculture to other land uses will also be difficult. Also the land purchase for the proposed project area is also difficult since only between 40% to 50% of the land owners are willing to part with their land holdings.

5.2.3 Site No.3: (Boregaon, Shene, Virani, Belawade Budruk, Walak, Mungoshi, Govirle, Belawade Khurd, Padale, Kopar, Ambeghar, Balawali, Ambiwali & Hamrapur)

The Total project area for T1, T2, T3 and T4 is 1042.51 acres. These pockets are spread at close intervals and connected by arterial roads as indicated below and together constitute the OSC project. The Project Area Map as also the satellite imagery for the same are shown in Figure 5-3.

The site is in four parcels which are closely located and internally connected by proposed ODR 25 of Pen Tehsil. Together the four parcels add to 1042.51 Acres which is almost double to the earlier locations. The villages falling within this site area are Boregaon, Virani, Shene, Ambeghar, Belawade Khurd, Belawade Budruk, Mungoshi, Govirle, Balawali, Padale, Walak, Kopar, Ambiwali and Hamrapur. The site is approached from SH 88 (Pen to Khopoli) highway at an RL of around 25–39 m from MSL. Since some of the land parcels are abutting creeks and also the railway and National Highway, the accessibility of the land parcels are greatly enhanced due to the availability of multi-modal transport and connectivity.

The major part of the site is situated at a contour of 200–220 which is developable. The site is divided into four parts and situated at different villages which are located nearby. Also none of the land parcels are below 100 acres and as such is considered a good parcel from Integrated Industrial Area development point of view and each parcel can function as a self-sustaining unit. This also facilitates the location of different types of industries on different parcels lending a unique character to each parcel. Considering other lands in Pen Tehsil, these parcels identified are observed to be non-fertile and non-irrigated and therefore more suitable for industrial development. The eastern part of the site stretches from North to South from Bhogeshwari River to the North to Mahal Mira village to the South. The western part extends around village Virani. The Western portion is relatively flat as compared to the Eastern portion. Due to the undulating features on the site which includes hill slopes as well as valley portion which are found to be undevelopable due to the steep slopes, almost 35% of the gross area is being left open. However these spaces can be well developed by landscaping and afforestation to augment the Open space requirements of the OSC project.

The valley portion also provides the opportunity for creation of a water retention pond especially during monsoon where in the runoff simply flows into the creek and completely wasted and unutilized. This proposed water retention pond will not only conserve water but also provide as a valuable resource for the sustenance of the OSC project. In addition this water retention pond can also be used for recreational purposes and contribute to the Imagery and microclimate of the non-Industrial Land Use area. The water retention pond also satisfies the stipulation of the MOEF guidelines with regard to water retention from rainfall runoff and also contribute to environmental conservation.

The hill slopes can also be proposed to be utilized for solar farming and other sources of renewable energy which could contribute to the energy requirements of street lighting, pumping etc.

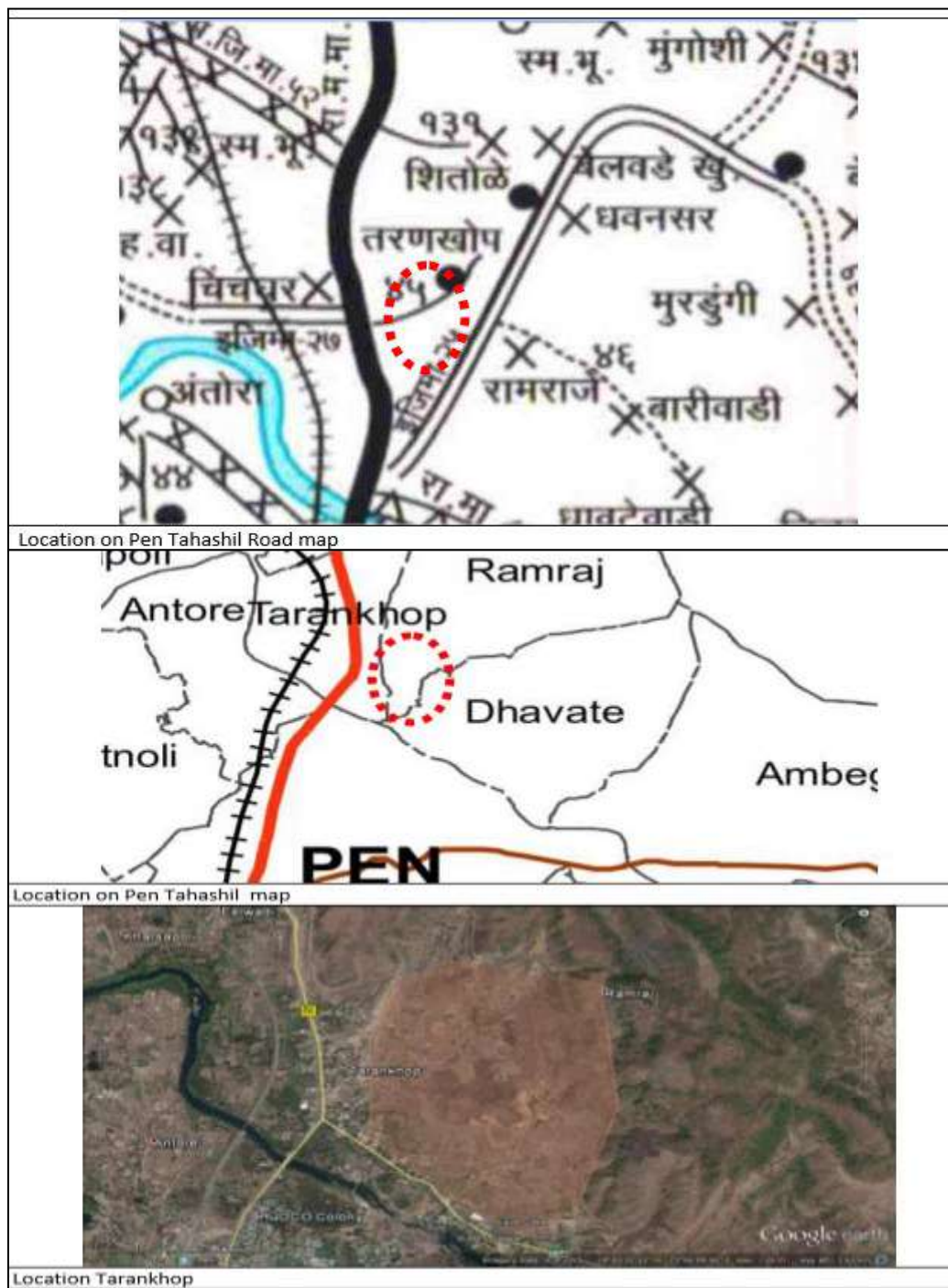


Figure 5-1: Site No. 1 – Tarankhop Ramraj and Dhavate

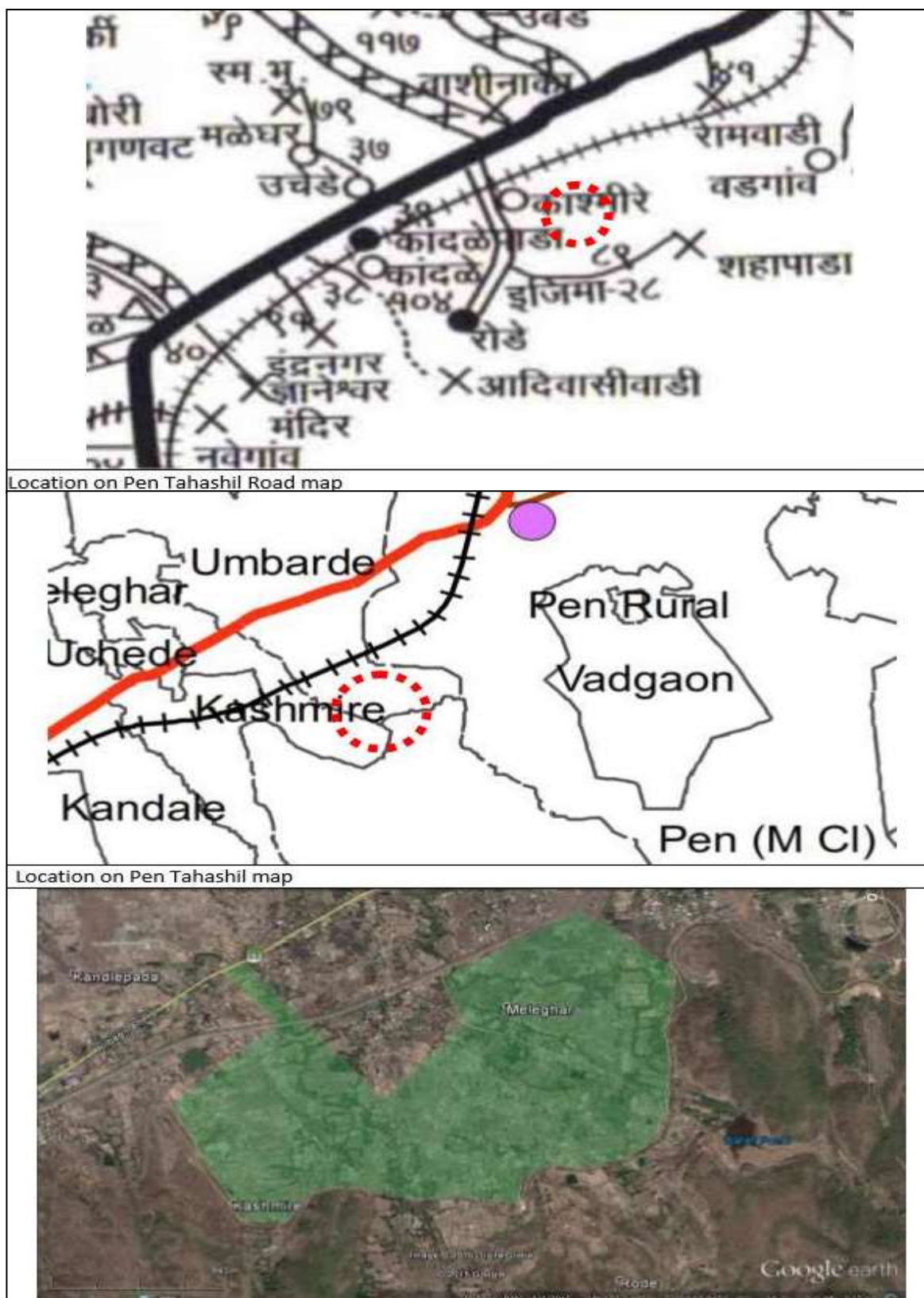


Figure 5-2: Site No. 2 – Meleghar and Kashmir

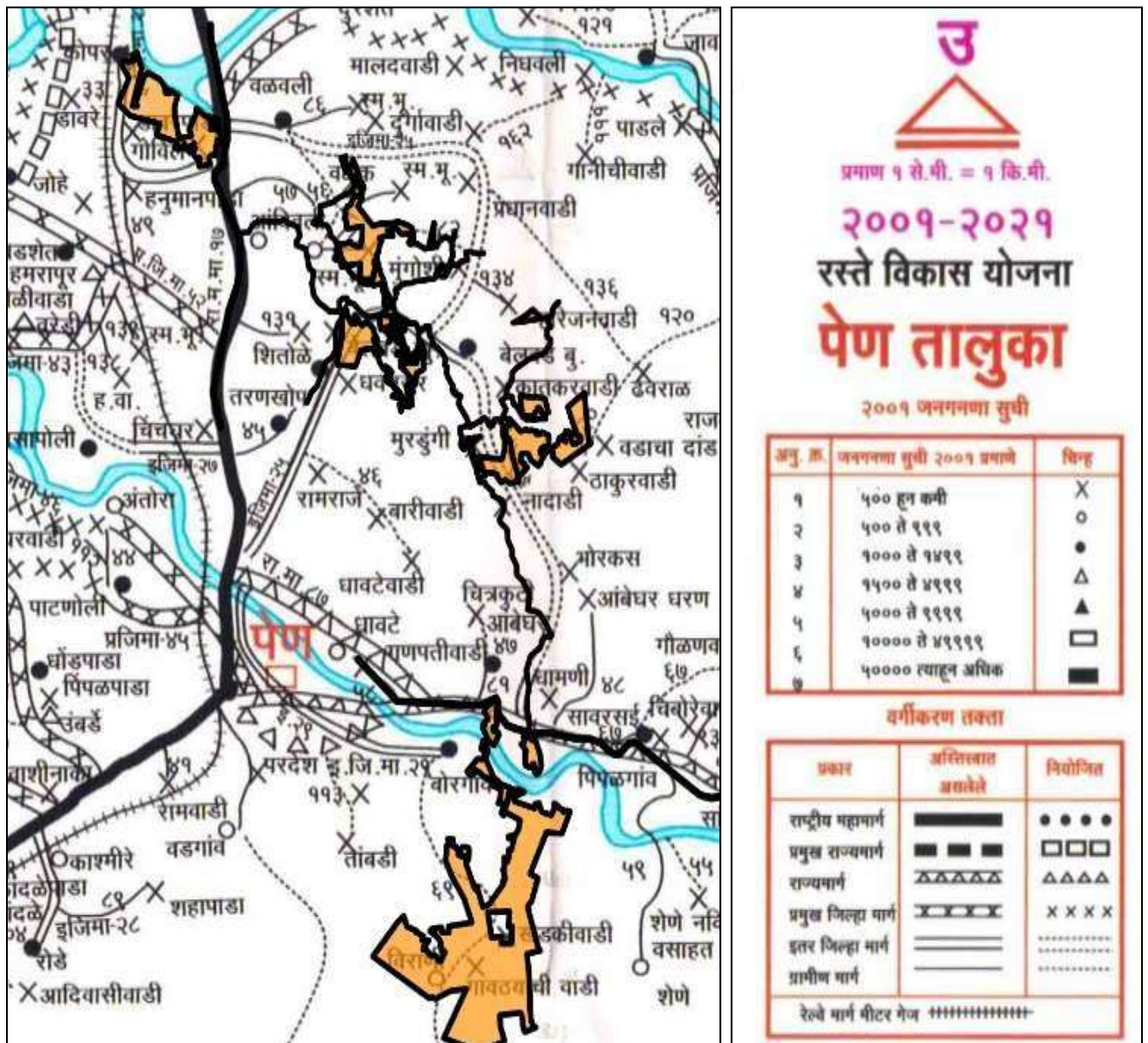


Figure 5-3: Site No. 3 – Boregaon, Shene, Virani, Belawade Budruk, Walak, Mungoshi, Govirle, Belawade Khurd, Padale, Kopar, Ambeghar, Balawali, Ambiwali & Hamrapur

5.2.4 Evaluation of Alternative Sites

The three sites are assessed with respect to various parameters like Connectivity, Terrain, Land Availability, Cost, Water Availability, Manpower Availability, and Proximity to JNPT. The key characteristics and comparative site evaluation on the basis of different aspects to have a better understanding of selection of a suitable site for development of Smart Integrated Township is presented in Table 5-1

Table 5-1: Key Characteristics and Comparative Site Evaluation

Sr. No	Aspect	Site – 1 Tarankhop & Ramraj	Site – 2 Meleghar & Kashmire	Site – 3 Boregaon, Shene, Virani, Belawade Budruk, Walak, Mungoshi, Govirle, Belawade Khurd, Padale, Kopar, Ambeghar, Balawali, Ambiwali & Hamrapur
1.	Connectivity	From state Highway and indirectly from National Highway	Access from ODR 28 of Pen Tehsil Required ROB on Railway for access from NH 66	Very good multi point access on National Highway and State Highway. Also feasible to have railhead and water transport connect near Hamarpur.
2.	Terrain	Plain	Plain	Plateau with slopes
3.	Availability of Land	50% Irrigated and 50% Fallow Land. Hence more agricultural land will be used for the project	80% Irrigated and 20% Non-irrigated	Predominant land use is land with / without scrub (31.04%), followed by other agricultural (19.02%), dense open vegetation (18.89%) as per Land use / land cover statistics
4.	Cost	High	Unaffordable	Relatively affordable
5.	Water Availability	Water can be available from Hetwane Dam	Only Hetwane Dam is nearest Water	Water can be available from Hetwane Dam
6.	Manpower Availability	Good	Moderate	Good
7.	Proximity to JNPT	Proximity to the proposed MTHL & JNPT within 30 to 35 kms respectively	Proximity to the proposed MTHL & JNPT within 30 to 35 kms respectively	Proximity to the proposed MTHL & JNPT within 21.32 to 20.8 kms respectively

Table 5-2: Comparative Analysis Table For Above Alternate Sites

Sr. No.	Locations/Options	Tarankhop & Ramraj (Option.1)	Melegghar & Kashmire (Option.2)	Boregaon, Shene, Virani, Belawade Budruk, Walak, Mungoshi, Govirle, Belawade Khurd, Padale, Kopar, Ambeghar, Balawali, Ambiwali & Hamrapur (Option.3)
	Site Selection Criteria			
1	Connectivity	9	4	9
2	Terrain	4	6	8
3	Land Availability	4	4	9
4	Cost	3	3	7
5	Water Availability	8	3	8
6	Manpower Availability	9	8	9
7	Proximity to JNPT	6	5	8
Total		43	33	58

Please note: 0-3: Poor; 4-7: Moderate; 8-10: Excellent

Based on the comparative evaluation of the three identified sites, it was decided that the third location covering villages Boregaon, Shene, Virani, Belawade Budruk, Walak, Mungoshi, Govirle, Belawade Khurd, Padale, Kopar, Ambeghar, Balawali, Ambiwali & Hamrapur was highly suitable for locating the OSC at the current location.

5.3 Suitability / Justification of Site for Development of Proposed Project

5.3.1 Industrial Development

The easy availability of land strengthens the scope of setting up of industries. At present there is minimum existence of transport infrastructure and industries in the region, however with the completion of the proposed project, the region will be well connected with the other major cities making it highly accessible and appropriate location for setting up of industries. Thus, the proposed investment will bring overall enhancement in communication, infrastructure facilities, human capital, local demand and connectivity.

5.3.2 Residential Development

In the long run, the residential sector in MMR is expected to have a stable demand with the increasing affordability of the population. With a perspective of the future infrastructure and economic growth initiatives proposed near the subject site, the residential sector assumes a moderate compatibility to the future development on the subject site and would play a supporting role to the dominant Industrial development. The residential development would be commensurate with the Industrial development. The walk to work concept will get implemented there by reducing carbon footprint etc.

5.3.3 Commercial Development

The commercial sector growth, which has gained some strength in recent past at Navi Mumbai may have an induced affect near the subject site region in a long term time frame of 10-12 years. As the demand shall pick up when the economic activities (IIP) and infrastructure development activities (MTHL, International Airport) become operational. In a medium timeframe of 4 -6 years, non-prime commercial spaces of basic typology like Banks, ATMs shall be feasible. Further, offices of telecom and insurance sector on a small scale may be developed in a time frame of 5 -6 years.

5.3.4 Education / Institutional and Healthcare Development

An Education facility/hub which complements the Residential development e is likely to be a strong attraction point for at the regional level. In the initial phases (2-3 year's time frame), the site for educational facility / hub as this activity is not dependent on the present infrastructure conditions or the present real estate demand. This activity shall also be instrumental in accelerating residential growth over a medium term (5-6 years).

However, a healthcare facility on a small scale may also be considered in the short term (2-3 years). The key to the development will be securing social activities such as educational institute, which are envisaged at the beginning of the projects. The sale of plotted development has been scheduled as next activity followed by development of apartments in the last stage of the project.

5.3.5 Retail Development

This sector may not have a sustained demand in the time frame of 5 -6 years. However, it may derive demand only from an expected in-migration of residential population after the proposed economic and infrastructure development activities take place. Thus the time frame for retail activities to pick up shall be higher (10 -12 years). It is recommended that any retail development proposed may suitably be positioned on the subject site to draw maximum benefits from a catchment of student population if an education hub is proposed in the subject site. Initially, neighborhood level shopping areas shall be sustained i.e. in 2-3 years' time frame. After the influx of more population (5-6 years' time frame) shopping arcades may be considered for development while stand-alone retail complexes of a higher scale may be feasible only after a 10 years time frame, after substantial catchment population is available to sustain the retail demand.

5.3.6 Hospitality / Leisure Entertainment

Considerable latent demand exists in the leisure and entertainment sector and it may have a moderate compatibility on site given the demand derived by the residential population, who are likely to be the frequent patrons of this destination. The subject site also fares high in respect of land availability (as leisure and entertainment are land intensive sectors) also coupled by ideal geographic settings.

In the initial 4-5 years' timeframe, small scale entertainment destinations like standalone Cinemas may be considered for development. However, high level entertainment activities like multiplexes, Golf Course and amusement park etc. may be considered only after a period of 10 years, when the substantial demand from residential population exists

6. ENVIRONMENTAL MONITORING PROGRAMME

Monitoring is one of the most paramount constituents of a management system. An environmental monitoring plan provides feedback about the discrepancy between actual environmental scenario and the impacts of the project on the environment. The purpose of environmental monitoring is to evaluate the efficacy of implementation of Environmental Management Plan (EMP) by periodically monitoring the important environmental parameters within the impact area, so that any adverse effects can be detected and timely action can be taken.

6.1 Objectives of Environmental Monitoring Plan

The key issues associated with the life cycle of a project are the monitoring of environmental parameters. Three types of environmental monitoring are associated with the project, during the project period to determine existing conditions ranges of variation and process of change. Effects/impact monitoring involves measurements of environmental variable during construction and operation phase of the project to assess the impact that may have been caused by the project. Finally, compliance monitoring takes the form of periodic sampling and continuous measurements of level of pollutant emissions in the air, waste discharge on land or water, level of noise to ensure that standards are met. The basic objectives of the environment monitoring program are:

- Planning a survey and sampling program for systematic data/information collection
Conducting survey and sampling program
- Analysis of samples and data/information collected, and interpretation of data and Information
- To ensure effective implementation of mitigation measures during project implementation;
- To provide constant feedback to the decision makers about the efficacy of their actions and measures taken;
- Environmental monitoring is carried throughout project operation phase to detect changes in the key environmental quality parameters, which can be attributed to the project;
- To determine the project's actual environmental impacts so that modifications can be affected to mitigate the impacts;
- To identify the need for enforcement action before irreversible environmental damage occurs;
- To provide scientific information about the response of an ecosystem to a given set of
- human activities and mitigation measures;
- Preparation of reports for submitting to management and statutory authorities.

The results of the monitoring program used to evaluate the following:

- Extent and severity of the environmental impacts against the predicted impacts;
- Performance of the environmental protection measures or compliance with pertinent rules and regulations
- Trends in impacts and Overall effectiveness of the project EMP

6.2 Suggested Environmental Monitoring Plan

The environmental monitoring plan for the proposed project has been developed in view of the institutional, scientific and fiscal issues pertaining to the project. For developing the monitoring plan, appropriate Value Ecosystem Components (VEC's) which are likely to be affected have been identified. For each component, suitable measurable environmental indicators which are appropriate to the impact mechanism and scale of disturbance and have a low natural variability, broad applicability and an existing data series have been defined. The monitoring plan has been designed for the construction and the operation phase of the project and the details of the plan have been presented in Table 6-1.

Table 6-1: Recommended Environmental Monitoring Programme

Sr. No.	Type	Locations	Parameters	Period and Frequency	Institutional Responsibility	
					Implementation	Supervision
Construction Phase						
1	Ambient Air Quality	5 locations	PM10, PM2.5, Sulphur dioxide (SO2), Oxides of nitrogen (NO2) Carbon monoxide (CO) Hydrocarbon (HC) Volatile Organic Compounds (VOC's)	24-hr (8hr for CO) average samples every quarter	Contractor through MoEF approved agency	OSCIPL
2	Ground Water	3 locations	pH, TSS, TDS, DO, BOD, Salinity, Total Hardness, Fluoride, Chloride and MPN (No. of coli forms / 100ml), Heavy Metals	Quarterly	Contractor through MoEF approved agency	OSCIPL
3	Surface Water	3 locations	pH, TSS, TDS, DO, BOD, Salinity, Total Hardness, Fluoride, Chloride and MPN (No. of coli forms/100ml), Heavy Metals	Quarterly	Contractor through MoEF approved agency	OSCIPL
4	Noise	4 locations	24hrly Day and Night time Leq levels	Quarterly	Contractor through MoEF approved agency	OSCIPL
5	Soil	4 locations	Organic matter, C, H, N, Alkalinity, Acidity, heavy metals and trace metal, Alkalinity, Acidity	Quarterly	Contractor through MoEF approved agency	OSCIPL

Sr. No.	Type	Locations	Parameters	Period and Frequency	Institutional Responsibility	
					Implementation	Supervision
Operation Phase						
1	Ambient Air Quality	4 locations as selected after consultation with MPCB	PM10, PM2.5, Sulphur dioxide (SO ₂), Oxides of nitrogen (NO ₂) Carbon monoxide (CO) Hydrocarbon (HC) Volatile Organic Compounds (VOC's)	24-hr (8hr for CO) average samples every quarter	OSCIPL through MoEF approved agency	OSCIPL
2	Ground Water	3 locations as selected after consultation with MPCB	pH, TSS, TDS, DO, BOD, Salinity, Total Hardness, Fluoride, Chloride and MPN (No. of coli forms / 100ml), Heavy Metals	Quarterly	OSCIPL through MoEF approved agency	OSCIPL
3	Surface Water	3 locations as selected after consultation with MPCB	pH, TSS, TDS, DO, BOD, Salinity, Total Hardness, Fluoride, Chloride and MPN (No. of coli forms / 100ml), Heavy Metals	Quarterly	OSCIPL through MoEF approved agency	OSCIPL
4	Noise	4 locations covering the project site and in the surrounding areas to be identified in consultation with MPCB	24hrly Day and Night time Leq levels	Quarterly	OSCIPL through MoEF approved agency	OSCIPL

Sr. No.	Type	Locations	Parameters	Period and Frequency	Institutional Responsibility	
					Implementation	Supervision
5	Soil	5 locations as selected after consultation with MPCB	Organic matter, C, H, N, Alkalinity, Acidity, heavy metals and trace metal, Alkalinity, Acidity	Quarterly	OSCIPL through MoEF approved agency	OSCIPL
6	Treated potable water quality	Water Treatment Plant	Parameters for horticulture use – BOD, pH, S.S, Coliforms	Half Monthly	OSCIPL through MoEF approved agency	OSCIPL
7	Treated Sewage Water Quality	All STPs (3 no.)	Parameters for horticulture use – BOD, pH, S.S, Coliforms	Half Monthly	OSCIPL through MoEF approved agency	OSCIPL
8	Treated Effluent Quality	ETP	As per IS 10500 – potable water standards	Half Monthly	OSCIPL through MoEF approved agency	OSCIPL

6.3 Data Analysis

The monitored data will be analyzed and compared with the baseline levels as established in the EIA study and the regulatory standards specified by different government agencies. The standards against which the different environment components will be compared are as per Table 6-2: Applicable Standards for Different Environmental Components

Table 6-2: Applicable Standards for Different Environmental Components

Sr. No.	Component	Applicable Standards
1	Ambient Air Quality	National Ambient Air Quality standards, CPCB
2	Noise Quality	Ambient Air Quality Standards with Respect to Noise, CPCB
3	Surface water quality	IS:2296: Class 'C' Water, CPCB
4	Ground water quality	IS: 10500 Standards, BIS
5	Soil Quality	--
6	Treated sewage water quality	IS 2490(1974) – Discharge into surface water, IS 3306(1974) – Discharge on land, IS 3307(1974)- Discharge for agricultural use
7	Effluent	Minimum National Standards (MINAS) for industries by CPCB

6.4 Reporting Schedule

The monitoring results of the different environmental components will be analyzed and compiled every six months during the construction and the operation phase.

The report will be assessed through competent environmental agencies to analyze and ascertain the reasons for any high pollutant level. The development possibly responsible for this high pollutant level will be identified by OSC Infrastructure Pvt. Ltd. The environmental management plan corresponding to that development or activity will be checked for its efficacy.

6.5 Emergency Procedures/Corrective Measures

Corrective measures will be adopted if the review of the monitoring report reveals that the environmental management plan is inadequate or has not been implemented properly. A detailed review will be carried out by the interdisciplinary team of experts of the Environment Management Cell for assessing the gaps between the EMP and its implementation. A corrective action plan will be worked out for the environmental component and a rigorous follow up of that plan will be adopted.

6.6 Detailed Budgetary Provisions

A MoEF accredited laboratory will be sub contracted for the monitoring work. The cost estimates for the proposed monitoring plan are as detailed in Table 6-3.

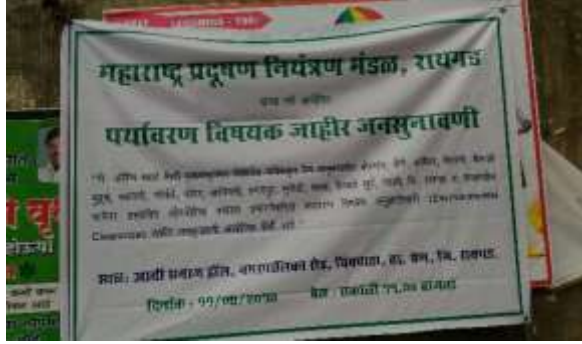
Table 6-3: Cost Estimates for Environmental Monitoring

Sr. No.	Parameter	Sampling Frequency	No. of Samples per annum	Cost per Sample (INR)	Total Annual Cost (INR)
A. Construction Phase					
1	Ambient air quality	Twice per quarter	32	17000	5,44,000
2	Noise quality	Twice per quarter	32	5000	1,60,000
3	Ground water	Twice per quarter	24	11000	2,64,000
4	Surface water	Twice per quarter	24	11000	2,64, 000
5	Soil quality	Twice per quarter	32	7000	2,24,000
	Total Cost				14,56,000
B. Operation Phase					
1	Ambient Air Quality	Twice per quarter	32	11000	3,52,000
2	Noise	Twice per quarter	32	5000	1,60,000
3	Ground Water	Twice per quarter	24	11000	2,64,000
4	Surface Water	Twice per quarter	24	12000	2,88,000
5	Soil	Twice per quarter	32	5000	1,60,000
6	Treated potable water quality	Six times per quarter	48	11000	5,28,000
7	Treated Sewage Water Quality	Six times per quarter	144	7000	10,08,000
8	Treated Effluent Quality	Twice per quarter	144	7000	10,08,000
Total Cost					37,68,000
Total Cost (A+B)					52,24,000

7. ADDITIONAL STUDIES

7.1 Public hearing

As per the EIA Notification 2006 and its amendments thereof all category ‘A’ projects need to undertake public hearing wherein the concerns of the local affected persons and others who have a plausible stake in the environmental aspects of the project or activity are ascertained with a view to take into account all the material concerns in the project or activity design as appropriate. In this context the public hearing for OSC was conducted at Aagri Samaj Hall, Nagarpalika Road, Chichpada, Tal:Pen, Dist Raigad on 11th July 2017 at 11.00 am.

	
Banner of public hearing at a prominent location depicting the venue and the time of public hearing.	A close up of the banner depicting the venue and the time of public hearing
	
A participant in the public hearing asking questions	OSC's representative Mr. C.S Sangvi explaining the project features

	
BEIPL representative Mr. Hrushikesh Kolatkar explaining the environmental aspects of the project	A public hearing participant expressing opinion in the public hearing

7.1.1 Public hearing compliances

The compliance of the comments /issues raised in public hearing are given below:

Sr.No	Queries	Compliance
Queries by Vaishali Tai Patil		
1	As per the Notification of MoEFCC, GoI dated 14 th September, 2006, it is mandatory to make available the copies of detail EIA report in vernacular language (Marathi) well before 30 days of the public hearing. However, the detailed report is not made available 30 days prior to the hearing.	The Public hearing has been carried out as per the Notification of MoEF&CC, GOI. The detailed report along with the Executive summary was provided by MPCB to the respective Gram Panchayats. MPCB had also published the Executive summary of EIA report on their website 30 days prior to the Public hearing.
2	There are discrepancies in informalities in Executive Summary and in the presentation.	Executive Summary has been prepared as per the guidelines mentioned in the EIA Notification 2006 and its amendments thereof, and it is an abridged version of the EIA report and includes the major findings of the EIA study.
3	Most of Grampanchayat offices has not received the copies of Executive Summary well before 30 days advance.	The Public hearing has been carried out as per the Notification of MoEF&CC, GOI. The detailed report along with the Executive summary

Sr.No	Queries	Compliance
		was provided by MPCB to the respective Gram Panchayats.
4	The project proponent's has not mentioned number of job opportunities created by the project. The project proponent has mentioned the total figure of laborers and future job opportunities.	Estimated Employment Opportunities after completion is depicted in Table: 2-1 in the EIA report.
5	The project proponent has not obtained "Consent to Establish," from MPCB. Project proponent informs that there may be change in the plan of the project. Hence if project plan is changed, then will project proponent conduct the public hearing again? .	The Project Proponent confirms that they have obtained the Consent to Establish from MPCB.
6	The project proponent did not inform the sources of water for the project.	The Sources of Water has been mentioned in Table no. 2-1 of EIA report i.e. Hetavane Dam.
7	Most of local people from Schedule Tribe Communities (Adivasi Community) could not attend the hearing due to the paddy sowing season. There are sixteen Adivasi hamlets (Vastis), they could not ' attend the hearing.	The date and time of public hearing was fixed by MPCB and not by the Project Proponent.
8	The page numbers in the report are not correct. Either the page numbers have been deleted or not written	It was an inadvertent mistake. The page numbers have been corrected in the EIA report.
9	As per the EIA Notification, 2006, EIA should be conducted for an area of 10 Kms radius of the proposed project. It was alleged that the Environment Advisor of the project have not visited the area. Proponent should give proof of the fact that they have visited the Grampanchayat office and conducted the meeting with officials of Gram Panchayat and local people.	BEIPL conducted the EIA studies as per the provisions of the EIA Notification 2006 and its amendments thereof and had undertaken socio-economic consultations during the study period from March 2015 to May 2015. The meeting was not conducted at the gram panchayat office. The interview with local people were conducted with adequate sampling size.
10	All the details mentioned in the EIA report are not included in the Executive Summary Report.	Executive Summary has been prepared as per the guidelines mentioned in the EIA Notification 2006 and its amendments thereof, and it includes the major findings of the EIA study.

Sr.No	Queries	Compliance
11	Hence the public hearing should be postponed and local people should be provided with complete EIA report in vernacular language. The next public hearing should be conducted on the project site only as per the directives of MoEF& CC.	The preparation of the EIA report and conducting of public hearing has been undertaken as per the provisions of the EIA Notification 2006 and its amendments thereof issued by MoEF&CC, GOI till date.
12	The project proponent did not inform the exact sources of water for the project. Hence local people fear that Proponent will lift the water from Hetvane or Ambegaon dam which will affect the drinking water system of the local people.	The Project Proponent has secured in-principle approval from the Irrigation Department, Govt. of Maharashtra, for the supply of water for the project.
13	Convener has not mentioned the venue of public hearing in the letter which they have sent to Grampanchyats.	The venue details were informed in the letters sent to Gram Panchayats. The Venue was also published in local newspaper (Marathi) and national newspaper.
14	It is suggested that after the meeting of public hearing, the summary/minutes/points of the meeting will have to be read before the public in the meeting only.	The summary / minutes / points of the meeting were read before the public in the meeting only.
Queries by Shri. Saniay Dangar, resident of Balavali, Tal. PenI Dist. Raigad:-		
1	Township will be developed on four sites which are not contiguous. Hence these sites will have to be connected by roads. But construction of road and availability of land for construction of road is not mentioned in the report. ‘	The four parcels in the township will be connected by roads of adequate length and width, thus making it contiguous. The details of the transport infrastructure can be referred to in the Section 2.36 titled “Traffic and Transportation Plan” in the EIA report. The details of the roads in the land parcels are given in Table-2-49 titled “Infrastructure related to road”.
2	The Patalganga, Balganga and Bhogeshwari rivers which flows in the vicinity of project have become highly polluted rivers due to discharge of industrial effluent from the existing	The Project Proponent commits that the industrial effluent will not be discharged in the Patalganga/Balganga and Bhogeshwari rivers.

Sr.No	Queries	Compliance
	chemical units. If the new hazardous and chemical factories allowed to develop in the project area, the effluent will be discharged in the river. The project proponent did not inform the treatment of treated domestic and industrial effluent.	
3	The ancient Badaruddin Darga is just adjacent to the project. Nothing is mentioned about the Darga in the presentation and in the report.	The Badaruddin Dargah is not a notified monument / structure by the Archaeological Survey of India. The aforesaid Dargah is located outside the project boundary. Extensive due diligence has been accorded while purchasing the land for the project site which excludes the said Dargah. OSC is planned as an eco-friendly city. Thus, the development envisaged will not affect the aforesaid Dargah.
4	The efforts were made in the past by the other project proponent for the development and they left the project. The local people fears that this total project will be handed over to another company. The local people are already suffering due to pollution of chemical factories and there will be increase in the pollution and new project proponent will not honour the promises made by the present proponent.	The Project Proponent has made considerable investment for the project and has firm commitment to completing it. OSC is envisaged to be an eco-friendly development and will comply will all the rules and regulations as per Environmental Protection Act, 1986. Adequate pollution control measures such as Sewage Treatment Plants, along with other extensive pollution control measures, have been planned to mitigate the adverse impacts, if any, from the proposed project.
Queries by Dilip Mukund Patil, Resident of Kane, Tal. Pen, Dist. Raigad		
1	In this presentation, it is mentioned that no village will be relocated or displaced. A detail of population of the project and floating population is not mentioned. This is not clear whether this project will be beneficial to local people. Project proponent answered that the no village will be relocated or displaced due to the	The population estimates include the resident population and the working population that includes the floating population. The same may be referred to in the Table:2-15 and Table 2-16. The estimated residential population amounts to 73068 and the estimated working population amounts to

Sr.No	Queries	Compliance
	project. Moreover, this project will bring prosperity in the vicinity of the project	149002 approximately which includes a floating population of about 42,572 during the operation phase. The project will also include affordable housing. The Project Proponent during the Public hearing confirmed that no village will be relocated or displaced. This project will generate direct and indirect employment opportunities. Project Proponent will also carry out necessary CSR activities as per the needs of the local people.
Queries by Shri. Dhairyashil Patil, MLA		
1	This is not a first attempt for the development of the project site. Previously, the efforts were made by other project proponents by planning to develop Kanchangiri Complex and for development of Special Economic Zone (SEZ). Both the project were abandoned. It is noted that after huge investment, the SEZ project, which is established in other parts of country, can give only 3% job Opportunities. The people have sighed of relief as SEZ project is abandoned. Now, the project proponent M/s OSCIPL, desires to develop Integrated Township. The project proponent has appointed an environment consultant for the preparation of EIA study. Naturally, the EIA study will be in favour of the project only.	The said projects were never planned at the proposed site of OSC. The job opportunities generated due to the project will be approximately 149002. . The EIA Consultant has been appointed as per the provisions of EIA Notification 2006 as amended till date. Moreover, the consultant is NABET Accredited Consultant and works under purview of MoEF&CC, GOI.
2	As per the EIA report, the population of the proposed city may be 300,000 (Three lakhs only). There may be more than 4,50,000 souls in the proposed project, hence the local people have to face civic issues.	The population estimates and the project infrastructure have been worked out as per the relevant applicable guidelines. Adequate infrastructure such as transportation network, sewage treatment, information technology etc. has been planned and designed by the Project Proponent to ensure that local people

Sr.No	Queries	Compliance
		do not face any civic issues because of the project or the influx of population in OSC.
3	The inception of the project will affect the drinking water sources of the Pen City. There may be decrease of nearly 2,000 hector irrigated land/area. The EIA report mentions that 36.0 MLD drinking water will require for the proposed project. But he feels that more quantity of water will be required than mentioned. The sewage of Pen City is already released in Bhogeshwari River. After township comes up sewage will be discharged in the Bhogeshwari River.	The development of OSC will not disturb the existing water supply arrangements of the surrounding area, including Pen Town. The water requirement for the project has been worked out taking into account the relevant guidelines. The Project Proponent has secured in-principle approval from the Irrigation Department, Govt. of Maharashtra, for the supply of water for the project. Sewage treatment plants of adequate capacity have been planned to cater to the domestic sewage and the details of the same can be referred to in the Section 2.23.2 titled “Wastewater Infrastructure”. The treated water amounting to 3.28 MLD is available for various uses.
4	In the EIA report, it is mentioned that the water will be lifted from Hetwane dam. This point is missing in the presentation. The water of Hetwane dam is reserved only for irrigation purposes and local people will oppose the lifting of water for this project. The water of Ambegaon dam which is exclusively reserved for Pen City and hence project proponent will not be allowed to lift the water from Ambegaon ‘ Dam.	The Sources of Water has been mentioned in Table no.2-1 of EIA report i.e. Hetavane Dam, The Development of Hetavane Dam is for dual purpose including Irrigation and Water Supply. Hetavane Dam supplies a small quantity of water for irrigation for about four months a year to the nearby areas of the dam and there is availability of surplus stock of water for drinking purpose. Hetavane Dam, at present, mostly supplies water to CIDCO for Navi Mumbai having an intake of about 150 MLD. The Ownership of the Dam is with Irrigation Department, Government of Maharashtra.

Sr.No	Queries	Compliance
		Irrigation Department, Government of Maharashtra has agreed in principle to supply of about 36 MLD of water for the project.
5	Due to this project, the local agriculture may be hampered.	The project will not affect the local agriculture. Adequate measures such as sprinkling of water etc. during the construction phase, and adequate mitigation measures have been integrated in the design of the project to counter adverse impacts, if any, during the operation phase of the project.
6	While acquiring the land in 2007, the project proponent has already issued Indemnity Letter of job Opportunities, from whom the land for the project was bought. After ten years, nothing is done. As per the policy, if at all the project is not implemented within five years, the land/plot has to be handed over to the owner of the plot.	Project will bring economic opportunity to the residents and businesses of the region, with a particular focus on local jobs, skill development and apprenticeships. Project Proponent will hire local workers with required skill sets throughout the lifecycle of the project and will also provide training opportunities to local residents in order to build a skilled labour force and long-term capacity and encourage local participation. The land purchase and aggregation to the extent of about 1042.51 acres on a 'willing buyer, willing seller' basis is a time consuming task. The project will move at a fast pace after Environment Clearance is received.
7	The project proponent has not considered the study/findings of KasturiRangan Committee, though the project area falls under Western Ghat. UNESCO has already declared Western Ghat as World Natural Heritage and declared more than 139 plants and animals as "highly sensitive protective species."	The project area doesn't fall in the Western Ghats.
8	This public hearing shall be cancelled & shall be re-conduct it	The public hearing has been carried out as per the provisions of the EIA

Sr.No	Queries	Compliance
		Notification, 2006 and its amendments thereof till date.
Queries by Shri. Vikas Mhatre, resident of Koproli, Tal. Pen Dist. Raigad		
1	He expressed the opinion that project proponent is promising the vague job opportunities to local youths as the requirement of manpower and labor is not bifurcated.	Estimated Employment Opportunities while in final operating stage is depicted in Table: 2-1 in the EIA report. The project will provide employment to an estimated working population of about 149002. The total labour during the construction phase will be around 500.
2	He further expressed the opinion that the project will require additional land.	The additional land if required will be taken through proper procedure and the requisite permissions will be secured.
3	He asked to Environment Consultant for the information of the Proprietor and Board of Directors of the project. Environment Consultant were unable to answer the same.	Name of proprietor & officers from the company was provided during public hearing.
Queries by Shri. PromodPatil, Member, Zilla Parishad Raigad		
1	Name of the project is Orange City, which is in English. This needs to be changed to Marathi. The company should consider conducting the public hearing in individual villages. However, if the project is going to benefit the people we will support it.	Name change is not relevant to Environmental public hearing. The public hearing has been conducted in accordance with the provisions of the EIA Notification 2006 and its amendments thereof till date. The project will generate direct and indirect employment opportunities and skill development which will enhance the socio-economic status of the surrounding area.
Queries by Shri. Jinesh Shirsath, resident of Antola, Tal. Pen, Dist. Raigad.		
1	It is mentioned that hazardous waste will be generated. If the project is a residential project how will hazardous waste be generated and if it is generated how it will be managed. Seasonal study for EIA is not carried out. In presentation, it is	The project is a planned mixed use development including residential, commercial and industrial components. Also, OSC has been planned as an eco-friendly smart city.

Sr.No	Queries	Compliance
	mentioned that the plan may change a bit but it is not mentioned in EIA report.	The individual industries will comply with the Hazardous Waste Management Rules 2016 which will be under the scrutiny of the Maharashtra Pollution Control Board. The EIA has been carried out for one season as per the provisions of the EIA Notification 2006 and its amendments thereof till date.
Queries by Koshitai Pawar, Sarpanch, Balavali, Tal. Pen, Dist. Raigad		
1	The report has been submitted in English, it should be submitted in Marathi. We can't read English. Water source will be affected.	The EIA report has been prepared as per the provisions of the EIA notification 2006 and its amendments thereof till date issued by MoEF&CC, GOI. As per MoEF&CC guidelines the Executive Summary was also made available in local language i.e. Marathi. The presentation during the public hearing was also made in local language Marathi. The development of OSC will not disturb the existing water supply arrangements of the surrounding area.
Queries by Shri. Madan Patil		
1	Shri. Madan Patil asked whether project proponent will buy construction materials from outside? It is informed that construction materials will be purchased from Authorized mines. He suggested that contract shall be given to the local people.	The Project Proponent will give priority to local contractor provided they are able to meet the contract requirements.
Queries by Shri. Saniay Naik, resident of Ambivali, Tal. Pen, Dist. Raigad.		
1	The total EIA report should be made available in Marathi and another public hearing should be arranged.	The preparation of the EIA report and the conducting of public hearing has been undertaken in accordance with the provisions of the EIA Notification 2006 and its amendments thereof issued by MoEF&CC, GOI till date.
Queries by Shri. Saniay Dangar, resident of Balavali, Tal. Pen, Dist. Raigad.		

Sr.No	Queries	Compliance
1	The project is proposed at four locations which are at a distance of 3 to 7 km and there is limited connectivity to reach this location. Will the company acquire land through government to strengthen the connectivity?	OSC is planned on 1042.51 acres located at 4 different location within 3 kms from each other. The sites are connected through NH66, SH88 and a ODR (Other District Road). The upgradation of existing connectivity is already in progress by the Government.
2	Historical monuments have not been mentioned in the report. Reply: -company representative clarified that the the road shown in the plans are along the ODR (other district roads).The company will use existing roads for connectivity purpose till such time that this road may be widen by the government at the later stage.	There are no notified historical monuments/relics etc. as notified by the Archaeological Survey of India within the project site and within the 10 km radial study area for which the EIA studies have been undertaken.

The notice for the conducting of public hearing published in the English newspaper and in the local vernacular language newspaper in shown below:

Notices for the conduct of public hearing in English newspaper and the local vernacular newspaper

forwarded to the respective DIV - DISTRICT -
 "Community tweeted about
 Indian Express - 9 June 2017

MAHARASHTRA POLLUTION CONTROL BOARD
 SUB REGIONAL OFFICE RAIGAD-2

NOTICE FOR ENVIRONMENTAL PUBLIC HEARING

M/s. Orange Smart City Infrastructure Ltd. has submitted the proposal for Development of Integrated Industrial Township in villages Boragan, Shene, Ambeghar, Vians: Belavade Bk, Belavali, Kopar, Ambhvali, Gaverle, Walek, Belavade Khurd, Padole, Mungoshi & Hamrapur, Tal. Pen, Dist. Raigad to M.P.C. Board. In this regard a Public Hearing is proposed to be conducted from environmental angle, about the project. All persons including local residents, environmental groups and others located at the project site can participate in the Public Hearing.

Suggestions, views, comments and objections of the public can be filed at the following addresses in writing within 30 days from the date of publication of this notice.

Sub Regional Office Raigad-2, M. P. C. Board, Raigad Bhavan,
 6th Floor, Sector- 11, CBD Belapur, Navi Mumbai - 400 814
 Ph. No. 27572740 E-Mail: aroraigad2@mpcb.gov.in

Oral and written suggestions can also be presented during the Public Hearing to be conducted at:

Venue	Aagari Samaj Hall, Nagarpatika Road, Chinchapada, Tal. Pen, Dist. Raigad.
Date	11/07/2017
Time	11:00 AM.

Copies of the Executive Summary containing the salient features of the project both in English and Marathi and Draft EIA Report, are available at the following offices:

1. District Collector Raigad, Alibag.
2. District Industries Centre Raigad, Alibag.
3. Zila Parishad Raigad, Alibag.
4. Regional Office Raigad & Sub Regional Office Raigad-2, MPC Board, Raigad Bhavan, 6th Floor, Sector- 11, CBD Belapur, Navi Mumbai.
5. Head Office, MPC Board, Kapsara Point, 3rd Floor, Sakinaka Scheme Road No.8, Opp. One Planet, Near Sion Circle, Sion (E), Mumbai - 40.
6. Zonal Office, Western Division, Ministry of Environment, Forests & Climate Change, B-5, Khandya Park, Vashi, Navi Mumbai, Link Road-3, Rameshwar Nagar, Shop No. 462/016.
7. Environment Department, Government of Maharashtra, New Administrative Building, 15th Floor, Marolli Nagar, Mumbai - 400 032.
8. Tehsildar Office Pen, Tal. Pen, Dist. Raigad.
9. Pan-Municipal Council, Pen, Tal. Pen, Dist. Raigad.
10. Grampanchayat Offices of villages of Boragan, Shene, Ambeghar, Vians: Belavade Bk, Belavali, Kopar, Ambhvali, Gaverle, Walek, Belavade Khurd, Padole, Mungoshi & Hamrapur, Tal. Pen, Dist. Raigad.

Concerned persons will be provided access to the Executive Summary of the project and Draft EIA Report during office hours at the above mentioned places.

Sd/-
 Sub Regional Officer, Raigad-2
 Maharashtra Pollution Control Board

महाराष्ट्र प्रदूषण नियंत्रण मंडळ
 उप प्रादेशिक कार्यालय, रायगड-२

पर्यावरण विषयक जनसुनावणीची सूचना

मे. ऑरेंज स्मार्ट सिटी इन्फ्रास्ट्रक्चर लिमिटेड यांचेकडून, पेन तालुक्यातील बोरागन, शेने, अंबेघार, चिराणी, बेलावडे खुर्द, बळवली, गोविंदे, कोपर, आंबेवली, हगरापुर, मुंगोशी, वालक, बेलावडे खुर्द, पडाले, जि. रायगड या गावामधील जागेवर प्रस्तावित औद्योगिक उपग्रह तयार करिता पर्यावरण विषयक जनसुनावणी आयोजित करण्याबाबत प्रस्तावित औद्योगिक उपग्रह झालेला आहे. सदर प्रस्तावासंबंधी पर्यावरणविषयक सूचना, विचार, टिप्पणी तसेच आक्षेप नोंदविण्यासाठी जाहीर पर्यावरणविषयक सुनावणीचे आयोजन पुढीलप्रमाणे करण्यात आलेले आहे.

ठिकाण : आशी समाज हॉल, नगरपालिका रोड,
 चिंचपडा, ता. पेन, जि. रायगड.

दिनांक : ११/०७/२०१७.

वेळ : सकाळी ११.०० वाजता.

सदर नियोजित प्रकल्पाच्या परिसरातील रहिवासी, पर्यावरण विषयी काम करणाऱ्या संस्था, सदर प्रकल्पामुळे विस्थापित होणारे रहिवासी किंवा सदर प्रकल्पामुळे अन्य प्रकारे प्रभावित होणारे रहिवासी यांना सदर प्रकल्पासंबंधी सूचना, टिप्पणी-टिप्पणी तसेच आक्षेप लोदी किंवा लेखी स्वरूपात नोंदवता येईल.

सदर प्रकल्पाबाबत लेखी स्वरूपात सूचना ही जहाजात प्रसिद्ध झाल्यापासून ३० दिवसांच्या आत खालील पर्यावरण पाटविण्यात याव्यात -

उप प्रादेशिक कार्यालय, रायगड-२ महाराष्ट्र प्रदूषण नियंत्रण मंडळ,
 रायगड भवन, ६ वा मजला, सेक्टर-११, सी. बी. डी. बेलपूर, नवी मुंबई - ४०० ६१४.

फोन नं. २७५७ २७५० ई-मेल: aroraigad2@mpcb.gov.in

सदर प्रकल्पासंबंधी माहिती असलेले कार्यालयीन कारांग अहवाल मराठी व इंग्रजी भाषेमध्ये तसेच पर्यावरण अहवाल मुल्यांकन अहवाल खालील कार्यालयांमध्ये उपलब्ध आहेत. संबंधित व्यक्ती या कार्यालयांमध्ये कार्यालयीन वेळेत सदर कागदपत्रे अभ्यासू शकतील.

१. जिल्हाधिकारी कार्यालय, रायगड, अलिबाग.
२. जिल्हा उद्योग केंद्र रायगड, अलिबाग.
३. जिल्हा परिषद रायगड, अलिबाग.
४. प्रादेशिक कार्यालय व उप प्रादेशिक कार्यालय रायगड-२, म.प्र.नि. मंडळ, रायगड भवन, ६ वा मजला, सेक्टर-११, सी.बी.डी. बेलपूर, नवी मुंबई-४०० ६१४.
५. म.प्र.नि. मंडळ (मुख्यालय), वास्तविक प्रॉडिट, तिसरा मजला, सामन-माटुंगा स्थान रोड क्र. ८, सिनेप्लेनेट समोर, सामन साकल जवळ, रायन (पूर्व), मुंबई-२२.
६. शोशल कार्यालय, पश्चिम झोन, पर्यावरण, बने व हयामान बदल मंत्रालय, ई-५, कैदिय पर्यावरण भवन, अंतरा कॉलनी, लिंक रोड-३, रवीशंकर नगर, मोरगाव-४६२ ०१६.
७. पर्यावरण विभाग, नविन प्रासादन भवन, १५ वा मजला, मण्डन कामा मार्ग, मंत्रालय, मुंबई-३२.
८. तहसिल कार्यालय पेन, ता. पेन, जि. रायगड.
९. पेन नगरपालिका, पेन, ता. पेन, जि. रायगड.
१०. ग्रामपंचायत कार्यालय, बोरागन, शेने, अंबेघार, चिराणी, बेलावडे खुर्द, बळवली, गोविंदे, कोपर, आंबेवली, हगरापुर, मुंगोशी, वालक, बेलावडे खुर्द, पडाले, ता. पेन, जि. रायगड.

सही/-
 उप प्रादेशिक अधिकारी, रायगड-२
 महाराष्ट्र प्रदूषण नियंत्रण मंडळ

7.2 Risk Assessment and Disaster Management Plan

The risk assessment is conducted for the project and accordingly DMP is prepared. The RA & DMP document is attached as Annexure XIX.

8. PROJECT BENEFITS

This section of report describes the direct and indirect benefits due to proposed project is expected to have at the local, regional or even national scale. The benefits from the project on the infrastructure in general and on the socio-economic status will be described.

The Project will have Industrial (less polluting), Residential & Commercial clusters with state-of-the-art infrastructure and globally benchmarked smart features. The project development envisages Indian and foreign investments over a period of 15 years, creating a total built-up area of 8.64 million square meter of industrial, residential and commercial space. The project also aims to become home to a population of approximately three lakhs and create job opportunities for approximately 1.5 lakhs skilled and unskilled professionals.

The said project will have some of the following major socio-economic benefits.

a) Employment

The socio-economic benefits arising out of this project for the local populace will include creation of direct and indirect jobs and consequent rise in the income levels, associated commercial and social infrastructure development in the mofussil areas, improved quality.

The skilled manpower required for operation of the industrial estate will be easily available from the proposed areas. Manpower training and skill up-gradation will be encouraged.

b) Infrastructure Development

The proposed project will increase the Infrastructural facility for the area especially which will provide an opportunity for employment generation and development of service sectors.

c) Economic Development

Proposed project will add benefit to the regional socio-economic status due to development of ancillary facilities besides main project.

d) Multiplier Effect

The project will have excellent multiplier effect and will become truly a win-win situation for all the stakeholders. Thus, the proposed project has substantial socio-economic and environmental benefits at the local, the State, the Regional and the National levels.

g) Aesthetic Environment

The proposed project will reduce the pollution load in the micro level environment. And the aesthetic beauty will get a chance to be much better than earlier.

8.1 Socio –Economic Welfare Measures

OSCIPL is committed for various social welfare development in the surrounding region. The following CSR measures will be implemented by OSCIPL which along with cost are given in Table 8-1: CSR measures along with cost.

Table 8-1: CSR measures along with cost and the timelines

Sr. No.	CSR measures	Cost (Rs. Crores)	Timelines
1	In the proposed development repair of primary schools will be undertaken and academic facilities will be developed. Assistance will be provided to start computer education classes	7-8	2022-2028
2	Skill development program for locals by conducting through ITI or special classes.	5-7	2022-2028
3.	Providing support for primary health care facilities, gymnasium and yoga classes & special programs will be undertaken on health education	2-3	2022-2028
4	Activities for women empowerment, support to women's self-help groups and child welfare	5-6	2022-2028
5.	Awareness program and activities on cleanliness (Swachh Bharat) and environment protection will be conducted	1-2	2022-2028
6.	Provision of social infrastructure such as pure drinking water, solar lights, development of community toilets etc.	12-15	2019-2025

8.2 Corporate Environmental Responsibility

As per the requirements of MoEF & CC, OSC will spend an amount of 10.16 crores (0.5% of the total project cost i.e, 2032 crores) for undertaking afforestation programme on the land identified outside the OSC premises.

9. ENVIRONMENTAL MANAGEMENT PLAN

9.1 Introduction

Environmental Management Plan (EMP) outlines the various pollution control systems and other measures envisioned for alleviating environmental impacts identified separately for construction and operation phases. Individual mitigation measures has been assessed with respect to:

- Adoption of state of art technological measures;
- Identification of human resources for its effective implementation;
- Allocation of financial resources for its effective implementation; and
- Effectiveness of mitigatory measures.

EMP specifies various technological measures for pollution prevention, waste minimization, attenuation etc. proposed to be undertaken to mitigate the environmental impacts on each sector of environment during each phase of the project, i.e. construction phase and operation phase.

Apart from mitigation measures, EMP also includes institutional set-up for implementation of various measures.

9.2 Environment Cell

Comprising of all environment and public relations departments of all departments formed under the project and headed by the OSCIPL Environmental Officer. The environment cell will be responsible for:

- Periodic review of environmental status
- Implementation and maintenance of green buffer areas,
- Overall environmental compliance management,
- Review of STP/CETP operations and taking corrective measures,if any,
- Monitoring of waste management system,
- Implementation of EMP and Compliance to conditions stipulated in Environmental clearances and consents,

The Environment Management Committee (EMC) shall undertake the activities as discussed below:

9.2.1 Inspection, Monitoring & Audit

The Environment cell under the Environment Management Committee will undertake inspection and monitoring of the environmental management measures during construction of infrastructure in order to ensure the effectiveness of suggested mitigations.

OSCIPL through its Project Management department will ensure that all the contractors comply with the requirements of conditions for all applicable permits and guidelines. The inspections and audits will be undertaken by an Environment cell directly or through external agencies/experts.

The inspection and audit findings will be implemented by the contractors in their respective areas. The entire process of inspections and audits will be documented.

Monitoring of green buffer areas, eco protection zone and other delineated area will also be undertaken by the Environment cell.

9.2.2 Reporting and Review

Reporting of environmental, health, safety and social performance reports or check list, incident record register etc will be developed and implemented through a program of reporting by the Environment Cell throughout the project.

All contractors engaged will be required to adhere to the reporting requirements in terms of timely report submission with required details. All complaints and enquiries will be addressed with records maintained in an assigned register by the safety officer of each contractor.

Internal and external reporting mechanism will be developed, internal reporting will comprise of the Environment Cell, the representatives of the contractors and the top management of OSCIPL while external reporting will comprise of the top management, other government agencies and civil society.

The internal reporting will be undertaken on quarterly basis while the external reporting will be undertaken as per the requirement of the authorities.

9.2.3 Record Keeping

OSCIPL will be required to keep records of all EHS (Environmental Health & Safety) and social aspects, which will be documented and updated. Personnel will be identified to ensure documentation with detail of responsibilities and training on documentation system. Documents of key importance to be developed and controlled include:

- Standard Operation Procedures (SOP);
- Register on Legal Commitment;
- Incident Communication Report;
- Complaints register and Grievances
- Emergency Response Procedures;
- Training Records;
- Monitoring Reports and;
- Inspection and Auditing Reports

9.2.4 Review and Amendments of EMP

This EMP shall be reviewed annually or as considered essential to incorporate any change in the organization, process, or regulatory requirements. Following a review, amended EMP will be communicated to all the staff.

9.3 Applicable Environment and Social Legislations

OSCIPL will abide by all the environmental and social legislations as enlisted below:

- The Environment (Protection) Act, 1986 and Environment (Protection) Rules 1986
- The Water (Prevention and Control of Pollution) Act 1974
- The Air (Prevention and Control of Pollution) Act 1981
- Environment Impact Assessment Notification, 2006 amended in 2009
- Municipal Solid Wastes (Management and Handling) Rules, 2016
- Bio-Medical Waste (Management and Handling) Rules, 2018 and its amendments thereof
- Hazardous Waste Management And Handling Rules 1998 and Other Wastes (Management and Transboundary Movement) Rules, 2016
- Central Ground Water Authority Notification
- Noise Pollution (Regulation and Control) Rules, 2000

9.4 Suggested Management and Monitoring Plans

Based on the findings of the Environmental Assessment management plans for mitigation, monitoring and performance improvement measures for identified social and environmental impacts has been prepared. The following plans are detailed in the following subsections:

- Environment Management Plan (EMP)
- Monitoring Action Plan (Environment)
- Disaster Management Plan (DMP)

9.5 Environment Management Plan (EMP)

The Environment management plan lists out the mitigation measures and management strategies for construction and operation phases of the proposed project. The proposed mitigation measures have been prepared considering all possible strategies oriented towards effective environmental management including pollution prevention and control, waste minimization and management, and residual attenuation for the proposed project. The environmental impacts and mitigation measures suggested for various environmental components for the construction and operation phase of the project are provided in Table 9-3 and Table 9-4 respectively

Table 9-1: Environmental Management Plan during the construction phase

Sr. No	Component	Significance of Impact Impacts Identified	Suggested Mitigation Measures	Responsibility
1.	Ambient Air Quality	Emissions from construction equipment, vehicles	- Proper maintenance of machines and vehicles. - Contractors to maintain proper records for fleet engaged. - Limited vehicular movement to be permitted on disturbed soil. - Vehicle speed to be restricted to 15 km/h on unpaved roads. - Trucks /dumpers engaged to be covered during off site transportation. - A minimum freeboard of six inches to be maintained by haul trucks when material is transported on any paved road. - Vehicles with valid Pollution under Control (PUC) certificate to be engaged for project. - Downwash of trucks to be undertaken prior to departure.	Implementation by Contractor and Supervision by OSCIPL
		Improper handling and storage of construction material	- Minimum possible drop height to be maintained while unloading /screening of material. - Stockpiling of excess fill material. - Covers and enclosures to be provided for loose construction material at construction site	Implementation by Contractor and Supervision by OSCIPL
		Dust emissions	- Suppression of dust emissions by spraying water, wetting of the stockpile, - Paved roads to be cleaned regularly and un-paved roads to be stabilized and watered regularly. - Inactive disturbed surfaces to be sprinkled with water on daily basis	Implementation by Contractor and Supervision by OSCIPL

Sr. No	Component	Significance of Impacts Identified	Suggested Mitigation Measures	Responsibility
		Emissions from onsite operation of diesel generators	- Power supply for construction will be sourced from local distribution company. - Generators to be used only as backup source. - Diesel generators to be optimally operated and regularly maintained. - Appropriate stack height as per the CPCB guidelines to be provided for DG sets.	Implementation by Contractor and Supervision by OSCIPL
		Burning of waste at labour facilities	- LPG cylinders to be provided in labour canteens and use of fuel wood to be discouraged. - Open burning of waste shall not be permitted. - Community kitchen to be promoted among subcontractors	Implementation by Contractor and Supervision by OSCIPL
2.	Water Resources and Quality	Burden on the water resources	- Water for construction phase to be sourced from existing sources allocated to PP supplemented with authorized tanker supply. - Optimal water consumption measures at labour facility sites along with adequate awareness programmers to be organized for the workers.	Implementation by Contractor and Supervision by OSCIPL
		Disposal of sewage from construction camps	- Adequate number of toilets (at least 8-10 toilets per 100 labours) to be provided onsite. - Random disposal of wastewater from labour facility to be restricted - Sludge from waste water treatment systems to be disposed off properly. - Regular removal of debris from construction site to be practiced.	Implementation by Contractor and Supervision by OSCIPL

Sr. No	Component	Significance of Impact Impacts Identified	Suggested Mitigation Measures	Responsibility
		Contamination of surface and groundwater resources from sewage and oil & grease	- Packaged STP to be deployed at the construction camp site - Oil and grease containing effluents to be pre-treated before discharge. - Sludge from the packaged STP to be used as manure for the green belt development / horticultural purposes	Implementation by Contractor and Supervision by OSCIPL
	Landscape and Topography	Change in topography and landscape	- The 90% soil requirement will be fulfilled from cutting within the site and only 10% will be sourced from approved quarries. - Excavated soil to be used in level raising; - Land surface contours to be restored in relation to the surroundings. - Construction footprint will be well defined and construction work to be carried out within the Project footprints only. - The construction contractors shall be instructed not to cut any tree without prior approval from OSCIPL. Whereas OSCIPL will facilitate to obtain permissions for tree cutting from relevant authority. - Green area and green buffers will be developed to improve the landscape.	Implementation by Contractor and Supervision by OSCIPL
		Localized flooding and related health issues due to decreased infiltration	- Diversion dykes to channel runoff to be constructed around the excavated site. - Road corridor to be provided with adequate cross drainage.	Implementation by Contractor and Supervision by OSCIPL
	Soil	Soil Erosion	- Top soil to be preserved and reused for landscaping purpose - Clearance of vegetative cover to be minimized to the extent possible and redeveloped later on.	Implementation by Contractor and Supervision by OSCIPL

Sr. No	Component	Significance of Impacts Identified	Impact	Suggested Mitigation Measures	Responsibility
				• Site grading and excavation to be undertaken during dry season. • Dikes, berms, drainage swales or ditches to be provided to divert surface run-off to specific channels. • A retention wall or bund to be provided around the storage areas for excavated soil and other construction material. • Completed earthworks to be sealed and/or re-vegetated at the earliest with the help of landscape expert. • Stacking of excavated soil material will be made only in earmarked areas. • Excavated soil to be used/ transported at the earliest for filling low lying areas. • Proper routing and adequate capacity of the storm water run-offs drains to be provided. • Movement and parking of heavy machinery and vehicles to be restricted to identified area. • Area used for parking purposes to be restored immediately after completion of each project activity.	
		Soil contamination		• All storage facilities to be designed with paved surface, provided with covered shed and adequate containment facility at the construction. • All waste to be handled as per applicable regulations. • Hazardous waste to be handled and disposed of in accordance with the requirements of Hazardous waste management rules 2016 • Contractor to develop spill contingency plan. • Provision of covered bins at labour facilities.	Implementation by Contractor and Supervision by OSCIPL

Sr. No	Component	Significance of Impacts Identified	Suggested Mitigation Measures	Responsibility
			- Waste to be segregated in biodegradable and non-biodegradable fraction. - Biodegradable waste will be treated with composting. - Contaminated sand/ soil shall be prevented during construction activities. - Trainings to be imparted to all workers and subcontractors regarding hazardous waste storage and disposal procedures	
	Traffic and transport	Increased traffic volume	- Wherever required temporary widening of roads to be undertaken. - Traffic and heavy machinery movement schedule to be communicated clearly to the local inhabitants. - Prior consultation with local Police Providing dedicated path within the site for entry and exit of the construction vehicles	Implementation by Contractor and Supervision by OSCIPL
		Damage to existing village roads	Roads damaged due to project vehicles will be continuously repaired	Implementation by Contractor and Supervision by OSCIPL
		Disruption of traffic and increased cases of road related hazards	- Provision of adequate training to drivers. - Dedicated parking area to be provided for project vehicles. - Parking along footpaths, single lane roads shall be prohibited. - Detailed plan for signage around the construction areas to be prepared to facilitate traffic movement. - Inventory of the vehicles used in project and construction equipment along with their PUC's to be maintained.	Implementation by Contractor and Supervision by OSCIPL
	Noise	Noise due to Construction activities (such as excavation, grading, erecting equipment, piling, etc)	- Adequate planning to avoid high noise activities to be undertaken. - Acoustic enclosures, noise barriers to be provided in areas of high noise generating sources.	Implementation by Contractor and Supervision by OSCIPL

Sr. No	Component	Significance of Impacts Identified	Suggested Mitigation Measures	Responsibility
			Rubber padding to be provided for vibration control	
		Noise due to operation of heavy equipment and machinery	- Construction workers to use ear muffs in areas with potential for high noise generation. - Regular maintenance of vehicles and repair of equipment. - Noise barriers will be provided between the activities and the receptors. - Restriction on use of equipment generating high noise during night time.	Implementation by Contractor and Supervision by OSCIPL
		Movement of vehicles	Movement of vehicles during night time to be limited.	Implementation by Contractor and Supervision by OSCIPL
		Noise due to construction equipment such as Concrete Mixers and Batching Plant	- Working hours and construction activities to be aligned and works to be prohibited during night hours. - Acoustical enclosures are strongly recommended with 30 dB Transmission Loss Rating for the Engine, to bring down the SPL below 80 dB. - The contractor should carefully choose the batching plant in order to meet with the CPCB Norms. - Hydraulic pumps and compressors should be covered with Acoustical Enclosures with 20 dB Transmission Loss Rating in order to reduce the noise. - Valves should be covered with Removable Acoustical Blankets. - The contractor should choose controlled operating hours for noisy activities such as delivery, loading unloading etc.	Implementation by Contractor and Supervision by OSCIPL
	Socio-Economic	- Loss of existing village assets - Loss of landholdings	- The persons who have sold the land for the project to be considered for benefits like employment, contracts etc. - Skilled and qualified local persons to be given preference in employment and other contractual benefits.	Implementation and Supervision by OSCIPL

Sr. No	Component	Significance of Impact Impacts Identified	Suggested Mitigation Measures	Responsibility
		- Impact on livelihood of the villages	.	
	Labour Camp Management	Domestic solid waste generation	- Regular removal of debris from construction site to be practiced. - Integrated solid waste management plan will be developed for collection, transportation, treatment and disposal of waste.	Implementation by Contractor and Supervision by OSCIPL
		Firewood for cooking and burning of garbage and subsequent deterioration in air quality	- Arrangement of cooking gas supply to be done by contractor - Awareness to be created among workers to avoid use of firewood or kerosene.	Implementation by Contractor and Supervision by OSCIPL
		Waste water generation	- Adequate number of toilets (at least 8-10 toilets per 100 labors) with septic tanks and soak pits arrangements to be provided onsite - Random disposal of wastewater from labour colonies to be restricted. - Packaged STP to be provided for workers	Implementation by Contractor and Supervision by OSCIPL
		Health and hygiene	- Workers to be provided with health and safety training. - First aid and essential medical services to be provided at site. - Health Check-up: (Quarterly) - Personal protective equipment - Creches for children: - Medicines and preliminary check-up equipment/ materials:	Implementation by Contractor and Supervision by OSCIPL

Sr. No	Component	Significance of Impacts Identified	Suggested Mitigation Measures	Responsibility
			• Site sanitation • Emergency/Exigencies(Ambulance hire basis+doctors+Hospitalization) • Educational and Safety Awareness Program⊗Audio-visual)	
	Occupational Health and Safety	• Injury due to improper handling, operation and execution	• Good housekeeping practices to be exercised. • Measures such as job rotations and stretch breaks to be adopted. • Proper signage to be provided around construction site. • Use of Personal Protection Equipment (PPEs) to be mandated at work site.	Implementation by Contractor and Supervision by OSCIPL
		• Trip and fall, inadequate fall safe arrangements	• Use of temporary fall protection measures in scaffolds and out edges of elevated work surfaces, such as hand rails and toe boards to prevent materials from being dislodged shall be done. • Safety harness to be ensured for workers while working at heights	Implementation by Contractor and Supervision by OSCIPL
		• Exposure to hazardous substances	• Workers to be provided with health and safety training. • First aid and essential medical services to be provided at site	Implementation by Contractor and Supervision by OSCIPL
	Employment and Local Economy	• Increased employment opportunities • Contracting opportunities for locals • Better avenues for Small scale service providers	• Project to utilize the facilities available from the local market to support the local economy to the extent possible. • Wherever possible, labour from local community will be employed for project.	Implementation by Contractor and Supervision by OSCIPL
	Ecology	• Loss of trees and ground vegetation	• Original soil profile shall be retained by storing each excavated layers separately and restoring it later.	Implementation by Contractor and Supervision by OSCIPL

Sr. No	Component	Significance of Impact Impacts Identified	Suggested Mitigation Measures	Responsibility
			Tree felling to be minimized to the extent possible. Contractors shall be instructed to practice the same.	
		Adverse impact on wildlife due to noise, vehicle movement	Standard noise levels to be maintained during construction activities	Implementation by Contractor and Supervision by OSCIPL
		Increased turbidity and siltation	No silt/waste to be allowed in the nearby waterbodies	Implementation by Contractor and Supervision by OSCIPL

Table 9-2: Environmental Management Plan during the operation phase⁴

Sr.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
1.	Air	Emission from industrial processes	- Comprehensive planning has been undertaken which ensures that the proposed Industrial areas and existing residential are placed in such a way to avoid the impact of air pollution on people. - Adequate buffer to be provided for Residential areas and industries. - Individual industries will be required to obtain adequate approvals such as Consent to Establish / Consent to Operate or Environment Clearance from MPCB / SEIAA / MoEF. - All emission sources to be provided with adequate stack height as per CPCB / MoEF norms.	Implementation by individual industry as per Env clearance obtained by them as applicable. Supervision by EMC ⁵

⁴ The proponent will run the project till full occupancy / till handover to the tenants. Once the project is completed, it is likely to be taken up by MIDC or by municipality.

⁵ Environmental Management Cell (EMC) will be managed by the area authority (such as Municipality /MIDC / Any other body) responsible for overall operations of Orange Smart City

Sr.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
			• Low emission fuels to be used by industries. • Air pollution control equipment to be deployed by industries. • Good housekeeping to be practiced. • PP to organize seminars and Capacity Building training programmes about the best practices in different industrial sectors. • PP in association with the MPCB to regularly monitor the environmental performance of the industries. • CETP – to be provided with adequate ventilation system to prevent emissions such as HAPs, Odour etc. The adequate management practices to be adopted to control and mitigate the air emissions during CETP operations; • Waste Management Facility: Odour control measures to be adopted. The adequate management practices to be adopted to control and mitigate the air emissions during facility operations; • All maintenance activities should ensure that the dust control measures are applied.	
2	Noise	• Increase in noise levels in residential areas and adjoining villages	• All habitations to have a suitable buffer area delineated around them. • Vegetative barriers in form of green belt to be provided around all industrial areas. • All industrial operations to have acoustic enclosure and employ noise attenuation measures. • All roads to be provided with vegetative barriers and barrier walls.	Implementation by individual industry and Supervision by EMC;
		• Movement of vehicles	• All roads to be provided with vegetative barriers and barrier walls as applicable.	OSCIPL

Sr.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
		D.G sets	Diesel Generator Sets are supposed to have Sound Pressure Levels of lesser than 75 dBA when measured at 1 meter distance. However, when multiple DG sets are supposed to be kept close to one another, a single Acoustical Enclosure combined for all the DG Sets is recommended with a minimum Transmission Loss Rating of 30 dBA	Implementation by individual industry & Supervision by EMC
		Sewage Treatment Plant/CETP	multiple of blowers and pumps, out of which blowers can generate noise levels exceeding 100 dB. Acoustical Enclosures for Blowers are strongly recommended, with 30 dB Transmission Loss Rating.	OSCIPL
		Exposure to high noise prone areas	All people working in the vicinity of the Equipment/Machinery with Sound Pressure Levels higher than 90 dB should wear protective ear plugs to avoid permanent hearing damage.	Implementation by individual industry & Supervision by EMC
		Increase in noise levels due to the various operations at the Waste Management Facility	- Use of heavy duty muffler systems on heavy equipment - Limiting certain activities - By using damping, absorption, dissipation, and deflection methods - By using common techniques such as constructing sound enclosures, applying mufflers, mounting noise sources on isolators, and/or using materials with damping properties - Preference to be given to low noise generating equipment while procurement - Use of ear protective devices. - In case of steady noise levels above 85-dB (A), initiation of hearing conservation measures, etc.	OSCIPL

Sr.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
3	Water	Increase load on fresh water sources	- Individual projects will have separate water meters and two inlet sources, one for fresh water and second for use of treated wastewater; - SCADA system to be implemented for monitoring leakages in the water conveyance system; - Minimise flow variation from the mean flow;	Implementation by individual industry and & Supervision by EMC;
		Unplanned disposal of industrial waste water generated and sewage leading to Contamination of natural water resources and ground water aquifers	- Building and plumbing code to propose dual plumbing layout; - Domestic and industrial wastewater generated will be treated separately; - Storing of oil wastes in lagoons should be minimized in order to avoid possible contamination of the ground water system. - All effluents containing acid/alkali/organic/toxic wastes should be properly treated - In case of oil waste, oil separation before treatment and discharge into the environment.	Implementation by individual industry and Supervision by EMC;

Sr.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
			For synthetic Organic chemicals industry - Develop spill prevention plans in case of chemical discharges and spills - Develop traps and containment system and chemically treat discharges on site - Treated wastewater (such as sewage, industrial wastes, or stored surface runoffs) can be used as cooling water makeup.	Implementation by respective industries and Supervision by EMC;
		Inadequate management of storm water	Proper and well-designed storm water drainage system is planned by OSCIPL	Supervision by OSCIPL
		Spills, leaks from industries, storage areas	Spill contingency plan to be delineated	Implementation by individual industry and Supervision by EMC;
		Contamination of the surface water and ground water by discharge of effluent from CETP	- Regular inspection of wastewater conveyance pipelines to be undertaken - Operation and maintenance of the all components of the CETP to be undertaken scrupulously at regular intervals - Backup plan for temporary storage for untreated effluent with adequate capacity in case of failure of CETP	Implementation by operator and Supervision by EMC;
		Contamination of the ground water by Solid Waste Management facility (Landfill)	- Collection and treatment of leachate, sewage and storm water run-off - Increased recycling of treated leachate - Monitoring of ground waters - Run-off control measures	Implementation by operator and Supervision by EMC;

Sr.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
4	Solid Waste	Inadequate collection and treatment of domestic waste and hazardous waste, e-waste leading to contamination of soil and ground water resources, unhygienic conditions and odour problem	- Industries generating hazardous waste to comply with the requirements of Hazardous Wastes (Management and Handling) Rules, 1998 and Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 - OSCIPL to comply with SWM Rules 2016 - OSCIPL to undertake benchmarking as per Ministry of Urban Development for SWM - Integrated solid waste management plan will be developed for collection, transportation, treatment and disposal of waste. - Facilities will be designed to cater to the requirements of horizon year - Industries to contact hazardous waste management facility near Taloja for disposal of their hazardous waste - E waste to be sold to authorized recyclers. - Recyclable waste to be collected separately and sold to authorized recyclers/ vendors.	Implementation by individual industry Supervision by EMC;
		Improper disposal of domestic sludge, CETP sludge and industrial waste	- Sludge will be generated from the sewage treatment plants which will be de-watered using filter press, dried and used for gardening purpose. - CETP sludge to be disposed off at the nearest CHWTSDF; - OSCIPL to secure necessary permission for disposing off CETP sludge at the nearest CHWTSDF;	Implementation by operator and Supervision by EMC;
5	Traffic Volume	Increase in traffic flow and volume	- The roads in general to be designed to carry the maximum traffic loads with anticipated future development and on a par with IRC (Indian Road Congress) Standards; - A well planned public transport infrastructure has been envisaged for the project; - The proposed road circulation shall provide for safe and efficient movement of people;	OSCIPL

Sr.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
			Maintenance of systematic spatial and technical database for the roads which would enable regular monitoring and feedback on road conditions thereby managing effective periodic maintenance;	
		Traffic congestion	- Non-motorized vehicles to be encouraged - Comprehensive traffic and travel surveys shall be conducted every 5 years to monitor traffic characteristics and travel pattern to develop strategies for effective transportation; - The proposed road circulation shall provide for safe and efficient movement of people; - Pedestrian Guard Rails, Road safety Signage and overhead signs shall be placed wherever necessary; - Road widths and lane configurations to be designed based on the modelling exercise;	OSCIPL
		Irregular Parking	- Each individual project shall develop parking facilities as per the Development Control Regulations. - Each residential project to provide parking facilities as per applicable norms and regulations. - Sufficient Loading/unloading space to be provided	Implementation by individual industries and Supervision by EMC;
6	Land use Pattern	Impacts on existing human settlements	- During the master planning stage, detailed analysis has been undertaken to delineate site for OSC and various site alternatives were examined and ranked to select the option based on socio-economic and environmental factors. - Adequate buffer has been provided around environmentally sensitive features - Industrial land use has not been proposed in proximity of the sensitive receptors. - The residential and commercial users to undertake the development in consonance with the master plan of OSC and also comply with the local regulation as applicable.	OSCIPL

Sr.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
7	Ecology	Impact on flora and fauna of the adjoining green areas	- As per master plan, no forest land is falling in the delineated area; - Only native and local species will be chosen for green area. - Each industry shall follow the CPCB guidelines; - Only permissible activities shall be planned in the green buffer. - The fronts of river passing adjacent to the sites is planned as green area.	Implementation by operator of common infrastructure and individual industries
		Illegal cutting of trees	The project proponent will not allow illegal cutting of trees in the project area by contractors /labourers working on the project site.	Implementation by operator of common infrastructure and individual industries
8	Social	Increased employment and business opportunities , Improvement in infrastructure Increased income levels, Stabilization of the rural economies , Potential for cultural conflict , Unplanned secondary development in the adjoining areas	- OSCIPL and individual project to undertake CSR program to ensure harmony and cooperation. . - OSC is willing to spend CSR money in providing skill development, clean and safe drinking water, sanitation facility, primary health care support in the nearby villages. Further details are presented in Section 8.2 titled ‘Socio –Economic Welfare Measures’ of the Chapter -8	OSCIPL

9.6 Green Belt Development Plan

Objectives of the green belt are to enhance the vegetation cover for increasing the biodiversity of the region and consequently creating a noise barrier, Maintain and enhance the ecological equilibrium of the area and to enhance the Aesthetic value of the area.

The green belt will also act as a barrier to the adjoining habitats and will have additional environmental benefits. The plantation/greenbelt development proposed project area is 268 acres/ 108 Ha. Thus, plantation will be carried out on 254.95 acres/ 106.2 Ha @ of 1500 trees/ha, which will be about 25% of the proposed project area. It is proposed to plan 1000 tree saplings every year. Some trees shall be planted along road side in proposed industrial project area. Development of green belt plantation within the industrial area along with plantations of different species for the purpose of minimizing air pollution as well as landscaping other than listed here. The list of recommended species for plantation is given in Table 9-3.

