CENTRAL PUBLIC WORKS DEPARTMENT

FORM-1 & FORM-1A

FOR

PROPOSED CONSTRUCTION OFFICE

AT

CUSTOM ENCLAVE (SULEMAN SHAH PLOT), WADALA (EAST), MUMBAI

[Total Project area = 56,523.13 SQ.M.
Built-up area = 3,04,580.67 sq. m.]

MARCH, 2017
(Issue 1, Rev 1)

Prepared by:

MIN MEC CONSULTANCY PVT. LTD.
A-121, Paryavaran Complex, IGNOU Road, New Delhi – 110 030
Ph : 29534777, 29532236, 29535891 ; Fax: 091-11-29532568
Email :minmec@gmail.com; Web site : www.minmec.co.in
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APPENDIX I
(See Paragraph – 6)
FORM 1
(Issue 1, Rev. 1, March 2017)

(I) Basic Information

1	Name of the Project:	Construction of Office Complex at Customs Enclave (Suleman Shah Plot), Wadala (East), Mumbai
2	S. No in the Schedule	8(b)
3	Proposed capacity/ area/ length/ tonnage to be handled/ command are/ lease area/ number of wells to be drilled	Total plot area = 56,523.13 sq.m Permissible ground coverage (50%) = 28,261.565 Proposed ground coverage (35.26%) = 19,930 sq.m Permissible FSI = 226092.52 sq.m Achieved FSI = 213702.66 sq.m. Non FSI (Basements) = 90878.01 sq.m Total Built-up area = FSI+ Non FSI 304580.67 sq.m ***Population details:*** Customs Officials (G+29) - 5935 Floating/ Visitors - 5935 **Total- 11870**
4	New/ Expansion/ Modernization	New
5	Existing capacity/ area* etc	Nil, it is a new project
6	Category of Project i.e. ‘A’ or ‘B’	'A’ category as per S.O. 3999 (E) dt. 09.12.2016
7	Does it attract general condition? If yes, please specify	Not Applicable
8	Does it attract specific condition? If yes, please specify	No as not located in any industrial complex/ estate/ SEZ etc.

9	Location	Refer ***Annexure I*** for location map
	Plot/ Survey/ Khasra no.	C.S No. 146 of salt division, F-North ward of Greater Mumbai. The Survey map is given ***Annexure II***.
	Village	-
	Tehsil	-
	District	Greater Mumbai
	State	Maharashtra
10	Nearest railway station/ airport along with distance in km	***Railway Stations:*** Nearest – Wadala R.S. 1.1 km, W Major station – Mumbai Central R.S., 7.4 km. ***Airports:*** Nearest – Chhatrapati Shivaji International Airport- 7.5 Km, N
11	Nearest town, city, district head quarters along with distance in kms	Project is within Mumbai District Head Quarter – Mumbai, 10.6,SW
12	Village Panchayats, Zilla Parishad, Municipal Corporation, Local Body (complete postal addresses with telephone nos. to be given).	Project is within Municipal Corporation of Greater Mumbai, Mahapalika Marg, Fort, Mumbai, Maharashtra 400001 Phone No. 022 2262 0251
13	Name of the applicant	Central Public Works Department
14	Registered Address	Custom Project Division, CPWD, Building No. 29, Room No. 953, Ground Floor, Sector-7, CGS Colony, Antop Hill, Mumbai
15	Address for correspondence :	
	Name	Mr. P Shridhar
	Designation (Owner/ Partner/ CEO)	Executive Engineer
	Address	Custom Project Division, CPWD, Building No. 29, Room No. 953, Ground Floor, Sector-7, CGS Colony, Antop Hill, Mumbai
	Pin Code	400037
	E mail	mumeecustomspd.cpwd@nic.in
	Telephone no.	022-24017115
	Fax	022-24017116
16	Details if Alternative sites examined, if any. Location of these sites should be shown in a toposheet	No alternate sites have been examined. Site has been allotted by Mumbai Metropolitan Region Development

		Authority for the construction of Custom Office.
17	Interlinked Projects	No
18	Whether separate application of interlinked project has been submitted?	No
19	If yes, date of submission	Not applicable
20	If no, reason	Not applicable
21	Whether the proposal involves approval/ clearance under : if yes, details of the same and their status to be gives:	
	(a) The Forest (Conservation) Act, 1980?	Yes as the mangrove forest is at 0.3 km, E. The application of forest NOC is under process.
	(b) The Wildlife (Protection) Act, 1972?	Not applicable
	(c) The CRZ Notification, 1991?	Yes as the site is in Coastal Regulation Zone – CR II. Application for CRZ clearance is being made separately.
22	Whether there is any Government Order/ Policy relevant/ relating to the site?	Mumbai Metropolitan Region Development Authority has allotted the land bearing C.S No. 146 to the “Additional Commissioner of Customs (PG)”, Custom Enclave Cell for the development of Custom Office. Refer ***Annexure III*** for land allotment letter. The site is in “Industrial zone” as per development plan of MMRDA. Urban Development Department Mantralaya, Mumbai, Government of Maharashtra has given permission for the construction of Customs office at the land bearing C.S No. 146. Refer ***Annexure IV.***
23	Forest land involved (hectares)	Nil

24 Whether there is any litigation pending against the project and/or land in which the project is proposed to be set up? Nil

(a) Name of Court — Not applicable

(b) Case No. — Not applicable

(c) Orders/ directions of the Court, if any and its relevance with the proposed project — Not applicable

25 Expected cost of the project: Rs. 1360 Crores approximately

* *Capacity corresponding to sectoral activity (such as production capacity for manufacturing, mining lease area and production capacity for mineral production, area for mineral exploration, length for linear transport infrastructure, generation capacity for power generation etc.)*

(II) Activity

1. Construction, operation or decommissioning of the Project involving actions, which will cause physical changes in the locality (topography, land use, changes in water bodies, etc.)

Sl. No.	Information/Checklist confirmation	Yes /No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
1.1	Permanent or temporary change in landuse, land cover or topography including increase in intensity of land use (with respect to local land use plan)	Yes	Total plot area is 56,523.13 sq.m. on which 3 basement, podium & G+29 floors will get constructed with built up area of 3,04,580.67 sq.m. At present the land is open with grasses, shrubs & few trees and one existing structure. Once there is permanent construction, the topography will change permanently. This land cover will change from open to “constructed” in the form of office building, road, green area, surface parking and open spaces. Layout and landscape plan attached as ***Annexure V***.
1.2	Clearance of existing land, vegetation and buildings?	Yes	The site is covered with grasses and shrubs along with few small trees which will be cleared for which permission will be taken from the forest department in case they have to be cut and in lieu, trees will be planted. There is one ground structure existing at the project site which will be demolished.
1.3	Creation of new land uses?	Yes	The project area lies under Industrial zone (I3). MMRDA has allotted the land of C.S No. 146 for the development of Custom Office at the area and Urban Development Department Mantralaya, Mumbai, Government of

Sl. No.	Information/Checklist confirmation	Yes /No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
			Maharashtra has given permission for the construction of Customs office at the land of C.S No. 146. The proposed land use of the project will be Office building (19930 sq.m.), road area (10087 sq.m.), surface parking (2723 sq.m.) and green area (23783 sq.m.).
1.4	Pre-construction investigations e.g. bore holes, soil testing?	Yes	Soil investigation for the proposed project has been done by M/s DBM Geotechnics & Constructions Pvt. Ltd, Mumbai and the relevant pages of the report containing interpretation of lab results, recommendations and bore log charts has been attached as ***Annexure VI.***
1.5	Construction works?	Yes	R.C.C. works of office & public semi public building, utility, road network etc. will be carried out. Development of commercial building will be done as per applicable norms/ byelaws of Development Authority which include commercial areas, public/ semi public areas, green areas, road network, etc.
1.6	Demolition works?	Yes	There is one ground structure existing at the project site which will be demolished. All the temporary construction such as warehouses, site office and sanitation facilities for workers will be dismantled after the completion of project. The temporary construction will be of porta cabin type and will be dismantled after the completion of construction works. Maximum components are recyclable and therefore, minimum waste will be generated.
1.7	Temporary sites used for construction works housing of construction workers?	Yes	Temporary site office will be established at the site with provision of shelter of workers. Construction workforce will be coming from the nearby areas. The remaining will be accommodated in temporary hutments which will be demolished after completion of construction. They will be provided with drinking water and sanitation facilities.
1.8	Above ground buildings, structures or earthworks including linear structures, cut and fill or excavations	Yes	Construction of building, erection of structures like overhead water storage, STP, piping, electric sub-stations, temporary site offices, maintenance facilities & other infrastructure shall be done. Besides, there shall be office building, services etc. in the project. Cut and fill technology shall be adopted to the extent

Sl. No.	Information/Checklist confirmation	Yes /No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
			possible. Building related earth work will be cutting (267635 cum) & Filling of 147182 cum (Project Site) + 120453 cum (Outside the project site)
1.9	Underground works including mining or tunneling?	No	Not applicable as no underground workings or mining or tunneling shall be carried out. Only there will be construction of basements.
1.10	Reclamation works?	No	Not applicable
1.11	Dredging?	No	Not applicable
1.12	Offshore structures?	No	Not applicable
1.13	Production and manufacturing processes?	No	No manufacturing units are proposed in proposed project.
1.14	Facilities for storage of goods or materials?	Yes	The storage of constructions material will be done in temporary sheds, warehouses and stock yards which will be dismantled after completion of construction activities. The temporary construction will be of porta cabin type and will be dismantled after the completion of construction works. Maximum components are recyclable and therefore, minimum waste will be generated.
1.15	Facilities for treatment or disposal of solid waste or liquid effluents?	Yes	The wastewater generated (285 KLD) will be treated in STP within project. Sewage network plan with STP is given in ***Annexure VII.*** 100% treated waste water will be used for HVAC after softening. 10% water discharged in softening process will be reused for gardening. Refer Section 4.3 of EMP given in ***Annexure XV*** for water calculations &balance. The estimated solid waste generation will be 1.8 T/Day which will be segregated and disposed as outlined in Section 9.0 of EMP givne in ***Annexure XV***.
1.16	Facilities for long term housing of operational workers?	No	Not applicable
1.17	New road, rail or sea traffic during construction or operation?	Yes	Construction vehicles will be very few and construction workers will either use bicycle or public transport system to travel to and from the site. During operation, movement of 11870 people including custom officials, trade users and service personnel will result in increase in traffic density, since most of them are anticipated to use public or personal transport.

Sl. No.	Information/Checklist confirmation	Yes /No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
			No rail or sea traffic is envisaged.
1.18	New road, rail, air waterborne or other transport infrastructure including new or altered routes and stations, ports, airports etc?	No	No airport, station or waterborne traffic is envisaged. No such alterations of the routes will take place. Transportation and infrastructure requirement will be fulfilled by already existing roads of the area. To augment the movement of personal transport vehicles, necessary roads having area of 10,087 sq.m area will be provided for circulation.
1.19	Closure or diversion of existing transport routes or infrastructure leading to changes in traffic movements?	No	No changes in the existing transport routes, closure or diversion is proposed.
1.20	New or diverted transmission lines or Pipelines?	No	There will not be any diversion of transmission and pipe line.
1.21	Impoundment, damming, culverting, realignment or other changes to the hydrology of watercourses or aquifers?	No	Not Applicable
1.22	Stream crossings?	No	
1.23	Abstraction or transfers of water from ground or surface waters?	No	Source of water considered shall be from the Municipal supply. Water requirement for the project is envisaged as 414 KLD of fresh water and 257 KLD of treated water. Thus, total of 671 KLD is envisaged. Provision for 15% water loss in case of emergency/ unforeseen leakage and separately for fire fighting has been kept. Both these demands will not rise everyday but only in case of emergency.
1.24	Changes in water bodies or the land surface affecting drainage or run-off?	Yes	The land surface will undergo changes due to construction of building which will affect the sheet flow of rain water. Therefore storm water drainage plan has been provided within the project as shown in ***Annexure IX***.
1.25	Transport of personnel or materials for construction, operation or decommissioning?	Yes	Transportation of building materials for construction of infrastructure and building will take place initially only. During operation phase, assuming that the

Sl. No.	Information/Checklist confirmation	Yes /No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
			custom office will operate from 09:00 to 17:30 hours, movement of 11870 people will take place.
1.26	Long-term dismantling or decommissioning or restoration works?	No	There will be no long-term dismantling or decommissioning or restoration works due to this project. Only dismantling of Warehouse/stock yard will be done, which is temporary construction of portal cabin type.
1.27	Ongoing activity during decommissioning which could have an impact on the environment?	No	The project is not likely to be decommissioned for the next few decades.
1.28	Influx of people to an area in either temporarily or permanently?	Yes	This is the Customs Enclave office building. The total custom officials will be 5935 along with 5935 floating and visitors. There will not be any permanent influx of residents.
1.29	Introduction of alien species?	No	
1.30	Loss of native species or genetic diversity?	No	
1.31	Any other actions?	No	

2. Use of Natural resources for construction or operation of the Project (such as land, water, materials or energy, especially any resources which are non-renewable or in short supply)

Sl. No.	Information/checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
2.1	Land especially undeveloped or agricultural land (ha)	Yes	At present, the land area of 56,523.13 sq.m is an undeveloped open land. It is an open space with grasses, shrubs and few trees. This land cover will change from open to constructed in the form of custom office building comprising of records, kitchen, Auditorium for 400 people, Convention centre, Malkhana, Court rooms, Armoury, offices for various departments of customs, road, green area, surface parking and open spaces. The layout and landscape plan has been attached as ***Annexure V***.
2.2	Water (expected	Yes	Source of water considered shall be from the

Sl. No.	Information/checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
	source & competing users) unit: KLD		Municipal supply. Water requirement for the project is envisaged as 414 KLD of fresh water and 257 KLD of treated water. Thus, total of 671 KLD is envisaged. Provision for 15% water loss in case of emergency/ unforeseen leakage and separately for fire fighting has been kept. Both these demands will not rise everyday but only in case of emergency.
2.3	Minerals (MT)	No	Not applicable.
2.4	Construction material – stone, aggregates, sand / soil (expected source – MT)	Yes	Tentative consumption of building material will be of Bricks (25476356 Nos.), Cement (13648048 Bags), Steel (300 Tonnes), Aggregate (200171 Cum), Sand (136480 Cum) and for road works will be Aggregate (18197 Cum) and Bitumen (145579 Kg) These will be purchased from various vendors. Hence, no permission is required separately.
2.5	Forests and timber (source – MT)	Yes	No deforestation is proposed. Timber will be required at places for construction of door and window frames or for woodwork. The quantum of use of timber in the building will be according to building design. To reduce the requirement of timber during construction, steel scaffolding and shuttering will be used. Latest environmental friendly options like aluplast, PVC frames and alternative materials' doors etc. will be used for construction of door and window frames etc.
2.6	Energy including electricity and fuels (source, competing users) Unit: fuel (MT), energy (MW)	Yes	The power demand for the building will be 10,000 KVA. Electric supply for the complex shall be received from MSEB on 33 KV from the nearest Grid Sub-Station through overhead line/ Underground Cable upto the 33 KV HT meter room proposed near the Gate Complex. Four numbers of Diesel Generator sets each of capacity 1010 KVA have been proposed for the building.
2.7	Any other natural resources (use appropriate standard units)	No	

3. Use, storage, transport, handling or production of substances or materials, which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health

Sl. No.	Information/ Checklist confirmation	Yes /No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
3.1	Use of substances or materials, which are hazardous (as per MSIHC rules) to human health or the environment (flora, fauna, and water supplies)	Yes	No hazardous substance will be used, stored and transported during construction phase which could be harmful to human health or the environment except some paints and thinners, which pose a risk on inhalation or inflammation. During operation, waste oil from DG sets, transformers and other equipment using oil coolants/ engine oil will be generated and sold to CPCB approved recycling vendors. Chlorine compounds may be used for last stage treatment of waste water as per optimum contact requirement.
3.2	Changes in occurrence of disease or affect disease vectors (e.g. insect or water borne diseases)	No	No changes in occurrence of disease or affect on disease vectors (e.g. insect or water borne diseases) because there will be no discharge of sewage or waste water outside project area without treatment. Spray of standard pesticides will be used near drainage and along the road side to control vectors.
3.3	Affect the welfare of people e.g. by changing living conditions?	Yes	There will be number of job and business opportunities after the development of the Customs Enclave building such as office workers, salesman, sweeper, gardener, driver, security guards etc.
3.4	Vulnerable groups of people who could be affected by the project e.g. hospital patients, children, the elderly etc.	No	Nil
3.5	Any other causes	No	Nil

4. Production of solid wastes during construction or operation or decommissioning (MT/month)

Sl. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
4.1	Spoil, overburden or mine wastes	No	Not applicable
4.2	Municipal waste (domestic and commercial wastes)	Yes	The total anticipated solid waste generation from the project will be 1.8 TPD.
4.3	Hazardous wastes (as per Hazardous Waste Management Rules)	Yes	The disposal of waste oil from D.G sets at the time of servicing shall be sold to authorized CPCB approved recycling vendor. The disposals of 3.9 tonnes/year of e-waste (@ 0.66 kg/capita/year) from building shall be stored separately and disposed of to the recyclers authorized by MPCB.
4.4	Other industrial process wastes	No	Not applicable
4.5	Surplus product	No	Not applicable
4.6	Sewage sludge or other sludge from effluent treatment	Yes	The sewage discharge envisaged for the project is about 285 KLD as per MoEF norms and the sewage sludge envisaged is 0.42 tonnes/day (@ 35 gm/capita/day), which will be produced after its treatment in the STP provided within the project site. Dried weight will be 30-35%, which will be available as manure.
4.7	Construction or demolition wastes	Yes	Construction debris like un-used concrete and masonry material is recommended to be used as land filling material or may used to construct the roads. Mixed debris with high gypsum, plaster shall be given to recyclers besides, metal scrap, plastics, glass etc. Wood scrap can be reused and the remaining will be disposed off.
4.8	Redundant machinery or equipment	No	There will be no generation of redundant machinery or equipment for disposal.
4.9	Contaminated soils or other materials	No	There will be no generation of contaminated soils or other materials.
4.10	Agricultural wastes	No	No agricultural waste will be generated during operation phase of this project. Only dry leaves, grasses, weeds, etc. will be cleared.
4.11	Other solid wastes	No	No other type of solid waste except municipal and used oil will be generated.

5. Release of pollutants or any hazardous, toxic or noxious substances to air (Kg/hr)

Sl. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
5.1	Emissions from combustion of fossil fuels from stationary or mobile sources	Yes	Low sulphur content fuel (HSD-Sulphur content: 0.05%) for DG sets will be used to control the emissions within permissible limits. However, DG sets will operate only at the time of power failure.
5.2	Emissions from production processes	No	Not applicable
5.3	Emissions from materials handling including storage or transport	Yes	During construction time, generally generation of high levels of PM_{10}, $PM_{2.5}$ are there and to a limited extent SO_2, and NO_X due to operation of fossil fuel based vehicles, machines and earthwork. During operation, street cleaning activities generate dust, SO_2 and NO_X.
5.4	Emissions from construction activities including plant and equipment	Yes	PM_{10}, $PM_{2.5}$, SO_2 and NO_x generated by construction machines and handling of building material will be limited to the construction period. The impact will be short-lived and reversible.
5.5	Dust or odours from handling of materials including construction materials, sewage and waste	Yes	Dust will be generated from loading and unloading of construction materials and transportation of cutting materials from the site. Water spraying during construction phase to control dust will be done. Proper collection, treatment and disposal methods will be planned for solid waste and waste water to control odor problems.
5.6	Emissions from incineration of waste	No	No incineration proposed.
5.7	Emissions from burning of waste in open air (e.g. slash materials, construction debris)	No	No burning of waste in open air will be done.
5.8	Emissions from any other sources	No	

6. Generation of Noise and Vibration, and Emissions of Light and Heat

Sl. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
6.1	From operation of equipment e.g. engines, ventilation plant, crushers	Yes	Noise shall be generated from operation of equipment e.g. engines, concrete vibrators, ready mix concrete discharge, electric welding, electric rod cutter, etc. during day time which will attenuate naturally to permissible levels within project boundary. The DG sets will be equipped with acoustic enclosures which minimize the noise to below permissible norms.
6.2	From industrial or similar processes	No	Not applicable
6.3	From construction or demolition	Yes	Noise will be generated due to construction equipment during construction phase only and from demolition equipments, which are temporary and reversible.
6.4	From blasting or buttress	No	Nil
6.5	From construction or operational traffic	Yes	Construction vehicles will be very few and construction workers are expected to either use bicycle or public transport system to travel to and from the site. Therefore, impact on noise will be insignificant.
6.6	From lighting or cooling systems	No	Generation of noise, vibration, and emission of Light and Heat from lighting or cooling systems will be there. For example, during operation phase air conditioners will be used which will generate heat outside the official/ commercial space, etc.
6.7	From any other sources	No	

7. Risks of contamination of land or water from releases of pollutants into the ground or into sewers, surface waters, groundwater, coastal waters or the sea

Sl. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
7.1	From handling, storage, use or spillage of hazardous materials	No	Care shall be taken that no spillage of waste oil takes place into the environment. There will be no risk of contamination of land or water since proper disposal facilities will be provided for the same.
7.2	From discharge of sewage or	Yes	Sewage will not be discharged into the

Sl. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
	other effluents to water or the land (expected mode and place of discharge)		land or water body, but will be collected through sewage network and treated in MBBR based STP (350 KLD capacity) within project. Entire treated waste water will be reused in HVAC after softening. 10% water will be discharged in softening process which will be utilized for gardening and irrigation. Refer Table 4 & Fig. 1 of EMP in ***Annexure XV*** for water requirement and water balance***.*** Only rain water runoff will be discharge during monsoon only.
7.3	By deposition of pollutants emitted to air into the land or into water	Yes	Deposition of dust on land & plants from air due to construction and during operation due to transportation will be there. However, winds disperse the settled dust and rains wash them off. Therefore, it is not a permanent deposition.
7.4	From any other sources	No	
7.5	Is there a risk of long term build up of pollutants in the environment from these sources?	No	There is no risk of long term build up of pollutants in the environment.

8. Risk of accidents during construction or operation of the Project, which could affect human health or the environment

Sl. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
8.1	From explosions, spillages, fires etc from storage, handling, use or production of hazardous substances	Yes	There is no proposal for storage, handling, use or production of hazardous substances except for chlorination. Hence, there are no risks. However, fire is a possibility and as per the laid down guidelines for the building complex, the complex will provide fire fighting devices for the same. Refer Section --- of DMP in ***Annexure XII*** for details of fire fighting system.
8.2	From any other causes	No	

Sl. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
8.3	Could the project be affected by natural disasters causing environmental damage (e.g. floods, earthquakes, landslides, cloudburst etc)?	No	Mumbai region falls in seismic zone III as per seismic zone map of Indian Standard IS 1893. The site being located near coastal zone in Mumbai, can get affected by natural disasters. Mumbai also experiences flooding/water logging during monsoons. Disaster Management Plan is given in ***Annexure XII***.

9. Factors which should be considered (such as consequential development) which could lead to environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality

Sl. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
9.1	Lead to development of supporting facilities, ancillary development or development stimulated by the project which could have impact on the environment e.g.:		
	• Supporting infrastructure (roads, power supply, waste or waste water treatment, etc.)	Yes	In order to support the building, power lines will be drawn within project site, roads will be constructed within the project as well as for access, water supply and sewage systems will be laid down extensively and STP shall be provided.
	• housing development	No	Nil
	• extractive industries	No	Nil
	• supply industries	No	Nil
	• other	No	
9.2	Lead to after-use of the site, which could have an impact on the environment	No	
9.3	Set a precedent for later developments	No	
9.4	Have cumulative effects due to proximity to other existing or planned projects with similar effects	No	This is a 'Proposed Construction of Office Complex at Customs Enclave Plot Wadala (E), Mumbai. Therefore the pollution potential is low. However, the cumulative effect of various industries and industrial areas in the 15 km radius is already existing which are given in ***Annexure X.***

(III) Environmental Sensitivity

Map from Google Earth of 15 km radius around project is given in ***Annexure XI***.

Sl. No.	Areas	Name/ Identity	Aerial distance (within 15 km.) Proposed project location boundary
1.	Areas protected under international conventions, national or local legislation for their ecological, landscape, cultural or other related value	List of such area is given in **Annexure X**	
2.	Areas which are important or sensitive for ecological reasons - Wetlands, watercourses or other water bodies, coastal zone, biospheres, mountains, forests	List of Sea, River, Nala, Ponds, Lakes, etc is given in **Annexure X**	
3.	Areas used by protected, important or sensitive species of flora or fauna for breeding, nesting, foraging, resting, over wintering, migration	As listed in Point 1 & 2 above	
4.	Inland, coastal, marine or underground waters	As in Point 2 above	
5.	State, National boundaries	Nil	Nil
6.	Routes or facilities used by the public for access to recreation or other tourist, pilgrim areas	List of Roads, railway line, railways station is given in **Annexure X**	
7.	Defense installations	Kalina Military Camp	6.6, N
8.	Densely populated or built-up area	The project lies in Wadala (East), Mumbai which it self is a densely populated area.	
9.	Areas occupied by sensitive man-made places *(hospitals, schools, places of worship, community facilities)*	There are several hospitals, schools, places of worship and community facilities in F/N ward as given in ***Annexure XXII.*** Also refer point 1.3 of Form 1A. Also refer ***Annexure X*** for list of historical, religious places	
10.	Areas containing important, high	List of ecological	

Sl. No.	Areas	Name/ Identity	Aerial distance (within 15 km.) Proposed project location boundary
	quality or scarce resources *(ground water resources, surface resources, forestry, agriculture, fisheries, tourism, minerals)*	important places is given in ***Annexure X*.**	
11.	Areas already subjected to pollution or Environmental damage. *(those where existing legal environmental standards are exceeded)*	Nil. Nearest is MIDC Industrial Area (Navi Mumbai, Maharashtra) at 16.5 km, ENE	
12.	Areas susceptible to natural hazard which could cause the project to present environmental problems (*earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions*)	The site area comes under seismic zone - III.	

(IV) Proposed Terms of Reference for EIA studies

Refer **Attachment XXIX**.

I hereby give undertaking that the data and information given in the application and enclosures are true to the best of my knowledge and belief and I am aware that if any part of the data and information submitted is found to be false or misleading at any stage, the project will be rejected and clearance given, if any to the project will be revoked at our risk and cost.

Date:
Place:

(Authorized Signatory)

Submit document supporting claim of authorized signatory for the specific project. (***Annexure XIII.*** - Authorisation to Signatory). The project report is attached as ***Annexure XVI.***

FORM-1A
(Only for construction projects listed under item 8 of the Schedule)
CHECK LIST OF ENVIRONMENTAL IMPACTS
(Project proponents are required to provide full information and wherever necessary attach explanatory notes with the Form and submit along with proposed environmental management plan & monitoring programme)

1. LAND ENVIRONMENT
(Attach panoramic view of the project site and the vicinity)

ANS: Refer ***Annexure XIV*** for panoramic view of project site.

1.1 Will the existing land use get significantly altered from the project that is not consistent with the surroundings? (Proposed land use must conform to the approved Master Plan / Development Plan of the area. Change of land use if any and the statutory approval from the competent authority be submitted). Attach Maps of (i) site location, (ii) surrounding features of the proposed site (within 500 meters) and (iii) the site (indicating levels & contours) to appropriate scales. If not available attach only conceptual plans:

ANS: The project area lies under Industrial zone (I3). Mumbai Metropolitan Development Authority has allotted the land of C.S No. 146 to the "Additional Commissioner of Customs (PG)", Custom Enclave Cell. Urban Development Department Mantralaya, Mumbai, Government of Maharashtra has given permission for the construction of Customs office at the land bearing C.S No. 146. Refer ***Annexure IV.***

Refer ***Annexure I*** for Location map, ***Annexure XVII*** for map showing the surrounding features within 500 m of the project site and the landscape and layout plan is attached as ***Annexure V.***

1.2 List out all the major project requirements in terms of the land area, built up area, water consumption, power requirement, connectivity, community facilities, parking needs etc.

a) Land Requirement

PROPOSED LAND USE OF THE PROJECT

Sl. No.	Land use	Area Details in sq.m	
		Area	%
1	Office Building	19930	35.26
2	Road Area	10087	17.85
3	Surface parking	2723	4.82
4	Green Area	23783	42.08
	Total	**56523.13**	**100.0**

The built-up area of the project is 3,04,580.67 sq.m.

b) Water Consumption

Total water requirement is 671 KLD (fresh + treated) shown in Table 2 of EMP attached as ***Annexure XV***. The total fresh water requirement for the project will be apprx. 414 KLD which will be taken from Municipal supply.

c) Power Requirement

The power demand for the building is 10,000 KVA. 4x1010 KVA DG set are proposed as power backup.

Source:

Electric supply for the complex shall be received from MSEB on 33 KV from the nearest Grid Sub- Station through overhead line /Underground Cable upto the 33 KV HT meter room proposed near the Gate Complex.

DG sets will be located at Basement 1. The location of DG sets has been shown in ***Annexure XIX***.

d) Connectivity

The proposed site is well connected to Roads, such as Eastern Freeway located at 0.02 km, E, Anik Wadala Road located adjoining in S, Bandra-Worli Sea Link at 5.7 km, W, NH-8 at 4.5 km, NW, Sion Panvel Expy at 4.6 km, NE, Jeejabai Bhosle Marg at 6.3 km, NE, Palm Beach Road at 14.0 km, E, NH-4B at 11.6 km, SE, Bombay Port Trust Road at 0.2, E, LBS Road at 2.8 km, NNW, Andheri Ghatkopar Road at 8.1 km, N, Lady Jamshedji Road at 3.3 km, W, Rafi Ahmad Kidwai Marg at 1.0 km, W, Netaji Subhash Chandra Bose Road at 9.1 km, SSW, NH-3 at 3.7 km, N, Dr. Ambedkar Road at 2.2 km, W, Link Road at 13.9, NNW.

The proposed site is approximately 7.5 Km, N from Chhatrapati Shivaji International Airport and 1.1 km, W from Wadala Railway Station.

e) Community Facilities

Community facilities are available at the city level within short distance.

f) Parking Facilities

Parking facility will be provided as follows:

Location	Parking
VIP Parking has been made as part of surface Parking integrated with landscape garden	198
Podium level	450
Basement - 1 level	300
Basement - 2 level	800
Basement - 3 level	400
Total Parking Provided	**2148**

Besides, there is also provision for 2-wheeler parking in the second basement and podium level.

A Comprehensive car parking management system is proposed with following facilities:-

- Automatic counting of cars and LED display about available parking space on each parking level.
- Automatic detection of vehicular movements and audio announcement system.
- An automatic vehicular identification and Access control system based on long range radio frequency Identity.
- The system will have facility to interconnect with computer to be installed in security room with in built capability to upgrade the system.

Provision has been made for different gates for general and visitors entry and exit. Besides, there will be common entry/exit for Executives. Circulation plan with surface parking is given in ***Annexure XX.*** Basement and Podium Parking Plans are given in ***Annexure VIII.***

1.3 What are the likely impacts of the proposed activity on the existing facilities adjacent to the proposed site? (Such as open spaces, community facilities, details of the existing land use, disturbance to the local ecology).

ANS: Greater Mumbai is divided into administrative wards for the purpose of local administration. The proposed project lies under F/N ward which measures around 12.94 sq.km and is bound by Thane Creek on the East, Central Railway on West, S.N Mankikar Marg on the North and Mumbai Marathi Granth Sangralaya Marg and Road No. 26 of Scheme No. 57 of Sion division on South side.

The eastern part of the ward is mostly situated in Industrial zone where there are various depots of Petroleum companies. The ward is fully developed except eastern Wadala area which is being developed for Residential User, for Govt. Central Ware Housing scheme and for Truck Terminus. The existing educational Institutes in this ward are Raja Chhatrapati Shivaji Vidyalaya at Hindu Colony, Dadar (E), Rula College of Arts & Science at Lakhamsi Nappu Road, Podar College of Commerce at Lokhamsi Nappu Road, S.I.E.S College of Science, Arts & Commerce, University Department of Chemical Technology at Nathelal Parekh Marg, Victoria Jubilee Technical Institute at Nathelal Parekh Marg, Khalsa College of Science, Arts & Commerce at Nathelal Parekh Marg. The Lokmanya Tilak Hospital at Dr. Ambedkar Marg is a prominent Municipal Hospital in this ward.

Impact on Ecology will be as follows

- A marginal impact is envisaged on ecology within the project area as only grasses, shrubs and few trees exist. Clearance of grass and shrubs will take place while tree cutting is not envisaged for accommodating the different facilities.In case, any tree is to be cut, it will be done after obtaining requisite permission.

- Trees will also be planted to improve the ecology of the project site.
- Sanjay Gandhi National Park is at 14.0 km, distance from the project site in north direction but there is no impact on the same as it is a commercial building construction project.
- Sewri-mahul mudflats (coordinates - 19.00N 72.86E) on eastern edge of Southern Mumbai are well known for housing flamingos during their annual migration in Mumbai. The Sewri mudflats are 2.3 km, SSW from the project site aerially. No impact due to the proposed project are anticipated on the Sewri mudflats as between the flamingo habitat and the project site lies various industries of Wadala and the major road- Eastern Expressway. Furthermore, there will not be any discharge of waste water from the project, which could eventually make its way to the Sewri mudflats to affect the flamingoes. The air, noise or solid waste from proposed project will not reach the mudflats either.

1.4 Will there be any significant land disturbance resulting in erosion, subsidence & instability? (Details of soil type, slope analysis, vulnerability to subsidence, seismicity etc. may be given).

ANS: Soil investigation has been done and as per the chemical analysis of the soil, the site falls under class II for sulphate and class V for chloride concentration. The relevant pages of the soil test report is attached as ***Annexure VI.*** The project exhibit flat terrain having minimum elevation of 28.314 m and maximum of 29.264 m with slope towards the southern side. The area within the 10 km radius from the proposed project constitutes buffer zone. The ground elevation of the buffer zone is minimum 0 m and maximum 295 m. The constructed building, roads and service facilities would obstruct the sheet flow and will lead to water logging and soil erosion. To ensure that this does not occur proper storm water drainage has been provided. There is no subsidence anticipated due to the construction of the proposed project.

As per IS 1893 (Part 1), the site falls under Seismic zone: IIII.

1.5 Will the proposal involve alteration of natural drainage systems? (Give details on a contour map showing the natural drainage near the proposed project site).

ANS: No it will not alter natural drainage system, as there is no natural drain through the site.

1.6 What are the quantities of earthwork involved in the construction activity cutting, filling, reclamation etc. (Give details of the quantities of earthwork involved, transport of fill materials from outside the site etc.)

ANS: Cut and fill technology shall be adapted to the extent possible as this involves least disturbances to the natural ground. Building related earth work is given below:

Sl. No.	Description	Quantity (Cum)	
		Cutting	Filling at project site
1.	Building, Site Development, Landscaping	2,67,635	1,47,182 (Project site) 1,20,453 (Outside the project site)

1.7 Give details regarding water supply, waste handling etc during the construction period.

ANS: Construction Phase:

a) Water supply

Water requirement during construction phase will be met through tankers. The project proponent will obtain necessary permission from the concerned authority. Domestic water supply for construction workers will be sourced through municipal supply.

b) Waste handling

Construction debris like un-used concrete and masonry material is recommended to be used as land filling material or may be used to construct the roads. Mixed debris with high gypsum, plaster shall be given to recyclers besides metal scrap, plastics, glass etc. shall be sold to recyclers. Wood scrap can be reused and the remaining will be disposed off.

c) Traffic

During construction phase, construction material will be transported to the site. This will add to increase in traffic as on the road.

d) Noise Level

Noise level in the vicinity of the construction site will increase due to operation of construction equipment, transport vehicles, portable generators, and other mechanical machinery.

1.8 Will the low-lying areas & wetlands get altered? (Provide details of how low lying and wetlands are getting modified from the proposed activity

ANS: No there will be no such alternation.

1.9 Whether construction debris & waste during construction cause health hazard? (Give quantities of various types of wastes generated during construction including the construction labour and the means of disposal)

ANS: No, there will not be any health hazard during construction due to construction debris and waste since they will be handled and disposed as per procedure. Further, the labour will be provided with PPE to avoid any accidental problems. Construction waste will predominantly be earth work generated during cutting which will be used for filling at the project site. Sewage will be treated in septic tanks before discharge.

2. WATER ENVIRONMENT

2.1 Give the total quantity of water requirement for the proposed project with the breakup of requirements for various uses. How will the water requirement met? State the sources & quantities and furnish a water balance statement.

ANS: Fresh water requirement will be sourced from Municipal supply. The total fresh water requirement will be approx. 414 KLD. Fresh water requirement for

the office population will be approx. 356 KLD and 283 KLD treated water will be used for HVAC makeup. Reject water of 6 KLD from softener-1 and 26 KLD from softener-2 will be used for irrigation purposes. Green cover in the complex works out to be 23,783 sq.m. which will utilize 32 KLD treated waste water.

Total STP treated water available for recycling will be 257 KLD. Entire treated water will be sent to the softener, 10% water will be discharged in softening process i.e 26 KLD which will be utilized for gardening and irrigation and rest 231 KLD softened water will be recycled for HVAC. Thus, there will be zero discharge from the project.

The details on water requirement and water balance diagram are presented in Table 6 and Fig. 1 of EMP appended as ***Annexure XV.***

2.2 What is the capacity (dependable flow or yield) of the proposed source of water?

ANS:

- 414 KLD fresh water will be sourced from municipal supply.
- A well planned distribution network has been worked out for the project depending on the slope and gradient in the site. ***Annexure XVIII*** gives the water distribution network in the proposed project.
- For watering in green areas like gardens, parks, green landscapes etc, it is proposed to use recycled water collected from STP so that water would be conserved.

Therefore, the sources of water identified for Water Supply System in the project are:

a) Municipal supply
b) Treated water from STP and discharge from Softener for HVAC and gardening.

2.3 What is the quality of water required, in case, the supply is not from a municipal source? (Provide physical, chemical, biological characteristics with class of water quality)

ANS: The water will be taken from the Municipal source.

2.4 How much of the water requirement can be met from the recycling of treated wastewater? (Give the details of quantities, sources and usage)

ANS: The sewage discharge envisaged for the project is 285 KLD. The sewage will be sent to the Advanced MBBR based Sewage Treatment Plant of 350 KLD capacity proposed within the project area. 257 KLD treated water will be available for recycling. Entire treated water will be sent to the softener, 10% water will be discharged in softening process i.e 26 KLD which will be utilized for gardening and irrigation and rest 231 KLD softened water will be recycled for HVAC. An second softener will also discharge 6 KLD, which too will be utilised in gardening. Thus there will be zero discharge from the project.

2.5 Will there be diversion of water from other users? (Please assess the impacts of the project on other existing uses and quantities of consumption)

ANS: Since the major source of water at the project site is Municipal water supply, the other users who are mostly residential/commercial/industrial will be the competing users. However, no diversion is envisaged.

2.6 What is the incremental pollution load from wastewater generated from the proposed activity? (Give details of the quantities and composition of wastewater generated from the proposed activity

ANS: Total quantity of waste water generation will be 285 KLD as per MoEF norms. The anticipated characteristics of the wastewater will be that of a typical weak to medium untreated domestic wastewater. The sewage treatment plant envisaged shall be designed to bring down BOD to below 20 mg/l and suspended solids to below 10 mg/l levels. The anticipated characteristics before and after treatment are anticipated to be as follows:

ANTICIPATED CHARACTERISTICS OF WASTE WATER BEFORE AND AFTER TREATMENT

Sl. No.	Parameter	Before treatment Concentration (mg/l)	After treatment Concentration (mg/l)
1.	Suspended solids	200-450	<100mg/l
2.	BOD	200-300	<30 mg/l
3.	COD	600-800	<80 mg/l
4.	Oil and grease	40-50	<5 mg/l
5.	pH	6.5-8	7 to 7.5

Source: Data Base Project Report of "Construction of Office Complex and Godown at Customs Enclave Plot", (Suleman Shah Plot), Wadala (East), Mumbai by Architect Suresh Goel & Associates

Refer ***Annexure VII*** for Sewage network plan and location of STP

2.7 Give details of the water requirements met from water harvesting? Furnish details of the facilities created.

ANS: As per Geo-technical investigation report, ground water table observed between 0.8 to 1.7 M below ground level(bgl), which is very high. Therefore, no artificial recharging will be proposed since Central Ground Water Board(CGWB) norms suggests that artificial recharging will not be done if the water table is less than 8 m.

(Source : Manual on norms and standards for environment clearance of large construction projects, MOEF,GOI, Chapter 2)

2.8 What would be the impact of the land use changes occurring due to the proposed project on the runoff characteristics (quantitative as well as qualitative) of the area in the post construction phase on a long-term basis? Would it aggravate the problems of flooding or water logging in any way?

ANS: Due to construction of building, the sheet flow of the runoff will be disturbed, however, rain water from terraces and other open areas shall be collected through rain water down take pipes and connected to storm water drainage

system. No rainwater harvesting is proposed as discussed is point 2.7 above.

2.9 What are the impacts of the proposal on the ground water? (Will there be tapping of ground water; give the details of ground water table, recharging capacity, and approvals obtained from competent authority, if any)

ANS: There will not be any impact on ground water as the complex will be dependent on municipal source for supply of water. As per the soil test report, the ground water was available at the depth of 0.8 m to 1.7 m.

No rainwater harvesting is proposed as discussed is point 2.7 above.

2.10 What precautions/measures are taken to prevent the run-off from construction activities polluting land & aquifers? (Give details of quantities and the measures taken to avoid the adverse impacts)

ANS: Following measures are adopted to avoid land degradation and soil erosion:

i) Side drains have been provided on both sides of the roads to facilitate drainage, which will, in turn, minimize soil erosion. The drains will have gentle gradient and side slopes to carry rainwater without erosion.
ii) Wherever possible, vegetative cover shall be immediately established on cut slopes.

2.11 How is the storm water from within the site managed? (State the provisions made to avoid flooding of the area, details of the drainage facilities provided along with a site layout indication contour levels)

ANS: In general the rain water from terraces and other open areas shall be collected through Rain water down take pipes and connected to catch basins. The Rain water from hard courts and landscaped area shall be collected by catch basins through a RCC pipe network or open drains with gratings. Storm water drainage layout is designed as per the site contour, in coordination with the available ground slopes keeping in view the strata of the plot. As the natural nalas are flowing near to the proposed site, discharge of rain water will be done in the same. The storm water drainage is attached as ***Annexure IX***.

2.12 Will the deployment of construction labourers particularly in the peak period lead to unsanitary conditions around the project site (Justify with proper explanation)

ANS: No, deployment of construction labourers will not lead to unsanitary conditions as proper temporary sanitation facilities will be provided to the labours to prevent unhygienic condition.

Moreover the deployment of construction labourers is temporary and so will be their houses, which will be dismantled after construction is over.

a) Community toilets shall be constructed on the site during construction phase and the waste water will be channelized to master plan sewer.
b) Minor construction waste shall be generated, most of which would be

recyclable and sellable to recycling vendors. Remaining waste shall be disposed in designated landfill site.

2.13 What on-site facilities are provided for the collection, treatment & safe disposal of sewage? (Give details of the quantities of wastewater generation, treatment capacities with technology & facilities for recycling and disposal)

ANS: The sewage generation envisaged for the project is 285 KLD, which will be collected by the sewage system and treated in the proposed STP. The capacity of the proposed STP is 350 KLD. After the treatment, 100% waste water will be recycled inside the complex for HVAC. During monsoon discharge water from the softener will go into the storm water drains and outside to nearby nala. The Sewage network plan with location of STP is attached as ***Annexure VII.***

2.14 Give details of dual plumbing system if treated wastewater used is used for flushing of toilets or any other use.

ANS: No, Dual plumbing system will not be developed in the proposed project because no treated waste water will be used for flushing. It will be 100% utilized in HVAC and gardening.

Water supply network is given in ***Annexure XVIII***.

3. VEGETATION

3.1 Is there any threat of the project to the biodiversity? (Give a description of the local ecosystem with it's unique features, if any)

ANS: No. There will not be any threat to biodiversity due to the proposed project (also refer point 1.3 earlier). Although the project area has some vegetation cover, which will be required to be cleared off for the construction work, ecology will be improved with help of green covers on 23,783 sq.m of land encompassing modest 42.08% of total land.

3.2 Will the construction involve extensive clearing or modification of vegetation? (Provide a detailed account of the trees & vegetation affected by the project)

ANS: The site is covered with grasses and shrubs along with few small trees. Grasses and shrubs will be cleared. Trees are not envisaged to be disturbed due to the layout of the project. In case any tree has to be cut, permission will be taken from the relevant department and in lieu, trees will be planted.

3.3 What are the measures proposed to be taken to minimize the likely impacts on important site features (Give details of proposal for tree plantation, landscaping, creation of water bodies etc along with a layout plan to an appropriate scale)

ANS: 42.08% green area is proposed within the premises. Total 331 trees will be planted. The landscape plan is given in ***Annexure V.***

4. FAUNA

4.1 Is there likely to be any displacement of fauna-both terrestrial and aquatic or creation of barriers for their movement? Provide the details

ANS: No there will be no such displacement

4.2 Any direct or indirect impacts on the avifauna of the area? Provide details

ANS: Due to the provision of the green area and plantation on the project site, it is expected that site will attract small fauna such as squirrels, birds, etc.

4.3 Prescribe measures such as corridors, fish ladders etc to mitigate adverse impacts on fauna

ANS: Not applicable since no water bodies are involved.

5. AIR ENVIRONMENT

5.1 Will the project increase atmospheric concentration of gases & result in heat islands? (Give details of background air quality levels with predicted values based on dispersion models taking into account the increased traffic generation as a result of the proposed constructions)

ANS: The heat island effect, if any shall be counter balanced by plantation of trees that will keep the micro climate cool. There will be increase in fugitive emissions due to earthmovers and construction equipments and transportation of construction raw materials during construction phase only. During operational phase, there will be emission of combustion gases from the stacks of the DG's. Low sulphur content fuel (HSD-Sulphur content: 0.05%) for DG sets will be used to control the emissions within permissible limits. However, DG sets will operate only at the time of power failure.

5.2 What are the impacts on generation of dust, smoke, odorous fumes or other hazardous gases? Give details in relation to all the meteorological parameters

ANS: ***Construction Phase:***

- Adverse impact due to dust, SO_2, NOx, & CO generated by construction machines and handling of building material.
- Impacts limited to the construction period will be short-lived and reversible.

Operation Phase:

- Silent DG sets with canopies will be used as power back up for essential services during power failure. Stack height as per CPCB norms will be maintained to disperse the flue gas emission from DG sets. Therefore, the impact will be negligible.

5.3 Will the proposal create shortage of parking space for vehicles? Furnish details of the present level of transport infrastructure and measures proposed for improvement including the traffic management at the entry & exit to the project site.

ANS: No, there will not be any shortage of parking as adequate parking space has been provided as per NBC/ development authority norms. Parking has been proposed on surface, podium and basement with provision of different gates for the entry and exit. The Circulation plan with surface parking is given in ***Annexure XX.***

Parking facility will be provided as follows:

Location	Parking
VIP Parking has been made as part of surface parking integrated with landscape garden	198
Podium level	450
Basement - 1 level	300
Basement - 2 level	800
Basement - 3 level	400
Total Parking Provided	**2148**

Besides, there is also provision for 2-wheeler parking in the second basement podium level.

A Comprehensive car parking management system is proposed with following facilities:-

- Automatic counting of cars and LED display about available parking space on each parking level.
- Automatic detection of vehicular movements and audio announcement system.
- An automatic vehicular identification and Access control system based on long range radio frequency Identity.
- The system will have facility to interconnect with computer to be installed in security room with in built capability to upgrade the system.

5.4 Provide details of the movement patterns with internal roads, bicycle tracks, pedestrian pathways, footpaths etc., with areas under each category.

ANS: The area under internal roads will be 10,087 m^2, which is 17.85 % of the total plot area.

5.5 Will there be significant increase in traffic noise & vibrations? Give details of the sources and the measures proposed for mitigation of the above.

ANS: On completion of construction of the project, about 11870 people will move to and from the project. The movement of this population will add to the traffic.

During construction phase, construction material will be transported to the site. This will add to increase in traffic in terms of trucks carrying construction material on the main road as well as on the road connecting the site and the impact of traffic on this road will be relatively low.

Impact & management of traffic

- The proposed development would generate large number of trips in a day.
- Increased traffic during construction & operation phase.
- Minor impact on the traffic on connecting roads.

Noise and Vibration

- Noise and Vibration is anticipated during the construction stage due to movement of heavy equipments, digging, shuttering etc.
- Noise level is anticipated to increase due to increase in traffic. But plantation along the roads and other green areas will absorb noise energy and reduce it significantly.

Management

- Roads of adequate capacity shall be provided within the complex to avoid congestion.
- Vehicle running with alternative fuel will be incentivized and priority parking will be provided for electric car along with power sockets.
- Manual Management system is recommended to avoid accidents.
- Blowing of horns will be discouraged within the project.
- Encouragement to employees to ensure PUC certification of their vehicles.
- Provision of avenue plantation on road side.
- Reduction of traffic through provision of facilities within the complex.
- Maintenance of roads to reduce traffic obstruction.
- PUC of vehicles to control air emissions.
- During operation phase, impact on noise level is limited mainly to increase due to increased vehicular traffic. Plantation of trees on the two sides of all roads as well as the green belt shall be developed for noise attenuation.

5.6 What will be the impact of DG sets & other equipment on noise levels & vibration in & ambient air quality around the project site? Provide details.

ANS: ***Impact & Management of Noise:***

DG set proposed for the project are 4 X 1010 KVA. DG set with acoustic enclosure will be used as power back up for essential facilities, like water works, lifts etc. during power failure. Adequate stack height will be provided to disperse the flue gas emission from DG sets. Therefore, the impact will be negligible. Moreover DG sets of Euro II quality will be used, which will minimize the emission to lowest extent. Provision of plantation shall be there which will act as sink.

Mitigation measures for pollution control:

The DG set shall be provided with acoustic shields or enclosures to limit the

sound level inside the project. Monitoring & modeling will be done according to the CPCB guidelines.

6. AESTHETICS

6.1 Will the proposed constructions in any way result in the obstruction of a view, scenic amenity or landscapes? Are these considerations taken into account by the proponents?

ANS: No it will not cause any obstruction as it is a construction of commercial building of Customs Enclave in Mumbai. Landscape planning will be done within the plot in open and green areas.

6.2 Will there be any adverse impacts from new constructions on the existing structures? What are the considerations taken into account

ANS: There is one ground structure present at the site which will be demolished for construction of the building.

6.3 Whether there are any local considerations of urban form & urban design influencing the design criteria? They may be explicitly spelt out.

ANS: No, there is no local consideration of urban form and urban design which is influencing the design criteria. The building design shall be as per local applicable building bylaws.

6.4 Are there any anthropological or archaeological sites or artifacts nearby? State if any other significant features in the vicinity of the proposed site have been considered

ANS: SION Fort, Worli Fort, Chaityabhoomi Dadar and few temples are present within the vicinity of the project but there will not be any adverse impact on them due to the project activity. The complete list of places of Historical/ Heritage/ Tourist importance is given in ***Annexure X***.

7. SOCIO-ECONOMIC ASPECTS

7.1 Will the proposal result in any changes to the demographic structure of local population? Provide the details

ANS: None of the activities from the project affect the demography in the surrounding areas as no residential population is anticipated to permanently move into the area due to the project. However socio-economic impact will be there.

During construction phase, there will be an influx of workers. Most of this labour force will be hired from local population, who will be paid their wages. With increased money supply, those who will be able to provide goods and services to the work force will be benefited economically. There will be growth of some temporary shops providing various items of daily necessities for sale as also for other services. These developments will have positive impact on the local socio-economic environment.