Table 9-3: List of recommended species for plantation

Sr. No.	Species/Local Name	Spacing	Important features	Evergreen/ Deciduous	Growth Rate
Trees for general green areas and also suitable for roadside/borders/avenue plantation					
1	<i>Ailanthus exelsa</i> (Maharukh)	3 x 3m	Native species and grows to the height of 10-15m. Have medicinal value. Large tree, good for roadside plantation	Deciduous	Quick growing
2	<i>Alstonia scholaris</i> (Satwin)	3 x 3m	Native species and grows to the height of 25m. Shady Tree, white	Evergreen	Moderately growing

Sr. No.	Species/Local Name	Spacing	Important features	Evergreen/ Deciduous	Growth Rate
			fragrant flowers		
3	<i>Albizia lebbbeck</i> (Kala Shirish)	3 x 3m	Shady tree, yellowish green fragrant flowers .Widely used for green belt development. The tree grows upto 18m-30m in height.	Briefly Deciduous	Quick growing
4	<i>Anthocephallus cadamba</i> (Kadamb)	3 x 3m	Native species and grows to the height of upto 35m Large tree, red flowers	Evergreen	Quick growing
5	<i>Azadirachta indica</i> (Neem)	3 x 3m	Native species and grows to the height of 8-12m. Have medicinal value. Large tree, good for roadside plantation	Evergreen	Quick growing
6	<i>Bauhinia racemose</i> (Apta)	3 x 3m	Small tree with small white flowers, grows to the height of 15-20m.	Deciduous	Quick growing

Sr. No.	Species/Local Name	Spacing	Important features	Evergreen/ Deciduous	Growth Rate
			Butterfly host plant		
7	<i>Bombax ceiba</i> (Katesavar)	3 x 3m	Native species and grows to the height of 12-35m. Large tree, with attractive red flowers. The flowers attract many birds to the trees.	Deciduous	Quick growing
8	<i>Butea Monosperma</i> (Palas)	3 x 3m	Medium sized deciduous tree. Beautiful orange flowers, Butterfly host plant Native species and grows to the height of 6-12m.	Moderately growing	Deciduous
9	<i>Pongamia pinnata</i> (Karanj)	3 x 3m	Medium size tree, 3-6 m tall. Shady tree usually planted along the roads. Seeds are harvested for its oil.	Evergreen	Quick growing
10	<i>Ficus retusa</i>	3 x 3m	Native species	Moderately growing	Evergreen

Sr. No.	Species/Local Name	Spacing	Important features	Evergreen/ Deciduous	Growth Rate
	(Nandrukh)		grows to the height of 15m or more taller. Shady tree, good for roadside plantation		
Trees for beautification of the garden/building premises					
11	<i>Butea Monosperma</i> (Palas)	3 x 3m	Medium sized tree. Beautiful orange flowers, Butterfly host plant Native species and grows to the height of 6-12m.	Moderately growing	Deciduous
12	<i>Cassia fistula</i> (Bahava)	3 x 3m	Medium sized deciduous tree. Beautiful yellow flowers, Butterfly host plant. Grows to the height of upto 10m to 12m in height	Deciduous	Quick growing
13	<i>Erythrina indica</i> (Pangara)	3 x 3m	Medium sized deciduous tree. Bright scarlet flowers, grows upto	Deciduous	Quick growing

Sr. No.	Species/Local Name	Spacing	Important features	Evergreen/ Deciduous	Growth Rate
			6m to 9m in height		
14	<i>Lagerstroemia flos-regineae</i> (Tamhan)	3 x 3m	State flower tree of Maharashtra a Medium sized tree, beautiful purple flowers Grows to the height of upto 20m	Evergreen	Quick growing
15	<i>Saraca asoka</i> (Sita Ashok)	3 x 3m	Shady tree with red-yellow flowers Grows to the height of 8-10m	Evergreen	Quick growing
16	<i>Caryota urens</i> (Bhirla Mad)	3 x 3m	Medium size Palm tree upto 12m in height The sap harvested from this palm is a very favorite drink of locals	Evergreen	Quick growing
17	<i>Putranjiva roxburghii</i>		A medium sized tree with drooping branches and grows	Evergreen	Quick growing

Sr. No.	Species/Local Name	Spacing	Important features	Evergreen/Deciduous	Growth Rate
			upto 12 m in height		
Shrubs					
	Species/Local Name	Spacing	Important features	Perennial/Annual	Evergreen/Deciduous
1	<i>Adhatoda vasica</i> (<i>Adulsa</i>)	1 x 1m	Native species and grows to the height of 2.5m. Very important medicinal plant in the locality	Perennial	Evergreen
2	<i>Cassia auriculata</i> (<i>Tarwad</i>)	1 x 1m	Native species and grows to the height of 1 to 1.5m. Have medicinal importance.	Perennial	Evergreen
3	<i>Plumbago zeylanica</i> (<i>Chitrak</i>)	1 x 1m	Native species grows upto 6 feet and very important medicinal plants for the locals. Beautiful white flowers throughout the year	Perennial	Evergreen
4	<i>Stachytarpheta indica</i>	1 x 1m	Native species and grows to the height	Perennial	Evergreen

Sr. No.	Species/Local Name	Spacing	Important features	Evergreen/ Deciduous	Growth Rate
			of 2m. Yields beautiful blue flowers.		
5	<i>Vitex negundo</i> (Nirgudi)	1 x 1m	Native species and grows to the height of 2 to 8m Commonly grows near water bodies in general.	Perennial	Deciduous

Apart from the above tree species, some Indian fruit trees will also be planted in the green belt. These trees may require longer duration of irrigation and maintenance. The list of these tree species are given below in Table 9-4.

Table 9-4: Recommended species for fruit tree plantation

Sr. No.	Tree Species	Spacing	Features
1.	<i>Mangifera indica</i> (Amba/Mango)	5 x 2m	Reach 15-20 m in height, with a crown radius of 10 m.
2.	<i>Achras zapota</i> (Chickoo/Sapota)	5 x 2m	Native to India, a middle sized tree, the average height is 12m.
3.	<i>Ziziphus mauritiana</i> (Bor)	5 x 2m	Fast growing & hardy plant
4.	<i>Artocarpus heterophyllus</i> or <i>Artocarpus heterophylla</i> (Jackfruit/Phanas)	5 x 2m	Fruit bearing tree of India. Grows upto 15m.
5.	<i>Syzygium cumini</i> (Jamun)	5 x 2m	Native Indian tree grows upto 20m.

This is hereby ensured that the mostly indigenous/ local plants will be planted all around the periphery of the project area and along the roadsides. Plantations would be of large leaf trees that provide adequate shade and are semi-evergreen to evergreen. The landscape plan showing green area, trees and table of tree species is enclosed.

Various native and indigenous trees would be planted for mitigation purpose which includes in the section below:

Sr. No.	Scientific Name
1	<i>Amorphophallus paeoniifolius</i>
2	<i>Abelmoschus indicus</i>
3	<i>Annona squamosa</i>
4	<i>Artocarpus heterophyllus</i>
5	<i>Carica papaya</i>
6	<i>Citrus lemon</i>
7	<i>Mangifera indica</i>
8	<i>Albizia odoratissima</i>
9	<i>Albizia procera</i>
10	<i>Azadirachta indica</i>
11	<i>Bauhinia variegata</i>
12	<i>Bauhinia purpuria</i>
13	<i>Bambusa arundanaceae</i>
14	<i>Blumea sp.</i>
15	<i>Butea superba</i>
16	<i>Butea frondosa</i>
17	<i>Cocos nucifera</i>

Sr. No.	Scientific Name
18	<i>Eucalyptus sp</i>
19	<i>Delonix regia</i>
20	<i>Leucena leucophloe</i>
21	<i>Abelmoschus esculentus</i>
22	<i>Abrus precatorius</i>
23	<i>Abutilon indicum</i>
24	<i>Acacia Arabica</i>
25	<i>Acacia auriculiformis</i>
26	<i>Acacia leucophloe</i>
27	<i>Achras sapota</i>
28	<i>Acalypha hispida</i>
29	<i>Acanthospermum hispidum</i>
30	<i>Achyranthes aspera</i>
31	<i>Adathoda vasica</i>
32	<i>Adiantum philippense</i>
33	<i>Adenanthera pavonina</i>
34	<i>Aegle marmelos</i>
35	<i>Aegeratum conyzoides</i>
36	<i>Ageratum conyzoides</i>
37	<i>Ailanthus excelsa</i>
38	<i>Albizia odoratissima</i>
39	<i>Albizia procera</i>
40	<i>Aloe barbedensis</i>

Sr. No.	Scientific Name
41	<i>Allophylus cobbe</i>
42	<i>Alternanthera sessilis</i>
43	<i>Alysicarpus hamosus</i>
44	<i>Alysicarpus monilifer</i>
45	<i>Argyreia elliptica</i>
46	<i>Argemone Mexicana</i>
47	<i>Asparagaus racemosus</i>
48	<i>Atalantia monophylla</i>
49	<i>Azadirachta indica</i>
50	<i>Barleria cuspidate</i>
51	<i>Bauhinia racemose</i>
52	<i>Bridelia retusa</i>
53	<i>Blepharis asperima</i>
54	<i>Blumea lacera</i>
55	<i>Bombax ceiba</i>
56	<i>Borreria stricta</i>
57	<i>Bridelia retusa</i>
58	<i>Buchanania lanzan</i>
59	<i>Butea monosperma</i>
60	<i>Caesalpina pulcherima</i>
61	<i>Calotropis procera</i>
62	<i>Canna indicda</i>
63	<i>Calycotropis floribunda</i>

Sr. No.	Scientific Name
64	<i>Careya arborea</i>
65	<i>Carissa carandus</i>
66	<i>Carissa spinarium</i>
67	<i>Carvia callosa</i>
68	<i>Casearia tomentosa</i>
69	<i>Cassia auriculata</i>
70	<i>Cassia obtuse</i>
71	<i>Cassia occidentalis</i>
72	<i>Cassia tora</i>
73	<i>Cassia fistula</i>
74	<i>Catunaregam spinose</i>
75	<i>Calycotropis floribunda</i>
76	<i>Ceiba pentandra</i>
77	<i>Celosia argentea</i>
78	<i>Cestrum noctrunum</i>
79	<i>Chromalaena odorata</i>
80	<i>Chrysanthemum sp</i>
81	<i>Cissus quadrangularis</i>
82	<i>Citrus media</i>
83	<i>Cleome viscose</i>
84	<i>Clematis triloba</i>
85	<i>Cocculus villosa</i>
86	<i>Cocos nucifera</i>

Sr. No.	Scientific Name
87	<i>Combretum ovalifolium</i>
88	<i>Commelina benghalensis</i>
89	<i>Cordia dichotoma</i>
90	<i>Cordia rothri</i>
91	<i>Crotalaria pallida</i>
92	<i>Crotalaria sp. 2</i>
93	<i>Croton bonplandinum</i>
94	<i>Cryptostegia grandiflora</i>
95	<i>Curcuma aromatic</i>
96	<i>Cuscuta reflexa</i>
97	<i>Dalbergia lanceolate</i>
98	<i>Dalbergia sisoo</i>
99	<i>Datura alba</i>
100	<i>Dendrophthe falcate</i>
101	<i>Desmodium gangeticum</i>
102	<i>Desmodium triflorum</i>
103	<i>Diploclisia glaucescens</i>
104	<i>Echinops echinatus</i>
105	<i>Eclipta alba</i>
106	<i>Eclipta prostrate</i>
107	<i>Eichhornia crassipes</i>
108	<i>Emblica officinalis</i>
109	<i>Entada pursaetha</i>

Sr. No.	Scientific Name
110	<i>Erythrina indica</i>
111	<i>Eupatorium glandulosum</i>
112	<i>Euphorbia nerifolia</i>
113	<i>Euphorbia neruri</i>
114	<i>Euphorbia nivula</i>
115	<i>Ficus asperrima</i>
116	<i>Ficus benghalensis</i>
117	<i>Ficus glomerata</i>
118	<i>Ficus hispida</i>
119	<i>Ficus microcarpa</i>
120	<i>Ficus racemosus</i>
121	<i>Ficus religiosa</i>
122	<i>Flacourtia indica</i>
123	<i>Flacourtia latifolia</i>
124	<i>Gardenia latifolia</i>
125	<i>Garuga pinnata</i>
126	<i>Garcinia indica</i>
127	<i>Gloriosa superba</i>
128	<i>Gossypium herbaceum</i>
129	<i>Grewia abutifolia</i>
130	<i>Grewia asiatica</i>
131	<i>Grewia subinaqualis</i>
132	<i>Helictris isora</i>

Sr. No.	Scientific Name
133	<i>Heliotropium indicum</i>
134	<i>Helitropium ovalifolium</i>
135	<i>Heterophragma quadriculare</i>
136	<i>Hemidesmus indicus</i>
137	<i>Hibiscus micronthus</i>
138	<i>Hibiscus ovalifolia</i>
139	<i>Hibiscus rosa-cianensis</i>
140	<i>Holarrhena antidysentrrica</i>
141	<i>Hygrophylla auriculata</i>
142	<i>Hymenodictyon excelsum</i>
143	<i>Hyptis suavalens</i>
144	<i>Ipomea sp.</i>
145	<i>Ixora parviflora</i>
146	<i>Ixora coccinea</i>
147	<i>Jasminum malbarichum</i>
148	<i>Jatropha gossypifolia</i>
149	<i>Justicia carnea</i>
150	<i>Justicia procumbens</i>
151	<i>Lantana camara</i>
152	<i>Lathyrus sativus</i>
153	<i>Lawsonia inermis</i>
154	<i>Largestromia lanceolate</i>
155	<i>Leea microphylla</i>

Sr. No.	Scientific Name
156	<i>Lepisanthes tetraphylla</i>
157	<i>Leucas aspera</i>
158	<i>Leucas stelligera</i>
159	<i>Loranthus sp</i>
160	<i>Mancranga peltata</i>
161	<i>Mangifera indica</i>
162	<i>Melia azadirachta</i>
163	<i>Merremia umbellate</i>
164	<i>Merremia vitifolia</i>
165	<i>Mimosa pudica</i>
166	<i>Mitrgyna parviflora</i>
167	<i>Moullava spicata</i>
168	<i>Mollugo hirta</i>
169	<i>Moringa oleifera</i>
170	<i>Mucuna pruriens</i>
171	<i>Murraya koenigii</i>
172	<i>Musa paradisiac</i>
173	<i>Nerium indicum</i>
174	<i>Ocimum americanum</i>
175	<i>Ocimum basillum</i>
176	<i>Ocimum sanctum</i>
177	<i>Operculina turpethum</i>
178	<i>Opuntia dillinii</i>

Sr. No.	Scientific Name
179	<i>Opuntia elator</i>
180	<i>Oxalis corniculata</i>
181	<i>Panicum notatum</i>
182	<i>Parthenium hysterophorus</i>
183	<i>Passiflora foetida</i>
184	<i>Pavonia zeylanica</i>
185	<i>Peltophorum ferrugineum</i>
186	<i>Peristrophe bicalculata</i>
187	<i>Phoenix aculis</i>
188	<i>Phyllanthus emblica</i>
189	<i>Phyllanthus nirurii</i>
190	<i>Physalis minima</i>
191	<i>Pithocolobium dulce</i>
192	<i>Polyalthia longifolia</i>
193	<i>Pongamia glabra</i>
194	<i>Pongamia pinnata</i>
195	<i>Portulaca oleracea</i>
196	<i>Psidium guava</i>
197	<i>Pteris sp</i>
198	<i>Punica granulatum</i>
199	<i>Rhus mysoorensis</i>
200	<i>Samanea saman</i>
201	<i>Sapindus emerginatus</i>

Sr. No.	Scientific Name
202	<i>Schleichera oleosa</i>
203	<i>Sida acuta</i>
204	<i>Sida cordifolia</i>
205	<i>Sida rhombifolia</i>
206	<i>Smilax zeylanica</i>
207	<i>Solanum nigrum</i>
208	<i>Solanum xanthocarpum</i>
209	<i>Spondias pinnata</i>
210	<i>Sterculia villosa</i>
211	<i>Strobilanthus callossus</i>
212	<i>Sygygium cumini</i>
213	<i>Tabernaemontana pandacaqui</i>
214	<i>Tagetes sp</i>
215	<i>Tamarindus indica</i>
216	<i>Tectona grandis</i>
217	<i>Tephrosia purpuria</i>
218	<i>Teramnus labialis</i>
219	<i>Terminalia paniculata</i>
220	<i>Terminalia chebula</i>
221	<i>Terminalia elliptica</i>
222	<i>Tetrasigma sp.</i>
223	<i>Thespesia populanea</i>
224	<i>Thespesia lampas</i>

Sr. No.	Scientific Name
225	<i>Thumbergia sp.</i>
226	<i>Tinospora cordifolia</i>
227	<i>Tragus biflorus</i>
228	<i>Trapa bispinosa</i>
229	<i>Trapa natans</i>
230	<i>Trema orientalis</i>
231	<i>Tridax procumbens</i>
232	<i>Triumferta pilosa</i>
233	<i>Urtica sp.</i>
234	<i>Vanda sp.</i>
235	<i>Vangueria spinose</i>
236	<i>Vanilla planifolia</i>
237	<i>Vernonia cinera</i>
238	<i>Vicoa indica</i>
239	<i>Vitex negungo</i>
240	<i>Woodfordia fruticose</i>
241	<i>Wrightia tinctoria</i>
242	<i>Wrightia tomentosa</i>
243	<i>Xanthium strumarium</i>
244	<i>Yucca gloriosa</i>
245	<i>Zizyphus jujube</i>
246	<i>Zizyphus mauritiana</i>
247	<i>Zizyphus nummularis</i>

Sr. No.	Scientific Name
248	<i>Zizyphus oenoplica</i>
249	<i>Cenchurus ciliaris</i>
250	<i>Apluda mutica</i>
251	<i>Chloris dolichosta</i>
252	<i>Cyanodactylon sp</i>
253	<i>Dichanthium annulatum</i>
254	<i>Aristida adscensionsis</i>
255	<i>Andropogon pertusus</i>
256	<i>Andropogon monticola</i>
257	<i>Cenchrus setifera</i>
258	<i>Cyperus aristatus</i>
259	<i>Cyperus rotundus</i>
260	<i>Cynadon dactylum</i>
261	<i>Digetaria bicornis</i>
262	<i>Digetaria Segetaria</i>
263	<i>Digetaria stricta</i>
264	<i>Eragrostis tenella</i>
265	<i>Fibrystylis dichotoma</i>
266	<i>Ischaemum pilosum</i>
267	<i>Heteropogon contortus</i>

Plantation of these trees will not only ensure the presence of native species but will also help in creating corridors for thriving faunal activities.

9.7 Cost of the mitigation measures

The cost of mitigation measures during the construction phase and the operation phase is presented in Table 9-5 and Table 9-6 respectively.

Table 9-5: Cost of mitigation measures – Construction Phase

Sr. No.	Parameter	Timeline for implementation	Recurring cost per year (Rs. Lacs)
1.	PPE	Progressive	25
2.	Site Sanitation Facility +Housekeeping	Progressive	5.5
3.	Drinking water facility	Progressive	3.0
4.	Solid Waste Management	Progressive	4.5
5.	Safety railing, platform, ladder, hoist, Cranes+ education and safety awareness program etc.	Progressive	6.0
7.	Health Check+ Ambulance facility +Crèche facility	Progressive	4.0
8.	Environmental Monitoring(Monitoring charges for air, water, waste water, drinking water ,soil, DG stack, noise.)	2019	15.0
9	Pollution Control – STP & Noise Control Measures (Sound Reflective barriers) Site barricading	2019	6.0 5.0
10	Dust control measures by engagement of sprinklers	2019	10.0
11	Storm water drains with silt traps and collection sump:	2019	28
12	EMC	2019	6
Total Cost			118

Table 9-6: Cost of mitigation measures- Operation Phase

S.No.	Description	Timeline for implementation	Capital Cost (Lakhs)	O&M Cost (lakhs) per annum

1	Rain Water Harvesting	2019-2029	50	5
2	Fire Fighting measures, Disaster Management Kit , Well-equipped Control Room , CCTV , Disaster Management training to labours and Security Staff, Mock Exercise , 2 way Public announcement system	2019 -2029	1500	150
3	Water supply system including WTP	2019 -2029	45000	2250
4	Sewerage System and Recycling System	2019 -2029	35600	2101
5	Landscaping	2019 -2029	2000	400
6	Solid Waste Management	2019 -2029	4000	200
7	Information and Communication Technology (ICT)	2019 -2029	3300	330
8	Energy saving	2024 -2029	1300	195
9	Traffic Management Plan Implementation	2019 -2029	500	50
10	Pollution Control – STP & Noise Control Measures Sound Reflective barriers, Acoustical Enclosures for STP Blowers	2019 -2029	24.2	38
11	EM Cell	--	Covered in construction phase	2
12	Ambient air quality sensors and display	2019 -2029	100	10
13	CETP	2019-2029	520	6
14	Landfill cost	2019-2029	200	13.5
	Total		94094.2	5750

The expenditure shown in the Table 9-6 has been included in the project cost

9.8 Environmental Management Cell

An Environmental Management Cell is proposed which will oversee the implementation of environmental safeguards as proposed below:

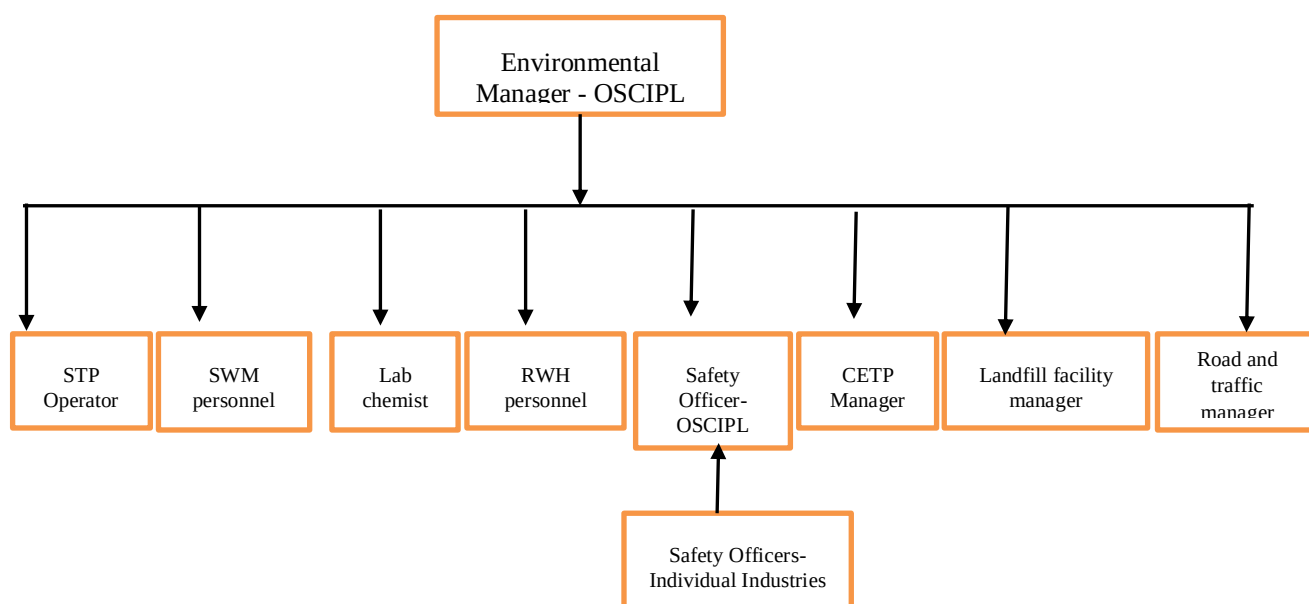


Figure 9-1: Structure of Environmental Management Cell

Table 9-7: Responsibilities of the EMC personnel

Sr.No	Personnel	Responsibility
1.	STP Operator	- The supervisor shall visit and check the devices daily. He will see that the STP is working properly and flow measurements are recorded properly in a register. - The effluent from the STP shall be got checked by him in the Laboratory once a week. Any parameter going out of the prescribed limits will be reported to the Environmental Manager for taking corrective action. He will pursue the matter at personal level to bring the parameters within permissible limits. - The Environmental Manager will keep in touch with the Environmental Consultant and seek their guidance for corrective action as and when required. - The Committee shall meet once every month to ensure implementation of the programme.

		The Environmental Manager will bring to the notice of the Managing Director any further action to be taken to ensure environmental requirements. The Managing Director will report to the Board of Directors, the action taken to set right deficiency, if any.
2.	SWM personnel	- Maintain the records / inventory of the solid waste generated at the site for onward disposal to the MPCB authorised vendor - Interface with the SWM machinery vendor for the maintenance of all the equipment related to the segregation of the solid waste at site - Supervise the segregation of the solid waste at the site. - Makes necessary field inspections to assure safe working conditions and that established methods and policies are followed. - To ensure compliance with the Solid Waste Management Rules 2016 and all the relevant statutes.
3.	Lab Chemist	- To analyse the samples collected for the environmental components such as air, water, noise and soil. - To maintain the records of the results of analysis - To maintain the laboratory equipment in working condition. - To identify the budgetary requirements for the upkeep of the environmental laboratory. - To oversee / supervise the environmental monitoring , if outsourced to the MoEF/NABL accredited laboratory. - To report the exceedance of the relevant parameters w.r.t regulatory standards and bring it to the notice of the Environmental Manager for corrective action.
4.	RWH personnel	- To supervise the installation of the RWH systems by the contractor. - To maintain the records of the results of rainwater harvesting quantities. - To supervise operation and maintenance of the rainwater harvesting structures and to keep a log of the same - To monitor the implementation of the RWH measures by individual industries.
5	CETP Manager	- To scrupulously check/ conduct inspections for all the equipment installed and treatment systems in the CETP at defined intervals as per the program. - To maintain the record pertaining to the measurements of flow and quality of effluent emanating from the CETP - To get the quality of effluent monitored /checked by the Environmental Laboratory at regular intervals. Any

		exceedance of the parameters / deviation from the normal values will be thoroughly investigated and corrective action taken. - To monitor the overall compliance by individual industries against the respective effluent disposal standards/ EC issued by MoEF & CC / CTE & CTO issued by SPCB. - To report any requirement for the procurement of any components/ upgradation of the CETP to the Environmental Management Committee.
6	Landfill Facility Manager	- To ensure regulatory compliance with SWM Rules 2016 - To oversee the monitoring of the ground and surface water quality/air quality/ around the landfill site as per the environmental monitoring plan outlined - To keep the records of the Solid Waste Transportation (Daily quantity of inert waste transported to landfill, No. of trips made to site per vehicle to landfill), Solid Waste Handling and Disposal (Daily quantity of inert waste received), Monitoring and Survey (Records of all monitoring carried out as per the finalized monitoring protocol) - To oversee monitoring of the leachate characteristics by a MoEF accredited laboratory. - To monitor the overall compliance against the EC issued/ CTE & CTO issued - To inspect all the equipment (weighbridge etc), vehicles at periodic intervals and to ensure their proper functioning.
7	Road & Traffic Manager	- To oversee the functioning of the smart traffic management system proposed for the OSC. - To check/ inspect the condition of the pavements at regular intervals, internal roads, bridges and to oversee the personnel undertaking the repairs of the same. - To maintain the records of the traffic volume and characteristics of traffic and to evolve a smooth traffic management plan on ground as per the specific requirement.
5.	Safety Officer	- To periodically review and update the Disaster Management Plan of the OSC. - To keep a log / checklist of the potential accidents that may occur. - To conduct mock drills with the safety heads of the individual industries

		• To ensure the preparedness of OSC to counter any emergency. • To ensure that the individual industries have an EHS plan in place along with necessary measures to counter emergencies.

10. SUMMARY AND CONCLUSION

10.1 Introduction

Orange Smart City Infrastructure Pvt. Ltd. (OSCIPL) has planned to develop an Integrated Industrial Township titled “Orange Smart City” at Taluka Pen, Dist Raigad, Maharashtra. Although it is not part of Government of India’s 100 Smart City Mission, but it has been planned along the lines of Smart City Guidelines of Government of India (GoI). This is the first green field smart city planned in Maharashtra.

OSC is a planned urban development having more open space which encourages walk to work communities. It is planned Transit Oriented Development (ToD), which reduces use of fuel with emphasis on walk-ability and pedestrian comfortable environment. The activities on different sites had been planned as per their significance to the functions/uses/business of the OSC. The location of these activities is encapsulated as cluster with the proximity to transport and facilities. OSC Development plan facilitates development of following industries:

- Category A and Life Sciences: Pharmaceutical, Bulk drugs and Intermediates
- Engineering: Automotive industries preferably one anchor unit and others will be tier-2 and tier-3 category.
- Food Processing: Fish poultry and Meat processing, Food processing and packaging, Sorting, grading and cold storage.
- IT/ITES
- Logistics
- KPO/BPO
- Other related industrial, commercial (offices) as per the predominant land use.

OSC is planned with mix use development with predominant industrial use. To support the industrial and other economic uses, Residential and commercial is also proposed with all required infrastructural utilities and allied facilities. The OSC is planned to address Industrial demand and new emerging housing need including affordable housing by creating infrastructure and a globally competitive environment that attracts investment and promotes sustainable development.

The project site spread across over 1042.51 acres of land, is closely clustered at four locations. The site parcels are located in close proximity to India's financial capital, Mumbai. The site cluster is well connected and is in close proximity of the Jawaharlal Nehru Port (JNPT), the well-developed urban center of Navi Mumbai, the proposed Mumbai Trans-Harbor Link (MTHL) and the proposed Navi Mumbai International Airport (NMIA).

OSC is within the influence zone of India's most ambitious infrastructure project – the Delhi Mumbai Industrial Corridor (DMIC) and is in vicinity of the terminal point of the Western Dedicated Freight Corridor (DFC). The NH-66 and the suburban railway network presently connect OSC to the major urban centres of the Mumbai Metropolitan Region (MMR).

The objective of OSC is to develop Green Sustainable Smart City to cater the industrial demand, create employment opportunities and provide sustainable smart housing with provision of adequate infrastructure and public services assurance of environmental justice and healthful living environment and achievement of the vision for a more livable city.

The project proposes to have sustainable economic base primarily driven by manufacturing product mix along with institutional, residential and commercial supporting activities. The township proposes to provide trunk infrastructure facilities including supporting social and physical infrastructure to boost the sustainable economy in combination of Industrial Parks, IT/ BT Parks and Logistics, Warehousing and Financial Centers.

As per the EIA Notification 2006 and its amendments thereof, The aforesaid project consists of category 'A' synthetic organic chemical industries, the whole industrial integrated township will be considered as Category 'A' and will be appraised at Central Level by MoEF& CC at Delhi by the relevant Expert Appraisal Committee.

10.2 Project Description

The key details of the project are presented in Table 10-1.

Table 10-1 : Key details of the project

Sr. No	Item	Details
1.	Name of the project	Orange Smart City (OSC)
2.	Project Type	Integrated Industrial Township
3.	Location	Pen, Raigad
4.	Name of the villages coming under project area	T1: Boregaon, Shene, Ambeghar& Virani T2: BelawadeBudruk T3: Balawali, Govirle, Kopar, Ambiwali&Hamrapur T4: Mungoshi, Walak, BelawadeKhurd, Padale and BelawadeBudruk
5.	Project Connectivity	NH 66 & SH 88
6.	Total site area	1042.51 acres
7.	Built Up Space	5.01 million sq.m
8.	Industrial Built Up Area	3075720 sq.m (approx)

Sr. No	Item	Details
9.	Commercial Built Up Area	710896 sq.m (approx)
10.	Residential Area	1100784 sq.m (approx)
11.	Green Area and Open spaces	1031746 sq.m
12.	Amenities / Utilities	23307 sq.m
13.	Estimated Population	73068
14.	Estimated Employment Opportunities	150000 (approx)
15.	Project Cost	Rs 2032 Crores (+Rs. 2000 crores land cost)
16.	Project Start Year	FY 2019
17.	Start of Operations	FY 2029
18.	Horizon Years of development	10 Years
19.	Project Land UseComponents	Includes industrial commercial residential and institutional developments as well as open and green spaces, industries such as Synthetic Organic Chemicals Logistics, Engineering, Agro, Electronics and Semi-Conductor, Life Sciences, Information technology, Gems and Jewellery, & Research and Development.
20.	<u>Power requirement</u>	Construction Phase: 5 MVA Operation Phase: 142.18 MVA
21.	Source of Power	Maharashtra State Electricity Distribution Company Ltd. (MSEDCL)
22.	<u>Water requirement</u>	Construction Phase: 320 m ³ /day Operation Phase: 38.60 MLD
23.	Source of water	Hetwane Dam
24.	<u>Waste water Generated</u>	Construction Phase: 256 m ³ /day Operation Phase: 21.56 MLD
25.	<u>Solid Waste Generation</u> Solid waste from residential areas Solid waste from industrial areas Solid waste from commercial areas	29.2 Tonnes (At 400 gms/capita/day) 13.1 Tonnes (At 150 gms/capita/day) 9.2 tonnes (At 9.22 gms/capita/day)
26.	Project Status	Detailed Project Report has been completed. The land is privately owned by company. Detailed Master Plan has been approved by MIDC. Public hearing has been held.

10.3 Description of the Environment

The various environmental attributes were studied from March 2015 to May 2015 which are as discussed as under :

10.3.1 Physiography

The project area is divided in four patches and these patches occupy diverse topography from a steeply sloping hilly terrain situated at higher elevations to almost plain topography along lower contours.

The T1 parcel is situated at southern downstream of Hetavane (Bhogeshwari) river. A South–North valley divides this parcel in two hills. This valley has upstream maximum elevation of 220 m and downstream minimum elevation of 26 m where it meets the river, whereas ridge has highest elevation of 340 m at top. The terrain of this land parcel has moderately steeper slopes but at the top it is flatter. T2 Parcel has relatively flat ground. The ground elevation of this Parcel ranges from 80 m to 55 m. The T3 land parcel is generally flat at top having slope leading to the Balganga River near the area where it meets creek having potentials of enhancing the site with a natural frontage. This land parcel is divided by downstream river of Govirle bandhara (minor earthen check dam) . The drainage channel passes through the T3 Site connecting to Balganaga River. For T3, elevation ranges from 80m to 40m. The T4 parcel is situated at base of major hills on West. T4 Parcel is made up of eighteen small land parcels and two major parcels. One of the major parcel have ground elevation ranges from 55m to 7m. And other major parcel is relatively hilly ground with elevations ranges from 86m to 12m.

10.3.2 Hydrogeological Observations

Groundwater Occurrence: The groundwater formation depends upon the topography as well as the subsurface geology in the area of interest. In the case of OSC project, the topography, as well as the subsurface rock are obstructing to the groundwater formation in this locale. However, the groundwater is not intensively used in this area.

The project area occupies a steeply sloping, highly undulating land occupying the highly placed plateau and hill slope portions. It is comprised of Deccan trap basaltic rock. Primarily, this rock has low porosity and permeability and hence, is considered as “Hard” from groundwater occurrence point of view. These factors are found to play vital role in poor groundwater occurrence in the study area.

Dug wells:

The dug wells in study and surrounding area are found to be located particularly in the ravines and low-lying gully portions and along the surface water courses (Plate 1). They are found 8 to 10 m in depth bgl. The static water level (pre-monsoon) in this region is reported to be ranging from 8.5 to 9.0 m bgl, while the same (post monsoon) is observed to be almost at par with the Ground level. These structures are largely found to be used as domestic water source.

Bore wells: The study and surrounding area hosts few bore wells. These are observed along the lower reaches. They are found to tap the semi confined and confined aquifer in this area. They are reported to be 90 to 100 m in depth bgl. Majority of bore wells are fitted with hand pump while few are installed with low capacity pumps as per requirement.

10.3.3 Meteorology

An onsite meteorological station was installed to study wind speed, wind direction and temperature during the period from March 2016 to May 2016. The predominant wind

direction during the period was from the West –North West quadrant. The findings are summarised in Table 10-2.

Table 10-2: Synopsis of onsite meteorological data

Month	Wind speed (m/sec)			Temperature (°C)		
	Max	Min	Avg	Max	Min	Avg
March -2016	5.5	0	1.25	39.1	18	26.8
April-2016	6	0	1.6	36	20.9	27.7
May -2016	4.6	0	1.57	34	23.4	29.4

The onsite meteorological data was compared with data from the nearest India Meteorological Department (IMD) station Murud. The predominant wind direction as per the IMD Murud station is from the West –North West quadrant. The summary of the IMD data is presented in Table 10-3.

Table 10-3: Synopsis of the IMD Murud data (March 2014 to May 2014)

Month	Wind speed (m/sec)			Temperature (°C)		
	Max	Min	Avg	Max	Min	Avg
March -2014	4.1	0	1.2	38.6	17.8	27
April-2014	3.9	0	1.4	36.6	19.2	27.7
May -2014	4.6	0	1.5	34.3	23.8	29.6

The onsite meteorological data is in general agreement with the IMD Murud data. The minor differences are observed due to the difference in the period of recording.

10.3.4 Ambient Air Quality

The ambient air quality was recorded at the 14 stations. The air quality was recorded w.r.t. the following parameters:

- Particulate Matter less than 10µm (PM10)
- Particulate Matter less than 2.5µm (PM2.5)
- Sulphur dioxide (SO₂)
- Oxides of nitrogen (NO₂)
- Carbon monoxide (CO)
- Hydrocarbon (HC)

vii. Volatile Organic Compounds (VoC)

The maximum 24 hourly values of the PM₁₀, PM_{2.5}, SO₂, NO_x were found to be within the National Ambient Air Quality Standards (NAAQS) limit. The CO levels were also found to be within the NAAQS limit of 2 mg/m³ for 8 hours. The Hydrocarbons and the VOCs were found to be below detectable limit throughout the monitoring period.

10.3.5 Noise Quality

The noise quality was recorded at 11 locations. The noise levels (Leq) observed during daytime in residential zone is in the range of 42.5 (Crosswind of T-3 at Kopar village) to 43.9 dB (A) (Upwind of T-1 Wirani Village) while during nighttime it is 32.5 (Downwind of T-4 at Mungoshi Village) to 33.8 dB (A) (Downwind of T-3 at Jite. village). The results reflect that the Leq (day) and Leq (night) was within the limits stipulated by Central Pollution Control Board (CPCB).

10.3.6 Water Quality

The ground water quality and the surface water quality was recorded at 6 stations and 8 surface monitoring locations. The ground water quality parameters were analysed as per IS 10500. The ground water results reflect that the calcium slightly exceeds the desirable limit of 75 mg/lit. The surface water quality parameters reflect that the water is chemically and bacteriologically non-potable at three locations while it is potable at remaining five locations.

10.3.7 Soil Quality

The soil quality was recorded at 8 locations. The results indicate that the texture was mostly clay and clay loam. The range of micronutrients reflect that the soil has good fertility level and fulfils the minimum nutrient requirement for growth of plants.

10.3.8 Ecology and Biodiversity

The project is situated in the hilly region of North Konkan, though the proposed activities are mainly in plain and rolling areas. The Forested hills in the surrounding area has moist evergreen forests that are mixed with deciduous varieties. Some of the Forests are Bombax dominant forests. The forest vegetation is interspersed with fruit trees like Mango, Cashew, Chickoo, Jackfruit, etc.

There are number of hills within 15 km boundary of project site that have reserved forest. The nearest Protected forest is Karnala Wildlife Sanctuary. The hillslopes are largely cultivated with millets whereas foothills are cultivated with Paddy. Many hillslopes are cultivated for Cucumber and other vegetables during the Monsoon. The entire area has low to moderate wildlife value and fauna is significantly dominated by fringe species that are usually associated with rural settings

An elaborate ecology and biodiversity study was conducted within the impact zone (10-15 km radius) of the project site. The conclusions of the study are given below:

The project area is outside any recorded forest area. In the project site, no formal logging of wood and other such activities were observed, the exploitation of the forest resources by the nearby villagers and the local communities was evident in the surroundings of the project site. The marks of forests fire were also visible near two locations viz. Chirner and Palas village.

Flora

By and large the habitat is dominated by evergreen and deciduous foliage. Amongst the locations surveyed, it was seen that many of the sites have localized biological diversity with a great variety of evergreen tree species as well as shrub layer. The development activities may result in clearing of many plant species mostly grasses and shrubs which are not unique or rare species because of their abundant occurrence in other areas. Thus, the loss of these species would have no serious ecological consequences.

Fauna

The project area could be home to general avifaunal species which are widespread and therefore any loss of habitat in this area is not expected to lead to any major loss in species numbers or diversity. Generally, the concerns of non-recorded species do exist although it may be on smaller scale owing to their non-sighting in the three day sampling period between Dec 16-18, 2015.

10.3.9 Socio –Economic Profile of the study area

The socio-economic baseline environment is described with respect to the various parameters are as given below:

i. Demographic profile

According to the 2011 Census data, population in the total study area was 364915 living in 84345 households whereas the villages population in the project area was 11187 persons that is about 3% of the total study area population and the population of all the rural villages within the 15 km radius of the study area

ii. Social Groups

The proportion of Scheduled Castes (SCs) and Scheduled Tribes (STs) population within the project study area is on an average 3.0% and 15.3% respectively. The proportion of SC population in affected villages is merely 0.8% found only in 13 villages, which is less than other rural villages (2.2%) and urban centres (4.9%) in the study area. Whereas the proportions of ST population for villages within the project area is (43.9%), which together constitutes to 44.7% which is much higher than the other rural villages (21.9%) & urban areas (18.3%)

iii. Sex Ratio

According to 2011 census, sex ratio in the total study area was found to be 953 while in the affected villages was found to be 972. The sex ratio in the villages other than the affected villages was found to be 957.

It is important to note that, literacy rate for male and female in project affected villages is 57% and 43% respectively which indicates that the literate male population is more than the female literate population.

iv. Vulnerability

As regards vulnerability, poverty is actually a reason for making any section of a population vulnerable. The data for families below poverty line for all the villages in study area is not available. However based on the studies in other areas of Maharashtra, most of the SC and ST

families can be considered as the vulnerable group which constitutes about 45% of the total population in the project affected villages in addition to any other BPL families in the region.

A primary baseline survey was also conducted by BEIPL and the details can be referred in the EIA study report.

v. Consultation with the villagers

The minutes of the consultation with the villagers in the affected area is given below in Table-1.9 below:

Date of Visit	20/10/2015		
Venue :	Project Site		
Client	BEIPL : Mr. Hrushikesh Kolatkar Client : Representative from Client		
Village Name	Kopar village	Belawade village	Ambeghar village
Discussion Points:			
Key points of the meeting were	The village has school only for Primary level and for Middle and high school students have to go to Jambhultep, Pen. There is no primary health center facility. For critical health related matters, Pen is the nearest place. Rain water and Dug-well are the main sources of irrigation. For domestic use, Dug-well and Hand pumps are the sources. Most of the people in the village are engaged in agriculture, dairy. Rice and seasonal vegetables are cultivated by the people. Most of the seasonal vegetables grown are sold in Pen and Navi Mumbai. Almost each family has cows or buffaloes to supplement their	The village has a total of 328 houses. The school in the village is only up to eight class. For studies after eight, students have to go to Pen. There is a private clinic of a Physician in the village. The nearest government primary health center is at Pen village. Most of the village land is rain fed for agriculture purpose. For the domestic use well and hand pumps are the sources. People of the village in general are engaged in agriculture, dairy and daily wage labourers. Rice and seasonal vegetables are cultivated by the people. Seasonal vegetable	The village Ambeghar has 427 houses. The village has relatively large population. It can be seen that the village is well connected by road. The village has Government school up to 8th standard. For studies after eight, students have to go to Pen. There is a private doctor in the village. The nearest government primary health center is at Pen. Most of the village land is irrigated through dug-wells and tube wells. For domestic use, dug-wells and hand pumps are the sources of water for villagers. People of the village in general are engaged in agriculture, dairy and wage labour. Main crops is rice and seasonal vegetables are also

	income by selling milk. There are also people who are engaged as daily wage labourers in agriculture and construction activity in nearby urban areas. Women in general support the family by engaging in agriculture and dairy activity & household chores.	grown are sold in nearby urban areas. Almost each family has cows or buffaloes to supplement their income. About half the male population of village is engaged in construction activity in nearby urban areas. The education level is generally low among the villagers Women in general support the family with household chores. In addition, women are also involved in agriculture and dairy activity of family.	cultivated. Some families are fully into vegetable cultivation which is a main source of income. In addition to agriculture, the other two main occupation for earning for the locals is dairy and wage labour. Almost each family has cows or buffaloes to supplement their income. Most of the male population of villages is engaged in construction and factories in Pen as wage labor. The education level is generally low among the villagers. Women in general support the family with household chores. In addition, women are also involved in agriculture and dairy activity of family.
Key observations and issues:	People are aware about the project and have a very positive opinion on the project. People expect the project would bring development in their villages and would open up opportunity of employment and other business avenues People were keen to know when the project would start and what kind of factories will come up.	People are aware about the project and have a very positive opinion on the project. People expect the project would bring development in their villages and would open up opportunity of employment and other business avenues	People are aware about the project and have a very positive opinion on the project. People expect the project would bring development in their villages and would open up opportunity of employment and other business avenues People were keen to know when the project would start and what kind of factories will come up

	People also expect the project to give preference to local in employment Unemployment and lack of opportunity is evident in the village.	People were keen to know when the project would start and what kind of factories will come up People also expect the project to give preference to local in employment In project during the construction phase the locals can be good source of construction labour as they are already in to that activities currently.	People also expect the project to give preference to local in employment In project construction phase the locals can be good source of construction labour as they are already in to that activities currently. There is large scale unemployment reported during the survey

10.4 Anticipated Environmental Impacts and Mitigation Measures

The impacts of the project activities were studied on the various environmental attributes by the matrix methods considering the severity, extent and duration of the activities. The summary of the impacts during the construction and the operation phase is given below:

Summary of impacts during the construction phase

Sr.No	Aspect	Impact Significance
1	Air	Moderate
2	Water Usage	Moderate
3	Water quality	Low
3	Land use	Positive
4	Landscape and Topography	Low
5	Soil	Low
6	Noise	Low
7	Socio –Economics	Low
8	Ecology	Low
9	Cultural Heritage	Low

The summary of the impacts during the operation phase are summarized below :

Sr.No	Aspect	Impact Significance
1	Air	Moderate
2	Water Resources & Usage	Moderate
3	Water quality	Moderate
4	Soil	Low
6	Noise	Moderate
7	Ecology	Low
8	Socio –Economics	Low

The detailed impacts and mitigation measures along with responsibility for the implementation and supervision of the mitigation measures during the construction and operation phases is given below:

Detailed responsibility matrix of mitigation measures for the implementation and supervision of the same during the construction phase is given below :

Sr. No	Component	Significance of Impacts Identified	Suggested Mitigation Measures	Responsibility
1.	Ambient Air Quality	Emissions from construction equipment, vehicles	- Proper maintenance of machines and vehicles. - Contractors to maintain proper records for fleet engaged. - Limited vehicular movement to be permitted on disturbed soil. - Vehicle speed to be restricted to 15 km/h on unpaved roads. - Trucks /dumpers engaged to be covered during off site transportation. - A minimum freeboard of six inches to be maintained by haul trucks when material is transported on any paved road. - Vehicles with valid Pollution under Control (PUC) certificate to be engaged for project. - Downwash of trucks to be undertaken prior to departure.	Implementation by Contractor and Supervision by OSCIPL
		Improper handling and storage of construction material	- Minimum possible drop height to be maintained while unloading /screening of material. - Stockpiling of excess fill material. - Covers and enclosures to be provided for loose construction material at construction site	Implementation by Contractor and Supervision by OSCIPL
		Dust emissions	- Suppression of dust emissions by spraying water, wetting of the stockpile, - Paved roads to be cleaned regularly and un-paved roads to be stabilized and watered regularly. - Inactive disturbed surfaces to be sprinkled with water on daily basis	Implementation by Contractor and Supervision by OSCIPL

Sr. No	Component	Significance of Impacts Identified	Suggested Mitigation Measures	Responsibility
		Emissions from onsite operation of diesel generators	- Power supply for construction will be sourced from local distribution company. - Generators to be used only as backup source. - Diesel generators to be optimally operated and regularly maintained. - Appropriate stack height as per the CPCB guidelines to be provided for DG sets.	Implementation by Contractor and Supervision by OSCIPL
		Burning of waste at labour facilities	- LPG cylinders to be provided in labour canteens and use of fuel wood to be discouraged. - Open burning of waste shall not be permitted. - Community kitchen to be promoted among subcontractors	Implementation by Contractor and Supervision by OSCIPL
2.	Water Resources and Quality	Burden on the water resources	- Water for construction phase to be sourced from existing sources allocated to PP supplemented with authorized tanker supply. - Optimal water consumption measures at labour facility sites along with adequate awareness programmers to be organized for the workers.	Implementation by Contractor and Supervision by OSCIPL
		Disposal of sewage from construction camps	- Adequate number of toilets (at least 8-10 toilets per 100 labours) to be provided onsite. - Random disposal of wastewater from labour facility to be restricted - Sludge from waste water treatment systems to be disposed off properly. - Regular removal of debris from construction site to be practiced.	Implementation by Contractor and Supervision by OSCIPL

Sr. No	Component	Significance of Impact Impacts Identified	Suggested Mitigation Measures	Responsibility
		Contamination of surface and groundwater resources from sewage and oil & grease	- Packaged STP to be deployed at the construction camp site - Oil and grease containing effluents to be pre-treated before discharge. - Sludge from the packaged STP to be used as manure for the green belt development / horticultural purposes	Implementation by Contractor and Supervision by OSCIPL
	Landscape and Topography	Change in topography and landscape	- The 90% soil requirement will be fulfilled from cutting within the site and only 10% will be sourced from approved quarries. - Excavated soil to be used in level raising; - Land surface contours to be restored in relation to the surroundings. - Construction footprint will be well defined and construction work to be carried out within the Project footprints only. - The construction contractors shall be instructed not to cut any tree without prior approval from OSCIPL. Whereas OSCIPL will facilitate to obtain permissions for tree cutting from relevant authority. - Green area and green buffers will be developed to improve the landscape.	Implementation by Contractor and Supervision by OSCIPL
		Localized flooding and related health issues due to decreased infiltration	- Diversion dykes to channel runoff to be constructed around the excavated site. - Road corridor to be provided with adequate cross drainage.	Implementation by Contractor and Supervision by OSCIPL
	Soil	Soil Erosion	- Top soil to be preserved and reused for landscaping purpose - Clearance of vegetative cover to be minimized to the extent possible and redeveloped later on.	Implementation by Contractor and Supervision by OSCIPL

Sr. No	Component	Significance of Impacts Identified	Impact	Suggested Mitigation Measures	Responsibility
				• Site grading and excavation to be undertaken during dry season. • Dikes, berms, drainage swales or ditches to be provided to divert surface run-off to specific channels. • A retention wall or bund to be provided around the storage areas for excavated soil and other construction material. • Completed earthworks to be sealed and/or re-vegetated at the earliest with the help of landscape expert. • Stacking of excavated soil material will be made only in earmarked areas. • Excavated soil to be used/ transported at the earliest for filling low lying areas. • Proper routing and adequate capacity of the storm water run-offs drains to be provided. • Movement and parking of heavy machinery and vehicles to be restricted to identified area. • Area used for parking purposes to be restored immediately after completion of each project activity.	
		Soil contamination		• All storage facilities to be designed with paved surface, provided with covered shed and adequate containment facility at the construction. • All waste to be handled as per applicable regulations. • Hazardous waste to be handled and disposed of in accordance with the requirements of Hazardous waste management rules 2016 • Contractor to develop spill contingency plan. • Provision of covered bins at labour facilities.	Implementation by Contractor and Supervision by OSCIPL

Sr. No	Component	Significance of Impacts Identified	Suggested Mitigation Measures	Responsibility
			- Waste to be segregated in biodegradable and non-biodegradable fraction. - Biodegradable waste will be treated with composting. - Contaminated sand/ soil shall be prevented during construction activities. - Trainings to be imparted to all workers and subcontractors regarding hazardous waste storage and disposal procedures	
	Traffic and transport	Increased traffic volume	- Wherever required temporary widening of roads to be undertaken. - Traffic and heavy machinery movement schedule to be communicated clearly to the local inhabitants. - Prior consultation with local Police Providing dedicated path within the site for entry and exit of the construction vehicles	Implementation by Contractor and Supervision by OSCIPL
		Damage to existing village roads	Roads damaged due to project vehicles will be continuously repaired	Implementation by Contractor and Supervision by OSCIPL
		Disruption of traffic and increased cases of road related hazards	- Provision of adequate training to drivers. - Dedicated parking area to be provided for project vehicles. - Parking along footpaths, single lane roads shall be prohibited. - Detailed plan for signage around the construction areas to be prepared to facilitate traffic movement. - Inventory of the vehicles used in project and construction equipment along with their PUC's to be maintained.	Implementation by Contractor and Supervision by OSCIPL
	Noise	Noise due to Construction activities (such as excavation, grading, erecting equipment, piling, etc)	- Adequate planning to avoid high noise activities to be undertaken. - Acoustic enclosures, noise barriers to be provided in areas of high noise generating sources.	Implementation by Contractor and Supervision by OSCIPL

Sr. No	Component	Significance of Impacts Identified	Suggested Mitigation Measures	Responsibility
			Rubber padding to be provided for vibration control	
		Noise due to operation of heavy equipment and machinery	- Construction workers to use ear muffs in areas with potential for high noise generation. - Regular maintenance of vehicles and repair of equipment. - Noise barriers will be provided between the activities and the receptors. - Restriction on use of equipment generating high noise during night time.	Implementation by Contractor and Supervision by OSCIPL
		Movement of vehicles	Movement of vehicles during night time to be limited.	Implementation by Contractor and Supervision by OSCIPL
		Noise due to construction equipment such as Concrete Mixers and Batching Plant	- Working hours and construction activities to be aligned and works to be prohibited during night hours. - Acoustical enclosures are strongly recommended with 30 dB Transmission Loss Rating for the Engine, to bring down the SPL below 80 dB. - The contractor should carefully choose the batching plant in order to meet with the CPCB Norms. - Hydraulic pumps and compressors should be covered with Acoustical Enclosures with 20 dB Transmission Loss Rating in order to reduce the noise. - Valves should be covered with Removable Acoustical Blankets. - The contractor should choose controlled operating hours for noisy activities such as delivery, loading unloading etc.	Implementation by Contractor and Supervision by OSCIPL
	Socio-Economic	Loss of existing village assets	The persons who have sold the land for the project to be considered for benefits like employment, contracts etc.	Implementation and Supervision by OSCIPL
		Loss of landholdings	Skilled and qualified local persons to be given preference in employment and other contractual benefits.	

Sr. No	Component	Significance of Impact Impacts Identified	Suggested Mitigation Measures	Responsibility
		- Impact on livelihood of the villages	.	
	Labour Camp Management	Domestic solid waste generation	- Regular removal of debris from construction site to be practiced. - Integrated solid waste management plan will be developed for collection, transportation, treatment and disposal of waste.	Implementation by Contractor and Supervision by OSCIPL
		Firewood for cooking and burning of garbage and subsequent deterioration in air quality	- Arrangement of cooking gas supply to be done by contractor - Awareness to be created among workers to avoid use of firewood or kerosene.	Implementation by Contractor and Supervision by OSCIPL
		Waste water generation	- Adequate number of toilets (at least 8-10 toilets per 100 labors) with septic tanks and soak pits arrangements to be provided onsite - Random disposal of wastewater from labour colonies to be restricted. - Packaged STP to be provided for workers	Implementation by Contractor and Supervision by OSCIPL
		Health and hygiene	- Workers to be provided with health and safety training. - First aid and essential medical services to be provided at site. - Health Check-up: (Quarterly) - Personal protective equipment - Creches for children: - Medicines and preliminary check-up equipment/ materials:	Implementation by Contractor and Supervision by OSCIPL

Sr. No	Component	Significance of Impacts Identified	Suggested Mitigation Measures	Responsibility
			- Site sanitation - Emergency/Exigencies(Ambulance hire basis+doctors+Hospitalization) - Educational and Safety Awareness Program⊗Audio-visual)	
	Occupational Health and Safety	• Injury due to improper handling, operation and execution	- Good housekeeping practices to be exercised. - Measures such as job rotations and stretch breaks to be adopted. - Proper signage to be provided around construction site. - Use of Personal Protection Equipment (PPEs) to be mandated at work site.	Implementation by Contractor and Supervision by OSCIPL
		• Trip and fall, inadequate fall safe arrangements	- Use of temporary fall protection measures in scaffolds and out edges of elevated work surfaces, such as hand rails and toe boards to prevent materials from being dislodged shall be done. - Safety harness to be ensured for workers while working at heights	Implementation by Contractor and Supervision by OSCIPL
		• Exposure to hazardous substances	- Workers to be provided with health and safety training. - First aid and essential medical services to be provided at site	Implementation by Contractor and Supervision by OSCIPL
	Employment and Local Economy	- Increased employment opportunities - Contracting opportunities for locals - Better avenues for Small scale service providers	- Project to utilize the facilities available from the local market to support the local economy to the extent possible. - Wherever possible, labour from local community will be employed for project.	Implementation by Contractor and Supervision by OSCIPL
	Ecology	• Loss of trees and ground vegetation	• Original soil profile shall be retained by storing each excavated layers separately and restoring it later.	Implementation by Contractor and Supervision by OSCIPL

Sr. No	Component	Significance of Impacts Identified	Suggested Mitigation Measures	Responsibility
			Tree felling to be minimized to the extent possible. Contractors shall be instructed to practice the same.	
		Adverse impact on wildlife due to noise, vehicle movement	Standard noise levels to be maintained during construction activities	Implementation by Contractor and Supervision by OSCIPL
		Increased turbidity and siltation	No silt/waste to be allowed in the nearby waterbodies	Implementation by Contractor and Supervision by OSCIPL

Detailed responsibility matrix of mitigation measures for the implementation and supervision of the same during the operation phase is given below :

Sr.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
1.	Air	Emission from industrial processes	- Comprehensive planning has been undertaken which ensures that the proposed Industrial areas and existing residential are placed in such a way to avoid the impact of air pollution on people. - Adequate buffer to be provided for Residential areas and industries. - Individual industries will be required to obtain adequate approvals such as Consent to Establish / Consent to Operate or Environment Clearance from MPCB / SEIAA / MoEF. - All emission sources to be provided with adequate stack height as per CPCB / MoEF norms. - Low emission fuels to be used by industries. - Air pollution control equipment to be deployed by industries. - Good housekeeping to be practiced.	Implementation by individual industry and as per Env clearance obtained by them as applicable

Sr.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
			• PP to organize seminars and Capacity Building training programmes about the best practices in different industrial sectors. • PP in association with the MPCB to regularly monitor the environmental performance of the industries. • CETP – to be provided with adequate ventilation system to prevent emissions such as HAPs, Odour etc. The adequate management practices to be adopted to control and mitigate the air emissions during CETP operations; • Waste Management Facility: Odour control measures to be adopted. The adequate management practices to be adopted to control and mitigate the air emissions during facility operations; • All maintenance activities should ensure that the dust control measures are applied.	
2	Noise	• Increase in noise levels in residential areas and adjoining villages	• All habitations to have a suitable buffer area delineated around them. • Vegetative barriers in form of green belt to be provided around all industrial areas. • All industrial operations to have acoustic enclosure and employ noise attenuation measures. • All roads to be provided with vegetative barriers and barrier walls.	Implementation by individual industry and Supervision by EMC;
		• Movement of vehicles	• All roads to be provided with vegetative barriers and barrier walls as applicable.	OSCIPL
		• D.G sets	• Diesel Generator Sets are supposed to have Sound Pressure Levels of lesser than 75 dBA when measured at 1 meter distance. However, when multiple DG sets are supposed to be kept close to one another, a single Acoustical Enclosure	Implementation by individual industry & Supervision by EMC;

Sr.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
			combined for all the DG Sets is recommended with a minimum Transmission Loss Rating of 30 dBA	
		Sewage Treatment Plant/CETP	multiple of blowers and pumps, out of which blowers can generate noise levels exceeding 100 dB. Acoustical Enclosures for Blowers are strongly recommended, with 30 dB Transmission Loss Rating.	OSCIPL
		Exposure to high noise prone areas	All people working in the vicinity of the Equipment/Machinery with Sound Pressure Levels higher than 90 dB should wear protective ear plugs to avoid permanent hearing damage.	Implementation by individual industry & Supervision by EMC;
		Increase in noise levels due to the various operations at the Waste Management Facility	- Use of heavy duty muffler systems on heavy equipment - Limiting certain activities - By using damping, absorption, dissipation, and deflection methods - By using common techniques such as constructing sound enclosures, applying mufflers, mounting noise sources on isolators, and/or using materials with damping properties - Preference to be given to low noise generating equipment while procurement - Use of ear protective devices. - In case of steady noise levels above 85-dB (A), initiation of hearing conservation measures, etc.	OSCIPL
3	Water	Increase load on fresh water sources	- Individual projects will have separate water meters and two inlet sources, one for fresh water and second for use of treated wastewater; - SCADA system to be implemented for monitoring leakages in the water conveyance system; - Minimise flow variation from the mean flow;	Implementation by individual industry and Supervision by EMC;

Sr.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
		Unplanned disposal of industrial waste water generated and sewage leading to Contamination of natural water resources and ground water aquifers	- Building and plumbing code to propose dual plumbing layout; - Domestic and industrial wastewater generated will be treated separately; - Storing of oil wastes in lagoons should be minimized in order to avoid possible contamination of the ground water system. - All effluents containing acid/alkali/organic/toxic wastes should be properly treated - In case of oil waste, oil separation before treatment and discharge into the environment.	Implementation by individual industry and supervision by EMC
			For synthetic Organic chemicals industry - Develop spill prevention plans in case of chemical discharges and spills - Develop traps and containment system and chemically treat discharges on site - Treated wastewater (such as sewage, industrial wastes, or stored surface runoffs) can be used as cooling water makeup.	Implementation by respective industries and supervision by EMC
		Inadequate management of storm water	Proper and well-designed storm water drainage system is planned by OSCIPL	Supervision by OSCIPL

Sr.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
		Spills, leaks from industries, storage areas	Spill contingency plan to be delineated	Implementation by individual industry and supervision by EMC
		Contamination of the surface water and ground water by discharge of effluent from CETP	- Regular inspection of wastewater conveyance pipelines to be undertaken - Operation and maintenance of the all components of the CETP to be undertaken scrupulously at regular intervals - Backup plan for temporary storage for untreated effluent with adequate capacity in case of failure of CETP	Implementation by operator and Supervision by EMC
		Contamination of the ground water by Solid Waste Management facility (Landfill)	- Collection and treatment of leachate, sewage and storm water run-off - Increased recycling of treated leachate - Monitoring of ground waters - Run-off control measures	Implementation by operator and Supervision by EMC
4	Solid Waste	Inadequate collection and treatment of domestic waste and hazardous waste, e-waste leading to contamination of soil and ground water resources, unhygienic conditions and odour problem	- Industries generating hazardous waste to comply with the requirements of Hazardous Wastes (Management and Handling) Rules, 1998 and Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 - OSCIPL to comply with SWM Rules 2016 - OSCIPL to undertake benchmarking as per Ministry of Urban Development for SWM - Integrated solid waste management plan will be developed for collection, transportation, treatment and disposal of waste. - Facilities will be designed to cater to the requirements of horizon year - Industries to contact hazardous waste management facility near Taloja for disposal of their hazardous waste - E waste to be sold to authorized recyclers.	Implementation by individual industry and supervision by EMC

Sr.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
		Improper disposal of domestic sludge, CETP sludge and industrial waste	- Recyclable waste to be collected separately and sold to authorized recyclers/ vendors. - Sludge will be generated from the sewage treatment plants which will be de-watered using filter press, dried and used for gardening purpose. - CETP sludge to be disposed off at the nearest CHWTSDF; - OSCIPL to secure necessary permission for disposing off CETP sludge at the nearest CHWTSDF;	Implementation by operator and Supervision by EMC
5	Traffic Volume	Increase in traffic flow and volume	- The roads in general to be designed to carry the maximum traffic loads with anticipated future development and on a par with IRC (Indian Road Congress) Standards; - A well planned public transport infrastructure has been envisaged for the project; - The proposed road circulation shall provide for safe and efficient movement of people; - Maintenance of systematic spatial and technical database for the roads which would enable regular monitoring and feedback on road conditions thereby managing effective periodic maintenance;	OSCIPL
		Traffic congestion	- Non-motorized vehicles to be encouraged - Comprehensive traffic and travel surveys shall be conducted every 5 years to monitor traffic characteristics and travel pattern to develop strategies for effective transportation; - The proposed road circulation shall provide for safe and efficient movement of people; - Pedestrian Guard Rails, Road safety Signage and overhead signs shall be placed wherever necessary; - Road widths and lane configurations to be designed based on the modelling exercise;	OSCIPL

Sr.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
		Irregular Parking	- Each individual project shall develop parking facilities as per the Development Control Regulations. - Each residential project to provide parking facilities as per applicable norms and regulations. - Sufficient Loading/unloading space to be provided	Implementation by individual industries and supervision by EMC
6	Land use Pattern	Impacts on existing human settlements	- During the master planning stage, detailed analysis has been undertaken to delineate site for OSC and various site alternatives were examined and ranked to select the option based on socio-economic and environmental factors. - Adequate buffer has been provided around environmentally sensitive features - Industrial land use has not been proposed in proximity of the sensitive receptors. - The residential and commercial users to undertake the development in consonance with the master plan of OSC and also comply with the local regulation as applicable.	OSCIPL
7	Ecology	Impact on flora and fauna of the adjoining green areas	- As per master plan, no forest land is falling in the delineated area; - Only native and local species will be chosen for green area. - Each industry shall follow the CPCB guidelines; - Only permissible activities shall be planned in the green buffer. - The fronts of river passing adjacent to the sites is planned as green area.	Implementation by operator of common infrastructure and individual industries
		Illegal cutting of trees	The project proponent will not allow illegal cutting of trees in the project area by contractors /labourers working on the project site.	Implementation by operator of common infrastructure and individual industries

Sr.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
8	Social	- Increased employment and business opportunities , Improvement in infrastructure - Increased income levels, Stabilization of the rural economies , Potential for cultural conflict , Unplanned secondary development in the adjoining areas	- OSCIPL and individual project to undertake CSR program to ensure harmony and cooperation. . - OSC is willing to spend CSR money in providing skill development, clean and safe drinking water, sanitation facility, primary health care support in the nearby villages. Further details are presented in Section 8.2 titled ‘Socio – Economic Welfare Measures’ of the Chapter -8	OSCIPL

10.5 Environmental Management Plan

The cost of the mitigation measures to be implemented during the construction phase and the operation phase, along with the structure of the Environmental Management Cell along with its duties and responsibilities is given in this section:

Cost of mitigation measures – Construction Phase

Sr. No.	Parameter	Timeline for implementation	Recurring cost per year (Rs. Lacs)
1.	PPE	Progressive	25
2.	Site Sanitation Facility +Housekeeping	Progressive	5.5
3.	Drinking water facility	Progressive	3.0
4.	Solid Waste Management	Progressive	4.5
5.	Safety railing, platform, ladder, hoist, Cranes+ education and safety awareness program etc.	Progressive	6.0
7.	Health Check+ Ambulance facility +Crèche facility	Progressive	4.0
8.	Environmental Monitoring(Monitoring charges for air, water, waste water, drinking water ,soil, DG stack, noise.)	2019	15.0
9	Pollution Control – STP & Noise Control Measures (Sound Reflective barriers) Site barricading	2019	6.0 5.0
10	Dust control measures by engagement of sprinklers	2019	10.0
11	Storm water drains with silt traps and collection sump:	2019	28
12	EMC	2019	6
Total Cost			118

Cost of mitigation measures- Operation Phase

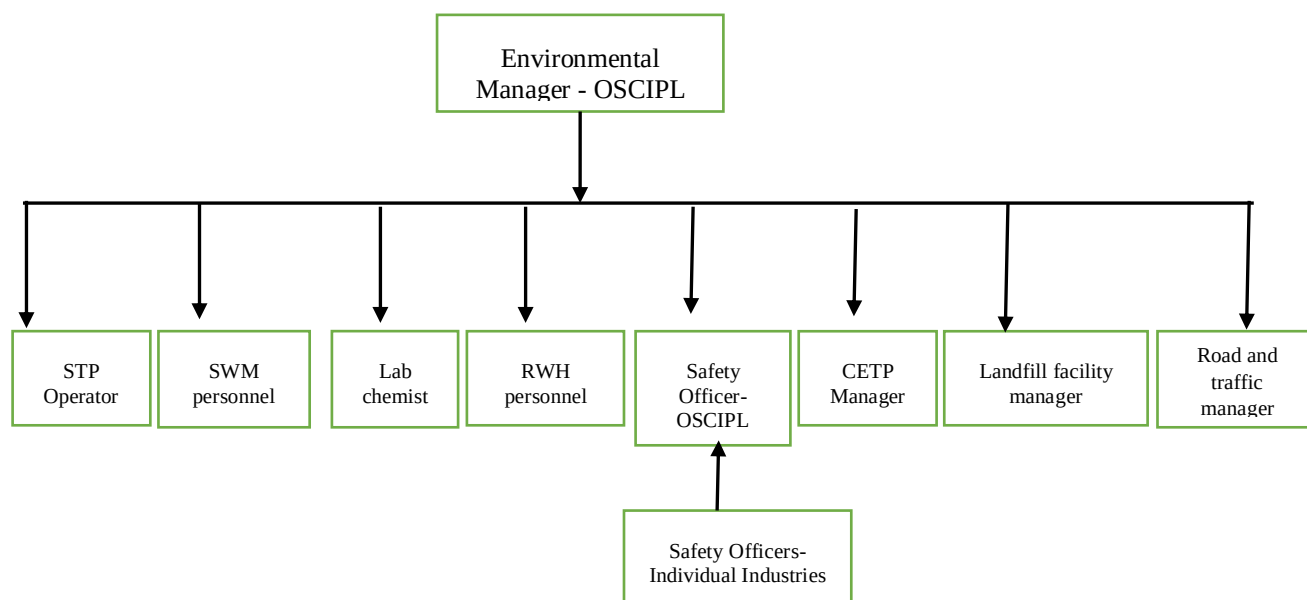
S.No.	Description	Timeline for implementation	Capital Cost (Lakhs)	O&M Cost (lakhs) per annum

1	Rain Water Harvesting	2019-2029	50	5
2	Fire Fighting measures, Disaster Management Kit , Well-equipped Control Room , CCTV , Disaster Management training to labours and Security Staff, Mock Exercise , 2 way Public announcement system	2019 -2029	1500	150
3	Water supply system including WTP	2019 -2029	45000	2250
4	Sewerage System and Recycling System	2019 -2029	35600	2101
5	Landscaping	2019 -2029	2000	400
6	Solid Waste Management	2019 -2029	4000	200
7	Information and Communication Technology (ICT)	2019 -2029	3300	330
8	Energy saving	2024 -2029	1300	195
9	Traffic Management Plan Implementation	2019 -2029	500	50
10	Pollution Control – STP & Noise Control Measures Sound Reflective barriers, Acoustical Enclosures for STP Blowers	2019 -2029	24.2	38
11	EM Cell	--	Covered in construction phase	2
12	Ambient air quality sensors and display	2019 -2029	100	10
13	CETP	2019-2029	520	6
14	Landfill cost	2019-2029	200	13.5
	Total		94094.2	5750

The expenditure shown in the above table has been included in the project cost

10.6 Environmental Management Cell

An Environmental Management Cell is proposed which will oversee the implementation of environmental safeguards as proposed below:



Structure of Environmental Management Cell

Responsibilities of the EMC personnel

Sr.No	Personnel	Responsibility
1.	STP Operator	- The supervisor shall visit and check the devices daily. He will see that the STP is working properly and flow measurements are recorded properly in a register. - The effluent from the STP shall be got checked by him in the Laboratory once a week. Any parameter going out of the prescribed limits will be reported to the Environmental Manager for taking corrective action. He will pursue the matter at personal level to bring the parameters within permissible limits. - The Environmental Manager will keep in touch with the Environmental Consultant and seek their guidance for corrective action as and when required. - The Committee shall meet once every month to ensure implementation of the programme. - The Environmental Manager will bring to the notice of the Managing Director any further action to be taken to ensure

		environmental requirements. The Managing Director will report to the Board of Directors, the action taken to set right deficiency, if any.
2.	SWM personnel	• Maintain the records / inventory of the solid waste generated at the site for onward disposal to the MPCB authorised vendor • Interface with the SWM machinery vendor for the maintenance of all the equipment related to the segregation of the solid waste at site • Supervise the segregation of the solid waste at the site. • Makes necessary field inspections to assure safe working conditions and that established methods and policies are followed. • To ensure compliance with the Solid Waste Management Rules 2016 and all the relevant statutes.
3.	Lab Chemist	• To analyse the samples collected for the environmental components such as air, water, noise and soil. • To maintain the records of the results of analysis • To maintain the laboratory equipment in working condition. • To identify the budgetary requirements for the upkeep of the environmental laboratory. • To oversee / supervise the environmental monitoring , if outsourced to the MoEF/NABL accredited laboratory. • To report the exceedance of the relevant parameters w.r.t regulatory standards and bring it to the notice of the Environmental Manager for corrective action.
4.	RWH personnel	• To supervise the installation of the RWH systems by the contractor. • To maintain the records of the results of rainwater harvesting quantities. • To supervise operation and maintenance of the rainwater harvesting structures and to keep a log of the same • To monitor the implementation of the RWH measures by individual industries.
5	CETP Manager	• To scrupulously check/ conduct inspections for all the equipment installed and treatment systems in the CETP at defined intervals as per the program. • To maintain the record pertaining to the measurements of flow and quality of effluent emanating from the CETP • To get the quality of effluent monitored /checked by the Environmental Laboratory at regular intervals. Any exceedance of the parameters / deviation from the normal values will be thoroughly investigated and corrective action taken.

		- To monitor the overall compliance by individual industries against the respective effluent disposal standards/ EC issued by MoEF& CC / CTE & CTO issued by SPCB. - To report any requirement for the procurement of any components/ upgradation of the CETP to the Environmental Management Committee.
6	Landfill Facility Manager	- To ensure regulatory compliance with SWM Rules 2016 - To oversee the monitoring of the ground and surface water quality/air quality/ around the landfill site as per the environmental monitoring plan outlined - To keep the records of the Solid Waste Transportation (Daily quantity of inert waste transported to landfill, No. of trips made to site per vehicle to landfill), Solid Waste Handling and Disposal (Daily quantity of inert waste received), Monitoring and Survey (Records of all monitoring carried out as per the finalized monitoring protocol) - To oversee monitoring of the leachate characteristics by a MoEF accredited laboratory. - To monitor the overall compliance against the EC issued/ CTE & CTO issued - To inspect all the equipment (weighbridge etc), vehicles at periodic intervals and to ensure their proper functioning.
7	Road & Traffic Manager	- To oversee the functioning of the smart traffic management system proposed for the OSC. - To check/ inspect the condition of the pavements at regular intervals, internal roads, bridges and to oversee the personnel undertaking the repairs of the same. - To maintain the records of the traffic volume and characteristics of traffic and to evolve a smooth traffic management plan on ground as per the specific requirement.
5.	Safety Officer	- To periodically review and update the Disaster Management Plan of the OSC. - To keep a log / checklist of the potential accidents that may occur. - To conduct mock drills with the safety heads of the individual industries - To ensure the preparedness of OSC to counter any emergency. - To ensure that the individual industries have an EHS plan in place along with necessary measures to counter emergencies.

10.7 Conclusion

The baseline environmental studies conducted and the impact identification carried out reflect that the activities in the Orange Smart City will have minimal impact on the various VEC's and the development of this project will outweigh the impacts by integrating the various prevention, control and mitigation measures into project planning phase, construction phase and the operation phase. In addition, it will bring economic prosperity to the region.

11. DISCLOSURE OF CONSULTANTS

BUILDING ENVIRONMENT INDIA PVT LTD

This report is released for the purpose of obtaining Environment clearance for project, under the provision of EIA notification dated 14th September 2006, of Orange Smart City. Information provided (unless attributed to referenced third parties) is otherwise copyrighted and shall not be used for any other purpose without the written consent of Building Environment India Pvt Ltd.

Report	Environmental Impact Assessment and Environmental Management Plan								
Project Details									
Name of the Report	Orange Smart City, Pen, Raigad. EIA / EMP Report for Integrated Industrial Township of “Orange Smart City”								
Client	Orange Smart City Infrastructure Pvt. Ltd.								
Prepared by	Building Environment India Pvt Ltd.								
Project Number		Report No		Version	01	Released Date	July 2018		
Contact Details									
Building Environment India Pvt Ltd, Dakshina Building, Office No-401,4th Floor, Beside Raigad Bhavan Sakal Bhavan Rd, Sector 11 CBD Belapur, Navi Mumbai, Maharashtra 400614 Tel. No.: 91-22-41237073 hkolkatkar@beipl.co.in									
NABET Accreditation No. – SA- 191 st AC Meeting May 12, 2017									
EC Application Reference Document	TOR Issued: ToR issued vide 151st meeting of Expert Appraisal Committee for projects related to Infrastructure Development, Coastal Regulation Zone, Building/Construction and Miscellaneous projects held on 7th – 9th September, 2015								
Issue Order									
Date	Building Environment India Pvt Ltd.				OSCIPL				
	Originated by		Checked and Approved by		Checked by	Approved by			
	Name	Signature	Name	Signature	Name	Signature			
	Mr. Kapil Awtani		Hrushikesh Kolatkar		Mr. Chintan Chheda				
Disclaimer									
Building Environment India Pvt Ltd. has taken all reasonable precaution in the preparation of this report as per its auditable quality plan. Building Environment India Pvt Ltd. also believes that the facts presented in the report are accurate as on the date it was written. However, it is impossible to dismiss absolutely, the possibility of errors or omissions. Building Environment India Pvt Ltd. therefore specifically disclaims any liability resulting from the use or application of the information contained in this report. The information is not intended to serve as legal advice related to the individual situation.									

Project Team

Nature of Work	Person Responsible (s)	Name of the person(s) responsible		
Issue of List of requirements, draft of covering letter & undertaking to Client	Project manager	Mr. Kapil Awtani		
Site Visit	EIA Coordinator	Mr. Hrushikesh Kolatkar		
	Associate EC	Mr. Vivek Kulkarni		
	Project Manager and FAEs	Mr. Hrushikesh Kolatkar Dr. Ajay Ojha/ Mr. Sanjay Shevkar Mr. Rishabh Sharma/ Mr. Kapil Awtani Mr. Chintan Athalye Mr. Shrivallabh kothe Ms. Shraddha Gathe Dr. Sandhya Clemente Mr. Vivek Kulkarni Mr. S.L Bonde/ Mr. Nilesh Potdar Ms. Rujwi Dawe/ Mr. Nilesh Potdar Mr. Vivek Kulkarni		
As per terms of reference given in MoEF EIA manual, the baseline data generation for different environmental parameters	All FAEs (In-house& Empanelled) each for the below given respective functional area			
	AREA		FAE	AFAE / Team Member
	Land Use		Mr. Hrushikesh Kolatkar	Mr. Kedarnath Rao Ghorpade (Replaced by Mr. Sanket Awsare from January 2018)
	Air	AP	Dr. Ajay Ojha (replaced by Mr. Sanjay Shevkar from May 2017)	Kapil Awtani
		AQ	Mr. Rishabh Sharma (replaced by Mr. Kapil Awtani from May 2018)	Ashok Bandgar
	Noise		Mr. Chintan Athalye	Anuja Pawar
	Water		Dr. Ajay Ojha (replaced by Mr. Sanjay Shevkar from May 2017)	Dilip Shenai

	Geology	Mr. Shrivallabh kothe (replaced by Mr. Bhushan Kachawe from May 2018)	Aditya Athavale
	Hydrogeology	Mr. Shrivallabh kothe (replaced by Mr. Bhushan Kachawe from May 2018)	Aditya Athavale
	Soil Conservation	Ms. Shradha Gathe	Pravin Gathe
	Risk & Hazard Assessment	Mr. S.L. Bondhe (replaced by Mr. Nilesh Potdar from May 2017)	Ketaki Patil
	Solid Waste & Hazardous Waste	SHW: Ms. Rujwi Dawe (replaced by Mr. Nilesh Potdar from May 2017)	Suvidha Patil
	Ecology & Biodiversity	Dr. Sandhya Clemente	Sunil Belvekar
	Socioeconomic	Mr. Hrushikesh Kolatkar	---
Preparation of EIA report			
Originator	Dr. Prajakta Kulkarni Mr. Kapil Awtani (Replaced since May 2017)	Checker	Mr. Hrushikesh Kolatkar
Approval of Report	QC Rep	Dr. Sandhya Clemente	
	Client	Orange Smart City Infrastructure Pvt. Ltd. Mr. Chintan Chheda 	

Declaration by Experts contributing to the EIA/ EMP of Orange Smart City project at Pen, District Raigad

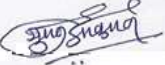
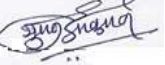
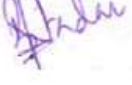
I, hereby, certify that I was a part of the EIA team in the following capacity that developed the above EIA.

EIA Coordinator:

Name	Mr. Hrushikesh Kolatkar	
Signature and Date	 20.07.2018	
Period of Involvement	January 2015 till date	
Contact Information	Address Building Environment India Pvt Ltd, Dakshina Building, Office No- 401,4th Floor, Beside Raigad Bhavan Sakal Bhavan Rd, Sector 11 CBD Belapur, Navi Mumbai, Maharashtra 400614	Contact Number Tel. No.: 91-22-41237073 hkolatkar@beipl.co.in

Functional Area Expert:

Functional Area	FAE	Signature	TEAM MEMBER	Signature
Land Use	Mr. Hrushikesh Kolatkar		TM - Mr. Kedarnath Rao Ghorpade (Replaced by Mr. Sanket Awasare)	
Air	AP Dr. Ajay Ojha (replaced by Mr. Sanjay Shevkar from May 2017)		Ms. Kapil Awtani	
	AQ Mr. Rishabh Sharma (replaced by Mr. Kapil Awtani from May 2018)		TM - Mr. Ashok Bandgar	
Noise	Mr. Chintan Athalye		Anuja Pawar	

Water	Dr. Ajay Ojha (replaced by Mr. Sanjay Shevkar from May 2017)		Dilip Shenai	
Geology	Mr. Shrivallabh kothe (replaced by Mr. Bhushan Kachawe from May 2018)		Mr. Aditya Athavale	
Hydrogeology	Mr. Shrivallabh kothe (replaced by Mr. Bhushan Kachawe from May 2018)		Mr. Aditya Athavale	
Soil Conservation	Ms. Shradha Gathe		Mr. Pravin Gathe	
Ecology & Biodiversity	Dr. Sandhya Clemente		Mr. Sunil Belvekar	
Risk & Hazard Assessment	Mr. S.L. Bondhe (replaced by Mr. Nilesh Potdar from May 2017)		Ms. Ketaki Patil	
Solid Waste & Hazardous Waste	SHW: Ms. Rujwi Dawe (replaced by Mr. Nilesh Potdar from May 2017)		Ms. Suvidha Patil	
Socioeconomic	Mr. Hrushikesh Kolatkar		----	

Declaration by the Head of the Accredited Consultant Organization:

I, Hrushikesh Kolatkar, hereby confirm that the above mentioned experts prepared the “EIA/ EMP Report for Industrial Integrated Township titled ‘Orange Smart City’. I also confirm that I shall be fully accountable for any misleading information mentioned in this statement.

Signature:



Name: Hrushikesh Kolatkar

Designation: Managing Director

Name of EIA Consultant Organization: Building Environment India Pvt Ltd.

NABET RA Certificate Number & Issue Date: Certificate No. NABET/RA/1518/SA 048 dated 12th May, 2017 valid till Nov 25, 2018

Functional Area Code Details:

Sr. No.	Functional Area Code	Complete Name of Functional Area
1	LU	Land Use
2	AP	Air Pollution Prevention, Monitoring & Control
3	AQ	Meteorology, Air Quality Modeling & Prediction
4	WP	Water Pollution Prevention, Control & Prediction of Impacts
5	EB	Ecology & Biodiversity
6	NV	Noise & Vibration
7	SE	Socio- Economic Aspects
8	HG	Hydrology, Ground Water & Water Conservation
9	GEO	Geology
10	SC	Soil Conservation
11	RH	Risk & Hazards Management
12	SHW (HW/SW/MSW)	Solid & Hazardous Waste Management (including Municipal solid wastes)

Annexure-I

F.No.21-130/2015-IA.III
Government of India
Ministry of Environment, Forest & Climate Change
(IA.III Section)

Indira Paryavaran Bhawan,
Jor Bagh Road,
New Delhi – 3.

Dated: 23rd November, 2015

To

The Managing Director & Chief Executive Officer,
M/s Karanja Infrastructure Pvt Ltd,
16th Floor, 165, 'C' Wing, Mittal Tower, Nariman Point,
Mumbai – 21 (Maharashtra)

Sub: 'Development of Integrated Industrial Township' in Villages Boregaon, Shene, Virani, Belavade, Walak, Mugoshi, Govirle & Hamrapur of Tehsil Pen, District Raigad (Maharashtra) by M/s Karanja Infrastructure Pvt Ltd – Terms of Reference - reg.

Sir,

This has reference to your application submitted the above mentioned proposal to this Ministry for seeking Terms of Reference (ToR) in terms of the provisions of the Environment Impact Assessment Notification (EIA), 2006 under the Environment (Protection), Act, 1986.

2. The proposal for **'Development of Integrated Industrial Township' in Villages Boregaon, Shene, Virani, Belavade, Walak, Mugoshi, Govirle & Hamrapur of Tehsil Pen, District Raigad (Maharashtra) by M/s Karanja Infrastructure Pvt Ltd**, was considered by the Expert Appraisal Committee (EAC) in the Ministry for Infrastructure Development, Coastal Regulation Zone, Building/ Construction and Miscellaneous projects, in its 151st meeting held on 7th – 9th September, 2015.

3. The details of the project, as per the documents submitted by the Project Proponents (PP), and also as informed during the above said EAC meeting, are reported to be as under:-

(i) The proposal involves development of Integrated Industrial Township in Villages Boregaon, Shene, Virani, Belavade, Walak, Mugoshi, Govirle & Hamrapur of Tehsil Pen, District Raigad (Maharashtra) by M/s Karanja Infrastructure Pvt Ltd. The project is to be developed under 'Integrated Industrial Area' (IIA) policy of MIDC, Maharashtra State Government's Industrial Infrastructure Agency.

(ii) The proposed project will be developed in four land parcels namely, T1, T2, T3, & T4 with land spread in the revenue map of 8 villages i.e. T1: Boregaon, Shene & Virani; T2 & T4: Belavade, Walak & Mugoshi & T3: Govirle & Hamrapur. The geographical coordinates of the site are given below:

T1: Latitude: 18°42'14.11" N, Longitude: 73°08'37.90" E;

T2: Latitude: 18°46'23.80" N, Longitude: 73°07'17.44" E;

T3: Latitude: 18°46'53.73" N, Longitude: 73°07'28.52" E and

T4: Latitude: 18°47'26.51" N, Longitude: 73°05'27.74" E.