In post completion period, additional jobs will be available within the project in the form of technical staff, gardeners, sweepers, drivers etc.

7.2 Give details of the existing social infrastructure around the proposed project.

ANS: There are several hospitals, schools, places of worship and community facilities in F/N ward as given in ***Annexure XXII*** and ***Annexure X.***

7.3 Will the project cause adverse effects on local communities, disturbance to sacred sites or other cultural values? What are the safeguards proposed?

ANS: No there will be no adverse impact. In fact it will create employment opportunity for near by natives which will help in increasing the economic standard

8. BUILDING MATERIALS

8.1 May involve the use of building materials with high-embodied energy. Are the construction materials produced with energy efficient processes? (Give details of energy conservation measures in the selection of building materials and their energy efficiency)

ANS:
- Lighting and ventilation will be energy efficient
- BMS system shall be installed for monitoring and operation of electro mechanical systems.
- CFL and LEDs shall be used for lighting partly
- A combination of Radiant and Convective air conditioning will be explored, which could result in substantial energy power saving.
- Rapidly Renewable material such as bamboo & poplar wood shall be used as building material.
- Construction material with high embodied energy will be avoided
- Street lights will be provided with timers and solar lighting
- Fly ash bricks shall be used, besides hollow blocks on the periphery.
- U & R values will be according to norms given by Bureau of Energy Conservation.

8.2 Transport and handling of materials during construction may result in pollution, noise & public nuisance. What measures are taken to minimize the impacts?

ANS: During construction phase much emphasis will be laid on the planning, in which due care shall be taken to prevent any pollution during transportation and handling. Following measures will be adopted:

1. Due care will be taken during loading and unloading of material.
2. Proper traffic management will be done to avoid any kind of congestion on the site during transportation of material.
3. Sprinkling of water during construction for dust suppression.

8.3 Are recycled materials used in roads and structures? State the extent of savings achieved?

ANS: Wherever possible, construction waste material, stones and other waste material will be utilized for roads and structures in conjunction with conventional construction material.

8.4 Give details of the methods of collection, segregation & disposal of the garbage generated during the operation phases of the project.

ANS: 1. Segregating organic and Inorganic waste in separate bags will be

implemented.

2. Disposal in common bins which will be provided on all the floors including basements.
3. Transportation by tipper up to final disposal site shall be ensured day-to-day.

9. ENERGY CONSERVATION

9.1 Give details of the power requirements, source of supply, backup source etc. What is the energy consumption assumed per square foot of built-up area? How have you tried to minimize energy consumption?

ANS: **Total Power Demand:** 10,000 KVA
Source: Maharashtra State Electricity Board (MSEB).
Back-up Source: 4 X 1010 KVA

Principles & guidelines for energy efficient buildings to minimize energy consumption :

- Site planning
- North-South building orientation with 20% glass opening on outer side and 25% on atrium side.
- Ventilation and lighting
- Energy efficient appliances and devices
- Windows and Doors
- Landscaping features
- Harnessing solar power by installation of solar photovoltaic cells for production of power.
- Provision of solar water heating systems

The energy consumption calculated per square foot of built-up area is 3.06 W.

9.2 What type of, and capacity of, power back up do you plan to provide?

ANS: 4 X 1010 KVA DG sets shall be provided. These will be operated in case of power failure and during peak exhibition times.

9.3 What are the characteristics of the glass you plan to use? Provide specifications of its characteristics related to both short wave and long wave radiation?

ANS: The project will provide anti glare, reflective glass having properties which will make it energy saving element in the building and shall provide safety and transparency of the desired level. Hermetically sealed double glass with air gap in windows to meet the green building norms.

9.4 What passive solar architectural features are being used in the building? Illustrate the applications made in the proposed project.

ANS: ***Building orientation***
The orientation of the building is done such that the larger façade of the

building are facing North & South directions to harness glare free natural light. This also ensures minimal heat gain due to exposure of shorter side to sun on East & West.
The entire program has been accommodated into two building blocks with a large pedestrian friendly interconnecting podium between the two blocks

Windows and Doors

1. It is planned that 20-25% of the room wall area will be allocated to windows and doors.
2. Use of double-glazing with air gaps doors can be used so that more than 40% of energy can be conserved.
3. Use of light shelves, louvers and optimum opening sizes of recessed windows ensures maximum daylight harvesting in interior spaces. This also ensures that there is no exposure of glass to direct sun light/heat.
4. Reduction of conventional lighting load by ensuring 75% daylight use as per LEED requirement

9.5 Does the layout of streets & buildings maximize the potential for solar energy devices? Have you considered the use of street lighting, emergency lighting and solar hot water systems for use in the building complex? Substantiate with details.

ANS: There will be provision of solar lighting in streetlights.

The green cover has been reported to reduce the ambient temperatures by about 2-3 degrees. Hence, 42.08 % of the area is dedicated to development of lawn & landscape green.

9.6 Is shading effectively used to reduce cooling/heating loads? What principles have been used to maximize the shading of Walls on the East and the West and the Roof? How much energy saving has been effected?

ANS: The orientation of the building is done such that the larger façade of the building are facing North & South directions to harness glare free natural light. This also ensures minimal heat gain due to exposure of shorter side to sun on East & West.

- Optimum use of central atrium has been incorporated to make a significant difference to energy consumption in the building.
- Use of blind curtains, shutters and air curtains will be enforced to be used appropriately for energy efficient operations. Use of double-glazing with air gap doors will be used so that more than 40% of the energy can be conserved.

9.7 Do the structures use energy-efficient space conditioning, lighting and mechanical systems? Provide technical details. Provide details of the transformers and motor efficiencies, lighting intensity and air-conditioning load assumptions? Are you using CFC and HCFC free chillers? Provide specifications.

ANS: The project is being designed as per the requirements of green building

norms of four star GRIHA rating. This involves use of chillers that do not contain any CFC and HCFC.

In order to attain energy savings, all mechanical equipment such as chillers, pumps, AHU's, Ventilation Equipments etc. shall be provided with energy efficient IE-3 motors, since all these equipment shall operate for extended periods of time. In addition AHUs shall be provided with economizer cycle to circulate fresh air in case of low enthalpy of outside air.
Each chilling unit would have screw compressor (efficiency at full load with COP >= 5.9).

9.8 What are the likely effects of the building activity in altering the micro-climates? Provide a self-assessment on the likely impacts of the proposed construction on creation of heat island & inversion effects?

ANS: The construction of the building will be done in such a way that it is well ventilated. There shall be minimal heat island effect due to free flow of convection air, which will further be cooled by plantation of trees. There are several instances where the green cover has been reported to reduce the ambient temperatures by about 2-3°C hence, 42.08% of the area is dedicated to development of lawn & landscape green.

9.9 What are the thermal characteristics of the building envelope? (a) Roof; (b) External walls; and (c) Fenestration? Give details of the material used and the U-values or the R-values of the individual components.

ANS: The thermal characteristics of the building envelope will be as per the GRIHA norms.

9.10 What precautions & safety measures are proposed against fire hazards? Furnish details of emergency plans

ANS: Fire safety will be taken into account and all the safety norms and regulations which are provided by National Building Code and other related Indian Standards will be followed.

I All electrical cables will be underground and sophisticated modern electrical distribution system will be used;

II The project will have a provision for underground firewater compartment of 200,000 liters capacity having 2 way fire brigade inlet connection. In case of fire, tenders of the Fire Department will have lifting pumps installed to draw water from these tanks. These static fire tanks will have the necessary provisions of manholes where from suction pipes can be immersed to draw water;

III Ample stocks of first aid and fire fighting gadgets;

IV The maintenance agency will have trained Fire Officers and Fire Men on their regular rolls, who will conduct mock drills to educate the people about the fire preventive measures and keep a total watch on systems. People will be trained for fire safety drill.

V This activity shall be controlled and monitored from a centralized control room and will work in close co-ordination with local Fire Authorities;

Building will be having its own fire fighting systems approved by the regulatory agencies. Refer ***Annexure XXI*** for fire fighting plan.

9.11 If you are using glass as wall material provides details and specifications including emissivity and thermal characteristics.

ANS: Glass will be used for façade cladding. Details and specifications of the glass are given in ***Annexure XXIV.***

9.12 What is the rate of air infiltration into the building? Provide details of how you are mitigating the effects of infiltration.

ANS: Pre-filter of 90% efficiency that can filter particles in air of size upto 10 micron with face velocity across the filters 1.78 m/sec(350 fpm) shall be provided.

Fresh air at a rate of 1 air change per hour in the conditioned return air will be added to mitigate the impact of infiltration.

9.13 To what extent the non-conventional energy technologies are utilized in the overall energy consumption? Provide details of the renewable energy technologies used.

ANS:

- Use of solar energy shall be promoted.
- Energy efficient appliances will be installed in the building.
- Constant monitoring of energy consumption and defining targets for energy conservation will be employed.
- Awareness on energy conservation will be raised among the users of the building.

Following renewable energy sources will be used:

Solar water heating will be explored. Wind energy production, however, will not be possible at the proposed site.

Photo voltaic lighting is proposed for landscape lighting. The building has been so designed keeping in view the solar gains in terms or building orientation to ensure that the impact of the solar radiation and illumination is optimized depending on the climatic conditions. Also, the building materials used shall consist of hollow blocks, tremble walls and other such technologies, which will significantly reduce the energy requirements of the building.

10. ENVIRONMENT MANAGEMENT PLAN

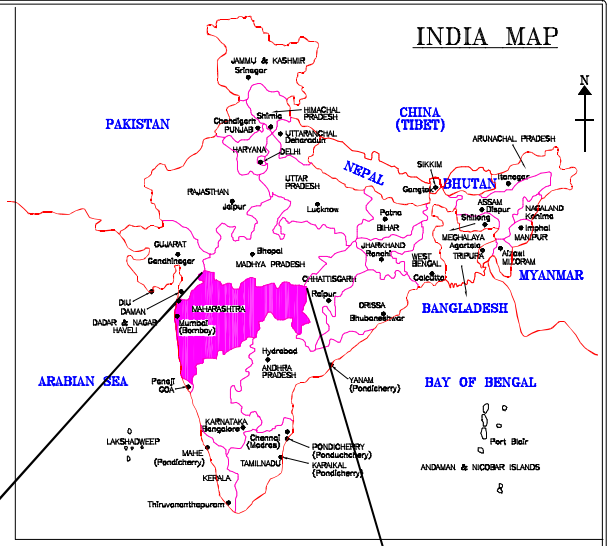
The Environment Management Plan would consist of all mitigation measures for each item wise activity to be undertaken during the construction, operation and the entire life cycle to minimize adverse environmental impacts as a result of the activities of the project. It would also delineate the environmental monitoring plan for compliance of various environmental regulations. It will state the steps to be taken in case of emergency such as accidents at the site

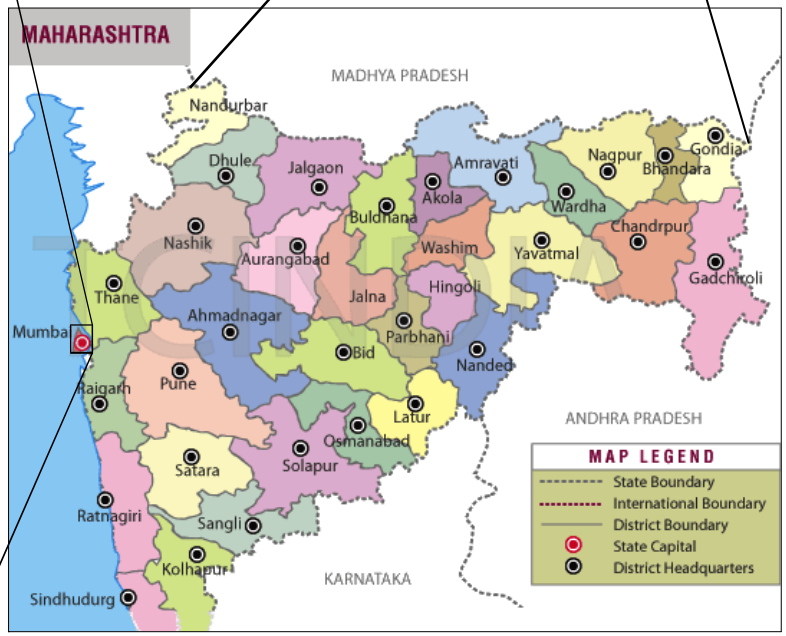
including fire.

ANS: Refer ***Annexure XV*** for Environmental Management Plan and ***Annexure XII*** for Disaster Management Plan.

LIST OF ANNEXURES TO FORM-1 AND FORM-1A

Annexure No.	Description
I	Location map
II	Survey map
III	Land allotment letter
IV	Permission letter from MMRDA for construction
V	Proposed layout and landscape plan
VI	Geo tech report – Relevant pages
VII	Sewage network plan with STP location
VIII	Basement and Podium parking plans
IX	Storm water drainage plan
X	List of Amenities in 15 km radius
XI	15 km radius map of the project site
XII	Disaster management plan
XIII	Authorization letter
XIV	Panoramic view of the site
XV	Environment management plan
XVI	Project report
XVII	Map showing the surrounding features within 500 m of the project site
XVIII	Water supply network plan
XIX	Location of D.G. sets in Basement 1
XX	Circulation plan with surface parking
XXI	Fire evacuation plan
XXII	Public Amenities
XXIII	Air Modeling
XXIV	Details and specification of Glass
XXV	Proposed TOR
XXVI	EIA Report





CLIENT: CENTRAL PUBLIC WORKS DEPARTMENT

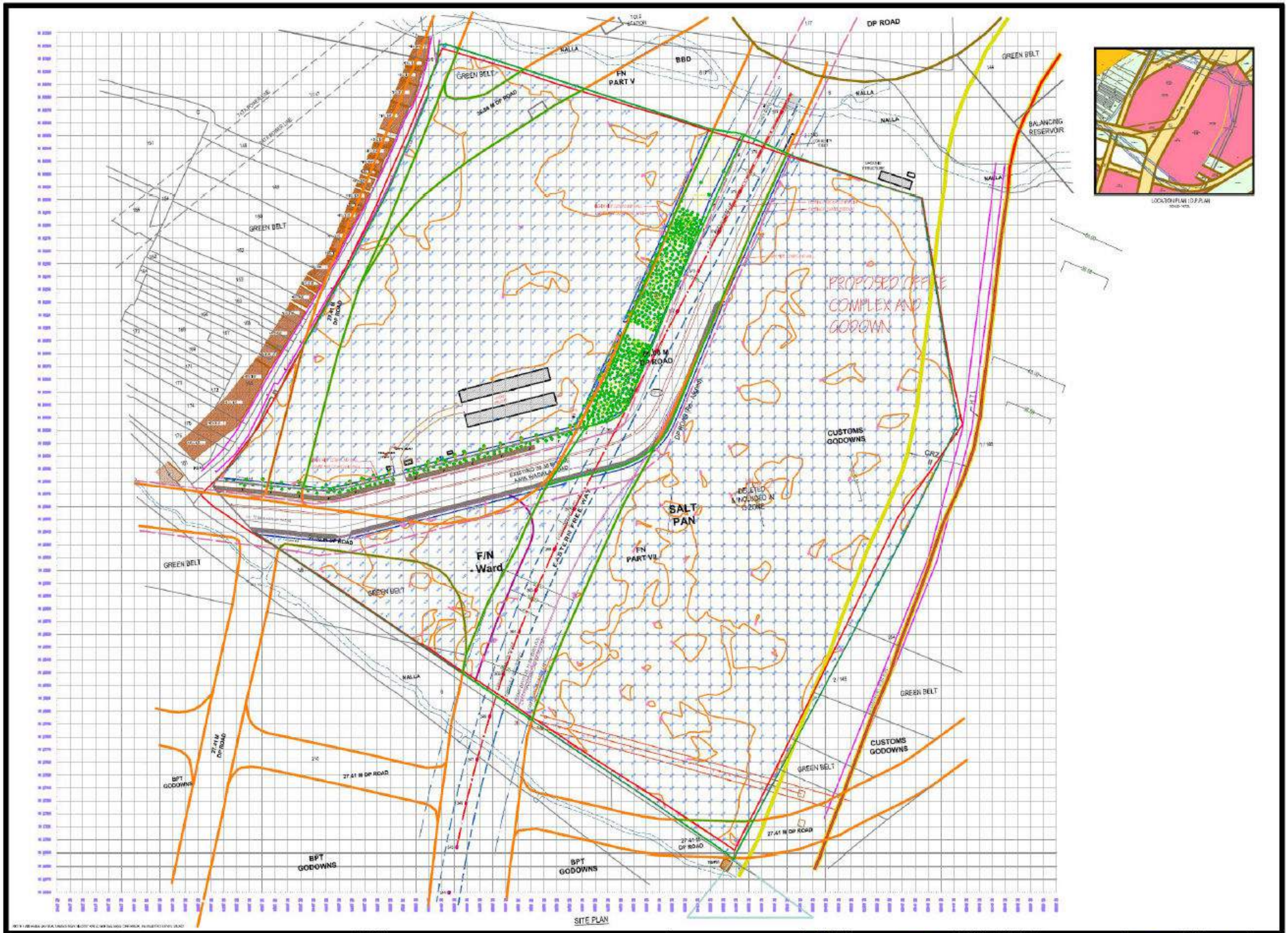
PROJECT: CONSTRUCTION OF OFFICE COMPLEX AT CUSTOMS ENCLAVE, WADALA (EAST), MUMBAI

TITLE: FORM-1

LOCATION MAP

DRAWN BY:	CHECKED BY:	FIG. NO.
RANJEET K.	M. SHARMA	*
SCALE : NOT TO SCALE	DATE : 09-10-2014	

ANNEXURE : I



LOCATION PLAN (D.P.PLAN)

TOTAL STATION SURVEY OF C.T.S.NO 146, OF CUSTOMS ENCLAVE, SALTPAN ROAD, WADALA (E), MUMBAI - 400 037

LEGENDS

CLIENT :- CPWD CUSTOM Office Building

ARCHITECT :- SURESH GOEL & ASSO.

RAJAN D. HATE
Licensed Surveyor - Civil Engineer & Hy.

ANNEXURE : II

ANNEXURE : III

MUMBAI METROPOLITAN REGION DEVELOPMENT AUTHORITY

ENGG/MUIP/JNNURM/EFW/ /10

Engineering Division
Date: /04/2010

To,
Additional Commissioner of Customs (PG)
Custom Enclave Cell
New Custom House
Ballard Estate,
Mumbai – 400 001.

Sir,

Sub.: Handing over the land of C. S. No 146 Custom Enclave plot for Eastern Freeway project from Prince of Wales Museum to Anik Junction (Start of APER)

Ref.: 1) Joint Metropolitan Commissioner's D.O. letter no. ENGG/MUIP/JNNURM/EFW/69/10 dated 10/2/2010.

2) Addl. Commissioner of Customs (PG) Mumbai's letter no. F. No.S/43-91/82 Bldg. (MMRDA) dated 24/02/2010.

3) Addl. Commissioner of Customs (PG) Mumbai's letter no. F. No. S/43-91/82-Bldg. (MMRDA) dated 11/03/2010.

4) Commissioner of Customs (General), Mumbai's letter no. F. No. S/43-91/82-Bldg. (MMRDA) dated Nil (Fax received on 24/03/10)

At the out set, let me express may gratitude for allowing us to develop the strip of land in Customs area for stacking of segments. The reply to the demands put forth by the Customs including methodology of granting and issuing TDR/F.S.I. is given vide letter under reference no.1. Further clarification to the queries made vide letter under reference no.2, 3 & 4 is as under.

As informed earlier, the area of Customs land required for Eastern Freeway project is 11936.69 sqmt. for 60m D.P width. Meanwhile, it is communicated by Customs vide letter under reference no. 4, that triangular plot area admeasuring 32764.548 Sqm. cannot be utilized for huge departmental construction project. Further it is asked to examine possibility of shifting of alignment or otherwise to handover equivalent area adjacent to Customs land.

Regarding shifting of alignment of Eastern Freeway to avoid Customs plot, various alternatives are tried upon, but it is found that, in any case it is not possible to shift the alignment outside Customs area. All the alternative alignments were discussed in various meetings with Customs officials and finally it was concluded that

Bandra-Kurla Complex, Bandra (East), Mumbai - 400 051
EPABX : 2659 4000 • FAX : 2659 1264 • WEB SITE : http://www.mmrdamumbai.org

the existing alignment is already [illegible] and is the most economic and efficient alignment. Therefore, at this juncture it is not feasible to shift the proposed freeway from Customs land to other place.

As far as handing over of equivalent land near Customs plot is concerned, it is to clarify that, there is no land which belongs to MMRDA adjacent to Customs area or in the vicinity.

However, the MMRDA has given thought to minimize the requirement of land in Customs area by way of reducing strip of land to 38.2 m width instead of 60 m width. Thus the area required in the Customs land works out to be 8375sq m instead of original 11936.69sq.m. The area of the remaining triangular portion now becomes 14152.84 Sqm as against 12764.548 Sq m. This area will be adequate for utilization and MMRDA will recommend MCGM to revise D.P width in Customs area from 60 m to 38.2 m.

[illegible]

As property/land under reference is falling in E-North ward i.e. in Island City and as per the D.C. Regulation No.32 of Greater Mumbai – 1991, the permissible F.S.I. for island city is 1.33. Hence, the compensation i.e. F.S.I. to be granted will be 1.33 times area acquired for construction of Eastern Freeway subject to the land use as per D.C. Rules and permissible F.S.I. specified for the land use. Therefore, the compensation to be given in terms of F.S.I. will be 1.33 times of the land acquired for construction. The F.S.I. will be released by MCGM as per MMRDA's recommendation.

Here, I would like to reiterate that, as per existing procedure, MMRDA recommends to grant the requisite F.S.I. to the MCGM, who are authorized to grant the F.S.I., as the Planning Authority. MMRDA will recommend MCGM to grant you the F.S.I. as soon as the land is transferred to MMRDA. This F.S.I. can be utilized by the Customs department in the surrounding land belonging to them. With the grant of equivalent F.S.I., effectively there will not be any loss to the Customs department in terms of availability of constructable land.

The preferred mode of compensation adopted by MMRDA as per the R & R policy being followed for various infrastructure projects in the region is granting of F.S.I. equivalent to the land area required for the project unless the entire land is acquired and no land is available for consumption of F.S.I. so generated. Since, MMRDA requires only a small portion of the total land belonging to Customs, the

F.S.I. generated on account of transfer of this land can be very much utilized in the remaining land keeping the utility of the land in tact.

There is a facility of conversion of the said F.S.I. into T.D.R. which is saleable in the market. The department can consider either of these options as per their requirement.

I hope this brings adequate clarity in the matter.

I, once again, request you to clear the proposal at the earliest as the work of Eastern Freeway is in full swing and likely to be completed by targeted date. I also request to allow contractor's vehicles for transportation of segments through Customs gate for stacking the same in the land strip required for Eastern Freeway as agreed upon by the Commissioner, Customs in the recent past.

The drawing showing revised areas is enclosed herewith for perusal and record.

Thanking you,

(Ashwini Bhide)
Joint Metropolitan Commissioner
MMRDA.

Encl. One drawing

ANNEXURE : IV

Maharashtra Regional and
Town planning Act, 1966.

Development plan of
F/North ward of Greater
Mumbai,1991.
Deletion of reservation
Under section 50 of the.....

GOVERNMENT OF MAHARASHTRA
Urban Development Department
Mantralaya ,Mumbai 400 032.
Dated 14th March 2005.

NOTIFICATION

Read : -

1. Chief Commissioner of Customs letter No. F.No. S/43-91/82 Bldgs/ Pt. E dt. 16/03/2004
2. Asstt. Commissioner of Custom's letter No. F.No. S/43-91/82 Building (Pt. E) dt 5/01/2005.

No. TPB-4304/608/CR 308/2004/UD-11

Whereas the Development Plan of "F/North" ward of Greater Mumbai(hereinafter referred to as "the said plan") has been sanctioned by the Government under section 31(1) of the Maharashtra Regional and Town Planning Act, 1966(hereinafter referred to as "the said Act") vide Urban Development Department's Notification no. TPB 4391/2361/CR-130/91/UD-11/RDR dated 2/1/1992 to come in to force with effect from 17/2/1992.

And whereas, the land bearing C.S. No. 146 of Salt Division (herein after referred to as " the said land) is partly reserved for the public purpose of "Custom Godowns" and partly earmarked as green Belt (2 location) (hereinafter referred to as " the said reservation") in the said plan.

And whereas, the Customs Department, the owner of the said land vide their above letter requested Government that on the said lands Department is in need to construct office as well as residential accommodation in addition to the Godown wing to acute shortage being faced by the customs department. The mixed land uses are not permissible due to the reservation of Custom Godowns therefore requested Government to delete the part reservation of the Custom Godown.

In view of the above fax Government find of necessary to delete the said lands from the said reservation (mode specifically shown on the plan appended hereto) in view of the power vested under section 50 of the said act, the Government hereby.

A) Sanctions the proposal of deletion thereby deleting the reservation of "Customs Godowns" save land as mark A-B-C-D-E-A in the plan appended hereto.

B) The land deleted from reservation shall be developed for the Construction of office and residential accommodation for the Custom Department as per the development control regulation for Greater Mumbai with due approval of concerned authority /department .

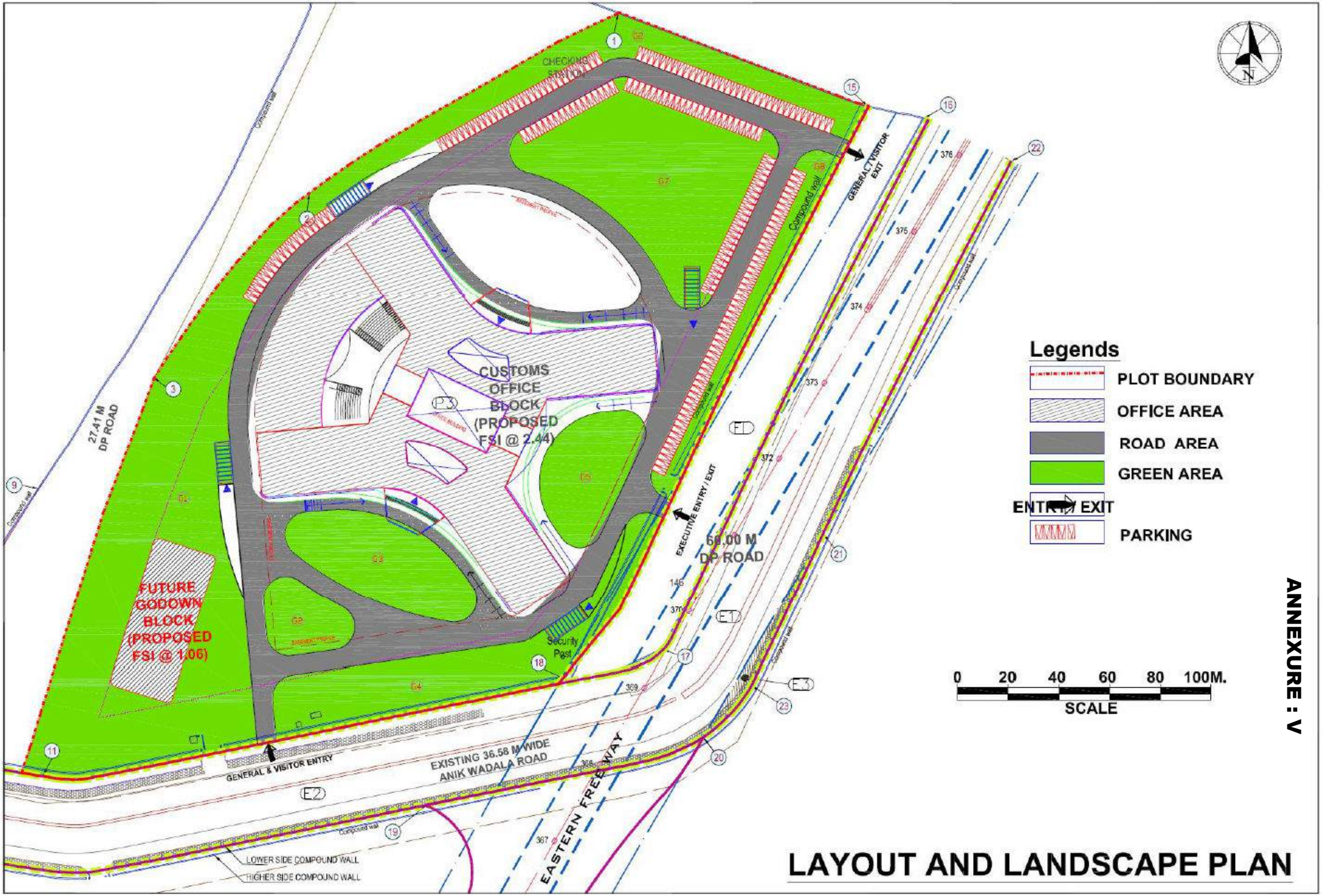
C) Fixes the date of publication of this notification in the official Gazette(Ordinary)as the date of coming in to force of this modification .

D) Directs the said corporation that in schedule of modification sanctioning the said plan after the last entry the above referred (A) shall be added.

By order and in the name of the Governor of Maharashtra

(S.R. Kini)
Under Secretary to Government

Note : This Notification is also available on Gov. Web site www.urban maharashtra .gov.in



LAYOUT AND LANDSCAPE PLAN

ANNEXURE : V

CENTRAL PUBLIC WORKS DEPARTMENT

OFFICE OF THE EXECUTIVE ENGINEER

REPORT ON GEOTECHNICAL INVESTIGATION

FOR

CONSTRUCTION OF OFFICE COMPLEX AND GODOWN

ON

CUSTOMS ENCLAVE PLOT (SULEMAN SHAH PLOT),

AT

WADALA (E), MUMBAI.

FINAL REPORT
DECEMBER - 2013

BY

DBM GEOTECHNICS & CONSTRUCTIONS PVT. LTD.
401, Grande Palladium, 175 CST Road, Kalina, Santacruz (E),
Mumbai- 400 098. Tel.:+91-22-33863500.
Fax: +91 22 33863605, URL : www.dbm.in, E-mail: dbm@dbm.in

ANNEXURE

BOREHOLE LOGS

CLIENT : **CENTRAL PUBLIC WORKS DEPARTMENT**

PROJECT : Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.

BORE HOLE NO.	: BH-01	SHEET NO.	: 1 OF 3
LOCATION	: –	DATE	: 20/11/2013 To 26/11/2013
CO-ORDINATES	: N 1100.343, E 1048.701	METHOD	: ROTARY DRILLING
GROUND R. L.	: 100.024m	CASING	: 100mm Ø Upto 2.00m & NX Ø Upto 19.00m BGL
GROUND W. T.	: 1.70m Below GL.	BOREHOLE DEPTH	: 24.50m

FIELD DATA									LABORATORY DATA														
										GRAIN SIZE ANALYSIS					CONSISTENCY LIMIT				ROCK		
DEPTH BELOW EGL (m)	DIA OF BOREHOLE	SAMPLE & IN-SITU TEST DEPTH (m)	SAMPLE TYPE & NO.	FIELD TEST RESULT (SPT'N')	TCR (%)	RQD (%)	LOG	DESCRIPTION	CLASSIFICATION	GRAVELS %	SAND %	SILT %	CLAY %	NMC	LL %	PL %	PLASTICITY INDEX	Cur (Kg/cm^2) / Ø (degrees)	UCS (Kg/cm^2)	PLI (Kg/cm^2)	Remark
0.50	150 mm Ø	0.00/0.50	DS1					Fill (Boulders)													
1.00																					
1.50																					
2.00		2.00/2.60	SPT1	(22) 07/10/12/18				Fill (SAND with gravels)													
2.50																					
3.00		3.20						Fill (Boulders)													
3.50		3.60/4.10	SPT2	(03) 01/02/01/01																	
4.00																					
4.50																					
5.00		5.00/5.60	SPT3	(04) 01/02/02/02																	
5.50																					
6.00																					
6.50		6.50/7.10	SPT4	(05) 01/02/03/03				Soft to medium stiff, greyish, silty CLAY													
7.00																					
7.50																					
8.00		8.00/8.40	UDS1						CH	00	03	38	59	57.89	81	34	47	0.15 / 3.20			
8.50																					
9.00																					
9.50		9.50/10.10	SPT5	(03) 01/01/02/03																	
10.00																					

ABBREVIATIONS :

DS	: DISTURBED SAMPLE	R	: REFUSAL 'N' VALUE	PL(%)	: PLASTIC LIMIT	Ø	: ANGLE OF INTERNAL FRICTION
UDS	: UNDISTURBED SOIL SAMPLE	RQD	: ROCK QUALITY DESIGNATION (%)	Co	: COHESION	UC	: UNCONFINED COMPRESSION TEST
N	: SPT VALUE	CR	: CORE RECOVERY (%)	NMC	: NATURAL MOISTURE CONTENT	PLI	: POINT LOAD INDEX
SPT	: STD. PENETRATION TEST	TCR	: TOTAL CORE RECOVERY (%)	LL (%)	: LIQUID LIMIT	UCS	: UNIAXIAL COMPRESSIVE STRENGTH

REMARKS : CONTINUED ON NEXT PAGE

DBM GEOTECHNICS AND CONSTRUCTIONS PVT. LTD. MUMBAI.
Tel.: +91-22-33863500, Fax: +91 22 33863505, E-mail: dbm@dbm.in, URL : www.dbm.in

Checked By : Mr. Prajit Nagrale | Drawn By: Trupti Parab | SCALE : 1: 50 | JOB NO : 3539

CLIENT : **CENTRAL PUBLIC WORKS DEPARTMENT**

PROJECT : Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.

BORE HOLE NO. : BH-01 | SHEET NO. : 2 OF 3

FIELD DATA									LABORATORY DATA													
DEPTH BELOW EGL (m)	DIA OF BOREHOLE	SAMPLE & IN-SITU TEST DEPTH (m)	SAMPLE TYPE & NO.	FIELD TEST RESULT (SPT'N')	TCR (%)	RQD (%)	LOG	DESCRIPTION	CLASSIFICATION	GRAIN SIZE ANALYSIS					CONSISTENCY LIMIT					ROCK		
										GRAVEL S %	SAND %	SILT %	CLAY %	NMC	LL %	PL %	PLASTICITY INDEX	Cu/ (kg/cm^2)/ Ø(degrees)	UCS(kg/cm^2)	PI(kg/cm^2)	Remark
10.50																						
11.00	150 mm Ø	11.00/ 11.40	UDS2																			
11.50																						
12.00																						
12.50		12.50/ 13.10	SPT6	(02) 01/01/01/02																		
13.00								Soft, greyish, silty CLAY														
13.50																						
14.00		14.00/ 14.60	SPT7	(03) 01/02/01/02																		
14.50																						
15.00																						
15.50		15.50/ 16.10	SPT8	(04) 01/02/02/02					CH	01	03	38	58	–	71	32	39	–				
16.00																						
16.50																						
17.00		17.00/ 17.60	SPT9	(03) 01/01/02/02																		
17.50																						
18.00		18.00																				
18.50		18.50/ 18.75	SPT10	(R) 15/54/-/-				Completely weathered, ROCK in form of Boulders														
19.00																						
19.50		19.50																				
20.00	NX				57	NIL		Moderately weathered, greyish, BRECCIA													1.77	

ABBREVIATIONS :

DS	DISTURBED SAMPLE	R	REFUSAL 'N' VALUE	PL(%)	PLASTIC LIMIT	Ø	ANGLE OF INTERNAL FRICTION
UDS	UNDISTURBED SOIL SAMPLE	RQD	ROCK QUALITY DESIGNATION (%)	Cu	COHESION	UC	UNCONFINED COMPRESSION TEST
N	SPT VALUE	CR	CORE RECOVERY (%)	NMC	NATURAL MOISTURE CONTENT	PLI	POINT LOAD INDEX
SPT	STD. PENETRATION TEST	TCR	TOTAL CORE RECOVERY (%)	LL (%)	LIQUID LIMIT	UCS	UNIAXIAL COMPRESSIVE STRENGTH

REMARKS : CONTINUED ON NEXT PAGE

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Tel.:+91-22-33863500, Fax: +91 22 33863605, E-mail: dbm@dbm.in, URL : www.dbm.in

Checked By : Mr. Prajit Nagrale | Drawn By : Trupti Parab | SCALE : 1:50 | JOB NO. : 3839

CLIENT : **CENTRAL PUBLIC WORKS DEPARTMENT**

PROJECT : Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Endave Plot (Suleman Shah Plot), Wadala (E), Mumbai.

BORE HOLE NO. : BH-01 | SHEET NO. : 3 OF 3

FIELD DATA										LABORATORY DATA													
DEPTH BELOW EGL (m)	DIA OF BOREHOLE	SAMPLE & IN-SITU TEST DEPTH (m)	SAMPLE TYPE & NO.	FIELD TEST RESULT (SPT'N')	TCR (%)	RQD (%)	LOG	DESCRIPTION	CLASSIFICATION	GRAIN SIZE ANALYSIS					CONSISTENCY LIMIT				ROCK			
										GRAVELS %	SAND %	SILT %	CLAY %	NMC	LL%	PL%	PLASTICITY INDEX	Cu' (kg/cm^2) / @(degrees)	UCS(kg/cm^2)	PLI(kg/cm^2)	Remark
20.50	NX	20.50			57	NIL		Moderately weathered, greyish, BRECCIA														
21.00					77	60		Slightly weathered, greyish, BRECCIA											305		
21.50		21.50																				
22.00					80	19																
22.50																						
23.00		23.00																				
23.50					88	57		Slightly weathered, greyish, BASALT											553		
24.00																						
24.50		24.50																				
25.00																						
25.50																						
26.00																						
26.50																						
27.00																						
27.50																						
28.00																						
28.50																						
29.00																						
29.50																						
30.00																						

ABBREVIATIONS :

DS	: DISTURBED SAMPLE	R	: REFUSAL 'N' VALUE	PL(%)	: PLASTIC LIMIT	ϕ	: ANGLE OF INTERNAL FRICTION
UDS	: UNDISTURBED SOIL SAMPLE	RQD	: ROCK QUALITY DESIGNATION (%)	Cu	: COHESION	UC	: UNCONFINED COMPRESSION TEST
N	: SPT VALUE	CR	: CORE RECOVERY (%)	NMC	: NATURAL MOISTURE CONTENT	PLI	: POINT LOAD INDEX
SPT	: STD. PENETRATION TEST	TCR	: TOTAL CORE RECOVERY (%)	LL (%)	: LIQUID LIMIT	UCS	: UNIAXIAL COMPRESSIVE STRENGTH

REMARKS : BORE HOLE IS TERMINATED AT DEPTH 24.50m BELOW GL.

DBM GEOTECHNICS AND CONSTRUCTIONS PVT. LTD. MUMBAI.
Tel.:+91-22-33863500, Fax: +91 22 33863905, E-mail: dbm@dbm.in, URL : www.dbm.in

Checked By :	Drawn By :	SCALE : 1: 50
Mr. Prajit Nagrale	Trupti Parab	JOB NO. : 3539

CLIENT : **CENTRAL PUBLIC WORKS DEPARTMENT**

PROJECT : Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.

BORE HOLE NO.	: BH-02	SHEET NO.	: 1 OF 3
LOCATION	: --	DATE	: 20/11/2013 To 26/11/2013
CO-ORDINATES	: N 1022.222 , E 1135.152	METHOD	: ROTARY DRILLING
GROUND R. L.	: 99.873m	CASING	: 100mm Ø Upto 2.00m & NX Ø Upto 4.00m BGL.
GROUND W. T.	: 0.80m Below GL.	BOREHOLE DEPTH	: 22.00m

FIELD DATA									LABORATORY DATA													
DEPTH BELOW EGL (m)	DIA OF BOREHOLE	SAMPLE & IN-SITU TEST DEPTH (m)	SAMPLE TYPE & NO.	FIELD TEST RESULT (SPT'N')	TCR (%)	RQD (%)	LOG	DESCRIPTION	CLASSIFICATION	GRAIN SIZE ANALYSIS: GRAVELS %	SAND %	SILT %	CLAY %	NMC	CONSISTENCY LIMIT: LL%	PL%	PLASTICITY INDEX	Cu (kg/cm²) / Ø(degrees)	ROCK: UCS(kg/cm²)	PLI(kg/cm²)	Remark
0.50		0.00/0.50	DS1																			
1.00								Fill (Boulders)														
1.50																						
2.00	NQ size	2.00/2.20	SPT1	(R) 19/51/--/--																		
2.50																						
3.00		3.00																				
3.50		3.50/4.10	SPT2	(02) 01/01/01/02																		
4.00																						
4.50																						
5.00		5.00/5.40	UDS1						CH	18	12	31	39	76.16	78	32	46	0.12 / 3.66			
5.50																						
6.00								Soft to medium stiff, greyish, silty CLAY with gravels														
6.50		6.50/7.10	SPT3	(06) 02/02/03/03																		
7.00																						
7.50																						
8.00		8.00/8.40	UDS2																			
8.50																						
9.00																						
9.50		9.50/10.10	SPT4	(03) 01/01/02/02																		
10.00																						

ABBREVIATIONS :

DS	: DISTURBED SAMPLE	R	: REFUSAL 'N' VALUE	PL(%)	: PLASTIC LIMIT	Ø	: ANGLE OF INTERNAL FRICTION
UDS	: UNDISTURBED SOIL SAMPLE	RQD	: ROCK QUALITY DESIGNATION (%)	Cu	: COHESION	UC	: UNCONFINED COMPRESSION TEST
N	: SPT VALUE	CR	: CORE RECOVERY (%)	NMC	: NATURAL MOISTURE CONTENT	PLI	: POINT LOAD INDEX
SPT	: STD. PENETRATION TEST	TCR	: TOTAL CORE RECOVERY (%)	LL (%)	: LIQUID LIMIT	UCS	: UNIAXIAL COMPRESSIVE STRENGTH

REMARKS : CONTINUED ON NEXT PAGE

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Tel.:+91-22-33853500, Fax: +91 22 33863605, E-mail: dbm@dbm.in, URL : www.dbm.in

Checked By : Mr. Prajit Nagrale	Drawn By : Trupti Parab	SCALE : 1: 50 JOB NO. : 3539

CLIENT : **CENTRAL PUBLIC WORKS DEPARTMENT**

PROJECT : Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Endave Plot (Suleman Shah Plot), Wadala (E), Mumbai.

BORE HOLE NO. : BH-02 | SHEET NO. : 2 OF 3

FIELD DATA									LABORATORY DATA													
										GRAIN SIZE ANALYSIS					CONSISTENCY LIMIT					ROCK	
DEPTH BELOW EGL (m)	DIA OF BOREHOLE	SAMPLE & IN-SITU TEST DEPTH (m)	SAMPLE TYPE & NO.	FIELD TEST RESULT (SPT N')	TCR (%)	RQD (%)	LOG	DESCRIPTION	CLASSIFICATION	GRAVELS %	SAND %	SILT %	CLAY %	NMC	LL%	PL%	PI (%)	Cu (kg/cm²) / Ø (degrees)	UCS (kg/cm²)	PL (kg/cm²)	Remark
10.00																					
11.00	150 mm Ø	11.00/11.60	SPT5	(03) 01/01/02/03																	
11.50																					
12.00																					
12.50		12.50/12.90	UDS3																		
13.00								Soft to medium stiff, greyish, silty CLAY													
13.50																					
14.00		14.00/14.60	SPT6	(05) 01/02/03/03																	
14.50																					
15.00																					
15.50		15.50/16.10	SPT7	(04) 01/02/02/03					CH	01	05	43	51	–	73	31	42				
16.00																					
16.50		16.50			36	NIL		Highly weathered, greyish, ROCK													
17.00	NX	17.00/17.10	SPT8	(R) 51/–/–/–																	
17.50					69	31														2.20	
18.00		18.50						Moderately weathered, greyish, BRECCIA													
18.50					62	23															
19.00																					
19.50																					
20.00		20.00																			

ABBREVIATIONS :

DS	: DISTURBED SAMPLE	R	: REFUSAL 'N' VALUE	PL(%)	: PLASTIC LIMIT	Ø	: ANGLE OF INTERNAL FRICTION
UDS	: UNDISTURBED SOIL SAMPLE	RQD	: ROCK QUALITY DESIGNATION (%)	Cu	: COHESION	UC	: UNCONFINED COMPRESSION TEST
N	: SPT VALUE	CR	: CORE RECOVERY (%)	NMC	: NATURAL MOISTURE CONTENT	PI	: POINT LOAD INDEX
SPT	: STD. PENETRATION TEST	TCR	: TOTAL CORE RECOVERY (%)	LL (%)	: LIQUID LIMIT	UCS	: UNIAXIAL COMPRESSIVE STRENGTH

REMARKS : CONTINUED ON NEXT PAGE

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Tel.:+91-22-33863500, Fax: +91 22 33863605, E-mail: dbm@dbm.in, URL : www.dbm.in

Checked By : Mr. Prajit Nagrale | Drawn By: Trupti Parab | SCALE : 1: 50 | JOB NO. : 3539

CLIENT : **CENTRAL PUBLIC WORKS DEPARTMENT**

PROJECT : Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.

BORE HOLE NO. : BH-02 | SHEET NO. : 3 OF 3

FIELD DATA										LABORATORY DATA													
											GRAIN SIZE ANALYSIS					CONSISTENCY LIMIT				ROCK		
DEPTH BELOW EGL (m)	DIA OF BOREHOLE	SAMPLE & IN-SITU TEST DEPTH (m)	SAMPLE TYPE & NO.	FIELD TEST RESULT (SPT'N')	TCR (%)	RQD (%)	LOG	DESCRIPTION	CLASSIFICATION	GRAVELS %	SAND %	SILT %	CLAY %	NMC	LL%	PL%	PLASTICITY INDEX	Cu/ (kg/cm²) / Ø(degrees)	UCS(kg/cm²)	PLI(kg/cm²)	Remark
20.50	NX	20.00			74	NIL		Moderately weathered, greyish, BASALT											200		
21.00		21.00																			
21.50					82	49		Slightly weathered, greyish, BASALT												21.03	
22.00		22.00																			
22.50																					
23.00																					
23.50																					
24.00																					
24.50																					
25.00																					
25.50																					
26.00																					
26.50																					
27.00																					
27.50																					
28.00																					
28.50																					
29.00																					
29.50																					
30.00																					

ABBREVIATIONS :

DS	: DISTURBED SAMPLE	R	: REFUSAL 'N' VALUE	PL(%)	: PLASTIC LIMIT	Ø	: ANGLE OF INTERNAL FRICTION
UDS	: UNDISTURBED SOIL SAMPLE	RQD	: ROCK QUALITY DESIGNATION (%)	Cu	: COHESION	UC	: UNCONFINED COMPRESSION TEST
N	: SPT VALUE	CR	: CORE RECOVERY (%)	NMC	: NATURAL MOISTURE CONTENT	PLI	: POINT LOAD INDEX
SPT	: STD. PENETRATION TEST	TCR	: TOTAL CORE RECOVERY (%)	LL (%)	: LIQUID LIMIT	UCS	: UNIAXIAL COMPRESSIVE STRENGTH

REMARKS : BORE HOLE IS TERMINATED AT DEPTH 22.00m.BELOW GL.

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Checked By :	Drawn By :	SCALE : 1: 80
Mr. Prajit Nagrale	Trupti Parab	JOB NO. : 3539

CLIENT : **CENTRAL PUBLIC WORKS DEPARTMENT**

PROJECT : Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.

BORE HOLE NO. : BH-03	SHEET NO. : 1 OF 3
LOCATION : –	DATE : 27/11/2013 To 03/11/2013
CO-ORDINATES : N 953.996 , E 1210.654	METHOD : ROTARY DRILLING
GROUND R. L. : 100.363m	CASING : 100mm Ø Upto 4.00m & NX Ø Upto 11.00m BGL
GROUND W. T. : 1.50m. Below GL	BOREHOLE DEPTH : 26.00m

FIELD DATA									LABORATORY DATA												
										GRAIN SIZE ANALYSIS					CONSISTENCY LIMIT				ROCK		
DEPTH BELOW EGL (m)	DIA OF BOREHOLE	SAMPLE & IN-SITU TEST DEPTH (m)	SAMPLE TYPE & NO.	FIELD TEST RESULT (SPT'N')	TCR (%)	RQD (%)	LOG	DESCRIPTION	CLASSIFICATION	GRAVELS %	SAND %	SILT %	CLAY %	NMC	LL%	PL%	PLASTICITY INDEX	Cu/ (kg/cm²)/ Ø(degrees)	UCS(kg/cm²)	PLI(kg/cm²)	Remark
0.50		0.00/ 0.50	DS1					Fill (Boulders)													
1.50	Ø 98	1.50/ 1.93	SPT1	(R) 08/10/52/--																	
3.00		3.00/ 3.02	SPT2	(R) 55/--/--/--																	
4.20		4.20						Soft, greyish, silty CLAY													
4.50		4.50/ 5.10	SPT3	(02) 01/01/01/01					CH	00	01	40	59	–	76	33	43				
6.00		6.00/ 6.50	UDS1																		
7.50		7.50/ 8.10	SPT4	(02) 01/01/01/02																	
9.00		9.00/ 9.50	UDS2						CH	13	21	29	37	57.59	69	27	42				
10.00																					

ABBREVIATIONS :

DS : DISTURBED SAMPLE	R : REFUSAL 'N' VALUE	PL(%) : PLASTIC LIMIT	Ø : ANGLE OF INTERNAL FRICTION
UDS : UNDISTURBED SOIL SAMPLE	RQD : ROCK QUALITY DESIGNATION (%)	Cu : COHESION	UC : UNCONFINED COMPRESSION TEST
N : SPT VALUE	CR : CORE RECOVERY (%)	NMC : NATURAL MOISTURE CONTENT	PLI : POINT LOAD INDEX
SPT : STD. PENETRATION TEST	TCR : TOTAL CORE RECOVERY (%)	LL (%) : LIQUID LIMIT	UCS : UNIAXIAL COMPRESSIVE STRENGTH

REMARKS : CONTINUED ON NEXT PAGE

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Tel.:+91-22-33863500, Fax: +91 22 33863605, E-mail: dbm@dbm.in, URL : www.dbm.in

Checked By : Mr. Prajit Nagrale | Drawn By: Trupti Parab | SCALE : 1: 50 | JOB NO. : 3539

CLIENT : **CENTRAL PUBLIC WORKS DEPARTMENT**

PROJECT : Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai

BORE HOLE NO. : BH-03 | SHEET NO. : 2 OF 3

FIELD DATA									LABORATORY DATA														
DEPTH BELOW EGL (m)	DIA OF BOREHOLE	SAMPLE & IN-SITU TEST DEPTH (m)	SAMPLE TYPE & NO.	FIELD TEST RESULT (SPT N')	TCR (%)	ROD (%)	LOG	DESCRIPTION	CLASSIFICATION	GRAIN SIZE ANALYSIS					CONSISTENCY LIMIT				ROCK			
										GRAVELS %	SAND %	SILT %	CLAY %	NMC	LL%	PL%	PLASTICITY INDEX	Cu' (kg/cm²) γ' (kN/m³) Φ(degrees)	UCS(kg/cm²)	PLI(kg/cm²)	Remark
10.50	150 mm Φ	10.50/11.00	SPT5	(03) 01/01/02/02																		
11.00																						
11.50																						
12.00		12.00/12.50	UDS3																			
12.50																						
13.00																						
13.50		13.50/14.10	SPT6	(03) 01/02/01/02				Soft, greyish, sandy CLAY														
14.00																						
14.50																						
15.00		15.00/15.60	SPT7	(04) 01/02/02/02																		
15.50																						
16.00																						
16.50		16.50/17.10	SPT8	(04) 01/02/02/03																		
17.00																						
17.50																						
18.00		18.00																				
18.50		18.60	SPT9	(15) 03/05/09/14				Medium dense,greyish silty SAND with gravels	SM	19	57	24	--	--	--	--	--				
19.00					16	NIL		Highly weathered, greyish, BRECCIA														
19.50	HX	19.50/19.52	SPT10	(R) 51/--/--/--																		
20.00		20.00			26	NIL																

ABBREVIATIONS :

DS	: DISTURBED SAMPLE	R	: REFUSAL 'N' VALUE	PL(%)	: PLASTIC LIMIT	Φ	: ANGLE OF INTERNAL FRICTION
UDS	: UNDISTURBED SOIL SAMPLE	RQD	: ROCK QUALITY DESIGNATION (%)	Cu	: COHESION	UC	: UNCONFINED COMPRESSION TEST
N	: SPT VALUE	CR	: CORE RECOVERY (%)	NMC	: NATURAL MOISTURE CONTENT	PLI	: POINT LOAD INDEX
SPT	: STD. PENETRATION TEST	TCR	: TOTAL CORE RECOVERY (%)	LL (%)	: LIQUID LIMIT	UCS	: UNIAXIAL COMPRESSIVE STRENGTH

REMARKS : CONTINUED ON NEXT PAGE

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Tel.:+91-22-33863500, Fax:+91 22 33863605, E-mail: dbm@dbm.in, URL : www.dbm.in

Checked By : Mr. Prajit Nagrale | Drawn By: Trupti Parab | SCALE : 1: 50 | JOB NO. : 3539

CLIENT : **CENTRAL PUBLIC WORKS DEPARTMENT**

PROJECT : Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.