Plot/Survey/Khasra No.: T1- 69, 113, 116, 118, 308, 117, 120, 170, 171, 172, 174, 189, 38, 46, 121, 25, 8, 10, 24, 26, 27, 30, 34, 40, 123, 131, 144, 295, 2, 87, 90, 93, 106, 279, 284, 4, 13, 74, 200, 209, 211, 136, 296, 303, 115, 124, 132, 135, 101, 276, 122, 39, 1A, 4/1-5/1, 4A, 21, 19, 4/A/4, 4/A/5, 4/A/7, 4/A/10, 4/A/11, 4/A/12, 4/A/13, 4/A/14, 4/A/15, 4/A/16, 4/A/17, 4/A/21, 4/A/25, 4/A/28, 4/A/29, 4/A/30, 4/A/31, 4/A/32, 4/A/33, 4/A/35, 4/A/36, 4/A/38, 4/A/39, 4/A/40, 4/A/42, 4/A/43, 21/1A/1, 21/1A/10, 21/1A/11, 21/1A/12, 21/1A/13, 1/A/3, 1/A/6, 1/A/7, 1/A/8, 1/A/17, 1/A/23, 1/A/34, 1/A/35, 1/A/46, 1/A/48, 1/A/57, 1/A/78, 1/A/89, 1/A/90, 1/A/94, 1/A/95, 1/A/98, 1/A/99, 1/A/127, 1/A/132, 1/A/135, 1/A/141, 1/A/147, 1/A/149, 1/A/150, 1/A/153, 1/A/154, 1/A/155, 1/A/265, 1/A/266, 1/A/267, 1/A/268, 1/A/269, 1/A/270, 1/A/271, 1/A/277, 1/A/278, 1/A/279, 1/A/284, 1/A/276, 4/A/1, 4/A/2, 4/A/3, 4/A/6, 4/A/34, 4/A/18, 4/A/19, 4/A/20, 4/A/21, 4/A/22, 4/A/23, 4/A/41, 4/A/44, 4/A/45, 4/A/46, 4/A/47, 4/A/53, 21/1A/7, 21/1A/8, 21/1A/9, 4/A/26, 4/A/27, 4/A/37, 21/1A/2, 4/A/49, 4/A/50, 4/A/51, 4/A/52, 4/A/54, 21/1A/14, 21/1A/15, 21/1A/16, 11/1A/1, 11/1A/2, 11/1A/3, 11/1A/4, 11/1A/5, 11/1A/6, 11/1A/7, 11/1A/8, 11/1A/9, 11/1A/10, 11/1A/11, 11/1A/12, 11/1A/13, 11/1A/14, 11/1A/15, 11/1A/16, 11/1A/17, 11/1A/18, 11/1A/19, 11/1A/20, 11/1A/21, 11/1A/22, 11/1A/23, 11/1A/24, 11/1A/25, 11/1A/26, 11/1A/27, 11/1A/28, 11/1A/29, 11/1A/30, 11/1A/31, 11/1A/32, 11/1A/33, 11/1A/34, 11/1A/35, 11/1A/36, 11/1A/37, 11/1A/38, 11/1A/39, 11/1A/40, 11/1A/41, 11/1A/42, 11/1A/43, 11/1A/44, 11/1A/45, 11/1A/46, 11/1A/47, 11/1A/48, 11/1A/49, 11/1A/50, 11/1A/51, 11/1A/52, 11/1A/53, 11/1A/54, 11/1A/55, 1/A/2, 1/A/4, 1/A/9, 1/A/10, 1/A/13, 1/A/14, 1/A/15, 1/A/16, 1/A/18, 1/A/19, 1/A/21, 1/A/22, 1/A/24, 1/A/26, 1/A/27, 1/A/28, 1/A/30, 1/A/36, 1/A/42, 1/A/43, 1/A/45, 1/A/47, 1/A/56, 1/A/58, 1/A/59, 1/A/60, 1/A/61, 1/A/62, 1/A/63, 1/A/64, 1/A/65, 1/A/66, 1/A/68, 1/A/69, 1/A/70, 1/A/71, 1/A/72, 1/A/73, 1/A/74, 1/A/75, 1/A/76, 1/A/77, 1/A/79, 1/A/80, 1/A/81, 1/A/83, 1/A/86, 1/A/91, 1/A/93, 1/A/96, 1/A/97, 1/A/100, 1/A/103, 1/A/105, 1/A/122, 1/A/123, 1/A/125, 1/A/126, 1/A/129, 1/A/130, 1/A/134, 1/A/143, 1/A/146, 1/A/159, 1/A/160, 1/A/161, 1/A/162, 1/A/232, 1/A/233, 1/A/234, 1/A/235, 1/A/236, 1/A/237, 1/A/106, 1/A/107, 1/A/108, 1/A/109, 1/A/110, 1/A/111, 1/A/112, 1/A/113, 1/A/114, 1/A/115, 1/A/116, 1/A/117, 1/A/118, 1/A/119, 1/A/120, 1/A/121, 1/A/145, 1/A/148, 1/A/151, 1/A/152, 1/A/156, 1/A/166, 1/A/167, 1/A/168, 1/A/169, 1/A/170, 1/A/171, 1/A/220, 1/A/221, 1/A/224, 1/A/225, 1/A/226, 1/A/227, 1/A/228, 1/A/254, 1/A/253, 1/A/255, 1/A/256, 1/A/275, 1/A/280, 1/A/281, 1/A/282, 1/A/283, 1/A/285, 1/A/286, 1/A/287, 1/A/288, 1/A/289, 1/A/290, 1/A/291, 1/A/292, 1/A/293, 1/A/294, 1/A/295, 1/A/124, 1/A/128, 1/A/131, 1/A/142, 1/A/144, 1/A/157, 1/A/158, 1/A/163, 1/A/164, 1/A/165, 1/A/172, 1/A/173, 1/A/174, 1/A/175, 1/A/176, 1/A/242, 1/A/243, 1/A/244, 1/A/245, 1/A/246, 1/A/247, 1/A/251, 1/A/252, 1/A/257, 1/A/258, 1/A/259, 1/A/260, 1/A/261, 1/A/262, 1/A/263, 1/A/1, 1/A/5, 1/A/11, 1/A/12, 1/A/20, 1/A/25, 1/A/29, 1/A/31, 1/A/32, 1/A/33, 1/A/37, 1/A/38, 1/A/39, 1/A/40, 1/A/41, 1/A/44, 1/A/49, 1/A/50, 1/A/51, 1/A/52, 1/A/53, 1/A/54, 1/A/55, 1/A/67, 1/A/82, 1/A/84, 1/A/85, 1/A/87, 1/A/88, 1/A/92, 1/A/101, 1/A/102, 1/A/104, 1/A/133, 1/A/137, 1/A/138, 1/A/177, 1/A/178, 1/A/179, 1/A/180, 1/A/181, 1/A/183, 1/A/184, 1/A/185, 1/A/186, 1/A/187, 1/A/188, 1/A/189, 1/A/190, 1/A/191, 1/A/192, 1/A/193, 1/A/194, 1/A/195, 1/A/196, 1/A/197, 1/A/198, 1/A/199, 1/A/200, 1/A/201, 1/A/202, 1/A/203, 1/A/204, 1/A/205, 1/A/206, 1/A/207, 1/A/208, 1/A/209, 1/A/210, 1/A/211, 1/A/212, 1/A/213, 1/A/214, 1/A/215, 1/A/216, 1/A/217, 1/A/218, 1/A/219, 1/A/222, 1/A/223, 1/A/229, 1/A/230, 1/A/231, 1/A/238, 1/A/239, 1/A/240, 1/A/241, 1/A/248,

1/A/249, 1/A/250, 1/A/264, 1/A/272, 1/A/273, 1/A/274, 1/A/296, 1/A/297, 1/A/298, 1/A/299, 1/A/300, 1/A/301, 1/A/302, 1/A/303, 1/A/304; **T2:** 277, 278, 311, 96, 102, 105, 113, 62, 94, 100; **T3:** 1-118 A, 1-18, 1-19, 2-7, 2-11, 2-13 B, 3-2, 3-5, 4-1, 4-4, 5-1, 7-1B, 2/1A 1, 2/3A 1, 5/2 B, 77/1, 77/2, 77/3, 81/6, 105, 106, 111, 31, 32, 2, 7, 3, 4, 5, 80, 81, 82, 83, 29, 59, 60, 78 and **T4:** 82, 180, 187, 192, 204, 222, 227, 23, 38, 50, 53, 18, 179, 42, 20, 140, 37, 41, 199, 207, 266, 22, 274, 85, 205, 123, 42, 21, 223, 17, 126, 14, 34, 241, 247, 248, 54, 10, 25, 101, 22, 244, 200, 214, 191, 181, 182, 185, 261.

(iii) The total plot area of proposed project is 1100 acres (44,51,700 sqm) and total built-up area 30,29,422 sqm.

(iv) The proposed project comprises of:

- Industrial Parks and Export Processing Zones (including 'A' Category Industries viz. Manmade Fibre, Synthetic Organic etc.)
- Physical infrastructures will include roads, amenities, bridges, water retention ponds, residential and commercial complexes etc..)
- IT/BT Parks
- Service Centers, Skill Development Centers
- Financial Centers and Services
- Logistic hubs, warehousing and freight terminals
- Mentoring and Counselling services

(v) The estimated quantity of solid waste would be about 32 Metric tons per day. Source segregation is proposed for recyclables (30%) and the other waste would be treated and disposed as per MSW Rules. The solid waste will be treated with the help of suitable technology in compliance with the site conditions. Sewage from various sources shall be send to the STP and treated sewage would be used for gardening and non-potable purposes.

(vi) STPs with combined capacity of about 18 MLD with suitable technology viz, MBR, MBBR or Constructed Wetland will be installed depending on the site conditions and requirement. Excess treated water and sludge from STP can be used for gardening or can be transported as manure to nearby villages for agriculture land. The effluent will be treated by using suitable ETPs & CETPs.

(vii) The site is in the vicinity of water bodies. The estimated total water requirement for the project would be about 19 MLD.

(viii) Total estimated power requirement for entire project is 505 MVA. The power will be sourced from MSEDCL.

(ix) Part of the project plot area (part of T3 site) lies in CRZ-III and therefore CRZ Notification is applicable to that part of the project. Hetawane Dam lies at a distance of 5 kms from project site towards east (T1). Also, part of the plot lies in CRZ III area (T3). Ambeghar Dam is about 1.25 kms on North of T1 and same is about 1.75 km south of T2. Except part of T3 CRZ area, there are no wet lands.

(x) **Investment/Cost:** The total cost of the project is Rs.14206 Crores.

4. The proposal was considered by the EAC and recommended in its 151st meeting held on 7th – 9th September, 2015 for grant of ToR. As per the recommendation of the EAC, the Ministry of Environment, Forest & Climate Change hereby accords ToR for **'Development of Integrated Industrial Township' in Villages Boregaon, Shene, Virani, Belavade, Walak, Mugoshi, Govirle & Hamrapur of Tehsil Pen, District Raigad (Maharashtra) by M/ Karanja Infrastructure Pvt Ltd**, with the following specific and general conditions for preparation of the Environment Impact Assessment (EIA) Report and Environment Management Plan (EMP):

- (i) Reasons for selecting the site with details of alternate sites examined/rejected/selected on merit with comparative statement and reason/basis for selection. The examination should justify site suitability in terms of environmental damage, resources sustainability associated with selected site as compared to rejected sites. The analysis should include parameters considered along with weightage criteria for short-listing selected site.
- (ii) Submit the details of the land use break-up for the proposed project. Details of land use around 10 km radius of the project site. Analysis should be made based on latest satellite imagery for land use with raw images. Check on flood plain of any river.
- (iii) Submit details of environmentally sensitive places, land acquisition status, rehabilitation of communities/ villages and present status of such activities.
- (iv) Examine the impact of proposed project on the nearest settlements.
- (v) Examine baseline environmental quality along with projected incremental load due to the project taking into account of the existing developments nearby.
- (vi) Environmental data to be considered in relation to the project development would be (a) land, (b) groundwater, (c) surface water, (d) air, (e) bio-diversity, (f) noise and vibrations, (g) socio economic and health.
- (vii) Submit a copy of the contour plan with slopes, drainage pattern of the site and surrounding area, and any obstruction of the same by the project.
- (viii) Details regarding project boundary passing through any eco- sensitive area and within 10 km from eco- sensitive area.
- (ix) Green buffer in the form of green belt to a width of 15 meters should be provided all along the periphery of the industrial area. The individual units should keep 33% of the allotted area as a green area.
- (x) Submit the details of the trees to be felled for the project.
- (xi) Submit the details of the infrastructure to be developed.
- (xii) Submit the present land use and permission required for any conversion such as forest, agriculture etc.
- (xiii) Submit details regarding R&R involved in the project
- (xiv) Zoning of the area in terms of 'type of industries' coming-up in the industrial area based on the resource requirement along with likely pollutants with quantity from the various industries.
- (xv) The project boundary area and study area for which the base line data is generated should be indicated through a suitable map. Justification of the parameters, frequency and locations shall be discussed in the EIA.
- (xvi) Submit Legal frame work for the implementation of Environmental Clearance conditions - to be clearly spelt out in the EIA report.
- (xvii) Submit Roles and responsibility of the developer etc for compliance of environmental regulations under the provisions of EP Act.

- (xviii) Site justification of the identified industry sectors from environmental angle and the details of the studies conducted if any.
- (xix) Ground water classification as per the Central Ground Water Authority.
- (xx) Submit the source of water, requirement vis-à-vis waste water to be generated along with treatment facilities, use of treated waste water along with water balance chart taking into account all forms of water use and management.
- (xxi) Rain water harvesting proposals should be made with due safeguards for ground water quality. Maximize recycling of water and utilization of rain water. Examine details.
- (xxii) Examine soil characteristics and depth of ground water table for rainwater harvesting.
- (xxiii) Examine details of solid waste generation treatment and its disposal.
- (xxiv) Examine and submit details of use of solar energy and alternative source of energy to reduce the fossil energy consumption.
- (xxv) In case DG sets are likely to be used during construction and operational phase of the project, emissions from DG sets must be taken into consideration while estimating the impacts on air environment. Examine and submit details.
- (xxvi) Examine road/rail connectivity to the project site and impact on the traffic due to the proposed project. Present and future traffic and transport facilities for the region should be analysed with measures for preventing traffic congestion and providing faster trouble free system to reach different destinations in the city.
- (xxvii) A detailed traffic and transportation study should be made for existing and projected passenger and cargo traffic.
- (xxviii) Examine the details of transport of materials for construction which should include source and availability.
- (xxix) Examine the details of National Highways/State Highways/ expressways falling along the corridor and the impact of the development on them.
- (xxx) Examine noise levels - present and future with noise abatement measures.
- (xxxi) Identify, predict and assess the environmental and sociological impacts on account of the project. A detailed description with costs estimates of CSR should be incorporated in the EIA / EMP report.
- (xxxii) Examine separately the details for construction and operation phases both for Environmental Management Plan and Environmental Monitoring Plan with cost and parameters.
- (xxxiii) Submit details of a comprehensive Disaster Management Plan including emergency evacuation during natural and man-made disaster.
- (xxxiv) Any further clarification on carrying out the above studies including anticipated impacts due to the project and mitigative measure, project

proponent can refer to the model ToR available on Ministry website "<http://moef.nic.in/Manual/IndustrialEstate>".

General Guidelines

- (i) The EIA document shall be printed on both sides, as far as possible.
- (ii) All documents should be properly indexed, page numbered.
- (iii) Period/date of data collection should be clearly indicated.
- (iv) Authenticated English translation of all material provided in Regional languages.
- (v) The letter/application for EC should quote the MoEF&CC File No. and also attach a copy of the letter prescribing the TOR.
- (vi) The copy of the letter received from the Ministry on the TOR prescribed for the project should be attached as an annexure to the final EIA-EMP Report.
- (vii) The final EIA-EMP report submitted to the Ministry must incorporate the issues in TOR and that raised in Public Hearing. The index of the final EIA-EMP report, must indicate the specific chapter and page no. of the EIA-EMP Report where the specific TOR prescribed by Ministry and the issue raised in the P.H. have been incorporated. Questionnaire related to the project (posted on MoEF&CC website) with all sections duly filled in shall also be submitted at the time of applying for EC.
- (viii) Grant of TOR does not mean grant of EC.
- (ix) Grant of TOR/EC to the present project does not mean grant of approvals in other regulations such as the Forest (Conservation) Act 1980 or the Wildlife (Protection) Act, 1972.
- (x) Grant of EC is also subject to Circulars issued under the EIA Notification 2006, which are available on the MoEF&CC website: www.envfor.nic.in.
- (xi) The status of accreditation of the EIA consultant with NABET/QCI shall be specifically mentioned. The consultant shall certify that his accreditation is for the sector for which this EIA is prepared.
- (xii) On the front page of EIA/EMP reports, the name of the consultant/consultancy firm along with their complete details including their accreditation, if any shall be indicated. The consultant while submitting the EIA/EMP report shall give an undertaking to the effect that the prescribed TORs (TOR proposed by the project proponent and additional TOR given by the MoEF) have been complied with and the data submitted is factually correct (Refer MoEF office memorandum dated 4th August, 2009).
- (xiii) While submitting the EIA/EMP reports, the name of the experts associated with/involved in the preparation of these reports and the laboratories through which the samples have been got analysed should be stated in the report. It shall clearly be indicated whether these laboratories are approved under the Environment (Protection) Act, 1986 and the rules made there under (Please refer MoEF office memorandum dated 4th August, 2009). The project leader of the EIA study shall also be mentioned.

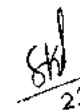
(xiv) All the TOR points as presented before the Expert Appraisal Committee (EAC) shall be covered.

5. A detailed draft EIA/EMP report should be prepared in terms of the above additional ToRs and should be submitted to the State Pollution Control Board for conduct of Public Hearing. Public Hearing to be conducted for the project in accordance with the provisions of Environmental Impact Assessment Notification, 2006 and the issues raised by the public should be addressed in the Environmental Management Plan. The Public Hearing should be conducted based on the ToR letter issued by the Ministry and not on the basis of Minutes of the Meeting available on the web-site.

6. The project proponent submit the detailed final EIA/EMP prepared as per ToRs including issues raised during Public Hearing to the Ministry for considering the proposal for environmental clearance within 3 years as per the MoEF&CC O.M. No.J-11013/41/2006-IA-II(I) (P) dated 08.10.2014.

7. The consultants involved in preparation of EIA/EMP report after accreditation with Quality Council of India/National Accreditation Board of Education and Training (QCI/NABET) would need to include a certificate in this regard in the EIA/EMP reports prepared by them and data provided by other Organization(s)/Laboratories including their status of approvals etc. vide notification of the MoEF dated 19.07.2013.

8. The prescribed ToRs would be valid for a period of three years for submission of the EIA/EMP Reports.


23/11/2015
(S.K. Srivastava)
Scientist E

Copy to:

The Member Secretary, Maharashtra Pollution Control Board, Kalpataru Points, 3rd & 4th floor, Opp. Cine Planet, Sion Circle, Sion (E), Mumbai - 22

Annexure-II

Certificate of Incorporation Consequent upon Conversion to
Public Limited Company



GOVERNMENT OF INDIA
MINISTRY OF CORPORATE AFFAIRS
Mumbai

Everest , 100 , Marine Drive Mumbai - 400002, Maharashtra, INDIA

Corporate Identity Number : U70102MH2007PLC171789.

Fresh Certificate of Incorporation Consequent upon Conversion from Private Company to Public Company.
IN THE MATTER OF Navi Mumbai SMART CITY Infrastructure Private limited

I hereby certify that Navi Mumbai SMART CITY Infrastructure Private limited which was originally incorporated on Nineteenth day of June Two Thousand Seven under any previous company law as Navi Mumbai SMART CITY Infrastructure Limited and upon an intimation made for conversion into Public limited by shares Company under Section 18 of the Companies Act, 2013; and approval of Central Government signified in writing having been accorded thereto by the Maharashtra, Mumbai vide SRN C59444158 dated 07/08/2015 the name of the said company is this day changed to Navi Mumbai SMART CITY Infrastructure Limited.

Given under my hand at Mumbai this Seventh day of August Two Thousand Fifteen.

Signature of
RAJENDER SINGH MEENA
Deputy Registrar of Companies
Mumbai

RAJENDER SINGH MEENA
Deputy Registrar of Companies
Registrar of Companies
Mumbai

Mailing Address as per record available in Registrar of Companies office:

Navi Mumbai SMART CITY Infrastructure Limited
SKIL HOUSE, 209, BANK STREET CROSS LANE, FORT,
MUMBAI - 400023,
Maharashtra, INDIA



GOVERNMENT OF INDIA
MINISTRY OF CORPORATE AFFAIRS
Registrar of Companies, Mumbai

Everest , 100 , Marine Drive Mumbai - 400002, Maharashtra, INDIA

Certificate of Incorporation pursuant to change of name
[Pursuant to rule 29 of the Companies (Incorporation) Rules, 2014]

Corporate Identification Number (CIN): : U70102MH2007PTC171789

I hereby certify that the name of the company has been changed from: Mahakaleshwar Knowledge Infrastructure Private Limited to Navi Mumbai SMART CITY Infrastructure Private limited with effect from the date of this certificate and that the company is limited by shares.

Company was originally incorporated with the name MAHAKALESHWAR PROPERTIES PRIVATE LIMITED

Given under my hand at Mumbai this Eleventh day of December Two Thousand Fourteen.

Signature valid

Digitally signed by
PADMAVATHI BALAKRISHNAN
DN: cn=PADMAVATHI
BALAKRISHNAN, o=GOVERNMENT OF INDIA, ou=MINISTRY OF CORPORATE AFFAIRS, email=padma.balakrishnan@nic.in, c=IN

PADMAVATHI BALAKRISHNAN
Deputy Registrar of Companies
Registrar of Companies
Mumbai

Mailing Address as per record available in Registrar of Companies office:

Navi Mumbai SMART CITY Infrastructure Private limited
SKIL HOUSE, 209, BANK STREET CROSS LANE, FORT,
MUMBAI - 400023,
Maharashtra, INDIA

भारत सरकार-कॉर्पोरेट कार्य मंत्रालय
कम्पनी रजिस्ट्रार कार्यालय, महाराष्ट्र, मुंबई

नाम परिवर्तन के पश्चात नया निगमन प्रमाण-पत्र

कॉर्पोरेट पहचान संख्या : U70102MH2007PTC171789

U701 MAHAKALESHWAR PROPERTIES PRIVATE LIMITED

कम्पनी का नाम (अंग्रेजी में) : MAHAKALESHWAR PROPERTIES PRIVATE LIMITED

जो मूल रूप में दिनांक 19/06/1956 को मजबूत रूप से कम्पनी अधिनियम, 1956 (1956 का 1) के अंतर्गत गैरसरकारी
MAHAKALESHWAR PROPERTIES PRIVATE LIMITED

के नाम में परिवर्तन की गई थी, के कम्पनी अधिनियम, 1956 की धारा 21 की शर्तों के अनुसार विधिवत आवश्यक विनिश्चय पारित करवा तथा
लिखित रूप में एक सचिव करण की ससे भाग्य का अनुमोदन, कम्पनी अधिनियम, 1956 की धारा 21 के साथ पत्रित, भारत सरकार, कम्पनी कार्य
विभाग, नई दिल्ली) की अधिसूचना सं. 507 (अ) दिनांक 24/06/1985 एस आर एन A63027072 दिनांक 18/06/2009 के द्वारा
काम हो गया है, जहां कम्पनी का नाम आज परिवर्तित रूप में किया
Mahakaleshwar Knowledge Infrastructure Private Limited

जो मूल से उसे यह प्रमाण-पत्र, कम्पनी अधिनियम की धारा 23(1) के अनुसार जारी किया जाता है।

यह प्रमाण-पत्र, मूल प्रमाण-पत्र मुंबई में जारी दिनांक अगस्त 1956 को जारी किया जाता है।

GOVERNMENT OF INDIA - MINISTRY OF CORPORATE AFFAIRS
Registrar of Companies, Maharashtra, Mumbai

Fresh Certificate of Incorporation Consequent upon Change of Name

Corporate Identity Number : U70102MH2007PTC171789

In the matter of M/s MAHAKALESHWAR PROPERTIES PRIVATE LIMITED

I hereby certify that MAHAKALESHWAR PROPERTIES PRIVATE LIMITED which was originally incorporated on
Nineteenth day of June Two Thousand Seven under the Companies Act, 1956 (No. 1 of 1956) as
MAHAKALESHWAR PROPERTIES PRIVATE LIMITED having duly passed the necessary resolution in terms of
Section 21 of the Companies Act, 1956 and the approval of the Central Government signified in writing having been
accorded thereto under Section 21 of the Companies Act, 1956, read with Government of India, Department of
Company Affairs, New Delhi, Notification No. G.S.R. 507 (E) dated 24/06/1985 vide SRN A63027072 dated
18/06/2009 the name of the said company is this day changed to Mahakaleshwar Knowledge Infrastructure Private
Limited and this Certificate is issued pursuant to Section 23(1) of the said Act.

Given under my hand at Mumbai the Eighteenth day of June Two Thousand Nine.




(ELSY PAPPACHAN)

सहायक कम्पनी रजिस्ट्रार / Assistant Registrar of Companies

महाराष्ट्र, मुंबई
Maharashtra, Mumbai

जो रजिस्ट्रार के कार्यालय अभिलेख में उपलब्ध जानकारी का पता

ing Address as per record available in Registrar of Companies office:

Mahakaleshwar Knowledge Infrastructure Private Limited

DM NO.109/110, MAHINDER CHAMBERS., W.T. PATIL ROAD, OPP. DUKES FACTORY, CHEMBUR,

MUMBAI - 400071,

Maharashtra, INDIA

भारत सरकार-कॉर्पोरेट कार्य मंत्रालय
कम्पनी रजिस्ट्रार कार्यालय, महाराष्ट्र, मुंबई

कम्पनी अधिनियम, 1956 की धारा 18 (1) (क)

उद्देश्य-खंडों में परिवर्तन की पुष्टि हेतु विशेष विनिश्चय के पंजीकरण का प्रमाण-पत्र

कॉर्पोरेट पहचान संख्या : U70102MH2007PTC171789

मैसर्स MAHAKALESHWAR PROPERTIES PRIVATE LIMITED

कै अंशधारकों ने दिनांक 04/06/2009 को आयोजित की गई वार्षिक / असाधारण बैठक में एक विशेष विनिश्चय पारित करके कम्पनी अधिनियम, 1956 (1956 का 1) की धारा 18 (1) का अनुपालन करते हुए अपने संगम-ज्ञापन के प्रावधानों में परिवर्तन कर लिया है।

मैं, एतद्वारा सत्यापित करता हूँ कि उक्त विशेष विनिश्चय की प्रतिलिपि, यथा परिवर्तित संगम-ज्ञापन के साथ, आज पंजीकृत कर ली गई है।

मेरे हस्ताक्षर द्वारा मुंबई में यह प्रमाण-पत्र, आज दिनांक नौ जून दो हजार नौ को जारी किया जाता है।

GOVERNMENT OF INDIA - MINISTRY OF CORPORATE AFFAIRS
Registrar of Companies, Maharashtra, Mumbai

SECTION 18(1)(A) OF THE COMPANIES ACT, 1956
Certificate of Registration of the Special Resolution Confirming Alteration of Object
Clause(s)

Corporate Identity Number : U70102MH2007PTC171789

The share holders of M/s MAHAKALESHWAR PROPERTIES PRIVATE LIMITED having passed Special Resolution in the Annual/Extra Ordinary General Meeting held on 04/06/2009 altered the provisions of its Memorandum of Association with respect to its objects and complied with the Section 18(1) of the Companies Act, 1956 (No. 1 of 1956).

I hereby certify that the said Special Resolution together with the copy of the Memorandum of Association as altered has this day been registered.

Given under my hand at Mumbai this Ninth day of June Two Thousand Nine.



(A S SINGH)

सहायक कम्पनी रजिस्ट्रार / Assistant Registrar of Companies

महाराष्ट्र, मुंबई

Maharashtra, Mumbai

कम्पनी रजिस्ट्रार के कार्यालय जलिलख में उपलब्ध पत्राचार का पता :

Mailing Address as per record available in Registrar of Companies office:

MAHAKALESHWAR PROPERTIES PRIVATE LIMITED

ROOM NO. 109/110, MAHINDER CHAMBERS, W.T. PATIL ROAD, OPP. DUKES FACTORY, CHENBUR

MUMBAI - 400071,
Maharashtra, INDIA

प्रामाणिक उद्धरण TRUE EXTRACT

महाराष्ट्र/सहायक कम्पनी रजिस्ट्रार
Addl./Asstt. Registrar of Companies

महाराष्ट्र, मुंबई
Maharashtra, Mumbai



प्रारूप 1
पंजीकरण प्रमाण-पत्र

कार्पोरेट पहचान संख्या : U70102MH2007PTC171789

2007 - 2008

मैं एतद्वारा सत्यापित करता हूँ कि मेरा सं

MAHAKALESHWAR PROPERTIES PRIVATE LIMITED

का पंजीकरण, कम्पनी अधिनियम 1956 (1956 का 1) के अंतर्गत आज किया जाता है और यह कम्पनी लिमिटेड है।

यह निगमन-पत्र आज दिनांक उन्नीस जून दो हजार सात को मेरे हस्ताक्षर से मुंबई में जारी किया जाता है।

Form 1
Certificate of Incorporation

Corporate Identity Number : U70102MH2007PTC171789

2007 - 2008

I hereby certify that MAHAKALESHWAR PROPERTIES PRIVATE LIMITED is this day incorporated under the Companies Act, 1956 (No. 1 of 1956) and that the company is limited.

Given under my hand at Mumbai this Nineteenth day of June Two Thousand Seven.

(SHYAM SUNDER .)

कम्पनी रजिस्ट्रार / Registrar of Companies

महाराष्ट्र, मुंबई

Maharashtra, Mumbai

कम्पनी रजिस्ट्रार के कार्यालय अभिलेख में उपलब्ध पत्राचार का पता :

Mailing Address as per record available in Registrar of Companies office:

MAHAKALESHWAR PROPERTIES PRIVATE LIMITED

202 SONA CHAMBERS, 507/509 J.S.S ROAD,

MUMBAI - 400002,

Maharashtra, INDIA

भारत सरकार-कॉर्पोरेट कार्य मंत्रालय
कम्पनी रजिस्ट्रार कार्यालय, महाराष्ट्र, मुंबई

कम्पनी अधिनियम, 1956 की धारा 18(1) (क)

उद्देश्य-खंडों में परिवर्तन की पुष्टि हेतु विशेष विनिश्चय के पंजीकरण का प्रमाण-पत्र

कॉर्पोरेट पहचान संख्या : U70102MH2007PTC171789

कंपनी MAHAKALESHWAR PROPERTIES PRIVATE LIMITED

कं अंशधारकों ने दिनांक 04/06/2009 को आयोजित की गई वार्षिक / असाधारण बैठक में एक विशेष विनिश्चय पारित करके कम्पनी अधिनियम, 1956 (1956 का 1) की धारा 18 (1) का अनुपालन करते हुए अपने संगम-आपन के प्रावधानों में परिवर्तन कर लिया है।

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मेरे हस्ताक्षर द्वारा मुंबई में यह प्रमाण-पत्र, आज दिनांक नौ जून को हजार नौ को जारी किया जाता है।

GOVERNMENT OF INDIA - MINISTRY OF CORPORATE AFFAIRS
Registrar of Companies, Maharashtra, Mumbai

SECTION 18(1)(A) OF THE COMPANIES ACT, 1956

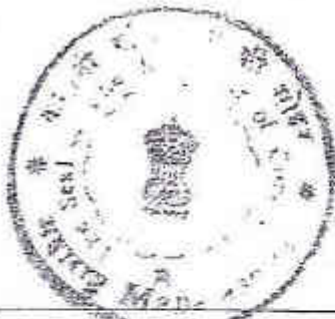
Certificate of Registration of the Special Resolution Confirming Alteration of Object
Clause(s)

Corporate Identity Number : U70102MH2007PTC171789

The share holders of M/s MAHAKALESHWAR PROPERTIES PRIVATE LIMITED having passed Special Resolution in the Annual/Extra Ordinary General Meeting held on 04/06/2009 altered the provisions of its Memorandum of Association with respect to its objects and complied with the Section (18)(1) of the Companies Act, 1956 (No. 1 of 1956).

I hereby certify that the said Special Resolution together with the copy of the Memorandum of Association as altered has this day been registered

Given under my hand at Mumbai this Ninth day of June Two Thousand Nine.



(A S SINGH)

सहायक कम्पनी रजिस्ट्रार / Assistant Registrar of Companies

महाराष्ट्र, मुंबई
Maharashtra, Mumbai

कम्पनी रजिस्ट्रार के कार्यालय अभिलेख में उपलब्ध पत्राचार का पता

Mailing Address as per record available in Registrar of Companies office:

MAHAKALESHWAR PROPERTIES PRIVATE LIMITED

ROOM NO.109/110, MAHINDER CHAMBERS, W.T. PATIL ROAD, OFF DUKES FACTORY, CHEMBUR

MUMBAI - 400071.

Maharashtra, INDIA.

प्रामाणिक दस्तखत TRUE EX

वित्तियक/सहायक कम्पनी

eddi./Assit. R

महाराष्ट्र, मुंबई
Maharashtra, Mumbai



प्रारूप 1
पंजीकरण प्रमाण-पत्र

कॉर्पोरेट पहचान संख्या : U70102MH2007PTC171789

2007 - 2008

मैं इसद्वारा सत्यापित करता हूँ कि मैंसर्त

MAHAKALESHWAR PROPERTIES PRIVATE LIMITED

का पंजीकरण, कम्पनी अधिनियम 1956 (1956 का 1) को अंतर्गत आज किया जाता है और यह कम्पनी लिमिटेड है।

यह निगमन-पत्र आज दिनांक उन्नीस जून दो हजार सात को मेरे हस्ताक्षर से मुंबई में जारी किया जाता है।

Form 1

Certificate of Incorporation

Corporate Identity Number : U70102MH2007PTC171789

2007 - 2008

I hereby certify that MAHAKALESHWAR PROPERTIES PRIVATE LIMITED is this day incorporated under the Companies Act, 1956 (No. 1 of 1956) and that the company is limited.

Given under my hand at Mumbai this Nineteenth day of June Two Thousand Seven.



Shyam Sunder

(SHYAM SUNDER)

कम्पनी रजिस्ट्रार / Registrar of Companies

महाराष्ट्र, मुंबई
Maharashtra, Mumbai

कम्पनी रजिस्ट्रार के कार्यालय-अभिलेख में उपलब्ध पताधार का पता :

Mailing Address as per record available in Registrar of Companies office:

MAHAKALESHWAR PROPERTIES PRIVATE LIMITED

202 SONA CHAMBERS, 507/509 J.S.S ROAD,

MUMBAI - 400002,

Maharashtra, INDIA

Annexure-III

MAHARASHTRA POLLUTION CONTROL BOARD

Tel: 24010706/ 24010437
Fax: 24023516
Website: <http://mpcb.gov.in>
E-mail: cac-cell@mpcb.gov.in



Kalpataru Point, 2nd - 4th Floor
Opp. Cine Planet Cinema,
Near Sion Circle, Sion (E)
Mumbai-400 022.

Consent order No: - BO/CAC-cell/ CE/CAC- 17/2000/115

Date- 06/12/2017

To,
ORANGE SMART CITY INFRASTRUCTURE PRIVATE LIMITED,
SKIL House, 209 Bank Street Cross Lane, Fort, Mumbai, India

Subject: Consent to Establish under RED category.

Ref :

1. Your Application approved in 6th CAC meeting of 2017-18 held on 31.10.2017

Your application No. UAN- 21926

Dated: 24.02.2017

For: 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 and Other Wastes (Management and 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: commissioning of the project or 5 years whichever is earlier.
2. The proposed capital investment of the project is Rs. 4032 crs. (As per documents submitted by project proponent).
3. The Consent to Establish is valid for construction of Industrial & Logistic Park proposed at

	Village Name	Corresponding survey nos	Total plot area in acres	Total BUA in sqm
T1	Borgaon	38(A), 46, 69, 113(1A), 116(A), 118(C), 118(D), 118(E), 308(A/1/C), 308(A/1), 118(A/1), 308(A/1/A/1), 118(A/2), 308(A/1/A/2), 117(1/C), 118(F), 308(A/1/D), 308(A/1/E), 308(A/1/F), 120, 136, 123, 131, 144, 295, 122, 113(2A), 296, 303(A), 115(1), 124, 132, 135, 2, 87, 90, 93, 106, 279, 284, 4, 13, 74(A), 276, 117(1/B), 117(1/A), 121, 101, 8, 115(2), 118 (G), 118 (H), 308(A/3), (308(A/4), 308(A/6), 308(A/1/G), 308(A/1/H)	723.32	3938771
	Shene	8, 26(5), 27(11), 30(11), 34(11), 40(3), 25(4A), 25(4B), 25(4C), 8(7), 10, 24(5), 25(4E)		
	Ambeghar	170, 171, 172, 173, 174, 189, 190, 200, 209, 211		
	Virani	1/A/1 to 1/A/304, 21/A/1, 21/A/2, 21/A/7 to 21/A/16, 11/1/A/1 to 11/1/A/55, 4/A/1 to 4/A/54, 19/1, 19/2, 19/3, 19/6.		
T2	Belawade-Budruk	62, 94, 96, 100, 102, 105, 113, 277, 278(1), 278(2), 278(5), 278(6), 311, 275	102.63	847061.7
T3	Balawali	105(5), 106(1), 111(2), 31(2A), 31(2B), 32, 105(5B), 105(2), 29(2)	113.22	862736.5
	Govirle	2(4), 2(13D), 2(14), 2(16), 7(1D), 7(1E), 7(4A), 2(5B), 2(6), 2(9), 2(12), 2(17), 2(13/A/1), 5(4), 7(1C), 7(1G), 2(13C), 7(1/H/1), 7(2A), 2(10), 7(1F), 3(3), 4(5), 7(3A), 2(15), 2(7), 2(13B), 3(5), 7(1B)		

	Kopar	80(1), 80(3), 80(5), 82(3), 82(5), 81(5), 81(8), 82(10), 80(8), 82(1), 81(2), 82(4), 82(6), 82(12), 82(13), 82(15), 82(16), 82(19), 83(7), 82(8), 82(18), 83(1), 83(3), 83(5), 83(6), 83(4), 83(2), 80(7), 82(21), 82(9), 80(2), 80(4), 80(6), 81(7), 82(7), 82(11), 82(14), 82(17), 82(20), 81(6), 2(1/A/1), 2(3/A/1), 5(2B)		
	Ambiwali	59(1), 60		
	Hamrapur	78(1B), 78(1C), 78(1A), 78(2), 77(3), 77(1), 77(2)		
T4	Mungoshi	42(2B), 42(2C), 42(2A), 85, 42(2D), 42(1), 42(2D), 54, 10, 10, 14	133.18	2999693.76
	Belawade-Budruk	20, 22, 21(2), 21(1), 17, 14, 101, 18(B), 23(B), 23(A), 34(2)		
	Belawade-Khurda	199, 207, 266, 274, 205, 123, 223, 244, 200, 214, 191, 181, 182, 185, 261, 126, 82, 180, 187, 192, 204, 222, 227		
	Padale	37, 41, 22(A), 22(C)		
	Ambeghar	25(1B)		
	Mungoshi	140		
Total			1072.35	8648263.2

including utilities and services as per construction commencement certificate issued by local body.

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

Sr. no.	Description	Permitted quantity of discharge (CMD)	Standards to be achieved	Disposal
1.	Trade effluent	Nil	NA	N.A.
2.	Domestic effluent	45000	As per Schedule -I	The treated domestic effluent shall be 60% recycled for secondary purposes such as toilet flushing, air conditioning, cooling tower make up, firefighting etc. and remaining shall be utilized on land for gardening and connected to the sewerage system provided by local body

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

Sr. No.	Description of stack/ source	Number Of Stack	Standards to be achieved
1	DG Sets 9 x 2000 KVA, 3550 KVA, 9 x 1000KVA, 550 KVA, 13 x 500 KVA, 700 KVA, , 250 KVA	35	As Per Schedule -II

6. Conditions under Municipal Solid Waste (Management and Handling) Rule, 2000 :

Sr. No.	Type Of Waste	Quantity	Treatment	Disposal
1	Bio-degradable waste	70 kg/D	Organic Waste Converter (OWC)	use as manure
2	Dry Garbage	50 Kg/D	-	Hand over to local body or sale for recycle
3	STP sludge	As actual Kg/D	-	use as manure

7. Conditions under E-Waste (Management and Handling) Rule, 2011 :

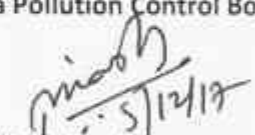
Sr. No.	Type Of Waste	Quantity	Treatment	Disposal

8. Conditions under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 for treatment and disposal of hazardous waste:

Sr. No.	Type Of Waste	Category	Quantity	UOM	Disposal
1	Spent Oil	5.1	1112	Lit/Y	Sale to authorized reprocessor

9. The Board reserves the right to review, amend, suspend, revoke etc. this consent and the same shall be binding on the industry.
10. This consent should not be construed as exemption from obtaining necessary NOC/permission from any other Government authorities.
11. PP shall not take any effective steps without obtaining prior Environmental Clearance and submit BG of Rs 10 lakh towards the compliance of the same.
12. Logistics & Industrial park shall mainly avail logistics facilities to Logistics, Engineering, Agro, Electronics and Semi-Conductor, Life Sciences, Information Technology, Gems and Jewellery and Research and Development.
13. Individual industry in the logistic & Industrial park will be responsible for obtaining their Consent to Establish and Operate separately from MPCB.
14. Applicant shall provide and operate common pollution control infrastructure facility such as STP, Bio-gas plant/OWC and ensure that the individual industries/units shall enter into MOU with Industrial park to ensure operation and maintenance of the common facility and other assets.
15. PP shall not allot the plot to the trade effluent generating industry.
16. PP shall achieve the treated domestic effluent standard for the parameter BOD- 30 mg/lit.
17. PP shall install online monitoring system for BOD, TSS and flow at the outlet of STP.

For and on behalf of the
Maharashtra Pollution Control Board


(P.K. Mirashe)
Member Secretary

Received Consent fee of:-

Sr. No.	DR No	Bank Name	Amount	Received date
1	0196623	Axis Bank	8064000	23.03.2017

Copy to:

1. Regional Officer, MPCB, Raigad and Sub-Regional Officer MPCB, Pune-2-- They are directed to ensure the compliance of the consent conditions.
2. Chief Accounts Officer, MPCB, Mumbai.
3. CC/CAC desk- for record & website updation purposes.

Schedule-I

Terms & conditions for compliance of Water Pollution Control:

- 1) A] As per your application, you have proposed to install 4 nos of Sewage Treatment Plant (STPs) having total capacity of 46 MLD.

- B] The Applicant shall operate the effluent treatment plant (STP) to treat the sewage 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	Standards prescribed by Board
		Limiting Concentration in mg/l, except for pH and Fecal Coliform
01	pH	6.5-9.0
02	BOD (3 days 27°C)	30
03	Suspended Solids	100
04	Fecal Coliform (FC) (Most Probable Number per 100 milliliter, MPN/100ml	<1000

- C] The treated domestic effluent shall be 60% recycled for secondary purposes such as toilet flushing, air conditioning, cooling tower make up, firefighting etc. and remaining shall be utilized on land for gardening and connected to the sewerage system provided by local body. In no case, effluent shall find its way to any water body directly/indirectly at any time. Project proponent shall provide flow meter to ensure 60% recycling of treated sewage and shall maintain the record with data logging system.

- 2) The Board reserves its rights to review plans, specifications or other data relating to plant setup for the treatment of water works 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 and extension or addition thereto.
- 3) 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.
- 4) In case, the water consumption of the project is not covered under the water consumption of local body, in that situation, the project proponent shall submit the CESS Returns in the prescribed format given under the provision of Water (Prevention & Control of Pollution) Cess Act, 1977 and Rules made there under for various category of water consumption.

In case the water consumption is duly assessed under the quantity of water consumption of local body, the project proponent shall submit certificate to that effect from the concern local body with the request not to assess CESS on their water consumption, being already assessed on the water consumption of local body.

Sr. no.	Purpose for water consumed	Water consumption quantity (CMD)
1.	Industrial Cooling, spraying in mine pits or boiler feed	Nil
2.	Domestic purpose	64000
3.	Processing whereby water gets polluted & pollutants are easily biodegradable	Nil
4.	Processing whereby water gets polluted & pollutants are not easily biodegradable and are toxic	Nil

Schedule-II

Terms & conditions for compliance of Air Pollution Control:

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

Sr. No.	Stack Attached To	APC System	Height in Mtrs.	Type Of Fuel	Quantity and UOM	S%
1	DG Sets 9 x 2000 KVA, 3550 KVA, 9 x 1000KVA, 550 KVA, 13 x 500 KVA, 700 KVA, , 250 KVA	Acoustic enclosure	2 each	HSD	@ 0.21 liters/hr/KVA at full load.	1

* Above roof of the building in which it is installed.

2. The applicant shall operate and maintain above mentioned air pollution control system, so as to achieve the level of pollutants to the following standards.

Particulate matter	Not to exceed	150 mg/Nm ³ .

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).
5. Conditions for utilities like Kitchen, Eating Places:-

- The kitchen shall be provided with exhaust system chimney with oil catcher connected to chimney through ducting.
- The toilet shall be provided with exhaust system connected to chimney through ducting.
- The air conditioner shall be vibration proof and the noise shall not exceed 68 dB(A).
- The exhaust hot air from A.C. shall be attached to Chimney at least 5 mtrs. higher than the nearest tallest building through ducting and shall discharge into open air in such a way that no nuisance is caused to neighbors.



Schedule-III
Details of Bank Guarantees

Proposed BG:

Sr. No.	Consent (C to E/O/R)	Amt of BG Imposed	Submission Period**	Purpose of BG	Compliance Period	Validity++
1	Consent to Establish	Rs. 25 lakh	15 days from date of issue of consent	Towards compliance of C to E conditions	COU or 5 years whichever is earlier	Validity of this consent + 4 months
2	Consent to Establish	Rs 10 lakh	15 day from date of issue of consent	Not to take effective steps without obtaining EC	COU or 5 years whichever is earlier	Validity of this consent + 4 months

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

++ The Bank Guarantee(s) shall be valid for a period upto: Validity of consent + 4 months



Schedule-IV

Conditions during construction phase:

a	During construction phase, applicant shall provide temporary sewage disposal and MSW facility for staff and worker quarters.
b	During construction phase, the ambient air and noise quality should be closely monitored to achieve Ambient Air Quality Standards and Noise by the project proponent through MoEF approved laboratory.
c	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.

General Conditions:

- 1) The applicant shall provide facility for collection of samples of 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.
- 2) The firm shall strictly comply with the Water (P&CP) Act, 1974, Air (P&CP) Act, 1981 and Environmental Protection Act 1986 and Municipal Solid Waste (Management & Handling) Rule 2000, Noise (Pollution and Control) Rules, 2000 and E-Waste (Management & Handling) Rule 2011.
- 3) Drainage system shall be provided for collection of sewage effluents. Terminal manholes shall be provided at the end of the collection system with arrangement for measuring the flow. No sewage shall be admitted in the pipes/sewers downstream of the terminal manholes. No sewage shall find its way other than in designed and provided collection system.
- 4) Vehicles hired for bringing construction material to the site should be in good condition and should conform to applicable air and noise emission standards and should be operated only during non-peak hours.
- 5) 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) Applicant 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) Applicant should make efforts to bring down noise level due to DG set, outside their premises, within ambient noise requirements by proper siting 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 MoEF dated 17.05.2002 regarding noise limit for generator sets run with diesel.
- 6) Solid Waste – The applicant shall provide onsite municipal solid waste processing system & shall comply with Municipal Solid Waste (Management & Handling) Rule 2000 & E-Waste (M & H) Rule 2011.
- 7) Affidavit undertaking in respect of no change in the status of consent conditions and compliance of the consent conditions the draft can be downloaded from the official web site of the MPCB.

- 8) Applicant shall submit official e-mail address and any change will be duly informed to the MPCB.
- 9) The treated sewage shall be disinfected using suitable disinfection method.
- 10) 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 provision of rule 14 of the Environmental (Protection) Second Amended rule 1992.
- 11) **The applicant shall obtain Consent to Operate from Maharashtra Pollution Control Board before commissioning of the project.**



Annexure-IV

Water Resources Department

NO OBJECTION CERTIFICATE

Subject:- No-Objection-Certificate for location clearance to develop Special Township @ Village - Borgaon & Virani, Tal. Fen, District: Raigad by M/s. Mahakaleshwar Properties, Pvt. Ltd. Panvel, in area under Mumbai Metropolitan Regional Plan.

Reference:- 1. Government Marathi letter No. Misc. 1008/196/2008/MS-1, Water Resources Department, Mumbai dated 9-3-2008.
2. Superintending Engineer, North Konkan Irrigation Project Circle, Kalwa-Thane's Marathi letter No. NKIPC/T-2/1655/2009 dt. 21-4-2009.

As per Urban Development Department's Notification No. TFS/1205/4448 DCR/CR-4406/UD-12 dated 10-3-2006, No-Objection-Certificate of Water Resources Department is required for issuing location clearance for development of Special Township in area under Mumbai Metropolitan Regional Plan.

Powers of issuing No-Objection-Certificate of Water Resources Department are delegated to Regional Chief Engineers vide Government of Maharashtra's Marathi Circular No. Misc. 2007/(170/2007)/RM (Revenue) dated 8-10-2007.

With reference to field report submitted by the Superintending Engineer, Thane Irrigation Circle, Thane vide Marathi letter No. TIC / PB-1 / Mahakaleshwar/PC No. 313/2362/2009 dated 17-4-2009, Superintending Engineer, North Konkan Irrigation Project Circle, Kalwa-Thane vide Marathi letter No. NKIPC / T-2/1655/2009 dated 21-4-2009 & Project Director & Superintending Engineer, Khar Land Development Circle, Thane vide Marathi letter No. KLDC / PB-3 / NOC/Borgaon-Virani/1088 dated 18-4-2009, No-Objection-Certificate is issued to M/s. Mahakaleshwar Properties, Pvt. Ltd. Panvel, for proposed Special Township at village Borgaon & Virani, Tal. Fen, District: Raigad for specified Survey-Hissa Nos. as per the statement attached having total area 259-68-0 ha. are as mentioned in Table given below subject to conditions mentioned after 'Table'.

Table

Sr. No.	Name of Village	Total Area as per 9/12 ha. are. point	Total Area of Township ha. are. point	Area reduced ha. are. point	Remarks
1	Borgaon	172-13-4	163-93-0	8-20-4	8-20-4 ha. are. point area is in Heavens project (2-33-0) ha. are. point area is under canal & 5-87-4 ha. are. point area is in command)
2	Virani	86-73-2	86-73-2		
	Total Area	258-86-6	250-66-2		

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CONDITIONS-

1. Violation of Maharashtra Irrigation Act 1976 will lead to cancellation of N.O.C.
2. Violation of Maharashtra Zilla Parishad & Panchayat Samiti Act 1961 will lead to cancellation of N.O.C.
3. Violation of Maharashtra Kharland Development Act 1978 will lead to cancellation of N.O.C.
4. This N.O.C. is subjected to Water Resources Department only. A separate N.O.C. is required from Ministry of Environment & other departments as stated in Urban Development Department's notification dated 10-3-2006.
5. Topographical changes may lead to cancellation of N.O.C.
6. At the time of construction & after development of Special township waste water, garbage should not be dumped into nearby water bodies like river, nalla, etc.
7. The water flowing in river, nallas of township area is the property of Water Resources Department & for use of this water approval of this Department is necessary.
8. Water supply to township is not bounded on GoM & whole responsibility is of developer only.
9. GoM is not responsible for encroachment if any.
10. If the land is already notified by other Department then this certificate may please be treated as cancelled.
11. This No-Objection-Certificate is strictly for Special Township at village Borgaon & Virani, Tal. Pen, District Raigad by M/s. Mahakaleshwar Properties Pvt. Ltd., Panvel & this N.O.C. is non-transferable.
12. If the development work is not started within two years from issue of N.O.C., the N.O.C. will not be valid after two years.
13. The condition accepted by M/s. Mahakaleshwar Properties Pvt. Ltd., Panvel in writing regarding flood lines with Executive Engineer, Raigad Irrigation Division, Kolad, Tal. Roha, Dist. Raigad, is binding on company. Subject to this condition this No-Objection will be valid.

Encl.: Statement showing area with details (11 pages)

No. 3818 / LC-Borgaon-Virani / T-1(1) / 2550

Chief Engineer, Kokan Region,
Water Resources Department,
Hongkong Bank Building, 4th Floor,
Hutabai Square, Mumbai- 400 001
Date: 24/4/2009.

(B.B. Paul)
Chief Engineer
Water Resources Department
Kokan Region
Mumbai- 400 001

(1) Copy submitted to the Secretary (WR), Water Resources Department, Maharashtra, Mumbai for information please.

Encl.: Statement showing area with details (11 pages)

(Attention:- Shri. P.R. Chapwale, Desk Officer, M.I-1)

(2) Copy submitted to the Secretary, Urban Development Department, Maharashtra, Mumbai for information please.

Encl.: Statement showing area with details (11 pages)

(Attention:- Shri. A.B. Paul, Desk Officer, Town Planning)

(3) Copy forwarded to M/s. Mahakaleshwar Properties Pvt. Ltd., Panvel for information please.

Encl.: Statement showing area with details (11 pages)

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दिनांक ०५/०५/२०२०

क्र.	वर्ग संख्या	अवधि संख्या	संख्या संख्या	संख्या संख्या	संख्या संख्या	संख्या संख्या
1	4/3/1	1	0.46.62	0.46.62	संख्या संख्या	संख्या संख्या
2	4/3/2	2	0.52.17	0.52.17	संख्या संख्या	संख्या संख्या
3	4/3/3	3	0.41.24	0.41.24	संख्या संख्या	संख्या संख्या
4	4/3/4	4	0.42.1	0.42.1	संख्या संख्या	संख्या संख्या
5	4/3/5	5	0.52.33	0.52.33	संख्या संख्या	संख्या संख्या
6	4/3/6	6	0.41.25	0.41.25	संख्या संख्या	संख्या संख्या
7	4/3/7	7	0.43.32	0.43.32	संख्या संख्या	संख्या संख्या
8	4/3/8	8	0.42.34	0.42.34	संख्या संख्या	संख्या संख्या
9	4/3/9	9	0.43.05	0.43.05	संख्या संख्या	संख्या संख्या
10	4/3/10	10	0.46.64	0.46.64	संख्या संख्या	संख्या संख्या
11	4/3/11	11	0.41.03	0.41.03	संख्या संख्या	संख्या संख्या
12	4/3/12	12	0.42.54	0.42.54	संख्या संख्या	संख्या संख्या
13	4/3/13	13	0.41.03	0.41.03	संख्या संख्या	संख्या संख्या
14	4/3/14	14	0.43.58	0.43.58	संख्या संख्या	संख्या संख्या
15	4/3/15	15	0.42.08	0.42.08	संख्या संख्या	संख्या संख्या
16	4/3/16	16	0.41.60	0.41.60	संख्या संख्या	संख्या संख्या
17	4/3/17	17	0.44.03	0.44.03	संख्या संख्या	संख्या संख्या
18	4/3/18	18	0.43.58	0.43.58	संख्या संख्या	संख्या संख्या
19	4/3/19	19	0.41.00	0.41.00	संख्या संख्या	संख्या संख्या
20	4/3/20	20	0.43.36	0.43.36	संख्या संख्या	संख्या संख्या
21	4/3/21	21	0.41.58	0.41.58	संख्या संख्या	संख्या संख्या
22	4/3/22	22	0.44.58	0.44.58	संख्या संख्या	संख्या संख्या
23	4/3/23	23	0.43.12	0.43.12	संख्या संख्या	संख्या संख्या
24	4/3/24	24	0.44.02	0.44.02	संख्या संख्या	संख्या संख्या
25	4/3/25	25	0.46.80	0.46.80	संख्या संख्या	संख्या संख्या
26	4/3/26	26	0.48.51	0.48.51	संख्या संख्या	संख्या संख्या
27	4/3/27	27	0.42.75	0.42.75	संख्या संख्या	संख्या संख्या
28	4/3/28	28	0.46.54	0.46.54	संख्या संख्या	संख्या संख्या
29	4/3/29	29	0.44.38	0.44.38	संख्या संख्या	संख्या संख्या
30	4/3/30	30	0.44.02	0.44.02	संख्या संख्या	संख्या संख्या
31	4/3/31	31	0.41.26	0.41.26	संख्या संख्या	संख्या संख्या
32	4/3/32	32	0.41.30	0.41.30	संख्या संख्या	संख्या संख्या
33	4/3/33	33	0.44.93	0.44.93	संख्या संख्या	संख्या संख्या
34	4/3/34	34	0.40.59	0.40.59	संख्या संख्या	संख्या संख्या
35	4/3/35	35	0.42.94	0.42.94	संख्या संख्या	संख्या संख्या
36	4/3/36	36	0.42.81	0.42.81	संख्या संख्या	संख्या संख्या
37	4/3/37	37	0.40.74	0.40.74	संख्या संख्या	संख्या संख्या
38	4/3/38	38	0.42.18	0.42.18	संख्या संख्या	संख्या संख्या
39	4/3/39	39	0.42.62	0.42.62	संख्या संख्या	संख्या संख्या
40	4/3/40	40	0.44.84	0.44.84	संख्या संख्या	संख्या संख्या
41	4/3/41	41	0.40.02	0.40.02	संख्या संख्या	संख्या संख्या
42	4/3/42	42	0.41.33	0.41.33	संख्या संख्या	संख्या संख्या
43	4/3/43	43	0.41.39	0.41.39	संख्या संख्या	संख्या संख्या

सर्वा संख्या	सर्वा संख्या	सेप. ई.आर.	इकाई संख्या	प्राप्त संख्या	प्राप्त संख्या
11/13/3	3	0.40.50	0.40.50	0.40.50	0.40.50
11/13/4	4	0.41.19	0.41.19	0.41.19	0.41.19
11/13/5	5	0.40.73	0.40.73	0.40.73	0.40.73
11/13/6	6	0.40.75	0.40.75	0.40.75	0.40.75
11/13/7	7	0.40.57	0.40.57	0.40.57	0.40.57
11/13/8	8	0.40.57	0.40.57	0.40.57	0.40.57
11/13/9	9	0.40.53	0.40.53	0.40.53	0.40.53
11/13/10	10	0.40.53	0.40.53	0.40.53	0.40.53
11/13/11	11	0.41.78	0.41.78	0.41.78	0.41.78
11/13/12	12	0.40.72	0.40.72	0.40.72	0.40.72
11/13/13	13	0.40.50	0.40.50	0.40.50	0.40.50
11/13/14	14	0.40.50	0.40.50	0.40.50	0.40.50
11/13/15	15	0.40.60	0.40.60	0.40.60	0.40.60
11/13/16	16	0.43.44	0.43.44	0.43.44	0.43.44
11/13/17	17	0.40.84	0.40.84	0.40.84	0.40.84
11/13/18	18	0.41.04	0.41.04	0.41.04	0.41.04
11/13/19	19	0.43.00	0.43.00	0.43.00	0.43.00
11/13/20	20	0.41.26	0.41.26	0.41.26	0.41.26
11/13/21	21	0.40.59	0.40.59	0.40.59	0.40.59
11/13/22	22	0.40.53	0.40.53	0.40.53	0.40.53
11/13/23	23	0.40.59	0.40.59	0.40.59	0.40.59
11/13/24	24	0.40.53	0.40.53	0.40.53	0.40.53
11/13/25	25	0.40.51	0.40.51	0.40.51	0.40.51
11/13/26	26	0.56.78	0.56.78	0.56.78	0.56.78
11/13/27	27	0.54.13	0.54.13	0.54.13	0.54.13
11/13/28	28	0.52.36	0.52.36	0.52.36	0.52.36
11/13/29	29	0.41.11	0.41.11	0.41.11	0.41.11
11/13/30	30	0.40.49	0.40.49	0.40.49	0.40.49
11/13/31	31	0.41.30	0.41.30	0.41.30	0.41.30
11/13/32	32	0.40.85	0.40.85	0.40.85	0.40.85
11/13/33	33	0.40.86	0.40.86	0.40.86	0.40.86
11/13/34	34	0.40.85	0.40.85	0.40.85	0.40.85
11/13/35	35	0.40.52	0.40.52	0.40.52	0.40.52
11/13/36	36	0.40.52	0.40.52	0.40.52	0.40.52
11/13/37	37	0.40.52	0.40.52	0.40.52	0.40.52
11/13/38	38	0.47.17	0.47.17	0.47.17	0.47.17
11/13/39	39	0.45.50	0.45.50	0.45.50	0.45.50
11/13/40	40	0.40.84	0.40.84	0.40.84	0.40.84
11/13/41	41	0.40.40	0.40.40	0.40.40	0.40.40
11/13/42	42	0.41.38	0.41.38	0.41.38	0.41.38
11/13/43	43	0.41.86	0.41.86	0.41.86	0.41.86
11/13/44	44	0.40.80	0.40.80	0.40.80	0.40.80
11/13/45	45	0.46.50	0.46.50	0.46.50	0.46.50
11/13/46	46	0.51.89	0.51.89	0.51.89	0.51.89
11/13/47	47	0.53.61	0.53.61	0.53.61	0.53.61
11/13/48	48	0.41.22	0.41.22	0.41.22	0.41.22
11/13/49	49	0.40.77	0.40.77	0.40.77	0.40.77

क्र.सं.	वर्ग	वर्ग सं.	वर्ग सं.	वर्ग सं.	वर्ग सं.
1	11/10/80	50	0.42.80	0.42.80	वैज्ञानिक इकाई/वर्ग
2	11/10/81	51	0.41.51	0.41.51	वैज्ञानिक इकाई/वर्ग
3	11/10/82	52	0.42.84	0.42.84	वैज्ञानिक इकाई/वर्ग
4	11/10/83	53	0.35.53	0.35.53	वैज्ञानिक इकाई/वर्ग
5	11/10/84	54	0.22.50	0.22.50	वैज्ञानिक इकाई/वर्ग
6	11/10/85	55	0.48.24	0.48.24	वैज्ञानिक इकाई/वर्ग
7	1/10/86	2	0.06.18	0.06.18	वैज्ञानिक इकाई/वर्ग
8	1/10/87	4	0.03.50	0.03.50	वैज्ञानिक इकाई/वर्ग
9	1/10/88	5	0.04.12	0.04.12	वैज्ञानिक इकाई/वर्ग
10	1/10/89	10	0.04.22	0.04.22	वैज्ञानिक इकाई/वर्ग
11	1/10/90	13	0.04.53	0.04.53	वैज्ञानिक इकाई/वर्ग
12	1/10/91	14	0.05.21	0.05.21	वैज्ञानिक इकाई/वर्ग
13	1/10/92	15	0.06.06	0.06.06	वैज्ञानिक इकाई/वर्ग
14	1/10/93	16	0.03.50	0.03.50	वैज्ञानिक इकाई/वर्ग
15	1/10/94	18	0.03.20	0.03.20	वैज्ञानिक इकाई/वर्ग
16	1/10/95	18	0.03.50	0.03.50	वैज्ञानिक इकाई/वर्ग
17	1/10/96	21	0.02.85	0.02.85	वैज्ञानिक इकाई/वर्ग
18	1/10/97	22	0.02.85	0.02.85	वैज्ञानिक इकाई/वर्ग
19	1/10/98	24	0.04.12	0.04.12	वैज्ञानिक इकाई/वर्ग
20	1/10/99	26	0.03.57	0.03.57	वैज्ञानिक इकाई/वर्ग
21	1/10/00	27	0.04.20	0.04.20	वैज्ञानिक इकाई/वर्ग
22	1/10/01	28	0.03.36	0.03.36	वैज्ञानिक इकाई/वर्ग
23	1/10/02	30	0.03.51	0.03.51	वैज्ञानिक इकाई/वर्ग
24	1/10/03	30	0.03.33	0.03.33	वैज्ञानिक इकाई/वर्ग
25	1/10/04	42	0.04.09	0.04.09	वैज्ञानिक इकाई/वर्ग
26	1/10/05	43	0.04.03	0.04.03	वैज्ञानिक इकाई/वर्ग
27	1/10/06	48	0.03.42	0.03.42	वैज्ञानिक इकाई/वर्ग
28	1/10/07	47	0.03.31	0.03.31	वैज्ञानिक इकाई/वर्ग
29	1/10/08	55	0.03.51	0.03.51	वैज्ञानिक इकाई/वर्ग
30	1/10/09	56	0.03.15	0.03.15	वैज्ञानिक इकाई/वर्ग
31	1/10/10	58	0.02.85	0.02.85	वैज्ञानिक इकाई/वर्ग
32	1/10/11	60	0.02.85	0.02.85	वैज्ञानिक इकाई/वर्ग
33	1/10/12	61	0.03.05	0.03.05	वैज्ञानिक इकाई/वर्ग
34	1/10/13	62	0.03.10	0.03.10	वैज्ञानिक इकाई/वर्ग
35	1/10/14	63	0.03.07	0.03.07	वैज्ञानिक इकाई/वर्ग
36	1/10/15	64	0.02.74	0.02.74	वैज्ञानिक इकाई/वर्ग
37	1/10/16	65	0.02.78	0.02.78	वैज्ञानिक इकाई/वर्ग
38	1/10/17	66	0.02.86	0.02.86	वैज्ञानिक इकाई/वर्ग
39	1/10/18	68	0.02.19	0.02.19	वैज्ञानिक इकाई/वर्ग
40	1/10/19	69	0.02.15	0.02.15	वैज्ञानिक इकाई/वर्ग
41	1/10/20	70	0.02.16	0.02.16	वैज्ञानिक इकाई/वर्ग
42	1/10/21	71	0.02.82	0.02.82	वैज्ञानिक इकाई/वर्ग
43	1/10/22	72	0.02.78	0.02.78	वैज्ञानिक इकाई/वर्ग
44	1/10/23	73	0.02.54	0.02.54	वैज्ञानिक इकाई/वर्ग
45	1/10/24	74	0.03.07	0.03.07	वैज्ञानिक इकाई/वर्ग
46	1/10/25	75	0.03.54	0.03.54	वैज्ञानिक इकाई/वर्ग
47	1/10/26	76	0.03.00	0.03.00	वैज्ञानिक इकाई/वर्ग

सर्क नंबर	पोस्ट नंबर	दैन्य ई.आर.	आवृत्ति/प्रतिदिन दैन्य ई.आर.	आवृत्ति/प्रतिदिन दैन्य ई.आर.	आवृत्ति/प्रतिदिन दैन्य ई.आर.
1/3/77	77	0.02.58	0.02.58	0.02.58	विश्वनाथरीत कुम्भखारपायन
1/3/78	78	0.02.75	0.02.75	0.02.75	विश्वनाथरीत कुम्भखारपायन
1/3/80	80	0.02.73	0.02.73	0.02.73	विश्वनाथरीत कुम्भखारपायन
1/3/81	81	0.02.20	0.02.20	0.02.20	विश्वनाथरीत कुम्भखारपायन
1/3/83	83	0.02.78	0.02.78	0.02.78	विश्वनाथरीत कुम्भखारपायन
1/3/86	86	0.03.00	0.03.00	0.03.00	विश्वनाथरीत कुम्भखारपायन
1/3/91	91	0.02.78	0.02.78	0.02.78	विश्वनाथरीत कुम्भखारपायन
1/3/93	93	0.03.41	0.03.41	0.03.41	विश्वनाथरीत कुम्भखारपायन
1/3/96	96	0.04.22	0.04.22	0.04.22	विश्वनाथरीत कुम्भखारपायन
1/3/97	97	0.03.48	0.03.48	0.03.48	विश्वनाथरीत कुम्भखारपायन
1/3/100	100	0.04.27	0.04.27	0.04.27	विश्वनाथरीत कुम्भखारपायन
1/3/103	103	0.03.51	0.03.51	0.03.51	विश्वनाथरीत कुम्भखारपायन
1/3/105	105	0.03.51	0.03.51	0.03.51	विश्वनाथरीत कुम्भखारपायन
1/3/122	122	0.03.44	0.03.44	0.03.44	विश्वनाथरीत कुम्भखारपायन
1/3/123	123	0.03.09	0.03.09	0.03.09	विश्वनाथरीत कुम्भखारपायन
1/3/125	125	0.04.10	0.04.10	0.04.10	विश्वनाथरीत कुम्भखारपायन
1/3/126	126	0.04.27	0.04.27	0.04.27	विश्वनाथरीत कुम्भखारपायन
1/3/129	129	0.02.85	0.02.85	0.02.85	विश्वनाथरीत कुम्भखारपायन
1/3/130	130	0.03.39	0.03.39	0.03.39	विश्वनाथरीत कुम्भखारपायन
1/3/134	134	0.02.56	0.02.56	0.02.56	विश्वनाथरीत कुम्भखारपायन
1/3/143	143	0.05.11	0.05.11	0.05.11	विश्वनाथरीत कुम्भखारपायन
1/3/146	146	0.03.55	0.03.55	0.03.55	विश्वनाथरीत कुम्भखारपायन
1/3/159	159	0.04.30	0.04.30	0.04.30	विश्वनाथरीत कुम्भखारपायन
1/3/160	160	0.03.54	0.03.54	0.03.54	विश्वनाथरीत कुम्भखारपायन
1/3/161	161	0.04.56	0.04.56	0.04.56	विश्वनाथरीत कुम्भखारपायन
1/3/162	162	0.04.36	0.04.36	0.04.36	विश्वनाथरीत कुम्भखारपायन
1/3/232	232	0.02.82	0.02.82	0.02.82	विश्वनाथरीत कुम्भखारपायन
1/3/233	233	0.02.06	0.02.06	0.02.06	विश्वनाथरीत कुम्भखारपायन
1/3/234	234	0.02.80	0.02.80	0.02.80	विश्वनाथरीत कुम्भखारपायन
1/3/235	235	0.03.29	0.03.29	0.03.29	विश्वनाथरीत कुम्भखारपायन
1/3/236	236	0.03.00	0.03.00	0.03.00	विश्वनाथरीत कुम्भखारपायन
1/3/237	237	0.03.87	0.03.87	0.03.87	विश्वनाथरीत कुम्भखारपायन
1/3/106	106	0.02.78	0.02.78	0.02.78	विश्वनाथरीत कुम्भखारपायन
1/3/107	107	0.04.78	0.04.78	0.04.78	विश्वनाथरीत कुम्भखारपायन
1/3/108	108	0.01.18	0.01.18	0.01.18	विश्वनाथरीत कुम्भखारपायन
1/3/109	109	0.03.95	0.03.95	0.03.95	विश्वनाथरीत कुम्भखारपायन
1/3/110	110	0.03.17	0.03.17	0.03.17	विश्वनाथरीत कुम्भखारपायन
1/3/111	111	0.04.72	0.04.72	0.04.72	विश्वनाथरीत कुम्भखारपायन
1/3/112	112	0.04.67	0.04.67	0.04.67	विश्वनाथरीत कुम्भखारपायन
1/3/113	113	0.03.82	0.03.82	0.03.82	विश्वनाथरीत कुम्भखारपायन
1/3/114	114	0.03.41	0.03.41	0.03.41	विश्वनाथरीत कुम्भखारपायन
1/3/115	115	0.03.87	0.03.87	0.03.87	विश्वनाथरीत कुम्भखारपायन
1/3/116	116	0.03.95	0.03.95	0.03.95	विश्वनाथरीत कुम्भखारपायन
1/3/117	117	0.04.38	0.04.38	0.04.38	विश्वनाथरीत कुम्भखारपायन
1/3/118	118	0.03.28	0.03.28	0.03.28	विश्वनाथरीत कुम्भखारपायन
1/3/119	119	0.03.74	0.03.74	0.03.74	विश्वनाथरीत कुम्भखारपायन
1/3/120	120	0.03.80	0.03.80	0.03.80	विश्वनाथरीत कुम्भखारपायन

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क्र.	वर्ष तथा	प्लॉट नं.	क्षेत्र ई.अ.र.	प्राप्तपट्टीफलकी वृद्धि क्षेत्र ई.अ.र.	अवशेष क्षेत्र	अवशेष ई.अ.र.
22	1/38/64	164	0.0137	0.0121	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
23	1/38/105	165	0.0165	0.0165	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
24	1/38/172	172	0.0487	0.0487	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
25	1/38/173	173	0.0486	0.0486	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
26	1/38/174	174	0.0537	0.0537	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
27	1/38/175	175	0.0180	0.0180	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
28	1/38/176	176	0.0232	0.0232	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
29	1/38/242	242	0.0337	0.0337	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
30	1/38/243	243	0.0382	0.0382	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
31	1/38/244	244	0.0485	0.0485	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
32	1/38/245	245	0.0476	0.0476	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
33	1/38/246	246	0.0380	0.0380	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
34	1/38/247	247	0.0421	0.0421	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
35	1/38/251	251	0.0300	0.0300	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
36	1/38/252	252	0.0416	0.0416	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
37	1/38/253	253	0.0800	0.0800	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
38	1/38/256	256	0.0306	0.0306	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
39	1/38/259	259	0.0324	0.0324	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
40	1/38/260	260	0.0504	0.0504	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
1	1/38/261	261	0.0328	0.0328	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
2	1/38/262	262	0.0503	0.0503	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
3	1/38/263	263	0.0474	0.0474	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
4	1/38/1	1	0.0825	0.0825	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
5	1/38/5	5	0.0433	0.0433	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
6	1/38/11	11	0.0560	0.0560	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
7	1/38/12	12	0.0473	0.0473	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
8	1/38/20	20	0.0294	0.0294	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
9	1/38/25	25	0.0281	0.0281	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
10	1/38/29	29	0.0387	0.0387	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
11	1/38/31	31	0.1035	0.1035	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
12	1/38/32	32	0.0601	0.0601	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
13	1/38/33	33	0.0774	0.0774	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
14	1/38/37	37	0.0346	0.0346	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
15	1/38/38	38	0.0356	0.0356	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
16	1/38/39	39	0.0358	0.0358	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
17	1/38/40	40	0.0297	0.0297	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
18	1/38/41	41	0.0385	0.0385	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
19	1/38/44	44	0.0724	0.0724	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
20	1/38/46	46	0.0606	0.0606	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
21	1/38/48	48	0.0780	0.0780	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
22	1/38/50	50	0.0419	0.0419	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
23	1/38/51	51	0.0414	0.0414	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
24	1/38/52	52	0.0382	0.0382	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
25	1/38/53	53	0.0543	0.0543	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
26	1/38/54	54	0.0378	0.0378	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
27	1/38/55	55	0.0408	0.0408	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
28	1/38/57	57	0.0306	0.0306	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र
29	1/38/58	58	0.0282	0.0282	पे.को.सि.क. इ.अ.र.प.र.र. सि.	विकसनाकरीत कुम्भखारपात्र

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सर्च नंबर	सार नंबर	शेयर ई.आर.	उपभोगीयपद्धति एकुप शेयर ई.आर.	संयोजक नाम	सारणीय शेयर
1	1/3/13	213	0.03.57	0.03.57	विकासकारीय शुद्धन्यायपत्र
2	1/3/214	214	0.03.14	0.03.14	विकासकारीय शुद्धन्यायपत्र
3	1/3/215	215	0.03.143	0.03.143	विकासकारीय शुद्धन्यायपत्र
4	1/3/216	216	0.04.56	0.04.56	विकासकारीय शुद्धन्यायपत्र
5	1/3/217	217	0.04.00	0.04.00	विकासकारीय शुद्धन्यायपत्र
6	1/3/218	218	0.03.14	0.03.14	विकासकारीय शुद्धन्यायपत्र
7	1/3/219	219	0.03.10	0.03.10	विकासकारीय शुद्धन्यायपत्र
8	1/3/220	220	0.06.66	0.06.66	विकासकारीय शुद्धन्यायपत्र
9	1/3/221	221	0.06.80	0.06.80	विकासकारीय शुद्धन्यायपत्र
10	1/3/222	222	0.06.41	0.06.41	विकासकारीय शुद्धन्यायपत्र
11	1/3/223	223	0.03.48	0.03.48	विकासकारीय शुद्धन्यायपत्र
12	1/3/224	224	0.03.32	0.03.32	विकासकारीय शुद्धन्यायपत्र
13	1/3/225	225	0.04.31	0.04.31	विकासकारीय शुद्धन्यायपत्र
14	1/3/226	226	0.03.57	0.03.57	विकासकारीय शुद्धन्यायपत्र
15	1/3/227	227	0.03.75	0.03.75	विकासकारीय शुद्धन्यायपत्र
16	1/3/228	228	0.06.65	0.06.65	विकासकारीय शुद्धन्यायपत्र
17	1/3/229	229	0.02.75	0.02.75	विकासकारीय शुद्धन्यायपत्र
18	1/3/230	230	0.04.20	0.04.20	विकासकारीय शुद्धन्यायपत्र
19	1/3/231	231	0.03.82	0.03.82	विकासकारीय शुद्धन्यायपत्र
20	1/3/232	232	0.03.87	0.03.87	विकासकारीय शुद्धन्यायपत्र
21	1/3/233	233	0.03.81	0.03.81	विकासकारीय शुद्धन्यायपत्र
22	1/3/234	234	0.05.44	0.05.44	विकासकारीय शुद्धन्यायपत्र
23	1/3/235	235	0.05.47	0.05.47	विकासकारीय शुद्धन्यायपत्र
24	1/3/236	236	0.06.25	0.06.25	विकासकारीय शुद्धन्यायपत्र
25	1/3/237	237	0.03.21	0.03.21	विकासकारीय शुद्धन्यायपत्र
26	1/3/238	238	0.04.81	0.04.81	विकासकारीय शुद्धन्यायपत्र
27	1/3/239	239	0.05.85	0.05.85	विकासकारीय शुद्धन्यायपत्र
28	1/3/240	240	0.04.08	0.04.08	विकासकारीय शुद्धन्यायपत्र
29	1/3/241	241	0.06.15	0.06.15	विकासकारीय शुद्धन्यायपत्र
30	1/3/242	242	0.42.60	0.42.60	विकासकारीय शुद्धन्यायपत्र
31	1/3/243	243	0.05.87	0.05.87	विकासकारीय शुद्धन्यायपत्र
32	1/3/244	244	2.00.56	2.00.56	विकासकारीय शुद्धन्यायपत्र
33	4/3/1	4	0.43.53	0.43.53	विकासकारीय शुद्धन्यायपत्र
34	4/3/2	5	0.41.41	0.41.41	विकासकारीय शुद्धन्यायपत्र
35	4/3/3	7	0.55.00	0.55.00	विकासकारीय शुद्धन्यायपत्र
36	4/3/4	10	0.41.86	0.41.86	विकासकारीय शुद्धन्यायपत्र
37	4/3/5	11	0.40.99	0.40.99	विकासकारीय शुद्धन्यायपत्र
38	4/3/6	12	0.40.95	0.40.95	विकासकारीय शुद्धन्यायपत्र
39	4/3/7	13	0.41.80	0.41.80	विकासकारीय शुद्धन्यायपत्र
40	4/3/8	14	0.40.74	0.40.74	विकासकारीय शुद्धन्यायपत्र
41	4/3/9	15	0.41.81	0.41.81	विकासकारीय शुद्धन्यायपत्र
42	4/3/10	16	0.41.80	0.41.80	विकासकारीय शुद्धन्यायपत्र
43	4/3/11	17	0.40.87	0.40.87	विकासकारीय शुद्धन्यायपत्र
44	4/3/12	18	0.42.33	0.42.33	विकासकारीय शुद्धन्यायपत्र
45	4/3/13	19	0.41.19	0.41.19	विकासकारीय शुद्धन्यायपत्र
46	4/3/14	20	0.42.46	0.42.46	विकासकारीय शुद्धन्यायपत्र
47	4/3/15	21	0.44.80	0.44.80	विकासकारीय शुद्धन्यायपत्र

क्र.सं.	मार्ग संख्या	प्लॉट संख्या	क्षेत्र (वर्ग मी.)	दस्तावेज संख्या	मालिक का नाम	प्लॉट का विवरण
1	4/31/30	30	0.41.04	0.41.04	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
2	4/31/31	31	0.41.25	0.41.25	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
3	4/31/32	32	0.42.06	0.42.06	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
4	4/31/33	33	0.42.08	0.42.08	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
5	4/31/35	35	0.52.13	0.52.13	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
6	4/31/36	36	0.61.53	0.61.53	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
7	4/31/38	38	0.46.51	0.46.51	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
8	4/31/39	39	0.45.47	0.45.47	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
9	4/31/40	40	0.42.78	0.42.78	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
10	4/31/42	42	0.48.12	0.48.12	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
11	4/31/43	43	0.47.55	0.47.55	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
12	21/138/1	101	0.60.02	0.60.02	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
13	21/138/10	110	0.47.31	0.47.31	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
14	21/138/11	111	0.48.83	0.48.83	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
15	21/138/12	112	0.41.25	0.41.25	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
16	21/138/13	113	0.41.12	0.41.12	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
17	1/31/3	3	0.04.14	0.04.14	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
18	1/31/8	8	0.03.84	0.03.84	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
19	1/31/7	7	0.02.75	0.02.75	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
20	1/31/6	6	0.00.05	0.00.05	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
21	1/31/17	17	0.03.80	0.03.80	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
22	1/31/23	23	0.03.81	0.03.81	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
23	1/31/24	24	0.05.19	0.05.19	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
24	1/31/25	25	0.03.54	0.03.54	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
25	1/31/46	46	0.03.28	0.03.28	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
26	1/31/48	48	0.03.46	0.03.46	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
27	1/31/57	57	0.03.85	0.03.85	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
28	1/31/71	71	0.02.55	0.02.55	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
29	1/31/89	89	0.03.56	0.03.56	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
30	1/31/90	90	0.03.80	0.03.80	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
31	1/31/94	94	0.02.28	0.02.28	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
32	1/31/95	95	0.03.03	0.03.03	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
33	1/31/96	96	0.02.84	0.02.84	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
34	1/31/99	99	0.02.47	0.02.47	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
35	1/31/127	127	0.03.89	0.03.89	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
36	1/31/132	132	0.03.05	0.03.05	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
37	1/31/135	135	0.03.84	0.03.84	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
38	1/31/141	141	0.03.86	0.03.86	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
39	1/31/147	147	0.03.84	0.03.84	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
40	1/31/149	149	0.02.44	0.02.44	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
41	1/31/150	150	0.03.14	0.03.14	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
42	1/31/153	153	0.03.32	0.03.32	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
43	1/31/154	154	0.03.71	0.03.71	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
44	1/31/155	155	0.03.66	0.03.66	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
45	1/31/265	265	0.03.90	0.03.90	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
46	1/31/266	266	0.04.12	0.04.12	श्रीमान देवराज	विकासकारी का कर्मचार्यालय
47	1/31/267	267	0.03.25	0.03.25	श्रीमान देवराज	विकासकारी का कर्मचार्यालय

Annexure-V

पुरातत्त्व व वस्तुसंग्रहालये संचालनालय

महाराष्ट्र शासन

सेंट जॉर्ज किल्ला, सेंट जॉर्ज रुग्णालय आवार, छत्रपती शिवाजी टर्मिनस जवळ, मुंबई ४०० ००१

पुरातत्त्व क्र.: ०२२-२२६२३४४६/३३८०

ई-मेल आयडी : mahaarchaeology@gmail.com

जा.क्र. तंत्र/२०१७/ 1921

दिनांक :

29 AUG 2017

प्रति,

उपाध्यक्ष (प्रकल्प),

नवी मुंबई स्मार्ट सिटी इन्फ्रास्ट्रक्चर लि.,

स्कील हाऊस, २०९ बँक स्ट्रीट क्रॉस लेन,

फोर्ट, मुंबई - २३

विषय:- मौजे विराणी, बेलवडे बुद्रुक, बेलवडे खुर्द, वलक, आंबेघर, मुंगोशी, पडाळे, बोरगाव, शेणे, बालवली, कोपर, गोर्विले, आंबिवली, हमरापूर, ता. पेन, जि. रायगड येथील एकात्मिक नगरवसाहत प्रकल्पासाठी ना - हरकत देण्याबाबत.

संदर्भ:- आपला दि. १६.०३.२०१७ तसेच दि. २१.०८.२०१७ रोजीचा अर्ज.

उपरोक्त दि. १६.०३.२०१७ रोजीच्या संदर्भाय पत्रान्वये मौजे विराणी, बेलवडे बुद्रुक, बेलवडे खुर्द, वलक, आंबेघर, मुंगोशी, पडाळे, बोरगाव, शेणे, बालवली, कोपर, गोर्विले, आंबिवली, हमरापूर, ता. पेन, जि. रायगड येथील एकात्मिक नगरवसाहत प्रकल्पासाठी ना - हरकत प्रमाणपत्र मिळणेबाबत आपले अर्ज संचालनालयास प्राप्त झाले होते. त्यानंतर दि. २१.०८.२०१७ रोजीच्या संदर्भाय अर्जान्वये नवी मुंबई स्मार्ट सिटी इन्फ्रास्ट्रक्चर लि., मुंबई यांच्या अंतर्गत सदर प्रकल्प "ऑरेज स्मार्ट सिटी" या नावाने प्रस्तावित असून सदर प्रकल्प हे "नवी मुंबई स्मार्ट सिटी इन्फ्रास्ट्रक्चर लि." या कंपनीच्या नावाने प्रकल्पासाठी ना - हरकत देण्यात यावे अशी विनंती करण्यात आली होती.