BORE HOLE NO. : BH-03 | SHEET NO. : 3 OF 3

FIELD DATA										LABORATORY DATA														
DEPTH BELOW EGL (m)	DIA OF BOREHOLE	SAMPLE & IN-SITU TEST DEPTH (m)	SAMPLE TYPE & NO	FIELD TEST RESULT (SPT'N)	TCR (%)	RQD (%)	LOG	DESCRIPTION	CLASSIFICATION	GRAIN SIZE ANALYSIS					CONSISTENCY LIMIT				ROCK			
										GRAVELS %	SAND %	SILT %	CLAY %	NMC	LL %	PL %	PLASTICITY INDEX	Cu' (kg/cm²) @(degrees)	UCS (kg/cm²)	PLI (kg/cm²)	Remark
20.50					28	NIL		Highly weathered, greyish, BRECCIA														
21.00		21.00																				
21.50	NX				63	33		Moderately weathered, greyish, BASALT											372		
22.00																						
22.50		22.50																				
23.00					93	77		Fresh, greyish, BASALT											825		
23.50																						
24.00		24.00																				
24.50		24.50			84	60		Slightly weathered, greyish, BASALT														
25.00					82	35													679		
25.50																						
26.00		26.00																				
26.50																						
27.00																						
27.50																						
28.00																						
28.50																						
29.00																						
29.50																						
30.00																						

ABBREVIATIONS :

DS	: DISTURBED SAMPLE	R	: REFUSAL 'N' VALUE	PL(%)	: PLASTIC LIMIT	@	: ANGLE OF INTERNAL FRICTION
UDS	: UNDISTURBED SOIL SAMPLE	RQD	: ROCK QUALITY DESIGNATION (%)	Cu	: COHESION	UC	: UNCONFINED COMPRESSION TEST
N	: SPT VALUE	CR	: CORE RECOVERY (%)	NMC	: NATURAL MOISTURE CONTENT	PLI	: POINT LOAD INDEX
SPT	: STD. PENETRATION TEST	TCR	: TOTAL CORE RECOVERY (%)	LL (%)	: LIQUID LIMIT	UCS	: UNIAXIAL COMPRESSIVE STRENGTH

REMARKS : BORE HOLE IS TERMINATED AT DEPTH 26.00m BELOW GL.

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Tel.:+91-22-33863500, Fax: +91 22 33863605, E-mail: dbm@dbm.in, URL : www.dbm.in

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CLIENT : **CENTRAL PUBLIC WORKS DEPARTMENT**

PROJECT : Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.

BORE HOLE NO.	: BH-05	SHEET NO.	: 1 OF 3
LOCATION	: –	DATE	: 24/11/2013 To 03/12/2013
CO-ORDINATES	: N 880.138 , E 897.572	METHOD	: ROTARY DRILLING
GROUND R. L.	: 100.109m	CASING	: 100mm Ø Upto 3.00m & NX Ø Upto 18.00m BGL
GROUND W. T.	: 1.40m. Below GL.	BOREHOLE DEPTH	: 30.00m

FIELD DATA									LABORATORY DATA														
DEPTH BELOW EGL (m)	DIA OF BOREHOLE	SAMPLE & IN-SITU TEST DEPTH (m)	SAMPLE TYPE & NO.	FIELD TEST RESULT (SPT N')	TCR (%)	ROD (%)	LOG	DESCRIPTION	CLASSIFICATION	GRAIN SIZE ANALYSIS					CONSISTENCY LIMIT					ROCK		
										GRAVELS %	SAND %	SILT %	CLAY %	MMC	LL%	PL%	PLASTICITY INDEX	Cu (kg/cm²)/ Ø(degree)	UCS(kg/cm²)	PI(kg/cm²)	Remark
0.50	100 (NX) Ø	0.00/ 0.50	DS1					Fill (Boulders)														
1.00																						
1.50		1.50																				
2.00																						
2.50																						
3.00		3.00																				
3.50																						
4.00																						
4.50		4.50																				
5.00																						
5.50																						
6.00		6.00																				
6.50		6.40																				
7.00		7.00/ 7.60	SPT1	(02) 01/01/01/01				Soft, greyish, silty CLAY	CH	00	02	43	55	–	70	26	44				
7.50																						
8.00																						
8.50																						
9.00		9.00/ 9.50	UDS1																			
9.50																						
10.00																						

ABBREVIATIONS :

DS	: DISTURBED SAMPLE	R	: REFUSAL 'N' VALUE	PL(%)	: PLASTIC LIMIT	Ø	: ANGLE OF INTERNAL FRICTION
UDS	: UNDISTURBED SOIL SAMPLE	RQD	: ROCK QUALITY DESIGNATION (%)	Co	: COHESION	UC	: UNCONFINED COMPRESSION TEST
N	: SPT VALUE	CR	: CORE RECOVERY (%)	NMC	: NATURAL MOISTURE CONTENT	PLI	: POINT LOAD INDEX
SPT	: STD. PENETRATION TEST	TCR	: TOTAL CORE RECOVERY (%)	LL (%)	: LIQUID LIMIT	UCS	: UNIAXIAL COMPRESSIVE STRENGTH

REMARKS : CONTINUED ON NEXT PAGE

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Tel.:+91-22-33863500, Fax: +91 22 33863605, E-mail: dbm@dbm.in, URL : www.dbm.in

Checked By : Mr. Prajit Nagrale | Drawn By : Trupti Parab | SCALE : 1: 50 | JOB NO. : 3539

CLIENT : **CENTRAL PUBLIC WORKS DEPARTMENT**

PROJECT : Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Sulaman Shah Plot), Wadala (E), Mumbai.

BORE HOLE NO. : BH-05 | SHEET NO. : 2 OF 3

FIELD DATA									LABORATORY DATA													
DEPTH BELOW EGL (m)	DIA OF BOREHOLE	SAMPLE & IN-SITU TEST DEPTH (m)	SAMPLE TYPE & NO.	FIELD TEST RESULT (SPT N°)	TCR (%)	RQD (%)	LOG	DESCRIPTION	CLASSIFICATION	GRAIN SIZE ANALYSIS				CONSISTENCY LIMIT					ROCK		
										GRAVELS %	SAND %	SILT %	CLAY %	NMC	LL %	PL %	PLASTICITY INDEX	Cu (kg/cm²) / Ø(degree)	UCS(g/cm²)	PI(kg/cm²)	Remark
10.50	100 mm Ø	10.50/11.10	SPT2	(03) 01/01/02/02																	
11.00																					
11.50																					
12.00		12.00/12.50	UDS2																		
12.50																					
13.00								Soft, greyish, silty CLAY													
13.50		13.50/14.10	SPT3	(02) 01/01/01/02																	
14.00																					
14.50																					
15.00		15.00/15.60	UDS3						CH	00	04	40	56	56.82	78	31	47	0.22 / 4.11			
15.50																					
16.00																					
16.50		16.00/17.10	SPT4	(38) 08/14/21/29					GC	28	27	26	19	--	39	16	21				
17.00								Dense, yellowish brown, clayey GRAVELS													
17.50																					
18.00		16.00/18.08	SPT5	(R) 53/--/--/--																	
18.50	RK				38	NIL		Highly weathered, greyish brown, BRECCIA													
19.00		19.00																			
19.50					45	NIL														0.90	
20.00		20.00																			

ABBREVIATIONS :

DS : DISTURBED SAMPLE	R : REFUSAL 'N' VALUE	PL(%) : PLASTIC LIMIT	Ø : ANGLE OF INTERNAL FRICTION
UDS : UNDISTURBED SOIL SAMPLE	RQD : ROCK QUALITY DESIGNATION (%)	Cu : COHESION	UC : UNCONFINED COMPRESSION TEST
N : SPT VALUE	CR : CORE RECOVERY (%)	NMC : NATURAL MOISTURE CONTENT	PLI : POINT LOAD INDEX
SPT : STD. PENETRATION TEST	TCR : TOTAL CORE RECOVERY (%)	LL (%) : LIQUID LIMIT	UCS : UNIAXIAL COMPRESSIVE STRENGTH

REMARKS : CONTINUED ON NEXT PAGE

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Tel.:+91-22-33863500, Fax: +91 22 33863605, E-mail: dbm@dbm.in, URL : www.dbm.in

Checked By : Mr. Prajit Nagrale | Drawn By : Trupti Parab | SCALE : 1:50 | JOB NO. : 3539

CLIENT : **CENTRAL PUBLIC WORKS DEPARTMENT**

PROJECT : Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.

BORE HOLE NO. : BH-05 | SHEET NO. : 3 OF 3

FIELD DATA									LABORATORY DATA													
DEPTH BELOW EGL (m)	DIA OF BOREHOLE	SAMPLE & IN-SITU TEST DEPTH (m)	SAMPLE TYPE & NO.	FIELD TEST RESULT (SPT N')	TCR (%)	RQD (%)	LOG	DESCRIPTION	CLASSIFICATION	GRAIN SIZE ANALYSIS					CONSISTENCY LIMIT				ROCK			
										GRAVELS %	SAND %	SILT %	CLAY %	NMC	LL%	PL%	PLASTICITY INDEX	Cur (kg/cm²) & Ø(degrees)	UCS(kg/cm²)	PLI(kg/cm²)	Remark
20.00		20.00																			
20.50					30	NIL															
21.00																					
21.50	NX	21.00																			
22.00					10	NIL		Highly weathered, greyish brown, BRECCIA													
22.50																					
23.00		23.00/ 23.05	SPT6	(R) 54/--/--/--																	
23.50					49	NIL															
24.00																					
24.50		24.50																			
25.00					52	08		Moderately weathered, greyish brown, BRECCIA												0.98	
25.50																					
26.00		26.00																			
26.50					20	NIL		Highly weathered, greyish brown, BRECCIA													
27.00		27.00																			
27.50					63	12														1.37	
28.00		28.00																			
28.50					60	NIL		Moderately weathered, greyish brown, BRECCIA													
29.00		29.00																			
29.50					52	NIL															
30.00		30.00																			

ABBREVIATIONS :

DS	: DISTURBED SAMPLE	R	: REFUSAL 'N' VALUE	PL(%)	: PLASTIC LIMIT	Ø	: ANGLE OF INTERNAL FRICTION
UDS	: UNDISTURBED SOIL SAMPLE	RQD	: ROCK QUALITY DESIGNATION (%)	Cu	: COHESION	UC	: UNCONFINED COMPRESSION TEST
N	: SPT VALUE	CR	: CORE RECOVERY (%)	NMC	: NATURAL MOISTURE CONTENT	PLI	: POINT LOAD INDEX
SPT	: STD. PENETRATION TEST	TCR	: TOTAL CORE RECOVERY (%)	LL (%)	: LIQUID LIMIT	UCS	: UNIAXIAL COMPRESSIVE STRENGTH

REMARKS : BORE HOLE IS TERMINATED AT DEPTH 30.00m.BELOW GL.

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Checked By :	Drawn By :	SCALE : 1: 50
Mr. Prajit Nagrale	Trupti Parab	JOB NO. : 3539

ANNEXURE

LABORATORY TEST RESULTS

SOIL TEST DATA SHEET

Project : *Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.*

Location : FLB 04 **DATE:** 18.12.2013

Bore Hole No.	Depth in m.	Sample Type	Density (Remoulded) gm/ cm³		Natural Moisture Content, in %	Soil Classification (IS)	Mechanical Analysis				Consistency Limits			Shrinkage Limit %	Shrinkage ratio	Shear Test			Cu from Unconfined Compression Test Kg/cm²	Free swell index %	Vertical Consolidation		Specific Gravity	Remarks
			Wet Density	Dry Density			Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index, Ip %			Type	Cohesion C_u kg/cm²	Degree Φ			Comp. Index C_{cr} (Lab)	Initial Void Ratio		
BH - 01	8.00 - 8.40	UDS 1	1.57	0.94	67.89	CH	0	3	38	59	81	34	47	15	1.22	TUU	0.16	3.20	0.20	----	0.66	1.73	2.62	
BH - 01	15.50 - 16.10	SPT 8	----	----	----	CH	1	3	38	58	71	32	39	----	----	----	----	----	----	----	----	----	----	

Chem : Chemical Analysis
Comp : Compaction Test
DS : Direct Shear
F : Permeability Test
FSI : Free Swell Test

Tuu : Triaxial Test (Un Consolidated Undrained)
Tcu : Triaxial Test (Consolidated Undrained)
Tcd : Triaxial Test (Consolidated Drained)
NP : Non Plastic
SL : Shrinkage Limit Test

SP : Swelling Pressure or Swelling Potential Test
SPT : Standard Penetration Test Sample
UDS : Undisturbed Soil Sample
VS : Laboratory Vane Shear Test
UC : Unconfined Compression Test

Φ : Angle of Internal Friction
Cu : Undrained Cohesion
Φ' : Effective Angle of Internal Friction
Cu' : Effective Cohesion
—Cr— : Combined Silt + Clay

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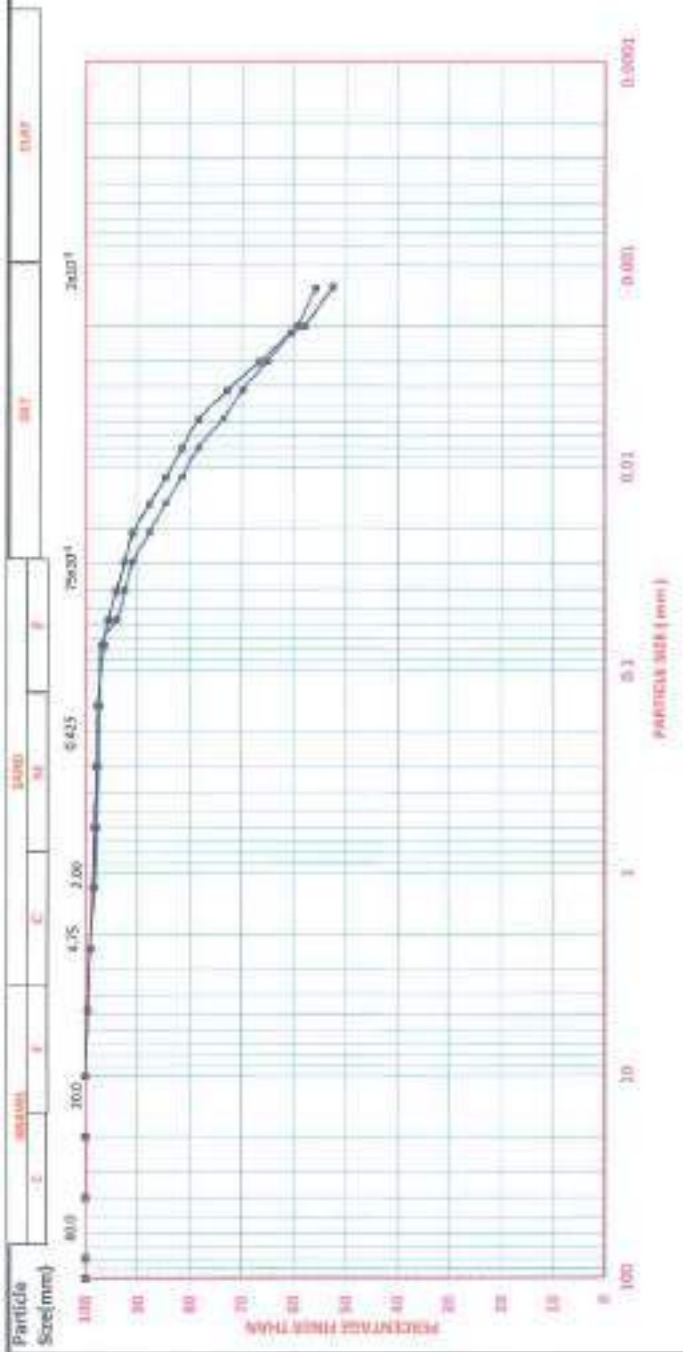
GRAIN SIZE DISTRIBUTION CURVE

Project :	*Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.*
Location :	-----



Symbol	Bore Hole No.	Depth in m	Classification (IS)	Gravel %	Sand %	Silt %	Clay %	D_{10} mm	D_{30} mm	D_{60} mm	Coeff. of Uniformity, $C_u = D_{60}/D_{10}$	Coeff. of Curvature $C_c = (D_{30})^2/(D_{60} \times D_{10})$	Liquid Limit, W_L	Plastic Limit, W_P	Plasticity Index, I_P	Remarks
	BH - 01	8.00 - 8.40	CH	0	3	38	59	----	----	----	----	----	81	34	47	UDS 1
	BH - 01	13.50 - 16.10	CH	1	3	38	58	----	----	----	----	----	71	32	39	SPT 8

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Job No. : 3539

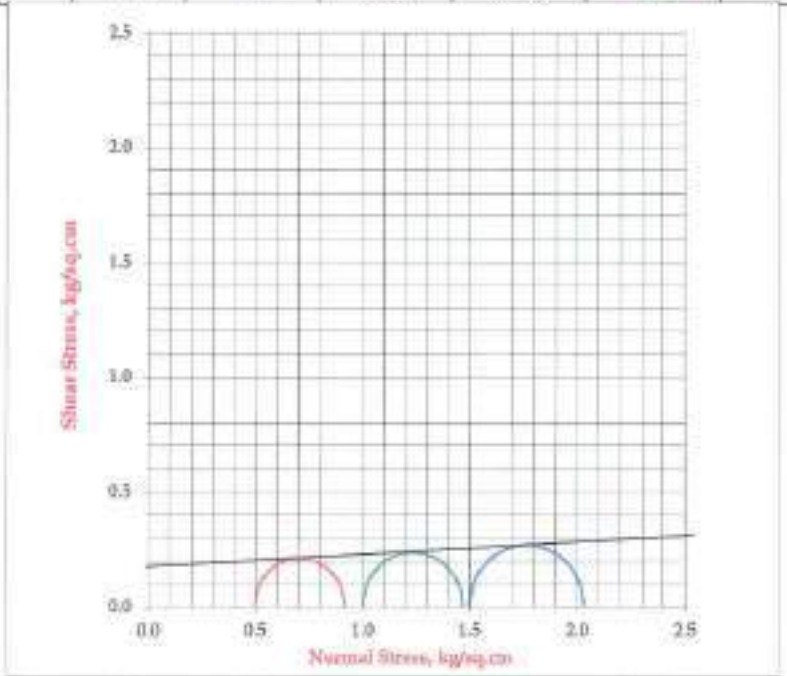
TRIAXIAL COMPRESSION TEST

IS 2720 - P 11, 1971

Project: Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.

Location:	-------			
Rate of Strain :	1.25	mm/min	Date:	16.12.2013
Diameter of Specimen:	38.00	mm	Bore Hole No.:	BH-01
Height of Specimen:	76.00	mm	Depth (m)	8.00 - 8.40
Dry Density, γ_d:	0.94	g/cm^3	Condition of Test :	TUU
Moisture Content:	67.89	%	State of Sample:	UDS 1

Serial No.	Cell Pressure σ_3	Deviatoric Force at Failure	Deviatoric Stress at Failure, σd	Normal Stress at Failure, $\sigma 1$	Change in Length at Failure, Δ_L	Strain at Failure, ε
	kg/cm^2	kg	kg/cm^2	cm	cm^2	%
1	0.50	5.25	0.416	0.916	7.60	10.00
2	1.00	6.04	0.469	1.469	9.12	12.00
3	1.50	6.92	0.531	2.031	9.88	13.00



Cohesion: 0.16 kg/cm^2 Angle of internal friction, 3.20

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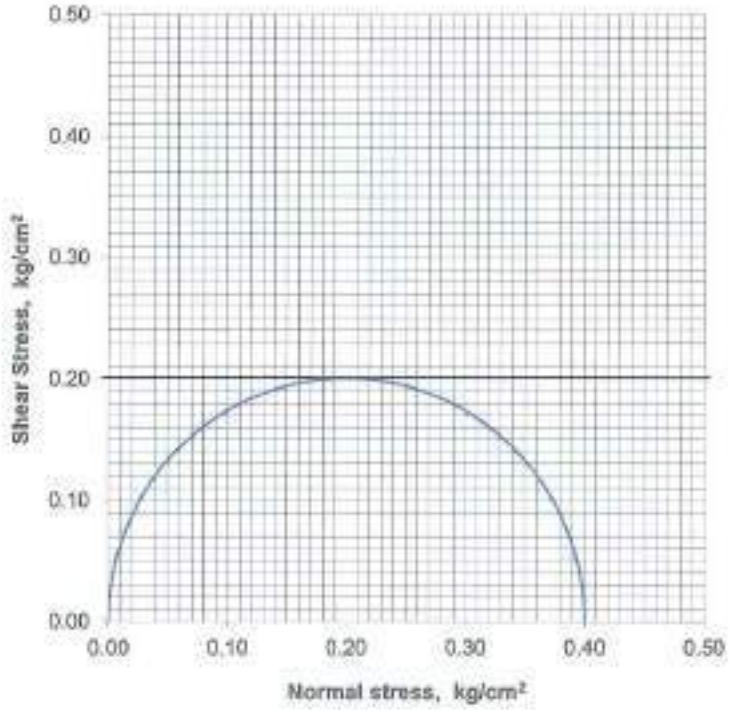
JOB No.	3330
Checked By:	Ravi A

UNCONFINED COMPRESSION TEST

Project	:	Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.			
Location	:			Date :	18.12.2013
Rate of strain	:	1.25	mm/min	Bore Hole No. :	BH - 01
Diameter of specimen	:	38.0	mm	Depth (m) :	8.00 - 8.40
Height of specimen	:	76.0	mm	State of the sample :	UDS 1
Dry Density γ_d	:	0.94	gm/cm^3		
Moisure content w	:	67.9	%		

Sr. No.	Axial load at failure	Axial stress at failure, q_u	Change in length at failure, ΔL	Strain at failure, ε
	kg	kg/cm^2	mm	%
1	4.93	0.40	6.08	8.00



COHESION c_u (= $q_u/2$) : 0.200 kg/cm^2

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	Chkd. By	H.R.M.