त्याअनुषंगाने संचालनालयामार्फत दि. २० ते २२.०६.२०१७ या तीन दिवसात मौजे विराणी, बेलवडे बुद्रुक, बेलवडे खुर्द, वलक, आंबेघर, मुंगोशी, पडाळे, बोरगाव, शेणे, बालवली, कोपर, गोर्विले, आंबिवली, हमरापूर, ता. पेन, जि. रायगड येथील एकात्मिक नगरवसाहत प्रकल्पासाठी प्रस्तावित जागेची पाहणी करण्यात आली आहे.

उपरोक्त एकात्मिक नगरवसाहत प्रकल्प ४ भागांमध्ये विभाजीत केले असून त्यांना T१, T२, T३ आणि T४ असे नाव दिली आहेत. त्यापैकी १) T१ मध्ये बोरगाव, शेणे, आंबेघर व विराणी या चार गांवाचा समावेश होत असून त्यात एकूण ७२१.५३ एकर जागा सदर प्रकल्पासाठी प्रस्तावित आहे. २) T२ मध्ये बेलवडे बुद्रुक या एकाच गावातील १०२.६२ एकर जागा सदर प्रकल्पासाठी प्रस्तावित आहे. ३) T३ मध्ये बालवली, गोर्विले, कोपर, आंबिवली व हमरापूर या पाच गावातील एकूण ११३.२२ एकर जागा सदर प्रकल्पासाठी प्रस्तावित आहे. ४) T४ मध्ये वलक, मुंगोशी, बेलवडे बुद्रुक, बेलवडे खुर्द, पडाळे व आंबेघर

या सहा गावातील एकूण १३३.१८ एकर जागा सदर प्रकल्पासाठी प्रस्तावित आहे. अशा प्रकारे १४ गावातील एकूण १०७०.५६ एकर जागा एकात्मिक नगरवसाहत प्रकल्पासाठी प्रस्तावित आहे.

सदर प्रकल्पासाठी प्रस्तावित असलेली अधिकांश जागा डोंगराच्या पायथ्याची असून काही भागात शेती केली जाते. ११ मधील बोरगाव, शेणे, आंबेघर व विराणी ही चार गावे डोंगराळ भागात स्थित असून सपाट जमीनीपासून जरा उच्चावर वसलेले आहेत. तर काही भागात शेती केली जाते. सदर जागेवर कोणतेही राज्य संरक्षित स्मारक पाहणी दरम्यान आढळून आले नाही. तथापि, पाहणी दरम्यान प्रकल्पाच्या जागेवर कोणतेही पुरातात्वीक पुरास्थळ/पुरावशेष पाहणी दरम्यान आढळून आले नाही.

मौजे विराणी, बेलवडे बुद्रुक, बेलवडे खुर्द, वलक, आंबेघर, मुंगोशी, पडाळे, बोरगाव, शेणे, बालवली, कोपर, गोर्विले, आंबिवली, हमरापूर, ता. पेन, जि. रायगड येथील एकात्मिक नगरवसाहत प्रकल्पासाठी प्रस्तावित १०७०.५५ एकर जागेच्या आजूबाजूस ५०० मीटर अंतरावर कोणतेही राज्य अथवा केंद्र संरक्षित स्मारक पाहणी दरम्यान आढळून आलेले नाही. त्यामुळे कोणत्याही स्मारकास हानी होत नाही. सदर एकात्मिक नगरवसाहत प्रकल्पास खालील अट व शर्तीच्या अधिन राहून आपणास परवानगी देण्यात येत असून संपादित १०७०.५५ एकर जागेच्या सर्वे नंबरची यादी सोबत जोडलेली आहे.

१. मौजे विराणी, बेलवडे बुद्रुक, बेलवडे खुर्द, वलक, आंबेघर, मुंगोशी, पडाळे, बोरगाव, शेणे, बालवली, कोपर, गोर्विले, आंबिवली, हमरापूर, ता. पेन, जि. रायगड येथील एकात्मिक नगरवसाहत प्रकल्पासाठी खोदकाम करीत असतांना प्राचीन वास्तू-अवशेष, पुरातत्वीय अवशेष आढळून आल्यास त्या संदर्भात या संचालनालयास तात्काळ कळविण्याची जबाबदारी आपली असेल.
२. सदर परवानगी ही फक्त पाच वर्षांसाठीच वैध असेल. पाच वर्षांनंतरही सदर विशेष नगर वसाहत प्रकल्पाचे काम चालू असल्यास किंवा सदर प्रकल्पात नवे क्षेत्र समावेश करायचे असल्यास पुनः एकदा संचालनालयाची परवानगी घेणे बंधनकारक असेल.

(डॉ. तेजस मदन गौ) संचालक

पुरातत्त्व व वस्तुसंग्रहालये
महाराष्ट्र राज्य

Annexure-VI

HMPD/PS-1/NOCT-14310017
Hetawne Medium Project Division
Kamari Tal Pen, Dist. Raigad
Date - 15/03/2017

To,

✓ Mrs. Navi Mumbai Smart City Infrastructure Ltd.
Skull House 309, Bank Street, Cross Lane,
Fort Mumbai 400023

Subj: Water demand (36 M.L.D.) and Proposed Construction of two
Bridges on Bhogeshwar river in proposed Navi Mumbai Smart City
Township Project in Vilaga bargaon and Virani in tal Pen Dist. Raigad
Ref: Your Office letter Dated 15/03/2017

We are thankful for your above mentioned reference letter, you have
asked for construction of two Bridges on Bhogeshwar river and applied
for demand of water for your in proposed Navi Mumbai Smart City
Township Project in Vilaga bargaon and Virani in tal Pen Dist. Raigad.

Your water demand (36 M.L.D.) and construction of two Bridges on
Bhogeshwar river near Pen is under consideration subject to submit the
following documents which we will have to send it to our Senior office with
our recommendation for their consideration and approve the same.

A) Land title clearance of the site 7/12 extract, MOU's with land owners
made if any.

B) Certificate of propose population.

C) NOC from local Grampanchayat.

D) Detailed calculation of water demand.

E) Necessary site maps with water supply distribution lines.

F) Detailed drawings of proposed two bridges with necessary
calculations and design of loading.

Thanking you.



Executive Engineer
Hetawne Medium Project Division,
Kamari Tal Pen, Dist. Raigad

Annexure-VII

(A Govt. of Maharashtra Undertaking)
CIN : U 40109MH2005SGC153645

PHONE NO: 02143-252099 / 253568
FAX NO : 252724
Email : sepen@mahadiscom.in
Website : www.mahadiscom.in

Office Of the Superintending Engineer (PC)
22KV Sub-Str. Yard, Antore Road, Pen
PEN - Dist: Raigad - 402 107,

Ref. No.: SE/PC/Tech/ABG/Cons. / **No 0 3 9 6 0.**

DATE: -

14 NOV 2014

By Post copy

To,
M/s Mahakaleshwar knowledge Infrastructure Private Limited.
SKIL House , 209, Bank Street Cross Lane, Fort , Mumbai-400 023.

Sub: Letter of interest for development of smart City (Industrial Township) Project at Pen,
Tal. Pen Dist. Raigad

Ref: Your letter No. NIL dated 11.11.14 received to this office on dated 12.11.14.

Dear sir,

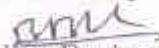
We are thankful for your letter under reference.

We will be very happy to supply you 25 MW power as required by you in Phases (5 MW in 1-3 years , 15 MW in 4-9 years & 25 MW after 9 years) as per ref. However this in principle is approval subject to you fulfilling the mandatory Regulatory , Commercial & Technical conditions. Further , it is extremely difficult to work out the details in absence of a detailed project report from your side.

You are requested to kindly give all the details in line with regulatory issue (along with application in prescribed format along with necessary documents available on Website www.mahadiscom.in) as also in line with the rules & regulations of MSEDCL, so that the case can be processed for further decision.

Thanking you,

Your's Faithfully


s/c Superintending Engineer (PC)
Pen

Copy f.w.cs to:-

The Superintending Engineer,
EHV O & M Circle , MSETCL TAKKA PANVEL.

--- Along with letter under Ref. for further needful action & compliance please.

Copy to:

1) The Executive Engineer
EHV O & M Division, MSETCL TAKKA Panvel.

--- Along with letter under Ref. for further needful action & compliance please.

2) The Executive Engineer,
MSEDCL Alibag Division .

--- Along with letter under Ref. for further needful action & compliance please

MAHARASHTRA STATE ELECTRICITY TRANSMISSION CO. LTD.

CIN No. U40109MH2005SGC153646

EHV PROJECTS CIRCLE, KALWA

Office of the Superintending Engineer

EHV Projects Circle, Kalwa

Thane Belapur Road, MSETCL Complex, Airoli Naka, Navi Mumbai 400 708

email: seehvckalwa@gmail.com / se7600@mahatrasco.in

Ref. No. SE/EHV/PC/KLW/ Tech/

No 00941

Date: **30 JUN 2017**

Shri. Shishir Rai,

Vice President (Projects), M/s. Orange Smart City. Ltd.,

SKIL House, 209 Bank Street Cross Lane, Fort Mumbai 400 023.

Sub: - Power Supply of 353MW load in phased manner for prospective Industrial/ Township/ Smart city project near Pen in respect of M/s. Orange Smart City Ltd. demand note for preliminary survey thereof.

Ref: - 1) Your Good Office Letter dated 15.03.2017.

2) L.No. SE/PC/Tech/PNL/Con./2421 dt.31.05.2017 from SE, MSEDCL Circle, Pen.

3) CE/EHV/PC O&M/Zone/VSH/T-5/No.1273 dt.21.06.2017.

Dear Sir,

With reference to above subject, this office is in receipt of letter under reference (3) from Zone office, Vashi in respect of submission of feasibility for power Supply of 353MW load in phased manner for prospective Industrial/ Township/ Smart city project near Pen in respect of M/s. Orange Smart City Ltd.

In view of above, it is requested to pay an amount of Rs. 28,750/- (25,000 + 15% service tax) as preliminary survey charges for survey of above mentioned work to this office & depute your representative for the joint survey of site after which feasibility will be proposed (additional charges/statutory variation in taxes if any, shall be payable by you afterwards accordingly).

The payment should be made at this office through demand draft or crossed cheque drawn in favour of "MSETCL" payable at Mumbai.

Your earliest approach will facilitate both MSETCL & your good self.

Thanking you.

Yours faithfully,

(P.E.SAWAKARE)

SUPERINTENDING ENGINEER,

EHV PROJECTS CIRCLE, KALWA.

Copy s.w.rs.to:-

The Chief Engineer, EHV Projects Cum O&M Zone, Vashi....., for information please.

Copy to:-

1) The Executive Engineer, EHV Projects Dn., Kalwa.....it is requested to arrange joint survey for subject work & submit the feasibility after payment of preliminary survey charges.

2) The Addl. Executive Engineer (C), S&I S/Dn., Kalwa.

MAHARASHTRA STATE ELECTRICITY TRANSMISSION CO. LTD.

CIN No. U40109MH2005SGC153646

1411

22-06-17

From,
Office of the Chief Engineer,
EHV PC O&M Zone, Vashi
4th Floor, MSEB Adm. Bldg.,
Sector-17, Vashi, Navi Mumbai-400703.
Tel: (022) 27665994(P) / 27665994 / 27665984,
Fax: 27662055, E-Mail: cevashi@mahatransco.in
Website: www.mahatransco.in

To,
The Superintending Engineer,
M.S. Elect. Trans. Co. Ltd.
EHV O&M Circle Panvel/
EHV Proj. Circle Kalwa.

No. CE/EHV/PC O&M/Zone/VSH/T-5/No.

01273

Date:-

21 JUN 2017

Sub:- Technical feasibility for power supply of 353 MW load in phased manner for prospective industrial / Town ship / Smart City project near pen in respect of M/s. Orange Smart City.

----- Technical feasibility report and estimate thereof.

Ref.:- Letter No. SE/PC/Tech/PNL/Con./2421 Dtd. 31.05.2017 from S.E., MSEDCL, Pen Circle.

This office is in receipt of Letter No. SE/PC/Tech/PNL/Con./2421 Dtd. 31.05.2017 from S.E., MSEDCL, Pen Circle, Pen regarding power supply of 353 MW load in phased manner for prospective industrial / Town ship / Smart City project near pen in respect of M/s. Orange Smart City.

In this context, it is requested to have a joint survey visit alongwith M/s. Orange Smart City. and submit the feasibility report as per load demand in phased manners 1) 1-2 Year- 100 MW 2) 3-9 Year-200 MW 3) After 10 years- 353 MW alongwith with Single Line Diagram and duly prepared HTXP proforma to this office whether it is feasible to release the power supply of 353 MW to M/s. Orange Smart City or vice versa. A copy of the said letter is enclosed herewith for your information and further needful please.

Your immediate action is requested please.

Encl. :- As Above.

Copy f.w.c.to:-

1) The Chief Engineer (KLNZ), MSEDCL, Kalyan Zone.

Copy to:-

1) The Superintending Engineer (PC), MSEDCL, Pen Circle.

2) The Executive Engineer, MSETCL, EHV O&M Dn., Mahad.

3) The Executive Engineer, MSETCL, EHV Project Dn., Kalyan.

--- for information and further needful please.

CC to:-

M/s. Orange Smart City, Skill House, 209 Bank Street Cross lane, Fort Mumbai 400 023.

(Sanjay Shinde)
CHIEF ENGINEER
EHV PC (O&M) ZONE, VASHI

EE(6)

Pl. forward to EE KLV
for D.A.

6/15
20/6

AECS
197
22/6/17

2421

MAHAVITARAN

Maharashtra State Electricity Distribution Co. Ltd.

(A Govt. of Maharashtra Undertaking)

CIN : U 40109MH2005SGC153645

PHONE NO: 02143-252099 / 253568

FAX NO : 252724

Email : sepen@mahadiscom.inWebsite : www.mahadiscom.in

Office Of the Superintending Engineer (PC)

22KV Sub-Stn. Yard, Antore Road, Pen

PEN - Dist: Raigad - 402 107.

Ref. No: SE/PC/Tech/PNL /Con. / **No 0 2 4 2 1**
— By E-mail/Post

Date:

31 MAY 2017

To,
The Chief Engineer,
EHV O&M Zone,
M.S.E.T.Co.Ltd, Vashi, Navi Mumbai.

Sub: Application for providing Feasibility for power supply of 353 MW load in Phased Manner for prospective Industrial/ Town ship/Smart City project near Pen in r/o M/s Orange Smart City

Ref: letter from Vice president (Project) Orange smart City dated 15.03.2017 received on dated 23.03.17.

In connection with the above subject, it is to inform you that vide ref. application is received for sanction of 353 MW load for proposed Industrial/ Town ship/Smart City project near Pen in Phased Manner as below.

- 1) 1-2 Years --- 100 MW
- 2) 3-9 Years -- 200 MW
- 3) After 10 Years - 353 MW

Hence it is kindly requested to communicate technical feasibility at the earliest so as to communicate to the consumer for his future planning.

Encl: Consumer application under ref.


Superintending Engineer (PC)
PEN

Copy s.w.rs to:

- 1) Hon. Regional Director, Konkan Region Kalyan.
- 2) The Chief Engineer (Commercial) H.O. Prakashgad Bandra.
- 3) The Chief Engineer, MSEDCL Kalyan Zone, Kalyan.

Copy f.w.c. to : The Superintending Engineer, MSETCL, O & M Circle Panvel.

Copy to: 1. The Ex. Engineer, MSETCL, EHV O & M Division, Panvel ✓

2. The Ex. Engineer, MSEDCL, O & M Division, Alibag Division.

----- He is directed to co-ordinate with MSETCL authority & take necessary steps in the said matter.

3. The Executive Engineer, MSEDCL Testing Division pen.

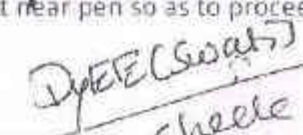
4. The Deputy Executive Engineer, MSEDCL Pen.

5. M/s Orange Smart City

SKIL House, 209 Bank Street Cross Lane, Fort Mumbai- 400 023.

You are requested to Co-ordinate all the above authority. You are also requested to provide the detail address of above said up coming project near pen so as to proceed further in the matter.

EHV PC O&M ZONE, VASHI	
INWARD NO. 2819	DATE 14/06/17
TECH	✓
ESA	
PC	


Dy. E.C. Swast
cheele
15/06

वर्षानिहाय टप्पाटप्पाने अंदाजे वीज पुरवठा मागणी तक्ता

परिशिष्ट - अ

अ.क्र.	वर्ष	अंदाजे वीजेची मागणी (MW)
१	पहीले १ ते २ वर्ष	१००
२	पुढील ३ ते ९ वर्ष	२००
३	१० वर्षांपुढील	३५३

M.S.E.D.C. Ltd.
Pen Charge Office Pen

4154
23 MAY 2017
Sr. Manager ()
#6A AE ()

दिनांक : १५ मार्च, २०१७

प्रति,
मा.अधिक्षक अभियंता (पी.सी),
पेण, जि.रायगड.

विषय : पेण जवळ प्रस्तावित एकात्मिक औद्योगिक क्षेत्र (IIA)/ एकात्मिक नगर
वसाहत (IIP)/ स्मार्ट सिटी हा प्रकल्प स्थापन करणेकरीता वीज पुरवठा करणेबाबत...
संदर्भ : आपले क्र. SE/PC/Tech/ABG/Cons./no.03960 चे १४ नोव्हेंबर, २०१४ चे
पत्र.

महोदय,

वरील विषयांकीत संदर्भीय पत्राअन्वये आपण मे.महाकालेश्वर नॉलेज इन्फ्रास्ट्रक्चर प्रा.लि. या कंपनीस एकूण 25 MW इतके वीज देण्याचे तत्वतः मान्य केले आहे.

या प्रकल्पास म.ओ.वि.महामंडळाने दि.२३ मार्च, २०१६ रोजी तत्वतः मंजूरी दिली आहे. (प्रपत्र १) परंतु सदर प्रकल्पाच्या आराखड्यामध्ये बऱ्याच सुधारणा झाल्या असून एकात्मिक औद्योगिक क्षेत्र (IIA)/ एकात्मिक नगर वसाहत (IIP) स्थापन करण्याच्या दृष्टीने आराखडे सुधारीत केले आहेत. प्रकल्पासाठी लागणारा प्रकल्प अहवाल व एकूण वीजेची गरज, कंपनी स्थावर शासनमान्य मे.मिटकॉन, पुणे यांच्याकडून तयार करून घेण्यात आले आहेत. प्रकल्प अहवालातील वीजेच्या गरजेबाबत सखोल माहिती दर्शविणाऱ्या अहवालातील संबंधित डेटाबेस प्रती सोबत जोडत आहोत. (प्रपत्र २) त्यानुसार प्रकल्पासाठी एकूण 353 MW इतक्या वीजेची टप्पाटप्पाने गरज भासणार आहे.

त्यास अनुसरून उपरोक्त "मे.मिटकॉन" यांच्या सुधारीत प्रकल्प अहवालानुसार टप्पाटप्पाने लागणार्या सुमारे 353 MW इतक्या वीज पुरवठ्यासाठी अंतिम मंजूरी देऊन तसे "मंजूरी पत्र" (Sanction Letter) आम्हास निर्गमित करावे ही विनंती.

तसेच यापूर्वीचा सर्व पत्रव्यवहार नवी मुंबई स्मार्ट सिटी इन्फ्रास्ट्रक्चर लि. या कंपनीच्या नावाने करण्यात आला होता. परंतु कंपनीने दि.५ ऑक्टोबर, २०१६ रोजी आपले नाव बदलून ऑरेंज स्मार्ट सिटी असे ठेवले आहे. त्याबाबतचे कागदपत्र सुलभ अवलोकनार्थ जोडले आहेत. (प्रपत्र ३)

तरी सदर सुमारे 353 MW इतक्या वीज पुरवठ्यासाठीची अंतिम मंजूरी मे. ऑरेंज स्मार्ट सिटी या कंपनीच्या नावे निर्गमित करावे, ही विनंती.

आभारपूर्वक,

आपले नम्र,

ऑरेंज स्मार्ट सिटी लि. कीता.

जि.रायगड
उपाध्यक्ष (प्रकल्प)
15/3/2017

सोबत प्रत : १) संदर्भीय पत्राची प्रत

२) म.ओ.वि.महामंडळाने प्रकल्पास दिलेल्या तत्वतः मान्यतेची प्रत

Registered Office: SKIL House, 209 Bank Street Cross Lane, Fort, Mumbai 400023, India.

T: +912263159204 | F: +912222634621

Annexure-VIII

ग्रुप ग्रामपंचायत बोरगाव

मु. बोरगाव, ता. पेण, जि. रायगड

गांव - बोरगाव, विराणी

वाडया :- तारझोंडा, कासमाळ, कोडबी, टेपाचीवाडी, वेलोशी, केतकवणे, धनगरमाळ, खपाचीवाडी, गावठ्याचीवाडी, खडकाचीवाडी, तांबडी, उंबरमाळ, खौसा, काजूचीवाडी, केळीचीवाडी

जावक क्र.:

दिनांक : १९ / ३ / २०१८

✧ सरपंच ✧

सौ. प्रगती परशुराम शिंदे



✧ उपसरपंच ✧

सौ. अस्मिता अशोक पाटील



✧ सदस्य ✧

सौ. धर्मी देवजी निरगुडा

श्री. कमलबा परश्या वाघ

सौ. दाही भिवा पारधी

सौ. गिता सुरेश वाघगारे

श्री. धाचा गौन्हा फसाळी

श्री. बुधानी दीलत पवार

सौ. पार्वती शंकर साळुंखे



ना हरकत दाखला

मी श्रीमती. प्रगती परशुराम शिंदे सरपंच ग्रुप ग्राम पंचायत बोरगांव (बोरगांव, विराणी, पेणग्रामीण) या नात्याने, आमच्या ग्रामपंचायत हद्ददीमध्ये विकसित होणा-या “ ऑरेंज स्मार्ट सिटी” या प्रकल्पाबद्दल मला माहिती आहे. त्यानुसार सार्वजनिक सुनावणीच्या वेळी प्रकल्प प्रस्तावकाने म्हटल्याप्रमाणे प्रकल्पामधील अतिरिक्त प्रकिया केलेले पाणी गाव विकासाकरिता मोफत स्वीकारण्यात आमची कोणतीही अडचण नाही व याला आम्ही पूर्ण सहमती देत आहोत.

तसेच प्रकल्पामधील पावसाळ्याचे पाणी नैसर्गिक नाले, वहाळ मधून सोडण्यास आमची पूर्ण सहमती आहे.

या प्रकल्पामुळे आमच्या व आजूबाजूच्या गावांचा सामाजिक व अर्थिक स्थर सुधारेल याचा आम्हाला आनंद आहे.

प्रकल्प वाटचालीस आमच्या शुभेच्छा.....

प.प.ई.ई.
सरपंच

ग्रामपंचायत बोरगांव

Annexure-IX



Mumbai Waste Management Ltd.

Plot No. P-32, MIDC Talaja, Dist. Raigad,
Tal. Panvel Maharashtra 410 208, India
Tel.: 022-2740 1468 to 71 & 2741 1473
Fax: 022-2740 1474
Email: mbdmwm@ramky.com
www.mumbaiwastemanagement.com

26th July 2017

To
Vice President (Projects)
Orange Smart City Infrastructure Pvt Ltd.
Skil House, 209, Bank Street Cross Lane,
FORT Mumbai 400023
India

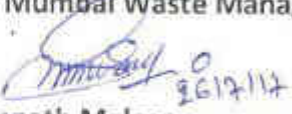
Sub.: Environmental Infrastructure Services: Hazardous Waste Management.

Dear Sir,

We are in receipt of your letter Ref No. OSCIL/RAMKY/OSC/ES/01/2017 dtd. 12.07.17 in response to that we would like to inform you that MWML can provide hazardous & Other Waste Management Services to Orange Smart city in Pen Taluka. It should be noted that you need to obtain necessary permission / NOC from Maharashtra Pollution Control Board & other regulatory body as required

Thank you,

Sincerely yours
For Mumbai Waste Management Ltd.


Somnath Malgar
Head - MWML

Certified by



bsi

ISO 9001:2008 | ISO 14001:2004 | OHSAS 18001:2007
C. No. FS 570487 | C. No. EMS 570497 | C. No. OHS 570500

Corporate Office:

Ramky Enviro Engineers Ltd.
Ramky Grandiose Floor, 12, 13, Ramky Tower Complex,
Gachibowli Hyderabad - 500 032

Tel.: 040-2301 5000 (40 Lines) • Fax: 040-2330 2355 • Website: www.ramky.com

Annexure-X

Cost of noise mitigation measures during the construction and operational phase

Sr. No.	Machinery / Equipment Description	Predicted SPL at 1 meter distance	Mitigations Required	Approx. Cost (Rs in Lacs)
1	JCB / Breaker or other Earth Moving Machines	85~95 dB	The JCB machines or Earth moving machines make Noise Levels of up to 85 dB when measured at 1 meter distance from the machine. When multiple machines are running simultaneously, the SPL can go up to 95 dB. This is an unavoidable source of noise which cannot be attenuated by any means. However, this source has been already considered In the Noise Modeling study, and its impact will not make any significant difference on the Noise Environment. For the people working in the near field of these equipment, 85 dBA is a perfectly safe noise level for continuous noise dose of up to 8 hours.	0
2	Concrete Mixers (2 Nos)	95~100 dB	Concrete mixer machines can generate sound pressure levels of up to 100 dB If they are driven by Diesel engine Acoustical enclosures are strongly recommended with 30 dB Transmission Loss Rating for the Engine, to bring down the SPL below 80 dB	4 Lacs
3	Batching Plant	100 dB	Batching plant consists of multiple number of different sources of noise as already listed in this report. Mitigations: 1. The contractor should carefully choose the above equipment in order to meet with the CPCB Norms. 2. Hydraulic pumps and compressors should be covered with Acoustical Enclosures with 20 dB Transmission Loss Rating in order to reduce the noise. 3. Valves should be covered with Removable Acoustical Blankets. 4. The contractor should choose	2 Lacs

			controlled operating hours for noisy activities such as delivery, loading unloading etc.	
4	DG Sets (Multiple Numbers)	<85 dB	Diesel Generator Sets are supposed to have Sound Pressure Levels of lesser than 75 dBA when measured at 1 meter distance. However, when multiple DG sets are supposed to be kept close to one another, a single Acoustical Enclosure combined for all the DG Sets is recommended with a minimum Transmission Loss Rating of 30 dBA	0
5	Submersible Pumps	80~85 dB	Submersible type de-watering pumps have lower Sound Pressure Levels than 80 or 85 dB, therefore no mitigations are necessary for this source of noise.	0
6	Cranes / Hoists	< 80 dB	1. Cranes usually are silent and have noise levels of less than 80 dB in case they are electrically driven and no mitigation is necessary for the same. 2. In case the cranes are driven using an engine, in that case, Acoustical Enclosure with 20 dB Transmission Loss , Rating is recommended for the engine and the driving mechanism	0
7	Sewage Treatment Plant	100 dB	1. STP consists of multiple of blowers and pumps, out of which blowers can generate noise levels exceeding 100 dB. Acoustical Enclosures for STP Blowers are strongly recommended, with 30 dB Transmission Loss Rating	4 Lacs
8	Additional Mitigations / Cares to take	N/A	1. Sound Reflective barriers to be installed at the boundary of the project site. 2. All people working in the vicinity of the Equipment/Machinery with Sound Pressure. Levels higher than 90 dB should wear protective ear plugs to avoid permanent hearing damage.	1. 0 for Reusable barriers if already available, Else 10 to 20Lacs. 2. 0.2Lacs

Annexure-XI

Recognized by Ministry of Environment and Forest (MoEF), Govt. of India

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Ambient Air Quality Monitoring Analysis Report

Sample Code	AB/PRO/03,04,05/2015-16/1849
Project Name	M/s. Karanja Infrastructure Pvt. Ltd.
Project Location	Tal:- Pen ,Dist:- Raigad
Sample Location	A1 Onsite of T-3 Land Parcel
Sample type	Ambient Air

Sr. No.	Date of Sampling	SO ₂	NOx	PM10	PM2.5	CO	VOC	HC
		≤80	≤80	≤100	≤60	≤04		
		μg/m ³	μg/m ³	μg/m ³	μg/m ³	mg/m ³	ppm	ppm
1	06/03/2015	18.20	36.45	56.25	38.42	0.3	BDL	BDL
2	10/03/2015	17.41	34.38	50.79	25.75	0.2	BDL	BDL
3	13/03/2015	18.10	34.26	55.66	27.89	BDL	BDL	BDL
4	17/03/2015	18.56	39.86	53.66	26.63	0.3	BDL	BDL
5	20/03/2015	17.20	44.75	52.19	26.42	0.2	BDL	BDL
6	24/03/2015	19.56	45.45	52.54	26.79	0.4	BDL	BDL
7	27/03/2015	18.52	47.85	55.26	28.25	0.3	BDL	BDL
8	31/03/2015	20.55	45.26	53.57	26.40	0.5	BDL	BDL
9	03/04/2015	21.20	48.58	51.29	26.16	0.6	BDL	BDL
10	07/04/2015	22.75	35.26	52.46	26.43	0.7	BDL	BDL
11	13/04/2015	18.52	41.86	53.56	26.62	0.2	BDL	BDL
12	17/04/2015	11.74	48.56	64.46	31.38	BDL	BDL	BDL
13	20/04/2015	19.28	46.38	53.16	26.63	0.3	BDL	BDL
14	20/04/2015	19.34	37.49	62.48	30.26	0.3	BDL	BDL
15	25/04/2015	20.23	41.75	52.19	26.35	0.4	BDL	BDL
16	28/04/2015	20.38	41.83	52.93	25.48	0.4	BDL	BDL
17	02/05/2015	19.45	46.52	52.25	25.38	0.3	BDL	BDL
18	07/05/2015	18.65	51.64	56.46	28.23	0.2	BDL	BDL
19	12/05/2015	18.04	46.45	53.42	25.42	0.2	BDL	BDL
20	18/05/2015	19.35	34.25	58.78	29.47	0.3	BDL	BDL
21	22/05/2015	19.25	46.72	49.29	24.73	0.4	BDL	BDL
22	25/05/2015	21.45	48.59	56.42	28.34	0.6	BDL	BDL
23	28/05/2015	21.85	37.48	57.58	27.75	0.6	BDL	BDL
24	31/05/2015	18.56	41.25	48.16	24.42	0.5	BDL	BDL
	Average	19.09	42.62	54.36	27.48	0.37	---	---
	Max	22.75	51.64	64.46	38.42	0.7	---	---
	Min	11.74	34.25	48.16	24.42	0.2	---	---
	98% Percentile	22.33	50.23	63.54	35.18	0.65	---	---



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Sample Code: AB/PRO/03,04,05/2015-16/1849

REMARKS / OBSERVATIONS:

- All above results are within National Ambient Air Quality standards.
- BDL – Below Detectable Limit.



Signature of Lab Executive



Signature of Technical Manager



Signature of Quality Manager



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Ambient Air Quality Monitoring Analysis Report

Sample Code	AB/PRO/03,04,05/2015-16/1850
Project Name	M/s. Karanja Infrastructure Pvt. Ltd.
Project Location	Tal:- Pen ,Dist:- Raigad
Sample Location	A-2 Downwind of T-3 at Rave Village
Sample type	Ambient Air

Sr. No.	Date of Sampling	SO ₂	NO _x	PM10	PM2.5	CO	VOC	HC
		≤80	≤80	≤100	≤60	≤04		
		μg/m ³	μg/m ³	μg/m ³	μg/m ³	mg/m ³	ppm	ppm
1	06/03/2015	11.25	21.85	52.32	26.33	BDL	BDL	BDL
2	10/03/2015	11.62	20.22	51.20	25.25	BDL	BDL	BDL
3	13/03/2015	12.30	22.20	54.28	27.49	BDL	BDL	BDL
4	17/03/2015	12.20	21.61	52.02	26.63	BDL	BDL	BDL
5	20/03/2015	11.22	20.75	49.17	24.10	BDL	BDL	BDL
6	24/03/2015	11.08	22.15	51.22	25.48	BDL	BDL	BDL
7	27/03/2015	10.30	20.82	50.19	20.21	BDL	BDL	BDL
8	31/03/2015	10.30	20.10	49.64	24.12	BDL	BDL	BDL
9	03/04/2015	10.20	20.04	50.46	21.52	BDL	BDL	BDL
10	07/04/2015	09.05	18.26	48.33	23.43	BDL	BDL	BDL
11	13/04/2015	10.22	19.14	50.41	24.62	BDL	BDL	BDL
12	17/04/2015	11.15	21.18	51.10	25.38	BDL	BDL	BDL
13	20/04/2015	12.28	22.52	52.25	26.63	BDL	BDL	BDL
14	20/04/2015	11.59	21.56	50.31	24.26	BDL	BDL	BDL
15	25/04/2015	09.55	18.85	48.19	22.35	BDL	BDL	BDL
16	28/04/2015	10.35	20.52	51.17	25.48	BDL	BDL	BDL
17	02/05/2015	10.40	19.41	51.35	24.38	BDL	BDL	BDL
18	07/05/2015	11.50	21.64	51.12	25.23	BDL	BDL	BDL
19	12/05/2015	12.20	22.11	51.50	24.68	BDL	BDL	BDL
20	18/05/2015	12.14	22.02	52.34	25.15	BDL	BDL	BDL
21	22/05/2015	12.06	21.10	52.02	25.49	BDL	BDL	BDL
22	25/05/2015	12.65	21.24	52.45	21.34	BDL	BDL	BDL
23	28/05/2015	10.33	20.28	49.58	23.12	BDL	BDL	BDL
24	31/05/2015	09.62	17.28	47.68	22.13	BDL	BDL	BDL
	Average	11.06	20.70	50.84	24.36	---	---	---
	Max	12.65	22.52	54.28	27.49	---	---	---
	Min	9.05	17.28	47.68	20.21	---	---	---
	98% Percentile	12.48	22.37	53.43	27.09	---	---	---



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ISO 9001: 2008 and OHSAS 18001: 2007 Certified Company
Sample Code: AB/PRO/03,04,05/2015-16/1850

REMARKS / OBSERVATIONS:

- All above results are within National Ambient Air Quality standards.
- BDL – Below Detectable Limit.



Signature of Lab Executive



Signature of Technical Manager



Signature of Quality Manager



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Ambient Air Quality Monitoring Analysis Report

Sample Code	AB/PRO/03,04,05/2015-16/1851
Project Name	M/s.Karanja Infrastructure Pvt. Ltd.
Project Location	Tal.- Pen ,Dist:- Raigad
Sample Location	A-3 Upwind of T-3 at Kharoshi Padale Village
Sample type	Ambient Air

Sr. No.	Date of Sampling	SO ₂	NO _x	PM10	PM2.5	CO	VOC	HC
		≤80	≤80	≤100	≤60	≤04		
		μg/m ³	μg/m ³	μg/m ³	μg/m ³	mg/m ³	ppm	ppm
1	07/03/2015	09.85	18.20	48.15	23.55	BDL	BDL	BDL
2	11/03/2015	10.25	20.10	45.45	22.02	BDL	BDL	BDL
3	14/03/2015	11.66	21.88	44.28	21.54	BDL	BDL	BDL
4	18/03/2015	10.55	20.55	42.02	21.65	BDL	BDL	BDL
5	21/03/2015	11.20	22.17	43.17	21.70	BDL	BDL	BDL
6	25/03/2015	09.52	18.22	37.22	18.48	BDL	BDL	BDL
7	28/03/2015	09.08	18.15	36.19	17.21	BDL	BDL	BDL
8	31/03/2015	10.74	20.10	45.64	22.32	BDL	BDL	BDL
9	04/04/2015	08.20	19.04	42.46	21.52	BDL	BDL	BDL
10	08/04/2015	12.45	23.15	50.33	25.56	BDL	BDL	BDL
11	14/04/2015	10.35	19.41	43.41	21.80	BDL	BDL	BDL
12	18/04/2015	08.15	16.00	42.10	21.03	BDL	BDL	BDL
13	21/04/2015	10.14	20.10	42.25	20.18	BDL	BDL	BDL
14	24/04/2015	10.77	19.32	40.31	19.65	BDL	BDL	BDL
15	27/04/2015	10.40	19.48	41.19	20.15	BDL	BDL	BDL
16	29/04/2015	11.11	20.15	42.45	20.15	BDL	BDL	BDL
17	04/05/2015	10.15	19.48	39.35	19.77	BDL	BDL	BDL
18	07/05/2015	09.75	18.47	38.12	19.07	BDL	BDL	BDL
19	12/05/2015	12.95	23.10	41.50	20.40	BDL	BDL	BDL
20	16/05/2015	10.44	20.82	40.34	19.82	BDL	BDL	BDL
21	20/05/2015	08.66	17.74	39.02	18.27	BDL	BDL	BDL
22	25/05/2015	11.45	21.04	40.45	20.18	BDL	BDL	BDL
23	28/05/2015	10.20	19.46	41.58	20.64	BDL	BDL	BDL
24	30/05/2015	09.33	18.61	38.08	19.33	BDL	BDL	BDL
	Average	10.30	19.78	41.87	20.66	---	---	---
	Max	12.95	23.15	50.33	25.56	---	---	---
	Min	8.15	16	36.19	17.21	---	---	---
	98% Percentile	12.72	23.12	49.32	24.63	---	---	---



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Sample Code: AB/PRO/03,04,05/2015-16/1851

REMARKS / OBSERVATIONS:

- All above results are within National Ambient Air Quality standards.
- BDL – Below Detectable Limit.



Signature of Lab Executive



Signature of Technical Manager



Signature of Quality Manager



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Ambient Air Quality Monitoring Analysis Report

Sample Code	AB/PRO/03,04,05/2015-16/1852
Project Name	M/s.Karanja Infrastructure Pvt. Ltd.
Project Location	Tal:- Pen ,Dist:- Raigad
Sample Location	A-4 Onsite T-4 Land Parcel
Sample type	Ambient Air

Sr. No.	Date of Sampling	SO ₂	NO _x	PM10	PM2.5	CO	VOC	HC
		≤80	≤80	≤100	≤60	≤04		
		μg/m ³	μg/m ³	μg/m ³	μg/m ³	mg/m ³	ppm	ppm
1	07/03/2015	13.63	23.01	59.20	29.55	0.4	BDL	BDL
2	11/03/2015	14.30	25.15	59.07	29.02	0.5	BDL	BDL
3	14/03/2015	13.25	24.28	58.11	27.14	0.4	BDL	BDL
4	18/03/2015	15.02	29.15	50.18	24.65	0.6	BDL	BDL
5	21/03/2015	14.00	26.17	58.49	29.10	0.4	BDL	BDL
6	25/03/2015	12.35	25.58	56.25	28.48	0.5	BDL	BDL
7	28/03/2015	09.70	19.44	59.18	28.21	BDL	BDL	BDL
8	31/03/2015	13.55	26.05	50.47	24.52	0.5	BDL	BDL
9	04/04/2015	10.38	23.47	56.52	28.15	0.3	BDL	BDL
10	08/04/2015	13.85	25.88	58.33	29.56	0.6	BDL	BDL
11	14/04/2015	12.30	24.21	55.41	27.20	0.4	BDL	BDL
12	18/04/2015	14.63	27.17	59.10	29.02	0.5	BDL	BDL
13	21/04/2015	14.80	27.11	61.25	31.78	0.5	BDL	BDL
14	24/04/2015	14.14	27.15	60.31	30.88	0.5	BDL	BDL
15	27/04/2015	13.33	25.65	60.19	30.15	0.4	BDL	BDL
16	29/04/2015	12.45	24.26	55.45	28.96	0.3	BDL	BDL
17	04/05/2015	11.52	22.07	54.35	27.17	0.1	BDL	BDL
18	07/05/2015	13.08	25.10	58.12	27.56	0.4	BDL	BDL
19	12/05/2015	12.57	23.25	56.50	27.52	0.2	BDL	BDL
20	16/05/2015	13.22	26.17	58.34	29.15	0.4	BDL	BDL
21	20/05/2015	09.58	19.15	47.02	23.27	BDL	BDL	BDL
22	25/05/2015	10.52	22.06	52.45	25.18	0.1	BDL	BDL
23	28/05/2015	13.21	23.45	57.58	28.04	0.3	BDL	BDL
24	30/05/2015	11.72	21.76	52.08	26.42	0.2	BDL	BDL
	Average	12.79	24.44	56.41	27.94	0.38	---	---
	Max	15.02	29.15	61.25	31.78	0.6	---	---
	Min	9.58	19.15	47.02	23.27	0.1	---	---
	98% Percentile	14.91	28.23	60.81	31.36	0.6	---	---



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Sample Code: AB/PRO/03,04,05/2015-16/1852

REMARKS / OBSERVATIONS:

- All above results are within National Ambient Air Quality standards.
- BDL – Below Detectable Limit.



Signature of Lab Executive



Signature of Technical Manager



Signature of Quality Manager



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Ambient Air Quality Monitoring Analysis Report

Sample Code	AB/PRO/03,04,05/2015-16/1853
Project Name	M/s.Karanja Infrastructure Pvt. Ltd.
Project Location	Tal:- Pen ,Dist:- Raigad
Sample Location	A-5 Downwind of T-4 at Balavali Village
Sample type	Ambient Air

Sr. No.	Date of Sampling	SO ₂	NO _x	PM ₁₀	PM _{2.5}	CO	VOC	HC
		≤80	≤80	≤100	≤60	≤04		
		μg/m ³	μg/m ³	μg/m ³	μg/m ³	mg/m ³	ppm	ppm
1	05/03/2015	9.80	18.01	43.20	19.55	BDL	BDL	BDL
2	09/03/2015	7.73	15.15	39.07	17.02	BDL	BDL	BDL
3	12/03/2015	8.24	16.28	38.11	17.14	BDL	BDL	BDL
4	16/03/2015	9.55	19.15	42.18	20.65	BDL	BDL	BDL
5	19/03/2015	7.66	13.17	38.49	17.10	BDL	BDL	BDL
6	23/03/2015	6.51	12.58	36.25	16.48	BDL	BDL	BDL
7	26/03/2015	9.08	18.44	39.18	16.21	BDL	BDL	BDL
8	30/03/2015	10.21	21.05	40.47	17.00	BDL	BDL	BDL
9	03/04/2015	9.22	18.47	38.52	16.52	BDL	BDL	BDL
10	06/04/2015	10.02	20.88	38.33	18.56	BDL	BDL	BDL
11	12/04/2015	9.20	19.21	37.41	18.20	BDL	BDL	BDL
12	16/04/2015	8.14	16.17	35.10	16.03	BDL	BDL	BDL
13	19/04/2015	8.40	19.41	36.25	18.18	BDL	BDL	BDL
14	21/04/2015	10.14	19.15	40.31	17.22	BDL	BDL	BDL
15	24/04/2015	9.10	19.22	37.19	18.15	BDL	BDL	BDL
16	29/04/2015	8.74	17.26	35.45	16.15	BDL	BDL	BDL
17	04/05/2015	9.15	19.07	39.35	15.77	BDL	BDL	BDL
18	08/05/2015	10.08	20.10	38.12	19.07	BDL	BDL	BDL
19	12/05/2015	11.57	23.25	41.50	20.40	BDL	BDL	BDL
20	17/05/2015	8.45	20.82	40.34	18.15	BDL	BDL	BDL
21	21/05/2015	7.40	15.75	39.02	17.27	BDL	BDL	BDL
22	25/05/2015	9.11	20.06	40.45	20.18	BDL	BDL	BDL
23	28/05/2015	7.20	13.45	37.58	18.04	BDL	BDL	BDL
24	30/05/2015	7.33	15.76	38.08	17.42	BDL	BDL	BDL
	Average	8.83	17.99	38.74	17.76	---	---	---
	Max	11.57	23.25	43.2	20.65	---	---	---
	Min	6.51	12.58	35.1	15.77	---	---	---
	98% Percentile	10.94	22.23	42.73	20.53	---	---	---



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Sample Code: AB/PRO/03,04,05/2015-16/1853

REMARKS / OBSERVATIONS:

- All above results are within National Ambient Air Quality standards.
- BDL – Below Detectable Limit.



Signature of Lab Executive



Signature of Technical Manager



Signature of Quality Manager



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Ambient Air Quality Monitoring Analysis Report

Sample Code	AB/PRO/03,04,05/2015-16/1854
Project Name	M/s.Karanja Infrastructure Pvt. Ltd.
Project Location	Tal:- Pen ,Dist:- Raigad
Sample Location	A-6 Upwind of T-4 at Nidhavali Village
Sample type	Ambient Air

Sr. No.	Date of Sampling	SO ₂	NO _x	PM10	PM2.5	CO	VOC	HC
		≤80	≤80	≤100	≤60	≤04		
		μg/m ³	μg/m ³	μg/m ³	μg/m ³	mg/m ³	ppm	ppm
1	05/03/2015	8.55	18.45	42.80	20.55	BDL	BDL	BDL
2	09/03/2015	7.52	14.85	39.15	18.86	BDL	BDL	BDL
3	12/03/2015	8.19	16.10	38.22	17.44	BDL	BDL	BDL
4	16/03/2015	9.58	19.15	43.38	21.31	BDL	BDL	BDL
5	19/03/2015	7.82	14.21	39.04	19.60	BDL	BDL	BDL
6	23/03/2015	6.50	12.21	36.46	18.19	BDL	BDL	BDL
7	26/03/2015	9.75	19.10	39.64	18.31	BDL	BDL	BDL
8	30/03/2015	10.04	20.18	40.15	20.02	BDL	BDL	BDL
9	03/04/2015	9.41	18.48	38.82	18.92	BDL	BDL	BDL
10	06/04/2015	10.11	20.42	39.13	18.68	BDL	BDL	BDL
11	12/04/2015	9.28	19.22	38.15	18.85	BDL	BDL	BDL
12	16/04/2015	8.02	16.25	37.89	16.76	BDL	BDL	BDL
13	19/04/2015	8.00	17.47	36.46	18.53	BDL	BDL	BDL
14	21/04/2015	10.25	19.68	40.12	19.77	BDL	BDL	BDL
15	24/04/2015	9.06	18.58	38.44	19.15	BDL	BDL	BDL
16	29/04/2015	8.45	16.10	36.02	17.58	BDL	BDL	BDL
17	04/05/2015	9.31	18.14	38.48	19.25	BDL	BDL	BDL
18	08/05/2015	9.85	19.20	38.82	19.50	BDL	BDL	BDL
19	12/05/2015	10.44	20.14	40.88	19.85	BDL	BDL	BDL
20	17/05/2015	8.92	16.82	37.14	18.65	BDL	BDL	BDL
21	21/05/2015	7.31	14.58	36.52	18.26	BDL	BDL	BDL
22	25/05/2015	9.18	19.28	38.05	19.59	BDL	BDL	BDL
23	28/05/2015	7.20	13.75	37.65	18.16	BDL	BDL	BDL
24	30/05/2015	7.28	14.21	38.18	19.20	BDL	BDL	BDL
Average		8.75	17.35	38.73	18.95	---	---	---
Max		10.44	20.42	43.38	21.31	---	---	---
Min		6.5	12.21	36.02	16.76	---	---	---
98% Percentile		10.35	20.30	43.11	20.96	---	---	---



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Sample Code: AB/PRO/03,04,05/2015-16/1854

REMARKS / OBSERVATIONS:

- All above results are within National Ambient Air Quality standards.
- BDL – Below Detectable Limit.



Signature of Lab Executive



Signature of Technical Manager



Signature of Quality Manager



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Ambient Air Quality Monitoring Analysis Report

Sample Code	AB/PRO/03,04,05/2015-16/1855
Project Name	M/s.Karanja Infrastructure Pvt. Ltd.
Project Location	Tal:- Pen ,Dist:- Raigad
Sample Location	A-7 Onsite T-2 Land Parcel
Sample type	Ambient Air

Sr. No.	Date of Sampling	SO ₂	NO _x	PM ₁₀	PM _{2.5}	CO	VOC	HC
		≤80	≤80	≤100	≤60	≤04		
		μg/m ³	μg/m ³	μg/m ³	μg/m ³	mg/m ³	ppm	ppm
1	02/03/2015	15.77	26.75	54.15	22.44	0.3	BDL	BDL
2	06/03/2015	16.59	27.41	53.75	21.57	0.3	BDL	BDL
3	09/03/2015	17.14	29.10	51.48	21.14	0.4	BDL	BDL
4	15/03/2015	14.75	23.11	53.62	21.71	0.2	BDL	BDL
5	19/03/2015	15.11	25.75	58.67	29.79	0.3	BDL	BDL
6	23/03/2015	14.72	24.55	51.43	21.15	0.2	BDL	BDL
7	25/03/2015	14.08	22.76	52.77	23.49	0.2	BDL	BDL
8	29/03/2015	16.00	25.40	52.48	28.11	0.3	BDL	BDL
9	02/04/2015	14.75	23.46	51.48	26.44	0.2	BDL	BDL
10	06/04/2015	16.25	25.78	46.87	23.42	0.3	BDL	BDL
11	12/04/2015	15.74	23.55	52.40	27.80	0.3	BDL	BDL
12	16/04/2015	14.77	22.72	43.45	21.66	0.2	BDL	BDL
13	19/04/2015	15.57	26.40	50.44	26.74	0.3	BDL	BDL
14	22/04/2015	14.77	22.45	50.10	25.02	0.2	BDL	BDL
15	25/04/2015	16.89	26.40	51.19	26.10	0.3	BDL	BDL
16	27/04/2015	17.41	29.15	52.45	26.88	0.4	BDL	BDL
17	03/05/2015	15.15	27.62	49.35	25.41	0.3	BDL	BDL
18	07/05/2015	14.75	24.01	48.12	25.55	0.2	BDL	BDL
19	12/05/2015	16.95	26.96	51.50	25.40	0.3	BDL	BDL
20	17/05/2015	15.23	23.82	50.34	23.15	0.3	BDL	BDL
21	23/05/2015	14.67	25.74	49.02	24.10	0.2	BDL	BDL
22	25/05/2015	15.78	26.04	50.45	25.00	0.3	BDL	BDL
23	28/05/2015	13.55	24.44	45.58	22.12	0.1	BDL	BDL
24	31/05/2015	14.81	25.17	52.08	25.22	0.2	BDL	BDL
	Average	15.47	25.35	50.96	24.55	0.26	---	---
	Max	17.41	29.15	58.67	29.79	0.4	---	---
	Min	13.55	22.45	43.45	21.14	0.1	---	---
	98% Percentile	17.28	29.12	56.59	29.017	0.4	---	---



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Sample Code: AB/PRO/03,04,05/2015-16/1855

REMARKS / OBSERVATIONS:

- All above results are within National Ambient Air Quality standards.
- BDL – Below Detectable Limit.



Signature of Lab Executive



Signature of Technical Manager



Signature of Quality Manager



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Ambient Air Quality Monitoring Analysis Report

Sample Code	AB/PRO/03,04,05/2015-16/1856
Project Name	M/s.Karanja Infrastructure Pvt. Ltd.
Project Location	Tal:- Pen ,Dist:- Raigad
Sample Location	A-8 Downwind of T-2 at South of Belawade Budruk
Sample type	Ambient Air

Sr. No.	Date of Sampling	SO ₂	NO _x	PM10	PM2.5	CO	VOC	HC
		≤80	≤80	≤100	≤60	≤04		
		µg/m ³	µg/m ³	µg/m ³	µg/m ³	mg/m ³	ppm	ppm
1	02/03/2015	8.96	17.58	39.68	19.45	BDL	BDL	BDL
2	06/03/2015	7.18	14.64	37.55	17.14	BDL	BDL	BDL
3	09/03/2015	8.08	15.96	37.08	17.75	BDL	BDL	BDL
4	15/03/2015	9.31	19.12	39.48	19.93	BDL	BDL	BDL
5	19/03/2015	7.35	14.20	37.55	16.86	BDL	BDL	BDL
6	23/03/2015	6.65	13.15	34.85	15.87	BDL	BDL	BDL
7	25/03/2015	8.72	17.28	37.18	18.56	BDL	BDL	BDL
8	29/03/2015	9.68	20.05	39.57	18.12	BDL	BDL	BDL
9	02/04/2015	9.26	18.28	38.86	18.56	BDL	BDL	BDL
10	06/04/2015	9.85	19.45	38.49	18.90	BDL	BDL	BDL
11	12/04/2015	8.95	19.47	37.44	17.85	BDL	BDL	BDL
12	16/04/2015	8.05	16.26	36.61	16.32	BDL	BDL	BDL
13	19/04/2015	8.14	18.22	36.78	16.30	BDL	BDL	BDL
14	22/04/2015	9.55	19.13	39.45	18.48	BDL	BDL	BDL
15	25/04/2015	8.79	19.22	38.18	17.64	BDL	BDL	BDL
16	27/04/2015	8.62	17.31	37.42	17.48	BDL	BDL	BDL
17	03/05/2015	9.08	18.22	39.35	18.56	BDL	BDL	BDL
18	07/05/2015	9.73	19.42	38.12	19.46	BDL	BDL	BDL
19	12/05/2015	10.11	20.34	40.18	20.22	BDL	BDL	BDL
20	17/05/2015	8.24	16.82	38.42	18.45	BDL	BDL	BDL
21	23/05/2015	7.28	15.21	37.55	17.67	BDL	BDL	BDL
22	25/05/2015	9.05	19.42	39.85	20.28	BDL	BDL	BDL
23	28/05/2015	7.18	14.26	35.66	18.14	BDL	BDL	BDL
24	31/05/2015	7.25	14.98	35.75	18.82	BDL	BDL	BDL
	Average	8.54	17.41	37.96	18.20	---	---	---
	Max	10.11	20.34	40.18	20.28	---	---	---
	Min	6.65	13.15	34.85	15.82	---	---	---
	98% Percentile	9.98	20.20	40.03	20.25	---	---	---



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Sample Code: AB/PRO/03,04,05/2015-16/1856

REMARKS / OBSERVATIONS:

- All above results are within National Ambient Air Quality standards.
- BDL – Below Detectable Limit.



Signature of Lab Executive



Signature of Technical Manager



Signature of Quality Manager



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Ambient Air Quality Monitoring Analysis Report

Sample Code	AB/PRO/03,04,05/2015-16/1857
Project Name	M/s.Karanja Infrastructure Pvt. Ltd.
Project Location	Tal:- Pen ,Dist:- Raigad
Sample Location	A-9 Upwind of T-2 at base of Hills
Sample type	Ambient Air

Sr. No.	Date of Sampling	SO ₂	NO _x	PM10	PM2.5	CO	VOC	HC
		≤80	≤80	≤100	≤60	≤04		
		μg/m ³	μg/m ³	μg/m ³	μg/m ³	mg/m ³	ppm	ppm
1	02/03/2015	9.54	18.05	40.56	19.52	BDL	BDL	BDL
2	06/03/2015	7.42	14.85	39.18	18.15	BDL	BDL	BDL
3	09/03/2015	8.28	16.36	37.58	17.06	BDL	BDL	BDL
4	15/03/2015	9.56	19.28	40.46	20.36	BDL	BDL	BDL
5	19/03/2015	7.88	13.49	37.89	18.25	BDL	BDL	BDL
6	23/03/2015	7.68	12.62	35.65	17.55	BDL	BDL	BDL
7	25/03/2015	8.93	18.88	38.68	19.41	BDL	BDL	BDL
8	29/03/2015	10.11	21.25	39.18	19.62	BDL	BDL	BDL
9	02/04/2015	9.08	18.49	38.65	19.56	BDL	BDL	BDL
10	06/04/2015	9.75	20.86	38.29	18.62	BDL	BDL	BDL
11	12/04/2015	9.11	19.22	37.32	18.66	BDL	BDL	BDL
12	16/04/2015	8.08	16.18	35.08	17.15	BDL	BDL	BDL
13	19/04/2015	8.18	19.43	36.11	18.08	BDL	BDL	BDL
14	22/04/2015	10.02	19.25	40.20	20.13	BDL	BDL	BDL
15	25/04/2015	9.31	19.15	37.26	18.49	BDL	BDL	BDL
16	27/04/2015	8.56	17.36	35.28	17.45	BDL	BDL	BDL
17	03/05/2015	9.04	19.15	39.89	19.48	BDL	BDL	BDL
18	07/05/2015	10.10	20.18	38.45	19.07	BDL	BDL	BDL
19	12/05/2015	11.35	23.30	41.50	20.85	BDL	BDL	BDL
20	17/05/2015	8.49	20.49	40.63	19.24	BDL	BDL	BDL
21	23/05/2015	7.40	15.72	39.12	19.32	BDL	BDL	BDL
22	25/05/2015	9.20	20.61	39.48	19.25	BDL	BDL	BDL
23	28/05/2015	7.27	13.44	38.33	19.18	BDL	BDL	BDL
24	31/05/2015	7.34	15.76	38.44	17.21	BDL	BDL	BDL
	Average	8.82	18.05	38.46	18.82	---	---	---
	Max	11.35	23.3	41.5	20.85	---	---	---
	Min	7.27	12.62	35.08	17.06	---	---	---
	98% Percentile	10.78	22.35	41.10	20.62	---	---	---



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Sample Code: AB/PRO/03,04,05/2015-16/1857

REMARKS / OBSERVATIONS:

- All above results are within National Ambient Air Quality standards.
- BDL – Below Detectable Limit.



Signature of Lab Executive



Signature of Technical Manager



Signature of Quality Manager



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Ambient Air Quality Monitoring Analysis Report

Sample Code	AB/PRO/03,04,05/2015-16/1858
Project Name	M/s.Karanja Infrastructure Pvt. Ltd.
Project Location	Tal:- Pen ,Dist:- Raigad
Sample Location	A-10 Onsite T-1 Land Parcel
Sample type	Ambient Air

Sr. No.	Date of Sampling	SO ₂	NO _x	PM10	PM2.5	CO	VOC	HC
		≤80	≤80	≤100	≤60	≤04		
		μg/m ³	μg/m ³	μg/m ³	μg/m ³	mg/m ³	ppm	ppm
1	02/03/2015	15.35	25.05	54.56	21.52	0.8	BDL	BDL
2	06/03/2015	16.22	26.36	60.18	20.15	0.7	BDL	BDL
3	09/03/2015	16.30	26.86	58.58	19.06	0.3	BDL	BDL
4	15/03/2015	16.50	26.28	57.46	22.36	0.4	BDL	BDL
5	19/03/2015	18.23	28.95	63.89	20.25	0.5	BDL	BDL
6	23/03/2015	18.38	28.63	59.65	19.55	0.4	BDL	BDL
7	25/03/2015	14.22	24.88	62.68	21.41	0.2	BDL	BDL
8	29/03/2015	15.11	21.25	63.18	21.62	0.3	BDL	BDL
9	02/04/2015	15.33	21.32	62.65	21.56	0.4	BDL	BDL
10	06/04/2015	15.28	20.86	62.29	20.62	0.5	BDL	BDL
11	12/04/2015	15.11	20.22	61.32	20.66	0.3	BDL	BDL
12	16/04/2015	14.98	24.85	59.08	19.15	BDL	BDL	BDL
13	19/04/2015	18.36	28.43	64.11	20.08	0.5	BDL	BDL
14	22/04/2015	15.02	25.25	54.20	22.13	0.4	BDL	BDL
15	25/04/2015	16.55	26.15	61.26	20.49	0.2	BDL	BDL
16	27/04/2015	17.40	27.36	59.28	19.45	0.6	BDL	BDL
17	03/05/2015	17.26	27.15	60.89	21.48	0.4	BDL	BDL
18	07/05/2015	15.72	25.18	57.45	21.07	0.2	BDL	BDL
19	12/05/2015	14.69	24.30	55.20	22.85	BDL	BDL	BDL
20	17/05/2015	14.54	24.49	54.63	21.24	BDL	BDL	BDL
21	23/05/2015	18.63	28.72	64.12	21.32	0.5	BDL	BDL
22	25/05/2015	17.68	27.61	59.48	21.25	0.4	BDL	BDL
23	28/05/2015	15.50	25.44	58.33	21.18	0.3	BDL	BDL
24	31/05/2015	14.10	24.76	54.44	19.21	0.5	BDL	BDL
	Average	16.10	25.43	59.53	20.81	0.4	---	---
	Max	18.63	28.95	64.12	22.85	0.8	---	---
	Min	14.1	20.22	54.2	19.06	0.2	---	---
	98% Percentile	18.51	28.84	64.11	22.62	0.76	---	---



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Sample Code: AB/PRO/03,04,05/2015-16/1858

REMARKS / OBSERVATIONS:

- All above results are within National Ambient Air Quality standards.
- BDL – Below Detectable Limit.



Signature of Lab Executive



Signature of Technical Manager



Signature of Quality Manager



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Ambient Air Quality Monitoring Analysis Report

Sample Code	AB/PRO/03,04,05/2015-16/1859
Project Name	M/s.Karanja Infrastructure Pvt. Ltd.
Project Location	Tal:- Pen ,Dist:- Raigad
Sample Location	A-11 Downwind of T-1 at Wirani Village
Sample type	Ambient Air

Sr. No.	Date of Sampling	SO ₂	NO _x	PM10	PM2.5	CO	VOC	HC
		≤80 μg/m ³	≤80 μg/m ³	≤100 μg/m ³	≤60 μg/m ³	≤04 mg/m ³	ppm	ppm
1	02/03/2015	9.54	18.05	40.56	19.52	BDL	BDL	BDL
2	06/03/2015	7.42	14.85	39.18	18.15	BDL	BDL	BDL
3	09/03/2015	8.28	16.36	37.58	17.06	BDL	BDL	BDL
4	15/03/2015	9.56	19.28	40.46	20.36	BDL	BDL	BDL
5	19/03/2015	7.88	13.49	37.89	18.25	BDL	BDL	BDL
6	23/03/2015	7.68	12.62	35.65	17.55	BDL	BDL	BDL
7	25/03/2015	8.93	18.88	38.68	19.41	BDL	BDL	BDL
8	29/03/2015	10.11	21.25	39.18	19.62	BDL	BDL	BDL
9	02/04/2015	9.08	18.49	38.65	19.56	BDL	BDL	BDL
10	06/04/2015	9.75	20.86	38.29	18.62	BDL	BDL	BDL
11	12/04/2015	9.11	19.22	37.32	18.66	BDL	BDL	BDL
12	16/04/2015	8.08	16.18	35.08	17.15	BDL	BDL	BDL
13	19/04/2015	8.18	19.43	36.11	18.08	BDL	BDL	BDL
14	22/04/2015	10.02	19.25	40.20	20.13	BDL	BDL	BDL
15	25/04/2015	9.31	19.15	37.26	18.49	BDL	BDL	BDL
16	27/04/2015	8.56	17.36	35.28	17.45	BDL	BDL	BDL
17	03/05/2015	9.04	19.15	39.89	19.48	BDL	BDL	BDL
18	07/05/2015	10.10	20.18	38.45	19.07	BDL	BDL	BDL
19	12/05/2015	11.35	23.30	41.50	20.85	BDL	BDL	BDL
20	17/05/2015	8.49	20.49	40.63	19.24	BDL	BDL	BDL
21	23/05/2015	7.40	15.72	39.12	19.32	BDL	BDL	BDL
22	25/05/2015	9.20	20.61	39.48	19.25	BDL	BDL	BDL
23	28/05/2015	7.27	13.44	38.33	19.18	BDL	BDL	BDL
24	31/05/2015	7.34	15.76	38.44	17.21	BDL	BDL	BDL
	Average	8.82	18.05	38.46	18.81	---	---	---
	Max	11.35	23.3	41.5	20.85	---	---	---
	Min	7.27	12.62	35.08	17.06	---	---	---
	98% Percentile	10.77	22.35	41.09	20.62	---	---	---



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Sample Code: AB/PRO/03,04,05/2015-16/1859

REMARKS / OBSERVATIONS:

- All above results are within National Ambient Air Quality standards.
- BDL – Below Detectable Limit.



Signature of Lab Executive



Signature of Technical Manager



Signature of Quality Manager



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Ambient Air Quality Monitoring Analysis Report

Sample Code	AB/PRO/03,04,05/2015-16/1860
Project Name	M/s.Karanja Infrastructure Pvt. Ltd.
Project Location	Tal:- Pen ,Dist:- Raigad
Sample Location	A-12 Upwind of T-1 at Talavali Village
Sample type	Ambient Air

Sr. No.	Date of Sampling	SO ₂	NO _x	PM10	PM2.5	CO	VOC	HC
		≤80	≤80	≤100	≤60	≤04		
		μg/m ³	μg/m ³	μg/m ³	μg/m ³	mg/m ³	ppm	ppm
1	02/03/2015	10.30	22.15	46.65	23.12	BDL	BDL	BDL
2	06/03/2015	9.42	18.63	45.92	22.84	BDL	BDL	BDL
3	09/03/2015	9.63	18.30	45.68	22.96	BDL	BDL	BDL
4	15/03/2015	11.36	20.35	47.26	23.75	BDL	BDL	BDL
5	19/03/2015	11.35	20.22	46.89	23.63	BDL	BDL	BDL
6	23/03/2015	10.85	19.34	40.65	19.87	BDL	BDL	BDL
7	25/03/2015	11.30	20.85	43.68	22.02	BDL	BDL	BDL
8	29/03/2015	14.32	23.25	48.18	24.09	BDL	BDL	BDL
9	02/04/2015	12.22	21.49	43.65	21.28	BDL	BDL	BDL
10	06/04/2015	13.38	20.86	45.65	22.72	BDL	BDL	BDL
11	12/04/2015	13.52	23.22	47.39	23.66	BDL	BDL	BDL
12	16/04/2015	9.62	19.18	45.08	22.15	BDL	BDL	BDL
13	19/04/2015	10.78	19.43	46.11	23.08	BDL	BDL	BDL
14	22/04/2015	12.08	21.10	48.20	24.13	BDL	BDL	BDL
15	25/04/2015	10.07	20.15	47.26	23.49	BDL	BDL	BDL
16	27/04/2015	11.47	21.36	46.28	22.45	BDL	BDL	BDL
17	03/05/2015	12.62	22.15	49.89	24.48	BDL	BDL	BDL
18	07/05/2015	13.55	22.78	50.45	25.07	BDL	BDL	BDL
19	12/05/2015	17.37	22.30	48.50	24.85	BDL	BDL	BDL
20	17/05/2015	12.75	21.39	43.63	21.24	BDL	BDL	BDL
21	23/05/2015	14.20	23.10	52.88	26.32	BDL	BDL	BDL
22	25/05/2015	14.62	23.65	53.02	26.77	BDL	BDL	BDL
23	28/05/2015	12.45	21.75	47.30	23.65	BDL	BDL	BDL
24	31/05/2015	11.27	20.30	46.44	22.22	BDL	BDL	BDL
	Average	11.90	21.13	46.94	23.32	---	---	---
	Max	14.62	23.65	53.02	26.77	---	---	---
	Min	9.42	18.3	40.65	19.87	---	---	---
	98% Percentile	14.48	23.46	52.95	26.56	---	---	---



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Sample Code: AB/PRO/03,04,05/2015-16/1860

REMARKS / OBSERVATIONS:

- All above results are within National Ambient Air Quality standards.
- BDL – Below Detectable Limit.



Signature of Lab Executive



Signature of Technical Manager



Signature of Quality Manager



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Ambient Air Quality Monitoring Analysis Report

Sample Code	AB/PRO/03,04,05/2015-16/1861
Project Name	M/s.Karanja Infrastructure Pvt. Ltd.
Project Location	Tal:- Pen ,Dist:- Raigad
Sample Location	A-13 Crosswind in North of the Project area at Village Jui Khurd
Sample type	Ambient Air

Sr. No.	Date of Sampling	SO ₂	NO _x	PM10	PM2.5	CO	VOC	HC
		≤80 μg/m ³	≤80 μg/m ³	≤100 μg/m ³	≤60 μg/m ³	≤04 mg/m ³	ppm	ppm
1	02/03/2015	10.36	19.24	47.17	22.46	BDL	BDL	BDL
2	06/03/2015	11.00	20.40	49.18	23.36	BDL	BDL	BDL
3	09/03/2015	13.77	22.26	51.30	22.65	BDL	BDL	BDL
4	15/03/2015	12.35	21.47	50.46	23.65	BDL	BDL	BDL
5	19/03/2015	9.88	19.49	47.89	23.20	BDL	BDL	BDL
6	23/03/2015	10.25	20.12	49.65	24.20	BDL	BDL	BDL
7	25/03/2015	13.63	23.88	51.18	25.41	BDL	BDL	BDL
8	29/03/2015	13.21	22.25	51.17	25.62	BDL	BDL	BDL
9	02/04/2015	12.65	21.30	50.65	25.56	BDL	BDL	BDL
10	06/04/2015	12.35	21.30	48.62	24.62	BDL	BDL	BDL
11	12/04/2015	11.44	19.90	47.32	23.66	BDL	BDL	BDL
12	16/04/2015	11.86	20.18	48.08	24.15	BDL	BDL	BDL
13	19/04/2015	12.35	20.66	49.11	24.75	BDL	BDL	BDL
14	22/04/2015	12.88	20.72	49.34	24.18	BDL	BDL	BDL
15	25/04/2015	13.80	22.31	50.26	25.00	BDL	BDL	BDL
16	27/04/2015	14.42	23.52	51.28	25.62	BDL	BDL	BDL
17	03/05/2015	14.33	23.15	51.89	25.11	BDL	BDL	BDL
18	07/05/2015	15.11	25.10	52.45	26.33	BDL	BDL	BDL
19	12/05/2015	12.40	21.22	49.50	24.85	BDL	BDL	BDL
20	17/05/2015	12.95	21.79	49.63	24.24	BDL	BDL	BDL
21	23/05/2015	12.33	20.72	48.12	19.32	BDL	BDL	BDL
22	25/05/2015	10.22	19.52	47.48	19.25	BDL	BDL	BDL
23	28/05/2015	10.58	19.87	48.16	19.18	BDL	BDL	BDL
24	31/05/2015	11.34	19.92	48.76	17.21	BDL	BDL	BDL
	Average	12.31	21.26	49.52	23.48	---	---	---
	Max	15.11	25.1	52.45	26.33	---	---	---
	Min	9.88	19.24	47.17	17.21	---	---	---
	98% Percentile	14.79	24.54	52.19	26.00	---	---	---



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Sample Code: AB/PRO/03,04,05/2015-16/1861

REMARKS / OBSERVATIONS:

- All above results are within National Ambient Air Quality standards.
- BDL – Below Detectable Limit.



Signature of Lab Executive



Signature of Technical Manager



Signature of Quality Manager



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Ambient Air Quality Monitoring Analysis Report

Sample Code	AB/PRO/03,04,05/2015-16/1862
Project Name	M/s.Karanja Infrastructure Pvt. Ltd.
Project Location	Tal.:- Pen ,Dist:- Raigad
Sample Location	A-14 Crosswind in South of the Project area at Village Shene
Sample type	Ambient Air

Sr. No.	Date of Sampling	SO ₂	NO _x	PM10	PM2.5	CO	VOC	HC
		≤80	≤80	≤100	≤60	≤04		
		μg/m ³	μg/m ³	μg/m ³	μg/m ³	mg/m ³	ppm	ppm
1	02/03/2015	10.25	19.21	41.20	19.68	BDL	BDL	BDL
2	06/03/2015	9.42	17.65	40.41	18.48	BDL	BDL	BDL
3	09/03/2015	9.28	17.62	39.66	17.66	BDL	BDL	BDL
4	15/03/2015	9.56	17.80	39.62	20.41	BDL	BDL	BDL
5	19/03/2015	10.20	19.25	38.22	19.30	BDL	BDL	BDL
6	23/03/2015	9.68	17.74	37.44	18.22	BDL	BDL	BDL
7	25/03/2015	8.93	14.30	35.77	17.20	BDL	BDL	BDL
8	29/03/2015	11.11	19.89	41.82	19.52	BDL	BDL	BDL
9	02/04/2015	10.30	18.87	42.33	19.33	BDL	BDL	BDL
10	06/04/2015	14.65	22.37	49.29	18.66	BDL	BDL	BDL
11	12/04/2015	14.62	23.66	49.32	18.48	BDL	BDL	BDL
12	16/04/2015	14.04	23.18	49.08	17.54	BDL	BDL	BDL
13	19/04/2015	12.37	21.30	46.11	18.75	BDL	BDL	BDL
14	22/04/2015	11.48	19.25	44.29	20.12	BDL	BDL	BDL
15	25/04/2015	10.77	19.15	43.26	18.79	BDL	BDL	BDL
16	27/04/2015	11.20	17.36	45.28	17.26	BDL	BDL	BDL
17	03/05/2015	9.48	15.15	39.89	19.38	BDL	BDL	BDL
18	07/05/2015	11.22	18.28	42.45	19.47	BDL	BDL	BDL
19	12/05/2015	12.87	18.67	41.50	20.81	BDL	BDL	BDL
20	17/05/2015	9.96	17.32	40.63	19.70	BDL	BDL	BDL
21	23/05/2015	13.41	21.30	46.12	20.52	BDL	BDL	BDL
22	25/05/2015	14.22	22.11	45.48	21.65	BDL	BDL	BDL
23	28/05/2015	13.46	21.17	44.33	21.57	BDL	BDL	BDL
24	31/05/2015	12.41	20.76	41.44	18.44	BDL	BDL	BDL
	Average	11.45	19.30	42.70	19.20	---	---	---
	Max	14.65	23.66	49.32	21.65	---	---	---
	Min	8.93	14.3	35.77	17.2	---	---	---
	98% Percentile	14.63	23.43	49.30	21.61	---	---	---



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Sample Code: AB/PRO/03,04,05/2015-16/1862

REMARKS / OBSERVATIONS:

- All above results are within National Ambient Air Quality standards.
- BDL – Below Detectable Limit.



Signature of Lab Executive



Signature of Technical Manager



Signature of Quality Manager



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Test Report

Sample Code	AB/PRO/05/2015-16/1863
Sample Name	GW-1 T-3 Land Parcel
Name of Client	M/s. Karanja Infrastructure Pvt. Ltd.
Address of Client	Tal-Pen, Dist-Raigad
Sample Collected by	M/s. Building Environment (I) Pvt. Ltd.
Sample type	Liquid
Sample received on date	30/05/2015
Analysis Date	01/06/2015 to 20/06/2015
Reporting date	20/06/2015
Sample returned /stored	Stored at 4°C for 1 week from the date of reporting

Sr. No.	Parameter	Results	Limits as per IS:10500(2012)	Units	Standard Method
Physical Parameter					
1	Turbidity	0.60	<1.0	NTU	IS: 3025 Part-10 (R.A : 2002)
2	TDS	293.0	<500	mg/lit	IS: 3025 Part-16 (R.A : 2006)
Chemical Parameter					
1	pH	6.60	6.5-8.5	--	IS: 3025 Part-11 (R.A : 2002)
2	E. Conductivity	521.1	N.S	μS/cm	IS: 3025 Part-14 (R.A : 2002)
3	Total Hardness as CaCO ₃	127.45	<200	mg/lit	IS: 3025 Part-21 (2009)
4	Total Alkalinity as CaCO ₃	115.79	<200	mg/lit	IS: 3025 Part-23 (R.A : 2003)
5	Chloride as Cl	12.25	<250	mg/lit	IS: 3025 Part-32 (R.A : 2003)
6	Sulphate as SO ₄	3.69	<200	mg/lit	APHA : 22 nd edition -(4500- SO ₄ ²⁻)
7	Fluoride as F	0.41	<1.0	mg/lit	APHA : 22 nd edition -(4500-F F)
8	Residual chlorine	<1.0	>0.2	mg/lit	APHA : 22 nd edition -(4500-Cl B)
9	Nitrate as NO ₃	0.01	<45	mg/lit	APHA : 22 nd edition -(4500- NO ₃ ⁻)
Elemental Testing					
1	Calcium as Ca	30.11	<75	mg/lit	IS: 3025 Part-02 (2004)
2	Magnesium as Mg	12.90	<30	mg/lit	IS: 3025 Part-02 (2004)
3	Iron as Fe	0.25	<0.3	mg/lit	IS: 3025 Part-02 (2004)
4	Copper as Cu	<0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
5	Cadmium as Cd	<0.01	<0.003	mg/lit	IS: 3025 Part-02 (2004)
6	Chromium as Cr	<0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
7	Lead as Pb	0.01	<0.01	mg/lit	IS: 3025 Part-02 (2004)
8	Selenium as Se	<0.01	<0.01	mg/lit	IS: 3025 Part-02 (2004)
9	Manganese as Mn	<0.01	<0.1	mg/lit	IS: 3025 Part-02 (2004)
10	Zinc as Zn	0.01	<5.0	mg/lit	IS: 3025 Part-02 (2004)
11	Sodium as Na	1.3	N.S	mg/lit	IS: 3025 Part-02 (2004)
12	Potassium As K	0.21	NS	mg/lit	IS: 3025 Part-02 (2004)
Microbiological Parameter					
1	Total Coliform	1600	Absent	MPN/100ml	IS: 1622 (R.A : 1996)
2	Fecal Coliform	27	Absent	MPN/100ml	IS: 1622 (R.A : 1996)

➤ REMARKS / OBSERVATIONS: Above parameter is chemically and bacteriologically non potable with respect to above parameters


Signature of Lab Executive


Signature of Technical Manager


Signature of Quality Manager

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Test Report

Sample Code	AB/PRO/05/2015-16/1864				
Sample Name	GW-2 T-4 Land Parcel				
Name of Client	M/s. Karanja Infrastructure Pvt. Ltd.				
Address of Client	Tal-Pen, Dist-Raigad				
Sample Collected by	M/s. Building Environment (I) Pvt. Ltd.				
Sample type	Liquid				
Sample received on date	30/05/2015				
Analysis Date	01/06/2015 to 20/06/2015				
Reporting date	20/06/2015				
Sample returned /stored	Stored at 4°C for 1 week from the date of reporting				
Sr. No.	Parameter	Results	Limits as per IS:10500(2012)	Units	Standard Method
Physical Parameter					
1	Turbidity	1.0	<1.0	NTU	IS: 3025 Part-10 (R.A : 2002)
2	TDS	298.0	<500	mg/lit	IS: 3025 Part-16 (R.A : 2006)
Chemical Parameter					
1	pH	6.94	6.5-8.5		IS: 3025 Part-11 (R.A : 2002)
2	E. Conductivity	425	N.S	µS/cm	IS: 3025 Part-14 (R.A : 2002)
3	Total Hardness as CaCO ₃	128.36	<200	mg/lit	IS: 3025 Part-21 (2009)
4	Total Alkalinity as CaCO ₃	112.63	<200	mg/lit	IS: 3025 Part-23 (R.A : 2003)
5	Chloride as Cl	11.76	<250	mg/lit	IS: 3025 Part-32 (R.A : 2003)
6	Sulphate as SO ₄	8.38	<200	mg/lit	APHA :22 nd edition -(4500-SO ₄ ²⁻ E)
7	Fluoride as F	0.83	<1.0	mg/lit	APHA :22 nd edition -(4500-F F)
8	Residual chlorine	<1.0	>0.2	mg/lit	APHA :22 nd edition -(4500-Cl B)
9	Nitrate as NO ₃	0.49	<45	mg/lit	APHA :22 nd edition -(4500-NO ₃ ²⁻ B)
Elemental Testing					
1	Calcium as Ca	28.15	<75	mg/lit	IS: 3025 Part-02 (2004)
2	Magnesium as Mg	14.46	<30	mg/lit	IS: 3025 Part-02 (2004)
3	Iron as Fe	0.13	<0.3	mg/lit	IS: 3025 Part-02 (2004)
4	Copper as Cu	0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
5	Cadmium as Cd	<0.01	<0.003	mg/lit	IS: 3025 Part-02 (2004)
6	Chromium as Cr	<0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
7	Lead as Pb	0.03	<0.01	mg/lit	IS: 3025 Part-02 (2004)
8	Selenium as Se	<0.01	<0.01	mg/lit	IS: 3025 Part-02 (2004)
9	Manganese as Mn	<0.01	<0.1	mg/lit	IS: 3025 Part-02 (2004)
10	Zinc as Zn	0.02	<5.0	mg/lit	IS: 3025 Part-02 (2004)
11	Sodium as Na	1.3	N.S	mg/lit	IS: 3025 Part-02 (2004)
12	Potassium As K	0.35	NS	mg/lit	IS: 3025 Part-02 (2004)
Microbiological Parameter					
1	Total Coliform	1600	Absent	MPN/100ml	IS: 1622 (R.A : 1996)
2	Fecal Coliform	900	Absent	MPN/100ml	IS: 1622 (R.A : 1996)

REMARKS / OBSERVATIONS: Above parameter is chemically and bacteriologically non potable with respect to above parameters


Signature of Lab Executive


Signature of Technical Manager


Signature of Quality Manager

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Test Report

Sample Code	AB/PRO/05/2015-16/1865				
Sample Name	GW-3 T-4 Land Parcel				
Name of Client	M/s. Karanja Infrastructure Pvt. Ltd.				
Address of Client	Tal-Pen, Dist-Raigad				
Sample Collected by	M/s. Building Environment (I) Pvt. Ltd.				
Sample type	Liquid				
Sample received on date	30/05/2015				
Analysis Date	01/06/2015 to 20/06/2015				
Reporting date	20/06/2015				
Sample returned /stored	Stored at 4°C for 1 week from the date of reporting				
Sr. No.	Parameter	Results	Limits as per IS:10500(2012)	Units	Standard Method
Physical Parameter					
1	Turbidity	1.0	<1.0	NTU	IS: 3025 Part-10 (R.A : 2002)
2	TDS	289.0	<500	mg/lit	IS: 3025 Part-16 (R.A : 2006)
Chemical Parameter					
1	pH	6.67	6.5-8.5	--	IS: 3025 Part-11 (R.A : 2002)
2	E. Conductivity	510	N.S	µS/cm	IS: 3025 Part-14 (R.A : 2002)
3	Total Hardness as CaCO ₃	155.56	<200	mg/lit	IS: 3025 Part-21 (2009)
4	Total Alkalinity as CaCO ₃	96.15	<200	mg/lit	IS: 3025 Part-23 (R.A : 2003)
5	Chloride as Cl	17.15	<250	mg/lit	IS: 3025 Part-32 (R.A : 2003)
6	Sulphate as SO ₄	26.96	<200	mg/lit	APHA : 22 nd edition -(4500-
7	Fluoride as F	0.01	<1.0	mg/lit	APHA : 22 nd edition -(4500-F F)
8	Residual chlorine	<1.0	>0.2	mg/lit	APHA : 22 nd edition -(4500-Cl B)
9	Nitrate as NO ₃	0.5	<45	mg/lit	APHA : 22 nd edition -(4500-
Elemental Testing					
1	Calcium as Ca	29.08	<75	mg/lit	IS: 3025 Part-02 (2004)
2	Magnesium as Mg	15.25	<30	mg/lit	IS: 3025 Part-02 (2004)
3	Iron as Fe	0.06	<0.3	mg/lit	IS: 3025 Part-02 (2004)
4	Copper as Cu	<0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
5	Cadmium as Cd	<0.01	<0.003	mg/lit	IS: 3025 Part-02 (2004)
6	Chromium as Cr	<0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
7	Lead as Pb	0.01	<0.01	mg/lit	IS: 3025 Part-02 (2004)
8	Selenium as Se	<0.01	<0.01	mg/lit	IS: 3025 Part-02 (2004)
9	Manganese as Mn	<0.01	<0.1	mg/lit	IS: 3025 Part-02 (2004)
10	Zinc as Zn	<0.01	<5.0	mg/lit	IS: 3025 Part-02 (2004)
11	Sodium as Na	1.9	N.S	mg/lit	IS: 3025 Part-02 (2004)
12	Potassium As K	0.30	NS	mg/lit	IS: 3025 Part-02 (2004)
Microbiological Parameter					
1	Total Coliform	220	Absent	MPN/100m	IS: 1622 (R.A : 1996)
2	Fecal Coliform	02	Absent	MPN/100m	IS: 1622 (R.A : 1996)

REMARKS / OBSERVATIONS: Above parameter is chemically and bacteriologically non potable with respect to above parameters

Signature of Lab Executive

Signature of Technical Manager

Signature of Quality Manager

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Test Report

Sample Code	AB/PRO/05/2015-16/1866				
Sample Name	GW-4 T-2 Land Parcel				
Name of Client	M/s. Karanja Infrastructure Pvt. Ltd.				
Address of Client	Tal-Pen, Dist-Raigad				
Sample Collected by	M/s. Building Environment (I) Pvt. Ltd.				
Sample type	Liquid				
Sample received on date	30/05/2015				
Analysis Date	01/06/2015 to 20/06/2015				
Reporting date	20/06/2015				
Sample returned /stored	Stored at 4°C for 1 week from the date of reporting				
Sr. No.	Parameter	Results	Limits as per IS:10500(2012)	Units	Standard Method
Physical Parameter					
1	Turbidity	1.90	<1.0	NTU	IS: 3025 Part-10 (R.A : 2002)
2	TDS	285.0	<500	mg/lit	IS: 3025 Part-16 (R.A : 2006)
Chemical Parameter					
1	pH	5.60	6.5-8.5	—	IS: 3025 Part-11 (R.A : 2002)
2	E. Conductivity	510	N.S	µS/cm	IS: 3025 Part-14 (R.A : 2002)
3	Total Hardness as	140.52	<200	mg/lit	IS: 3025 Part-21 (2009)
4	Total Alkalinity as	107.89	<200	mg/lit	IS: 3025 Part-23 (R.A : 2003)
5	Chloride as Cl	12.74	<250	mg/lit	IS: 3025 Part-32 (R.A : 2003)
6	Sulphate as SO ₄	28.38	<200	mg/lit	APHA :22 nd edition -(4500-
7	Fluoride as F	0.53	<1.0	mg/lit	APHA :22 nd edition -(4500-F F)
8	Residual chlorine	<1.0	>0.2	mg/lit	APHA :22 nd edition -(4500-Cl B)
9	Nitrate as NO ₃	0.01	<45	mg/lit	APHA :22 nd edition -(4500-
Elemental Testing					
1	Calcium as Ca	27.90	<75	mg/lit	IS: 3025 Part-02 (2004)
2	Magnesium as Mg	19.89	<30	mg/lit	IS: 3025 Part-02 (2004)
3	Iron as Fe	0.145	<0.3	mg/lit	IS: 3025 Part-02 (2004)
4	Copper as Cu	<0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
5	Cadmium as Cd	<0.01	<0.003	mg/lit	IS: 3025 Part-02 (2004)
6	Chromium as Cr	<0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
7	Lead as Pb	0.01	<0.01	mg/lit	IS: 3025 Part-02 (2004)
8	Selenium as Se	0.01	<0.01	mg/lit	IS: 3025 Part-02 (2004)
9	Manganese as Mn	<0.01	<0.1	mg/lit	IS: 3025 Part-02 (2004)
10	Zinc as Zn	0.065	<5.0	mg/lit	IS: 3025 Part-02 (2004)
11	Sodium as Na	1.09	N.S	mg/lit	IS: 3025 Part-02 (2004)
12	Potassium As K	0.32	N.S	mg/lit	IS: 3025 Part-02 (2004)
Microbiological Parameter					
1	Total Coliform	<2	Absent	MPN/100m	IS: 1622 (R.A : 1996)
2	Fecal Coliform	<2	Absent	MPN/100m	IS: 1622 (R.A : 1996)

Note : For E.coli and Coliform <2 can be considered as Absent

REMARKS / OBSERVATIONS: Above parameter is chemically and bacteriologically potable with respect to above parameters

Signature of Lab Executive

Signature of Technical Manager

Signature of Quality Manager

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Test Report

Sample Code	AB/PRO/05/2015-16/1867				
Sample Name	GW-5 T-1 Land Parcel				
Name of Client	M/s. Karanja Infrastructure Pvt. Ltd.				
Address of Client	Tal-Pen ,Dist-Raigad				
Sample Collected by	M/s. Building Environment (I) Pvt. Ltd.				
Sample type	Liquid				
Sample received on date	30/05/2015				
Analysis Date	01/06/2015 to 20/06/2015				
Reporting date	20/06/2015				
Sample returned /stored	Stored at 4°C for 1 week from the date of reporting				
Sr. No.	Parameter	Results	Limits as per IS:10500(2012)	Units	Standard Method
Physical Parameter					
1	Turbidity	1.00	<1.0	NTU	IS: 3025 Part-10 (R.A : 2002)
2	TDS	286.0	<500	mg/lit	IS: 3025 Part-16 (R.A : 2006)
Chemical Parameter					
1	pH	7.10	6.5-8.5	--	IS: 3025 Part-11 (R.A : 2002)
2	E. Conductivity	490.20	N.S	µS/cm	IS: 3025 Part-14 (R.A : 2002)
3	Total Hardness as CaCO ₃	145.75	<200	mg/lit	IS: 3025 Part-21 (2009)
4	Total Alkalinity as CaCO ₃	114.21	<200	mg/lit	IS: 3025 Part-23 (R.A : 2003)
5	Chloride as Cl	18.88	<250	mg/lit	IS: 3025 Part-32 (R.A : 2003)
6	Sulphate as SO ₄	23.27	<200	mg/lit	APHA :22 nd edition -(4500- SO ₄ ²⁻)
7	Fluoride as F	0.69	<1.0	mg/lit	APHA :22 nd edition -(4500- F F)
8	Residual chlorine	<1.0	>0.2	mg/lit	APHA :22 nd edition -(4500-Cl B)
9	Nitrate as NO ₃	0.01	<45	mg/lit	APHA :22 nd edition -(4500- NO ₃ ²⁻)
Elemental Testing					
1	Calcium as Ca	10.05	<75	mg/lit	IS: 3025 Part-02 (2004)
2	Magnesium as Mg	3.605	<30	mg/lit	IS: 3025 Part-02 (2004)
3	Iron as Fe	0.07	<0.3	mg/lit	IS: 3025 Part-02 (2004)
4	Copper as Cu	<0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
5	Cadmium as Cd	<0.01	<0.003	mg/lit	IS: 3025 Part-02 (2004)
6	Chromium as Cr	<0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
7	Lead as Pb	<0.01	<0.01	mg/lit	IS: 3025 Part-02 (2004)
8	Selenium as Se	<0.01	<0.01	mg/lit	IS: 3025 Part-02 (2004)
9	Manganese as Mn	<0.01	<0.1	mg/lit	IS: 3025 Part-02 (2004)
10	Zinc as Zn	<0.01	<5.0	mg/lit	IS: 3025 Part-02 (2004)
11	Sodium as Na	1.12	N.S	mg/lit	IS: 3025 Part-02 (2004)
12	Potassium As K	0.42	N.S	mg/lit	IS: 3025 Part-02 (2004)
Microbiological Parameter					
1	Total Coliform	1600	Absent	MPN/100ml	IS: 1622 (R.A : 1996)
2	Fecal Coliform	350	Absent	MPN/100ml	IS: 1622 (R.A : 1996)

REMARKS / OBSERVATIONS: Above parameter is chemically and bacteriologically non potable with respect to above parameters

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Signature of Quality Manager

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Test Report

Sample Code	AB/PRO/05/2015-16/1868				
Sample Name	GW-G T-1 Land Parcel				
Name of Client	M/s. Karanja Infrastructure Pvt. Ltd.				
Address of Client	Tal-Pen, Dist-Raigad				
Sample Collected by	M/s. Building Environment (I) Pvt. Ltd.				
Sample type	Liquid				
Sample received on date	30/05/2015				
Analysis Date	01/06/2015 to 20/06/2015				
Reporting date	20/06/2015				
Sample returned /stored	Stored at 4°C for 1 week from the date of reporting				
Sr. No.	Parameter	Results	Limits as per IS:10500(2012)	Units	Standard Method
Physical Parameter					
1	Turbidity	0.60	<1.0	NTU	IS: 3025 Part-10 (R.A : 2002)
2	TDS	304.0	<500	mg/lit	IS: 3025 Part-16 (R.A : 2006)
Chemical Parameter					
1	pH	6.61	6.5-8.5	—	IS: 3025 Part-11 (R.A : 2002)
2	E. Conductivity	515.69	N.S	µS/cm	IS: 3025 Part-14 (R.A : 2002)
3	Total Hardness as CaCO ₃	199.35	<200	mg/lit	IS: 3025 Part-21 (2009)
4	Total Alkalinity as CaCO ₃	117.89	<200	mg/lit	IS: 3025 Part-23 (R.A : 2003)
5	Chloride as Cl	48.02	<250	mg/lit	IS: 3025 Part-32 (R.A : 2003)
6	Sulphate as SO ₄	22.57	<200	mg/lit	APHA :22 nd edition -(4500-
7	Fluoride as F	0.14	<1.0	mg/lit	APHA :22 nd edition -(4500-F F)
8	Residual chlorine	<1.0	>0.2	mg/lit	APHA :22 nd edition -(4500-Cl B)
8	Nitrate as NO ₃	1.73	<45	mg/lit	APHA :22 nd edition -(4500-
Elemental Testing					
1	Calcium as Ca	76.09	<75	mg/lit	IS: 3025 Part-02 (2004)
2	Magnesium as Mg	14.88	<30	mg/lit	IS: 3025 Part-02 (2004)
3	Iron as Fe	1.74	<0.3	mg/lit	IS: 3025 Part-02 (2004)
4	Copper as Cu	<0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
5	Cadmium as Cd	<0.01	<0.003	mg/lit	IS: 3025 Part-02 (2004)
6	Chromium as Cr	<0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
7	Lead as Pb	0.01	<0.01	mg/lit	IS: 3025 Part-02 (2004)
8	Selenium as Se	<0.01	<0.01	mg/lit	IS: 3025 Part-02 (2004)
9	Manganese as Mn	<0.01	<0.1	mg/lit	IS: 3025 Part-02 (2004)
10	Zinc as Zn	0.02	<5.0	mg/lit	IS: 3025 Part-02 (2004)
11	Sodium as Na	1.17	N.S	mg/lit	IS: 3025 Part-02 (2004)
12	Potassium As K	0.40	N.S	mg/lit	IS: 3025 Part-02 (2004)
Microbiological Parameter					
1	Total Coliform	02	Absent	CFU/100ml	IS: 1622 (R.A : 1996)
2	Fecal Coliform	<2	Absent	MPN/100m	IS: 1622 (R.A : 1996)

REMARKS / OBSERVATIONS: Above parameter is chemically and bacteriologically potable with respect to above parameters


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Test Report

Sample Code	AB/PRO/05/2015-16/1859				
Sample Name	SW- 1 Upstream of the Balganga River				
Name of Client	M/s. Karanja Infrastructure Pvt. Ltd.				
Address of Client	Tal-Pen ,Dist-Raigad				
Sample Collected by	M/s. Building Environment (I) Pvt. Ltd.				
Sample type	Liquid				
Sample received on date	30/05/2015				
Analysis Date	01/06/2015 to 20/06/2015				
Reporting date	20/06/2015				
Sample returned /stored	Stored at 4°C for 1 week from the date of reporting				
Sr. No.	Parameter	Results	As per IS : 2296 Class C (Clause 3.3)	Units	Standard Method
Physical Parameter					
1	Turbidity	0.90	NS	NTU	IS: 3025 Part-10 (R.A : 2002)
2	TDS	412.0	<1500	mg/lit	IS: 3025 Part-16 (R.A : 2006)
Chemical Parameter					
1	pH	7.09	6.5-8.5	--	IS: 3025 Part-11 (R.A : 2002)
	E. Conductivity	690.20	NS	µS/cm	IS: 3025 Part-14 (R.A : 2002)
2	Total Hardness as CaCO ₃	155.10	NS	mg/lit	IS: 3025 Part-21 (2009)
3	Total Alkalinity as CaCO ₃	82.63	NS	mg/lit	IS: 3025 Part-23 (R.A : 2003)
4	Chloride as Cl	105.64	<600	mg/lit	IS: 3025 Part-32 (R.A : 2003)
5	Sulphate as SO ₄	80.29	<400	mg/lit	APHA :22 nd edition -(4500-SO ₄ ²⁻ E)
6	Fluoride as F	0.25	<1.5	mg/lit	APHA :22 nd edition -(4500-F F)
7	Residual chlorine	<1.0	NS	mg/lit	APHA :22 nd edition -(4500-Cl B)
8	Nitrate as NO ₃	0.72	<50	mg/lit	APHA :22 nd edition -(4500- NO ₃ ⁻ E)
Elemental Testing					
1	Calcium as Ca	56.90	NS	mg/lit	IS: 3025 Part-02 (2004)
2	Magnesium as Mg	39.60	NS	mg/lit	IS: 3025 Part-02 (2004)
3	Iron as Fe	0.05	<60	mg/lit	IS: 3025 Part-02 (2004)
4	Copper as Cu	0.01	<1.5	mg/lit	IS: 3025 Part-02 (2004)
5	Cadmium as Cd	<0.01	<0.01	mg/lit	IS: 3025 Part-02 (2004)
6	Chromium as Cr	<0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
7	Lead as Pb	<0.01	<0.1	mg/lit	IS: 3025 Part-02 (2004)
8	Selenium as Se	0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
9	Manganese as Mn	<0.01	NS	mg/lit	IS: 3025 Part-02 (2004)
10	Zinc as Zn	0.02	<15	mg/lit	IS: 3025 Part-02 (2004)
11	Sodium as Na	1.12	NS	mg/lit	IS: 3025 Part-02 (2004)
12	Potassium As K	0.38	NS	mg/lit	IS: 3025 Part-02 (2004)
Microbiological Parameter					
1	Total Coliform	240	5000	CFU/100ml	IS: 1622 (R.A : 1996)
2	Fecal Coliform	130	NS	MPN/100m	IS: 1622 (R.A : 1996)

REMARKS / OBSERVATIONS: Above parameter is chemically and bacteriologically potable with respect to above parameters

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Test Report

Sample Code	AB/PRO/05/2015-16/1870				
Sample Name	SW- 2 Downstream of Balganga River				
Name of Client	M/s. Karanja Infrastructure Pvt. Ltd.				
Address of Client	Tal-Pen ,Dist-Raigad				
Sample Collected by	M/s. Building Environment (I) Pvt. Ltd.				
Sample type	Liquid				
Sample received on date	30/05/2015				
Analysis Date	01/06/2015 to 20/06/2015				
Reporting date	20/06/2015				
Sample returned /stored	Stored at 4°C for 1 week from the date of reporting				
Sr. No.	Parameter	Results	As per IS : 2296 Class C (Clause 3.3)	Units	Standard Method
Physical Parameter					
1	Turbidity	0.97	NS	NTU	IS: 3025 Part-10 (R.A : 2002)
2	TDS	350.0	<1500	mg/lit	IS: 3025 Part-16 (R.A : 2006)
Chemical Parameter					
1	pH	6.85	6.5-8.5	--	IS: 3025 Part-11 (R.A : 2002)
2	E. Conductivity	490.20	NS	µS/cm	IS: 3025 Part-14 (R.A : 2002)
3	Total Hardness as CaCO ₃	123.96	NS	mg/lit	IS: 3025 Part-21 (2009)
4	Total Alkalinity as CaCO ₃	65.96	NS	mg/lit	IS: 3025 Part-23 (R.A : 2003)
5	Chloride as Cl	106.56	<600	mg/lit	IS: 3025 Part-32 (R.A : 2003)
6	Sulphate as SO ₄	49.12	<400	mg/lit	APHA :22 nd edition -(4500- SO ₄ ²⁻ E)
7	Fluoride as F	0.33	<1.5	mg/lit	APHA :22 nd edition -(4500-F F)
8	Residual chlorine	<1.0	NS	mg/lit	APHA :22 nd edition -(4500-Cl B)
9	Nitrate as NO ₃	0.77	<50	mg/lit	APHA :22 nd edition -(4500- NO ₃ ²⁻ B)
Elemental Testing					
1	Calcium as Ca	58.30	NS	mg/lit	IS: 3025 Part-02 (2004)
2	Magnesium as Mg	37.50	NS	mg/lit	IS: 3025 Part-02 (2004)
3	Iron as Fe	0.05	<50	mg/lit	IS: 3025 Part-02 (2004)
4	Copper as Cu	0.01	<1.5	mg/lit	IS: 3025 Part-02 (2004)
5	Cadmium as Cd	<0.01	<0.01	mg/lit	IS: 3025 Part-02 (2004)
6	Chromium as Cr	<0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
7	Lead as Pb	<0.01	<0.1	mg/lit	IS: 3025 Part-02 (2004)
8	Selenium as Se	0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
9	Manganese as Mn	<0.01	NS	mg/lit	IS: 3025 Part-02 (2004)
10	Zinc as Zn	0.02	<15	mg/lit	IS: 3025 Part-02 (2004)
11	Sodium as Na	1.09	NS	mg/lit	IS: 3025 Part-02 (2004)
12	Potassium As K	0.32	NS	mg/lit	IS: 3025 Part-02 (2004)
Microbiological Parameter					
1	Total Coliform	252	5000	CFU/100ml	IS: 1622 (R.A : 1996)
2	Fecal Coliform	133	NS	MPN/100ml	IS: 1622 (R.A : 1996)

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Sample Code : AB/PRO/05/2015-16/1870

REMARKS / OBSERVATIONS: Above parameter is chemically and bacteriologically potable with respect to above parameters



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Test Report

Sample Code	AB/PRO/05/2015-16/1871				
Sample Name	SW- 3 Ambeghar Dam				
Name of Client	M/s. Karanja Infrastructure Pvt. Ltd.				
Address of Client	Tal-Pen ,Dist-Raigad				
Sample Collected by	M/s. Building Environment (I) Pvt. Ltd.				
Sample type	Liquid				
Sample received on date	30/05/2015				
Analysis Date	01/06/2015 to 20/06/2015				
Reporting date	20/06/2015				
Sample returned /stored	Stored at 4°C for 1 week from the date of reporting				
Sr. No.	Parameter	Results	As per IS : 2296 Class C (Clause 3.3)	Units	Standard Method
Physical Parameter					
1	Turbidity	0.60	NS	NTU	IS: 3025 Part-10 (R.A : 2002)
2	TDS	63.0	<1500	mg/lit	IS: 3025 Part-16 (R.A : 2006)
Chemical Parameter					
1	pH	7.25	6.5-8.5	--	IS: 3025 Part-11 (R.A : 2002)
2	E. Conductivity	190.20	NS	µS/cm	IS: 3025 Part-14 (R.A : 2002)
3	Total Hardness as CaCO ₃	42.48	NS	mg/lit	IS: 3025 Part-21 (2009)
4	Total Alkalinity as CaCO ₃	39.47	NS	mg/lit	IS: 3025 Part-23 (R.A : 2003)
5	Chloride as Cl	7.84	<600	mg/lit	IS: 3025 Part-32 (R.A : 2003)
6	Sulphate as SO ₄	4.69	<400	mg/lit	APHA 22 nd edition -(4500- SO ₄ ²⁻ E)
7	Fluoride as F	0.19	<1.5	mg/lit	APHA 22 nd edition -(4500-F F)
8	Residual chlorine	<1.0	NS	mg/lit	APHA 22 nd edition -(4500-Cl B)
9	Nitrate as NO ₃	0.05	<50	mg/lit	APHA 22 nd edition -(4500- NO ₃ ⁻ B)
Elemental Testing					
1	Calcium as Ca	9.72	NS	mg/lit	IS: 3025 Part-02 (2004)
2	Magnesium as Mg	3.645	NS	mg/lit	IS: 3025 Part-02 (2004)
3	Iron as Fe	0.06	<50	mg/lit	IS: 3025 Part-02 (2004)
4	Copper as Cu	<0.01	<1.5	mg/lit	IS: 3025 Part-02 (2004)
5	Cadmium as Cd	<0.01	<0.01	mg/lit	IS: 3025 Part-02 (2004)
6	Chromium as Cr	<0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
7	Lead as Pb	<0.01	<0.1	mg/lit	IS: 3025 Part-02 (2004)
8	Selenium as Se	<0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
9	Manganese as Mn	<0.01	NS	mg/lit	IS: 3025 Part-02 (2004)
10	Zinc as Zn	0.02	<15	mg/lit	IS: 3025 Part-02 (2004)
11	Sodium as Na	0.89	NS	mg/lit	IS: 3025 Part-02 (2004)
12	Potassium As K	0.22	NS	mg/lit	IS: 3025 Part-02 (2004)
Microbiological Parameter					
1	Total Coliform	300	5000	CFU/100ml	IS: 1622 (R.A : 1996)
2	Fecal Coliform	17	NS	MPN/100ml	IS: 1622 (R.A : 1996)

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Sample Code : AB/PRO/05/2015-16/1871

REMARKS / OBSERVATIONS: Above parameter is chemically and bacteriologically Non potable with respect to above parameters



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Test Report

Sample Code	AB/PRO/05/2015-16/1872
Sample Name	SW- 4 Hetwane Dam
Name of Client	M/s. Karanja Infrastructure Pvt. Ltd.
Address of Client	Tal-Pen ,Dist-Raigad
Sample Collected by	M/s. Building Environment (I) Pvt. Ltd.
Sample type	Liquid
Sample received on date	30/05/2015
Analysis Date	01/06/2015 to 20/06/2015
Reporting date	20/06/2015
Sample returned /stored	Stored at 4°C for 1 week from the date of reporting

Sr. No.	Parameter	Results	As per IS : 2296 Class C (Clause 3.3)	Units	Standard Method

Physical Parameter

1	Turbidity	0.63	NS	NTU	IS: 3025 Part-10 (R.A : 2002)
2	TDS	61.00	<1500	mg/lit	IS: 3025 Part-16 (R.A : 2006)

Chemical Parameter

1	pH	7.33	6.5-8.5	—	IS: 3025 Part-11 (R.A : 2002)
	E. Conductivity	490.20	NS	µS/cm	IS: 3025 Part-14 (R.A : 2002)
2	Total Hardness as CaCO ₃	41.20	NS	mg/lit	IS: 3025 Part-21 (2009)
3	Total Alkalinity as CaCO ₃	37.60	NS	mg/lit	IS: 3025 Part-23 (R.A : 2003)
4	Chloride as Cl	7.65	<600	mg/lit	IS: 3025 Part-32 (R.A : 2003)
5	Sulphate as SO ₄	4.56	<400	mg/lit	APHA : 22 nd edition -(4500-SO ₄ ²⁻ E)
6	Fluoride as F	0.17	<1.5	mg/lit	APHA : 22 nd edition -(4500-F F)
7	Residual chlorine	<1.0	NS	mg/lit	APHA : 22 nd edition -(4500-Cl B)
8	Nitrate as NO ₃	0.03	<50	mg/lit	APHA : 22 nd edition -(4500- NO ₃ ²⁻ B)

Elemental Testing

1	Calcium as Ca	8.63	NS	mg/lit	IS: 3025 Part-02 (2004)
2	Magnesium as Mg	2.43	NS	mg/lit	IS: 3025 Part-02 (2004)
3	Iron as Fe	0.05	<50	mg/lit	IS: 3025 Part-02 (2004)
4	Copper as Cu	<0.01	<1.5	mg/lit	IS: 3025 Part-02 (2004)
5	Cadmium as Cd	<0.01	<0.01	mg/lit	IS: 3025 Part-02 (2004)
6	Chromium as Cr	<0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
7	Lead as Pb	<0.01	<0.1	mg/lit	IS: 3025 Part-02 (2004)
8	Selenium as Se	<0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
9	Manganese as Mn	<0.01	NS	mg/lit	IS: 3025 Part-02 (2004)
10	Zinc as Zn	0.01	<15	mg/lit	IS: 3025 Part-02 (2004)
11	Sodium as Na	1.09	NS	mg/lit	IS: 3025 Part-02 (2004)
12	Potassium As K	0.32	NS	mg/lit	IS: 3025 Part-02 (2004)

Microbiological Parameter

1	Total Coliform	266	5000	CFU/100ml	IS: 1622 (R.A : 1996)
2	Fecal Coliform	15	NS	MPN/100ml	IS: 1622 (R.A : 1996)

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REMARKS / OBSERVATIONS: Above parameter is chemically and bacteriologically Non potable with respect to above parameters



Signature of Lab Executive



Signature of Technical Manager



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Test Report

Sample Code	AB/PRO/05/2015-16/1873				
Sample Name	SW- 5 Kasar Talao				
Name of Client	M/s. Karanja Infrastructure Pvt. Ltd.				
Address of Client	Tal-Pen, Dist-Raigad				
Sample Collected by	M/s. Building Environment (I) Pvt. Ltd.				
Sample type	Liquid				
Sample received on date	30/05/2015				
Analysis Date	01/06/2015 to 20/06/2015				
Reporting date	20/06/2015				
Sample returned /stored	Stored at 4°C for 1 week from the date of reporting				
Sr. No.	Parameter	Results	As per IS : 2296 Class C (Clause 3.3)	Units	Standard Method
Physical Parameter					
1	Turbidity	2.10	NS	NTU	IS: 3025 Part-10 (R.A : 2002)
2	TDS	193.0	<1500	mg/lit	IS: 3025 Part-16 (R.A : 2006)
Chemical Parameter					
1	pH	6.71	6.5-8.5	--	IS: 3025 Part-11 (R.A : 2002)
2	E. Conductivity	289.46	NS	µS/cm	IS: 3025 Part-14 (R.A : 2002)
3	Total Hardness as CaCO ₃	81.96	NS	mg/lit	IS: 3025 Part-21 (2009)
4	Total Alkalinity as CaCO ₃	43.68	NS	mg/lit	IS: 3025 Part-23 (R.A : 2003)
5	Chloride as Cl	18.62	<600	mg/lit	IS: 3025 Part-32 (R.A : 2003)
6	Sulphate as SO ₄	17.52	<400	mg/lit	APHA : 22 nd edition -(4500-SO ₄ ²⁻ E)
7	Fluoride as F	0.46	<1.5	mg/lit	APHA : 22 nd edition -(4500-F F)
8	Residual chlorine	<1.0	NS	mg/lit	APHA : 22 nd edition -(4500-Cl B)
9	Nitrate as NO ₃	0.06	<50	mg/lit	APHA : 22 nd edition -(4500-NO ₃ ²⁻ B)
Elemental Testing					
1	Calcium as Ca	15.94	NS	mg/lit	IS: 3025 Part-02 (2004)
2	Magnesium as Mg	6.265	NS	mg/lit	IS: 3025 Part-02 (2004)
3	Iron as Fe	0.03	<50	mg/lit	IS: 3025 Part-02 (2004)
4	Copper as Cu	<0.01	<1.5	mg/lit	IS: 3025 Part-02 (2004)
5	Cadmium as Cd	<0.01	<0.01	mg/lit	IS: 3025 Part-02 (2004)
6	Chromium as Cr	<0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
7	Lead as Pb	<0.01	<0.1	mg/lit	IS: 3025 Part-02 (2004)
8	Selenium as Se	<0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
9	Manganese as Mn	<0.01	NS	mg/lit	IS: 3025 Part-02 (2004)
10	Zinc as Zn	<0.01	<16	mg/lit	IS: 3025 Part-02 (2004)
11	Sodium as Na	0.76	NS	mg/lit	IS: 3025 Part-02 (2004)
12	Potassium As K	0.49	NS	mg/lit	IS: 3025 Part-02 (2004)
Microbiological Parameter					
1	Total Coliform	1600	5000	CFU/100ml	IS: 1622 (R.A : 1996)
2	Fecal Coliform	34	NS	MPN/100ml	IS: 1622 (R.A : 1996)

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REMARKS / OBSERVATIONS: Above parameter is chemically and bacteriologically Non potable with respect to above parameters



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Test Report

Sample Code	AB/PRO/05/2015-16/1874				
Sample Name	SW- 6 Modi Dam				
Name of Client	M/s. Karanja Infrastructure Pvt. Ltd.				
Address of Client	Tal-Pen, Dist-Raigad				
Sample Collected by	M/s. Building Environment (I) Pvt. Ltd.				
Sample type	Liquid				
Sample received on date	30/05/2015				
Analysis Date	01/06/2015 to 20/06/2015				
Reporting date	20/06/2015				
Sample returned /stored	Stored at 4°C for 1 week from the date of reporting				
Sr. No.	Parameter	Results	As per IS : 2296 Class C (Clause 3.3)	Units	Standard Method
Physical Parameter					
1	Turbidity	0.83	NS	NTU	IS: 3025 Part-10 (R.A : 2002)
2	TDS	70.00	<1500	mg/lit	IS: 3025 Part-16 (R.A : 2006)
Chemical Parameter					
1	pH	7.29	6.5-8.5	--	IS: 3025 Part-11 (R.A : 2002)
2	E. Conductivity	240.20	NS	µS/cm	IS: 3025 Part-14 (R.A : 2002)
3	Total Hardness as CaCO ₃	43.60	NS	mg/lit	IS: 3025 Part-21 (2009)
4	Total Alkalinity as CaCO ₃	39.20	NS	mg/lit	IS: 3025 Part-23 (R.A : 2003)
5	Chloride as Cl	7.82	<600	mg/lit	IS: 3025 Part-32 (R.A : 2003)
6	Sulphate as SO ₄	4.66	<400	mg/lit	APHA :22 nd edition -(4500-SO ₄ ²⁻ E)
7	Fluoride as F	0.17	<1.5	mg/lit	APHA :22 nd edition -(4500-F F)
8	Residual chlorine	<1.0	NS	mg/lit	APHA :22 nd edition -(4500-Cl B)
9	Nitrate as NO ₃	0.03	<50	mg/lit	APHA :22 nd edition -(4500- NO ₃ ²⁻ B)
Elemental Testing					
1	Calcium as Ca	7.42	NS	mg/lit	IS: 3025 Part-02 (2004)
2	Magnesium as Mg	3.43	NS	mg/lit	IS: 3025 Part-02 (2004)
3	Iron as Fe	0.05	<50	mg/lit	IS: 3025 Part-02 (2004)
4	Copper as Cu	<0.01	<1.5	mg/lit	IS: 3025 Part-02 (2004)
5	Cadmium as Cd	<0.01	<0.01	mg/lit	IS: 3025 Part-02 (2004)
6	Chromium as Cr	<0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
7	Lead as Pb	<0.01	<0.1	mg/lit	IS: 3025 Part-02 (2004)
8	Selenium as Se	<0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
9	Manganese as Mn	<0.01	NS	mg/lit	IS: 3025 Part-02 (2004)
10	Zinc as Zn	0.01	<15	mg/lit	IS: 3025 Part-02 (2004)
11	Sodium as Na	0.69	NS	mg/lit	IS: 3025 Part-02 (2004)
12	Potassium As K	0.12	NS	mg/lit	IS: 3025 Part-02 (2004)
Microbiological Parameter					
1	Total Coliform	273	5000	CFU/100ml	IS: 1622 (R.A : 1996)
2	Fecal Coliform	18	NS	MPN/100ml	IS: 1622 (R.A : 1996)

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Sample Code : AB/PRO/05/2015-16/1874

REMARKS / OBSERVATIONS: Above parameter is chemically and bacteriologically potable with respect to above parameters



Signature of Lab Executive



Signature of Technical Manager



Signature of Quality Manager



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Test Report

Test Report					
Sample Code		AB/PRO/05/2015-16/1875			
Sample Name		SW- 7 Upstream of the Bhogeshwari River			
Name of Client		M/s. Karanja Infrastructure Pvt. Ltd.			
Address of Client		Tal-Pen ,Dist-Raigad			
Sample Collected by		M/s. Building Environment (I) Pvt. Ltd.			
Sample type		Liquid			
Sample received on date		30/05/2015			
Analysis Date		01/06/2015 to 20/06/2015			
Reporting date		20/06/2015			
Sample returned /stored		Stored at 4°C for 1 week from the date of reporting			
Sr. No.	Parameter	Results	As per IS : 2296 Class C (Clause 3.3)	Units	Standard Method
Physical Parameter					
1	Turbidity	0.92	NS	NTU	IS: 3025 Part-10 (R.A : 2002)
2	TDS	255.0	<1500	mg/lit	IS: 3025 Part-16 (R.A : 2006)
Chemical Parameter					
1	pH	7.35	8.5-8.5	--	IS: 3025 Part-11 (R.A : 2002)
2	E. Conductivity	359.85	NS	µS/cm	IS: 3025 Part-14 (R.A : 2002)
3	Total Hardness as CaCO ₃	129.50	NS	mg/lit	IS: 3025 Part-21 (2009)
4	Total Alkalinity as CaCO ₃	53.10	NS	mg/lit	IS: 3025 Part-23 (R.A : 2003)
5	Chloride as Cl	94.48	<600	mg/lit	IS: 3025 Part-32 (R.A : 2003)
6	Sulphate as SO ₄	42.85	<400	mg/lit	APHA :22 nd edition -(4500- SO ₄ ²⁻ E)
7	Fluoride as F	2.10	<1.5	mg/lit	APHA :22 nd edition -(4500- F ⁻ F)
8	Residual chlorine	<1.0	NS	mg/lit	APHA :22 nd edition -(4500-Cl B)
9	Nitrate as NO ₃	0.68	<50	mg/lit	APHA :22 nd edition -(4500- NO ₃ ⁻ B)
Elemental Testing					
1	Calcium as Ca	49.30	NS	mg/lit	IS: 3025 Part-02 (2004)
2	Magnesium as Mg	20.30	NS	mg/lit	IS: 3025 Part-02 (2004)
3	Iron as Fe	0.04	<50	mg/lit	IS: 3025 Part-02 (2004)
4	Copper as Cu	0.01	<1.5	mg/lit	IS: 3025 Part-02 (2004)
5	Cadmium as Cd	<0.01	<0.01	mg/lit	IS: 3025 Part-02 (2004)
6	Chromium as Cr	<0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
7	Lead as Pb	<0.01	<0.1	mg/lit	IS: 3025 Part-02 (2004)
8	Selenium as Se	0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
9	Manganese as Mn	<0.01	NS	mg/lit	IS: 3025 Part-02 (2004)
10	Zinc as Zn	0.01	<15	mg/lit	IS: 3025 Part-02 (2004)
11	Sodium as Na	1.0	NS	mg/lit	IS: 3025 Part-02 (2004)
12	Potassium As K	0.22	NS	mg/lit	IS: 3025 Part-02 (2004)
Microbiological Parameter					
1	Total Collform	233	5000	CFU/100ml	IS: 1622 (R.A : 1996)
2	Fecal Collform	111	NS	MPN/100m	IS: 1622 (R.A : 1996)

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Sample Code : AB/PRO/05/2015-16/1875

REMARKS / OBSERVATIONS: Above parameter is chemically and bacteriologically potable with respect to above parameters



Signature of Lab Executive



Signature of Technical Manager



Signature of Quality Manager



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Test Report

Test Report					
Sample Code		AB/PRO/05/2015-16/1876			
Sample Name		SW- 8 Downstream of Bhogeshwari River			
Name of Client		M/s. Karanja Infrastructure Pvt. Ltd.			
Address of Client		Tal-Pen ,Dist-Raigad			
Sample Collected by		M/s. Building Environment (I) Pvt. Ltd.			
Sample type		Liquid			
Sample received on date		30/05/2015			
Analysis Date		01/06/2015 to 20/06/2015			
Reporting date		20/06/2015			
Sample returned /stored		Stored at 4°C for 1 week from the date of reporting			
Sr. No.	Parameter	Results	As per IS :	Units	Standard Method
			2296 Class C (Clause 3.3)		
Physical Parameter					
1	Turbidity	0.22	NS	NTU	IS: 3025 Part-10 (R.A : 2002)
2	IDS	222.0	<1500	mg/lit	IS: 3025 Part-16 (R.A : 2006)
Chemical Parameter					
1	pH	7.25	6.5-8.5	—	IS: 3025 Part-11 (R.A : 2002)
2	E. Conductivity	390.20	NS	µS/cm	IS: 3025 Part-14 (R.A : 2002)
3	Total Hardness as CaCO ₃	115.0	NS	mg/lit	IS: 3025 Part-21 (2009)
4	Total Alkalinity as CaCO ₃	59.0	NS	mg/lit	IS: 3025 Part-23 (R.A : 2003)
5	Chloride as Cl	72.38	<300	mg/lit	IS: 3025 Part-32 (R.A : 2003)
6	Sulphate as SO ₄	22.21	<400	mg/lit	APHA :22 nd edition -(4500- SO ₄ ²⁻ E)
7	Fluoride as F	1.07	<1.5	mg/lit	APHA :22 nd edition -(4500-F F)
8	Residual chlorine	<1.0	NS	mg/lit	APHA :22 nd edition -(4500-Cl B)
8	Nitrate as NO ₃	0.65	<50	mg/lit	APHA :22 nd edition -(4500- NO ₃ ²⁻ B)
Elemental Testing					
1	Calcium as Ca	29.44	NS	mg/lit	IS: 3025 Part-02 (2004)
2	Magnesium as Mg	17.12	NS	mg/lit	IS: 3025 Part-02 (2004)
3	Iron as Fe	0.04	<50	mg/lit	IS: 3025 Part-02 (2004)
4	Copper as Cu	0.01	<1.5	mg/lit	IS: 3025 Part-02 (2004)
5	Cadmium as Cd	<0.01	<0.01	mg/lit	IS: 3025 Part-02 (2004)
6	Chromium as Cr	<0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
7	Lead as Pb	<0.01	<0.1	mg/lit	IS: 3025 Part-02 (2004)
8	Selenium as Se	0.01	<0.05	mg/lit	IS: 3025 Part-02 (2004)
9	Manganese as Mn	<0.01	NS	mg/lit	IS: 3025 Part-02 (2004)
10	Zinc as Zn	0.01	<15	mg/lit	IS: 3025 Part-02 (2004)
11	Sodium as Na	0.56	NS	mg/lit	IS: 3025 Part-02 (2004)
12	Potassium As K	0.02	NS	mg/lit	IS: 3025 Part-02 (2004)
Microbiological Parameter					
1	Total Coliform	233	5000	CFU/100ml	IS: 1622 (R.A : 1996)
2	Fecal Coliform	129	NS	MPN/100ml	IS: 1622 (R.A : 1996)

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Sample Code : AB/PRO/05/2015-16/1876

REMARKS / OBSERVATIONS: Above parameter is chemically and bacteriologically potable with respect to above parameters



Signature of Lab Executive



Signature of Technical Manager



Signature of Quality Manager



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EAnalyse®

Noise Monitoring Report	
Sample Code	AB/PRO/05/2015-16/1885
Project Name	M/s. Karanja Infrastructure Pvt. Ltd.
Project Location	Tal:- Pen ,Dist:- Raigad
Sample Location	Onsite Of T-3 Land Parcel
Sampling Date	02/05/2015
Sample type	Noise

Sr. No.	Time	Unit	Result (Day Time)	Result (Night Time)
			<55	<45
1	06:00	dB(A)	42.8	--
2	07:00	dB(A)	43.4	--
3	08:00	dB(A)	41.7	--
4	09:00	dB(A)	42.9	--
5	10:00	dB(A)	43.6	--
6	11:00	dB(A)	42.4	--
7	12:00	dB(A)	43.2	--
8	13:00	dB(A)	41.8	--
9	14:00	dB(A)	41.3	--
10	15:00	dB(A)	42.4	--
11	16:00	dB(A)	43.6	--
12	17:00	dB(A)	41.7	--
13	18:00	dB(A)	42.3	--
14	19:00	dB(A)	44.2	--
15	20:00	dB(A)	41.8	--
16	21:00	dB(A)	43.6	--
17	22:00	dB(A)	--	32.8
18	23:00	dB(A)	--	31.9
19	24:00	dB(A)	--	32.6
20	01:00	dB(A)	--	33.5
21	02:00	dB(A)	--	33.2
22	03:00	dB(A)	--	31.9
23	04:00	dB(A)	--	32.3
24	05:00	dB(A)	--	31.4
Average		dB(A)	39.2	


Signature of Lab Executive


Signature of Technical Manager


Signature of Quality Manager


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EAnalyse™

Noise Monitoring Report				
Sample Code	AB/PRO/05/2015-16/1886			
Project Name	M/s. Karanja Infrastructure Pvt. Ltd.			
Project Location	Tal:- Pen ,Dist:- Raigad			
Sample Location	Crosswind Of T-3 at Kopar Village			
Sampling Date	07/05/2015			
Sample type	Noise			
Sr. No.	Time	Unit	Result (Day Time)	Result (Night Time)
			<55	<45
1	06:00	dB(A)	43.6	--
2	07:00	dB(A)	42.8	--
3	08:00	dB(A)	44.2	--
4	09:00	dB(A)	42.1	--
5	10:00	dB(A)	41.6	--
6	11:00	dB(A)	42.8	--
7	12:00	dB(A)	43.6	--
8	13:00	dB(A)	42.2	--
9	14:00	dB(A)	41.4	--
10	15:00	dB(A)	41.7	--
11	16:00	dB(A)	42.3	--
12	17:00	dB(A)	41.8	--
13	18:00	dB(A)	40.4	--
14	19:00	dB(A)	42.3	--
15	20:00	dB(A)	43.9	--
16	21:00	dB(A)	41.3	--
17	22:00	dB(A)	--	33.6
18	23:00	dB(A)	--	32.5
19	24:00	dB(A)	--	32.8
20	01:00	dB(A)	--	33.6
21	02:00	dB(A)	--	31.7
22	03:00	dB(A)	--	32.6
23	04:00	dB(A)	--	33.5
24	05:00	dB(A)	--	34.2
Average		dB(A)	39.3	



Signature of Lab Executive



Signature of Technical Manager



Signature of Quality Manager



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Noise Monitoring Report	
Sample Code	AB/PRO/05/2015-16/1887
Project Name	M/s. Karanja Infrastructure Pvt. Ltd.
Project Location	Tal:- Pen ,Dist:- Raigad
Sample Location	Downwind Of T-3 at Jite Village
Sampling Date	07/05/2015
Sample type	Noise

Sr. No.	Time	Unit	Result (Day Time)	Result (Night Time)
			<55	<45
1	06:00	dB(A)	43.6	--
2	07:00	dB(A)	42.2	--
3	08:00	dB(A)	41.4	--
4	09:00	dB(A)	42.6	--
5	10:00	dB(A)	43.4	--
6	11:00	dB(A)	42.7	--
7	12:00	dB(A)	43.6	--
8	13:00	dB(A)	42.7	--
9	14:00	dB(A)	41.8	--
10	15:00	dB(A)	40.9	--
11	16:00	dB(A)	41.7	--
12	17:00	dB(A)	43.6	--
13	18:00	dB(A)	42.8	--
14	19:00	dB(A)	43.6	--
15	20:00	dB(A)	41.7	--
16	21:00	dB(A)	42.3	--
17	22:00	dB(A)	--	33.2
18	23:00	dB(A)	--	34.1
19	24:00	dB(A)	--	35.2
20	01:00	dB(A)	--	33.6
21	02:00	dB(A)	--	34.1
22	03:00	dB(A)	--	32.5
23	04:00	dB(A)	--	33.2
24	05:00	dB(A)	--	34.1
Average		dB(A)	39.6	

Signature of Lab Executive

Signature of Technical Manager

Signature of Quality Manager



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Noise Monitoring Report	
Sample Code	AB/PRO/05/2015-16/1888
Project Name	M/s. Karanja Infrastructure Pvt. Ltd.
Project Location	Tal:- Pen ,Dist:- Raigad
Sample Location	Onsite of T-4 Land Parcel
Sampling Date	18/05/2015
Sample type	Noise

Sr. No.	Time	Unit	Result (Day Time)	Result (Night Time)
			<55	<45
1	06:00	dB(A)	42.8	--
2	07:00	dB(A)	41.4	--
3	08:00	dB(A)	40.6	--
4	09:00	dB(A)	43.2	--
5	10:00	dB(A)	42.8	--
6	11:00	dB(A)	41.4	--
7	12:00	dB(A)	42.6	--
8	13:00	dB(A)	43.6	--
9	14:00	dB(A)	42.7	--
10	15:00	dB(A)	41.3	--
11	16:00	dB(A)	40.8	--
12	17:00	dB(A)	41.4	--
13	18:00	dB(A)	42.3	--
14	19:00	dB(A)	43.5	--
15	20:00	dB(A)	40.7	--
16	21:00	dB(A)	41.4	--
17	22:00	dB(A)	--	32.5
18	23:00	dB(A)	--	37.6
19	24:00	dB(A)	--	34.5
20	01:00	dB(A)	--	32.8
21	02:00	dB(A)	--	33.6
22	03:00	dB(A)	--	31.8
23	04:00	dB(A)	--	35.6
24	05:00	dB(A)	--	37.2
Average		dB(A)	39.5	


Signature of Lab Executive


Signature of Technical Manager


Signature of Quality Manager



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ENalyze

Noise Monitoring Report	
Sample Code	AB/PRO/05/2015-16/1889
Project Name	M/s. Karanja Infrastructure Pvt. Ltd.
Project Location	Tal:- Pen ,Dist:- Raigad
Sample Location	Downwind Of T-4 at Mungoshi Village
Sampling Date	22/05/2015
Sample type	Noise

Sr. No.	Time	Unit	Result (Day Time)	Result (Night Time)
			<55	<45
1	06:00	dB(A)	41.5	--
2	07:00	dB(A)	43.6	--
3	08:00	dB(A)	42.4	--
4	09:00	dB(A)	40.7	--
5	10:00	dB(A)	49.8	--
6	11:00	dB(A)	40.3	--
7	12:00	dB(A)	41.7	--
8	13:00	dB(A)	42.8	--
9	14:00	dB(A)	43.9	--
10	15:00	dB(A)	42.8	--
11	16:00	dB(A)	41.4	--
12	17:00	dB(A)	42.5	--
13	18:00	dB(A)	43.2	--
14	19:00	dB(A)	44.1	--
15	20:00	dB(A)	42.8	--
16	21:00	dB(A)	40.9	--
17	22:00	dB(A)	--	33.6
18	23:00	dB(A)	--	32.8
19	24:00	dB(A)	--	32.7
20	01:00	dB(A)	--	31.4
21	02:00	dB(A)	--	32.5
22	03:00	dB(A)	--	33.2
23	04:00	dB(A)	--	31.5
24	05:00	dB(A)	--	32.2
Average		dB(A)	39.3	


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Signature of Quality Manager



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Noise Monitoring Report	
Sample Code	AB/PRO/05/2015-16/1890
Project Name	M/s. Karanja Infrastructure Pvt. Ltd.
Project Location	Tal.- Pen ,Dist:- Raigad
Sample Location	Upwind Of T-4 at Ambivali Village
Sampling Date	25/05/2015
Sample type	Noise

Sr. No.	Time	Unit	Result (Day Time)	Result (Night Time)
			<55	<45
1	06:00	dB(A)	43.9	--
2	07:00	dB(A)	43.2	--
3	08:00	dB(A)	44.5	--
4	09:00	dB(A)	42.9	--
5	10:00	dB(A)	42.6	--
6	11:00	dB(A)	41.4	--
7	12:00	dB(A)	43.9	--
8	13:00	dB(A)	43.5	--
9	14:00	dB(A)	42.7	--
10	15:00	dB(A)	44.8	--
11	16:00	dB(A)	42.3	--
12	17:00	dB(A)	43.6	--
13	18:00	dB(A)	44.2	--
14	19:00	dB(A)	43.9	--
15	20:00	dB(A)	41.4	--
16	21:00	dB(A)	42.5	--
17	22:00	dB(A)	--	36.8
18	23:00	dB(A)	--	33.5
19	24:00	dB(A)	--	35.2
20	01:00	dB(A)	--	32.3
21	02:00	dB(A)	--	33.4
22	03:00	dB(A)	--	32.7
23	04:00	dB(A)	--	34.9
24	05:00	dB(A)	--	33.2
Average		dB(A)	40.1	


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Noise Monitoring Report				
Sample Code	AB/PRO/05/2015-16/1891			
Project Name	M/s. Karanja Infrastructure Pvt. Ltd.			
Project Location	Tal.: Pen, Dist.: Raigad			
Sample Location	Upwind Of T-2 At Belvade Village			
Sampling Date	31/05/2015			
Sample type	Noise			
Sr. No.	Time	Unit	Result (Day Time)	Result (Night Time)
			<55	<45
1	06:00	dB(A)	41.4	--
2	07:00	dB(A)	42.3	--
3	08:00	dB(A)	43.4	--
4	09:00	dB(A)	44.2	--
5	10:00	dB(A)	42.5	--
6	11:00	dB(A)	41.4	--
7	12:00	dB(A)	43.2	--
8	13:00	dB(A)	42.8	--
9	14:00	dB(A)	43.6	--
10	15:00	dB(A)	41.4	--
11	16:00	dB(A)	43.6	--
12	17:00	dB(A)	42.3	--
13	18:00	dB(A)	41.7	--
14	19:00	dB(A)	43.6	--
15	20:00	dB(A)	44.2	--
16	21:00	dB(A)	43.2	--
17	22:00	dB(A)	--	33.2
18	23:00	dB(A)	--	34.2
19	24:00	dB(A)	--	32.5
20	01:00	dB(A)	--	33.2
21	02:00	dB(A)	--	31.5
22	03:00	dB(A)	--	32.5
23	04:00	dB(A)	--	33.6
24	05:00	dB(A)	--	32.1
Average		dB(A)	39.5	


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Noise Monitoring Report				
Sample Code	AB/PRO/05/2015-16/1892			
Project Name	M/s. Karanja Infrastructure Pvt. Ltd.			
Project Location	Tal.:- Pen ,Dist:- Raigad			
Sample Location	Downwind of T-1 Within Land Parcel			
Sampling Date	31/05/2015			
Sample type	Noise			
Sr. No.	Time	Unit	Result (Day Time)	Result (Night Time)
			<55	<45
1	06:00	dB(A)	41.4	--
2	07:00	dB(A)	42.3	--
3	08:00	dB(A)	43.4	--
4	09:00	dB(A)	44.2	--
5	10:00	dB(A)	42.5	--
6	11:00	dB(A)	41.4	--
7	12:00	dB(A)	43.2	--
8	13:00	dB(A)	42.8	--
9	14:00	dB(A)	43.6	--
10	15:00	dB(A)	41.4	--
11	16:00	dB(A)	43.6	--
12	17:00	dB(A)	42.3	--
13	18:00	dB(A)	41.7	--
14	19:00	dB(A)	43.6	--
15	20:00	dB(A)	44.2	--
16	21:00	dB(A)	43.2	--
17	22:00	dB(A)	--	33.2
18	23:00	dB(A)	--	34.2
19	24:00	dB(A)	--	32.5
20	01:00	dB(A)	--	33.2
21	02:00	dB(A)	--	31.5
22	03:00	dB(A)	--	32.5
23	04:00	dB(A)	--	33.6
24	05:00	dB(A)	--	32.1
Average	dB(A)		39.8	


Signature of Lab Executive


Signature of Technical Manager


Signature of Quality Manager



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ENalyze

Noise Monitoring Report	
Sample Code	AB/PRO/05/2015-16/1893
Project Name	M/s. Karanja Infrastructure Pvt. Ltd.
Project Location	Tal.- Pen ,Dist:- Raigad
Sample Location	Upwind Of T-1 at Wirani Village
Sampling Date	31/05/2015
Sample type	Noise

Sr. No.	Time	Unit	Result (Day Time)	Result (Night Time)
			<55	<45
1	06:00	dB(A)	41.4	--
2	07:00	dB(A)	42.3	--
3	08:00	dB(A)	45.6	--
4	09:00	dB(A)	44.2	--
5	10:00	dB(A)	42.5	--
6	11:00	dB(A)	43.9	--
7	12:00	dB(A)	43.2	--
8	13:00	dB(A)	41.7	--
9	14:00	dB(A)	43.6	--
10	15:00	dB(A)	41.4	--
11	16:00	dB(A)	43.6	--
12	17:00	dB(A)	47.2	--
13	18:00	dB(A)	44.1	--
14	19:00	dB(A)	45.9	--
15	20:00	dB(A)	44.2	--
16	21:00	dB(A)	43.2	--
17	22:00	dB(A)	--	33.2
18	23:00	dB(A)	--	36.5
19	24:00	dB(A)	--	35.2
20	01:00	dB(A)	--	32.4
21	02:00	dB(A)	--	31.5
22	03:00	dB(A)	--	32.5
23	04:00	dB(A)	--	33.6
24	05:00	dB(A)	--	32.1
Average		dB(A)	40.2	


Signature of Lab Executive


Signature of Technical Manager


Signature of Quality Manager


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ISO 9001: 2008 and OHSAS ISO 18001: 2007 Certified Company

Noise Monitoring Report				
Sample Code	AB/PRO/05/2015-16/1894			
Project Name	M/s. Karanja Infrastructure Pvt. Ltd.			
Project Location	Tal:- Pen ,Dist:- Raigad			
Sample Location	Crosswind Of T-1 Abutting Plot Boundary			
Sampling Date	31/05/2015			
Sample type	Noise			
Sr. No.	Time	Unit	Result (Day Time)	Result (Night Time)
			<55	<45
1	05:00	dB(A)	41.4	--
2	07:00	dB(A)	42.3	--
3	08:00	dB(A)	43.4	--
4	09:00	dB(A)	44.2	--
5	10:00	dB(A)	42.5	--
6	11:00	dB(A)	41.4	--
7	12:00	dB(A)	43.2	--
8	13:00	dB(A)	42.8	--
9	14:00	dB(A)	43.6	--
10	15:00	dB(A)	41.4	--
11	16:00	dB(A)	43.6	--
12	17:00	dB(A)	42.3	--
13	18:00	dB(A)	41.7	--
14	19:00	dB(A)	43.6	--
15	20:00	dB(A)	44.2	--
16	21:00	dB(A)	43.2	--
17	22:00	dB(A)	--	33.2
18	23:00	dB(A)	--	34.2
19	24:00	dB(A)	--	32.5
20	01:00	dB(A)	--	33.2
21	02:00	dB(A)	--	31.5
22	03:00	dB(A)	--	32.5
23	04:00	dB(A)	--	32.6
24	05:00	dB(A)	--	32.1
Average	dB(A)			


Signature of Lab Executive


Signature of Technical Manager


Signature of Quality Manager



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Noise Monitoring Report				
Sample Code	AB/PRO/05/2015-16/1895			
Project Name	M/s. Karanja Infrastructure Pvt. Ltd.			
Project Location	Tal.:- Pen ,Dist:- Raigad			
Sample Location	Crosswind of T-1 Within Land Parcel			
Sampling Date	31/05/2015			
Sample type	Noise			
Sr. No.	Time	Unit	Result (Day Time)	Result (Night Time)
			<55	<45
1	06:00	dB(A)	41.4	--
2	07:00	dB(A)	42.3	--
3	08:00	dB(A)	43.4	--
4	09:00	dB(A)	44.2	--
5	10:00	dB(A)	42.5	--
6	11:00	dB(A)	41.4	--
7	12:00	dB(A)	43.2	--
8	13:00	dB(A)	42.8	--
9	14:00	dB(A)	43.6	--
10	15:00	dB(A)	41.4	--
11	16:00	dB(A)	43.6	--
12	17:00	dB(A)	45.3	--
13	18:00	dB(A)	41.7	--
14	19:00	dB(A)	43.6	--
15	20:00	dB(A)	44.2	--
16	21:00	dB(A)	43.2	--
17	22:00	dB(A)	--	33.2
18	23:00	dB(A)	--	34.2
19	24:00	dB(A)	--	32.5
20	01:00	dB(A)	--	33.2
21	02:00	dB(A)	--	31.5
22	03:00	dB(A)	--	32.5
23	04:00	dB(A)	--	33.6
24	05:00	dB(A)	--	32.1
Average		dB(A)	39.6	


Signature of Lab Executive


Signature of Technical Manager


Signature of Quality Manager



Test Report

Sample Code	AB/PRO/05/2015-16/1877			
Sample Name	Onsite of T-3 Land Parcel on North			
Name of Client	M/s. Karanja Infrastructure Pvt. Ltd.			
Address of Client	Village Belawadi, Virani, Ambeghar, Tal-Pen, Dist-Raigad			
Sample Collected by	M/s. Building Environment (I) Pvt. Ltd.			
Sample type	Solid			
Sample received on date	30/05/2015			
Analysis Date	30/05/2015 to 24/06/2015			
Reporting date	24/06/2015			
Sample returned /stored	Stored at room temp. for 1 week from the date of reporting			
Sr. No.	Parameter	Result	Unit	Standard Method
Physical Parameter				
1.	Salinity	0.02	percent	--
2.	Water Holding Capacity	50.0	percent	IS : 2720
3.	Soil texture	Clay Loam	--	IS : 2720
Chemical Parameter				
1.	pH	5.99	--	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
2.	Electrical Conductivity	476.0	µS/cm	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
3.	Total Organic Matter	3.15	percent	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
4.	Total Nitrogen	1120.0	mg/kg	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
5.	Sodium Absorption Ratio	2.85	--	ICP Method
Elemental Testing				
1.	Potassium as K	493.40	mg/kg	APHA (Edition 22 nd) 3120 B
2.	Phosphorous as P	1054.0	mg/kg	APHA (Edition 22 nd) 3120 B
3.	Sodium as Na	513.0	mg/kg	APHA (Edition 22 nd) 3120 B
4.	Calcium as Ca	5965.0	mg/kg	APHA (Edition 22 nd) 3120 B
5.	Magnesium as Mg	2825.0	mg/kg	APHA (Edition 22 nd) 3120 B
6.	Iron as Fe	28810.0	mg/kg	APHA (Edition 22 nd) 3120 B
7.	Copper as Cu	121.30	mg/kg	APHA (Edition 22 nd) 3120 B
8.	Manganese as Mn	1848.0	mg/kg	APHA (Edition 22 nd) 3120 B
9.	Zinc as Zn	117.20	mg/kg	APHA (Edition 22 nd) 3120 B
10.	Nickel as Ni	64.78	mg/kg	APHA (Edition 22 nd) 3120 B



Signature of Lab Executive



Signature of Technical Manager



Signature of Quality Manager

Test Report				
Sample Code	AB/PRO/05/2015-16/1878			
Sample Name	Onsite of T-3 Land Parcel On South			
Name of Client	M/s. Karanja Infrastructure Pvt. Ltd.			
Address of Client	Village Belawadi, Virani, Ambeghar, Tal-Pen, Dist-Raigad			
Sample Collected by	M/s. Building Environment (I) Pvt. Ltd.			
Sample type	Solid			
Sample received on date	30/05/2015			
Analysis Date	30/05/2015 to 24/06/2015			
Reporting date	24/06/2015			
Sample returned /stored	Stored at room temp. for 1 week from the date of reporting			
Sr. No.	Parameter	Result	Unit	Standard Method
Physical Parameter				
1.	Salinity	0.004	percent	--
2.	Water Holding Capacity	55.0	percent	IS : 2720
3.	Soil texture	Clay	--	IS : 2720
Chemical Parameter				
1.	pH	6.46	--	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
2.	Electrical Conductivity	78.0	µS/cm	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
3.	Total Organic Matter	3.22	percent	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
4.	Total Nitrogen	910.0	mg/kg	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
5.	Sodium Absorption Ratio	0.96	--	ICP Method
Elemental Testing				
1.	Potassium as K	242.60	mg/kg	APHA (Edition 22 nd) 3120 B
2.	Phosphorous as P	2575.0	mg/kg	APHA (Edition 22 nd) 3120 B
3.	Sodium as Na	100.40	mg/kg	APHA (Edition 22 nd) 3120 B
4.	Calcium as Ca	1193.0	mg/kg	APHA (Edition 22 nd) 3120 B
5.	Magnesium as Mg	1476.0	mg/kg	APHA (Edition 22 nd) 3120 B
6.	Iron as Fe	22570.0	mg/kg	APHA (Edition 22 nd) 3120 B
7.	Copper as Cu	294.30	mg/kg	APHA (Edition 22 nd) 3120 B
8.	Manganese as Mn	3622.0	mg/kg	APHA (Edition 22 nd) 3120 B
9.	Zinc as Zn	193.20	mg/kg	APHA (Edition 22 nd) 3120 B
10.	Nickel as Ni	97.97	mg/kg	APHA (Edition 22 nd) 3120 B



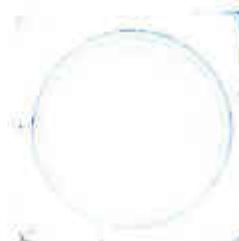
Signature of Lab Executive



Signature of Technical Manager



Signature of Quality Manager



Test Report

Sample Code	AB/PRO/05/2015-16/1879			
Sample Name	Onsite of T-4 Land Parcel on North			
Name of Client	M/s. Karanja Infrastructure Pvt. Ltd.			
Address of Client	Village Belawadi, Virani, Ambeghar, Tal-Pen, Dist-Raigad			
Sample Collected by	M/s. Building Environment (I) Pvt. Ltd.			
Sample type	Solid			
Sample received on date	30/05/2015			
Analysis Date	30/05/2015 to 24/06/2015			
Reporting date	24/06/2015			
Sample returned /stored	Stored at room temp. for 1 week from the date of reporting			
Sr. No.	Parameter	Result	Unit	Standard Method
Physical Parameter				
1.	Salinity	0.02	percent	--
2.	Water Holding Capacity	60.0	percent	IS : 2720
3.	Soil texture	Clay	--	IS : 2720
Chemical Parameter				
1.	pH	6.06	--	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
2.	Electrical Conductivity	339.0	µS/cm	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
3.	Total Organic Matter	9.91	percent	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
4.	Total Nitrogen	2380.0	mg/kg	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
5.	Sodium Absorption Ratio	1.42	--	ICP Method
Elemental Testing				
1.	Potassium as K	383.10	mg/kg	APHA (Edition 22 nd) 3120 B
2.	Phosphorous as P	2601.0	mg/kg	APHA (Edition 22 nd) 3120 B
3.	Sodium as Na	178.70	mg/kg	APHA (Edition 22 nd) 3120 B
4.	Calcium as Ca	1793.0	mg/kg	APHA (Edition 22 nd) 3120 B
5.	Magnesium as Mg	2052.0	mg/kg	APHA (Edition 22 nd) 3120 B
6.	Iron as Fe	47300.0	mg/kg	APHA (Edition 22 nd) 3120 B
7.	Copper as Cu	654.80	mg/kg	APHA (Edition 22 nd) 3120 B
8.	Manganese as Mn	6157.0	mg/kg	APHA (Edition 22 nd) 3120 B
9.	Zinc as Zn	327.70	mg/kg	APHA (Edition 22 nd) 3120 B
10.	Nickel as Ni	163.70	mg/kg	APHA (Edition 22 nd) 3120 B


 Signature of Lab Executive


 Signature of Technical Manager


 Signature of Quality Manager

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Test Report				
Sample Code	AB/PRO/05/2015-16/1880			
Sample Name	Onsite of T-4 Land Parcel On South			
Name of Client	M/s. Karanja Infrastructure Pvt. Ltd.			
Address of Client	Village Belawadi, Virani, Ambeghar, Tal-Pen, Dist-Raigad			
Sample Collected by	M/s. Building Environment (I) Pvt. Ltd.			
Sample type	Solid			
Sample received on date	30/05/2015			
Analysis Date	30/05/2015 to 24/06/2015			
Reporting date	24/06/2015			
Sample returned /stored	Stored at room temp. for 1 week from the date of reporting			
Sr. No.	Parameter	Result	Unit	Standard Method
Physical Parameter				
1.	Salinity	0.01	percent	--
2.	Water Holding Capacity	55.0	percent	IS : 2720
3.	Soil texture	Clay Loam	--	IS : 2720
Chemical Parameter				
1.	pH	6.36	--	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
2.	Electrical Conductivity	265.0	µS/cm	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
3.	Total Organic Matter	4.35	percent	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
4.	Total Nitrogen	2170.0	mg/kg	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
5.	Sodium Absorption Ratio	1.39	--	ICP Method
Elemental Testing				
1.	Potassium as K	62.40	mg/kg	APHA (Edition 22 nd) 3120 B
2.	Phosphorous as P	999.0	mg/kg	APHA (Edition 22 nd) 3120 B
3.	Sodium as Na	166.80	mg/kg	APHA (Edition 22 nd) 3120 B
4.	Calcium as Ca	1399.0	mg/kg	APHA (Edition 22 nd) 3120 B
5.	Magnesium as Mg	2003.0	mg/kg	APHA (Edition 22 nd) 3120 B
6.	Iron as Fe	16070.0	mg/kg	APHA (Edition 22 nd) 3120 B
7.	Copper as Cu	251.10	mg/kg	APHA (Edition 22 nd) 3120 B
8.	Manganese as Mn	3894.0	mg/kg	APHA (Edition 22 nd) 3120 B
9.	Zinc as Zn	128.80	mg/kg	APHA (Edition 22 nd) 3120 B
10.	Nickel as Ni	87.43	mg/kg	APHA (Edition 22 nd) 3120 B



Signature of Lab Executive



Signature of Technical Manager



Signature of Quality Manager

Test Report				
Sample Code	AB/PRO/05/2015-16/1881			
Sample Name	Onsite of T-2 Land Parcel			
Name of Client	M/s. Karanja Infrastructure Pvt. Ltd.			
Address of Client	Village Belawadi, Virani, Ambeghar, Tal-Pen, Dist-Raigad			
Sample Collected by	M/s. Building Environment (I) Pvt. Ltd.			
Sample type	Solid			
Sample received on date	30/05/2015			
Analysis Date	30/05/2015 to 24/06/2015			
Reporting date	24/06/2015			
Sample returned /stored	Stored at room temp. for 1 week from the date of reporting			
Sr. No.	Parameter	Result	Unit	Standard Method
Physical Parameter				
1.	Salinity	0.01	percent	--
2.	Water Holding Capacity	60.0	percent	IS : 2720
3.	Soil texture	Clay Loam	--	IS : 2720
Chemical Parameter				
1.	pH	6.44	--	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
2.	Electrical Conductivity	225.0	μS/cm	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
3.	Total Organic Matter	3.54	percent	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
4.	Total Nitrogen	1890.0	mg/kg	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
5.	Sodium Absorption Ratio	2.02	--	ICP Method
Elemental Testing				
1.	Potassium as K	333.80	mg/kg	APHA (Edition 22 nd) 3120 B
2.	Phosphorous as P	1738.0	mg/kg	APHA (Edition 22 nd) 3120 B
3.	Sodium as Na	401.50	mg/kg	APHA (Edition 22 nd) 3120 B
4.	Calcium as Ca	4460.0	mg/kg	APHA (Edition 22 nd) 3120 B
5.	Magnesium as Mg	5137.0	mg/kg	APHA (Edition 22 nd) 3120 B
6.	Iron as Fe	49760.0	mg/kg	APHA (Edition 22 nd) 3120 B
7.	Copper as Cu	470.60	mg/kg	APHA (Edition 22 nd) 3120 B
8.	Manganese as Mn	6338.0	mg/kg	APHA (Edition 22 nd) 3120 B
9.	Zinc as Zn	240.20	mg/kg	APHA (Edition 22 nd) 3120 B
10.	Nickel as Ni	167.80	mg/kg	APHA (Edition 22 nd) 3120 B


Signature of Lab Executive


Signature of Technical Manager


Signature of Quality Manager

Test Report

Sample Code	AB/PRO/05/2015-16/1882			
Sample Name	Onsite of T-1 Land Parcel on North			
Name of Client	M/s. Karanja Infrastructure Pvt. Ltd.			
Address of Client	Village Belawadi, Virani, Ambeghar, Tal-Pen, Dist-Raigad			
Sample Collected by	M/s. Building Environment (I) Pvt. Ltd.			
Sample type	Solid			
Sample received on date	30/05/2015			
Analysis Date	30/05/2015 to 24/06/2015			
Reporting date	24/06/2015			
Sample returned /stored	Stored at room temp. for 1 week from the date of reporting			
Sr. No.	Parameter	Result	Unit	Standard Method
Physical Parameter				
1.	Salinity	0.01	percent	--
2.	Water Holding Capacity	65.0	percent	IS : 2720
3.	Soil texture	Clay Loam	--	IS : 2720
Chemical Parameter				
1.	pH	6.34	--	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
2.	Electrical Conductivity	190.10	µS/cm	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
3.	Total Organic Matter	3.26	percent	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
4.	Total Nitrogen	1750.0	mg/kg	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
5.	Sodium Absorption Ratio	8.97	--	ICP Method
Elemental Testing				
1.	Potassium as K	876.50	mg/kg	APHA (Edition 22 nd) 3120 B
2.	Phosphorous as P	1592.0	mg/kg	APHA (Edition 22 nd) 3120 B
3.	Sodium as Na	1467.0	mg/kg	APHA (Edition 22 nd) 3120 B
4.	Calcium as Ca	7385.0	mg/kg	APHA (Edition 22 nd) 3120 B
5.	Magnesium as Mg	7388.0	mg/kg	APHA (Edition 22 nd) 3120 B
6.	Iron as Fe	48230.0	mg/kg	APHA (Edition 22 nd) 3120 B
7.	Copper as Cu	298.87	mg/kg	APHA (Edition 22 nd) 3120 B
8.	Manganese as Mn	5870.0	mg/kg	APHA (Edition 22 nd) 3120 B
9.	Zinc as Zn	204.80	mg/kg	APHA (Edition 22 nd) 3120 B
10.	Nickel as Ni	179.60	mg/kg	APHA (Edition 22 nd) 3120 B


Signature of Lab Executive


Signature of Technical Manager


Signature of Quality Manager

Test Report

Sample Code	AB/PRO/05/2015-16/1883			
Sample Name	Onsite of T-1 Land Parcel in Centre			
Name of Client	M/s. Karanja Infrastructure Pvt. Ltd.			
Address of Client	Village Belawadi, Virani, Ambeghar, Tal-Pen, Dist-Raigad			
Sample Collected by	M/s. Building Environment (I) Pvt. Ltd.			
Sample type	Solid			
Sample received on date	30/05/2015			
Analysis Date	30/05/2015 to 24/06/2015			
Reporting date	24/06/2015			
Sample returned /stored	Stored at room temp. for 1 week from the date of reporting			
Sr. No.	Parameter	Result	Unit	Standard Method
Physical Parameter				
1.	Salinity	0.03	percent	--
2.	Water Holding Capacity	68.0	percent	IS : 2720
3.	Soil texture	Clay Loam	--	IS : 2720
Chemical Parameter				
1.	pH	6.49	--	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
2.	Electrical Conductivity	201.40	μS/cm	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
3.	Total Organic Matter	3.63	percent	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
4.	Total Nitrogen	1863.0	mg/kg	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
5.	Sodium Absorption Ratio	9.39	--	ICP Method
Elemental Testing				
1.	Potassium as K	892.20	mg/kg	APHA (Edition 22 nd) 3120 B
2.	Phosphorous as P	1660.0	mg/kg	APHA (Edition 22 nd) 3120 B
3.	Sodium as Na	1556.0	mg/kg	APHA (Edition 22 nd) 3120 B
4.	Calcium as Ca	7860.0	mg/kg	APHA (Edition 22 nd) 3120 B
5.	Magnesium as Mg	7581.0	mg/kg	APHA (Edition 22 nd) 3120 B
6.	Iron as Fe	47361.0	mg/kg	APHA (Edition 22 nd) 3120 B
7.	Copper as Cu	305.26	mg/kg	APHA (Edition 22 nd) 3120 B
8.	Manganese as Mn	5982.0	mg/kg	APHA (Edition 22 nd) 3120 B
9.	Zinc as Zn	222.30	mg/kg	APHA (Edition 22 nd) 3120 B
10.	Nickel as Ni	186.50	mg/kg	APHA (Edition 22 nd) 3120 B


Signature of Lab Executive


Signature of Technical Manager


Signature of Quality Manager

Test Report

Sample Code	AB/PRO/05/2015-16/1884
Sample Name	Onsite of T-1 Land Parcel on South
Name of Client	M/s. Karanja Infrastructure Pvt. Ltd.
Address of Client	Village Belawadi, Virani, Ambeghar, Tal-Pen, Dist-Raigad
Sample Collected by	M/s. Building Environment (I) Pvt. Ltd.
Sample type	Solid
Sample received on date	30/05/2015
Analysis Date	30/05/2015 to 24/06/2015
Reporting date	24/06/2015
Sample returned /stored	Stored at room temp. for 1 week from the date of reporting

Sr. No.	Parameter	Result	Unit	Standard Method

Physical Parameter

1.	Salinity	0.05	percent	--
2.	Water Holding Capacity	75.0	percent	IS : 2720
3.	Soil texture*	Clay	--	IS : 2720

Chemical Parameter

1.	pH	6.82	--	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
2.	Electrical Conductivity	308.10	µS/cm	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
3.	Total Organic Matter	5.66	percent	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
4.	Total Nitrogen	1533.0	mg/kg	C.A. Black, American Society of Agronomy 5 th Edition, 65-15800
5.	Sodium Absorption Ratio	9.20	--	ICP Method

Elemental Testing

1.	Potassium as K	882.50	mg/kg	APHA (Edition 22 nd) 3120 B
2.	Phosphorous as P	1663.0	mg/kg	APHA (Edition 22 nd) 3120 B
3.	Sodium as Na	1557.0	mg/kg	APHA (Edition 22 nd) 3120 B
4.	Calcium as Ca	7651.0	mg/kg	APHA (Edition 22 nd) 3120 B
5.	Magnesium as Mg	7755.0	mg/kg	APHA (Edition 22 nd) 3120 B
6.	Iron as Fe	44662.0	mg/kg	APHA (Edition 22 nd) 3120 B
7.	Copper as Cu	310.25	mg/kg	APHA (Edition 22 nd) 3120 B
8.	Manganese as Mn	5525.0	mg/kg	APHA (Edition 22 nd) 3120 B
9.	Zinc as Zn	211.07	mg/kg	APHA (Edition 22 nd) 3120 B
10.	Nickel as Ni	186.40	mg/kg	APHA (Edition 22 nd) 3120 B



Signature of Lab Executive



Signature of Technical Manager



Signature of Quality Manager

Annexure-XII

Annexure-XIII

CLIENT : **MR.KALE SAHEB**

PROJECT : Geotechnical Investigation Work for Pen Site.

BORE HOLE NO. : BH-01

SHEET NO. : 1 OF 2

LOCATION : Dhamani

DATE : 07/03/2016 to 18/03/2016

CHAINAGE : --

METHOD : ROTARY DRILLING

GROUND R. L. : --

CASING : 100 mm Ø Nx Upto 1.50 m Below G.L.

GROUND W. T. : 2.00 m.BGL

DEPTH (m.)	DIA. OF BORE HOLE		LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS	
					DEPTH (m)	TYPE	15	15	15	15					
1.00	N X		+	Brownish Highly weathered ROCK	0.00	DS1									
					0.50										
2.00					1.50	Rock									
					3.00										3.00
4.00						4.50									Rock
					5.00	Brownish Highly weathered BASALT									
7.00				7.50											Rock
					8.00										
9.00				Rock											
					10.00										

SPT N=STANDARD PENETRATION TEST VALUE

RQD = ROCK QUALITY DESIGNATION

UDS = UNDISTURBED SOIL SAMPLE

SCALE : 1: 50

CR = CORE RECOVERY

DS = DISTURBED SOIL SAMPLE

VST = VANE SHEAR TEST

JOB NO. : 165

REMARKS : CONTINUED ON NEXT PAGE

Reviewed By :

Checked By :

Drawn By :

SKW SOIL AND SURVEY CO. NEW MUMBAI.

-

V. Patil

Dinesh

CLIENT : **MR.KALE SAHEB**

PROJECT : Geotechnical Investigation Work for Pen Site.

BORE HOLE NO. : BH-01

SHEET NO. : 2 OF 2

LOCATION : Dhamani

DATE : 07/03/2016 to 18/03/2016

CHAINAGE : --

METHOD : ROTARY DRILLING

GROUND R. L. : --

CASING : 100 mm Ø Nx Upto 1.50 m Below G.L.

GROUND W. T. : 2.00 m.BGL

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
		+	Brownish Completely weathered Rock	0.00	Rock						08	NIL	
11.00		+		10.50									
		▽	Brownish Highly weathered fracture BASALT		Rock						15	07	
12.00		▽		12.00									
		▽	Brownish Slightly weathered BASALT		Rock						55	54	
13.00		▽		13.50									
14.00													
15.00													
16.00													
17.00													
18.00													
19.00													
20.00													

SPT N = STANDARD PENETRATION TEST VALUE

RQD = ROCK QUALITY DESIGNATION

UDS = UNDISTURBED SOIL SAMPLE

SCALE : 1: 50

CR = CORE RECOVERY

DS = DISTURBED SOIL SAMPLE

VST = VANE SHEAR TEST

JOB NO. : 165

REMARKS : THE BORE HOLES TERMINATE AT DEPTH 13.50 MTR BGL.

Reviewed By :

Checked By :

Drawn By :

SKW SOIL AND SURVEY CO. NEW MUMBAI.

-

V. Patil

Dinesh

CLIENT : **MR.KALE SAHEB**

PROJECT : Geotechnical Investigation Work for Pen Site.

BORE HOLE NO. : BH-02

SHEET NO. : 1 OF 2

LOCATION : Belwade

DATE : 18/03/2016 to 22/03/2016

CHAINAGE : --

METHOD : ROTARY DRILLING

GROUND R. L. : --

CASING : 100 mm Ø Nx Upto 3.00 m Below G.L.

GROUND W. T. : 6.00 m.BGL

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
0.00	100 Ø MM		Reddish gray fine silty SAND	0.00	SPT1								
1.50				2.10		15 02	30 04	40 06	60 09	N 10			
3.00				3.00	SPT2	10 52	--	--	--	N R			
3.10				3.10		--	--	--	--	R			
4.50	N X		Reddish highly weathered Fracture BASALT	4.50	SPT3	08 52	--	--	--	N R			
4.58				4.58		--	--	--	--	R			
6.00				6.00	SPT4	04 52	--	--	--	N R			
6.04				6.04		--	--	--	--	R	20	NIL	
7.50	N X		Reddish Moderately weathered BASALT	7.50	Rock								
8.00				8.00							51	15	
9.00				9.00	Rock								
10.00				10.00							51	23	

SPT N = STANDARD PENETRATION TEST VALUE

RQD = ROCK QUALITY DESIGNATION

UDS = UNDISTURBED SOIL SAMPLE

SCALE : 1: 50

CR = CORE RECOVERY

DS = DISTURBED SOIL SAMPLE

VST = VANE SHEAR TEST

JOB NO. : 165

REMARKS : CONTINUED ON NEXT PAGE

Reviewed By :

Checked By :

Drawn By :

SKW SOIL AND SURVEY CO. NEW MUMBAI.

-

V. Patil

Dinesh

GROUND W. T. : 6.00 m.BGL

Drawn By:
Dinesh

CLIENT : **MR.KALE SAHEB**

PROJECT : Geotechnical Investigation Work for Pen Site.

BORE HOLE NO. : BH-03

SHEET NO. : 1 OF 2

LOCATION : Boregoan (Virani)

DATE : 26/03/2016 to 28/03/2016

CHAINAGE : --

METHOD : ROTARY DRILLING

GROUND R. L. : --

CASING : 100 mm Ø Nx Upto 1.50 m Below G.L.

GROUND W. T. : 5.50 m.BGL

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS			
				DEPTH (m)	TYPE	15	15	15	15							
1.00	N X		Gray Highly weathered BASALT	0.00	DS1						21	17				
				0.50												
			1.50	Rock	55						37					
2.00			Gray Moderately weathered BASALT													
3.00					3.00						Rock					
4.00				4.50	Rock						51	42				
5.00				6.00	Rock											
6.00				7.50	Rock						63	61				
7.00				9.00	Rock											
8.00				Gray Slightly weathered BASALT											61	61
9.00																
10.00															87	80

SPT N = STANDARD PENETRATION TEST VALUE

RQD = ROCK QUALITY DESIGNATION

UDS = UNDISTURBED SOIL SAMPLE

SCALE : 1: 50

CR = CORE RECOVERY

DS = DISTURBED SOIL SAMPLE

VST = VANE SHEAR TEST

JOB NO. : 165

REMARKS : CONTINUED ON NEXT PAGE

Reviewed By :

Checked By :

Drawn By :

SKW SOIL AND SURVEY CO. NEW MUMBAI.

-

V. Patil

Dinesh

CLIENT : **MR.KALE SAHEB**

PROJECT : Geotechnical Investigation Work for Pen Site.

BORE HOLE NO. : BH-03

SHEET NO. : 2 OF 2

LOCATION : Boregoan (Virani)

DATE : 26/03/2016 to 28/03/2016

CHAINAGE : --

METHOD : ROTARY DRILLING

GROUND R. L. : --

CASING : 100 mm Ø Nx Upto 1.50 m Below G.L.

GROUND W. T. : 5.50 m.BGL

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
11.00		▽▽▽▽	Gray Slightly weathered BASALT	10.50	Rock						87	80	
12.00		△△△△	Gray Moderately weathered BRACCIA	12.00	Rock						61	60	
13.00		△△△△	Gray Moderately weathered BASALT	13.50	Rock						60	58	
14.00		△△△△									62	61	
15.00		△△△△		15.00	Rock								
16.00													
17.00													
18.00													
19.00													
20.00													

SPT N = STANDARD PENETRATION TEST VALUE

RQD = ROCK QUALITY DESIGNATION

UDS = UNDISTURBED SOIL SAMPLE

SCALE : 1: 50

CR = CORE RECOVERY

DS = DISTURBED SOIL SAMPLE

VST = VANE SHEAR TEST

JOB NO. : 165

REMARKS : THE BORE HOLES TERMINATE AT DEPTH 15.00 MTR BGL.

Reviewed By :

Checked By :

Drawn By :

SKW SOIL AND SURVEY CO. NEW MUMBAI.

-

V. Patil

Dinesh

CLIENT : **MR.KALE SAHEB**

PROJECT : Geotechnical Investigation Work for Pen Site.

BORE HOLE NO. : BH-04

SHEET NO. : 1 OF 2

LOCATION : Olakh

DATE : 01/04/2016 to 2/04/2016

CHAINAGE : --

METHOD : ROTARY DRILLING

GROUND R. L. : --

CASING : 100 mm Ø Nx Upto 3.00 m Below G.L.

GROUND W. T. : 7.50 m.BGL

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
			Filling Up Material	0.00	DS1								
				1.00									
1.00				1.00	SPT1	10	--	--	--	N			
				1.10		52	--	--	--	R			
				1.50	SPT2	08	--	--	--	N			
2.00				1.58		52	--	--	--	R			
			Grayish silty sand with GRAVELS										
3.00	75 mm Ø			3.00	SPT1	10	--	--	--	N			
				3.10		54	--	--	--	R			
4.00													
				4.50									
5.00											20	NIL	
6.00			Blackish highly weathered BASALT	6.00	Rock								
7.00											27	NIL	
				7.50	Rock								
8.00											59	59	
			Blackish Moderately weathered BASALT										
9.00	N X			9.00	Rock						64	64	
10.00													

SPT N = STANDARD PENETRATION TEST VALUE

RQD = ROCK QUALITY DESIGNATION

UDS = UNDISTURBED SOIL SAMPLE

SCALE : 1: 50

CR = CORE RECOVERY

DS = DISTURBED SOIL SAMPLE

VST = VANE SHEAR TEST

JOB NO. : 165

REMARKS : CONTINUED ON NEXT PAGE

Reviewed By :

Checked By :

Drawn By :

SKW SOIL AND SURVEY CO. NEW MUMBAI.