CONSOLIDATION TEST

IS - 2720 , P-15

Project: *Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.*

Location: ---------- Date: 18.12.2013

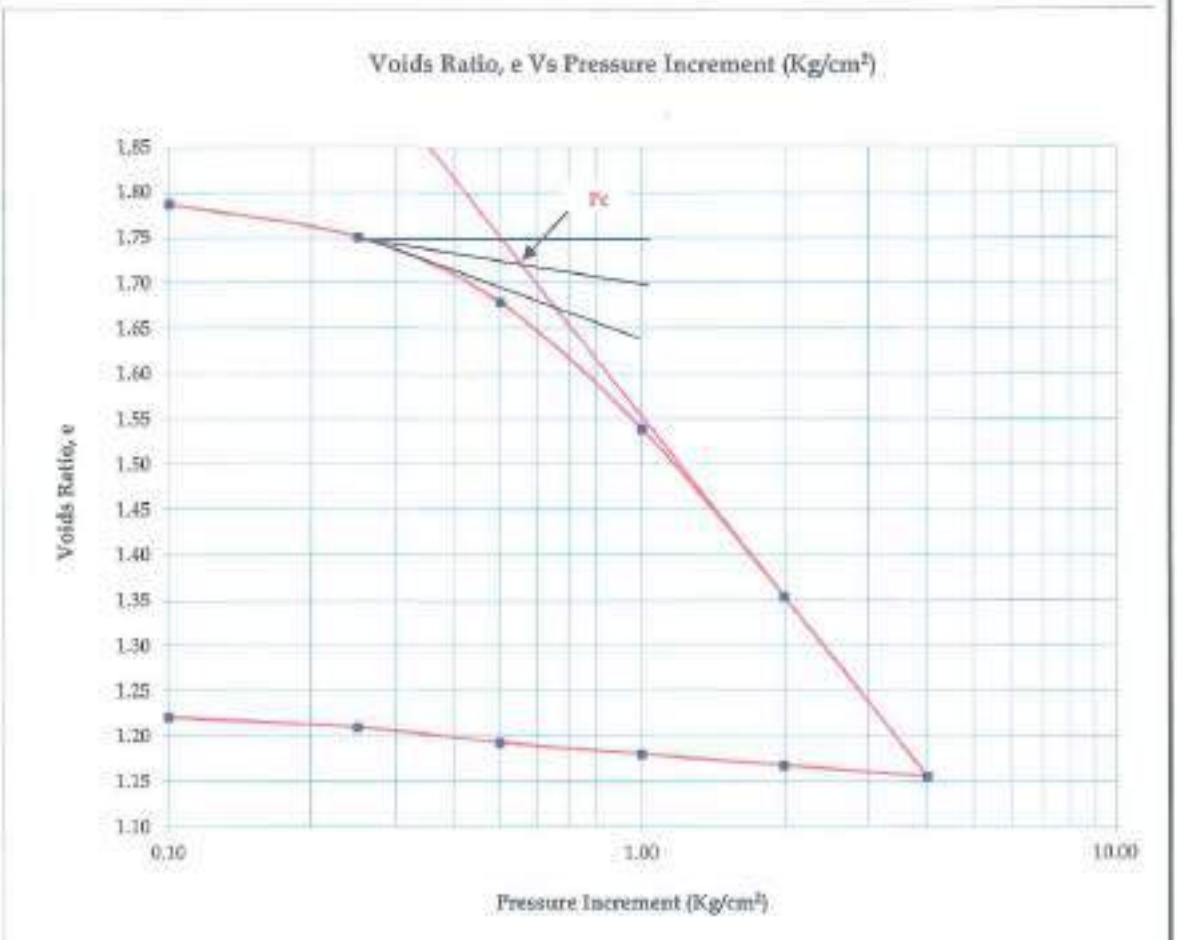
Bore Hole No./Trial Pit No.: BH - 01 Dia.of Specimen: 60 mm

Depth in M.: 8.00 - 8.40 Height of specimen: 20 mm

Type of Samples: UDS - 1

Properties of Soil	Start	End	
Dry density γ_d	0.94	1.18	gm/cm^3
Moisture Content, w	67.89	46.60	%
Initial Void Ratio,e_o	1.79	1.22	
Specific Gravity,G	2.62	2.62	
Degree of Saturation, S_r	99.54	100.00	%
Compression Index, Cc:$\Delta e/\text{Log}\Delta\sigma$		0.66	
Preconsolidation Pressure, P_c		0.56	kg/cm^2

Pressure Increment	Coefficient of consolidation Cv	Coefficient of volume compressibilty mv	Permeability (K)
kg/cm^3	m^2/year	cm^2/kg	cm/sec
0.10 - 0.25	2.17	8.68E-02	5.97E-05
0.25 - 0.50	1.55	1.05E-01	5.15E-05
0.50 - 1.00	1.33	1.05E-01	4.41E-05
1.00 - 2.00	1.11	7.28E-02	2.56E-05
2.00 - 4.00	0.74	4.21E-02	9.88E-06



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Job No.:	3539
Checked By:	PRAJIT

SOIL TEST DATA SHEET

Project : *Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.*

Location : FLB 04 **DATE:** 18.12.2013

Bore Hole No.	Depth in m	Sample Type	Density (Remoulded) gm/cm³		Natural Moisture Content, w %	Soil Classification (I.S)	Mechanical Analysis				Consistency Limits			Shrinkage Limit%	Shrinkage ratio	Shear Test			Cu from Unconfined Compression Test Kg/cm²	Free swell index %	Vertical Consolidation		Specific Gravity	Remarks
			Wet Density	Dry Density			Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index, I_p %			Type	Cohesion C_u kg/cm²	Degree Φ			Comp. Index C_c (Lab)	Initial Void Ratio		
BH - 02	5.00 - 5.40	UDS 1	1.52	0.86	76.16	CH	18	12	31	39	78	32	46	14	1.78	TUU	0.12	3.66	0.151	----	0.63	2.05	2.62	
BH - 02	15.50 - 16.10	SPT 7	----	----	----	CH	1	5	43	51	73	31	42	----	----	----	----	----	----	----	----	----	----	

CHEM : Chemical Analysis
COMP : Compaction Test
DS : Direct Shear
k : Permeability Test
FSI : Free Swell Test

Tau : Triaxial Test (Unconsolidated Undrained)
TUu : Triaxial Test (Consolidated Undrained)
Tcd : Triaxial Test (Consolidated Drained)
NP : Non Plastic
SL : Shrinkage Limit Test

SP : Swelling Pressure or Swelling Potential Test
SPT : Standard Penetration Test Sample
UDS : Undisturbed Soil Sample
VL : Laboratory Vane Shear Test
UC : Unconfined Compression Test

Φ : Angle of Internal Friction
Cu : Undrained Cohesion
Φ' : Effective Angle of Internal Friction
Cu' : Effective Cohesion
----> : Combined Silt + Clay

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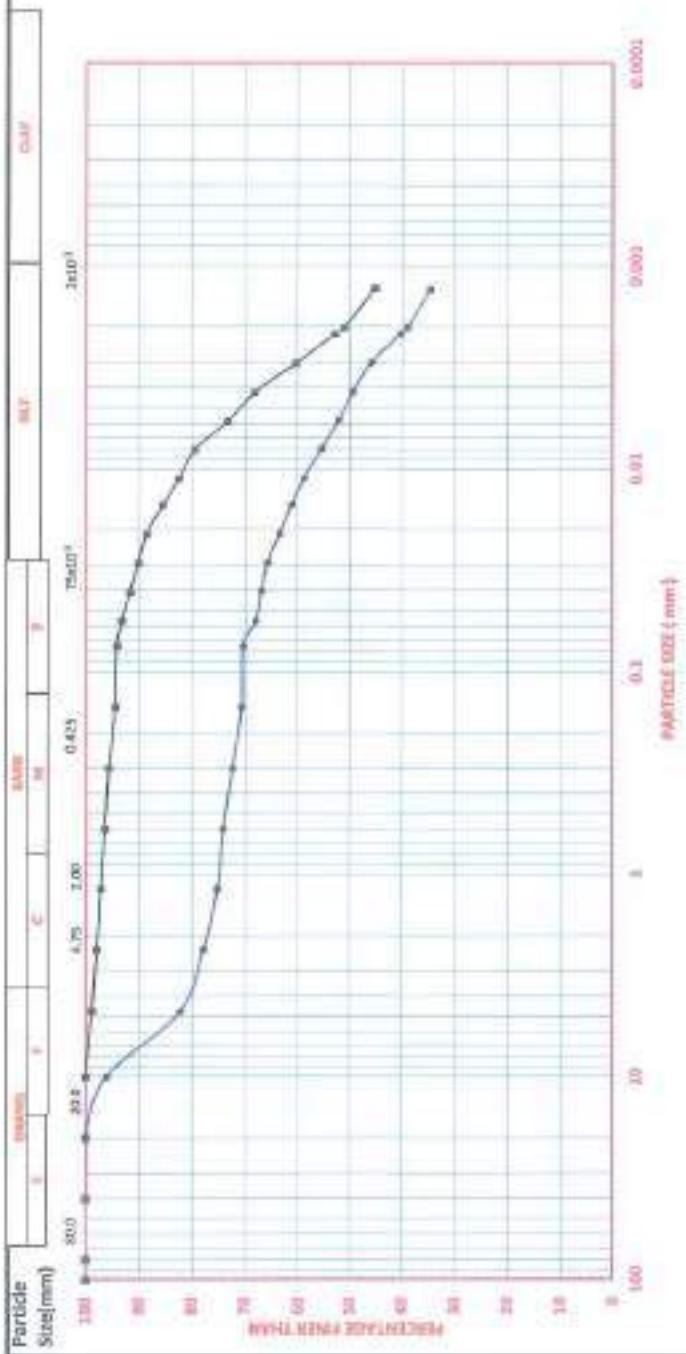
GRAIN SIZE DISTRIBUTION CURVE

Project :	*Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.*
Location :	----



Symbol	Bore Hole No.	Depth in m.	Classification (IS)	Gravel %	Sand %	Silt %	Clay %	M_Φ mm	M_Φ mm	M_Φ mm	Coeff. of Uniformity $C_u = D_{60}/D_{10}$	Coeff. of curvature C_c $D_{30}^2/D_{10}*D_{60}$	Liquid Limit, W_L	Plastic Limit, W_p	Plasticity Index, I_p	Remarks
●	BH - 02	5.00 - 5.40	CH	18	12	31	39	—	—	—	—	—	78	32	46	UDS 1
●	BH - 02	13.50 - 16.10	CH	1	5	43	51	—	—	—	—	—	73	31	42	SPT 7
●																
●																
●																

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Job No. : 3539

TRIAXIAL COMPRESSION TEST

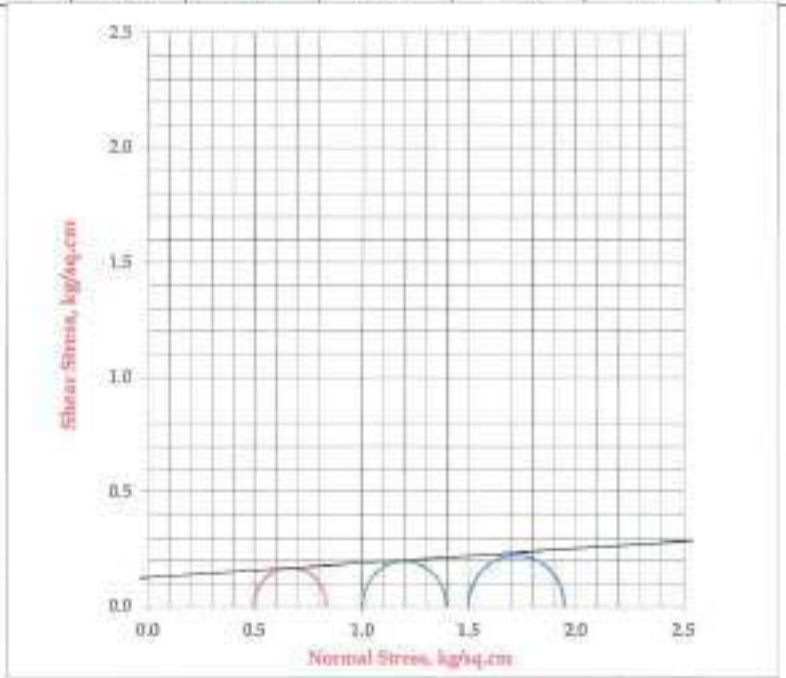
IS 2720 - P 11, 1971

Project: Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.

Location: ———

Rate of Strain :	1.25	mm/min	Date:	16.12.2013
Diameter of Specimen:	38.00	mm	Bore Hole No.:	BH - 02
Height of Specimen:	76.00	mm	Depth (m)	5.00 - 5.40
Dry Density, γ_d :	0.86	g/cm^3	Condition of Test :	TUU
Moisture Content:	76.16	%	State of Sample:	UDS 1

Serial No.	Cell Pressure σ_3	Deviatoric Force at Failure	Deviatoric Stress at Failure, σd	Normal Stress at Failure, $\sigma 1$	Change in Length at Failure, Δ_1	Strain at Failure, ε
	kg/cm^2	kg	kg/cm^2	cm	cm^2	%
1	0.50	4.29	0.337	0.837	8.36	11.00
2	1.00	5.09	0.395	1.395	9.12	12.00
3	1.50	5.89	0.446	1.946	10.64	14.00



Cohesion: 0.12 kg/cm^2 Angle of internal friction, 3.66

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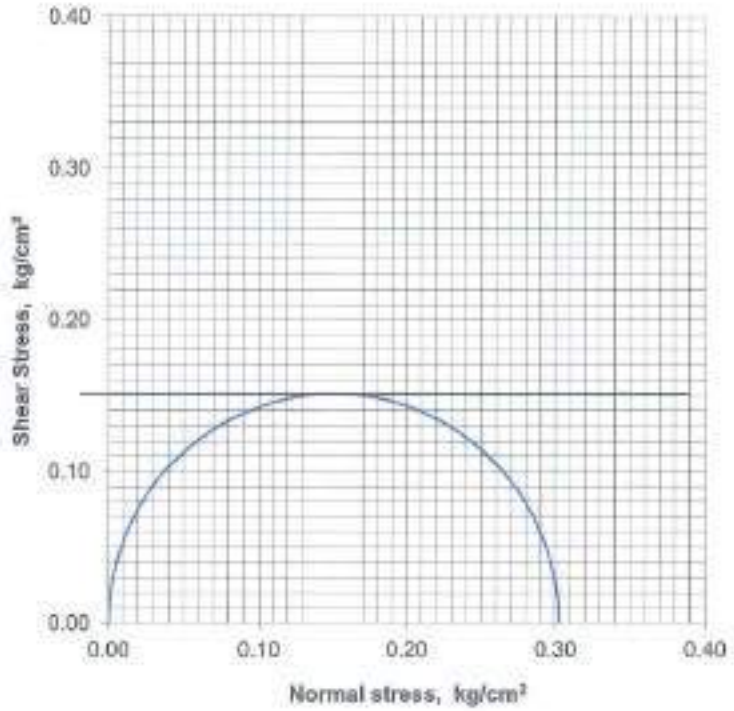
JOB No.	3330
Checked By:	Ravi A

UNCONFINED COMPRESSION TEST

Project	:	Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.			
Location	:			Date :	18.12.2013
Rate of strain	:	1.25	mm/min	Bore Hole No. :	BH - 02
Diameter of specimen	:	38.0	mm	Depth (m) :	5.00 - 5.40
Height of specimen	:	76.0	mm	State of the sample :	UDS 1
Dry Density γ_d	:	0.86	gm/cm^3		
Moisure content w	:	76.16	%		

Sr. No.	Axial load at failure	Axial stress at failure, q_u	Change in length at failure, ΔL	Strain at failure, ε
	kg	kg/cm^2	mm	%
1	3.90	0.30	9.12	12.00



COHESION c_u (= q_u/2) : 0.151 kg/cm^2

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	Chkd. By	H.R.M.

CONSOLIDATION TEST

IS - 2720 , P-15

Project: *Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.*

Location: ———

Date: 18.12.2013

Bore Hole No/Trial Pit No.: BH - 02

Dia.of Specimen: 60 mm

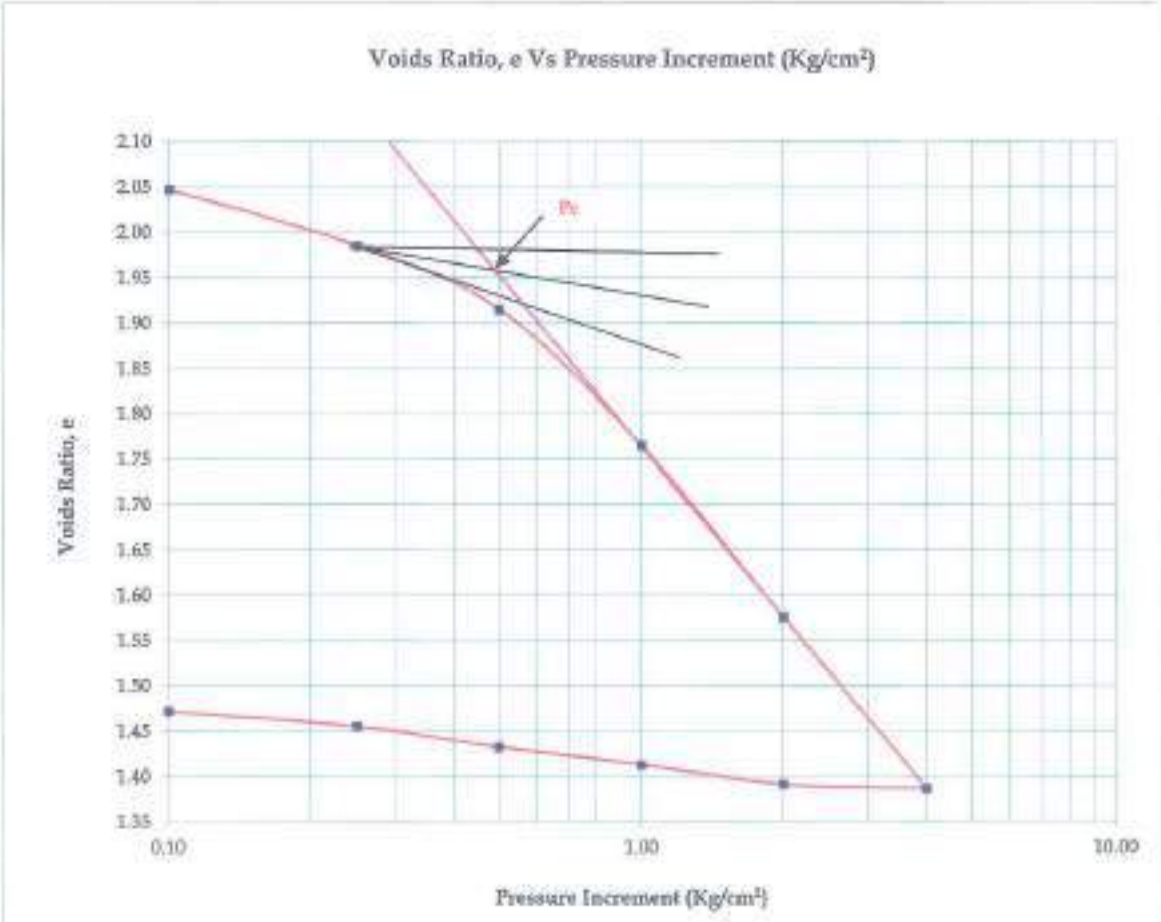
Depth in M.: 5.00 - 5.40

Height of specimen: 20 mm

Type of Samples: UDS-01

Properties of Soil	Start	End	
Dry density γ_d	0.86	1.06	gm/cm^3
Moisture Content, w	76.16	56.17	%
Initial Void Ratio,e_o	2.05	1.47	
Specific Gravity,G	2.62	2.62	
Degree of Saturation, S_r	97.48	100.00	%
Compression Index, Cc:$\Delta e/\text{Log}\Delta\sigma$		0.63	
Preconsolidation Pressure, P_c		0.49	kg/cm^2

Pressure Increment	Coefficient of consolidation Cv	Coefficient of volume compressibility mv	Permeability (K)
kg/cm^2	m^2/year	cm^2/kg	cm/sec
0.10 - 0.25	3.43	1.36E-01	1.48E-04
0.25 - 0.50	2.61	9.38E-02	7.76E-05
0.50 - 1.00	1.37	1.03E-01	4.47E-05
1.00 - 2.00	0.89	6.87E-02	1.94E-05
2.00 - 4.00	0.59	3.66E-02	6.85E-06



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Job No.:	3539
Checked By:	PRAJIT

SOIL TEST DATA SHEET

Project : *Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.*

Location : FLB 04 **DATE:** 18.12.2013

Bore Hole No.	Depth in m.	Sample Type	Density (Remoulded) gm/cm³		Natural Moisture Content, w %	Soil Classification (I.S)	Mechanical Analysis				Consistency Limits			Shrinkage Limit(%)	Shrinkage ratio	Shear Test			Cu from Unconfined Compression Test kg/cm²	Free swell Index %	Vertical Consolidation		Specific Gravity	Remarks
			Wet Density	Dry Density			Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index, Ip %			Type	Cohesion C, kg/cm²	Degree ϕ			Comp. Index C_c, (Ult)	Initial Void Ratio		
BH - 03	4.50 - 5.10	SPT 3	-----	-----	-----	CH	0	1	40	59	76	33	43	16	1.57	-----	-----	-----	-----	-----	-----	-----	-----	
BH - 03	9.00 - 9.50	UDS 2	1.64	1.04	57.59	CH	13	21	29	37	69	27	42	----	----	-----	-----	-----	----	----	----	----	2.63	Gravels and shell contents
BH - 03	18.00 - 18.60	SPT 9	-----	-----	-----	SM	19	57	24		----	----	----	----	----	-----	-----	-----	----	----	----	----	----	

CHAM : Chemical Analysis
COMP : Compaction Test
DS : Direct Shear
K : Permeability Test
FSI : Free Swell Test

Tue : Triaxial Test (Unconsolidated Undrained)
Tcu : Triaxial Test (Consolidated Undrained)
Tcd : Triaxial Test (Consolidated Drained)
NP : Non Plastic
SL : Shrinkage Limit Test

SP : Swelling Pressure or Swelling Potential Test
SPT : Standard Penetration Test Sample
UDS : Undisturbed Soil Sample
VS : Laboratory Vane Shear Test
UC : Unconfined Compression Test

ϕ : Angle of Internal Friction
Cu : Undrained Cohesion
ϕ' : Effective Angle of Internal Friction
Cu' : Effective Cohesion
——> : Combined Silt + Clay

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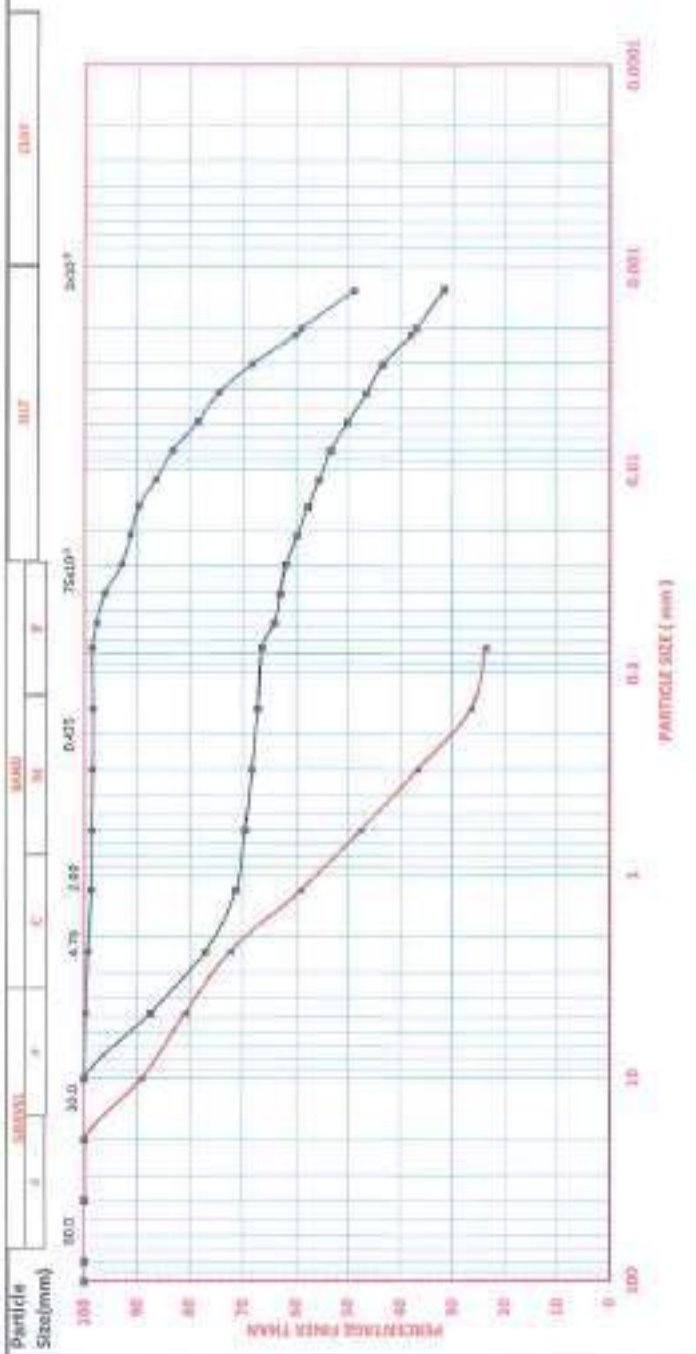
GRAIN SIZE DISTRIBUTION CURVE

Project : *Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.*

Location : ——



Symbol	Bore Hole No.	Depth in m.	Classi-fication (IS)	Gravel %	Sand %	Silt %	Clay %	D_{10} mm	D_{30} mm	D_{60} mm	Coeff. of Uniformity, $C_u = D_{60}/D_{10}$	Coeff. Of Curvature $C_c = D_{30}^2/(D_{60} \times D_{10})$	Liquid Limit, W_L	Plastic Limit, W_P	Plasticity Index, I_P	Remarks
◆	BH - 03	4.50 - 5.10	CH	0	1	40	59	—	—	—	—	—	76	33	43	SPT 3
◆	BH - 03	9.00 - 9.50	CH	13	21	29	37	—	—	—	—	—	69	27	42	UDS 2
◆	BH - 03	18.00 - 18.60	SM	19	57	24		—	—	—	—	—	—	—	—	SPT 9

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Job No. : 3539

SOIL TEST DATA SHEET

Project : *Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.*

Location : FLR 04 DATE: 18.12.2013

Bore Hole No.	Depth in m.	Sample Type	Density (Remoulded) gm/cm³		Natural Moisture Content, w %	Soil Classification (I.S)	Mechanical Analysis				Consistency Limits			Shrinkage Limit%	Shrinkage ratio	Shear Test			Cu from Unconfined Compression Test kg/cm²	Free swell index %	Vertical Consolidation		Specific Gravity	Remarks
			Wet Density	Dry Density			Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index, I_p %			Type	Cohesion C_u kg/cm²	Degree Φ			Comp. Index C_c (Lab)	Initial Void Ratio		
BH - 05	7.00 - 7.80	SPT 1	——	——	——	CH	0	2	43	55	70	26	44	——	——	——	——	——	——	——	——	——	——	
BH - 05	15.00 - 15.50	UDS 3	1.63	1.04	56.62	CH	0	4	40	56	78	31	47	15	1.29	TUU	0.22	4.11	0.244	——	0.60	1.51	2.61	
BH - 05	16.50 - 17.10	SPT 4	——	——	——	GC	28	27	26	19	39	18	21	——	——	——	——	——	——	——	——	——	——	

CHEM : Chemical Analysis
COMP : Compaction Test
DS : Direct Shear
K : Permeability Test
FS : Free Swell Test

Tuu : Triaxial Test (Unconsolidated Undrained)
Tcu : Triaxial Test (Consolidated Undrained)
Tcd : Triaxial Test (Consolidated Drained)
NP : Non Plastic
SL : Shrinkage Limit Test

SP : Swelling Pressure or Swelling Potential Test
SPT : Standard Penetration Test Sample
UDS : Undisturbed Soil Sample
VS : Laboratory Vane Shear Test
UC : Unconfined Compression Test

Φ : Angle of Internal Friction
Cu : Undrained Cohesion
Φ' : Effective Angle of Internal Friction
Cu' : Effective Cohesion
---> : Gravel and Silt + Clay