-

V. Patil

Dinesh

GROUND W. T. : 7.50 m.BGL

Drawn By:
Dinesh

Annexure-XIV

ANNEXURE -7



Different Ecosystems
Observed in the Buffer Zone



Ecology Biodiversity
Survey in the Buffer Zone



Some of the Forest Patches observed in Buffer Zone



Representative Floral species





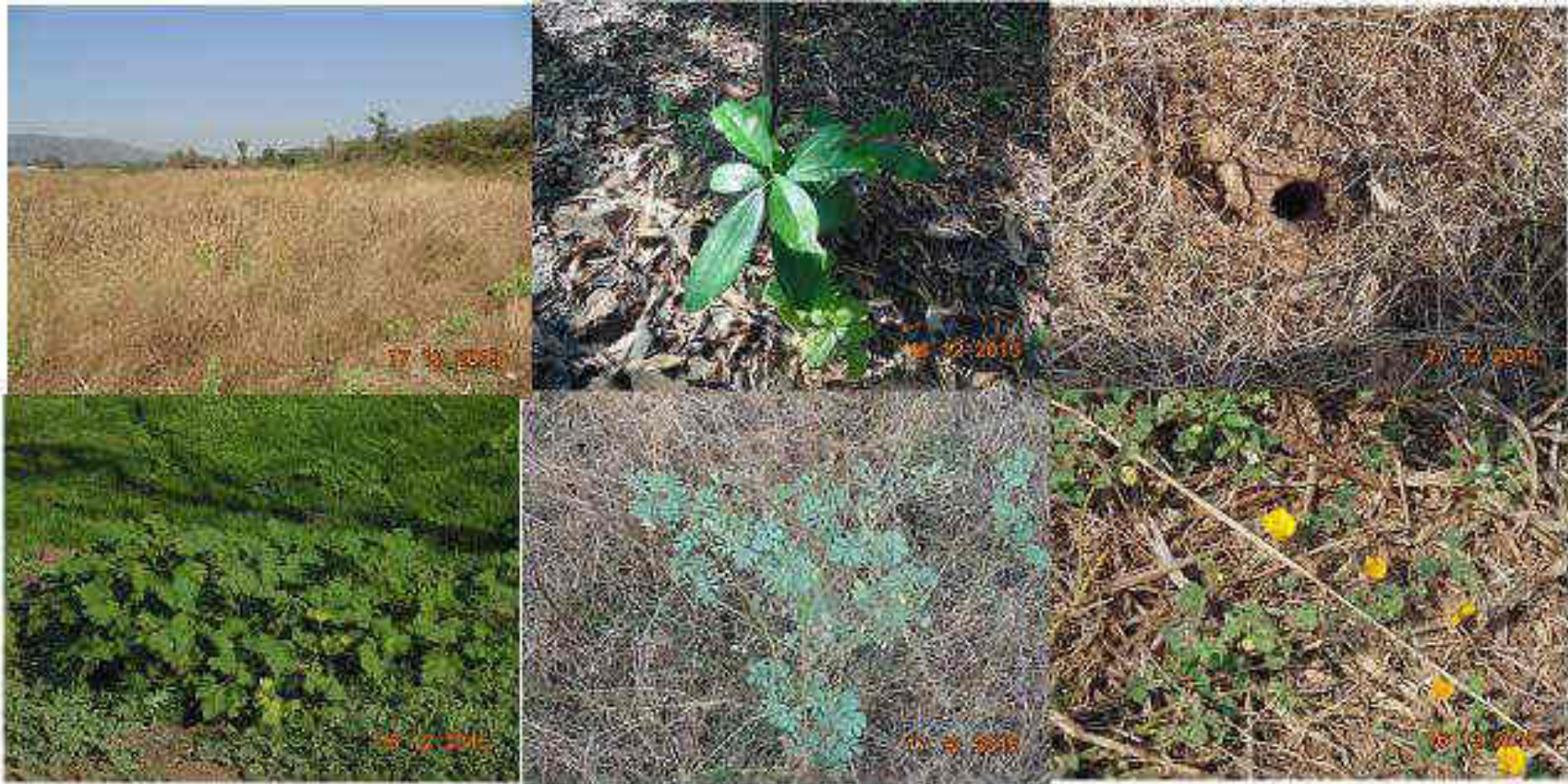




Fern Species observed



Representative Fauna Observed



Representative Ground Cover Observed

Annexure-XV

List of Trees reported at Karnala WLS

Sr. No	Names	Sr. No	Names
1.	<i>Vangueria spinosa</i>	2.	<i>Acacia ferruginea</i>
3.	<i>Flacoartia indica</i>	4.	<i>Randia uliginosa</i>
5.	<i>Bauhinia racemosa</i>	6.	<i>Ficus religiosa</i>
7.	<i>Morinda pubescens</i>	8.	<i>Ficus arnottiana</i>
9.	<i>Bridelia retusa</i>	10.	<i>Oleo dioica</i>
11.	<i>Emblica officinalis</i>	12.	<i>Albizzia chinensis</i>
13.	<i>Spondias pinnata</i>	14.	<i>Microcos paniculata</i>
15.	<i>Mangifera indica</i>	16.	<i>Dalbergia paniculata</i>
17.	<i>Ficus glomerata</i>	18.	<i>Mimusops elengi</i>
19.	<i>Terminalia timentosa</i>	20.	<i>Cassia fistula</i>
21.	<i>Hymenodictyon excelsum</i>	22.	<i>Pterocarpus Marsumpium</i>
23.	<i>Ficus asperrima</i>	24.	<i>Elaeodendron glaucum</i>
25.	<i>Murraya koenigii</i>	26.	<i>Semecarpus anacaeidum</i>
27.	<i>Dillenia pentagyna</i>	28.	<i>Aegle marmelos</i>
29.	<i>Pongamia glabra</i>	30.	<i>Terminalia bellirica</i>
31.	<i>Mitragyana parvifolia</i>	32.	<i>Lagerstroemia parviflora</i>
33.	<i>Garuga pinnata</i>	34.	<i>Cordia dichotoma</i>
35.	<i>Lepisanthes tetraphylla</i>	36.	<i>Ziziphus jujuba</i>
37.	<i>Wrightia tinctoria</i>	38.	<i>Thespesia populnea</i>
39.	<i>Anacardium occidentale</i>	40.	<i>Murraya exotica</i>
41.	<i>Sideroxylon tomentosum</i>	42.	<i>Dolichondrone falcate</i>
43.	<i>Albizia procera</i>	44.	<i>Madhuca latifolia</i>
45.	<i>Casearia tomentosa</i>	46.	<i>Maba nigrescens</i>
47.	<i>Holarrhena antidysentrrica</i>	48.	<i>Trewia nudiflora</i>
49.	<i>Schleichera oleos</i>	50.	<i>Sapindus emerginata</i>
51.	<i>Garcinia indica</i>	52.	<i>Wringhtia arborea</i>
53.	<i>Bauhinia malabarica</i>	54.	<i>Ixora parvifolia</i>
55.	<i>Stericulia cotorata</i>	56.	<i>Ixora arborea</i>
57.	<i>Careya arborea</i>	58.	<i>Ficus Bengalensis</i>

Sr. No	Names	Sr. No	Names
59.	<i>Stereospermum xylocarpum</i>	60.	<i>Albizia odoratissima</i>
61.	<i>Sterculia cotorata</i>	62.	<i>Heterophragma roxburghii</i>
63.	<i>Streblus asper</i>	64.	<i>Kotoptelea integrifolia</i>
65.	<i>Mimusops hexandra</i>	66.	<i>Embelia robusta sensu</i>
67.	<i>Acacia catechu</i>	68.	<i>Kydia calycina</i>
69.	<i>Randia dumetorum</i>	70.	<i>Albizia lebbek</i>
71.	<i>Gliricidia sepium</i>	72.	<i>Gmelina arborea</i>
73.	<i>Ziziphus xylopyrus</i>	74.	<i>Dalbergia lalifolia</i>
75.	<i>Grewia serrulata</i>	76.	<i>Lannea coromandelica</i>
77.	<i>Erinocarpus nimmonii</i>	78.	<i>Phoenix sylvestris</i>
79.	<i>Bauhinia foveolata</i>	80.	<i>Mallotus philippensis</i>
81.	<i>Macaranga peltata</i>	82.	<i>Tectono grandis</i>
83.	<i>Tamarindus indica</i>	84.	<i>Alstonia scholaris</i>
85.	<i>Lagerstroemia</i>	86.	<i>Bombax ceiba</i>
87.	<i>Xylia xylocarpa</i>	88.	<i>Salmalia insignis</i>
89.	<i>Eugenia jambolana</i>	90.	<i>Sageraea laurifolia</i>
91.	<i>Oroylum indicum</i>	92.	<i>Mammea suriga</i>
93.	<i>Diospyros melanoxylon</i>	94.	<i>Terminalia chebula</i>
95.	<i>Borassus Flabellifer</i>	96.	<i>Adina cordifolia</i>
97.	<i>Gardenia gummifera</i>	98.	<i>Saccopetalum tomentosum</i>
99.	<i>Cordia macleodii</i>	100.	<i>Grewia titiaefolia</i>
101.	<i>Ficus heterophylla</i>	102.	<i>Anogeissus latifolius</i>
103.	<i>Dalbargia lanceolaria</i>	104.	<i>Tabernaemontana heyneana</i>
105.	<i>Butea monosperma</i>	106.	<i>Lagerstroemia microcarpa</i>
107.	<i>Stereospermum chelonides</i>	108.	<i>Azadirachta indica</i>
109.	<i>Ficus tseila</i>	110.	<i>Ficus retusa</i>
111.	<i>Peltophorum ferrugineum</i>	112.	<i>Erythrina indica</i>

Annexure-XVI

List of Shrubs, Herbs, Climbers & Grasses reported at Karnala WLS

Shrubs	Climbers	Herbs	Grasses
<i>Adhatoda Vasica</i>	<i>Gnetum ula</i>	<i>Hemidesmus indicus</i>	<i>Ischaemum pilosum</i>
<i>Jatropha curcas</i>	<i>Calycopteris floribunda</i>	<i>Blumea tecera</i>	<i>Eragrostis tenella</i>
<i>Carissa congesta</i>	<i>Gloriosa superba</i>	<i>Indigofera enephylla</i>	<i>Andropogon pumilis</i>
<i>Moghania Strobelifera</i>	<i>Celastrus Paniculatos</i>	<i>Cassia tora</i>	<i>Andropogon pertusus</i>
<i>Strobilanthes Callosus</i>	<i>Mucuna pruriens</i>	<i>Urena lobata</i>	<i>Andropogon monticola</i>
<i>Crotolaria refusa</i>	<i>Entada rheedei</i>	<i>Pavetta tomentosa</i>	<i>Dendrocalamus strictus</i>
<i>Lantana camera</i>	<i>Abrus precatorius</i>	<i>Cleome viscose</i>	<i>Ischaemum rugousm</i>
<i>Allophylus cobbe</i>	<i>Tinospora cordifolia</i>	<i>Musa superba</i>	<i>Andropogontriticeus</i>
<i>Zizphus rugosa</i>	<i>Caesalpinia sepiaria</i>	<i>Solanum anguivi</i>	<i>Anthistria ciliate</i>
<i>Wood fordia fruticosa</i>	<i>Butea superta</i>	<i>Cureuma aromatic</i>	<i>Andropogon annulatus</i>
<i>Datura innoxia mill</i>	<i>Dalbergia horrida</i>	<i>Asteracantha iongifolia</i>	<i>Andropogon schoenanthus</i>
<i>Vitex negundo</i>	<i>Combretum ovalifolium</i>	<i>Senecio grahami</i>	<i>Ischaemum indicum</i>
<i>Opuntia elatior</i>	<i>Capparis sepiaria</i>		<i>Cynodon dactylon</i>
<i>Pogostemon purpurascens</i>	<i>Clematis triloba</i>		
<i>Barteria prionitis</i>	<i>Wagatea Spicata</i>		
<i>Helicteris isora</i>	<i>Diploclisia glaucescens</i>		
<i>Ocimum americanum</i>			
<i>Thespesia lampas</i>			
<i>Eupatorium glandulosum</i>			
<i>Calotropis gigantean</i>			
<i>Xanthium indicum</i>			

Annexure-XVII

Birds Reported In Karnala Wild Life Sanctuary

	R/M	Status
Babbler		
Indian Scimitar	R	C
Jungle	R	C
Puff Throated (Spotted)	R	C
Tawny Bellied	R	O
Fulveta Brown Checked (Quaker Babbler)	R	C
Barbet		
Brown headed (large green)	R	C
Coppersmith (Crimson breasted)	R	C
Bee Eater		
Small green	R	O
Bulbul		
Red vented	R	C
Red Whiskered	R	C
White Browed	R	C
White Eared (White checked)	R	Rare
Buzzard		
Oriental Honey	R	C
White Eyed	LM	O
Crow		
House	R	C
Large billed (Jungle)	R	C
Coucal (Crow Pheasant)	R	C
Cuckoo		
Koel Asian	R	C
Banded bay	BM	O
Common Hawk	BM	O
Drongo	BM	Rare
Pied	BM	O
Dove		
Emerald		
Spotted		
Drongo		
Black	R	C
Bronzed	R	O
Greater Racket tailed	R	C
Hair crested	M	O
White bellied	R	O
Eagle		
Black	LM	Rare
Booted	M	Rare

Crested Serpent	R	C
Egret		
Cattle	R	C
Falcon		
Common Kestrel	LM	O
Peregrine-Shaheen	R	C
Hawk/Shikra		
Shikra	R	C
Basera Sparrow hawk	M	Rare
Eurasian Sparrow hawk	M	Rare
Flower pecker		
Pale billed (Tickle's)	R	C
Thick billed	R	C
Flycatcher		
Asian brown	M	O
Asian Paradise	LM	O
Grey headed	M	O
Monarch	R	C
Red Breasted	M	O
Rusty tailed	M	Rare
Tickle's blue	R	C
Ultramarine	M	O
Verditer	M	O
White Throated	R	C
Heron		
Black crown	R	C
Indian Pond	R	C
Hoopoe		
Common	M	O
Hornbill		
Indian Grey	R	C
Iora		
Fowl		
Jungle fowl, Grey	R	Rare
Peafowl, Common	R	Rare
Spur fowl, Red	R	Rare
Kingfisher		
Common	R	C
Oriental dwarf (three-toed)	BM	Rare
White Throated	R	C
Kite		
Black	R	C
Black Shouldered	R	O
Lapwing		
Red Wattled	R	C

Lark		
Malabar	R	O
Leaf bird		
Blue winged /Jordon's	R	C
Golden fronted	R	C
Martin		
Dusky crag	R	C
Minivet		
Orange	R	C
Small	R	C
Munia		
Scaly breasted	R	C
White rumped	R	O
Avadavat, red	R	O
Myna		
Common	R	C
Jungle	R	O
Nightjar		
Grey	R	O
Jungle	R	O
Oriole		
Black hooded	R	C
Black napped	M	Rare
Eurasian golden	M	C
Owlet/Owl		
Jungle barred	R	C
Spotted	R	O
Parakeet		
Alexandrine	R	C
Plum-headed	R	C
Rose ringed	R	C
Vernal hanging (Lorikeet)	LM	Rare
Grey fronted	R	C
Blue Rock	R	C
Yellow footed Green	R	O
Pipit		
Tree		
Pitta		
Indian Pitta	R	O
Redstart		
Black	M	Rare
Robin		
Indian	R	C
Oriental Magpie	R	C
Roller		

Indian	M	Rare
Sandpiper		
Common	M	O
Green	M	O
Shama		
White rumped	R	C
Shrike		
Long tailed/ backed	M	C
Common hood	R	C
Black headed	BM	O
Large grey	R	O
Sparrow		
Chestnut – shoulder	R	C
Sparrow house	R	C
Starling		
Asian pied	R	O
Chest nut tailed	M	O
Sunbird		
Crimpson	R	O
Crimpson-backed	R	C
Loten's	R	O
Purple	R	C
Purple rumped	R	C
Swallow		
Barn	M	C
Red Rumped	R	O
Swift		
Asian Palm	R	C
House	LM	O
Tailor Bird		
Common	R	C
Thrush		
Blue Rock	M	Rare
Blue capped rock	M	Rare
Malabbar whistling	R	C
Orange headed	R	C
Tree Pie		
Rufous	R	C
Wagtail		
Forest	M	O
Grey	M	O
Booted	M	C
Greenish	M	C
Sulpher bellied	M	O
Water Hen		

White breasted	R	C
Weaver		
Baya	R	C
Wood pecker		
Brown capped Pigmy	R	C
Heart spotted	R	O
Rufus	R	C
White napped	R	Rare
Yellow crowed	R	O

Annexure-XVIII



उप वनसंरक्षक, अलिबाग वन विभाग, अलिबाग यांचे कार्यालय
मु.पो.ता. अलिबाग, जि. रायगड, पिन नं. ४०२२०१, फोन नं. २२२०१६-०२१४१, फॅक्स नं. २२२२१६-०२१४१.
ईमेल - dycfalibag@mahaforest.gov.in

विषय- List of Flora& fauna and
avifauna From the Working
Plan of the Raigad Dist.Reg
जा.क्र. ब/११/सर्व्हे / ३०५५ / २०१७-१८
अलिबाग ,दिनांक- २४/१०/२०१७

प्रति,

✓ श्री. विवेक कुलकर्णी

मुख्य कार्यकारी अधिकारी,

बील्डींग इन्व्हायरमेंट (इंडीया) प्रा.लि.

दक्षीणा बिल्डींग , ४०१ , ४था माळा , प्लॉट नं.२

सेक्टर नं. ११ , रायगड भवन जवळ ,

सीबीडी बेलापुर नवि मुंबई ४०००६१४

संदर्भ:- आपलेकडील पत्र क्र. BEIPL/DCF/ALIBAG/२०१७/०१
दिनांक- २९/०९/२०१७

विषयांकीत प्रकरणी आपलेकडील उपरोक्त संदर्भित पत्रान्वये मागणी करणेत आलेली अलिबाग वनविभागाच्या सन- २०१६-१७ ते २०२५-२६ या कालावधीसाठी मंजूर करणेत आलेल्या कार्यआयोजना मध्ये समाविष्ट केलेली Flora& fauna बाबतची माहिती सोबत जोडणेत येत आहे.

सहपत्र:- वरील प्रमाणे


उप वनसंरक्षक
अलिबाग

CHAPTER II- A

FLORA AND FAUNA

FOREST FLORA

Section – I:- TREES.

2.1.1. The tree enumeration work was executed by Survey of Forest Resources Nasik during 2003-2004 to 2008-2009. It was done using "Systematic Line plot sampling with random start the statistical sampling method and the data collected was further analyzed by the Chief Forest Statistician, Maharashtra State, Nagpur. The information is spread into five different proformas as under;

Statement I : - Estimated growing stock – number of sound trees

Statement II : - Estimated growing stock number of sound trees per ha.

Statement III: - Percentage distribution of total stock of species overall girth classes

Statement IV: - Percentage of stock of species in a girth class to the total stock in that particular girth class

Statement V: - Estimated growing stock in cmt. / ha.

All these statements are enclosed as Appendix XLIX.

2.1.2. The data thus procured further revealed some noteworthy results. It is pertinent to note that 60% of the trees are in lowermost girth class i.e. 15 U 30 and 30 U 45. The tree enumeration data has been tabulated as under considering working circles of old working plan.

Statement showing estimated no. of trees per Ha. for current tree enumeration.

Sr. No.	Name of working circle	No. of trees / Ha.	
		Current Enumeration	Previous Enumeration
1.	Improvement Working Circle	84.224	---
2.	Conversion Working Circle	102.527	---
3.	Pulpwood Working Circle	173.738	---
4.	Selection cum Improvement Working Circle	102.172	---
5.	Coppice with Reserved Working Circle	73.591	---
6.	Afforestation Working Circle	41.257	---
7.	Protection Working Circle	67.441	---
8.	Main (Timber) Working Circle	---	311.34

It is very much evident that the forest has low growing stock for the reasons need to be ascertained separately.

2.1.3. The trees have been further categorized as per their utility and these are as under

(a) Species of General Utility: - Bondara, Kakad, Teak, Ain, Bibla, Shisham.

(b) Species of Special Utility: - Khair, Sawar, Kalamb, Haldu, Dhawada, Hiwar, Shivan, Salai.

(c) Minor Forest Produce Species: - Moha, Jambhul, Apta, Aonla, Behada, Biba, Amba, Nilgiri, Palas, Tembhuran, Chinha, Hirda, Kaju, Shiras.

(e) Other Species:-

The percentage of stock to the total stock in each Working Circle is tabulated below:

Sr. No.	Name of Working Circle	General Utility Species %	Special Utility Species %	Minor Forest Produce Species %	Other Species %
1.	Improvement Working Circle	23.30	23.85	16.87	35.98
2.	Conversion Working Circle	42.43	18.63	7.14	31.80
3.	Pulpwood Working Circle	21.70	9.82	8.72	59.76

4.	Selection cum Improvement Working Circle	40.70	20.13	9.09	30.08
5.	Coppice with Reserve Working Circle	59.64	17.94	3.97	18.45
6.	Afforestation Working Circle	43.36	24.58	10.42	21.64
7.	Protection Working Circle	47.64	15.29	11.74	25.33

Section 2 – GENERAL DESCRIPTION OF THE GROWING STOCK:-

2.2.1. Major portion of the forest areas belongs to the formation “South Indian Moist Deciduous Forests” and remaining is (1) Southern Tropical Broad Leaved Forest (2) Southern Tropical Semi evergreen Forest (3) Tropical Riparian Fringing Forest and (4) Tided Swamp Forest as per revised classification of the forest types of India by Champion and Seth.

2.2.2. Within the above formations, considerable local variations are observed depending upon the nature of soil, topography, past treatment and biotic influences, following sub-types and local sub-types are observed within the above types.

Sr. No.	Group / Sub Group	Type / Sub-Type	Title	Local sub-type
1.	3B	(i) C 1a (ii) C 1b (iii) C 2	Very Moist Teak Forests Moist Teak Forests Moist Mixed Deciduous Forest	Mixed Forests Mixed Forests Mixed Forests
2.	2A	C2	West coast semi Evergreen Forests	Mixed Forests
3.	4E	Rs1	Riparian Fringing Forests	Mixed Forests
4.	4B	Ts1	Mangrove Scrub Forests	Mixed Forests

The Alibag Forest Division was endowed with good teak forest in the past at many patches and the same has been degraded due to biotic factors in the last two/three decades converting the natural wealth as a mixed forests. The general description of the growing stock in each of the above four type of subgroup is described below.

2.2.3. South Indian Moist Deciduous Forest – Moist teak to very moist teak forests C1a and C1b. Here teak was one of the predominating species attaining large size and its natural regeneration is scanty or absent whereas regeneration of ain is profuse to adequate, but it is badly grown due to hacking by the local dwellers. This forests type occurs in Karjat, Panvel, Alibag, Nagothane, Pen, and Sudhagad ranges and mostly confined to lower slopes of hills. The entire forests belt of this type is severely affected with biotic influence like illicit cutting, grazing and repeated fires.

2.2.4. The floral composition of each type is as under:

(1) South Indian Moist Deciduous Forests: - Moist teak to very moist teak forests,
(3B C1a – C1b)

Top Canopy: - *Ain (Terminalia tomentosa)*, *Kakad (Garuga pinnata)*, *Kinjal (Terminalia paniculata)*, *Teak (Tectona grandis)*, *Sawar (Salmalia malbarica)*, *Behada (Terminalia belarica)*, *Hed (Adina cardifolia)*, *Dhavada (Anogissus latifolia)*, *Biba (Pterocarpus marsupium)*, *Siras (Albizia lebbek)*, *Shisham (Dalbergia latifolia)*.

Second storey: - *Shemat (Lannea coromandalica)*, *Dhaman (Grevia tilaefolia)*, *Kumbha (Carex arboria)*, *Humb (Saccopetalum tomentosum)*, *Waras (Hatrophargm aquadicularo)*.

Under Storey: - *Kalakuda (Wrightia tinctoria)*, *Awla (Emblica officinalis)*, *Palas (Butea monorperma)*.

Bamboo: - Mostly absent barring old plantation of *Bambusa bambus*.

Shrubs: - *Athrun (Flacourtia indica)*, *Karvand (Carissa carendus)*, *Phangali (Pogostomon parviflora)*, *Kevani (Murudsheng Helictis isora)*, *Bharang (Clerodendorn serratum)*, *Dinda (Leeta microphylla)*, *Kuda (Holerrhena antidysentrica)*, *Ranbhendi (Thespesia lampous)*, *Jinsaya (Hamiltonea suaveolens)*, *Baman (Colebrookea oppositifolia)*, *Wavding (Limbelica ribes)*.

Herbs: - *Chikna (Sida carpinifolia)*, *Salvan (Desmodium gangeticum)*, *Kakganga (Desmodium triquetertrem)*, *Pithwan (Uraria picta)*, *Chicali (Souropus quadrangularis)*, *Chikta (Desmodium diffusum)*, *Anantmul (Hemidesmus indicus)*, *Kolshina (Asteracantha longifolia)*

Grasses: - *Kusali (Heteropogon contortus)*, *Phulari (Themeda quadrivalvis)*, *Marvel (Dichanthum annulatum)*

Climbers:- *Abai (Canvialia ensiformis)*, *Bondvel (Litiosomia elliptica)*, *Chambel (Bauhinia vahili)*, *Chilar (Acacia intsia)*, *Kuhili (Mucun pruiens)*, *Gunja (Abrus precatorius)*,

Shemba (*Acacia pennata*), *Shatavari* (*Asparagus racemosus*), *Ukshi* (*Calycopteris floribunda*), *Sapsan* (*Aristolochia indica*), *Lokhandi* (*Vetilago madraspantana*), *Gavel* (*Argyrlia sericea*)

2.2.5. SOUTHERN MOIST MIXED DECIDUOUS FORESTS:- Mixed Forests 3BC2

Top Canopy: - *Ain* (*Terminalia tomentosa*), *Kakad* (*Garuga pinnata*) *Kinjal* (*Terminalia paniculata*), *Teak* (*Tectona grandis*), *Sawar* (*Salmalia malaherica*), *Behda* (*Terminalia belerica*), *Hed* (*Adina cordifolia*), *Kalam* (*Mitragyna parviflora*), *Dhavda* (*Anogeissus latifolia*), *Nana* (*Lagerstroemia lanceolata*), *Shiras* (*Albizia lebbek*), *Shisham* (*Dalbergia latifolia*).

Second Storey:- *Shemat* (*Lannea coromandalica*), *Dhaman* (*Grevia tilifolia*), *Kumbha* (*Carea arboria*), *Humb* (*Saccopetalum tomentosum*), *Waras* (*Hatrophargma quadricularo*).

Under Storey: - *Kalakuda* (*Wrightia tinctoria*), *Awla* (*Emblia officinalis*), *Palas* (*Butea monorperma*).

Bamboo: - Mostly absent barring old plantation of *Bambusa bambus*

Shrubs: - *Athrun* (*Flacourtia indica*), *Karvand* (*Carissa carendus*), *Phangali* (*Pogostomon parviflora*), *Kevani* (*Murudsheng Helictirisora*), *Bharang* (*Clerodendorn serratum*), *Dinda* (*Leeta microphylla*), *Kuda* (*Holerrhena antidysentrica*), *Ranbhendi* (*Thespesia lampous*) *Jitsaya* (*Hamilltonea suaveolens*), *Baman* (*Colebrookea oppositifolia*), *Wavding* (*Embelica ribes*).

Herbs: - *Chikna* (*Sida carpinifolia*), *Salvan* (*Desmodium gangeticum*), *Kakganga* (*Desmodium triquetertrem*), *Pithwan* (*Uraria picta*), *Chicali* (*Souropus quadrangularis*), *Chikta* (*Desmodium diffusum*), *Anantmul* (*Hemidesmus indicus*), *Kolshina* (*Asteracantha langifolia*)

Grasses: - *Kusali* (*Heteropogon contortus*), *Phulari* (*Themeda quadrivalvis*), *Marvel* (*Dichanthum annulatum*)

Climbers:- *Abai* (*Canvialia ensiformis*), *Bondvel* (*Littosomia elliptica*), *Chambel* (*Bauhinia vahilit*), *Chilar* (*Acacia imsia*), *Kuhili* (*Mucun pruiens*), *Gunja* (*Abrus precatorius*), *Shemba* (*Acacia pennata*), *Shatavari* (*Asparagus racemosus*), *Ukshi* (*Calycopteris floribunda*), *Sapsan* (*Aristolochia indica*), *Lokhandi* (*Vetilago madraspantana*), *Gavel* (*Argyrlia sericea*)

2.2.6. WEST COAST SEMI EVERGREEN FORESTS: - Mixed forests 2A/C2

Top canopy: - Jambul (*Eugenia jambolana* syn *Syzygium cumini*), Amba (*Mangifera indica*), Ain (*Terminalia tomentosa*), Kinjal (*Terminalia paniculata*), Waras (*Heterophragma quadrilatera*)

Second Story: - Umbar (*Ficus glomerata*), Alu (*Vernonia spinosa*), Dhaman (*Grevia tiliaefolia*)

Bamboo: - Assent.

Shrubs: - Dinda (*Leuca microphylla*), Karvand (*Carissa carandus*), Karvi (*Carvia cellosus*), Papat (*Pavetta indica*)

Herbs: - Chikna (*Sida carpinifolia*), Salvan (*Desmodium gangeticum*), Pithwan (*Uraria picta*), Chikali (*Souropous quadrangularis*), Kolshina (*Asteracantha longifolia*).

Climbers: - Abai (*Canavalia ensiformis*), Bondvel (*Lottosomia elliptica*), Chambvel (*Bauhinia vahili*), Shikekai (*Acacia concinna*), Kavali (*Cryptostegia grandiflora*), Kuhili (*Mucuna pruriens*).

2.2.7. TROPICAL RIPARIAN FRINGING FORESTS:-Mixed forests 4E/RS1

The area covered by this type is very little in extent. The floristic is

Top canopy: - Umbar (*Ficus glomerata*), Jambul (*Syzygium cumini*), Karanj (*Pongamia pinnata*), Amba (*Mangifera indica*).

Second Storey: - Taman (*Lagerstroemia speciosa*), Patal (*Stereospermum perconatum*).

Bamboo: - Occasionally *Bambusa bambus*

Shrubs: - Karvand (*Carissa carandus*), Kuda (*Holarrhena antidysenterica*), Ranbhendi (*Thespesia lanpos*)

Herbs: - Chikna (*Sida carpinifolia*), Salvan (*Desmodium gangeticum*), Chikata (*Desmodium diffusum*), Kolshina (*Asteracantha longifolia*).

Grasses: - Nagarmoth (*Cyperus kokensis*) & (*Cyperus retundus*) (*Cyperus corymbosus*)

Climbers: - Chambvel (*Bauhinia vahili*), Bondvel (*Lottosomia elliptica*), Chilar (*Acacia intia*), Ukashi (*Calicospteris floribunda*), Lokhandi (*Vantilago madraspatana*), Garvel (*Argyreia sericea*), Kusari (*Jasminum arbusceus*)

2.2.8. TIDAL SWAMP FORESTS: - Mangrove scrub 4B/Ts1

This forest type is along the creeks and has achieved importance as the outcome of directives issued by Bombay High court in PIL No. 3246 of 2004. Moreover, some of the mangrove areas were taken in possession in the past against diverted forestland in proposals under FC Act, 1980. The floristics are

Top canopy :- (Avicennia officinalis) Tiwar, (Rhizophora spp) Kandal, Sonneratia apetala

Scrub: - Acanthus ilicifolium.

Section 3: INJURIES TO WHICH CROP IS LIABLE:-

2.3.1. (i) Injuries caused by the local inhabitants to Alibag Forest Division are of two types (a) due to abuse of privileges and (b) due to illicit cutting and encroachment, for the purpose of cultivation.

(a) Abuse of privileges :- The overuse and abuse of privileges granted in the past, like that of *tahal* cutting under Kolaba Privilege Code resulted in extermination of most of trees and thereby depletion of stock of valuable trees. The areas most affected are nearer to habitation, where forests have been literally reduced to scrub and now consisting mostly of malformed coppice shoots of tree species and shrubs and other rank growth.

The other privilege is in respect of collection of leaf litter and brushwood, for the rab burning and this indiscriminate cutting has resulted on deterioration of soil fertility.

(b) Illicit Cutting and encroachment for cultivation: - There was considerable illicit cutting and theft of forest produce in the last few decades, resulting into the depletion of woodlands. The present status of the offence cases detected up to year 2013-14 is given in Chapter XII.

The privilege regarding collection of deadwood was also abused by the dwellers, by manipulating deadwood with a technique of girdling and drying the trees. The present health of the forest has been adversely affected due to these activities and the forests are needed to conserve it from such adverse local factors including fire. The State Government on the recommendations of high power committees had allocated a large piece of forestland to the then landless dwellers for cultivation. This position had been further aggravated by regularizing the encroachments between 1/4/1972 to 31/3/1978 and the last but not the least with the enactment of Forests Rights Act, 2006. The dwellers normally cultivate either paddy or ragi crop in which ragi is mostly in the form of shifting cultivation. Both the crops have strong tendency to swell their areas as they are not defined thereby enhancing its magnitude.

All such cultivations were never demarcated in the past and most of these areas are interspersed with the adjoining forestland and some of them are encompassed with the forestland. The Alibag Forest Division has been burdened with dalhi plots since 1907 and there after some of such plots were dereserved and some were in the process, but it was stuck upwith the promulgation of Forest (Conservation) Act, 1980. The Division has made some attempts to demarcate Dalhi lands, in the past but without any maps. These halfhearted efforts did not yield any influence on the fixation of dalhi plots permanently. All these previous decisions pertaining to regularization of encroachment have led to unabated demand for the forestland for cultivation, coupled with ruthless cutting and burning of natural forests. The forest lands in Uran, Panvel, Sudhagad, Karjat East and West ranges are very close to developed areas and require tremendous protection efforts and similar efforts are required for this forest land from Alibag, Pen, Wadkhal and Nagothane Ranges. The details of forest land diverted for non-forestry purposes are given in Appendix No. XIX.

(ii) Fires: - Fires are common and are due to careless burning of rabs in the cultivations adjacent to the forest. All the fires are manmade and these are caused in the process of collection of NWFP and occasionally for illegal shikar. The fire data as given by the Dy.C.F. of Alibag is given in Chapter XII . There has been no systematic fire protection plan executed by the field staff. The efforts of demarcating fire lines are made mostly to the tune of funds made available and the same are not maintained. The fire adversely affects the natural regeneration, loss of humous in the forest, erosion of soil and environment degradation. Fires also indirectly promote growth of fire hardy shrubs suppressing the natural regeneration of valuable species, in addition, to causing severe damage.

(iii) Grazing: - Incidences of grazing is high in closed areas and is also common in almost all the forest. Heavy uncontrolled grazing all over the forest areas has resulted into serious damage to young natural regeneration and due to repeated trampling it has compacted surface soil with little moisture. A statement showing number of cases of unauthorized grazing and cattle impounded are given in Chapter XII. The Govt. of Maharastra has approved the Sheep and Goats grazing settlement report pertaining to reserved forest area of Alibag Forest Division vide it letter No.A/11/sur/2841, Dt. 08/10/2012 , GR No.MFP-2013/PK-135/F-1, Dt.6/5/2008. The report has been drafted by Shri. Ashok Jadhav, the then ACF of Alibag Forest Division and same was sanctioned by state government vide No. MFP-2103/PK-135/F-1, Revenue & Forest Deptt. Mantralaya, Mumbai Dated- 06/05/2008.

The salient features of this report are as follows:-

1. Total Range – 11
2. Reserve Forests - 88229.6286 Ha.
3. Area proposed for close to grazing – 22010.6089 Ha.
4. Area available for grazing – 66219.0191 Ha.
5. Total No. of grazing units – 46
6. Total No. of cattle units – 58130.
7. Area required for total cattle unit – 40691 Ha.
(Sr. No. 6 x 0.7)
8. Permissible cattle unit – 94599

Grazing needs to be regulated as prescribed in Grazing Settlement Plan.

(iv) Climbers: - The climbers are profuse in wooded areas of Alibag Forest Division. They do a considerable damage to the standing crop. The most harmful climbers are:-

Abi (Conavalia ensiforma)

Chambal (Bauhinia vahili)

Chilar (Acacia intsia)

Kuhili (Mucuna pruriens)

Ukshi (Calycopteris floribuda)

Bondvel (Lottozomia elliptica)

Dhasiri (Hippocratea obtusifolia)

Khandvel (Vantilagom adrapatana)

Gotvel (Stilex macrophylla)

Mastoran (Zizyphus oenopia)

Kavali (Cryptostegia grandiflora)

Wakeri (Waghatia spicata)

Although climbers do an enormous damage to young growth, yet they do form a part of the eco-system. These may be tended if these are really damaging artificial regeneration areas.

(v) Weeds: - The lantana is spread in Sudhagad Panvel, Karjat and Pen ranges. Karvi grows very thick above suitable altitude and suppress the natural regeneration of valuable

species. Karvand and Ukasli are other shrubs appearing in abundance, in plant able areas and are interfere with young growth.

- (vi) Winds: - Damage due to winds, storms is not common but occurs only occasionally, along the coastal plains and in Matheran plateau. The earlier Working Plan exhibits about such incidences pertaining to year 1946 and 1966. However, no such data of post 1966 are been made available. The losses are if trivial nature.
- (vii) Insects and Fungi: - There is a sporadic attack of teak skeletoniser (Haplia machaeralis) every year.
- (viii) Parasites: - Loranthus (*Loranthu longifolius* and *Viscum angulatum*) attacks are seen mainly on the trees by the side of rivers and perennial nallas.
- (ix) Soil Erosion:- Some of the forest areas of Alibag Forest Division are devoid of tree growth and heavy rainfall annually expose the subsoil and this is commonly observed in Ranges of Karjat, Pen and Sudhagad. In many areas, overgrazing has eliminated the vegetal cover and because of which the infertility of the soil goes on increasing. Heavy erosion also takes place along the seacoast due to the impact of tidal waves at the time of onset of monsoon and even during the monsoon. However, no systematic data has been maintained.

CHAPTER II-B

FLORA AND FAUNA

FOREST FAUNA

Section – 1 General History of Wild Life.

2.1.1. The Raigad (Erstwhile Kolaba) district was once known for its game especially prior to & during the British regime the game, however, dwindled down after 1947 i.e. after independence due to indiscriminate shooting & poaching. The habitat of wildlife has reduced due to increasing pressure of human & cattle populations in major parts of the division. Occurrence of wildlife in the area is now confined only to some pockets which are located in inaccessible hilly areas or villages of the Western Ghats where human population is scanty. At other places, the forest areas are confined to compartments surrounded by cultivation land on lower slopes. In addition, forests are shrinking due to rapid deforestation by cultivation under various pretexts of land allotment or encroachment which rendered shelter less habitat. Wildlife in the search of shelter & food has started migrating & moving outside the forest areas.

There is Kamala Bird sanctuary which has been notified vide Notification No.WLP/ 1667/34846/y, dated 6/5/68, the area is 4.27 Sq.Km. & has been carved out from Panvel Range. It is managed by the Conservator of Forest, Wildlife Thane. This area can be safely said as an assured habitat for deserted animals but the area is very small. Further part area of Bhimashankar sanctuary also falls in eastern part of the division having area 13.82 km² & under the control of Chief Conservator of Forest Wildlife, Pune.

The census report for the year 2014 as submitted by the Dy.C.F. Alibag is given as under,

Leopard	Hare	Bhekar	Wild Pig	Mon-key	Taras	Fox	Nad-sur	Pea-fowl	Wild Cat	Waner	Wild Cock	Squaral
2	193	50	102	395	14	4	1	68	14	1004	31	6

(I) Carnivores:-

1. **The leopard – Panther pardus (Bibhat wagh)** is rarely seen & may be due to migration to adjoining forest areas.
2. **Striped Hyena- *Hyaena hyaena* (Taras):** Hyena is found all over the scrubs forests / open forests and grasslands. It is often mistaken for a small tiger due to its striped coat by the local villagers.
3. **The wolf or landaga (*Canis lupis*)** is also common in the Northern and Eastern tract of the division.
4. **The wildcat or ran manjar (Flis chaus)** is found in large numbers as it can thrive in open grass and pastures dotted with bushes and in scrub jungle around human habitations. It is also a great menace to poultry.
5. **The Indian Mongoose (*Herpestes edwardsi*)** is common all over the region and is known for destruction of snakes both poisonous and non poisonous.
6. **The Jackal and Bengal Fox or Khokad (*Vulpes bengalensis*)** are quite common in this area. Jackal were earlier categorized as vermin as they predate upon poultry, lambs, birds, sickly goats, sheep and also damage agricultural crops. Fox is however, regarded as a friend of farmer as it destroys rats, land scrubs and insects which are harmful to agricultural crops.

(II) Herbivores :-

1. **Barking Deer- *Muntiacus muntjak* (Bhekar):** Barking Deer is found in small numbers in the Western ghats.
2. **Wild Pig- *Sus scrofa* (Ran Dukkar):** Wild Pig is also seen in large numbers distributed all over the division. They damage the bamboo plantations and adjoining agricultural fields. Aswal or sloth bear (*Ursus arctos*) & chital (*Axis axis*) are also reported from the dense forest areas in the North-eastern , Eastern and South eastern parts of the Alibag division. Among the Antelopes.
3. **Mouse Deer- *Tragulus meminna* (Pisori, Aheda):** Mouse Deer is reported to occur in the higher richers of the Western ghats but is really seen. Other smaller include Hare (*Lepus ruficaudatus*) , Makad (*Macaca radiata*) , Rhesus monkey (*Macaca Mulatta*) , Flying Squirrel (*Ratufa indica*) , Kalindri (*Viverra Malaccanisis*) , Sayal (*Hystix Leucura*) etc.

4. **Blacknaped Hare- *Lepus nigricollis* (Sasa):** Hare is the most abundant wild animal found distributed all over the Division.

(III) Avifauna :-

Many bird species are found in the forest of Alibag. Both migrant and resident birds are found in this tract. Presence of large dams and water bodies necessitates migration of birds from other places. Alibag has a long coastal belt stretching from Panvel range in the north to Alibag range in the western part of the Division. Both Aquatic and Terrestrial birds are found in this division. The famous “Karnala Bird Sanctuary” has been carved out and notified as a bird sanctuary from the rich forests of the Alibag Division. The important birds found in the division are as under.

Whitebellied Sea Eagle – *Haliaeetus leucogaster* (Sagari garud) is the only Scheduled I bird found in the sea near Alibag. The important birds found in the division are: - Little Grebe – *Tachybaptus ruficollis* (Pandubi), Little Cormorant – *Phalacrocorax niger* (Chotapankawl), Purple Heron – *Ardea purpurea* (pavkali bagla) Smaller Egret – *Egretta intermedia*, Lesser Whisting Teal – *Dendrocygna javanica* (Mraal), Common Pochard – *Aythya ferina* (Lal chari), Ferruginous Duck – *Aythya nyroca* (Nayansari), Pariah Kite- *Milvus migrans* (Ghar), Shikra - *Accipiter badius* (Shikra), Indian Whitebacked Vulture – *Gyps bengalensis* (Gidhad), Grey Jungle Fowl – *Gallus sonneratti* (Rakhi ran kombda), Whitebreasted Waterhen – *Amaurornis phoenicurus* (Kukud Kombdi), Pheasanttailed Jacana – *Hydrophasianus chirurgus* (Panmor), Redwattled Lapwing – *Vanellus indicus* (Lalmukhi titvi), Common Greenshank – *Tringa nebularia* (Timbla), Blue Rock Pigeon – *Columba livia* (Parva), Indian Ring Dove – *Streptopelia decaocto* (Pitha hola), Spotted Dove *Streptopelia chonensis* (Thipkya kavada), Emerald Dove – *Chalcophaps indica* (Pachu Kavda), Roseringed Parakeet – *Psittacula krameri* (Popat), Blossomheaded Parakeet– *Psittacula cyanocephala* (Keera), Brain Fever Bird – *Cuculus varius* (Pavshaa), Indian Koel – *Eudynamys scolopacea* (Kokil), Crow Pheasant – *Centropus sinensis* (Bharadwaj), Spotted Owl – *Athene brama* (Pingla), Common Kingfisher – *Alcedo atthis* (Dhivar Khandya), Whitebreasted Kingfisher – *Halcyon smyrnensis* (Khandya), Crimsonbreasted Barbet – *Megalaima haemacephala* (Juktuk), Yellowfronted Pied Woodpecker – *Picoides maharattensis* (Kaudya Sutar), Common Myna – *Acridotheres tristis* (Shale), Bank Myna – *Acridotheres ginginianus* (Gnga Myna), Indian Tree Pie – *Dendrocitta vagabunda*

(Takkachor), House Crow – *Corvus splendens* (kaola), Jungle Crow – *Corvus macrorhynchos* (Dom Kaula), Common Wood Shrike – *Tebhrodornis pondicerianus* (Jangli), Goldfronted Chloropsis – *Chloropsis aurifrons* (Hirva Bulbul), Goldmantled Chloropsis – *Chloropsis cochinchinensis* (Harewa), Redvented Bulbul – *Pycnanotus cafer* (Lalabudya bulbul), Yellow Eyed Babbler – *Chrysomma sinense* (Piviya), Paddyfield Pipit – *Amhus novaeseelandiae* (Bhartriya pipit), House Sparrow – *Passer domesticus* (Chimni).

(IV) Reptiles :-

The following species of Reptiles are found in the Tract:

Magar or Indian Crocodile – *Crocodilus Pallustris* (Muggar), Indian Pond Terrapin – *Melanochelys trijuga* (Kasau), Olive Ridley Turtle, Common Garden Lizard – *Calotes versicolor* (Sargota), Indian Chameleon – *Chameleon zeylanicus* (Girgit), Common Indian Monitor – *Varanus bengalensis* (Ghorpad), Common or Russell's Sand Boa – *Eryx conisus* (Durkiya Ghoonas), Red or Blunt Tailed Sand Boa – *Eryx Johni* (Dutondya), Common Wolf Snake – *Lycodon aulicus* (Kaudya), Green Keelback – *Macropisthodon plumbicolor* – (Gautya), Buffstriped or striped Keelback – *Amphiesma stolata* (Naneti), Common Red Snake – *Ptyas mucosus* (Dhaman), Fasciolated Red Snake or Banded Race – *Argyrogena fasciolatus* (Dhul nagin), Common Indian Bronzeback – *Bendrilaphis tristis* (Rookai), Common Green Whipsnake or Vine Snake – *Ahaetulla nasutus* (Sarpatoli), Common Indian Krait – *Bungarus caeruleus* (Manyar, Kandar), Indian Cobra – *Naja naja* (Nag), Russell's Viper – *Daboia russellia* (Ghoonas), Saw Scaled Viper – *Echis carinatus* (Phoorasa).

(V) Fish :-

Alibag Forest Division has both Fresh Water and Marine fishes. The common Fresh water fishes are: Stinging Cat Fish – *Seccobranthus fossilis* (Nal Singali), Cat Fish – *Aystus gulis* (Shingala), Mureel – *Chana gachus* (Dhokh, Daku), Fresh Water Goby – *Gobius giupeioides* (Kharadi), Major Carp – *Catla catla* (Catta), Major Carp – *Labeo rohita* (Rohu), Wallago – *Wallago attu* (Shivda), and Carps – *Puntius spp.* (Khavlya, Khavil).

The marine fishes found in the coastal areas Alibag Division are:

Mullet – *Mugil cephalus* (Boi, Pilsa), Bombay Duck – *Harpodon nehereus* (Bombil), Cat Fish – *Techysurus Spp.*(Shingala), Golden Anchovy – *Coilia dussumieri* (Mandeli), Mudskippers – *Boleophthalmus spp.* (Nivti), and Ribbon Fish – *Trichiurus spp.* (Vagti).

Section 2: - Legal Position.

2.2.1. The Union Government as well as the State Government have enacted various legislation & rules to protect wild life. Following are the important Acts & Rules:-

- 1) The Wildlife (Protection) Act 1972 (Amended upto 2011)
- 2) The Wild Life (Protection) Rules 2013

The Government of India separately notified under section 63 of the Wildlife (Protection) Act 1972 vide their Ministry of Agriculture (Department of Agriculture) No.F 11014/5/72 FRY (WLP dated 1/6/1973) the following two sets of rules namely.

- 1) Wild Life (Stock declaration) Rule 1973.
- 2) Wildlife (Transactions & Taxidernny) Rule 1973.

The Principal chief Conservator of Forest Wildlife has been nominated as Chief Wildlife Warden vide Government of Maharashtra's Notification no.WLP – 0613 / CR 199/F-1 dated 20/7/2013 Further the State Government under same notification number dated 21/7/2013 appointed all Additional Principal Chief Conservator of Forest Wildlife Chief Conservator of forest.

Section 3: -Rights & Concessions.

2.3.1. No rights or privileges have been admitted for hunting of wild animals or birds anywhere in the State.

Section 4: - Injury To The Wildlife.

2.4.1. The injuries to which the wildlife are likely to sustain are by way of poaching in a day time or at night using search lights, snares, traps for capturing killing or poisoning, the same. This results dwindling down the wild animals & the wild birds in number. The working plan unit did not receive the data regarding the animals captured hunted or otherwise dead.

Section 5: -Management Of Fauna.

2.5.1. No specific wildlife management in the division was taken up in the past barring the transfer of forest area to wildlife wing notified Karnala Bird Sanctuary & Bhimashankar Wildlife Sanctuary. Forest field staff should be trained in capture & rehabilitation of problem animals, to offer proper medical treatment, etc. The Wildlife related offences should be dealt with all seriousness within shortest possible time; there is a grave need to explore the potentials of the existing long coastal tract for marine fauna.

Annexure-XIX

**MAHARASHTRA POLLUTION CONTROL BOARD
SUB-REGIONAL OFFICE-RAIGAD-2**

Phone :2757 2740.
Fax :2757 1586.
Navi Mumbai 400 614



Raigad Bhavan, 6th Floor,
Sector-11, C.B.D. Belapur,

No. MPCB/SRO-II/PH/TB- 2210/17
To,
The Joint Director (WPC),
MPC Board, Mumbai.

Date: - 13/10/17

Sub :- Submission of public hearing proceeding in respect of M/s Orange Smart City Infrastructure Ltd., for development of Integrated Industrial Township in villages Borgaon, Shene, Ambeghar, Virani, Belavade Bk, Balavali, Kopar, Ambivali, Govirle, Walak, Belavade Khurd, Padole, Mungoshi, & Hamrapur, Tal. Pen, Dist. Raigad

Ref :- 1) Application submitted by project proponent.
2) Office Order issued vide letter dtd. 30/06/2017.
3) Public Hearing advertisement published in Marathi daily newspaper Raigad Times & The Indian Express on dtd. 09/06/2017.
4) Public Hearing conducted on dtd. 11/07/2017 at Agari Samaj Hall, Chinchapada, Pen, Tal. Pen, Dist. Raigad.
5) Duly approved minutes of meeting received from District Collector Office, Raigad, Alibag on dtd. 12/10/2017.

Sir,

With reference to above subject, submitting herewith the duly approved proceedings of public hearing conducted on dtd. 11/07/2017 at Agari Samaj Hall Chinchapada, Pen, Tal. Pen, Dist. Raigad in respect of M/s Orange Smart City Infrastructure Ltd., for development of Integrated Industrial Township in villages Borgaon, Shene, Ambeghar, Virani, Belavade Bk, Balavali, Kopar, Ambivali, Govirle, Walak, Belavade Khurd, Padole, Mungoshi, & Hamrapur, Tal. Pen, Dist. Raigad along with following documents.

- 1) Copies of public notice in daily 'Raigad Times' (Marathi) & 'The Indian Express' (English) newspapers.
 - 2) Board Office order in respect of formation of public hearing panel.
 - 3) Zerox copies of acknowledgements of various departments.
 - 4) Minutes of public hearing in English & Marathi.
 - 5) Zerox Copy of Attendance register.
 - 6) Soft copy of EIA Report.
 - 7) Copy of executive summary in English & Marathi.
 - 8) Hard copy of EIA report.
 - 9) Video shooting of public hearing in the form of DVD.
 - 10) Zerox copies of objections/suggestions received during public hearing.
- This is submitted for information & onward submission please.

DA- As above in duplicate

Copy submitted formation to -
The Regional Officer, MPC Board, Raigad.

Sub Regional Officer, Raigad-2.

પર્યાવરણ જન સુનાવણી, પેળા

મા. જિલ્લાધિકારી તથા જિલ્લા પંડાધિકારી, રાયગડ
પેળા, શાલાલત પર્યાવરણ સંલ્લિત ઢોજ્યાત
લ્લાયિલ પ્રમાણે અપરિથિલી

જિલ્લા રાયગડ. - ઓરેંજ સમાર્ટ સિટી પ્રોજેક્ટ

શાંચ્યા અલ્લયકુરિતે લ્લાલ્લી, સમાર્ટ સિટી
આલેલ્લા જનસુનાવણીચ્લા લેણી
હોલી

क्र	नाव	गावाचे नाव	हस्ताक्षर/पद
१)	विश्वनाथ गोपाळ बेलावेडे	मुंगेरगि	लोकास पाटील
२)	रामेश गजानन पाटील - वळवली	वळवली	ग्रामपंचायत भाजप
३)	शोबे लुणा पाटील - भाजिवली	भाजिवली	ग्रामपंचायत भाजप
४)	सूर्यकांत लक्ष्मण डांडे	गोविंद	शेतकरी
५)	सुनिता गजानन डांडे	इरवाडी	ग्र.प. सदस्य
६)	महेश नारायण पाटील	हनुमानपडा (चोवर)	शेतकरी
७)	कमलका नारायण वारगाडे	भाजकस वडि	शेतकरी
८)	सैलीप काळोकर उंगर	वळवली	शेतकरी
९)	सुरज राजाराम पाटील	वळवली	शेतकरी
१०)	परशुराम चंगा राहीन	वळवली	शेतकरी
११)	कृष्ण पदम पाटील	वळवली	शेतकरी
१२)	जनादेव महादेव पाटील	वळवली	वळवली
१३)	विजय गजानन भामे	जिने	शेतकरी
१४)	नरेश नारायण भामे	जिने	शेतकरी
१५)	राजेंद्र नारायण पाटील	जिने	शेतकरी
१६)	चंद्रकांत नाथा शेत	जिने	शेतकरी
१७)	विश्वनाथ रामोद डांडे	कोपर	शेतकरी
१८)	राजेश जयराम उंगर	दुखोन	—
१९)	राशिमान धर्मा पाटील	कोपर	—

क्र	फोन नं	स्वाक्षरी
१)	९२ ७३ ६४ ८४८८	<u>03/11/20</u>
२)	८०८७५०७००३	<u>Pr</u>
३)	९२०९३२८६८७	<u>Lupat</u>
४)	९२०००४९६४९	<u>Pr</u>
५)	७०५७८८४०३६	<u>Pr</u>
६)	९९२१३७४४७८	<u>Pr</u>
७)	९२०९०५३०१७	<u>Pr</u>
८)	९८२३६९८५६२	<u>Songar</u>
९)	८०८७३५६०१७	<u>Pr</u>
१०)	७२७६६३६१६८	<u>Pr</u>
११)	८६९८८९१५०६	<u>K.P. Bhat</u>
१२)	८५२५८६८८५६	<u>Pr</u>
१३)	८०८७३६९३१२	<u>Nmhat</u>
१४)	७०६६०२१७७९	<u>Pr</u>
१५)	९४२३३७९००९	<u>E.N.M.</u>
१६)	८८०६८०३२३७	<u>Pr</u>
१७)	७२७६८११३९९	<u>Pr</u>

क्र.	नाव	गावाचे नाव	हुद्दा/पद
२०)	ज्योत्सना राम पाटील	बोमबेट	बोमबेरी
२१)	राधाकाश काश पाटील	ना	ना
२२)	दत्त वामजी हांबेरे	ना	ना
२३)	लक्ष्मी परशुराम पाटील	ना	ना
२४)	महाराज सावर	मुंगीरी	ना
२५)	श्री. विष्णू राम	बोमबेट	ना
२६)	परशू काश वाहा	विहारी	ना
२७)	वसुधारा वसुधारा काश	बादगाव	ना
२८)	महेश हरिदास महाडिक	बोमबेट	ना
२९)	शुभाष महा पाटील	बोमबेट	ना
३०)	हारीश विठ्ठल पाटील	बोमबेट	ना
३१)	विठ्ठल महादेव महाडिक	बोमबेट	ना
३२)	पिनेश देवाराज सुभाष	बोमबेट	ना
३३)	नाथनाथ काश पाटील	ना	ना
३४)	नरेश ए. पाटील	बोमबेट	ना
३५)	सहित शिंदे	ना	ना
३६)	Shuman Arun	ना	ना
३७)	Mokla	ना	ना
३८)	Ram	ना	ना
३९)	नाथनाथ महाडिक	ना	ना

फोन नं.	शेती
९९२२२२२४६०	मीना
९२३३२३११९५	मीना
९०११७६८३५२	द.रा. हांबेरे
९२०५५८९१२५	मीना
९२०५५८९३२	मीना
९२७२५१३०३७	मीना
८००७०७५७१२	मीना
९७५५४१०८०९	मीना
९२६०८५१५९९	मीना
९९२३९५४४५१	मीना
९२७१९८७२९५	मीना
९२७३८३३८२०	मीना
९२०९९९५७५९	मीना
८५५१८८७९७५	मीना
७०२८१७८५२३	मीना
९६१९७१२९५८	मीना
९६२३८८३६७५	मीना
९५५५००८८०३	मीना

क्र.	नाव	गावाचे नाव	हुद्दा/पद	फोन नं	शेती
40)	सिमन हरिभाऊ पाटील	बेळवडे कुल		2208452446	क. ए. पाटील
41)	विनायक भाऊ कामाकर	Balavali		-	Pratik
42)	निखिल नरदाम पाटील	बेळवडे कुल		-	Pratik
43)	विठ्ठल महेश पाटील	बेळवडे कुल			
44)	विजय विठ्ठल मोकल	दे. सागर अक्का रामराज प्रेम वामन		9822102277	Vijaymohali@gmail.com
45)	प्रविण भाऊ पाटील	बेळवडे. शिवयोगेश. ता. उपासक		9604020359	Pratik
46)	रामराज विठ्ठल गोळे	मुंगोरी	शेत	9260645264	Pratik
47)	नामदेव रामदास महडिक	बोरगांव		9225319964	Pratik
48)	गणेश वामन पाटील	बोरगांव	अ. म. ल. क.	7176813737	V.B. Talwar
49)	प्रमोद कृष्ण पवार	दुर्गावली			Pratik
50)	शंकर बाबू पापणे	मुंगोरी		9765613641	Pratik
51)	सचिन कृष्णदास गायकवाड	-		9225319964	Pratik
52)	नामन भिऊ जागलाप	बोरगांव			Pratik
53)	जगदीश नावायन पाटील	बोरगांव			Pratik
54)	शंकर वामन मोडेर	जिने	दीनकर		Pratik
55)	अनिल अश्विनराव पाटील	शुवाडी (विंध्यर)	शेत	9225319964	Pratik
56)	जयराज वामन पाटील	शुवाडी (विंध्यर)	शेत		Pratik
57)	दिनेश वामन पाटील	शुवाडी (विंध्यर)	शेत		Pratik
58)	बाबुराव विठ्ठल पाटील	बेळवडे कुल	शेत	9028249822	Pratik
59)	राजू वामन पाटील	-	शेत	9798119193	Pratik
60)	महेश शंकर पाटील	विंध्यर	शेत	9225319964	Pratik
61)	बाबुराव वामन पाटील	शुवाडी (विंध्यर)	शेत	9225319964	Pratik

क्र.	नाम	गावचे नाव	डुग / ५६	मो. नं	अधी
62)	Lalit ravindra patil	pen.	—	8805144405	कल्याण...
63)	भाऊचंद्र पुढोदक पटील	पाटोबर	—	9881374752	B
64)	मंगेश हरिचंद्र पटील	पाटोबर	उपसरप	8888163131	Mang
65)	वासुदेव रामदास म्हात्रे	मिर्ज	—	8149740640	Phule
66)	परशुराम शेका शिंदे	केरवांग	बेगवई	9209531789	BS412
67)	अशाक गणपत पाटील	—	—	—	अधी
68)	अनिल कारिनाथ पटेल	कवडी	—	—	अधी
69)	गजानन वालामास पटेल	कवडी	—	—	अधी
70)	Ramreddh Narayan Theker	जडे	विमर	8793850682	Phaker
71)	हरिचंद्र दासोड	जडे	—	—	अधी
72)	विठ्ठल भुरे	देवडी	महाहरप	9272707267	अधी
73)	अम. सी. जी. पडकर	ग्रामसेवक निघवडी	ग्रामसेवक	9423726835	Phelalkar
74)	मोक्ष सुधु भागकर	वरवडी	—	8698835307	अधी
75)	राजेंद्र हरिचंद्र म्हात्रे	कांगेर	फेल	—	अधी
76)	अश्विनी हरिचंद्र म्हात्रे	विश्ववीरवाडी	अधी	0766343456	अधी
77)	दमयंती नवनाथ खात्री	ब कोपर	—	—	अधी
78)	पितामह २१५ पाटील	वेरवडी	CRP	8607401957	अधी
79)	Pritam Arun Patil	पेण	अधी	9028564142	अधी
80)	शंकर मंगलदास पाटील	कावगाव	शेगाव	9764139331	अधी
81)	कांगार पंडुरंग पाटील	पेण	शेगाव	9975597183	अधी
82)	Y. D. Chogale	पांडुरंग	शेगाव	9421002157	अधी
83)	Rupesh S. Mhatre	डेवडी	—	9448122000	अधी
84)	M. S. G. Mhatre	Belwade	Chamsewar	9421483842	अधी
85)	Jayaram Ram Paul	—	अधी	9767346029	अधी
86)	Rajendra Mhatre	Kupoli	अधी	9270997553	अधी
87)	Ekmath V. Patil	Belwade	अधी	9281188406	अधी
88)	Mehul Ashwin P	M. P. J. J. J.	अधी	9822913071	अधी
89)	Charat Mhatre	RAVE	अधी	9762927221	अधी
90)	Raju Patil	RAVE	अधी	8796480404	अधी
91)	वासुदेव रामदास पाटील	अधी	अधी	—	अधी
92)	राजेंद्र मंगलदास पाटील	अधी	अधी	—	अधी
93)	राजेंद्र मंगलदास पाटील	अधी	अधी	—	अधी

क्र.	नाव	गावाचे नाव	हुद्दा / पद	फोन नं.	रही
94)	महेश्वर स. पिंपल	चिखाम		925094573	Shilpi
95)	पेठेनाथ भो. पाटील	वेळवेडे		9873031416	P.B. Pethale
96)	महावंत राजपुत कायरे	वेळवेडे		9263058029	कायरे कायरे
97)	अंगाराम सखाराम पवार	निधवळ		9272923534	B.S. Pawar
98)	आंतोष लुळुशिराम पाटील	वळवळ		9272333499	Shilpi
100)	अमिनील पाटील	राखुराव		7107208839	Shilpi
101)	महावंत गोवान मेकळे	मुंगार		9270931314	Shilpi
102)	गुजवीर नथवंत पाटील	वेळवेडे		7083885623	Shilpi
103)	पी. के. ठाकूर	चिखाम		8988661618	Shilpi
104)	आकाश लु. पाटील	चिखाम		7278842145	Shilpi
105)	अमिनील पाटील	चिखाम		9028363148	Shilpi
106)	जगदीश धर्मा ठाकूर	गोविल		8169629665	Shilpi
107)	कुशिर माझी पाटील	चिखाम		9028288566	Shilpi
108)	विजय शंकर भांबुळे	चिखाम		9272288080	V.S. Salunkar
109)	मधुकर देवरा ठाकूर	चिखाम		6940620944	Mr.
110)	Ram. Devaji Thakur	चिखाम		8879521010	Ram
111)	सोहिदास गोविंद भायकवाड	चिखाम		9273138725	Shilpi
112)	विशाल गमान ओरठ	चिखाम		8087648121	Shilpi
113)	रामराज भायक पाटील	चिखाम		8149939494	R.B. Patil
114)	दत्ता ओरठ	चिखाम		9850885614	Shilpi
115)	सोहिदास गोविंद भायकवाड	चिखाम		9888336864	Shilpi
116)	प्रभाकर रघुनाथ धरठ	चिखाम	भा. अरपे	9269430992	Shilpi
117)	माचिरी लक्ष्मी पाटील	चिखाम		9209443033	Shilpi
118)	मेरा परशुराम भाय	चिखाम		7198140820	Shilpi
119)	लडू लुकास पाटील	चिखाम		9226367945	Shilpi
120)	जगदीश भायक पाटील	चिखाम		9130274448	Shilpi
121)	भायक दिवाकर भाय	चिखाम		9423898556	Shilpi
122)	संजय दीशभाऊ भाय	चिखाम		8446297713	Shilpi
123)	अमिनील गोविंद धरठ	चिखाम		9270771431	Shilpi
124)	प्रभाकर दिशोर भाय	चिखाम		9765393056	Shilpi
125)	दिपक भा. भाय	चिखाम		8237304242	Shilpi

क्र.	नाव	गोवाचे नाव	हुद्दा / पद	फोन नं.	शेडी
126	रमेश भागुनेछावडे	पेन	Peaple	9011614959	
127	Sanjit Chaudhari	PEN	Peaple	9422383134	
128	Rohan Manore	PEN	Peaple	8698579111	
129	Nardev A. Patil	Kaleshni	Sarpanch	9850600622	
130	रमेश नकुलाम घाटीस	वळवळी	मात्री सरपंच	9271716149	
131	शक्ति देवा पेरवी (पुतळपार)	पेन-कै. प्रहार	अध्यक्ष-फो फ्रीसवली	9145424646	
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**MINUTES OF THE PUBLIC HEARING FOR PROPOSED
DEVELOPMENT OF ORANGE SMART CITY (OSC) TO BE
DEVELOPED BY PROJECT PROPONENT M/S ORANGE SMART
CITY INFRASTRUCTURE PVT. LTD., (OSCIPL)
AT TALUKA – PEN, DIST – RAIGAD**

The public hearing for proposed development of integrated Industrial Township as “ORANGE SMART CITY (OSC)” at Taluka - Pen, Dist- Raigad to be developed by M/s Orange Smart City Infrastructure Pvt. Ltd. Navi Mumbai, was conducted on 11-07-2017 at 11.00 a.m. at Agari Samaj Hall, Pen, Tal- Pen, Dist- Raigad.

Following were the panel members for conducting public hearing as per the Board's Office Order E-51 of 2017 under letter no.BO/JD(WPC)/PH/B-2575, dated 30/06/2017.

1) Shri. Kiran Panbude Additional District Magistrate, Raigad (Representative of District Magistrate, Raigad	- Chairman,
2) Dr. A. N. Harshawardhan Regional Officer, MPCB, Raigad (Representative of the MPCB, Mumbai)	- Member
3) Shri S. L. Waghmare Sub Regional Officer, Raigad-II, MPCB, Raigad	-Convener

The Convener of the Public Hearing Committee and Sub Regional Officer, MPCB Raigad-II, welcomed Hon'ble Chairman, Project officials, Environmentalists, Journalists and General Public and informed that, as per Environment Impact Assessment (EIA) Notification of Ministry of Environment, Forest, Climate Change, Govt. of India (MoEFCC, GoI) dated 14th September, 2006, as amended, on 1st December, 2009, it is mandatory to conduct prior public hearing to certain projects which are covered in the schedule of the said Notification. The Sub Regional Office, MPCB, Raigad-II was in receipt of application of project proponent M/s Orange Smart City Infrastructure Pvt. Ltd., Navi Mumbai for conducting public hearing for developing Orange Smart City, Tal – Pen, Dist-Raigad. The Convener further informed that, as per said Notification, the project falls under Category A 7 (c).

Convener of the meeting further informed that the aim of conducting public hearing is to make local people aware the likely impact of the proposed Integrated Township on environment.

Mrs. Vaishali Patil, resident of Pen, Tal. Pen, Dist. Raigad objected on the copy of the Detail Report of the Environment Impact assessment. She said that this is season of sowing paddy in Konkan region. Hence though they are sixteen hamlets of Adivasi i.e. Schedule Tribes, nobody could attend the public hearing. This public hearing should have been conducted on project site only. As per EIA Notification, 2006,

the Annexure IV is also not attached to the report. As per directives of Environment Department, Govt. of Maharashtra dated 25/03/2015, any report/letter should be made available to common people in local language only. As per the EIA notification 2006, detailed report should have been made available to the villagers 30 days advance of the public hearing. This hearing is illegal.

Shri. Sanjay Dangar, Balavali, Tal. Pen, Dist. Raigad has also noted that the place of public hearing is not mentioned in letter along with EIA report submitted to various Grampanchyats. The public hearing is conducted without following the due process of law,

Member of Legislative Assembly, Maharashtra Shri. Dhairyshil Patil informed that the efforts were made by other project proponent to develop Kanchangiri project. Land has been acquired to set up Special Economic Zone. But both these projects have not been completed. If the proposed Township is beneficial to the local people and if there is no adverse impact on the environment, then only local people will support the project.

Some villagers were demanding to defer the public hearing. Committee informed that this Committee has no right to defer the public hearing. The Committee is constituted to carry the public consultation and the suggestions and/or objections made will be sent to Expert Committee of Ministry of Environment, Forest and Climate Change

(MoEFCC) Govt. of India (GoI) for consideration. The local people appealed to co-operate to conduct the public hearing.

The Convener, further informed that as per EIA Notification, 2006, one month advance public notice was published in the local newspapers on 09/06/2017 in 'The Raigad Times' for Marathi and in 'The Indian Express' for English in which the venue & date of public hearing was mentioned. He said that copies of EIA report and executive summary were also made available at MoEFCC, Nagpur and at various offices of Govt. of Maharashtra i.e. District Magistrate Office, Raigad, Sub Divisional Office, Tal-Pen, Dist-Raigad, Zilla Parishad, Raigad, District Industries Centre, Raigad, Sub Regional Office, Raigad-II, Regional Office, MPCB, Raigad and at Head Office of MPCB, Mumbai, Environment Department, Govt. of Maharashtra, Mumbai and Grampanchayat offices at Borgaon, Shene, Ambeghar, Virani, BelvadeKh, BelvadeKh, Balavali, Kopar, Ambivali, Govirle, Walak, Padole, Mungoshi, Hamrapur, Tal-Pen, Dist-Raigad. The public in general were appealed to send any objection / suggestion regarding the above project. The office of Sub Regional Officer, MPCB, Raigad-II, 6th Floor, Raigad Bhavan, Sector 11, CBD Belapur, Navi Mumbai has not received any suggestions/objections. Convener of the meeting appealed Chairman of the Committee to allow to start the proceedings of public hearing.

The Chairman of Committee welcomed all and directed representative of company to present the project details in Marathi. Further representative of the company, presented details of the project including area, location, phases involved the details about pollution control devices and environment management plan of the project, etc., in local language Marathi. He further appealed general public to give objection / suggestion if any, about the project after technical presentation of the unit.

The Environment Consultant appointed by the company, presented the project. The presentation given includes the details of phases/location of proposed project, the details of activities involved in the project, the details of employment generation, the details of environmental study, industrial safety & social economy, CSR plan of the company etc.

After completion, Chairman of the Committee and Member appealed general public to give their objections/suggestions for the proposed project.

A) Mrs. Vaishali Tai Patil, resident of Pen, Tal. Pen, Dist. Raigad.

Mrs. Vaishali Tai Patil objected that -

- 1) As per the Notification of MoEFCC, Gol dated 14th September, 2006, it is mandatory to make available the copies of detail EIA report in vernacular language (Marathi) well before 30 days of the public

hearing. However the detailed report is not made available 30 days prior to the hearing.

- 2) There are discrepancies in informaties in Executive Summary and in the presentation.
- 3) Most of Grampanchayat offices has not received the copies of Executive Summary well before 30 days advance.
- 4) The project proponent's has not mentioned number of job opportunities created by the project. The project proponent has mentioned the total figure of laborers and future job opportunities.
- 5) The project proponent has not obtained "Consent to Establish," from MPCB. Project proponent informs that there may be change in the plan of the project. Hence if project plan is changed, then will project proponent conduct the public hearing again?
- 6) The project proponent did not inform the sources of water for the project.
- 7) Most of local people from Schedule Tribe Communities (Adivasi Community) could not attend the hearing due to the paddy sowing season. There are sixteen Adivasi hamlets (Vastis), they could not attend the hearing.
- 8) The page numbers in the report are not correct. Either the page numbers have been deleted or not written.

- 9) As per the EIA Notification, 2006, EIA should be conducted for an area of 10 Kms radius of the proposed project. It was alleged that the Environment Advisor of the project have not visited the area. Proponent should give proof of the fact that they have visited the Grampanchayat office and conducted the meeting with officials of Gram Panchayat and local people.
- 10) All the details mentioned in the EIA report are not included in the Executive Summary Report.
- 11) Hence the public hearing should be postponed and local people should be provided with complete EIA report in vernacular language. The next public hearing should be conducted on the project site only as per the directives of MoEFCC.
- 12) The project proponent did not inform the exact sources of water for the project. Hence local people fears that Proponent will lift the water from Hetvane or Ambegaon dam which will affect the drinking water system of the local people.
- 13) Convener has not mentioned the venue of public hearing in the letter which they have sent to Grampanchyats.
- 14) It is suggested that after the meeting of public hearing, the summary/minutes/points of the meeting will have to be read before the public in the meeting only.

B) Shri. Sanjay Dangar, resident of Balavali, Tal. Pen, Dist. Raigad:-

Shri Sanjay Dangar, resident of the Balavali, objected that –

- 1) Township will be developed on four sites which are not contiguous.
Hence these sites will have to be connected by roads . But construction of road and availability of land for construction of road is not mentioned in the report.
- 2) The Patalganga, Balganga and Bhogeshwari rivers which flows in the vicinity of project have become highly polluted rivers due to discharge of industrial effluent from the existing chemical units. If the new hazardous and chemical factories allowed to develop in the project area, the effluent will be discharged in the river. The project proponent did not inform the treatment of treated domestic and industrial effluent.
- 3) The ancient Badaruddin Darga is just adjacent to the project. Nothing is mentioned about the Darga in the presentation and in the report.
- 4) The efforts were made in the past by the other project proponent for the development and they left the project. The local people fears that this total project will be handed over to another company. The local people are already suffering due to pollution of chemical factories and there will be increase in the pollution and new project proponent will not honour the promises made by the present proponent.

Here, Project proponent answered that existing roads will be used for connectivity purpose. If the local people request & co-operates, the road will be developed. Otherwise, the road project will be declared as separate project.

C) Dilip Mukund Patil, Resident of Kane, Tal. Pen, Dist. Raigad

Shri. Dilip Mukund Patil, resident of Kane opined that -

- 1) In this presentation, it is mentioned that no village will be relocated or displaced. A detail of population of the project and floating population is not mentioned. This is not clear whether this project will be beneficial to local people.

Project proponent answered that the no village will be relocated or displaced due to the project. Moreover, this project will bring prosperity in the vicinity of the project.

D) Shri. Dhairyashil Patil, MLA

- 1) This is not a first attempt for the development of the project site. Previously, the efforts were made by other project proponents by planning to develop Kanchangiri Complex and for development of Special Economic Zone (SEZ). Both the project were abandoned. It is noted that after huge investment, the SEZ project, which is established in other parts of country, can give only 3% job opportunities. The people have sighed of relief as SEZ project is abandoned. Now, the project proponent M/s Orange Smart City

Infrastructure Pvt. Ltd., desires to develop Integrated Township. The project proponent has appointed an environment consultant for the preparation of EIA study. Naturally, the EIA study will be in favour of the project only.

- 2) As per the EIA report, the population of the proposed city may be 3,00,000 (Three lakhs only). There may be more than 4,50,000 souls in the proposed project, hence the local people have to face civic issues.
- 3) The inception of the project will affect the drinking water sources of the Pen City. There may be decrease of nearly 2,000 hector irrigated land/area. The EIA report mentions that 36.0 MLD drinking water will require for the proposed project. But he feels that more quantity of water will be required than mentioned. The sewage of Pen City is already released in Bhogeshwari River. After township comes up sewage will be discharged in the Bhageshwari River.
- 4) In the EIA report, it is mentioned that the water will be lifted from Hetwane dam. This point is missing in the presentation. The water of Hetwane dam is reserved only for irrigation purposes and local people will oppose the lifting of water for this project. The water of Ambegaon dam which is exclusively reserved for Pen City and hence project proponent will not be allowed to lift the water from Ambegaon Dam.

- 5) Due to this project, the local agriculture may be hampered.
- 6) While acquiring the land in 2007, the project proponent has already issued Indemnity Letter of job opportunities, from whom the land for the project was bought. After ten years, nothing is done. As per the policy, if at all the project is not implemented within five years, the land/plot has to be handed over to the owner of the plot.
- 7) The project proponent has not considered the study/findings of KasturiRangan Committee, though the project area falls under Western Ghat. UNESCO has already declared Western Ghat as World Natural Heritage and declared more than 139 plants and animals as "highly sensitive protective species."
- 8) This public hearing shall be cancelled & shall be re-conduct it.

E) Shri. Vikas Mhatre, resident of Koproli, Tal. Pen, Dist. Raigad

- 1) Shri. Vikas Mhatre supported the views expressed by Vaishali tai Patil and local MLA Shri. Dhairyashil Patil. He expressed the opinion that project proponent is promising the vague job opportunities to local youths as the requirement of manpower and labor is not bifurcated.
- 2) He further expressed the opinion that the project will require additional land.

- 3) Shri. Mhatre asked to Environment Consultant for the information of the Proprietor and Board of Directors of the project. Environment Consultant were unable to answer the same.

F) Shri. Promod Patil, Member, Zilla Parishad Raigad-

- 1) Name of the project is Orange City, which is in English. This needs to be changed to Marathi. The company should consider conducting the public hearing in individual villages. However, if the project is going to benefit the people we will support it.

G) Shri. Jinesh Shirsath, resident of Antola, Tal. Pen, Dist. Raigad.

- 1) It is mentioned that hazardous waste will be generated. If the project is a residential project how will hazardous waste be generated and if it is generated how it will be managed. Seasonal study for EIA is not carried out. In presentation, it is mentioned that the plan may change a bit but it is not mentioned in EIA report.

H) Koshitai Pawar, Sarpanch, Balavali, Tal. Pen, Dist. Raigad-

- 1) The report has been submitted in English, it should be submitted in Marathi. We can't read English. Water source will be affected.

I) Shri. Madan Patil, resident of

- 1) Shri. Madan Patil asked whether project proponent will buy construction materials from outside? It is informed that construction materials will

be purchased from Authorized mines. He suggested that contract shall be given to the local people.

J) Shri. Sanjay Naik, resident of Ambivali, Tal. Pen, Dist. Raigad.

- 1) The total EIA report should be made available in Marathi and another public hearing should be arranged.

K) Shri. Sanjay Dangar, resident of Balavali, Tal. Pen, Dist. Raigad.

- 1) The project is proposed at four locations which are at a distance of 3 to 7 km and there is limited connectivity to reach this location. Will the company acquire land through government to strengthen the connectivity?
- 2) Historical monuments have not been mentioned in the report.

Reply: -company representative clarified that the the road shown in the plans are along the ODR (other district roads).The company will use existing roads for connectivity purpose till such time that this road may be widen by the government at the later stage.

After going through suggestion, objections of the public hearing, representative of the company explained water calculations, numbers of job opportunities to be created for locals in initial phase. Environment Consultant of company briefed about disposal method of hazardous

waste if generated, method used for sampling to collect data for EIA report etc and also noted the suggestions made by the local peoples.

Chairman of the Committee informed that written objections have been received by the Committee and it will sent along with the minutes of pubic hearing.

As agreed, Chairman of the Committee read all the objections/suggestions made during the meeting and discussed the issues.

Objections received by the Committee and MPCB office will be sent along with the proceedings of the meeting with objections, also suggestions given in the meeting along with video recording will be sent to Ministry of Environment, Forest & Climate Change, Govt. of India. Chairman of Committee concluded the meeting extending thanks to all.



(S. L. Waghmare)
Convener
and Sub Regional Officer,
MPCB, Raigad II



Dr. A.N. Harshawardhan)
Member,
and Regional Officer,
MPCB, Raigad.



(Kiran Panbude)
Chairman,
Public Hearing Committee and
Addl. District Magistrate, Raigad

Annexure-XX

Risk Assessment and Disaster Management Plan

For

Proposed Integrated Industrial Township
“Orange Smart City”, Taluka Pen, District Raigad

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1 INTRODUCTION

This report is prepared to identify the risks associated with the proposed project activities, evaluate the same, propose the risk prevention and mitigation measures and delineation of on-site and off-site disaster management plan. In this report, the various components and the related activities are considered to identify the potential sources of hazard during operation phase of the project. However, these hazards are generic in nature as the individual capacity of industries and the extent of the operations envisaged within the project are not known at this point of time. Hence individual industries and developers need to formulate the specific Risk Assessment and Disaster Management Plan in line with the specific requirements, relevant statutes and regulatory framework.

2 RISK ASSESSMENT

Risk assessment is the process to:

- Identify hazards.
- Analyse or evaluate the risk associated with that hazard.
- Determine appropriate ways to eliminate or control the hazard.

In practical terms, a risk assessment is a thorough look to identify those things, situations, processes, etc. that may cause harm, particularly to people. After identification is made, there are need to evaluate how likely and severe the risk is, and then decide what measures should be in place to effectively prevent or control the harm from happening.

2.1 Hazard Identification

A hazard is the potential for harm (physical or mental). In practical terms, a hazard often is associated with a condition or activity that, if left uncontrolled, can result in an injury or illness. Identifying hazards and eliminating or controlling them as early as possible will help prevent injuries and illnesses.

Hazard identification is a process used to identify possible situations where people may be exposed to injury, illness or disease, the type of injury or illness that may result from these and the way in which work is organized and managed.

The proposed project consist of following component.

1. Industrial
2. Residential
3. Commercial
4. Open Space& Undevelopable area

2.1.1 Natural Hazard

The following natural hazards are identified for the project area:

Table 2-1: Potential Natural Hazards

S.N	Disasters	Vulnerability Yes/No	Reason
A	Natural Disasters		
1	Flood	Yes	The T3 site is prone to flooding in peak rains.

2	Earthquake	Yes	Project site located in Seismic Zone IV as per the Seismic Zoning Map of India. This is a 'High damage Risk Zone' and has the potential to give effects of MSK VIII scale.
3	Cyclone	Yes	The proposed project site is in Pen, Raigad, District and as per NDMA report, Raigad region comes under Moderate damage risk zone – A ($V_b = 44$ m/s) Therefore, the Proposed project has a moderate risk to Cyclones.
4	Landslide	Yes	Due to nature of site slope in T1

2.1.2 Manmade Hazard

The following key potential manmade hazards are associated with proposed project activities:

Table 2-2: Potential Manmade Hazards

S.N.	Disasters	Vulnerability Yes/No	Reason
1	Physical Hazard	Yes	Due to industrial workplace activities
2	Fire/Explosion/Toxic Release	Yes	Due to use of fuel, chemicals, gas etc.
3	Building Collapse	Yes	Due to non-conformity with the design
4	Vehicle Mishap	Yes	The proposed project will help in handling and transport of personnel, raw material and finished products

The various manmade hazards during construction and operation phase are identified in following sections.

2.1.2.1 Construction Phase

One of the most hazardous and accident-prone working environments is the construction site. Everyday construction workers are exposed to excessive construction site dangers that could result in injury or even death. The most frequent hazards/risks in the construction industry fall into two main categories:

- hazards/risks that may cause occupational accidents, sometimes fatal, immediately or soon after they occur;
- hazards/risks that may cause occupational illness, sometimes also fatal, in the medium or long term (from a few hours to many years later).

The leading accident hazards/risks on the construction site are:

i) Physical hazards

- ✓ Falls from height (from unguarded floors, platforms, scaffoldings, roofs, etc.);
- ✓ Caught in/between (malfunction of machinery, etc.);
- ✓ Excavation related accidents;
- ✓ Cave in (malfunction of the shoring system, sloping missing in excavations, etc.);
- ✓ Electrocution (by contact with power lines, power tools, etc.); and

- ✓ Struck by (falling objects, etc.);
- ✓ Fire/Explosion;
- ✓ Failure of temporary structures;
- ✓ Others (Slipping on the same level, oxygen deficiency in confined spaces, lightning strike etc.)

ii) Chemical Hazards

Hazards arising due to exposure to dangerous substances/chemicals.

iii) Health Hazards

The leading occupational illnesses hazards/risks on the construction site are:

- ✓ Back injuries (from carrying heavy loads, working in inappropriate positions, etc.);
- ✓ Respiratory diseases (from inhaling dust, fumes, etc.);
- ✓ Musculoskeletal disorders (from sprains and strains of the muscles, injuries affecting the hand and wrist, the shoulders, neck and upper back, the knees, etc.);
- ✓ Hearing losses (from long time exposure to noise); and
- ✓ Skin diseases (manipulation of dangerous materials, exposure to the ultraviolet rays).

iv) Hazards arising due to hazardous/dangerous activities

1. Excavation works

Excavations are of three types:

- ✓ Trenches;
- ✓ wide excavations
- ✓ Pits/shafts (for pad and pile foundations)

They expose workers to similar hazards and accidents. Accidents in excavation works occur in one of the following ways

a. Collapse of sides / cave-in:

Cave-in is perhaps the most feared and chief cause of accidents in excavation works. It buries workers and/or cause crushing injuries to survivors.

b. Contact with necessities:

Works in excavations often encounter obstructions from intersecting utilities lines, if any, that may cause injuries and/or fatalities to workers by:

- ✓ Electrocution and/or explosion when electrical cables are damaged;
- ✓ Collapse of excavation due to flooding led by damage to water lines and/or sewer lines; and
- ✓ Drowning in floods from damaged water/sewer lines

c. Dangerous atmospheres:

Dangerous atmospheres in excavations may result from oxygen deficiency as well as the presence of carbon dioxide, carbon monoxide, nitrous fumes and methane gas, which suffocate workers, kill or cause respiratory problems.

d. Workers being struck by falling materials/objects from top.**e. Workers falling into excavations.**

Excavation-related accidents and identified five hazard rating variables for excavation works, viz:

- ✓ Excavation configuration (depth, width and length);
- ✓ Geological condition (soil type and water table);
- ✓ Presence of underground utilities (electrical, water and sewer lines)
- ✓ Nearby vehicular traffic (vibration and surcharge load); and
- ✓ Nearby structures.

2. Scaffolding and ladder works;

Scaffolding is the most common way of providing platforms to works at heights. The following hazards are associated with scaffold use:

- ✓ Workers falling from the working platform;
- ✓ Workers below the working platform being struck by materials falling from it; and
- ✓ The scaffold or part of it collapsing and throwing workers off with the collapsed structure and crushing workers under it or nearby.

Access to scaffolds is provided by ladders. Also, ladders themselves are often used as working platforms for the performance of light works. Many serious accidents result from the misuse of ladders because:

- (1) Ladders slip when users are climbing or working from them;
- (2) Users slip or miss their footing while climbing;
- (3) Users overbalance when carrying materials or tools; and
- (4) When defective ladders are used, they fracture under the weight of the user.

Two key risk factors in scaffolding and ladder-related accidents:

- **Design factors** - height of the scaffold/ladder; suitability of the type for the task and height; and adequacy of design (member size, bracing, guardrails, platform size, and toe board).
- **Work environment and conditions** – defects in the members of the scaffold/ladder; slippery condition on the platform; loading of materials and workers on the platform; and the nature of the platform the scaffold/ladder is rested on.

4. Workers being struck by falling materials/objects from top.

5. Workers falling into excavations.

3. Falseworks (temporary structures);

A falsework is defined as a temporary structure used to support a permanent structure during its construction and until it becomes self-supporting. Falseworks may be required to support in-situ and pre-cast concrete construction, masonry arches as well as timber and steel frameworks. Accidents in falseworks occur by two means:

- Total or partial collapse of falseworks leading to workers being thrown off or falling off from their place of work; and
- Other than the collapse of falseworks, workers slip and fall from falseworks through unprotected edges and holes of decking, and access ladders.

Two causes for falseworks collapses:

Inadequate design – deficiency in falsework design is caused by:

- (1) Failure to correctly estimate the type and extent of loading;
- (2) Inadequate foundation;
- (3) Incorrect choice or use of materials; and/or
- (4) Lack of provision for lateral stability.

Poor assembly – caused by the failure to inspect the materials (such as struts, planks, etc.), the soil condition at the foundation and the falsework erection

4. Roof works

Falls from roofs constitute the leading cause for work-related fall fatalities. The injuries caused by falls from roofs are typically extremely severe, requiring long periods of treatment and recovery and resulting in substantial medical costs (observed a higher proportion of roofing accidents during maintenance). These include roof edge falls, falls through fragile roofing materials and falls from the internal structure of roofs.

5. Erection of structural frameworks

The most serious accidents that occur during the erection and assembly of structural steel or pre-cast frameworks are:

- ✓ Erectors falling from heights when at their places of work, going to or returning from them;
- ✓ The collapse of the whole or part of the framework causing workers to fall or striking those at lower levels; and
- ✓ Workers at lower levels being struck by tools or materials falling or being thrown down.

The hazard level in erection works is dictated by the following variables:

- ✓ Height and size of the structure/erection;
- ✓ Design and erection method; and
- ✓ Provision of a safe workplace such as safe access/egress, safe working platform at heights, safe tools containers and safety equipment (safety belt, harness, net, etc.).

6. Crane use

Hazards associated with the use of cranes are:

- ✓ Overturning of a crane or the structural failure of its parts
- ✓ Dropping of the suspended load
- ✓ Electrocution
- ✓ Trapping of people
- ✓ Accidents during erection and dismantling as well as loading and unloading.

7. Construction machinery and tools usage

The types of machinery involved in accidents include excavators and shovels, earthmoving equipment (i.e. crawler tractors and bulldozers, scrapers and graders), dumpers and dump trucks, forklift trucks, road rollers and Lorries. Accidents in construction machinery usage occur in one of the following modes

- ✓ Workers being run-over or struck by machinery moving forward or reversing
- ✓ Collision between machinery or with fixed objects such as falseworks or scaffoldings;
- ✓ Overturning of machinery while in operation; and
- ✓ Workers falling from machinery.

These accidents are caused by the following major factors:

- ✓ Failure of machinery- inoperative back-up alarms, brake failures
- ✓ Inadequate site planning resulting in poor visibility, inadequate manoeuvre space
- ✓ Inadequate signboards and poor site traffic control;
- ✓ Lack of supervision and training of workers and operators; and

Use of construction tools cause injuries and fatalities to workers by the following ways

- ✓ Eye injuries caused by foreign objects getting into eyes by operations such as grinding, welding, cutting, drilling and breaking
- ✓ Finger/hand injuries by cut and burns
- ✓ Injuries caused by moving/broken machine parts
- ✓ Electrocution
- ✓ Vibration from powered hand-held tools, causing a group of diseases. One of them is blood circulation disturbance known as “vibration white finger”.

Most of the hazards are the result of faulty tools and/or unsafe handling of tools. Moreover, the type of tools and duration of use also dictate the hazard.

8. Welding and cutting works

Welding and cutting works on construction sites expose workers to both injury and health hazards. Injury hazards due to welding and cutting are:

- ✓ Fire or explosion due to extreme temperatures (up to 10,000° F) from welding sparks coming into contact with flammable materials (e.g. coatings of metals, gasoline, oil, paint, thinner, wood, cardboard, paper, acetylene, hydrogen, etc.)
- ✓ Electric shock from excess moisture (e.g. perspiration or wet conditions) and contact with metal parts which are "electrically hot"
- ✓ Injuries due to flying sparks, particles of hot metals, molten metals, liquid chemicals, acids or caustic liquids, or chemical gases or vapours
- ✓ Falls during work on ladders, above ground and in confined spaces.

Health hazards due to welding works are:

- ✓ Exposure to high noise levels from welding equipment, power sources and processes;

- ✓ Exposure to ultraviolet (UV) radiation resulting in skin burns and skin cancer. "Welder's flash" (brief exposure to UV radiation) may result in temporary swelling and fluid excretion of the eyes or temporary blindness
- ✓ Irritation of lungs due to heat and UV radiation
- ✓ Exposure to fumes and chemical substances

The level of hazard in welding and cutting works depends on the following variables:

- ✓ The volume of work
- ✓ Location of welding and cutting (confined space, underground, on ladders, etc.
- ✓ The use of safety protective equipment
- ✓ Housekeeping

10. Works in confined spaces

The term “confined space” refers to a space, which by design has limited openings for entry and exit, unfavorable natural ventilation that could contain or produce dangerous air contaminants and is not intended for continuous employee occupancy. Confined spaces include tanks, process vessels, pits, silos, pipelines, manholes, box girders and columns. Workers are required to enter confined spaces for tasks such as repair, inspection and maintenance, and are often exposed to multiple hazards. Fatal injuries that occur in confined spaces are most likely to be from atmospheric hazards. The types of atmospheric hazards in confined spaces can be quite varied – some examples are shown in Table below:

Type of atmospheric hazard	Example
1. Toxic gas	• Hydrogen sulphide • Carbon monoxide • Hydrogen cyanide
2. Inert gas	• Argon • Helium • Nitrogen
3. Simple asphyxiant	• Nitrogen • Methane • Carbon dioxide
4. Oxygen deficiency	• Oxygen in air consumed or displaced
5. Solvents	• Freons • Chlorinated hydrocarbons • Gasoline
6. Explosive mixtures	• Methane • Toluene vapour

The exact nature of construction activity, the components involve & the type of structure proposed are not available in details at this stage. Therefore, it is recommended that the construction contractors refer this document as a guidance and prepare an activity specific plan for safety & disaster management.

2.1.2.2 Operations Phase

In this section, the various components and the related activities are considered to identify the potential sources of hazard during operation phase of the project. However, these hazards are generic in nature as the individual capacity of industries and the extent of the operations envisaged within the project are not known at this point of time. Hence individual industries and developers need to formulate the specific Risk Assessment and Disaster Management Plan in line with the specific requirements, relevant statutes and regulatory framework.

The various hazards anticipated due to operation of various project components, utilities, facilities etc. during the operation phase are as under:

The following disasters may occur at the project site as depicted in **Table: 2.5**.

Table 2-3: Identification of Hazards during Operation Phase

Sr. No	Component		Hazard
1.	LPG release		Fire /explosion
2.	Diesel spill at DG set		Fire /explosion
3.	AC, refrigerators Units		Fire /explosion
4.	Vehicles		Accident/Fire /explosion /toxic / flammable gas release
5.	Transformer		Fire /explosion
6.	E – waste		Fire/ toxic release
7.	Break Electrical Wires		Fire/Shock
8.	Hazardous Waste		Toxic, corrosive
9.	Storage Area	Chemicals, fuels, hazardous waste etc.	Toxic, corrosive, Fire & Accident
16	Hospital Equipment		Toxic, corrosive, Fire & Accident
17	Patient handling	ambulatory (outpatients)	panic, chaos, hazard evacuation, avoidable injuries and loss of lives
		admitted patients (inpatients)	panic, chaos, hazard evacuation, avoidable injuries and loss of lives
18	Vehicle mishaps		Fire /explosion /toxic / flammable gas release
19	Services and Utilities	From within and from outside to inside the building (Water supply pipelines, Electricity cables & wires, Gas pipelines, Sewage pipelines, Telecommunication wires, Rainwater drain pipes, Elevators, Air-conditioning ducts)	Fire /explosion /toxic
19	Building Structure	Improper planning, design, construction and maintenance	Structural failure, Fire & Accident

2.2 Risk Evaluation

The next step in the disaster management cycle is assessment of risk level of probable disasters to understand their vulnerability potential. This analysis helps further to formulate a project specific 'Disaster Management Plan'.

This section describes the risk level associated with the identified 5 disasters in operation phase. The risk level is calculated by referring 'ASSA: OHS, T.4F4- Risk Level Calculators' version 7.0 issued in 01/2012' document.

- STEP 1: Consider how likely a risk is encountered and what might happen (Likelihood - L)
- STEP 2: Use the risk level calculator to determine the likely risk level to persons who may be exposed to the hazards (Consequences - C)
- STEP 3: Determination of Risk Level outcome
- STEP 4: Identify & develop effective control measure

The risk level of identified 5 events is explained in detail below:

STEP 1: LIKELIHOOD ANALYSIS

Table 2-4: Likelihood of Event Occurring

Likelihood of event occurring	
Almost Certain	Event is expected to occur in most circumstances
Likely	Event will probably occur in most circumstances
Possible	Event might occur at some time
Unlikely	Event could occur at some time
Rare	Event may occur only in exceptional circumstances

Table 2-5: Likelihood Analysis for Project Specific Disasters

Project Specific Disasters	Likelihood
Flood	likely
Earthquake	Unlikely
Cyclone	Rare
Landslide	Unlikely
Physical Hazards	likely
Fire/explosion/toxic release	likely
Building Collapse	Rare
Vehicle Mishap	likely

STEP 2: CONSEQUENCES ANALYSIS

Table 2-6: Consequence Level of Event Occurring

Level of Consequences	
Catastrophic (C)	Fatality or permanent disability; toxic release of chemicals, long-term environmental impact; loss of facilities; very high financial loss
High (H)	Long-term illness or serious injury; serious medium-term environmental effects; major property damage; loss of production; high financial loss

Moderate (M)	Medical treatment requiring up to several days off work; spillage contained with outside assistance; significant property damage; med – high financial loss,
Low (L)	Minor injury requiring First-Aid; spillage contained on site; moderate property damage; low-med. financial loss
Insignificant (I)	No injuries; minor property or environmental damage; very low financial loss

Table 2-7: Consequence Analysis for Project Specific Disasters

Project Specific Disasters	Level of Consequences
Flood	Moderate
Earthquake	Moderate
Cyclone	Low
Landslide	Low
Physical Hazards	Moderate
Fire	Moderate
Building Collapse	Low
Vehicle Mishap	Moderate

STEP 3: DETERMINATION OF RISK LEVEL OUTCOME**Table 2-8: Risk Level Matrix**

Likelihood → Consequences ↓	Risk Level Outcome				
	Almost Certain	Likely	Possible	Unlikely	Rare
Catastrophic (I)	E	E	E	E	H
High (H)	E	E	E	H	M
Moderate/Medium (M)	E	H	M	M	L
Low (L)	H	H	M	M	L
Insignificant (I)	H	M	L	L	L

Where, E – Extreme; H- High; M – Medium; L- Low;

Based on the results obtained for project specific disaster's likelihood & consequences, their risk level is determined as below:

Table 2-9: Determination of Project Specific Risk Level

Sr. No.	Project Specific Disaster	Likelihood	Consequence	Risk Level
1)	Flood	likely	Moderate	H (High)
2)	Earthquake	Unlikely	Moderate	M (Medium)
3)	Cyclone	Rare	Low	L (Low)
4)	Landslide	Unlikely	Low	M (Medium)
5)	Physical Hazards	likely	Moderate	H(High)
6)	Fire	likely	Moderate	H (High)
7)	Building Collapse	Rare	Low	L (Low)
8)	Vehicle Mishap	likely	Moderate	H (High)

STEP 4: IDENTIFY & DEVELOP EFFECTIVE CONTROL MEASURE

This step describes the type of actions required to control the measured risk.

Table 2-10: Action Plan for Risk Level

Sr. No.	Risk Level outcome (from matrix)	Action Required
1	E – Extreme	URGENT - Immediate action required to control risk
2	H- High	Highest management decision required urgently
3	M- Medium	Follow management instructions regarding risk
4	L- Low	These risks may not require immediate attention - monitor

The determination of risk control actions with respect to project specific disasters are given below:

Table 2-11: Determination of Project Specific Risk Control Actions

Sr. No.	Hazard	Risk Level outcome (from matrix)	Action Required
1	Flood	H (High)	Highest management decision required urgently
2	Earthquake	M (Medium)	Follow management instructions regarding risk
3	Cyclone	L (Low)	These risks may not require immediate attention - monitor
4	Landslide	M (Medium)	Follow management instructions regarding risk
5	Physical Hazards	H(High)	Highest management decision required urgently
6	Fire	H (High)	Highest management decision required urgently
7	Building Collapse	L (Low)	These risks may not require immediate attention - monitor
8	Vehicle Mishap	H (High)	Highest management decision required urgently

3 PREVENTIVE MEASURES**3.1 Safety Inspection**

Regular inspection of equipment and systems mandated by Chief Fire Officer in the NOC granted.

3.2 Approved Plan

- i) Scrupulous adherence to approved plan of buildings, Commercial & industrial units
- ii) Protection of system put in place to handle disaster.

3.3 Maintenance of Equipment And Systems

Preventive maintenance of following systems

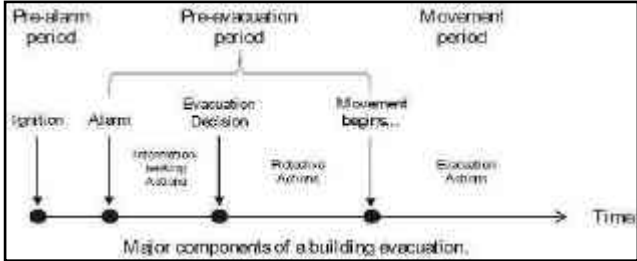
- ✓ Fire hydrant system.

- ✓ Sprinkler system.
- ✓ Ventilator
- ✓ Boyles Apparatus
- ✓ Bedside Monitors
- ✓ Colour Doppler
- ✓ Endoscopes
- ✓ Phototherapy unit
- ✓ Operating Microscope
- ✓ Detectors calibration.
- ✓ CCTV system.
- ✓ Emergency power system.
- ✓ Rescue equipment.
- ✓ Emergency communication systems
- ✓ Industrial Equipment
- ✓ Any other equipment as deemed necessary

3.4 Precautions and Preparedness During Construction Phase

1.	Flood	- Proposed project will have proper drainage network. Storm water drainage plan is attached as Annexure. - To provide emergency management training for workers & staff - Preparedness of Evacuation of Plan - Dewatering pump - Life jackets, Floats, - Ring buoys. - Counter Plan showing catchment areas
2.	Earthquake	- New seismic design/methods/techniques will improve the structural stability of the Building / Unit which will help to reduce damage. - To provide emergency management training for workers & staff - Preparedness of Evacuation of Plan
3.	Cyclone	- New seismic design/methods/techniques will improve the structural stability of the Building which will help to reduce damage. - To provide emergency management training for workers & staff - Preparedness of Evacuation of Plan - Lightening arrestors (during construction phase also)
4.	Landslide	- To provide emergency management training for Occupant, workers & staff - Preparedness of Evacuation of Plan - Slope stability and landslide prevention measures (such as plantation etc.)

5.	Physical Hazard	- To provide emergency management training for Occupant, workers & staff - Work inspection should be carried out - SOP should be prepared and followed - Housekeeping should be carried out in construction & operation phase - Proper personal protective equipment should be used.
6.	Fire	- Fire detection and alarm at fire Control room system, Automatic Smoke detector system especially at electric meter room, Automatic Water sprinkler system with Thermal Detector. CCTV security system, Sprinkler System. - Fire water Underground storage tank, Fire water pumps, Portable Fire extinguishers CO2, DCP, Foam, sand buckets type, Emergency power DG set, Mechanical Ventilation system, Two hrs. Fire Resistant Doors. - To provide emergency management training for workers & staff - Hazardous material kept away from worker & staff during construction & operation phase - Proper personal protective equipment should be used.
7.	Building Structure	- New seismic design/methods/techniques will improve the structural stability of the Building / Unit which will help to reduce damage. - To provide emergency management training for Occupant, workers & staff - Preparedness of Evacuation of Plan
8.	Vehicle Mishap	- Provide adequate signs and signages - Signs at lift landings, - Floor numbering signs, - Stair and elevator identification signs, - Exit signs at each exit door, Stair re-entry signs, - Floor layout plans, - Escape route direction signs. - Escape route near each change of direction in the route, - Install safety mirrors to aid visibility in conflict points - Provide speed humps to regulate speed of vehicles - Exit signs - Escape route direction signs. - Escape route near each change of direction in the route - Emergency Control Centre (ECC) and First aid - Assembly point, Emergency Control Centre (ECC) and First aid, Danger sign at electrical rooms.
9.	Improper Patient handling in the hospital	Hazards and Risks: In and around the hospital through prominently displayed posters, wall hangings and hoardings. The posters, wall hangings and hoardings shall be permanent and displayed at all times in the hospital premises and shall be updated as necessary. Emergency Exit Routes and Evacuation Plans: to be followed during disasters through the prominent display of exit and

		evacuation route maps at strategic locations throughout the hospital premises. Hospitals shall also ensure that their alarms, emergency communication and Hospital Safety and Security Procedures, adequately take into consideration the needs of patients, their attendants and visitors; and ensure that no panic and chaos is initiated.
10.	Construction Activities	• Environment, Health & Safety Policy communication to all the employees & workmen through display boards, Posters, EHS Meetings & Pep Talk & etc. • Appointment of OHSAS certified contactor • Implementation of OHSAS 18001 during Construction work • Observe "No Smoking" rule • Periodical maintenance of safety construction machinery, equipment by certified, competent person at regular intervals. • Work Permit Systems. • Use of Proper PPE's like Helmet, Goggles, boot & hand gloves etc. • Use of safety nets while working from heights, use of life line • Safety trainings/ safety checks/ and use of PPE • Proper storage and handling of any potentially hazardous chemicals, gases. • Educating / Training of all concerned on adoption of safe practices at construction site. • Documentation, investigation of every dangerous occurrence and required notifications and reports to the appropriate authorities.
11.	Emergency Evacuation	Ensure effective emergency communication during evacuation to avoid panic and stampede. Siren / bell with clearly defined emergency alarm code for fire, evacuation and all clear. Intercoms & Cell phones, Two way radio, Hand held loud speaker.  In order to reduce the evacuation time other than movement period Periodic Safety Awareness programs are suggested for effective and timely evacuation.
12.	Search & Rescue Kit	Torch with battery, Whistles, Ropes-Nylon (800 m) , Ladder

		Search light Two way radio Manual Siren Portable Mega Phone Metal Cutting set, Hand tools (Axe, shovel). Barricade tape, Flags, First Aid Box, Stretcher PPE - Safety shoes, hard hats, Mask, Reflective jackets.
13.	Personnel Protective Equipment (PPE)	Safety Helmet, Safety Goggles, Safety Shoes/ Boots, Masks, Life jackets, Full Body Harness
14.	DMP	DMP Copy at ECC Structural audit Mock drill, fire drill, Periodic Safety Training for Construction workers, fire DMP awareness programs for Staff, workers & occupants

3.5 Preparedness

3.5.1 Warning System

- Nodal agencies for early warning of different natural hazards

Disasters	Agencies
Earthquakes	IMD
Floods	Meteorology Department, Irrigation Department Central Water Commission
Cyclones	IMD (Indian Meteorological Department)
Epidemics	Public Health Department
Road accidents	Police
Industrial & Chemical Accidents	Industry, Police
Fires	Fire Brigade, Police
Landslides	Geological Survey of India

- Two-way communication to emergency respondents.
- Warning to workers by PAS/ hand held loudspeaker and Siren electrical/ hand operated located at strategic location and operated from at ECC by fire & security department.

3.5.2 Siren Code

Emergency Level 1 & 2	:	One continuous wailing sound of 30 seconds duration. Repeat after a minute.
Emergency Level 3	:	Three interrupted wailing sounds of 15 seconds duration each with a gap of 30 seconds. Repeat after a minute gap.
All Clear	:	Long whistle of one minute duration.

3.5.3 Fire Protection System

- ✓ Fire Alarm System
- ✓ Portable Fire extinguishers CO₂ , DCP , Foam , sand buckets type ,
- ✓ Emergency power DG set

3.5.4 Emergency Control Centre (ECC)

Emergency Control Center - Construction Phase	
Emergency level	Construction Phase
Emergency Level 1	Security Office – Construction Contractor
Emergency Level 2	Security Office of OSC
Emergency Level 3	Site Safety Managers Office.
Emergency Control Center - Operation Phase	
Emergency Level	Operation Phase
Emergency Level 1	Security Office of Individual Units
Emergency Level 2	Security Office of OSC

ECC equipped with following items;

- ✓ Copy of “DMP” and Technical Manuals on operating, maintenance procedures.
- ✓ Telephone (Internal and External).
- ✓ Networked Computer Systems, Note pads, pencil etc.
- ✓ Personal Protective Equipment (PPE). Safety helmets, Safety shoes, Safety goggles, Reflective jackets, SCBA, Full Body Harness
- ✓ Public Address System (PAS).
- ✓ Control panels & layout drawing for CCTV, Fire Alarm, electrical single line diagram.
- ✓ First aid box, stretcher Hand tools (Axe, shovel), Mega Phone, Manual siren, Ring buoys, Explosive meter Search light/ torch, Spare Portable fire extinguishers
- ✓ Uninterruptible Power Supplies with Generators.

3.5.5 Life Saving Measures (Fire Safety Plan)

- ✓ Evacuation diagram
- ✓ Assembly point
- ✓ Site surroundings map

3.5.6 Assembly Point

Assembly Point - Construction Phase	
Emergency Level	Construction Phase
Emergency Level 1	Near Site Office.
Emergency Level 2	Near Site Office.
Emergency Level 3	Near Site Office.
Assembly Point - Operation Phase	
Emergency Level	Operation Phase
Emergency Level	Residential, Industrial & commercial
Emergency Level 1	Outside the respective building/unit
Emergency Level 2	Nearest RG

Guidelines to Reduce Evacuation Time

Measures Proposed	Additional Measures Required
Pre Alarm Period	
1. Early warning system a) Fire alarm & fire detection system. b) Signal located at fire Control room. c) With appropriate zonal indications. d) Smoke detector system. e) Auto water sprinkler with Thermal. f) Detector. g) LPG /PNG detector system. h) CCTV system. 2. Watch and ward staff.	1. Automatic smoke detection system shall be provided in lift machine room and electric meter room. 2. Trained security staff & fire staff shall be posted on duty at strategic location around the clock.
Pre Evacuation Period	
1. Communication systems a) Intercoms & Cell phones. b) Public address system. c) Hand held loud speaker. d) Two way radio. e) Siren.	1. Periodic Awareness programs.
Movement Period	
1. Detailed SOP's for disaster management in Section 9 of DMP. 2. ECC, Refuge floor, Escape route signage, enclosed staircases, fire resistance doors, illumination of escape route, emergency power supply etc. as per NBC provisions.	1. Mock drill shall be conducted regularly 2. Building / Unit management system 3. Voice evacuation system will be additional advantage

3.5.7 Decontamination Support

Sources of contamination such as accidental oil spills e.g. Diesel, transformer oil; paint brush washings during construction phase will be minimized by using mechanical means to contain & recover the oil & chemical means to disperse or clean it.

3.5.8 Special Population Support

Special consideration during evacuation required construction workers at site during construction phase.

3.5.9 Training

Drills:

These test a single emergency response function and involve an actual field response. Drills are generally practiced or tested under realistic conditions.

Functional Drill:

This is used to assess the allocation of resources and manpower. It also evaluates the communication between different groups and assesses the adequacy of current procedures and policies. The exercise is a simulation and while it covers the complete extent of the deployment of resources at the simulated level it does not go beyond the exercise room.

Mock Drill/ Full Scale Exercise:

Evaluates the operational capability of the system in an interactive manner, allows for coordination of information, communication capabilities to be explored, inter-tenant and tenant landlord cooperation to be explored and for negotiation skills to be deployed. Full scale exercises will have a number of observers and invitation to the relevant government agency to attend. Observations will be recorded and actions will be implemented based on learning points that are discussed at the review session, where necessary.

Note: Real Emergencies during Exercises

There is always the potential for a real emergency to arise during the conduct of a drill. This situation calls for an immediate cessation of the exercise/drill and Emergency respondents should stand by for further instructions.

4 ON-SITE DISASTER MANAGEMENT PLAN

4.1 Disaster Management Organization

DMP ORGANISATION			
Sr. No.	Designation for DMP	Construction Phase	Housing Society Operation Phase
		Designation / Agency / Group	Designation /Agency / Group
1	Site Main Controller	Project manager	Chairman of CHS, Incharge of Industry & Commercial Units
2	Site Incident Controller	Site manager	Secretary of CHS, Industry & Commercial Units
3	Emergency Coordinator	EHS Manager	Manager CHS, Industry & Commercial Units
4	Supervisor	Site Supervisor Contractor supervisor	Fire & Safety staff
5	SAR Team	Security guards ,First aiders , Fire fighters, staff & workmen, External IRTS	watch & ward personnel, Police, fire brigade; Agencies sent by district disaster control room such as Civil defense, NDRF, medical team, home guard etc.
6	Engineering Team	Electricians , operators	Pump operators Electricians
7	Advisory Team	Architect , Consultants	Active past committee members
8	All others at site	Contractors, Staff, Workers, Visitors, Drivers, construction workers colony	Residents shops Occupants Visitors

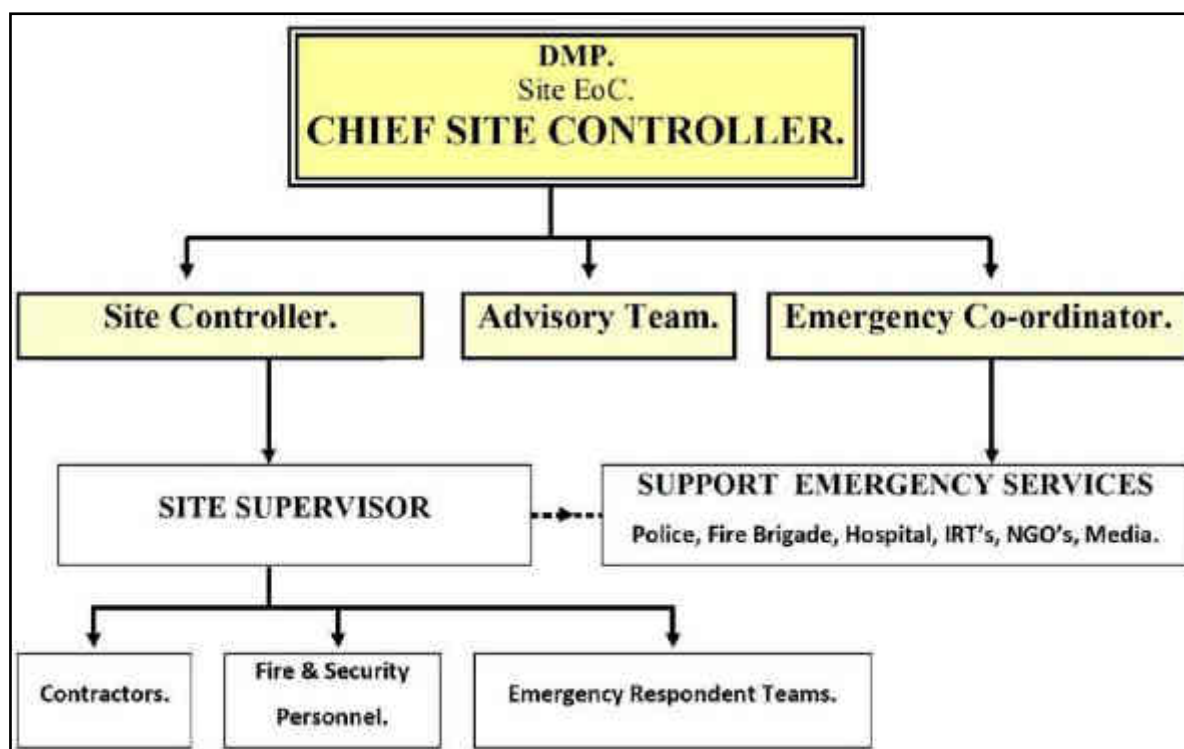


Figure 4-1: Structure of Onsite Disaster Management Cell

4.2 List of DMP Resources Proposed

(Hazard specific infrastructure, equipment and manpower)

Item No	Name	Description
1.	Life Protection	
		PORTABLE FIRE EXTINGUISHERS.
		Carbon Dioxide (CO2) fire extinguisher
		ABC Dry Powder fire extinguisher
		Foam Type fire extinguisher
		Sand Bucket post buckets with sand.
		FIRE ALARM SYSTEM
		Response Indicator at ECC.
		Addressable Fire Alarm Panel.
		Emergency Power: DG Set
2.	SAR KIT	Torch with battery.
		Whistles.
		Ropes -Nylon (800 m).
		Ladder.
		Search light.
		Two-way radio.
		Hand Operating Siren.
		Metal Cutting set.
		Life jackets.
		PPE – Safety Helmet.
		PPE – Safety Goggles.
		PPE – Safety Shoes/ Boots.
		PPE – Reflective jackets.

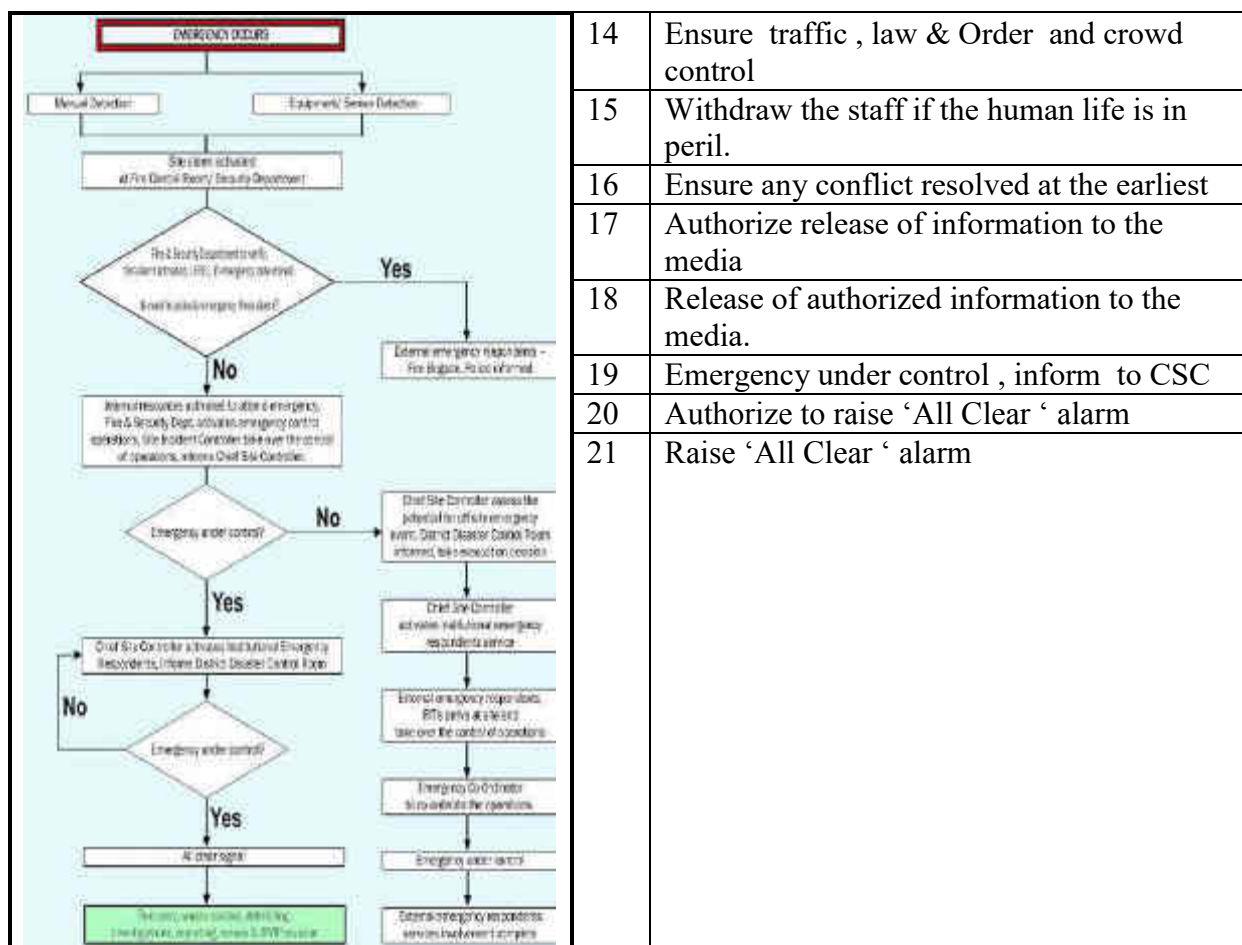
		PPE – Masks.
		PPE –safety harness ,net
		Public Address System (PAS).
		Portable Mega Phone.
		Barricade tape.
		Flags.
		Emergency lights in escape route.
		First Aid Box.
		Stretcher.
3.	SIGNAGES	layout plans. ,Assembly point., Emergency Control Centre (ECC). ,First aid.Danger at electrical rooms. Exit signs at each exit door.
4.	Security	Watch and ward system
		Vehicle checking mirror

Note: The Ministry of Home Affairs, Government of India has developed a web-based database of resource named India Disaster Resource Network (IRDN). This database contains information about **equipment** (such as boats, bulldozers, chain saw, etc), **manpower** (divers, swimmers, etc) and **critical supplies** (oxygen cylinder, firefighting foams, etc) required during response. It can be accessed by anyone and its direct link is <http://idrn.gov.in/publicaccess/countryquerypublic.asp>. One can also access it by clicking on the **Quick link to inventory of disaster response resources** on the idrn site (idrn.gov.in);

4.3 Emergency Response Guide

Where the numerical indicate task, number detailed in the following table.

DMP FLOW CHART	S.N	Task
	1	Raising the site emergency alarm.
	2	Inform police, Fire brigade and Mobilizing site emergency services.
	3	Determination of level of emergency, help from Advisory team, if required.
	4	Mobilizing ECC and AP.
	5	Mobilizing Emergency Respondent teams, (IRT's)
	6	Mobilize resources for emergency response teams
	7	Ensure Co-ordination between site emergency services.
	8	Review situation, assess the emergency level, consult advisory team, take external help if required, inform district disaster control cell, and declare off site emergency.
	9	Evacuation
	10	Ensure operations as per SOP
	11	Ensure proper coordination between all IRTs
	12	Head count at assembly point
	13	Feedback of head count to SAR



4.4 Rescue and Relief Operation

The priority of the SAR will be to:

- ✓ Protect life;
- ✓ Maintain safety;
- ✓ Protect assets;
- ✓ Ensure security; and
- ✓ Maintain or return business continuity.

4.5 Requisition of Off-Site Services/ Assistance

In case of any situation beyond the scope of On-site Disaster Management Plant, the Emergency coordinator will establish communication with all the relevant external agencies for requisition of services/support.

5 OFF-SITE DISASTER MANAGEMENT

The Offsite Disaster Management Plan is aimed at responding to the disaster and establish various protocols to minimize the loss of life and property with aid of external agencies including local, regional or state level support. Different stakeholders from the proposed development, district administration, public, NGO sector, civil defense, interest groups are required to play a major role in disaster mitigation. It has been divided into three phases viz Pre-Disaster Phase, Impact Phase and Recovery Phase.

5.1 Pre-Disaster Phase

Preparedness in "no disaster situation"; in the pre-disaster Phase - prevention, Mitigation and Preparedness activities are undertaken. The key activities are:-

- ✓ Formulation/updating of the Disaster Management Plan.
- ✓ Allocation of responsibilities to the individual respondents / Groups/ Institutions/ Organizations.
- ✓ Training and capacity building etc.

5.2 Impact Phase

This phase includes relief measures taken immediately after the disaster. The key activities are:-

- ✓ Rescue operation/Evacuation by teams (already identified) and providing basic infrastructure and movement to rescue centers.
- ✓ Functioning of the Disaster management Control Rooms
- ✓ To take Coordination with Disaster management stake holders and Control Rooms such as
 - Police control room
 - Fire brigade control room
 - District disaster management control room
 - Civil defence control room
 - High way authorities control room
- ✓ Management of Rescue Shelters
- ✓ Monitoring Disaster Management by ensuring a line of control through
 - Police & Paramilitary forces,
 - Civil Defence,
 - Fire services, Civilians,
 - NGOs etc.
 - Administration of Relief.

5.3 Recovery Phase

All measures at this stage aim at damage assessment and relief to achieve speedy recovery of the affected areas and return to normalcy and to mitigate the long-term consequence of the disaster. The key activities are:-

- Assessment & enumeration of damage.
- Developing a Reconstruction and Rehabilitation plan.
- Monitoring Relief Operation organized by outside agencies/ NGOs/ PSUs/ other states etc. through District Administration.
- Restoration of Communication- Roads, Railways, Electronic Communication etc.
- Maintenance of Law & Order.
- Provision of Medical facilities, Minimum sanitation, drinking water, food etc. Removal of debris and disposal of carcasses.
- Coordination with Disaster management Control Rooms and stakeholders to take stock of the situation.
- Collection of Information and submission of daily situation report to Government through District Collector.
- Documentation of the entire event - Black & white/ Audio & Video.

5.4 Disaster Management Cycle

Three major functional areas were recognized as necessary components of a comprehensive approach; prevention, response and recovery. The key responsibilities of agencies include:

- **Planning**
The analysis of requirements and the development of strategies for resource utilization
- **Preparedness**
The establishment of structures, development of systems and testing and evaluation by organizations of their capacity to perform their allotted roles
- **Co-ordination**
The bringing together of organizations and resources to ensure

5.5 Mitigation Measures

- **Provision of Helpline number:** The Helpline number shall be displayed at prominent public places and Panic/ Emergency call points are installed throughout the smart city.
- **Call Centre for Residents:** Residents can call to Emergency response call center by means of mobile, landline, installed emergency call points and established two-way audio communications with Emergency Response Team.
- Helpline Call Center from Command and control center will receive call and providing response mechanism for safety, security, utility management.

- Well trained operators will provide the response solution based on the type of call / emergency.
- Response team such as police help, fire help, medical help, etc. shall be integrated to Emergency Response System.

5.6 Warning System

Nodal Agency:

Nodal agencies for early warning of different hazards:

Table 5-1: Nodal agencies for early warning of different natural hazards

Disasters	Agencies
Earthquakes	IMD, MERI
Floods	Meteorology Department, Irrigation Department Central Water Commission
Cyclones	IMD(Indian Meteorological Department)
Epidemics	Public Health Department
Road accidents	Police
Industrial & Chemical Accidents	Industry, Police
Fires	Fire Brigade, Police
Tsunami	Indian National Centre for Oceanic Information Services (INCOIS) Hyderabad
Landslides	Geological Survey of India

5.7 Role & Responsibilities

Police Commissionerate

- ✓ Maintain law and order
- ✓ Control crowd
- ✓ Dispose of corpses
- ✓ Transport / shift injured persons to hospitals
- ✓ Transport / shift stranded or affected persons through police and other vehicles
- ✓ Aid and supplement efforts and activities of all other departments and agencies with regard to disaster management.

Fire Brigade

- ✓ Firefighting operations in the affected area
- ✓ Rescue operations
- ✓ Transport of injured to the hospitals on a priority
- ✓ Evacuation of persons from the affected area
- ✓ Ensure safety from electrical installations or power supply at disaster site
- ✓ Clearing of roads or pathways due to uprooted trees
- ✓ Salvage operations

Hospital

- ✓ First-aid to victims of accident and treatment at local level.
- ✓ Hospitalization and treatment in the case of large scale exposure.
- ✓ Ensure availability of adequate medicines/equipment.

DETAILS	CONTACTS
Pen Fire Station	101
Disaster Management Cell	(022)-25331155
Pen Police Station Police Department Hanuman Ali, Ziral Ali Pen, Maharashtra 402107	02143 252 066
Police Control Room	100
Hospitals & Ambulance	
Mahajan Hospital Agri Samaj Rd, Chinchpada Pen, Maharashtra 402107	02143 252 418
Soham Hospital Prem Nagar Rd, Chinchpada Pen, Maharashtra 402107	092723 36664
District Civil Surgeon Blood Bank Rotary Club New Panvel Charitable Trust S Late Dr. B.V. Limaye Blood Bank	022 27459322, 022 32092960
NDRF National disaster Response Force	+91-9711077372
SDRF	022- 26514742/26556805 9833620113

ANNEXURE 1: Standard Operating Procedure (SOP)

Sr. No.	Procedures
A.	CONSTRUCTION PHASE
1.	Excavation
2.	Tower Crane
3.	Scaffold – Fixed and Mobile
4.	Bar Bending
5.	Bar Cutting
6.	Construction fires
B.	OPERATION PHASE
7.	Flood
8.	Earthquake
9.	Fire
10.	Lightning

CONSTRUCTION PHASE:**1. Excavation/Trenching**

Standard Operating Procedure – Safety Department	
Subject: Excavation Or Trenching	Number: 01
Effective Date:	Page:

- 1. Objective:** To carry excavation work smoothly and control accidents generally occurs due to excavation hazard & risk.

2. General Information:

Excavation and trenching are among the most hazardous construction operations. Excavation is any man-made cut, cavity, trench, or depression in the earth's surface formed by earth removal. A trench is defined as a narrow underground excavation that is deeper than it is wide, and is no wider than 15 feet (4.5 meters).

2.1 Excavation Risks:

- The most common hazard at any work site is the threat of cave-in. A cave-in occurs when walls of an excavation collapse
- Accidental contact with utility lines
- Crushing and striking hazards posed by mechanized equipment
- Atmospheric Conditions
- Materials/Equipment falling into excavation site
- Struck by Accidents
- Asphyxiation
- Explosion
- Fall Hazard

2.2 Preparedness:

- Re-route traffic whenever possible, and keeping only the heavy; Construction equipment needed near the excavation
- Keeping the spoil pile at least 2 feet back from the edge of the excavation
- Pumping water out of the excavation before any one enters it
- Using protective systems when required
- Establish and maintain a safety and health program for the worksite
- Provide adequate systematic policies, procedures, practices
- Wear warning vests when near traffic
- Trained employees to operate heavy equipment
- Passing order to Stay away from loads being handled by lifting/digging equipment
- Use barricades, hand or mechanical signals, stop logs to keep operators safe
- Barricade or cover wells, pits, shafts
- Use appropriate PPE's.
- Trenches 4 m or more feet deep need a safe means of egress
 - Stairway
 - Ladder
 - Ramps
- Means of egress shall kept fixed and secure
- Keep surface materials approximately 2 feet from the edge of excavation sites

2.3 Access and Egress

- Safe access and egress to all excavations, including ladders, steps, ramps, or other safe means of exit for employees working in trench excavations 4 feet (1.22 meters) or deeper. These devices must be located within 25 feet (7.6 meters) of all workers.

3. Roles & Responsibilities

3.1 Roles & responsibility of Head- HSE:

1. Will restrict the entry of un protected trench.
2. Arrange protective system to 5 feet (1.5 meters) deep or greater trenches before permitting the entry.
3. Arrange protective system be designed by a registered professional engineer to 20 feet (601 meters) deep or greater.

3.2 Roles and responsibilities of Project Manager:

1. Inspection of trench condition daily before workers entry to eliminate excavation hazard.
2. Ensuring heavy equipment are away from the trench edges.
3. Ensuring surcharge load at least 2 feet (0.6 meters) from trench edges.
4. Test for low oxygen, hazardous fumes and toxic gases before workers entry.
5. Inspect trench at the start of each shift.
6. Inspect trench following a rainstorm.
7. Provision of PPE's for the workers.

3.3 Roles and responsibilities of Site supervisor:

1. Check the barricades of all edges do they are on their place or not.
2. Check the excavated debris is unloaded away from the trench
3. Inspect ladders, steps; ramps are in safe conditions for workers use.
4. Ensure the use of PPE's by excavation workers
5. Ensure the worker is following safe working procedure or not.
6. Take PEP talk daily for workers before starting the work.
7. Immediate reporting to the safety manager in case of any accident & its recording.
8. Immediate reporting to the safety manager in case of finding any unsafe condition.
9. Arranging first aid facility or ambulance immediately in case of injury to any personnel.

3.4 Roles and responsibility of worker:

1. Follow the safety supervisors/ officer direction for work.
2. Use of provided PPE's while working.
3. Immediate reporting to safety supervisor/ officer in case of any danger.
4. Keep tools at its proper place after completing the work.

2. Tower Crane

Standard Operating Procedure – Safety Department	
Subject: Tower Crane	Number: 02
Effective Date:	Page:

- Objective:** To carry lifting, shifting and material handling task without any damage to the human and property and also to avoid accidents generally occurs due to tower crane operation

2. General Information

2.1 Operating rules for crane operators

- The crane should be centered over the load before starting the hoist to avoid swinging of the load as lifting starts. Load should not be swung by cranes to reach areas not under or within reach of crane.
- Crane should be operated smoothly to avoid jerk & abrupt movements of the load. Slack must be taken from the sling & hoisting ropes before the load is lifted.
- The crane hoisting ropes should be kept vertical. Crane must not be used for side pulls.
- The area should be clear and all persons in the area aware when load is lifted. This is to be ensured by a warning signal while lifting, lowering & while moving. Additional warning signal to be used in high traffic density area.
- The load should be checked to be certain that it is lifted high enough to clear all observations and personnel when moving.
- Loads must not be carried over people, especially loads carried by magnets. Load or part of loads, held magnetically may drop. Failure in power to magnets will result in dropping of the load unless backup power supply is furnished.
- Lift should not be attempted beyond the rated load capacity of the crane, sling ropes chains etc.
- On all capacity near capacity loads, the hoist brakes should be tested by returning the motor switch or push button to the OFF position after raising the load a few inches of the floor. If the hoist brakes do not hold the load should be set on the floor and the crane not further operated. The defect should be reported immediately to the supervisor.
- Before moving a load, load slings, load chains or other load lifting devices must be fully seated on the saddle of the hook.
- The block should never be lowered below the point where less than two full wraps of the rope remain on the drum. Should all the rope get unwrapped from the drum, it should be rewound in the drum groove in the correct direction and seated properly in the groove otherwise the rope may get damaged and the hoist limit switch will not operate to stop the hoist in the high position.
- At no time a load should be held suspended from the crane with the power “ON” unless the operator is at the operator’s switch. Under this condition the load should be kept as close as possible to the floor to minimize the possibility of an injury if the load should drop.
- When a hitcher is used, it is the joint responsibility of the crane operator and the hitcher to see that hitches are secure and that all loose materials has been removed from the load before starting a lift.
- Sling hooks hanging loose should not be used to lift loads (if slings hooks are not needed, they should be properly stored)
- All slings or ropes should be removed from the crane hooks when not in use (Dangling slings or hooks hung in sling rings can inadvertently snag other objects when moving the crane)

15. The crane should not be operated if the limit switches are out of order or if ropes show defects or wear.
16. Crane operators should not use limit switches to stop the hoist under normal operating conditions.
17. Limit switch should not be blocked adjusted or disconnected in order to go higher than what switch will allow.
18. Electrical limit switches or warning devices should never be bypassed.
19. Upper limit switches and lower limit switches should be tested in stopping the hoist at the beginning of each shift or as frequently as may be directed.
20. Load limit switch or overload devices must not be used to measure loads being lifted. This is an emergency switching device and is not to be used as a production operating control.
21. A crane should never move or bump another crane that has a warning signal displayed.
22. Contact with runway stops or other crane shall be made with extreme caution. The operator must take particular care for the safety of persons on or below the crane and only after making certain that persons on the other cranes are aware of what is being done.
23. If plugging protector is not provided, the controller must always be stopped momentarily in **OFF** position before reversing (A slight pause is necessary to give the braking mechanism time to operate.)
24. In case of an emergency or swing inspection, repairing, cleaning or lubricating a warning sign or signal should not be displayed and the main switch should be locked in **OFF** position.
25. A attempt should never be made to close a switch that has an **OUT OF ORDER** or **DO NOT OPERATE** card on it. It is necessary to make a careful check to determine that no one else is working on crane, before removing the card.
26. If the electrical power is disrupted, the controllers must be placed in **OFF** position and kept there until power is again available.
27. Before closing main or emergency switches, all controllers must be in **OFF** position before reversing expect to avoid accidents (a slight pause is necessary to give the breaking mechanism time to operate)
28. Before leaving the crane the operator should perform the following:
 - a) Raise all hooks to an intermediate position
 - b) Spot the crane at an approved designated location
 - c) Place all controls in **OFF** position
 - d) Open the main switch to the **OFF** position
 - e) Make visual check before leaving the crane

3. Roles & Responsibilities:

3.1 Roles & responsibility of Head- HSE:

1. Will allot an certified contractor for this tower crane work
2. Will check weekly report of an tower crane operation

3.2 Roles and responsibilities of Project Manager:

1. Will inspect the tower crane installation with its engineer
2. Will check daily maintenance report done by its engineer
3. Will take care of the comfort of the tower crane operators by doing rotation shift wise
4. Will ensure that operator is certified and competent for the operation
5. Will ensure the medical checkup report of the operator before allotting for the job
6. Should provide required PPE's

3.3 Roles and responsibilities of Safety supervisor:

1. Should direct and supervise tower crane operation
2. Should check the use of necessary PPE's
3. Should ensure that no one stand below the tower crane while operation
4. Will ensure presence of fist aid box in the tower crane cabin

2. Scaffolding- Fixed and Mobile

Standard Operating Procedure – Safety Department	
Subject: Scaffolding- Fixed And Mobile	Number: 03
Effective Date:	Page:

1. Objective: To avoid the fall accident while working on scaffold

2. General Information

2.1 Potential Hazards

- Collapse of scaffold due to overload, sinking into ground, struck by site traffic, insufficient bracing, unlocked castors.
- Incorrect assembly of scaffolding (insufficient planks, mismatched parts, no guard rails, fittings unsecured, work platform split or has gaps)
- Material handling hazards (force, posture, lifting, lowering, pushing/pulling and vibration)
- Struck by falling objects
- Slip/Trip/Fall
- Exposure to weather
- Sprains/Strains
- Electrocution

2.2 Pre-Operational Safety Checks:

- Ensure all components are well maintained. Do not use components that are in poor condition.
- Do not mix components from differently branded scaffolding systems.
- Read and follow the manufacturer's specifications, assembly instructions and warning labels.
- Inspect scaffold before its first use and at the start of each day. Ensure scaffold remains level and plumb at all times. Incomplete or defective scaffolds must never be accessed. Use barricades, danger tags or warning signs to prevent unauthorized access.
- Ensure edge protection (hand rails, mid-rails and toe boards) is provided at every open edge of a work platform
- Familiarize yourself with safe work procedures for the task.
- Wear appropriate personal protective equipment such as safety footwear (with slip-resistant soles), safety glasses and head protection.
- Review weather conditions before starting. Do not work during a storm, wet conditions or high winds.

2.3 Operational Safety Checks:

- Castor brakes are to be applied at all times while the mobile scaffold is stationary.
- Access is to be only by way of an internal ladder. No climbing is allowed on the scaffold itself.
- Only work on fully planked work platforms. Ensure that working platforms are kept clear of debris and obstructions along their length. DO NOT leave tools and equipment on scaffolds.
- Scaffold is not to be moved while workers are on the scaffold work platform.

- Limit the number of workers on a scaffold at any one time. More than one worker should be present as a safety precaution.
- DO NOT exceed the safe working load of the scaffold.
- DO NOT make any unauthorized alterations to the scaffold (such as removing guard rails, planks, ties, toe boards and braces).
- DO NOT permit workers or other persons to stand directly below a scaffold.
- DO NOT drop materials from the platforms.
- DO NOT fix high voltage leads and cables to the scaffolding.
- NEVER use ladders or makeshift devices on top of scaffolds to increase height.
- Adhere to the work practices itemized on the safe work method statement.
- If identified controls are insufficient, cease work, revise processes, implement new controls and resume work. Document any changes on the SWMS/risk assessment.

2.4 Safety Tips:

- DO NOT use scaffold unless you have been trained in its safe use and operation.
- Inspect scaffold before its first use and at the start of each day.
- Do not work in isolation when using scaffolding.
- Scaffolding less than 4 m is to be supervised by a competent person.
- Work on mobile scaffold above 6 m must be undertaken by licensed scaffolder
- Scaffold must be inspected by safety officer after installation before use.

3. Roles & Responsibilities:

3.1 Roles & responsibility of Head-HSE:

1. Will allot an certified personnel for this scaffold installation
2. Should ensure the quality and durability of scaffold system and its necessary parts

3.2 Roles and responsibilities of Project Manager:

1. Will inspect the scaffold installation with civil engineer
2. Will check daily maintenance report done by its engineer
3. Should check report of scaffold condition
4. Should provide required PPE's

3.3 Roles and responsibilities of Site supervisor:

1. Should inspect the scaffold thoroughly periodically
2. Should ensure lifeline hooks at risky area work
3. Should ensure daily maintenance of scaffold
4. Should check the use of necessary PPE's

3.4 Housekeeping staff

1. Check and maintain all scaffold parts. Repair or discard and replace any damaged pieces immediately.
2. Lubricate moving parts of all fittings.

4. Bar Bending

Standard Operating Procedure – Safety Department	
Subject: Bar Bending	Number: 04
Effective Date:	Page:

1. Objective: To avoid the fatal and other injuries while working bar bending machine

2. General Information

2.1 Pre-Operational Safety Checks:

- Guards or safety devices must never be removed or adjusted, except by an authorized person for maintenance purposes.
- Working parts (ie. hinges) should be well lubricated and working surfaces kept free of rust and dirt.
- Ensure no slip/trip hazards are present in workspaces and walkways.
- Be aware of other personnel in the immediate vicinity and ensure the area is clear before using equipment.
- Familiarize yourself with all machine operations and controls- refer to ‘User Manual’.
- Faulty equipment must not be used. Immediately report suspect machinery.

2.2 Operational Safety Checks:

- Never use this machine for bending metal that is beyond the machine’s capacity with respect to thickness, shape, or type. Refer to the manufacturer ‘User Manual’.
- Never attempt to wire, strap, or spring steel sheets in this machine.
- Adjust for thickness of work piece – rotate adjusters either ends of clamp bar.
- Insert work piece and align bending edge of clamp bar & bending-beam with the bend line of the work piece.
- Press and hold the ‘START’ button (this applies pre-clamping pressure to the work piece).
- Using other hand lift handle (this applies full clamping) and continue bend to required angle.
- Keep clear of moving handles and bending-beam.
- Slotted or short clamp bars should be used for bending box shapes – refer to ‘user manual’.

3. Roles & Responsibilities:

3.1 Roles & responsibility of Head-HSE:

1. Should arrange to provide standard ISI coded machine for the job

3.2 Roles and responsibilities of Project Manager:

1. Should provide sufficient place for the job & storage
2. Should provide adequate quantity required PPE’s for the job

3.3 Roles and responsibilities of Site supervisor:

1. Should inspect the working area thoroughly daily
2. Should ensure the use of necessary PPE’s
3. Should ensure working procedure is in correct manner or not
4. Should check out any oil spillage on machine or bars while preventive maintenance

5. Should check for preventive maintenance tag
6. Should ensure that worker is competent or not

3.4 Housekeeping staff

1. Ensure machine is turned off after use.
2. Return all accessories to storage racks.
3. Leave the work area in a safe, clean and tidy state.

4. Safety Tips

4.1 Do's for workers job:

- Safety glasses must be worn at all times in work areas
- Appropriate footwear with substantial uppers must be worn
- Long and loose hair must be contained
- Close fitting/protective clothing must be worn

4.2 Don'ts for workers job

- Rings and jewellery must not be worn
- Gloves must not be worn when using this machine
- DO NOT use this machine unless a teacher has instructed you in its safe use and operation and has given permission

5. Bar Cutting

Standard Operating Procedure – Safety Department	
Subject: Bar Cutting	Number: 05
Effective Date:	Page:

1. Objective: To avoid the fatal and other injuries while working bar bending machine

2. General Information

2.1 Pre-Operational Safety Checks:

- Ensure fixed guards are in place to prevent hands or other parts of the body from entering the trapping space.
- Guards or safety devices must never be removed or adjusted, except by an authorized person for maintenance purposes.
- Working parts should be well lubricated and free of rust and dirt.
- The area around the machine must be adequately lit and kept free of materials, which might cause slips or trips.
- Be aware of other personnel in the immediate vicinity and ensure the area is clear before using equipment.
- Familiarize yourself with and check all machine operations and controls.
- Ensure cutting table is clear of scrap and tools.
- Faulty equipment must not be used. Immediately report suspect machinery.

2.2 Operational Safety Checks:

- Do not attempt to cut material beyond the capacity of the machine.
- Never attempt to cut rod, strap or wire with this machine.
- Use correct lifting procedures when handling large sheets of material.
- Take extreme care during the initial feeding of the work piece into the machine.
- The work piece should always be held sufficiently far back from the edge being fed into the guillotine.
- Ensure fingers and limbs are clear before actuating the guillotine.
- Hold material firmly to prevent inaccurate cutting due to creep.
- When cutting ensure feet are positioned to avoid contact with the foot operated lever

3. Roles & Responsibilities:

3.1 Roles & responsibility of Head-HSE:

1. Should arrange to provide standard ISI coded machine for the job

3.2 Roles and responsibilities of Project Manager:

1. Should provide sufficient place for the job & storage
2. Should provide adequate quantity required PPE's for the job

3.3 Roles and responsibilities of Site supervisor:

1. Should inspect the working area thoroughly daily
2. Should ensure the use of necessary PPE's
3. Should ensure working procedure is in correct manner or not
4. Should check out any oil spillage on machine or bars while preventive maintenance
5. Should check the fineness of the cutter blade

6. Should check for preventive maintenance tag
7. Should ensure that worker is competent or not

3.4 Housekeeping staff

1. Remove all off cuts and place them in either in the storage rack or waste bin.
2. Leave the work area in a safe, clean and tidy state.

4. Safety Tips

4.1 Do's for workers job:

- Safety glasses must be worn at all times in work areas
- Appropriate footwear with substantial uppers must be worn
- Long and loose hair must be contained
- Close fitting/protective clothing must be worn

4.2 Don'ts for workers job:

- Rings and jewellery must not be worn
- Gloves must not be worn when using this machine
- DO NOT use this machine unless a teacher has instructed you in its safe use and operation and has given permission

6. Fire during Construction

Standard Operating Procedure – Safety Department	
Subject: Fire during Construction	Number: 06
Effective Date:	Page:

1. Objective: To avoid the burn injuries, loss of property and delay in work schedule.

2. General Information:

Construction fire are generally occurred due to the improper storage of shuttering oil, diesel, uncovered electric cables, unsafe practice of gas welding & gas cutting, unsafe stacking of empty & filled LPG & acetylene cylinder and unsafe act by workers sometimes.

3. Role & responsibility

3.1 Role & responsibility of project Manager:

1. Provide adequate place for storage of Shuttering oil, diesel and cylinders separately
2. Contact fire brigade & police in case of fire for evacuation & law work by having talk with Project Manager.
3. Provide sufficient no of required fire extinguishers as per requirement at designated location
4. Provision of adequate no of sand buckets & water at security cabin, storage room and welding area.
5. Provision of PPE's to workers
6. Ask for emergency response team for action in case of emergency by informing to HSE manager/ Project Manager

3.2 Role & responsibility of Site supervisor :

1. Ensure the prevention of leakage of oil & diesel daily
2. Ensure the stacking of empty and filled cylinders is done separately or not
3. Ensure the use of PPE's by workers
4. Supervise the working procedure of gas welding & cutting
5. Check the condition of noses, hose pipe & flash back arrester before the welding process
6. Arrange for the periodical fire training
7. Conduct mock drill

3.3 Role & responsibility of worker/Housekeeping:

1. Follow the orders of EHS officer while working
2. Do stacking of cylinder as per the EHS officer direction or as per training
3. Check drum before storing of oil & cover it by lid
4. Don't smoke in oil & diesel storage room
5. Report to EHS officer immediately in case of any danger
6. Wear PPE's daily before going for the job

3.4 Role & responsibility of First aid leader:

1. Organize evacuation by serious patient, priority wise shift them by **first aid person** to safe place for First aid /Artificial breathing
2. Identify the number of burnt patients & make arrangement for shifting to burn ward by **first aid person**

3. Ensure that **first aid person** had supported oxygen cylinder the one who had breathing problem due smoke inhalation for long period
4. Ensure that **first aid person** had supported saline the one who had become weak due to trapping

7. Fire (During operation Phase)

Standard Operating Procedure – Safety Department	
Subject: Fire (During operation Phase)	Number: 07
Effective Date:	Page:

1. **Objective:** To avoid burn injuries of the occupants & working staff, loss of occupant, Staff & workers, property, building / unit property and to avoid fatal accident.

2. Policy

- To ensure that the procedure is simple, clear and easy to follow to enable continuous training of all concerned persons and effective handling of the incident if it occurs.

3. Definition of a Fire

- A process in which substances combine chemically with oxygen from the air and typically give out bright light, heat, and smoke; combustion or burning. Fires start when a flammable or a combustible material, in combination with a sufficient quantity of an oxidizer such as oxygen gas or another oxygen-rich compound (though non-oxygen oxidizers exist), is exposed to a source of heat or ambient temperature above the flash point for the fuel/oxidizer mix, and is able to sustain a rate of rapid oxidation that produces a chain reaction.



4. Classes of Fire

There are six classes of fire i.e. class A, class B, class C, class D, class E & class F.

- **Class A:** Class A fire occurs generally due to wood, paper, fabric, plastic and most kind of trash.
- **Class B:** Class B fire occurs generally due to flammable liquids (for example gasoline, petrol, diesel etc.)
- **Class C:** Class C fire occurs generally due to burning of gases (for example natural gas)
- **Class D:** Class D fire occurs generally due to combustible metals* such as magnesium, potassium, titanium and zirconium [* Exception of the metals that burn in contact with air and water (for example sodium)]
- **Class E:** Class E fire occurs due to electrical equipment which are potentially energized
- **Class F:** Class F fire occurs due to unsaturated cooking oils in well insulated cooking appliances located in commercial kitchens.

5. Understanding:

- Fire is a process in which substances combine chemically with oxygen from the air and typically give out bright light, heat and smoke; combustion or burning.
- It is very important to understand the nature of threat and the procedures to be adopted.
- All agencies from Building / Unit Management to security department should involved in evacuation must have a common understanding of their roles and responsibilities in order to avoid confusion and panic behavior.
- Different situations demand different priorities and hence the responsibility for ordering evacuation is assigned to different agencies.
- All evacuations will be ordered only by the State Relief Commissioner, District Magistrate & Collector, Police, Fire Brigade or by the Security Officer.

6. Pre-Fire Preparations

While Fire will strike without any notice or warning, certain pre-fire preparations can go a long way in mitigating the post incident losses and damages. These are as follows:

- Ensure that the structure is fire-proof.
- Procedures and drills on evacuation are regularly practiced.
- All the occupants, worker & staff are in the know of their roles and responsibilities for all contingencies.
- Continuous liaison is maintained with civic agencies so that prompt assistance is received, when required.
- Items and objects maybe which cause injury, like heavy/blunt/sharp items, ought to preferably not be kept overhead, especially in the shops/Pantry/office.
- Requisite emergency and recovery equipment, like ladders and personal protective equipment should be catered for and every one should know their location and usage.
- Automatic Sprinkler system on each floor level
- Sprinklers shall be distributed throughout the building as per the National Building Code requirement, so as to cover every 12 sq.m area

Sprinklers shall be provided in lobbies at all levels.

- The sprinkler pump shall be suitable for automatic operation in case of a drop of pressure in the system. Sprinklers shall be provided throughout the building/unit with a separate sprinkler riser. All the risers shall be provided with installation control valves. An electrical sensor switch shall be provided on each floor and connected to the fire control panel in the security room to make it possible to identify the location of effected floor immediately.
- An overhead water storage tank adequate capacity shall be provided to back up the firefighting system.
- Automatic drencher system on each car parking floor.
- Fire Hydrant Cabinets with hose reels & hand held Fire Extinguishers.
- Fire tank capacities as per NOC, with separate fire pumps for Hydrants and Sprinklers.
- Under Ground Fire Tank
- Over Head Fire Tank.
- Stand by diesel operated pumps.
- All fire pumps will be powered from the emergency panel, which in turn is fed by DG sets.
- Fire pumps are manufactured as per BIS and selected based on that the pumps should deliver water at terrace with minimum pressure of 3.2 kg/sq.mt.

Types of Fire Extinguishers

TYPE of EXTINGUISHER		WATER	FOAM	WET CHEMICAL	CO2	VAPORISING LIQUID
CLASS	TYPE OF FIRE					
A	Water	✓ YES Most Suitable	✓ YES	✓ YES	✓ YES Not Very Suitable	✓ YES Not Suitable
B	Vapourising Liquid	✗ NO	✓ YES Special Foam Required for Alcohol, Dry-Tie	✗ NO	✓ YES	✓ YES
C	Foam	✗ NO	✗ NO	✗ NO	✓ YES	✓ YES
D	Co2	✗ NO	✗ NO	✗ NO	✗ NO	✗ NO
E	Wet Chemical	✗ NO	✗ NO	✗ NO	✓ YES	✓ YES

SOP of Building / unit occupant evacuation under supervision of Building / Unit Management

3. Role & Responsibility

3.1 Role & Responsibility Society / Unit In-charge

1. Keeps watch on Main receiving stations, parking areas and other fire likely hazard areas by Safety Officers reports/ Security reports/any other personnel report.
2. Communicate or Display steps /arrangement which will be helpful during fire situation.
3. Ensure the working of sprinklers/ smoke detectors & fire alarms periodically.
4. Ensure the working of fire hydrant system and also ensure that all necessary required equipment of hydrant system are available on their designated locations.
5. Ensure the working of all fire pumps & standby pumps periodically
6. All evacuations should be reported to DM & Collector or District Superintendent of Police immediately.
7. Arrange equipment and lifesaving appliance available at assembly point
8. Monitor Fire Evacuation operation and coordinate with external agencies for help.
9. Conduct mock drill for occupants, workers & staff in every six months.
10. Arrange periodical training session for an emergency team.
11. Arrange wheel chairs, crèches to rescue team during emergency.

3.2 Role & responsibility of Security In-charge

1. Will arrange adequate water supply source for fire brigade tankers for putting off fire.
2. He will do adequate provision of applicable fire extinguishers as per class of fire, sand buckets & other equipment for controlling fire.
3. He will arrange dust masks, smoke masks, blankets and SCBA.
4. He should do arrangement of walky-talky, torch, First aid, personal medicines & Ambulance service.
5. He will give direction to rescuers for the evacuation of occupant, workers & staff priority wise for eg.
 - I- Injured or affected persons will be evacuated first
 - II- Handicapped & disabled persons will be evacuated by providing wheel chairs etc.
 - III- Women's & small children will be evacuated will specials arrangements
 - IV- Other occupant, workers & staff will be evacuated by other alternative arrangements

- V- Dead bodies will be removed very soon and will be handed over to family or responsible departments for identification.
- 6. Will take current information from managers of the electric supply & STP/OWC during fire accident.

3.3 Role & responsibility Manager/Electrician

1. He should coordinate with Security In-charge to ensure no one is trapped before switch off equipment/Lift supply
2. He should provide D G Supply to evacuation light system continuously to assembly point & refuge areas
3. He should arrange power supply to Control room & Telecommunication equipment

3.4 Role & responsibility of Manager Environmental facilities

1. He should ensure that fire should not travel till electric panel of STP
2. He should ensure that fire should not travel till diesel operating pumps & temporary storage area of diesel & oil
3. He should arrange to enclose the OWC room if not got caught by fire or will arrange members to empty the OWC room from garbage stored there.

3.5 Role & responsibility of Security officer

1. He should control stamped of Panic crowd
2. He should watch and ward assembly point resident
3. He should give direction to the emergency rescue team
4. He should control robbery & theft of buildings / Units

3.6 Role & responsibility of Parking In-charge

1. Evacuate people trapped in parking area by coordinating with evacuation team leader or site controller
2. Arrange systematic car flow out from parking area
3. Internal road should not block due to panic driving
4. Continuous reporting of the parking situation to the Site controller/Chief Site Controller
5. Ensuring that all occupants, worker & staff had evacuated from the parking area
6. Inform exact fire location to fire brigade team to control.

3.7 Role & responsibility of Elected Building / Unit Chairman

1. Organize group of Occupant, Staff & workers
2. Guide Occupant, Staff & workers to safe place
3. Advice Evacuation team leader their duties
4. Instruct & confirm that all light/oven/geyser/LPG Cylinder /Gas line taps are closed properly
5. Confirm that all Occupant, Staff & workers of floor wise /wing wise left their Buildings / Units temporally till fire get in control by fire brigade team

3.8 Role & responsibility of First Aid Team Leader

1. Organize evacuation by serious patient, priority wise shift them by **first aid person** to safe place for First aid /Artificial breathing
2. Identify the number of burnt patients & make arrangement for shifting to burn ward by **first aid person**
3. Ensure that **first aid person** had supported oxygen cylinder the one who had breathing problem due smoke inhalation for long period

4. Ensure that **first aid person** had supported saline the one who had become weak due to trapping

3.9 Role & responsibility of Evacuation Team Leader

1. Ensure that evacuation team had rescued all occupant, workers & staff has been evacuated from fire area
2. Ensure that fire brigade team had rescued all Occupant, Staff & workers
3. Ensure that all occupants had been shifted to safe location from building /unit assembly points and main assembly points
4. Arrange adequate provision of required

4. Safety Tips

4.1 Do's to stay safe during a fire:

5. If fire occurs, first switch off all gas, pipe line knobs & electrical switches.
6. Close all windows to cut the oxygen source and then leave the home / unit.
7. If fire rises in your home / unit before you evacuate, go to the nearest refuge area or assembly point as soon as possible.
8. Turn off all utilities at the main power switch and close the main gas & pipe valve of the building / unit if advised to do so.
9. If your clothes catch fire, Stop Drop and Roll to put them out.
10. Apply antiseptic or take treatment from first aid person as soon as possible if you got affected from fire.
11. When leaving, close doors behind you and pull any fire alarms you may pass.
12. Stay low — beneath the smoke where the air is clearer and safer to breathe.
13. Cool burns quickly with water — get medical attention immediately.
14. Keep a wet handkerchief or piece of cloth/ sari on face during evacuation

4.2 Don'ts to stay safe during a fire:

- Do not panic, evacuate calmly and quickly perpendicular to wind direction through the designated escape route
- Never ignore fire or smoke alarms.
- Leave the building / unit immediately — do not stop to collect belongings.
- Don't pay attention to the rumors and don't spread rumors.

8. Flood

Standard Operating Procedure – Safety Department	
Subject: Flood	Number: 08
Effective Date:	Page:

1. Objective: To safeguard the lives of occupants, workers & staff by evacuation and mitigation measures during flooding conditions or flooding.

2. General Information:

2.1 Category of flood disaster

- Category IV: Low Flood (Water level between Warning Level and Danger Level)
- Category III: Moderate Flood (Water Level below 0.50m. less than HFL and above Danger Level)
- Category II: High Flood (Water Level less than Highest Flood Level but still within 0.50m. of the HFL)
- Category I: Unprecedented Flood (Water Level equal and above Highest Flood Level (HFL))

2.2 Understandings:

- Flood disasters category will be different and may require evacuation of occupants, workers & staff from category I to III.
- It is important to understand the nature of threat and the procedures to be adopted.
- All agencies from Building / Unit Management to security department should involved in evacuation must have a common understanding of their roles and responsibilities in order to avoid confusion and panic behaviour.
- Different situations demand different priorities and hence the responsibility for ordering evacuation is assigned to different agencies.
- All evacuations will be ordered only by the State Relief Commissioner, District Magistrate & Collector, Police, Fire Brigade or by the Security Officer.

2.3 Evacuation Planning

- Shelter sites should be within one hour's walk and three miles (5 km) of dwellings.
- The evacuation routes should be away from the flood-prone areas.
- Evacuation routes should not include roads likely to be submerged in flood, but may include pathways.
- Ensure proper evacuation by seeking community participation along the following lines:
 - Evacuation should be undertaken with assistance from community leaders
 - Care should be taken to see that evacuation routes are not blocked.
 - It is always preferable to encourage the entire family to evacuate together as a unit.
 - In case of inadequate transport or limited time, encourage community for emergency evacuation in the following order:
 - I. Seriously injured and sick
 - II. Children, women and handicapped
 - III. Aged persons
 - IV. Able-bodied. [An evacuation plan on a priority basis helps avoid stampede and confusion.]

2.4 Emergency Evacuations Procedure:

- Families should be encouraged to take along adequate supplies of water, food, clothing and emergency supplies.
- The families should be encouraged to assemble at project main assembly point

SOP of Building / Unit occupants, workers & staff evacuation under supervision of Building / Unit Management**3. Role & Responsibility****3.1 Role & Responsibility Society / Unit In-charge**

1. Keeps watch on flood forecasting stations received by Metrological dept/civil authorities/ TV/Paper.
2. Communicate or Display steps /arrangement during likely Flood situation
3. All evacuations should be reported to DM & Collector or District Superintendent of Police immediately.
4. Arrange equipment and lifesaving appliance available at assembly point
5. Monitor Flood Evacuation operation and coordinate with external agencies for help.

3.2 Role & responsibility of Security In-charge

1. He should arrange adequate supply of water in closed unbreakable containers.
2. He should do adequate supply of non-perishable packaged food and dry rations.
3. He should arrange clothing and rain gear, blankets and bed sheets, towels.
4. He should do arrangement of Buckets, plates, glasses, mugs made of plastic, Battery-powered radio, torch, lantern, matches, and Personal medicines.

3.3 Role & responsibility Manager/Electrician

1. He should do coordinate with Security In-charge to ensure that no one trapped inside lift before switch off equipment / Lift supply
2. He should provide D G Supply to flood light system continuously to assembly point & dewatering pumps
3. He should arrange power supply to Control room & Telecommunication equipment

3.4 Role & responsibility of Manager environmental facilities

1. He should ensure that no flood water enter in aeration tank
2. He should ensure that no STP waste water overflow in parking area

3.5 Role & responsibility of Security officer

1. He should do control stamped of Panic crowd
2. He should watch and ward assembly point occupants, workers & staff
3. He should Control robbery & theft of building flats / unit

3.6 Role & responsibility of Parking In-charge

1. Evacuate people trapped in parking area
2. Arrange systematic car flow out from parking area
3. Internal road should not block due to panic driving

3.7 Role & responsibility of Elected Building / Unit Chairman

1. Organize group of occupants, workers & staff
2. Guide them to safe place

3. Advice team leader their duties
4. Instruct & confirm that all light/oven/geyser/LPG Cylinder /Gas line taps are closed properly
5. Confirm that all occupants, workers & staff of floor wise /wing wise locked their flats / units

3.8 Role & responsibility of First Aid Team Leader

1. Organize evacuation by serious patient priority wise shift them to safe place for First aid /Artificial breathing
2. Identify who need extra support on Raft/rubber boat
3. Support by saline/oxygen cylinder who submerged
4. Identify the fainted person and do the needful procedure for getting normal.

3.9 Role & responsibility of Evacuation Team Leader

1. Provide Life jacket /boats/raft who need extra support on Raft/rubber boat

4. Safety Tips

4.1 Do's to stay safe during a flood:

- If flooding occurs, go to higher ground and avoid areas subject to flooding.
- If water rises in your buildings before you evacuate, go to the top floor, attic, or roof.
- If water rises in your units before you evacuate, go to the top floor, attic, or roof.
- Listen to a battery-operated radio for the latest storm information.
- Turn off all utilities at the main power switch and close the main gas valve if advised to do so.
- If you've come in contact with floodwaters, wash your hands with soap and disinfected water.

4.2 Don'ts to stay safe during a flood:

- Do not attempt to walk across flowing streams or drive through flooded roadways.
- Don't swim through fast flowing water
- Don't drive through a flooded area
- Don't get carried away by rumours and don not spread rumours.

9. Earthquake

Standard Operating Procedure – Safety Department	
Subject: Earthquake	Number: 09
Effective Date:	Page:

1. Objective: To safeguard the lives of occupants, workers & staff by evacuation and mitigation measures during earthquake

2. General Information:

➤ Magnitude Class of Earthquake:

Earthquakes are also classified in categories ranging from minor to great, depending on their magnitude.

Class	Magnitude
Great	8 or more
Major	7 - 7.9
Strong	6 - 6.9
Moderate	5 - 5.9
Light	4 - 4.9
Minor	3 - 3.9

2.2 Understanding:

- An **earthquake** is the perceptible shaking of the surface of the Earth, which can be violent enough to destroy major buildings, other properties, vegetation and kill thousands of people.
- It is important to understand the nature of threat and the procedures to be adopted.
- All agencies from Building / Unit Management to security department should involved in evacuation must have a common understanding of their roles and responsibilities in order to avoid confusion and panic behavior.
- Different situations demand different priorities and hence the responsibility for ordering evacuation is assigned to different agencies.
- All evacuations will be ordered only by the State Relief Commissioner, District Magistrate & Collector, Police, Fire Brigade or by the Security Officer.

2.3 Evacuation Planning

All building / unit occupants, workers & staff will be shifted to a nearest Open land location within the city or few kilometer away.

Sequence of evacuation:

1. First Site controller will arrange announcement of evacuation plan
2. Secondly site controller will arrange crèches for the evacuation of small babies
3. Then site controller will arrange different route for disabled and handicapped people by some special arrangement
4. Then site controller will arrange some special facilities for the evacuation of old people.
5. Then site controller will arrange first aid facilities and medical treatment to all injured people.

6. Then all occupants, workers & staff will be evacuated to safe place by DM members as per the direction given by site controller
7. Then site controller will arrange for the search and removal of dead bodies and its handover to concern ward/police/ or family to avoid spreading of diseases.

3. Roles & responsibilities:

3.1 Roles & responsibilities of Society / Unit In-charge to all levels/departments

1. Keep watch on aftershocks scale and frequency received by Metrological dept/civil authorities/ TV/Paper.
2. Communicate or Display steps /arrangement during likely Earthquake situation
3. All evacuations should be reported to DM & Collector or District Superintendent of Police immediately.
4. Arrange equipment and lifesaving appliance available at assembly point
5. Monitor Earthquake Evacuation operation and coordinate with external agencies for help.
6. Arrange basic necessity of human for all evacuated building / unit occupants, workers & staff
7. Monitor the food, water & blanket distribution to all evacuated building / unit occupants, workers & staff
8. Collect updates about the situation time to time from site controller/ first aid person/security or other local people daily.

4. Earthquake procedure:

a. During all earthquake (all occupants, workers & staff)

Inside the Building / Unit (Do's & don't)

- Duck under the nearest sturdy object and hold onto it until tremors stops. If you are not near a sturdy object, make yourself as small as possible and cover your head and neck.
- If you stand in a doorway, brace yourself against the frame and watch out for a swinging door or other obstruction.
- Avoid windows, filing cabinets, bookcases, and other heavy objects that could fall or shatter.
- Stay under cover until tremors stops, then leave the building / unit and go to the EAA, refuge area or another designated location. Report to your roll taker.
- If safe, before evacuating, neutralize / turn off any flammable source (cooking gas, electricity etc.) that could lead to further danger.

Outside the Building / Unit (Do's & don't)

- Move away from trees, signs, buildings, units, electrical poles and wires, fires, and smoke.
- Protect your head with your arms from falling debris.
- Proceed to the EAA or a pre-designated alternate assembly area. Report to your roll taker.
- Stay alert for further instructions.
- Don't stand below any shade, quickly move to open area as soon as possible.

b. After a MAJOR Earthquake (*violent shaking motion*). Evacuation Wardens shall:

- **Check for injuries to personnel in your area.** Do not attempt to move seriously injured persons unless they are in immediate danger. Render first aid assistance if required.
- Be familiar with the location of first aid and kits, fire alarms and extinguishers as well as personnel with first aid kits.
- Check for fires or fire hazards, spills of flammable or combustible liquids, or leaks of flammable gases.
- Turn off ignition and heat sources if properly trained and it is safe to do so.
- Shut off all gas sources if trained to do so.
- Exit the building / unit, if possible
- Do not reenter until the building has been declared safe by trained emergency personnel
- **Use the telephone system only for urgent matters.** Call or send a runner to the Emergency Operations Center or Unit Response Center to notify them of any needed assistance and emergencies that may exist. Use handheld radios if telephone services are not available.
- Expect Aftershocks.

c. After a MINOR Earthquake

- Restore calm.
- **Examine your area for damage. Evacuation Directors may use checklist to help assess if the building / unit should be occupied, evacuated, and/or re-entered. Look for:**
 - Damaged, leaking or ruptured utility lines (gas, water, electrical, telephone, computer network)
 - Toppled furnishings or equipment
 - Spilled hazardous materials
 - Damaged building components such as ceilings, walls, beams, columns, doors
- Evacuate the building / unit if damage is found or the power is out. Report evacuation to Safety In-charge. Do not reenter until the building has been declared safe by trained emergency personnel.

5. Standard Operating Procedure (SOP)

A. Search & Rescue:

Objective

To trace and locate people who are physically trapped and distressed, people who are living in buildings, workers & staff working in units & other industry to rescue these persons, move them to the safe locations identified in advance and to organize further care.

Composition of the Disaster Management committee:

Ten to twelve young, physically and mentally strong men and women with following skills sets will constitute the search and rescue (S & R) task force: driver, swimmer, cutter and climber. All members will have a basic knowledge of first aid and who normally reside in the building during the expected disaster season.

Pre-Disaster Preparedness Activities for Earthquake:

- The DMC will familiarize themselves with existing response mechanisms of the Government at all levels to ensure effective coordination and reduced response time during disasters.
- The **Society / Unit In-charge** may arrange for the necessary S&R equipment with the help of local self-government, industrial houses and NGO as and when required.
- The **Security In-charge** will keep the equipment in a safe place, use the equipment properly and maintain it well.
- The **Security In-charge** will have with it a detailed map of the building indication vulnerable areas, individuals and households, safe areas safe shelter, evacuation routes and transport arrangements.
- The **Security In-charge** will devise search strategies and rescue plans, which are hazard specific.
- The DMC will organize themselves into pairs (buddy system).
- The DMC will have back up teams ready so that shifts and the rotation of personnel can be organized.
- The DMC will prepare themselves mentally for what they expect to see and what they can expect in terms of emotional responses to themselves and others.

During Earthquake:

- The DMC will if caught inside stand with their backs against a strong indoor wall.
- The DMC if outside during the earthquake will run to an open space away from trees, buildings and electric lines.
- The DMC if in a moving vehicle will stop and stay inside.

Standard Operating Procedures for Earthquake: Post Disaster

- Before undertaking any search and rescue operation the DMC will make a preliminary assessment and plan their response based on the following criteria:

Degree of Damage and Risk	Should an Intervention be attempted
Heavy/High	No. Too dangerous. Secure the perimeter and restrict access into the structure
Moderate/Medium	Perform only quick and safe removals, limit on site medical treatment of checking for breathing, stopping major bleeding and treating for shock. Limit the number of rescuers involved
Light/Low	Yes. Locate victims, check airway, breathing and circulation of those unconscious's and prioritize removal of victims to the designated treatment area.

- The **Society / Unit In-charge** will conduct a general hazard assessment to determine the possible hazards that they may encounter during the operation.
- The **Security In-charge** will make a quick head count and maintain a list of missing persons.
- The **Security person** will conduct a physical search involving a systematic movement across the site whilst listening to calls for help.
- The **Security person** will clear debris and fallen trees in order to reach trapped victim.

- The **Society / Unit In-charge** will activate hazard specific rescue plans for the following rescue scenarios resulting from an earthquake.
 - Rescuing drowning victims.
 - Rescuing victims trapped under a collapsed structure.
 - Rescuing victims trapped in a structure in which there is a raging fire.
 - Rescuing victims who have fallen into a well.
 - Rescuing victims involved in road and rail accidents and trapped in a vehicle in an awkward position for example behind a steering wheel.
- The **Society / Unit In-charge** will communicate with the Block and District levels on matters of additional assistance in terms of manpower and equipment.
- The **Security In-charge** will coordinate closely with the first aid team to administer primary health care to rescued victims.
- The **Security In-charge** will coordinate with the evacuation team to shift rescued persons to an open space/tents in case of aftershocks.
- The **Security manage** will coordinate closely with families and the sanitation team to ensure that dead bodies are identified and cremated.
- The **Security In-charge** will coordinate with relief team to direct rescued victims to available relief assistance: water, food, public information and temporary shelter.
- The **Security In-charge /Security person** will act as support persons to firemen, home guards, police and other external agencies during the search and rescue operation.
- The **Security In-charge** will communicate correct information of rescued persons to the Block/District Emergency Operation Centre and local community as well.

Development/ Mitigation Activities.

The DMC can train other members of the building / unit to form search and rescue sub-groups/back up teams as well as assist the police and home guards at social events and mass rallies.

B. Relief Co-ordination:

Objective:

To co-ordinate the first stage response to the disaster by establishing contact with the Block control room, civil society organizations and NGOs and organize the distribution of assistance in terms of food, water, medicines, temporary shelter materials, blankets, household kits, candles and so on in a fair and equitable manner.

Composition of the Disaster Management committee:

The DMC for relief coordination will be comprised of ten to twelve people including representatives of all the buildings, important figure heads and respected leaders of the city, women members of SHGs and the owner of the fair price shop.

During Earthquake:

- The DMC will if caught inside stand with their backs against a strong indoor.
- The DMC will if outside during the earth quake will run to an open space away from trees, buildings, unit and electric lines.
- The DMC if in a moving vehicle will stop and stay inside.