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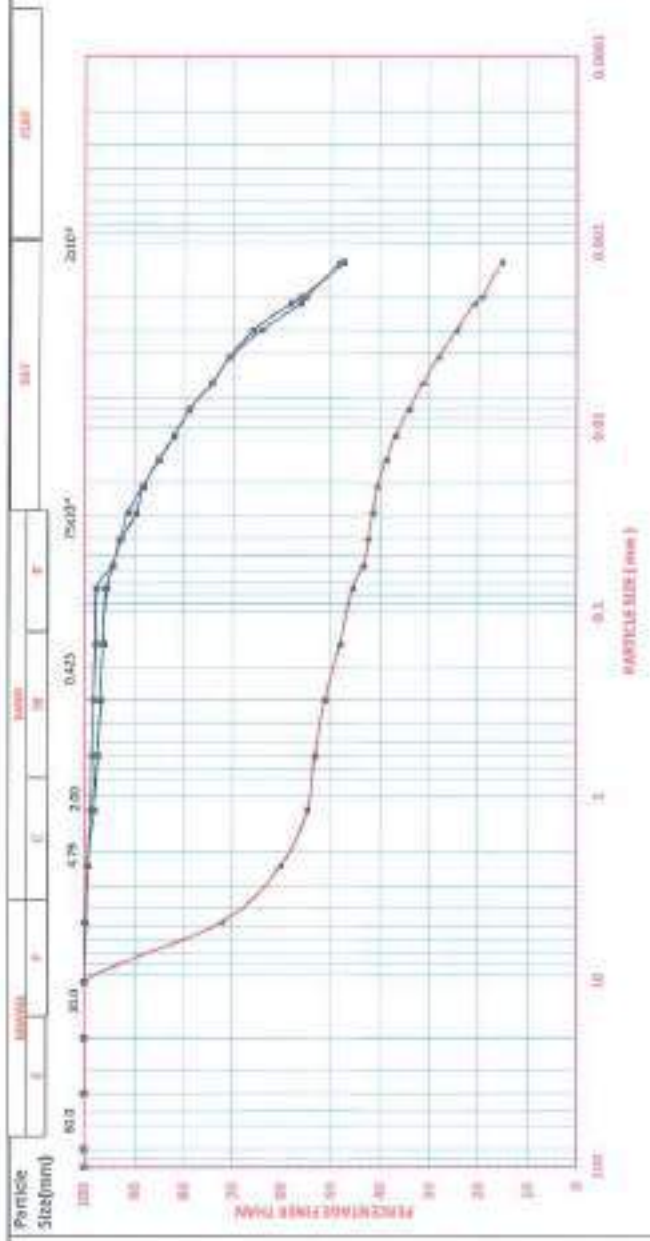
Job. No. : 3539

GRAIN SIZE DISTRIBUTION CURVE

Project :	*Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Sulemon Shah Plot), Wadala (E), Mumbai.*
Location :	—



Remarks	Symbol	Bore Hole No.	Depth in m	Classification (IS)	Gravel %	Sand %	Silt %	Clay %	D_{10} mm	D_{30} mm	D_{60} mm	Coeff. of Uniformity $C_u = D_{60}/D_{10}$	Coeff. of Curvature $C_c = (D_{30})^2/(D_{60} \times D_{10})$	Liquid Limit %	Plastic Limit %	Plasticity Index %
SPT 1		BH -05	7.00 - 7.60	CH	0	2	43	55	—	—	—	----	----	70	26	44
UDS 2		BH -05	15.00 - 15.50	CH	0	4	40	56	—	—	—	----	----	78	31	47
SPT 4		BH -05	16.50 - 17.10	GC	28	27	36	19	—	—	—	—	—	38	38	21

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Job No. : 3539

TRIAXIAL COMPRESSION TEST

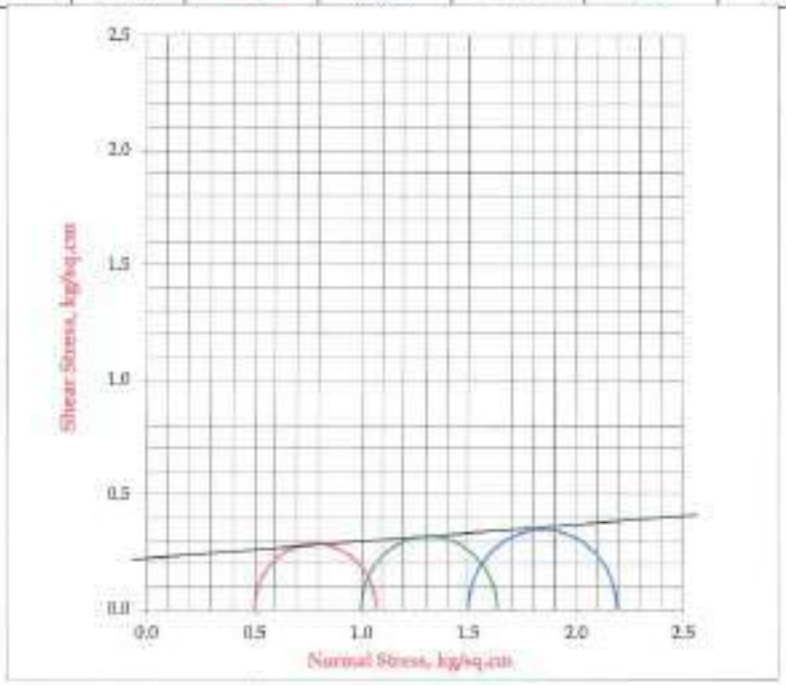
IS 2720 - P 11, 1971

Project: Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.

Location: ---------

Rate of Strain :	1.25	mm/min	Date:	16.12.2013
Diameter of Specimen:	38.00	mm	Bore Hole No.:	BH - 05
Height of Specimen:	76.00	mm	Depth (m)	15.00 -
Dry Density, γ_d :	1.04	g/cm^3	Condition of Test :	TU/U
Moisture Content:	56.62	%	State of Sample:	UDS 3

Serial No.	Cell Pressure σ_3	Deviatoric Force at Failure	Deviatoric Stress at Failure, σd	Normal Stress at Failure, $\sigma 1$	Change in Length at Failure, Δ_L	Strain at Failure, ε
	kg/cm^2	kg	kg/cm^2	cm	cm^2	%
1	0.50	7.16	0.568	1.068	7.60	10.00
2	1.00	8.03	0.630	1.630	8.36	11.00
3	1.50	8.99	0.689	2.189	9.88	13.00



Cohesion: 0.22 kg/cm^2 Angle of internal friction, 4.11

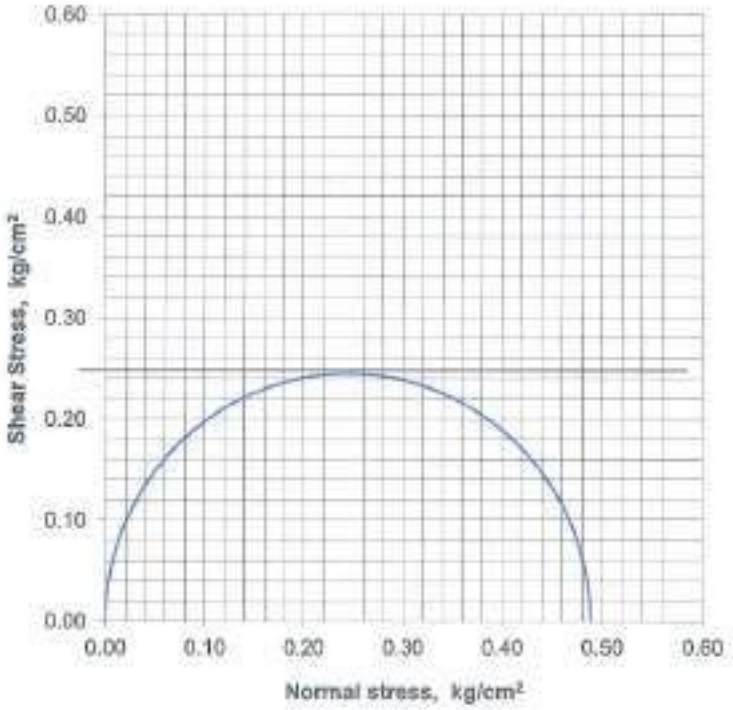
DBM GEOTECHNICS AND CONSTRUCTIONS PVT. LTD.

JOB No.	3550
Checked By:	Ravi A

UNCONFINED COMPRESSION TEST

Project	:	Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.			
Location	:			Date :	18.12.2013
Rate of strain	:	1.25	mm/min	Bore Hole No. :	BH - 05
Diameter of specimen	:	38.0	mm	Depth (m) :	15.00 - 15.50
Height of specimen	:	76.0	mm	State of the sample :	UDS 3
Dry Density γ_d	:	1.04	gm/cm^3		
Moisure content w	:	56.62	%		

Sr. No.	Axial load at failure	Axial stress at failure, q_u	Change in length at failure, ΔL	Strain at failure, ε
	kg	kg/cm^2	mm	%
1	6.44	0.49	10.64	14.00



COHESION c_u (= q_u/2) : 0.244 kg/cm^2

DBM GEOTECHNICS & CONSTRUCTIONS PVT. LTD.	Job No.	3539
	Chkd. By	H.R.M.

CONSOLIDATION TEST

IS - 2720 , P-15

Project: *Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.*

Location: ----------

Date: 18.12.2013

Bore Hole No./Trial Pit No.: BH - 05

Dia.of Specimen: 60 mm

Depth in M.: 15.00 - 15.50

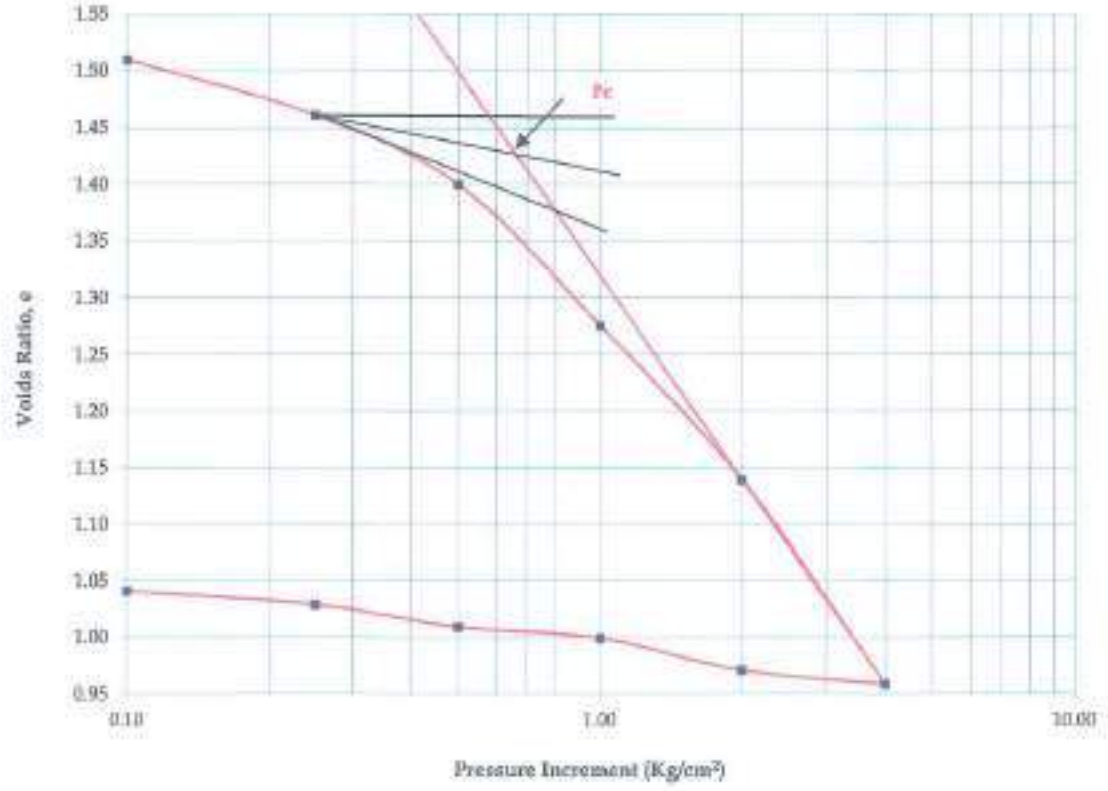
Height of specimen: 20 mm

Type of Samples: UDS 3

Properties of Soil	Start	End	
Dry density γ_d	1.04	1.28	gm/cm^3
Moisture Content, w	56.62	39.89	%
Initial Void Ratio,e_o	1.51	1.04	
Specific Gravity,G	2.61	2.61	
Degree of Saturation, S_r	97.87	100.00	%
Compression Index, Cc:$\Delta e/\text{Log}\Delta\sigma$		0.60	
Preconsolidation Pressure, P_c		0.66	kg/cm^2

Pressure Increment	Coefficient of consolidation Cv	Coefficient of volume compressibility mv	Permeability (K)
kg/cm^2	m^2/year	cm^2/kg	cm/sec
0.10 - 0.25	3.29	1.30E-01	1.36E-04
0.25 - 0.50	1.21	9.91E-02	3.80E-05
0.50 - 1.00	1.14	1.04E-01	3.77E-05
1.00 - 2.00	0.91	5.98E-02	1.73E-05
2.00 - 4.00	0.79	4.21E-02	1.05E-05

Voids Ratio, e Vs Pressure Increment (Kg/cm^2)



DBM GEOTECHNICS AND CONSTRUCTIONS PVT. LTD.

Job No.: 3539

Checked By: PRAJIT

TEST RESULTS OF ROCK CORES

Site : Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.

Location: ---------- FLB 09 Date : 17.12.2013.

Sr. No.	Bore Hole No.	Core No.	Depth, m	Diameter, cm	Height, cm	H : D (1:H/D)	Correction Factor	Condition of Test	Failure Load	Uniaxial Compressive Steength	Modulus of Elasticity	Point Load Index	Brazilian Test	Porosity	Water Absorption	Dry Density	Specific Gravity	Remarks
				cm	cm				kN	kg/cm²	kg/cm²	kg/cm²	kg/cm²	%	%	gm/cm³		
1	BH - 01	1	19.50 - 20.00	5.42	5.89	1.09	0.84	Soaked	0.50	----	----	1.77	----	13.05	5.34	2.45	----	
2	BH - 01	14	20.50 - 21.50	5.44	10.74	1.98	1.00	Soaked	69.50	305	----	----	----	2.87	1.11	2.59	----	
3	BH - 01	35	23.00 - 24.50	5.43	10.22	1.88	0.99	Soaked	127.3	553	----	----	----	2.15	0.84	2.55	----	
4	BH - 02	8	17.10 - 18.50	5.44	5.98	1.10	0.85	Soaked	0.625	----	----	2.20	----	12.15	5.09	2.39	----	
5	BH - 02	28	20.00 - 21.00	5.42	7.82	1.44	0.92	Soaked	49.10	200	----	----	----	2.74	1.10	2.49	----	
6	BH - 02	34	21.00 - 22.00	5.46	7.10	1.30	0.89	Soaked	6.00	----	----	21.03	----	10.13	4.10	2.47	----	
7	BH - 03	12	21.00 - 22.50	5.43	8.83	1.63	0.95	Soaked	88.60	372	----	----	----	1.81	0.71	2.56	----	VEIN
8	BH - 03	18	22.50 - 24.00	5.43	10.81	1.99	1.00	Soaked	142.00	625	----	----	----	1.42	0.55	2.59	----	
9	BH - 03	24	24.50 - 26.00	5.44	8.94	1.64	0.95	Soaked	162.30	679	----	----	----	1.30	0.51	2.57	----	
10	BH - 05	10	19.00 - 20.00	5.36	7.40	1.38	0.91	Soaked	0.25	----	----	0.90	----	17.90	8.51	2.10	----	
11	BH - 05	37	24.50 - 26.00	5.07	3.43	0.68	0.70	Soaked	0.25	----	----	0.98	----	14.84	6.06	2.45	----	
12	BH - 05	44	27.00 - 28.0	5.32	5.63	1.06	0.83	Soaked	0.375	----	----	1.37	----	15.81	6.60	2.39	----	

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JOB NO. 3539

CHEMICAL TEST RESULT OF SOIL SAMPLES.

FLB 10

SITE : Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.

LOCATION:

Date: 23.12.2013

Sr. No.	Bore Hole No.	Depth in m.	Type of Sample	pH Electrometrically	Sulphate as SO_3 (%)	Chloride as Cl (%)	Remark
1	BH - 1	8.00 - 8.40	UDS 1	8.49	0.161	0.595	
2	BH - 2	5.00 - 5.40	UDS 1	8.32	0.393	1.495	
3	BH - 3	4.50 - 5.10	SPT 3	8.01	0.396	1.505	
4	BH - 5	7.00 - 7.60	SPT 1	7.99	0.427	1.624	

DBM GEOTECHNICS & CONSTRUCTIONS PVT. LTD | **Job No.** 3539

CHEMICAL TEST RESULT OF WATER SAMPLES.

FLB 10

SITE : Geotechnical Investigation for Proposed Construction of Office Complex And Godown At Customs Enclave Plot (Suleman Shah Plot), Wadala (E), Mumbai.

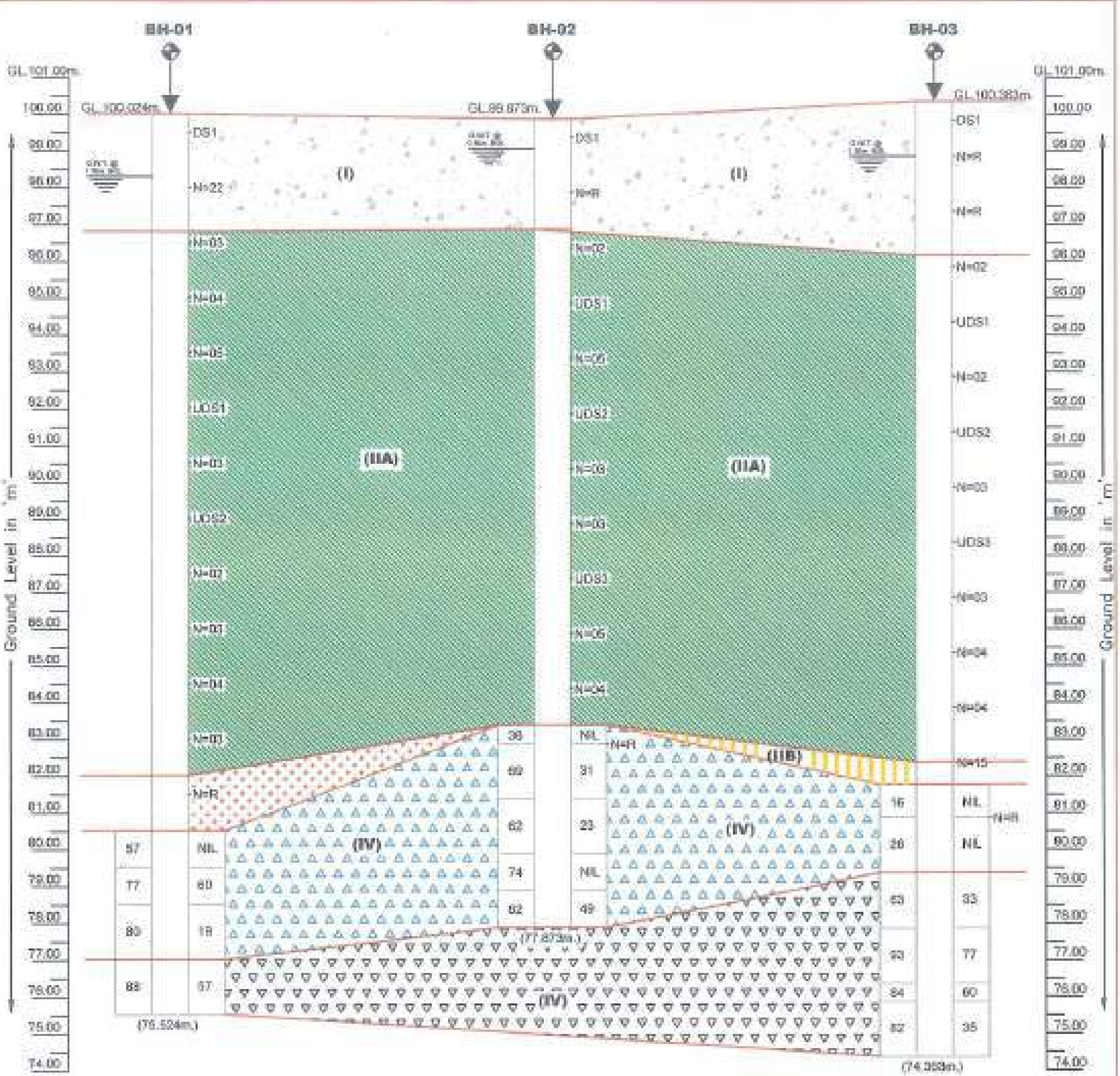
LOCATION: **Date:** 23.12.2013

Sr. No.	Bore Hole No.	Depth in m.	pH Electrometrically	Sulphate as SO_3 (PPM)	Chloride as Cl (PPM)	Remark
1	BH - 1	1.70	6.94	175.703	579.820	
2	BH - 2	0.80	6.69	3296.275	12196.218	
3	BH - 3	1.50	7.35	4308.188	18094.389	
4	BH - 5	1.40	7.15	4046.361	16994.730	
DBM GEOTECHNICS & CONSTRUCTIONS PVT. LTD					**Job No.**	3539

ANNEXURE

SUB-SURFACE PROFILE

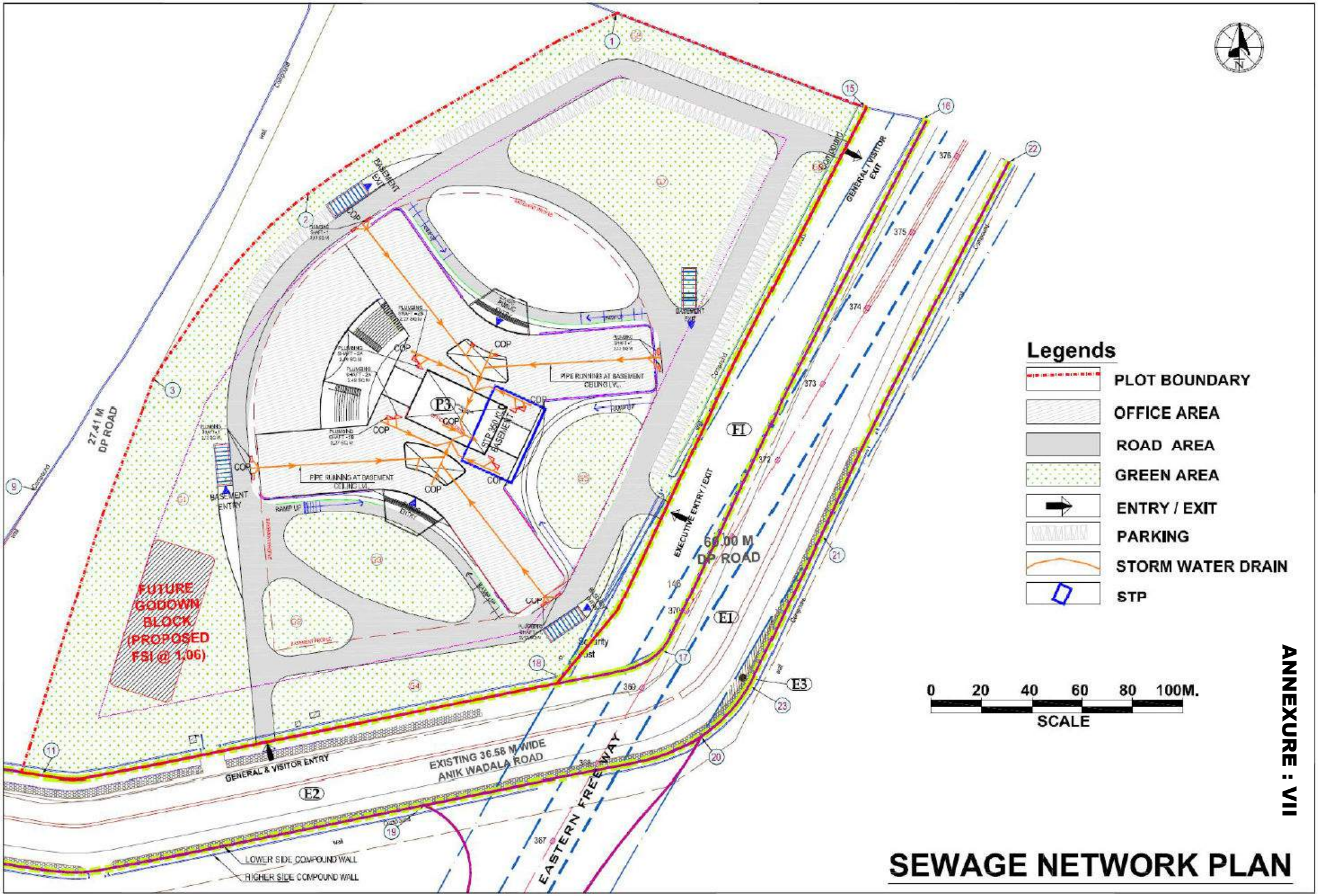
DBM



LEGEND :
LAYERS

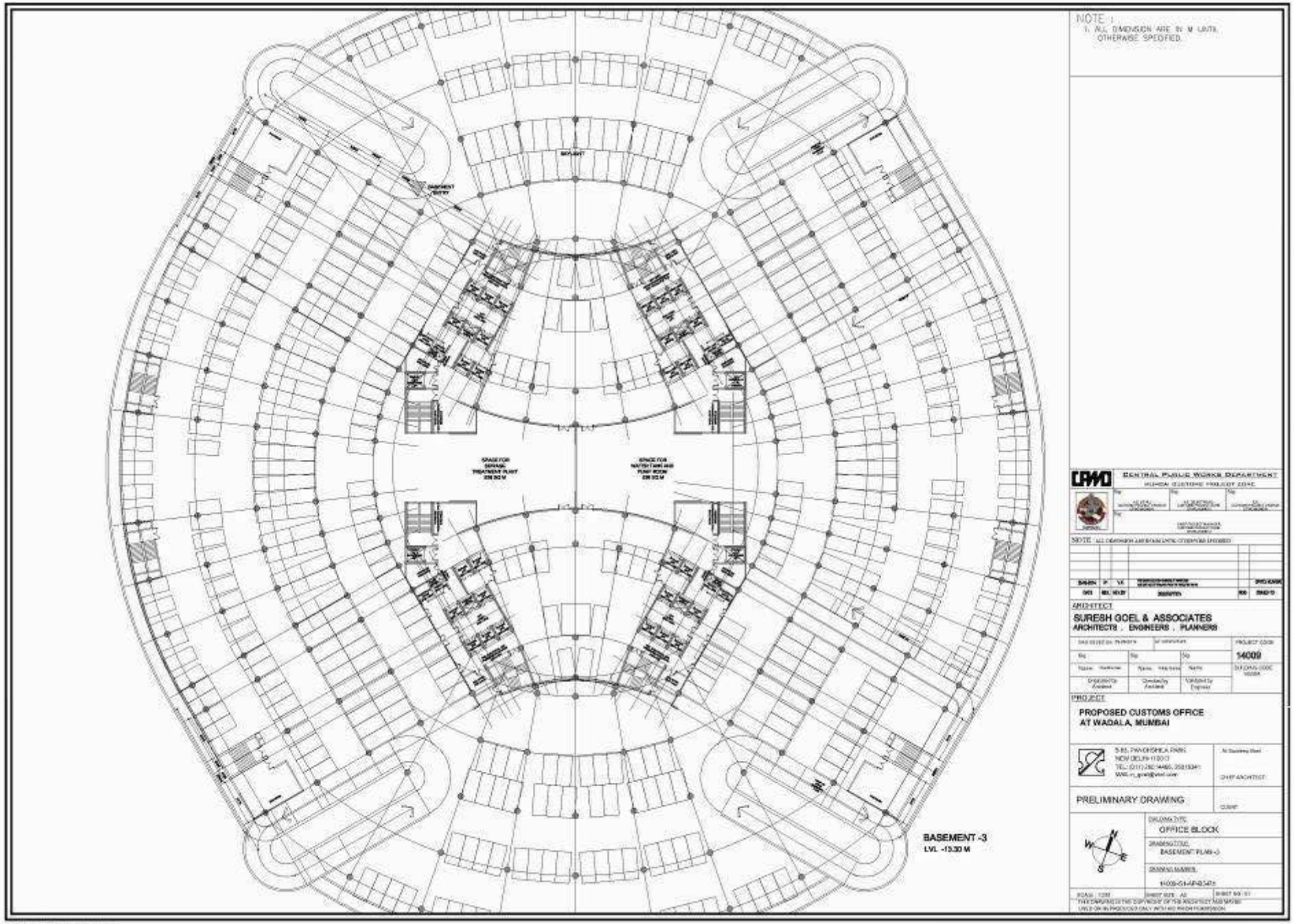
- (I) FILL
- (IIA) MARINE CLAY
- (IIB) RESIDUAL SOIL
- (IV) BASALT/BRECCIA BEDROCK