Standard Operation Procedures for Earthquake: Recovery Phase of Disaster

- The **Society / Unit In-charge** of buildings/ Unit will conduct a complete damage and needs assessment.
- Based on a preliminary needs assessment in line with the following check list the **Society / Unit In-charge** of building / unit will communicate their preferences to the Block Emergency Operation Center and NGOs.
 - The size, scope and likely duration of the distribution of relief material.
 - The estimated number of people affected and demographic characteristics.
 - Local capacity and resources as well as what will be required externally.
 - The needs of the groups affected.
 - Access to the affected population and the best methods for making assistance available.
- The **Security In-charge** will do assessment findings to other Task Force groups, local authorities, and civil society organizations.
- The **Society / Unit In-charge** will establish a distribution center or community kitchen and immediately begin distributing what is locally available within the Building / Unit for emergencies until external assistance arrives.
- The **Security In-charge** will ensure that food and other materials are distributed in an equitable manner addressing the needs of the most vulnerable.
- The **Security Manager** will prioritize the elderly persons, pregnant women, children, workers, staff and injured persons in relief distribution.
- The **Society / Unit In-charge** will provide information on the quantity and type of ration to be distributed for each distribution cycle.
- The **Security In-charge** communicates with individuals and institutions along the supply chain in order to highlight anticipated shortfalls or problems with the supply of food and other commodities.
- The **Security In-charge** will make a physical inventory of stocks when external assistance arrives.
- The **Society / Unit In-charge** will co-ordinate with the communications group to keep people informed about the government policies which entitle them to assistance in cash and kind.
- The **Society / Unit In-charge** will work closely with the communication group to stay in constant touch with Block level Officials and external aid agencies.
- The **Security In-charge** will organize a general meeting to evaluate the experience, internalize learning and ensure accountability when the relief phase is over.
- The **Security Manager** will keep the undistributed relief material in a safe place/godown and preserve the stock.

Development/Mitigation Activities:

The DMC will develop stocks of dry food, medicines and temporary shelter materials within the buildings, unit, maintain these stocks, replenish them and account for them.

C. Early Warning and Communication:

Overall Objectives:

To ensure that: (a) the warning of the impending disaster reaches every single household, thereby allowing people to take timely action to protect their lives and property (b) accurate information is provided regularly as events unfold (c) information flows quickly and reliably upwards to Block level and downwards from Block level to Building / Unit level.

Composition of the Disaster Management committee:

Ten to twelve members, who can communicate orally confidently and accurately, are literate, mobile and energetic, who have a land line phone, mobile phone, radio or television and or read the newspapers regularly.

Development/Mitigation Activities:

The group will be involved in raising awareness of hazard specific do's and don'ts by distributing leaflets and putting up posters within the buildings / Unit. The group will also maintain the communications equipment stored in the communications room * which will be open to the members for accessing news.

D. First Aid and Health:**Objective**

To provide primary health care to the ill or injured until more advanced care is provided and the patient is transported to a hospital.

Composition of Disaster Management committee:

The group will be comprised of three to seven people who are literate, have some health related knowledge or are working in medicine and are respected members of the community.

Pre-Disaster Preparedness Activities for Earthquake:

- The **First aid head** will maintain a list of pregnant women/ occupant, staff & worker, infants, the disabled, sick and old in the buildings to ensure that their medical needs are met.
- The **First aid head** will keep a First Aid kit ready and ensure that expired drugs are replaced with new ones.
- The **First aid person** will distribute basic medicines (chlorine tablets, ORS packets and so on) and demonstrate their use, to families in advance.
- The **First aid person** will keep stretchers/local alternative ready to carry injured people.

During Earthquake:

- The DMC will if caught inside stand with their backs against a strong indoor.
- The DMC will if outside during the earth quake will run to an open space away from trees, buildings, units and electric lines.
- The DMC if in a moving vehicle will stop and stay inside.

Standard Operation Procedures for Earthquake: Recovery Phase of Disaster

- The **First aid head** will attend to the injuries and trauma of rescued people.
- The **First aid person** will help doctors and paramedics shift the ill and the injured to hospitals.
- The **First aid head** will isolate cases with infectious diseases and prevent them from spreading.
- The **First aid person** will provide preventive medication if there is a danger of epidemics like cholera, gastroenteritis, dysentery, and malaria spreading.
- The **First aid head** will inform the relief group about medical supplies that are running low.

Development/Mitigation Activities:

The group will work with the local PHC during normal times, assisting in government programs such as polio and leprosy camps and imparting training to other interested volunteers in the building. The group will also launch an awareness campaign about HIV/AIDS.

E. Evacuation and Shelter Management:**Objectives**

To construct/identify, maintain and make repairs to the temporary earthquake shelters, to evacuate people on receipt of a warning and to make all the necessary arrangements to accommodate evacuees during an earthquake.

Composition of Disaster Management committee:

The group will constitute between ten or twelve people with knowledge of construction and preferable including a civil engineer.

During Earthquake:

- The DMC will if caught inside stand with their backs against a strong indoor.
- The DMC will if outside during the earth quake will run to an open space away from trees, buildings, unit and electric lines.
- The DMC if in a moving vehicle will stop and stay inside.

Standard Operation Procedures for Earthquake: Recovery Phase of Disaster

- The **Society / Unit In-charge** will organize for tents and materials for the construction of temporary shelters to be provided to the local community.
- The **Security Manager** will help the community to reconstruct their permanent shelters (providing and identifying local material which can be used for reconstruction)
- The **Security In-charge** will help NGOs and their engineers in conduction general meetings and other rehabilitation and reconstruction related activity.
- The **Security Manager** will monitor the rehabilitation and reconstruction process of the community.

Development/Mitigation Activities:

The DMC will contribute to government programs and the reconstruction programs of other NGOs and aid agencies operating in the city. The DMC will undertake a program to raise awareness of seismic and earthquake safe construction techniques and technologies which build upon local knowledge and construction skills.

Disaster Psychology:

Since all the task force members will be in constant contact with survivors it is important that they understand the distinct emotional phases that survivors go through.

Stage

The Impact phase

Characteristics

Survivors do not panic; they may display no emotions and do what they must to keep themselves and their families alive.

The Inventory phase (period which immediately follows the Disaster)

Survivors assess damage and try to locate other survivors. During this phase routine social ties are disrupted in favor of the more functional relationships required for initial response activities such as search and rescue.

Stage

Rescue phase

Characteristics

Emergency rescue services and DMC members arrive on the scene and survivors are willing to take their directions without protest. They trust that the rescuers will help address their needs so that they can then get their lives together quickly. DMC members must be easily identifiable with helmets, armbands and so on.

Recovery phase

Survivors may feel that rescue and relief efforts are not proceeding quickly enough and this coupled with a sense of frustration with insurance and compensation claims aggravates stress levels. Frustration may be directed towards DMC members.

In the post-disaster scenario as people pick up the pieces of their lives shattered by calamity they may experience the following psychological and physiological conditions.

Psychological

Fear of recurrence

Frustration

Self-blame and blame towards others

Feeling overwhelmed

Sadness and grief

Coordination and memory problems

Denial

Physiological

Loss of appetite

Headaches

Stomach cramps and diarrhea

Hyperactivity

Increase in alcohol or drug consumption

Fatigue and low energy

Nightmares and sleeplessness, Mood swings

It is important for all DMC members to remember the following:

- Talk to the survivors and encourage them to express their feelings and physiological needs.
- Listen attentively to what the person has to say.
- Respond with empathy, understand the concerns of the individual and reassure them that such feelings are expected.
- Keep information confidential and respect their confidence.

10. Lightning

Standard Operating Procedure – Safety Department	
Subject: Lightning	Number: 10
Effective Date:	Page:

1. Objective: To avoid burn injury, fire catch, damage of occupant, staff, worker, building & unit property & fatal accident caused due to lightning storm.

2. General Information:

2.1 Introduction:

Lightning is a sudden electrostatic discharge during an electrical storm between electrically charged regions of a cloud (called intra-cloud lightning or IC), between that cloud and another cloud (CC lightning), or between a cloud and the ground (CG lightning).

- It is important to understand the nature of threat and the procedures to be adopted.
- All agencies from Building / unit Management to security department should involved in evacuation must have a common understanding of their roles and responsibilities in order to avoid confusion and panic behavior.
- Different situations demand different priorities and hence the responsibility for ordering evacuation is assigned to different agencies.
- All evacuations will be ordered only by the State Relief Commissioner, District Magistrate & Collector, Police, Fire Brigade or by the Security Officer.

2.2 Types of lightning

- **Intra-Cloud:** The most common type of lightning. It happens completely inside the cloud, jumping between different charge regions in the cloud. Intra-cloud lightning is sometimes called sheet lightning because it lights up the sky with a 'sheet' of light.
- **Cloud to Cloud:** Lightning that occurs between two or more separate clouds.
- **Cloud to Ground:** Lightning that occurs between the cloud and the ground.
- **Cloud to Air:** Lightning that occurs when the air around a positively charged cloud top reaches out to the negatively charged air around it.
- **Bolt from the blue:** A positive lightning bolt which originates within the updraft of the storm, typically 2/3rds of the way up, travels horizontally for many miles, then strikes the ground.
- **Anvil Lightning:** A positive lightning bolt which develops in the anvil, or top of the thunderstorm cloud, and travels generally straight down to strike the ground.
- **Heat Lightning:** Lightning from a thunderstorm that is too far away to be heard.

2.3 Lightning Safety Tips (will be displayed by Security In-charge in building):

- The best shelter from lightning is inside a large enclosed structure, such as your home or school. No place outside is safe during a thunderstorm. Once inside, stay away from any windows and doorways, electrical appliances, lighting, electric sockets and plumbing, such as toilets and showers.
- If you can't get to a house, a vehicle with a solid metal roof and metal sides (such as a bus) is a reasonable second choice. Avoid contact with the windows. Close the windows and lean away from the door. Don't touch anything metal, such as the steering wheel, ignition, gear shifter or radio.
- Stay inside for 30 minutes after you last see lightning or hear thunder. People have been struck by lightning from storms centered as far as 10 miles (16 kilometers) away.

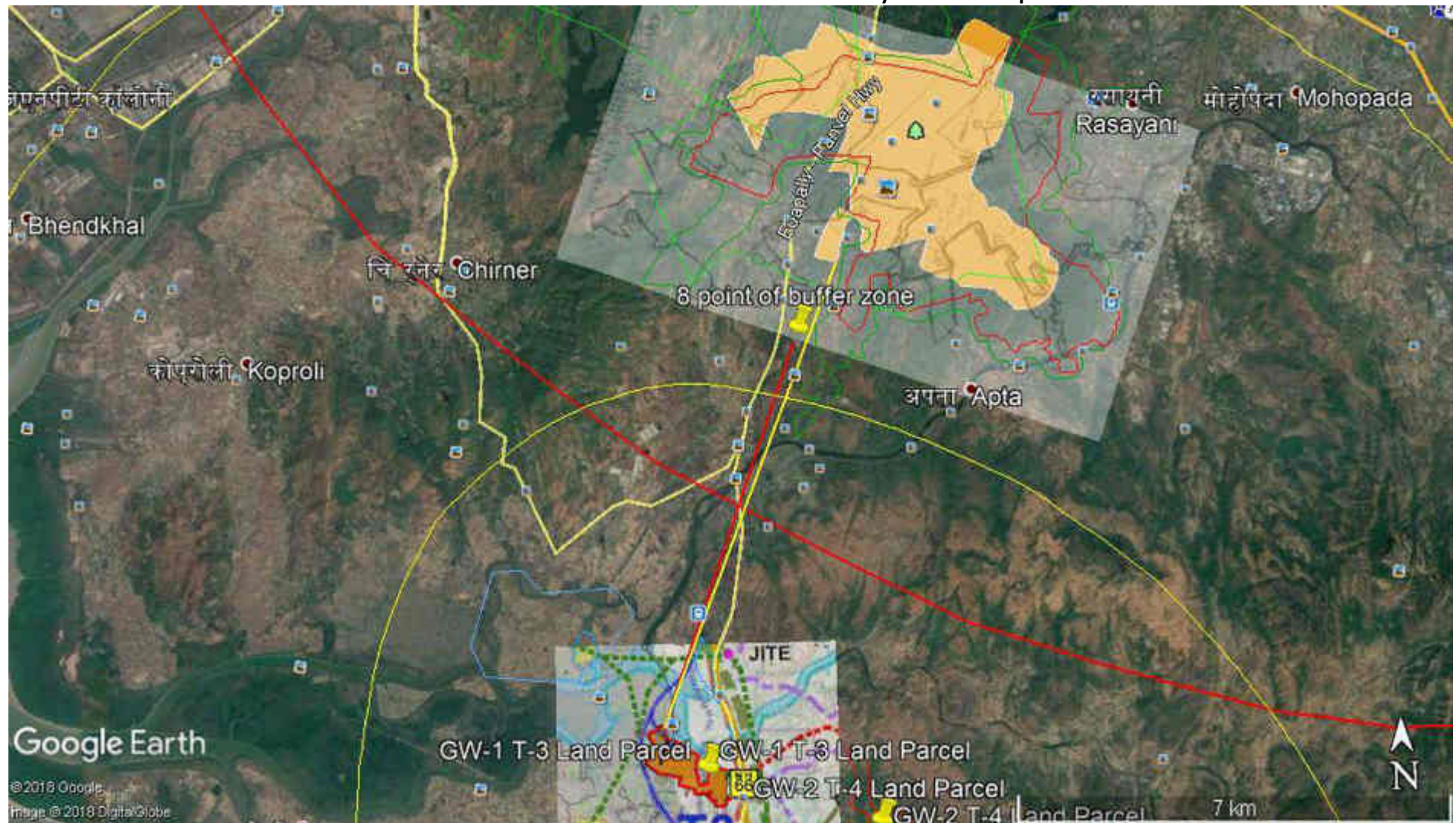
- Find a low spot or depression and crouch down as low as possible, but don't lie down on the ground. Lightning can move in and along the ground surface, and many victims are struck not by bolts but by this current.
- Stay away from:
 - Tall isolated objects (trees, flag poles, light poles, lawn, telephone poles)
 - Wide-open areas (garden, terrace, balcony on height)
 - Water related activities (swimming pool, fountains etc.)
 - Open vehicles (battery car, riding lawn mowers, trucks & open jeep)
 - Metal (fences, bleachers, tools etc.)
- Avoid using electrical devices. When a lightning storm rages outside, it's a good idea to avoid using electrical devices inside. This means you should avoid using the telephone during a lightning storm. Also, it's advisable that you turn off the television, turn off your computer, and any other electrical device. Although very rare, it's possible that the electrical surges caused by the lightning storm can travel through your telephone line or electrical wiring. ***Cordless phones and cell phones are considered safe.***
- Use of surge protector. Surge protectors are safety plugs designed to automatically protect electrical devices in case lightning should strike. They try and reduce the amount of surge before it reaches your equipment. Surge protectors are highly recommended for all computers and electrical appliances. Using a surge protector can not only help prevent damage being done to your expensive electrical devices, but can also prevent fire in case lightning strikes. However, as long as lightning has a conductive path, there is risk of damage.
- Lightning arrestor must be installed to the buildings which should be grounded.
- Every individual should remove metal or jewelry worn or carried by him/her during lightning.

3. Roles & Responsibilities

3.1 Roles & Responsibilities of Society / Unit In-charge:

1. Will ensure the working of lightning arrester periodically.
2. Will ask electric supply manager to switch off the power till the lightning gets stops.
3. Will ensure all facility room electric supply is been switch off by taking info from concern In-charge, Parking In-charge & Security In-charge.

Annexure-XXI
Distance of the buffer zone of the Karnala Bird Sanctuary from T3 land parcel



Annexure-XXII

Tree Census Details

Sr.No	Land Parcels	No of trees (species) identified at the sites
1.	T1	1261 (37)
2	T2	317 Nos (25)
3	T3	11 (5)
4	T4	103 (17)
	Total	1692

A Tree census and inventory Report-T1 Land Parcel

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Table 1. Species composition of the study site

Table 2. Relative abundance of the species

Table 3. Density and Basal of the different tree species

Table 4. Mean DBH of the different tree species

Figure 1. Location of the Project site

Figure2. Location of Tree with GPS point near Wirani viilage of Site T1

Figure3. Location of Tree with GPS point near road site for T1 sit

Figure 4. Girth class of total trees of the area

Summary of the Report

This study assessed the diversity, abundance, density of trees in 86.97 ha plot in Pen area. Each tree was counted and marked on a GPS device. The girth of the trees and shrubs were measured and species identified. A total of 37 species belonging to 32 genera and 19 families were recorded. **Leguminosae** had the highest number of genera 10 and species 10 followed by the **Moraceae** with 4 species and 2 genera. *Acacia auriculiformis* recorded the highest tree density (9.01 individual's ha⁻¹).

The girth class distribution showed that with the highest number of trees in the larger girth class (>29.9 cm). Tree number decreases with lower girth (<29.9) class. In this site, most of the tree species are **understorey** (medium sized trees). Tree diameter and height range of trees shows that site is disturbed with anthropogenic activities. A **dominance index** of trees was 0.6.

Site T1 shows the **very poor diversity** with $H' = 1.68$. In terms of evenness, the Pielou's Evenness value of the site is 0.23. It shows that site has **lower value for evenness**. If this site is selected for any developmental activity, along with conservation, more focus should be given for mixed plantation including different native species of Herbs, Shrubs and Trees. It will increase species richness of the site and will provide protected habitat for different faunal species of nearby area.

1. Introduction

The present document is a Tree census and inventory report of the ‘**Integrated Industrial Township**’ at Pen, Dist Raigad, Maharashtra. The present Tree census and inventory report was done to quantify, map and to create an inventory of Tree species.

The present study gives a detailed account of Tree diversity, health status, density, distribution and their locations by using GIS and mapping tool.

2. Background of the Project

2.1 Physical setting of the Proposed Project Site:

The proposed “**Integrated Industrial Township**” by Karanja Infrastructure (P) Ltd. will be developed in Pen region of Raigad district. Raigad district forms a part of Maharashtra littoral, the micro level divisions of coastal plain. Though the districts form an important part of the traditional “Konkan Plain”, ruggedness and uneven topography form the governing theme in its physical features. The Sahyadri (Western Ghats) in the east send several transverse numbers of subsidiary hills westwards denying the plains of a uniform level and continuous character.

The proposed site lies on leeward side of Sahyadri i.e Western ghat. The project site is irregular in shape and overlooks the River Bhogeshwari & Balganga. The site is at a height of 185 meters above mean sea level. The highest point within the site is at 201m whereas the lowest point of the site is at 84 meter. This site is highly contoured with a little vegetation cover.

2.2 Climate:

The climate of the district is typical of that on the west coast of India, with plentiful, regular and seasonal rainfall during the monsoon season. Being a coastal

district, the diurnal and seasonal variations in temperature is not large. The temperature here averages 26.9°C.

2.3 Rainfall:

The south- west monsoon commences by about the first week of June and the rains continue till about the beginning of October. The average rainfall for the district is 3207 mm.

Location: **T1:** Latitude: 18042'14.11" N
Longitude: 73008'37.90" E

2.4 Location

Pen town is located at 18°40'.N, 73°05' E, on the outskirts of Mumbai Metropolitan Region. It gained prominence in ancient times due to vantage location on trade routes to Deccan, proximity to both Mumbai & Pune and its central position in the Raigad District. It lies on the bank of Bhogavati creek about 16 km from its mouth. Pen has total area of 199.6 sq. miles and area of Pen City is 6.75 sq.miles.

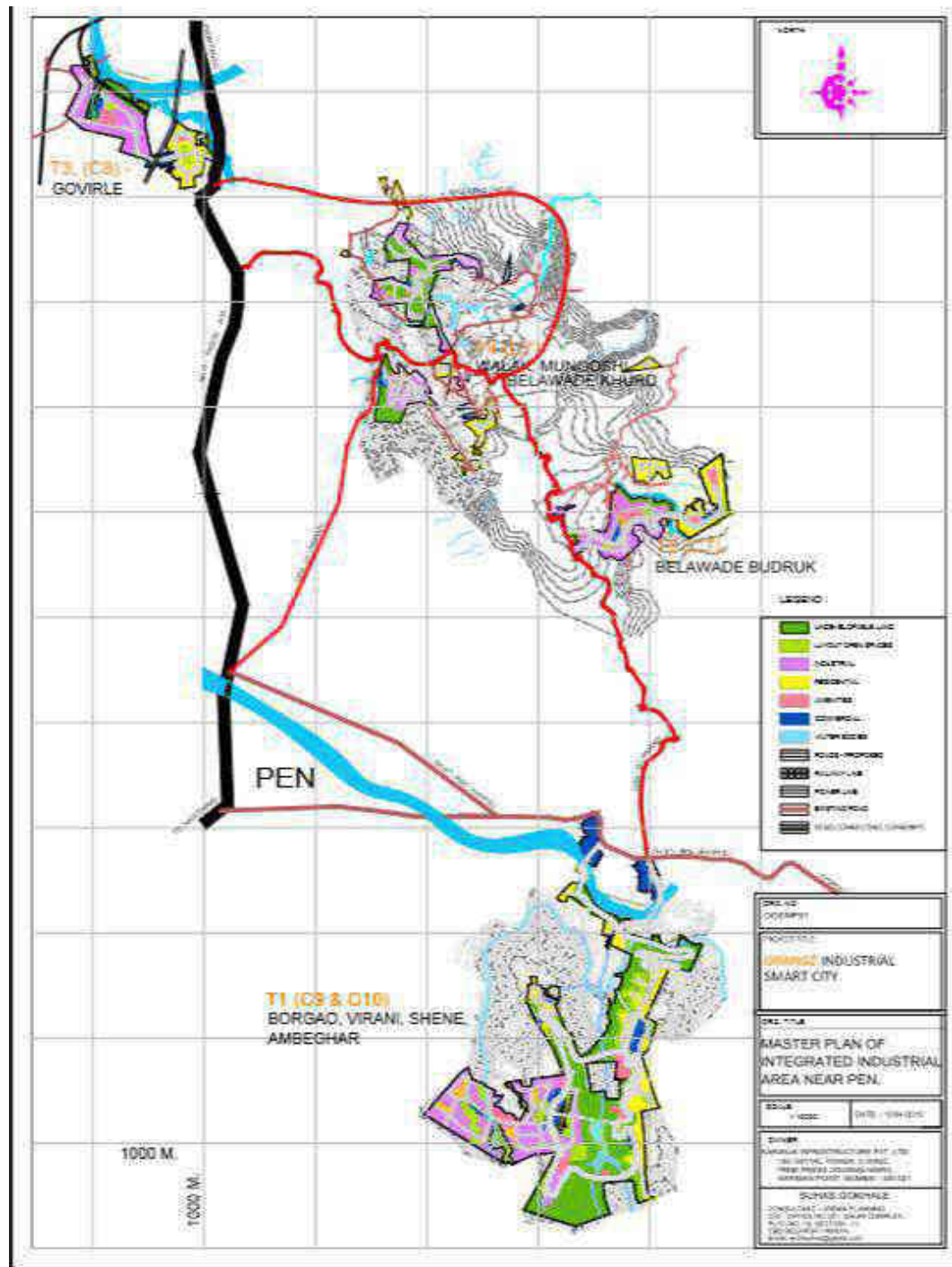


Figure 1. Location of the Project site



Figure 2: Location of Tree with GPS point near Wirani viilage of Site T1



Figure 3: Location of Tree with GPS point near road site for T1 site

3. Scope of the study

3.1 Objectives:

1. To make an inventory of tree individuals and tree species in the proposed project site with the help of GPS
2. To create a distribution / vegetation map of the whole area representing Tree individuals
3. To undertake ecological analysis with the help of
 - a. Abundance, Relative abundance
 - b. Density and Basal area
 - c. Simpson's biodiversity Index, Shannon's Biodiversity index
 - d. Diameter class and height of the trees
4. Assessment of species protected by specific legislation (Rare, endangered, critically endangered, endemic and vulnerable)

3.2. Sampling

Since the purpose of the project was to create a detailed inventory of Tree individuals and species, the "Census" was used as a sampling technique. In total, 214.93, acres of the project site were surveyed and each tree was counted and marked on a GPS device.

Within each plot (survey no), all individual trees were identified, measured, and recorded. The diameters at breast height of the species were measured using a measuring tape. Trees were grouped into the following diameter classes: medium-sized trees (16–29.9 cm), and large trees (>29.9 cm).

1. These species were further grouped into four life forms defined by their maximum attainable heights as follows: treelets (small trees) (<10 m), understorey (10–20 m), canopy (20–30 m), and emergent (>30 m) .

3.3 Identification of Tree species

Most of the tree species encountered were identified on field on the basis of their morphological characters - Bark shape, texture, and color, Leaves- shape, size, texture, color, arrangement, flower and fruit color, shape, size, internal morphology, odor and arrangement of reproductive features. Morphological characteristics were used to identify the Tree species to the species level. The Flora of Maharashtra, and Bombay Presidency were used as references and online database of The International Plant Names Index (IPNI) was used to find out the latest and acceptable international scientific name of the Tree species.

3.4 Technology used

GPS device (GARMIN 76S) was used to take GPS positioning of each tree individuals.

ArcGIS was used as platform to create GIS based maps.

3.5 Data Processing and Analysis

(i) Density, abundance, Relative abundance of plant species were calculated. The basal area of each individual tree species was calculated

(ii) Species diversities and evenness were determined using

a) The Shannon-Weaver Diversity Index

$$H = - \sum_{i=1}^n p_i \ln p_i$$

Where $P_i = n_i/N$, n_i = number of individuals of species and N = total number of individuals

Typical values are generally between 1.5 and 3.5 in most ecological studies, and the index is rarely greater than 4. A Plant community is said to be rich if it has a Shannon Diversity value ≥ 3.5 .

b) Simpson's Diversity Index

$$D = 1 - \left(\frac{\sum n(n-1)}{N(N-1)} \right)$$

n = the total number of organisms of a particular species

N = the total number of organisms of all species

The value of D ranges between 0 and 1. With this index, 1 represents infinite diversity and 0, no diversity.

c) Pielou evenness index (J_{sw}) is calculated as $J_{sw} = H'/H'_{\max} = H'/\ln S$

4. Results

4.1 Species composition of Trees

Table 1(see Annexure file) shows the different Tree species found in the study area. A total of 37 species were recorded belonging to 19 families and 32 genera. Table 1 shows the different plant species, their families found in the study site T1. A total of 1261 tree individuals (height above 3 meters) species were recorded in the study site (Table 1).

4.2 Abundance

From the 19 families recorded in the study sites, the Leguminosae had the highest number of genera (10) and species (10) followed by the Moraceae with 4 species and 2 genera. A total of 32 genera were recorded in the study sites. *Acacia auriculiformis* (Leguminosae) were the most abundant Tree species. This was followed by the species *Eucalyptus globulus* (Myrtaceae), *Gliricidia sepium* (Leguminosae) and *Mangifera indica* (Anacardiaceae) having 108, 61 and 48 species respectively.

There were 11 rare species of this site having only one individual. Out of which only 2 species were exotic. Cultivated species has higher population over study area. Majority of the Native species are rare having very little population. First three abundant species of the site are cultivated species. Those three cultivated species (*Acacia auriculiformis*, *Eucalyptus globulus*, *Gliricidia sepium*) make up 74% of total population. One cultivated species having 21 number of i remain unidentified.

4.3 Relative abundance

Table 2 (see Annexure file) shows the different trees species found in the study sites and their relative abundance. In this site, 1261 individuals were sampled. The

species with the highest number of individual was *Acacia auriculiformis* (784) with a relative abundance of 60.17%. It was followed by *Eucalyptus globulus* (108 individuals and relative abundance of 8.56%), *Gliricidia sepium* (61) and *Mangifera indica* (48) with relative abundance of 4.83% and 3.80% respectively.

4.4 Diversity

The Shannon-Weaver Diversity Index (H'), Pielou's Evenness, and the species richness (d) of the study site is shown in following table. Site T1 shows the very poor diversity with $H'=1.68$. In terms of evenness, the Pielou's Evenness value of the site is 0.23. It shows that site has lower value I.e below 0.5 for evenness. The site is less diverse with 37 numbers of species over such a large area of 86.97 hectares. The site shows greater value of simpson index i.e 0.6.

Parameter	Value
Shannon's diversity index (H')	1.6877
Pielou evenness index (J_{sw})	0.23
Simpson index (C_d)	0.60
Richness (total number of species)	37

Table 3 Characteristics of trees in the study area.

4.5 Diameter classes and height of the trees

Trees with different diameter classes were found in the different study sites. The diameter range was grouped as medium-sized trees (16.9–29.9 cm), and large trees (>29.9 cm). The site was dominated by trees species having diameters (>29.9 cm) (large trees). There were only 7 trees with medium diameters (16.9–

26.9 cm). Those trees include – *Trema orientalis* (2 trees), *Acacia auriculiformis* (3 trees), *Gliricidia sepium* (1 tree), *Holoptelea integrifolia* (1 tree).

Out of the 1261 species identified in the study sites, 561 species were treelets, mostly <10 m tall, and 605 species were understory trees <20 m tall and 94 reaching the canopy (20-30m). One emergent species (>30m) of *Mangifera indica* was found.

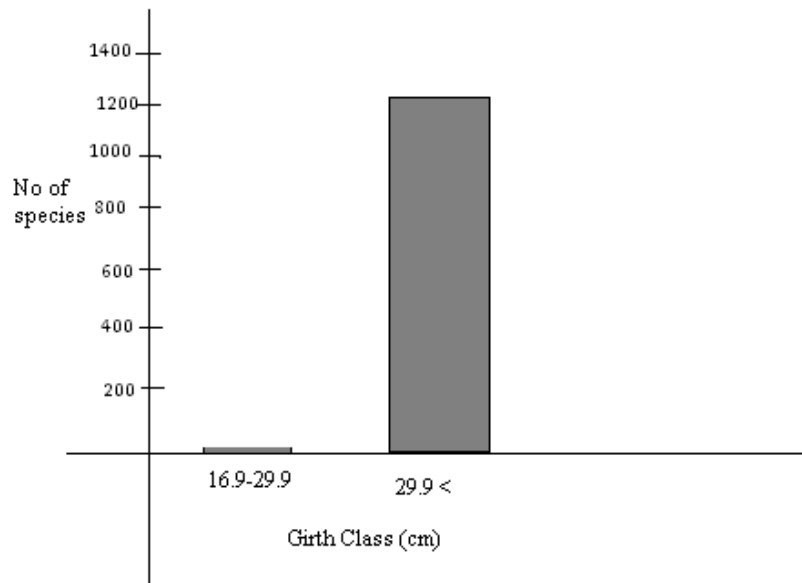


Figure 3: Girth class of total trees of the area

4.6 Assessment of species protected by specific legislation

The site T1 does not contain any species which is protected by specific legislation (Rare, endangered, critically endangered, endemic and vulnerable).

5. Discussion:

The Leguminosae were observed to be the most prevalent family. This may be due to their fast germination ability, associated with sym-biotic properties which have enabled species to easily establish within this habitat. Leguminosae is well represented family of western ghat. The site T1 represents Leguminosae as a largest family having 10 genera and 10 species of this family. *Acacia auriculiformis* having highest population of 784 trees. This makes more than half of the total population. Though the number of this species is high, the risk of invasion is low (the risk of invasion was not widely reported in India). Monoculture of this species is also one of the reasons for lower value of species diversity index.



Photograph of *Acacia auriculiformis* on site T1

First three abundant species of the site are cultivated species. Those three cultivated species (*Acacia auriculiformis*, *Eucalyptus globulus*, *Gliricidia sepium*) make up 74% of total population. These species are exotic species. This underlines

that 74% area of the site is under cultivation of Exotic species and which is not good for biodiversity of the study area and nearby area.

Certain problems have emerged as a result of growing *G. sepium* on large area in various regions. The seed germination rate of *Gliricedia sepium* above 90% are typical. Following germination, trees grow extremely quickly and may attain a height of 3 m before flowering at age 6-8 months. This species inhibit the growth of other vegetation. So it negatively affects biodiversity of the nearby area. *Eucalyptus globulus* also inhibit the growth of other vegetation and it has 60% germination rate. At many places, forest areas in India plantation of *Gliricedia sepium* was removed and cultivated by other native species. This was done for protection of exiting Biodiversity and for Biodiversity richness.



Photograph of *Gliricedia sepium*

Generally, species diversity is one of the most important indices used to evaluate an ecosystem. A rich eco-system with high species diversity has a large value (H') while an ecosystem with low value (H') will have low species diversity. The present study site had a poor diversity of trees. i.e ($H'=1.68$). In case of Simpson's

dominance index - The lower the index value, the lower the dominance of species. The greater the value of index of dominance, the lower is the species diversity. This site has higher value of dominance index. It shows that this site has low species diversity.

As shown by Pielou's Evenness value (0.23), tree community of study area has low level of evenness or unevenly distributed.

The stem density of tree species increases with increase in girth class distribution in the study area. This could result from anthropogenic activities such as the cutting and burning of trees for plantation crops and domestic purpose by local people and tribes.

In this site most of the tree species are medium sized trees (understorey) with a height between 10-20m. It also signifies anthropogenic disturbance.

6. Conclusions

This study revealed that the site T1 has low tree species diversity. Leguminosae is the dominant family and *Acacia auriculiformis* is the dominant species of this area. The result of ecological analysis shows that this site is very poor in diversity and disturbed. It may be due to the anthropogenic activities.

Following major things are observed and concluded from the survey of site T1

- a) 74% area of the site is under cultivation of Exotic species and which is not good for Biodiversity of the study area and nearby area.
- b) Certain problems will be emerged because of large population of *G. sepium* on large area. Because this species inhibit the growth of other vegetation. So it negatively affects biodiversity of the nearby area.
- c) This site comprises a low level of diversity of Tree species.
- d) Tree community of study area is unevenly distributed.
- e) It has no significance as a habitat for wildlife. No wild life has been observed during the survey.
- f) It does not includes Trees of a rare, vulnerable or endangered species
- g) This site does not contain tallest layer of vegetation. Only one emergent tree of *Mangifera indica* was found. This site has more individuals of medium size (10-20). So it shows poor natural regeneration potential of the site.
- h) Very few species in the lower girth class also indicates that site has poor natural regeneration potential
- i) *Acacia auriculiformis* is representative of the total vegetation but it is monocultured and its population is more than half of the total population i.e 62%. Large population of *Mangifera* is one of the reasons for low value of evenness.

7. Recommendations:

1. If this site is selected for any developmental activity, along with conservation more focus should be given for mixed plantation. Plantings should include a diverse array of species, genera, and families, of different herbs shrubs and trees. This will provide protected habitat for different faunal species of nearby area.
2. Particularly those trees other than *Mangifera indica* and *exotic species* should be selected for plantation.
3. The removal of *Gliricedia sepium* and replantation of the site T1 with different native species will have positive effect on Biodiversity
4. Only 1 (Bulbul) species of bird were found during the survey. The reason (which we heard) behind it was shocking. For some tribes living near study area, some birds still form a part of their diet. Tribes near the study area still lead a nomadic life and hunt some birds for food.

If this site is planted with different native species of herbs, shrubs and trees. And along with this if supply of fresh, clean water is provided within the site then it will attract many birds. Creation of these types of environments within the Industrial Township will give roosting, protective place for birds. This will be a major step towards sustainability.

5. Maintain and restore plants native to the place, so as to facilitate adaptability and reap the environmental benefits. Benefits and time are lost when older trees are removed and replaced with smaller and younger tree species.
6. Protect or restore existing water bodies, so as to promote biodiversity.
7. Transplantation is a good option to protect Biodiversity.

Photo Gallery of T1 site















**A Tree census and inventory Report-T2
Land Parcel**

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Table 1. Species composition of the study site

Table 2. Relative abundance of the species

Table 3. Density and Basal of the different tree species

Table 4. Mean DBH of the different tree species

Figure 1. Location of the Project site

Figure 2. GPS point showing location of Tree

Figure 3. A Rank – abundance curve

Figure 4. Girth class of total trees of the area

Summary of the Report

This study assessed the diversity, abundance, density of trees in a 41.35 ha plot in Pen. Each tree was counted and marked on a GPS device. The girth of the trees and shrubs were measured and species identified. A total of 25 species belonging to 23 genera and 15 families were recorded. Fabaceae had the highest number of genera 4 and species 4 followed by the Mimosaceae with 4 species and 3 genera. *Mangifera indica* recorded the highest tree density (4.52 individual's per ha).

The girth class distribution showed that with the highest number of trees in the larger girth class (>29.9 cm). Tree number decreases with lower girth (<29.9) class. In this site most of the tree species are treelets (small trees) with a height <10 m. Tree diameter and height range of trees shows that site is disturbed with anthropogenic activities. A dominance index of trees was 0.635.

Site T2 shows the very poor diversity with $H' = 1.74$. In terms of evenness, the Pielou's Evenness value of the site is 0.54. It shows that species richness is exactly intermediate in evenness. If this site is selected for any developmental activity, along with conservation, more focus should be given for mixed plantation including different native species of Herbs, Shrubs and Trees. It will increase species richness of the site and will provide protected habitat for different faunal species of nearby area.

1. Introduction

The present document is a Tree census and inventory report of the ‘**Integrated Industrial Township**’ at Pen, Dist Raigad, Maharashtra. The present Tree census and inventory report was done to quantify, map and to create an inventory of Tree species.

The study gives a detailed account of Tree diversity, health status, density, distribution and their locations by using GIS and mapping tool.

2. Physical setting of the Proposed Project Site

The proposed “**Integrated Industrial Township**” by Karanja Infrastructure (P) Ltd. will be developed in Pen region of Raigad district. Raigad district forms a part of Maharashtra littoral, the micro level divisions of coastal plain. Though the districts form an important part of the traditional “Konkan Plain”, ruggedness and uneven topography form the governing theme in its physical features. The Sahyadri (Western Ghats) in the east send several transverse numbers of subsidiary hills westwards denying the plains of a uniform level and continuous character.

The proposed site lies on leeward side of sahyadri i.e Western ghat. The project site is irregular in shape and overlooks the River Bhogeshwari & Balganga. The site is at a height of 189.01 meters above mean sea level. The highest point within the site is at 201 m whereas the lowest point of the site is at 72 meters. This site is highly contoured with a little vegetation cover.

2.1 Climate:

The climate of the district is typical of that on the west coast of India, with plentiful, regular and seasonal rainfall during the monsoon season. Being a coastal

district, the diurnal and seasonal variations in temperature is not large. The temperature here averages 26.9°C.

2.2 Rainfall:

The south- west monsoon commences by about the first week of June and the rains continue till about the beginning of October. The average rainfall for the district is 3207 mm.

Location: **T2:** Latitude: 18°04'23.80" N
Longitude: 73°00'17.44" E

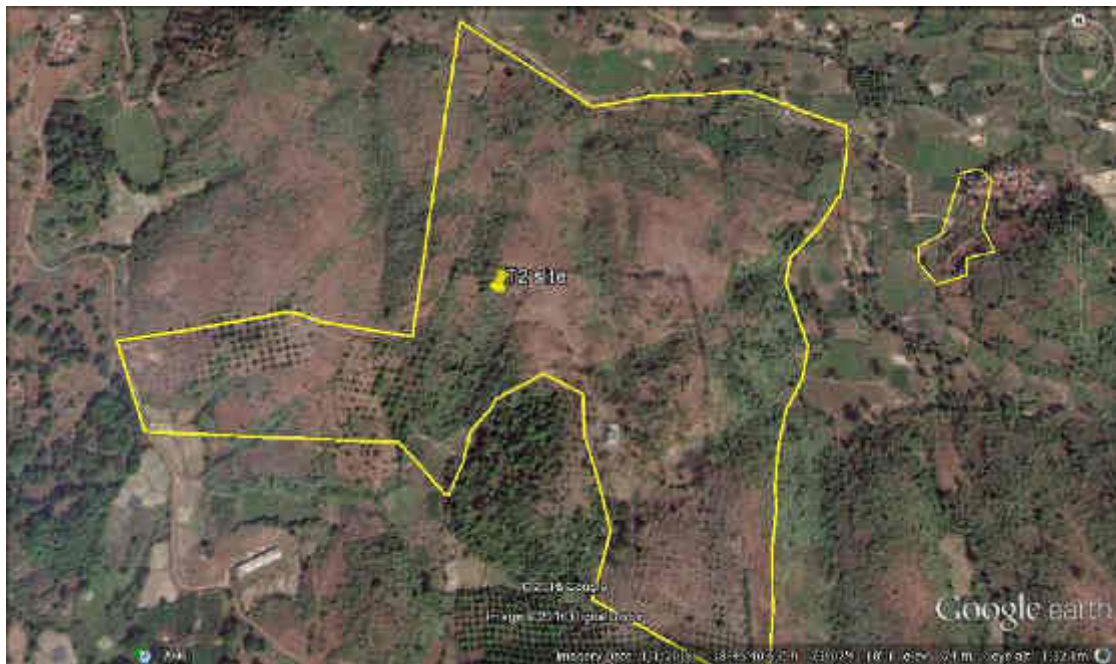


Figure 1. Location of the Project site

3.0 Scope of the study

3.1 Objectives:

1. To make an inventory of tree individuals and tree species in the proposed project site with the help of GPS
2. To create a distribution / vegetation map of the whole area representing Tree individuals
3. To undertake ecological analysis with the help of
 - a. Abundance, Relative abundance
 - b. Density and Basal area
 - c. Simpson's biodiversity Index, Shannon's Biodiversity index
 - d. Diameter class and height of the trees
4. Assessment of species protected by specific legislation (Rare, endangered, critically endangered, endemic and vulnerable)

3.2. Sampling

Since the purpose of the project was to create a detailed inventory of Tree individuals and species, the "Census" was used as a sampling technique. In total, 102.20, acres of the project site were surveyed and each tree was counted and marked on a GPS device.

Within each plot (survey no), all individual trees were identified, measured, and recorded. The diameters at breast height of the species were measured using a measuring tape. Trees were grouped into the following diameter classes: medium-sized trees (16–29.9 cm), and large trees (>29.9 cm).

1. These species were further grouped into four life forms defined by their maximum attainable heights as follows: treelets (small trees) (<10 m), understorey (10–20 m), canopy (20–30 m), and emergent (>30 m) .

3.3 Identification of Tree species

Most of the tree species encountered were identified on field on the basis of their morphological characters - Bark shape, texture, and color, Leaves- shape, size, texture, color, arrangement, flower and fruit color, shape, size, internal morphology, odor and arrangement of reproductive features. Morphological characteristics were used to identify the Tree species to the species level. The Flora of Maharashtra, and Bombay Presidency were used as references and online database of The International Plant Names Index (IPNI) was used to find out the latest and acceptable international scientific name of the Tree species.

3.4 Technology used

GPS device (GARMIN 76S) was used to take GPS positioning of each tree individuals.

ArcGIS was used as platform to create GIS based maps.

3.5 Data Processing and Analysis

(i) Density, abundance, Relative abundance of plant species were calculated. The basal area of each individual tree species was calculated

(ii) Species diversities and evenness were determined using

a) The Shannon-Weaver Diversity Index

$$H = -\sum_{i=1}^S p_i \ln p_i$$

Where $P_i = n_i/N$, n_i = number of individuals of species and N = total number of individuals

Typical values are generally between 1.5 and 3.5 in most ecological studies, and the index is rarely greater than 4. A Plant community is said to be rich if it has a Shannon Diversity value ≥ 3.5 .

b) Simpson's Diversity Index

$$D = 1 - \left(\frac{\sum n(n-1)}{N(N-1)} \right)$$

n = the total number of organisms of a particular species

N = the total number of organisms of all species

The value of D ranges between 0 and 1. With this index, 1 represents infinite diversity and 0, no diversity.

c) Pielou evenness index (J_{sw}) is calculated as $J_{sw} = H'/H'_{\max} = H'/\ln S$

4. Results

4.1 Species composition of Trees

Table 1(see Annexure file) shows the different Tree species found in the study area. A total of 25 species were recorded belonging to 15 families and 23 genera. Table 1 shows the different plant species, their families found in the study site T2. A total of 317 tree individuals (height above 3 meters) species were recorded in the study site (Table 1).

4.2 Abundance

From the 15 families recorded in the study sites, the Fabaceae had the highest number of genera 4 and species 4 followed by the Mimosaceae with 4 species and 3 genera. A total of 23 genera were recorded in the study sites. *Mangifera indica* (Anacardiaceae) were the most abundant Tree species. This was followed by the species *Bombax ceiba* (Bombacaceae), *Phyllanthus emblica* (Euphorbiaceae) and *Butea monosperma* (Fabaceae) having 22, 20 and 19 species respectively.

There were 11 rare species of this site having only one individual. Out of which 4 species were exotic. The rare native species of the included –*Pterocarpus marsupium*, *Terminalia paniculata*, *Albizia procera*, *Syzygium cuminii*, *Albizia lebbeck*, *Sterculia villosa* and *Trema orientalis*.

4.3 Relative abundance

Table 2 (see Annexure file) shows the different trees species found in the study sites and their relative abundance. In this site, 317 individuals were sampled. The species with the highest number of individual was *Mangifera indica* (187) with a

relative abundance of 59%. It was followed by *Bombax ceiba* (22 individuals and relative abundance of 6.9%), *Phyllanthus emblica* (20) and *Butea monosperma* (19) with relative abundance of 6.3% and 6% respectively.

Rank abundance curve: Rank abundance curve is one of the way to plot species abundance data, in which each species is represented by a vertical bar proportional to its abundance. See Figure 1. Notice the long “tail” of rarer species. A rank-abundance plot for a hypothetical community with perfect evenness would be flat instead of declining, indicating that every species had the same abundance. Here species rank abundance plot of site T2 shows long tail which means this community is unevenly distributed. The value of evenness in this report is calculated by formula of Pielou evenness index which shows that species richness is exactly intermediate in evenness.

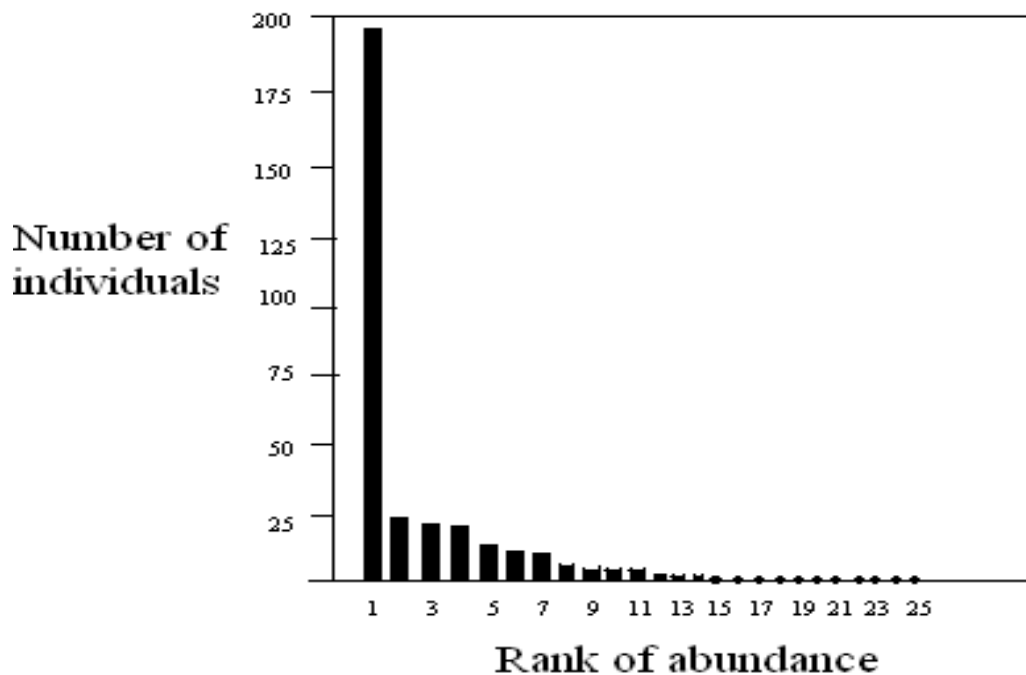


Figure 3. A Rank – abundance curve

4.4 Diversity

The Shannon-Weaver Diversity Index (H'), Pielou's Evenness, , and the species richness (d) of the study site is shown in following table. Site T2 shows the very poor diversity with $H'=1.74$. In terms of evenness, the Pielou's Evenness value of the site is 0.54. It shows that species richness is exactly intermediate in evenness. The site is less diverse with 25 numbers of species over such a large area of 41.35 hectares. The site shows greater value of simpson index i.e 0.635.

Parameter	Value
Shannon's diversity index (H')	1.741921
Pielou evenness index (J_{sw})	0.541158
Simpson index (C_d)	0.635
Richness (total number of species)	25

Table .3 Characteristics of trees in the study area.

4.5 Diameter classes and height of the trees

Trees with different diameter classes were found in the different study sites. The diameter range was grouped as small trees medium-sized trees (16.9–29.9 cm), and large trees (>29.9 cm). The site was dominated by trees species having diameters (>29.9 cm) (large trees). There were only 15 trees with medium diameters (16.9–26.9 cm). Those trees include – *Mangifera indica* (6 trees), *Tectona grandis* (2 trees), *Phyllanthus emblica* (3 trees), *Ficus racemosa* (1 tree), *Butea monosperma* (2 tree), *Cordia dichotoma* (1 tree).

Out of the 317 species identified in the study sites, 310 species were treelets, mostly <10 m tall, and 7 species were understory trees <20 m tall. No canopy and emergent tree species were found in the site.

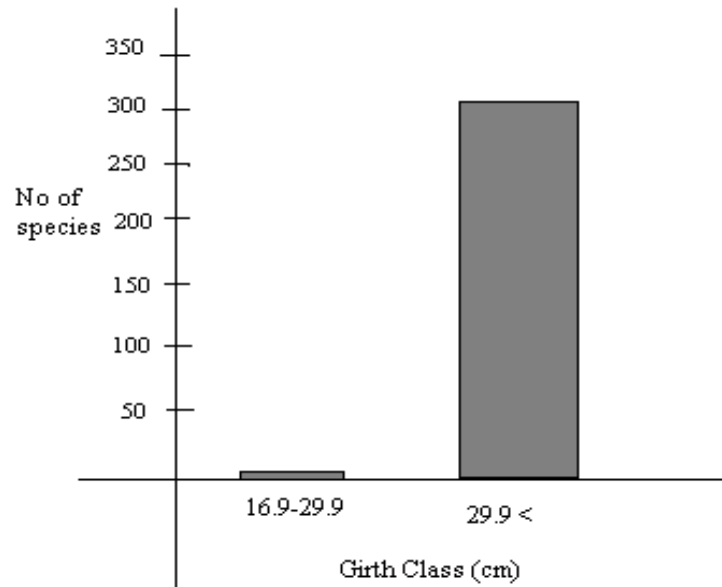


Figure 3 : Girth class of total trees of the area

4.6 Assessment of species protected by specific legislation

The site T2 does not contain any species which is protected by specific legislation (Rare, endangered, critically endangered, endemic and vulnerable).

5. Discussion:

The Fabaceae were observed to be the most prevalent family. This may be due to their fast germination ability, associated with sym-biotic properties which have enabled species to easily establish within this habitat. Fabaceae/Leguminosae is well represented family of western ghat. Though site represents Fabaceae as a largest family, total individuals of this family are less than *Mangifera indica* of Anacardiaceae. This is due to the cultivation of *Mangifera indica* on large area. Monoculture of *Mangifera indica* is also one of the reasons for lower value of species diversity index.

Generally, species diversity is one of the most important indices used to evaluate an ecosystem. A rich eco-system with high species diversity has a large value (H') while an ecosystem with low value (H') will have low species diversity. The present study site had a poor diversity of trees. i.e ($H'=1.74$). In case of Simpson's dominance index - The lower the index value, the lower the dominance of species. The greater the value of index of dominance, the lower is the species diversity. This site has higher value of dominance index. It shows that this site has low species diversity.

As shown by Pielou's Evenness value (0.54), tree community of study area is exactly intermediate in evenness.

The stem density of tree species increases with increase in girth class distribution in the study area. This could result from anthropogenic activities such as the cutting and burning of trees for plantation crops and domestic purpose by local people and tribes.

In this site most of the tree species are treelets (small trees) with a height <10 m. It also signifies anthropogenic disturbance.

6. Conclusion:

This study revealed that the site T2 has low tree species diversity. Fabaceae is the dominant family and *Mangifera indica* is the dominant species of this area. The result of ecological analysis shows that this site is very poor in diversity and disturbed. It may be due to the anthropogenic activities.

Following major things are observed and concluded from the survey of site T2

- a) This site comprises a low level of diversity of Tree species
- (b) It has no significance as a habitat for wildlife. No wild life has been observed during the survey.
- (c) It does not includes Trees of a rare, vulnerable or endangered species
- (d) This site does not contain tallest layer of vegetation i.e canopy or emergent tree species are not observed on the site. So it shows poor natural regeneration potential of the site.
- (e) Very few species in the lower girth class also indicates that site has poor natural regeneration potential
- (f) *Mangifera indica* is representative of the total vegetation but it is monocultured and its population is more than half of the total population. Large population of *Mangifera* is one of the reasons for low value of evenness.

Photo Gallery:



Dominat Mango Plantation









A tree census and inventory Report of T3
Orange Smart City, Mungoshi, Pen, Raigad,
Maharashtra

Location of the Site: Latitude: 18⁰46'53.73" N
Longitude: 73⁰07'28.52" E

Area: 111.26 acre

Vegetation of the site: This study assessed the diversity, abundance, density of trees in a 111.26 acre plot. Each tree was counted and marked on a GPS device. This Site is a barren land having very less vegetation. Only 11 trees are there on this site. No shrub was found on site. All the trees of this site are treelets (<10 m tall).

Species composition:

Following table shows the different Tree species found in the study area. A total of 5 species were recorded belonging to 5 families and 5 genera. Table shows the different plant species, their families found on the study site T3. A total of 11 tree individuals (height above 3 meters) were recorded in the study site (Table 1). *Bombax ceiba* is the most dominant species of the site having 7 individuals.

Common name	Scientific name	Family	No of species
Saver	<i>Bombax ceiba</i>	Bombacaceae	7
Bhokar	<i>Cordia dichotoma</i>	Boraginaceae	1
Umber	<i>Ficus racemosa</i>	Moraceae	1
Nimb	<i>Azardirachta indica</i>	Meliaceae	1
Hirda	<i>Terminalia chebula</i>	Combretaceae	1

Table : Species composition of the study site

A Tree census and inventory Report Site T4,
Orange Smart City, Valak-Mungoshi, Pen,
Raigad, Maharashtra

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4.5 Diameter classes and height of trees

4.6 Assessment of species protected by specific legislation

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Table 1. Species composition of the study site

Table 2. Relative abundance of the species

Table 3. Density and Basal of the different tree species

Figure 1. Location of the Project site

Summary of the Report

This study assessed the diversity, abundance, density of trees in a 78.48 ha plot. Each tree was counted and marked on a GPS device. The girth of the trees and shrubs were measured and species identified. A total of 17 species belonging to 16 genera and 13 families were recorded. Leguminosae had the highest number of genera 5 and 5 species. *Bombax ceiba* recorded the highest tree density (0.86 individual's ha⁻¹).

The girth class distribution showed that with the highest number of trees in the larger girth class (>29.9 cm). Tree number decreases with lower girth (<29.9) class. In this site all the tree individuals are small trees (treelets) except 2. Diameter class of the trees shows that site is disturbed with anthropogenic activities. A dominance index of trees was 0.52.

Site T4 shows the very poor diversity with $H' = 1.44$. In terms of evenness, the Pielou's Evenness value of the site is 0.50. It shows that site has intermediate value for evenness. If this site is selected for any developmental activity, along with conservation, more focus should be given for mixed plantation including different native species of Herbs, Shrubs and Trees. It will increase species richness of the site and will provide protected habitat for different faunal species of nearby area.

This site has one patch having dense and diverse vegetation of shrubs and trees. One deity is there in the middle of this vegetation patch. This vegetation patch must be conserved and 100 % protection should be to this specific patch while developing the site.

Introduction

The present document is a Tree census and inventory report of the ‘Integrated **Industrial Township**’ at Pen, Dist Raigad, Maharashtra. The present Tree census and inventory report was done to quantify, map and to create an inventory of Tree species.

The study gives a detailed account of Tree diversity, health status, density, distribution and their locations by using GIS and mapping tool.

Physical setting of the Proposed Project Site:

The proposed “**Integrated Industrial Township**” by Karanja Infrastructure (P) Ltd. will be developed in Pen region of Raigad district. Raigad district forms a part of Maharashtra littoral, the micro level divisions of coastal plain. Though the districts form an important part of the traditional “Konkan Plain”, ruggedness and uneven topography form the governing theme in its physical features. The Sahyadri (Western Ghats) in the east send several transverse numbers of subsidiary hills westwards denying the plains of a uniform level and continuous character.

The proposed site lies on leeward side of Sahyadri i.e Western ghat. The project site is irregular in shape and overlooks the River Bhogeshwari & Balganga. The site is at a height of 185 meters above mean sea level. The highest point within the site is at 201m whereas the lowest point of the site is at 84 meter. This site is highly contoured with a little vegetation cover.

Climate:

The climate of the district is typical of that on the west coast of India, with plentiful, regular and seasonal rainfall during the monsoon season. Being a coastal district, the diurnal and seasonal variations in temperature is not large. The temperature here averages 26.9°C.

Rainfall:

The south- west monsoon commences by about the first week of June and the rains continue till about the beginning of October. The average rainfall for the district is 3207 mm.

Location: T4: Latitude: 18047'26.51" N
Longitude: 73005'27.74" E

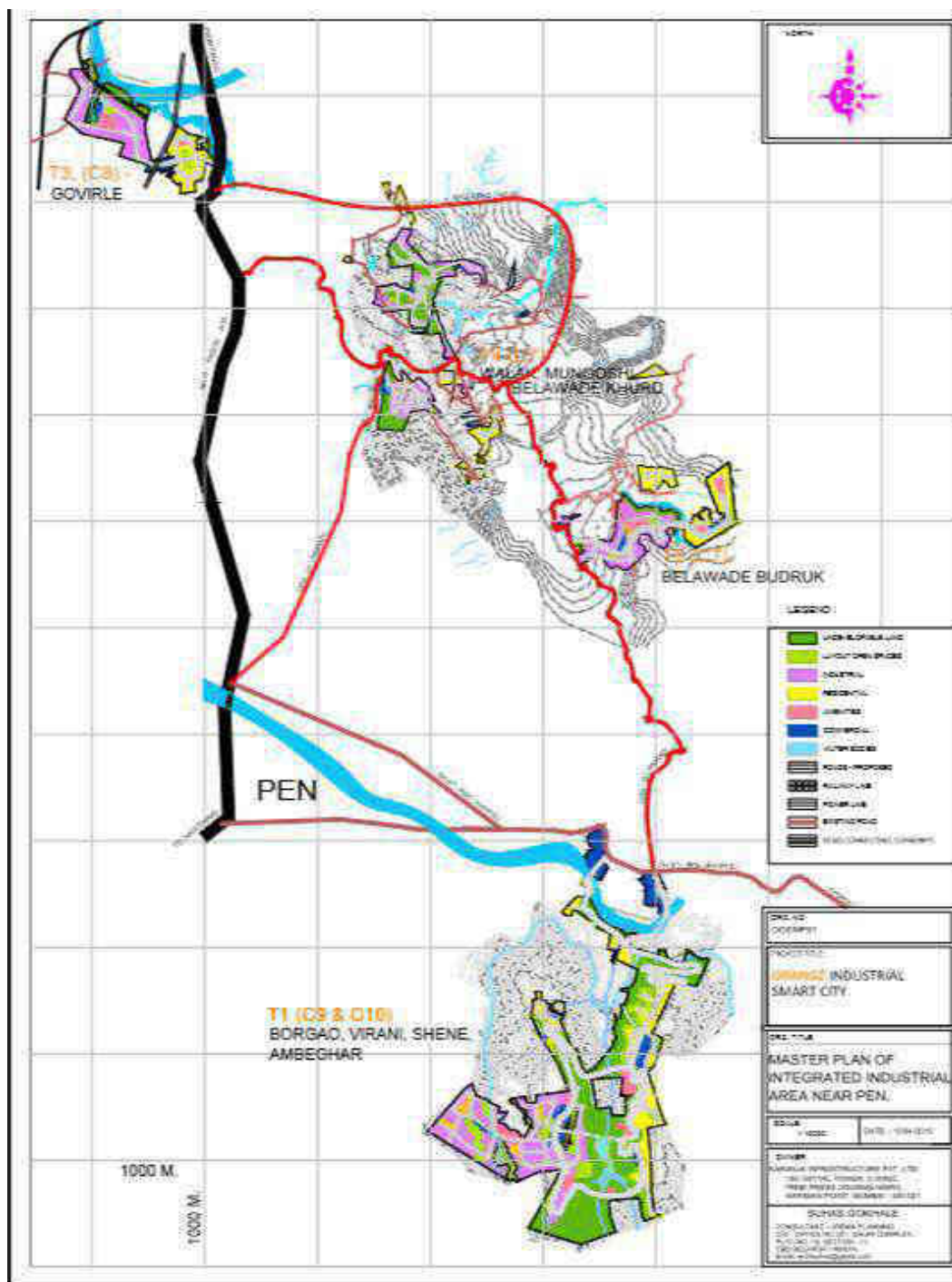


Figure 1. Location of the Project site

2.0 Scope of the study

2.1 Objectives:

1. To make an inventory of tree individuals and tree species in the proposed project site with the help of GPS
2. To create a distribution / vegetation map of the whole area representing Tree individuals
3. To undertake ecological analysis with the help of
 - a. Abundance, Relative abundance
 - b. Density and Basal area
 - c. Simpson's biodiversity Index, Shannon's Biodiversity index
 - d. Diameter class and height of the trees
4. Assessment of species protected by specific legislation (Rare, endangered, critically endangered, endemic and vulnerable)

2.2. Sampling

Since the purpose of the project was to create a detailed inventory of Tree individuals and species, the "Census" was used as a sampling technique. In total, 193.95, acres of the project site were surveyed and each tree was counted and marked on a GPS device.

Within each plot (survey no), all individual trees were identified, measured, and recorded. The diameters at breast height of the species were measured using a measuring tape. Trees were grouped into the following diameter classes: medium-sized trees (16–29.9 cm), and large trees (>29.9 cm).

1. These species were further grouped into four life forms defined by their maximum attainable heights as follows: treelets (small trees) (<10 m), understorey (10–20 m), canopy (20–30 m), and emergent (>30 m) .

2.3 Identification of Tree species

Most of the tree species encountered were identified on field on the basis of their morphological characters - Bark shape, texture, and color, Leaves- shape, size, texture, color, arrangement, flower and fruit color, shape, size, internal morphology, odor and arrangement

of reproductive features. Morphological characteristics were used to identify the Tree species to the species level. The Flora of Maharashtra, and Bombay Presidency were used as references and online database of The International Plant Names Index (IPNI) was used to find out the latest and acceptable international scientific name of the Tree species.

2.4 Technology used

GPS device (GARMIN 76S) was used to take GPS positioning of each tree individuals. ArcGIS was used as platform to create GIS based maps.

2.5 Data Processing and Analysis

(i) Density, abundance, Relative abundance of plant species were calculated. The basal area of each individual tree species was calculated

(ii) Species diversities and evenness were determined using

a) The Shannon-Weaver Diversity Index

$$H = -\sum_{i=1}^S p_i \ln p_i$$

Where $P_i = n_i/N$, n_i = number of individuals of species and N = total number of individuals

Typical values are generally between 1.5 and 3.5 in most ecological studies, and the index is rarely greater than 4. A Plant community is said to be rich if it has a Shannon Diversity value ≥ 3.5 .

b) Simpson's Diversity Index

$$D = 1 - \left(\frac{\sum n(n-1)}{N(N-1)} \right)$$

n = the total number of organisms of a particular species

N = the total number of organisms of all species

The value of D ranges between 0 and 1. With this index, 1 represents infinite diversity and 0, no diversity.

c) Pielou evenness index (J_{sw}) is calculated as $J_{sw} = H'/H'_{\max} = H'/\ln S$

3. Results

3.1 Species composition of Trees

Table 1(see Annexure file) shows the different Tree species found in the study area. A total of 17 species were recorded belonging to 13 families and 16 genera. Table 1 shows the different plant species, their families found in the study site T3. A total of 103 tree individuals (height above 3 meters) were recorded in the study site (Table 1).

3.2 Abundance

From the 13 families recorded in the study sites, the Leguminosae had the highest number of genera (5) and species (5) followed by the Moraceae with 2 species and 1 genus. A total of 16 genera were recorded in the study sites. *Bombax ceiba* (Bombacaceae) was the most abundant Tree species. This was followed by the species *Erythrina stricta* (Leguminosae), *Casearia tomentosa* (Salicaceae) and having 5 species of both.

There were 9 rare species of this site having only one individual. All those species are native to India. No exotic species was found on the site except disturbed plantation *Acacia auriculiformis*. It must be caused by cutting of large *Acacia auriculiformis* trees.

3.3 Relative abundance

Table 2 (see Annexure file) shows the different trees species found in the study sites and their relative abundance. In this site, 103 individuals were sampled. The species with the highest number of individual is *Bombax ceiba* (68) with a relative abundance of 70.04%. It was followed by *Erythrina stricta* and *casearia tomentosa* (5 individuals and relative abundance of 5.15%).

3.4 Diversity

The Shannon-Weaver Diversity Index (H'), Pielou's Evenness, and the species richness (d) of the study site is shown in following table. Site T4 shows the very poor diversity with $H'=1.44$. In terms of evenness, the Pielou's Evenness value of the site is 0.50. It shows that

site has intermediate value i.e 0.5 for evenness. The site is less diverse with 17 numbers of species over such a large area of 193.95 acres. The site shows intermediate value of simpson index i.e 0.52

Parameter	Value
Shannon's diversity index (H')	1.4463
Pielou evenness index (Jsw)	0.50
Simpson index (Cd)	0.52
Richness (total number of species)	17

Table .3 Characteristics of trees in the study area.

3.5 Diameter classes and height of the trees

Trees with different diameter classes were found in the different study sites. The diameter range was grouped as medium-sized trees (16.9–29.9 cm), and large trees (>29.9 cm). 24 tree species of the area were measured between 16.9–26.9 cm. 79 species are large trees (>29.9)

Out of the 103 species identified in the study sites, 101 species were treelets (<10 m tall), and only 2 species were understory trees (10-20 m tall).

3.6 Assessment of species protected by specific legislation

The site T4 does not contain any species which is protected by specific legislation (Rare, endangered, critically endangered, endemic and vulnerable)

4. Discussion:

The Leguminosae were observed to be the most prevalent family. This may be due to their fast germination ability, associated with sym-biotic properties which have enabled species to easily establish within this habitat. Leguminoceae is well represented family of western ghat. The site T4 represents Leguminosae as a largest family having 5 genera and 5 species of this family.

The species with highest number of individual is *Bombax ceiba* (68) with a relative abundance of 70.04%. The seed dispersal mechanism is very important in species distribution and composition of woody plants. *Bombax ceiba* shows anomophilous mode of seed dispersal. This may be one of the reasons for its population and evenly distribution in and outside the study area.

There were 9 rare species of this site having only one individual. All those species are native to India. No exotic species was found on the site except disturbed and plantation *Acacia auriculiformis*. It must be caused by cutting of large *Acacia auriculiformis* trees.



Photograph of disturbed plantation – *Acacia auriculiformis*

Generally, species diversity is one of the most important indices used to evaluate an ecosystem. A rich eco-system with high species diversity has a large value (H') while an ecosystem with low value (H') will have low species diversity. The present study site had a poor diversity of trees. i.e ($H'=1.44$). In case of Simpson's dominance index - The lower the index value, the lower the dominance of species. The greater the value of index of dominance, the lower is the species diversity. This site has intermediate value of dominance index (0.52). It shows that this site is having intermediate status of species diversity.

As shown by Pielou's Evenness value (0.50), tree community of study area has intermediate level of evenness.

The stem density of tree species increases with increase in girth class distribution in the study area. This could result from anthropogenic activities such as the cutting and burning of trees for plantation crops and domestic purpose by local people and tribes.

In this site out of 103 trees, 101 are small sized trees (treelets) with a height smaller than 10m. It also signifies anthropogenic disturbance.

Instead of having low species diversity, this site has one patch where tree diversity is high. Though this specific patch is small, it has dense vegetation compare to other area. This patch has dense and diverse shrub and tree diversity than other vegetation patches of the site. Woody climbers are also present on some trees. One deity is there in the middle of this vegetation patch. Tribes and communities of surrounding area respects and do worship of this deity.



Photograph of Deity on site T4

5. Conclusion:

This study revealed that the site T4 has low tree species diversity. Leguminosae is the dominant family and *Bombax ceiba* is the dominant species of this area. The result of ecological analysis shows that this site is very poor in diversity and disturbed. It may be due to the anthropogenic activities.

Though this site is poor in species diversity, this site has one patch having dense and diverse vegetation of shrub and tree. One deity is there in the middle of this vegetation patch. This

vegetation patch must be conserved and 100 % protection should be to this area while developing the site

Following major things are observed and concluded from the survey of site T1

- a) All the species of this area are native to Maharashtra.
- b) This site comprises a low level of diversity Tree species.
- c) Tree community of study area showed intermediate value for evenness.
- e) It has no significance as a habitat for wildlife. No wild life has been observed during the survey.
- f) It does not includes Trees of a rare, vulnerable or endangered species
- g) This site has more individuals of small size (treelets). So the site shows good natural regeneration potential.
- h) Very few species in the lower girth class shows anthropogenic disturbance. This could result from anthropogenic activities such as the cutting and burning of trees for plantation of crops and domestic purpose by local people and tribes.

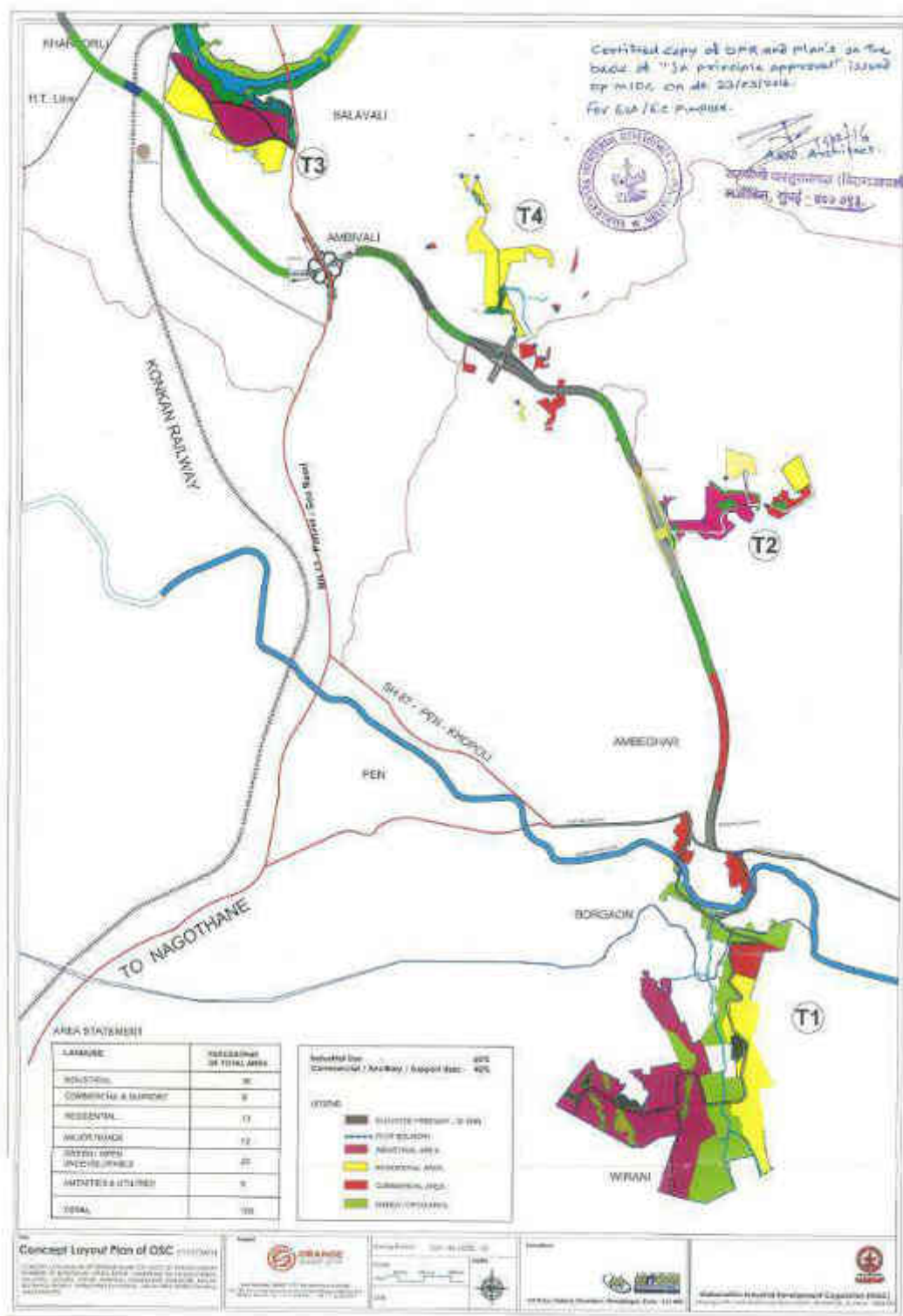
6. Recommendations:

1. If this site is selected for any developmental activity, along with conservation more focus should be given for mixed plantation. Plantings should include a diverse array of species, genera, and families, of different herbs shrubs and trees. This will provide protected habitat for different faunal species of nearby area.
2. Particularly those trees other than *Bombax ceiba* and *exotic species* should be selected for plantation.
3. The removal of disturbed plantation of *Acacia auriculiformis* and re- plantation of the site T4 with different native species will have positive effect on Biodiversity
4. This site has one patch having dense and diverse vegetation of shrub and tree. One deity is there in the middle of this vegetation patch. This vegetation patch must be conserved and 100 % protection should be to this area while developing the site.
5. No bird was found during the survey. The reason (which we heard) behind it was shocking. For some tribes living near study area, some birds still form a part of their diet. Tribes near the study area still lead a nomadic life and hunt some birds for food.

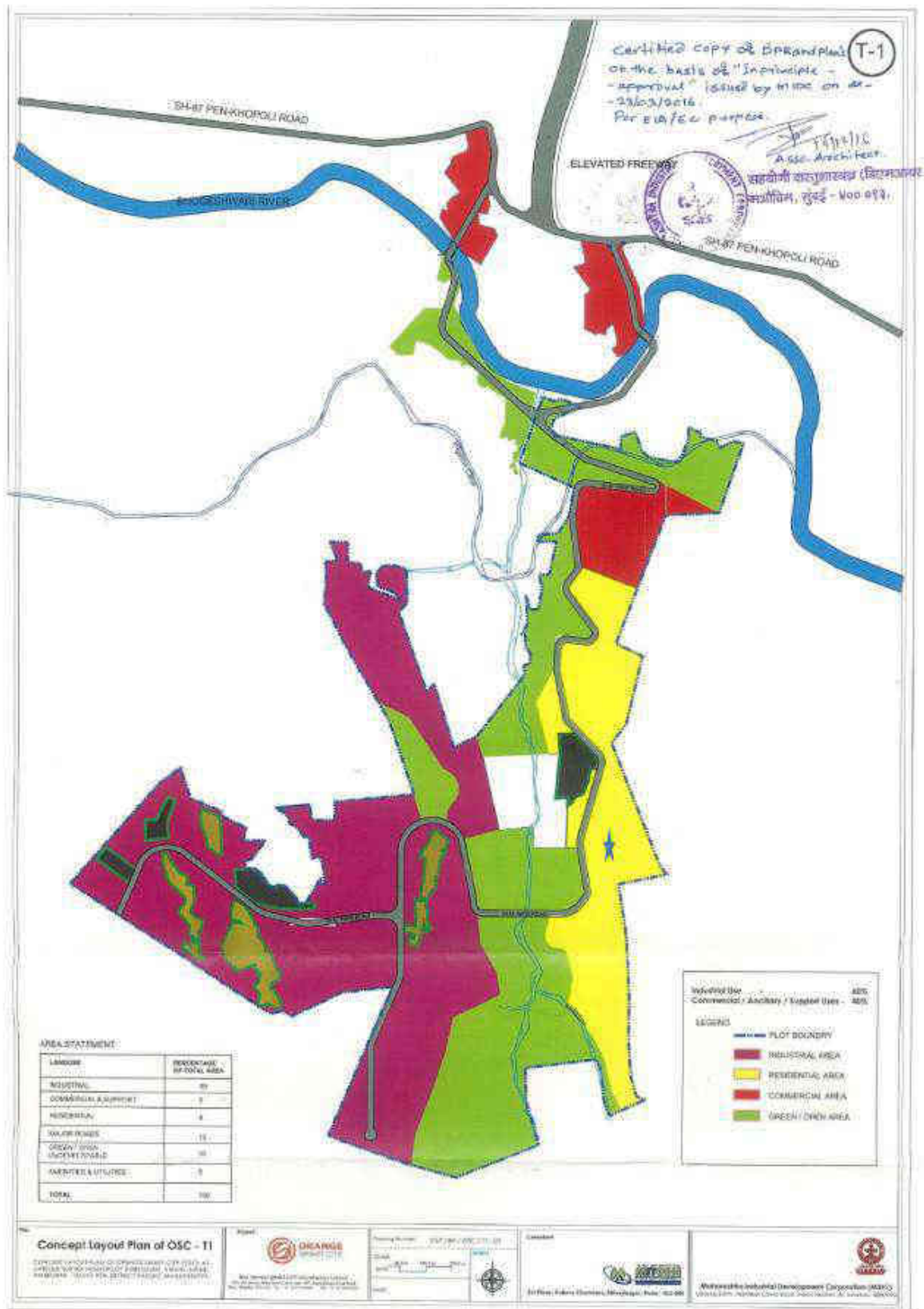
If this site is planted with different native species of herbs, shrubs and trees. And along with this if supply of fresh, clean water is provided within the site then it will attract many birds. Creation of these types of environments within the Industrial Township will give roosting, protective place for birds. This will be a major step towards sustainability.

6. Maintain and restore plants native to the place, so as to facilitate adaptability and reap the environmental benefits. Benefits and time are lost when older trees are removed and replaced with smaller and younger tree species.
7. Protect or restore existing water bodies, so as to promote biodiversity.
8. Transplantation is a good option to protect Biodiversity.

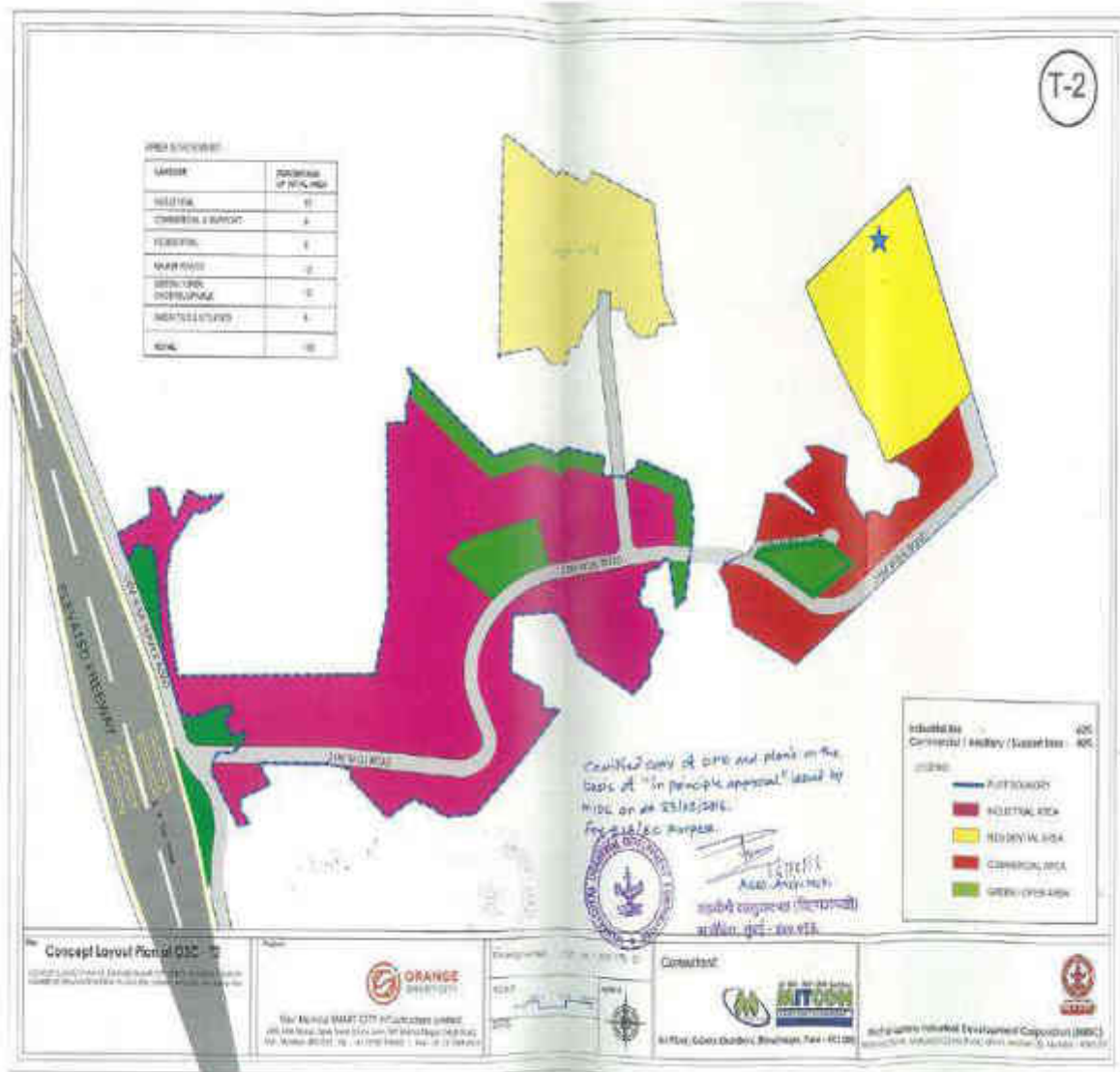
Approved Concept Master Plan



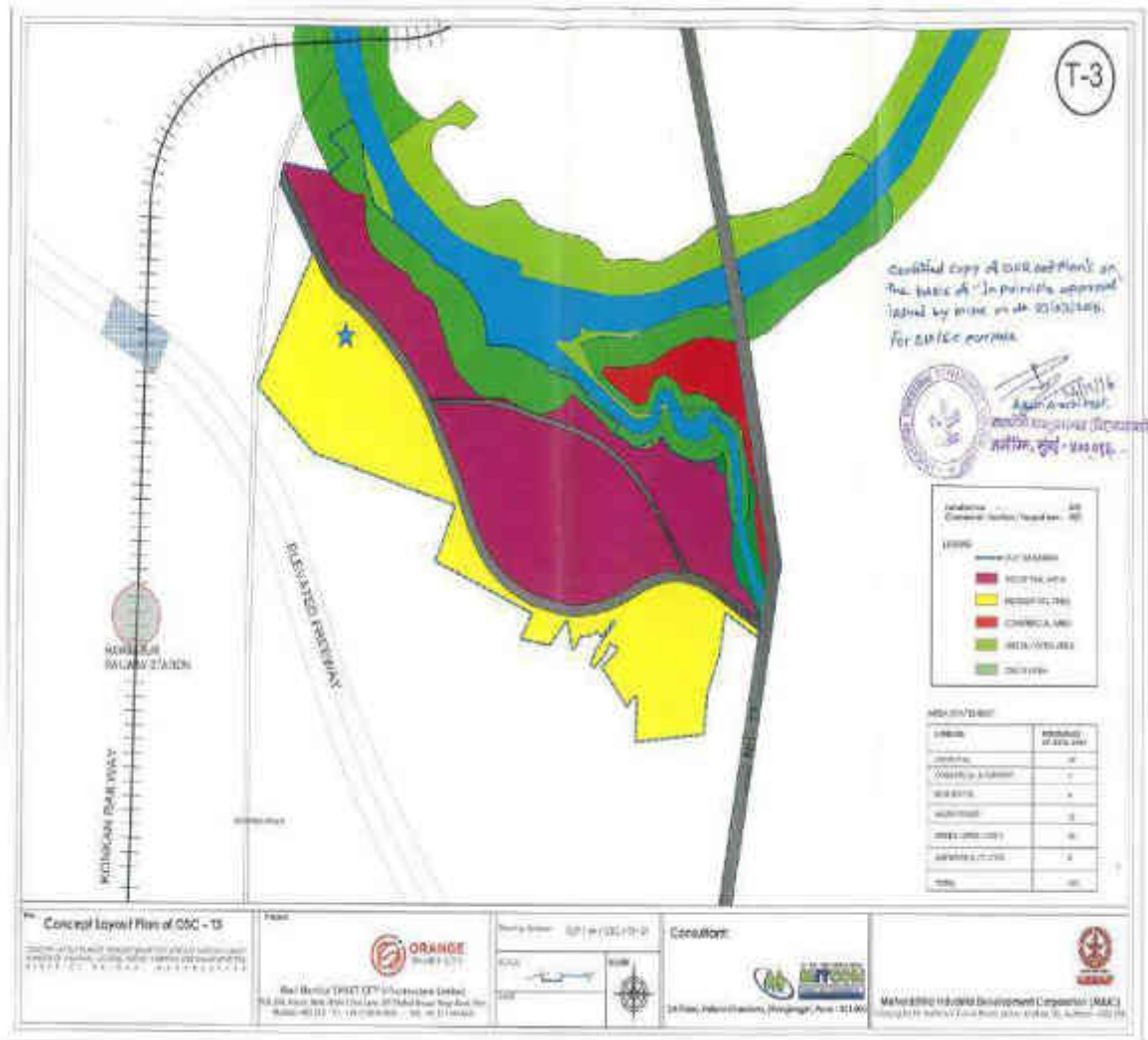
Approved Layout Plan for T1 Land parcel



Approved Layout Plan for T2 Land parcel



Approved Layout Plan for T3 Land parcel



Approved Layout Plan for T4 Land parcel