CLIENT : CENTRAL PUBLIC WORKS DEPARTMENT	
TITLE : Sub surface Profile Through Boreholes for Construction of Office Complex & Godown On Customs Enclave Plot (Suleman Shah Plot), at Wadala (E), Mumbai	
DBM GEOTECHNICS AND CONSTRUCTIONS PVT. LTD.	
Drawn By : Trupti Parab	Date : December - 2013
Checked By : B. S. Telang	Scale : H:- NTS, V:- 1:100
Appr. by : Prajit Nagrale	Drg. No. : DBM/3539/CPWD/SSP-1

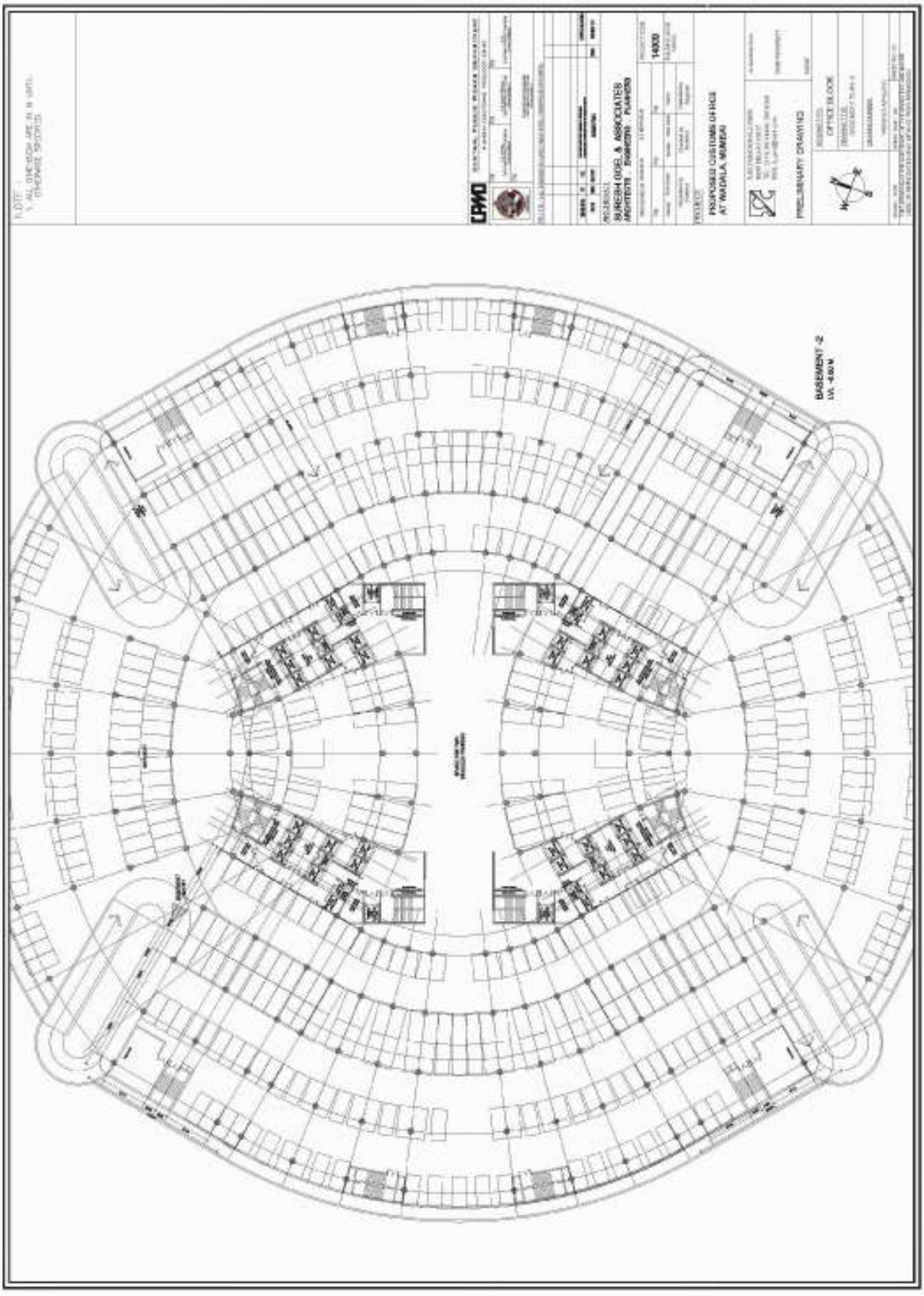


ANNEXURE : VII

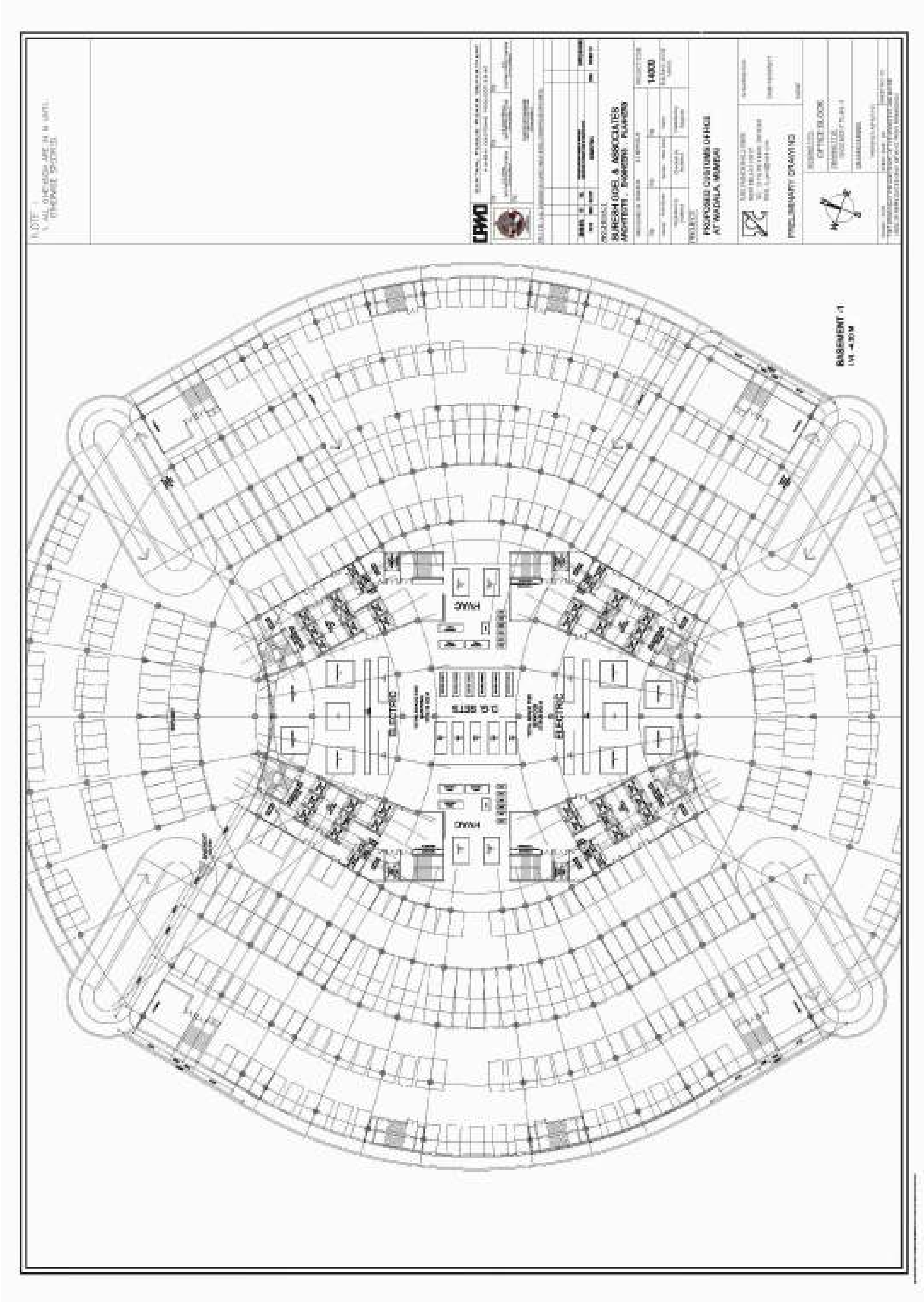
SEWAGE NETWORK PLAN



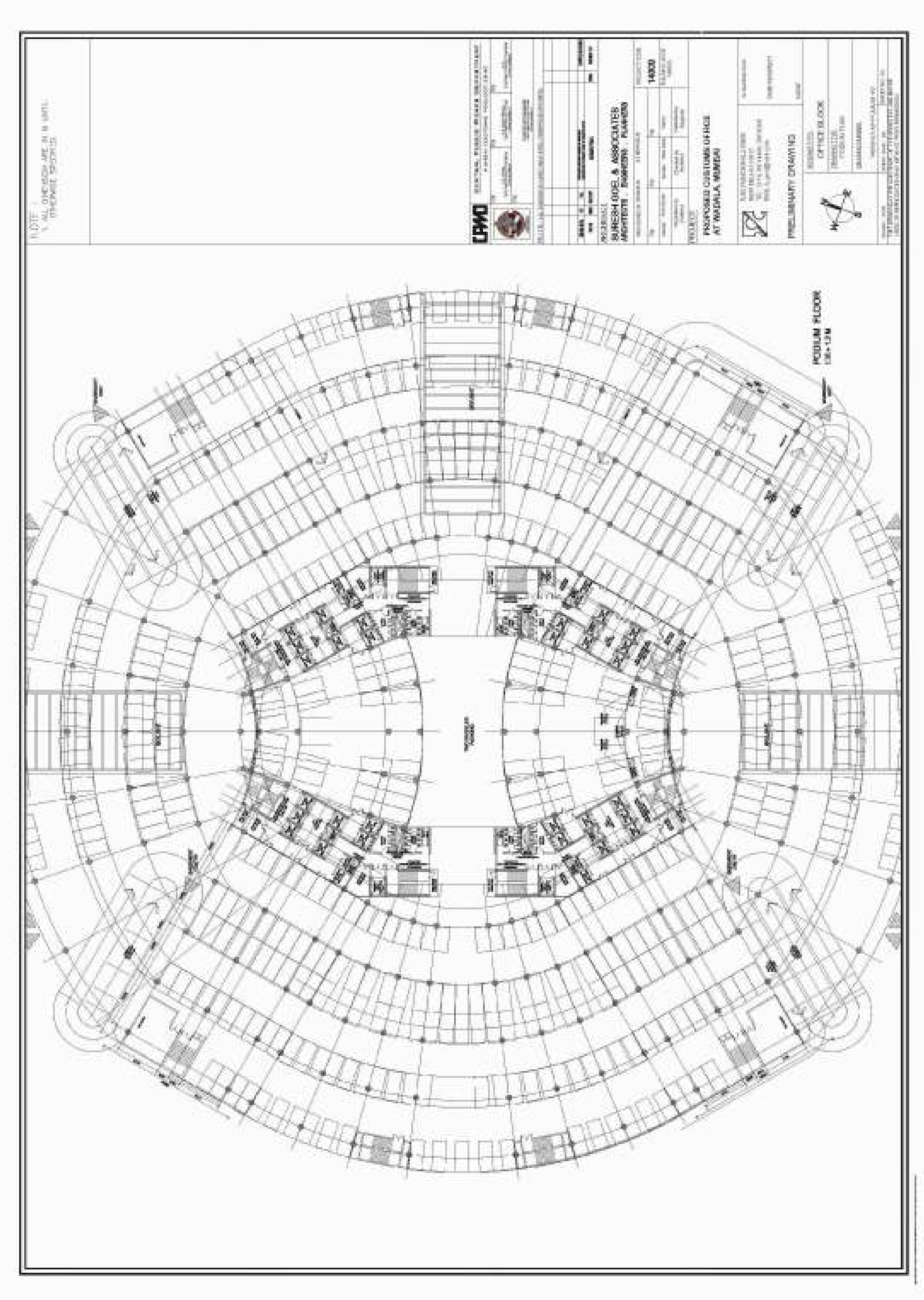
ANNEXURE : VIII

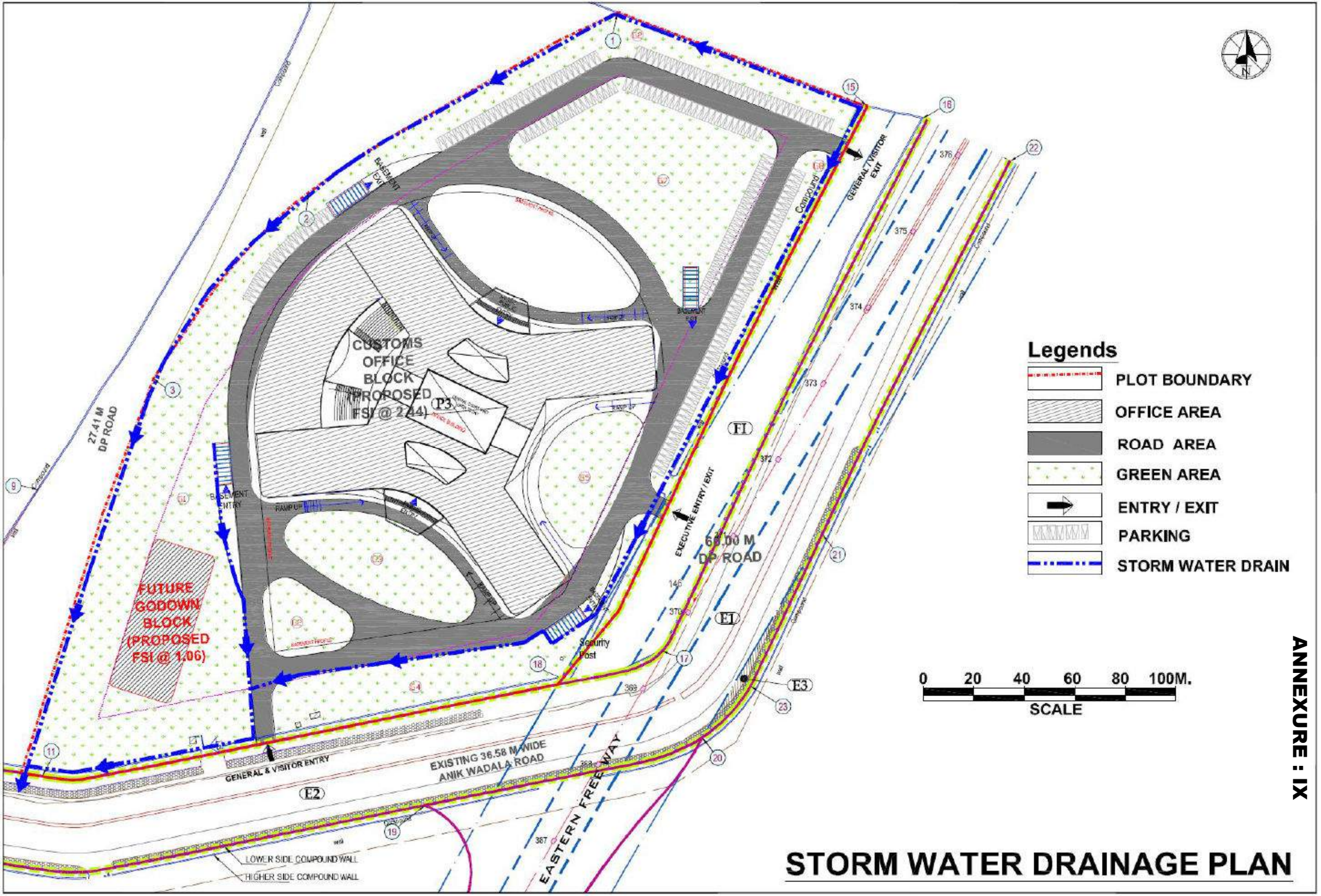

NOTE :
1. ALL DIMENSIONS IN MM UNLESS OTHERWISE SPECIFIED
CMD
SURESH GOEL & ASSOCIATES
ARCHITECTS : PLANNERS
14000
PROPOSED CUSTOMS OFFICE
AT WADALA, MUMBAI
PRELIMINARY DRAWING
OFFICE BLOCK
BASEMENT -2
LVL -8.60 M

ANNEXURE : VIII Contd..



ANNEXURE : VIII Contd..





STORM WATER DRAINAGE PLAN

ANNEXURE : IX

ANNEXURE : X

LIST OF AMMENITIES

Sl. No.	Name	Distance (km)/ Direction
MONUMENTS, TOURIST PLACES & RELIGION PLACES.		
1.	Asiatic Society of Mumbai	10.1/SSW
2.	Bandra	5.8/NW
3.	Bandra Fort	6.2/WNW
4.	Basilica of Mount Mary Bandra	5.9/WNW
5.	Banganga	11.4/SW
6.	Bhuleshwar	8.1/SW
7.	Bombay Natural History Museum	10.8/SSW
8.	Bombay Stock Exchange	10.4/SSW
9.	Chhatrapati Shivaji Maharaj Vastu Sangrahalaya formerly Prince of Wales Museum	10.7/SSW
10.	Chaityabhoomi dadar	3.9/WSW
11.	Chhatrapati Shivaji Terminus	9.4/SSW
12.	Cuffe Parade	12.8/SSW
13.	Chowpatty Beach	9.2/SW
14.	Crawford Market	8.7/SSW
15.	Dharavi	3.1/NW
16.	Dr. Bhau Daji Lad Museum formerly The Victoria and Albert Museum	5.7/SW
17.	Dhanraj Mahal	11.0/SSW
18.	Elephanta Caves	8.3/SE
19.	Fashion Street	9.7/SSW
20.	Film City	15.0/N
21.	Flora Fountain now renamed to Hutatma Chowk	10.2/SSW
22.	Gateway of India	11.1/SSW
23.	Gurdwara Shree Guru Singh Sabha	3.4/NE
24.	Hotel Taj Mahal Place	11.2/SSW
25.	Haji Ali Mosque	7.5/SW
26.	Hanging Gardens	9.6/SW
27.	Hiranandani Gardens Garden skyscraper city	11.5/NNE
28.	High Court	14.0/SSW
29.	The Imperial Towers Tallest building in India	8.0/SW
30.	ISKCON Hare Krishna Temple	11.3/NNW

ANNEXURE : X Contd..

Sl. No.	Name	Distance (km)/ Direction
31.	INS Vikrant	9.8/SSW
32.	Jehangir Art Gallery	10.6/SSW
33.	Jijamata Udyaan	5.4/SW
34.	Juhu Beach	8.8/NW
35.	Kamala Nehru Park	9.7/SW
36.	Land's End, Bandra	6.0/NW
37.	Mahalaxmi Racecourse	6.1/SW
38.	Mani Bhavan Gandhi Museum	8.9/SW
39.	Marine Drive earlier historically referred to as Queen's Necklace	9.4/SW
40.	India Government Mint	10.2/SSW
41.	Nehru Science Centre	6.2/SW
42.	Nehru Planetarium	6.6/SW
43.	Powai Lake	11.5/NNE
44.	Prithvi Theatre	10.6/NW
45.	Rajabai Tower	10.5/SSW
46.	Palais Royale Skyscraper	5.6/WSW
47.	Reserve Bank of India	9.9/SSW
48.	Taraporewala Aquarium	9.2/SW
49.	Vihar Lake	13.8/NNE
50.	Maharashtra Legislative Assembly	10.8/SSW
51.	Siddhivinayak Temple	4.2/W
52.	Mahalaxmi Temple	8.1/SW
53.	Fire Temple	7.7/SW
54.	Shri Swaminarayan Temple, Mumbai	2.7/W
55.	Mumba Devi Temple	8.3/SSW
56.	University of Mumbai	10.2/SSW
57.	Worli Fort	5.6/W
58.	Worli Sea Face	5.8/WSW
59.	Shri Walkeshwar Temple	11.4/SW
60.	National Gallery of Modern Art	10.8/SSW
61.	Keneseth Eliyahoo Synagogue	10.5/SSW
62.	Holy Name Cathedral	11.1/SSW
63.	Afghan Church	13.4/SSW
64.	St. Thomas's Cathedral	10.1/SSW
65.	Babulnath Temple	9.2/SW

Sl. No.	Name	Distance (km)/ Direction
66.	Babu Amichand Panalal Adishwarji Jain Temple	10.7/SW
67.	Shivaji Park	3.4/WNW
68.	Ballard Bunder Gatehouse Navy Museum	9.7/SSW
69.	Sion Fort	2.9/NNW
INDUSTRIES		
1.	Hpcl Terminal, Wadala	1.0/SW
2.	Godrej food product (Mumbai)	1.3/SW
3.	BPCL Terminal Mumbai (Mumbai)	0.9/SW
4.	IBP SEWRI Oil Terminal Mumbai	2.1/SW
5.	Bpcl Sewri Terminal	2.0/SW
6.	IOCL Sewri Terminal	2.6/SW
7.	Wintex Wire Industries	2.8/SW
8.	Bharat Rice Mills Compound	4.3/SW
9.	United India Mills	4.4/SW
10.	Jam Mill	4.7/SW
11.	Digvijay Mill, Kalachowki	4.8/SW
12.	India United Mills	4.7/SW
13.	Mafatlal Mills	4.9/SW
14.	Poddar Mills	5.2/SW
15.	Sun Mill Compound	5.1/SW
16.	Phoenix Mills	5.4/SW
17.	Mathuradas Mill Compound	4.7/SW
18.	SHREERAM MILLS	5.7/WSW
19.	Phoenix Mills Limited	5.0/WSW
20.	Kamala Mills Compound.	4.7/WSW
21.	National Bicycle corporation of India Ltd.	5.2/WSW
22.	Century Mills	4.9/WSW
23.	Tata Mills	3.3/WSW
24.	Gold Mohur Mill	3.1/WSW
25.	Kohinoor Mill	2.4/W
26.	Hindoostan Mills	4.3/W
27.	India United Mills No 6	4.0/WNW
28.	New City Of Bombay Mills	5.0/SW
29.	Sewree Dockyards	3.5/SW
30.	Khatau Mill	6.4/SW

Sl. No.	Name	Distance (km)/ Direction
31.	Mechwell Industries Limited	5.7/SSW
32.	Mukesh Mill	12.3/SSW
33.	Trombay Thermal Power Station	2.0/NE
34.	The Hindustan Petroleum Refinery	2.3/E
35.	BPCL- Mumbai Refinery	1.5/E
36.	Trombay Indusrial Area	2.6/SE
37.	Swadeshi Mill	4.1/N
38.	N.A.D - Ghatkopar	7.4/NNE
39.	Capgemini India Pvt. Ltd.	9.5/NNE
40.	Ghatkopar Industrila Estate	9.9/NNE
41.	Godrej and Boyce Plant	10.2/NNE
42.	Mittal Industrial Estate	9.3/N
43.	Parle Biscuit Factory	10.0/NNW
44.	Chakala Cigrate factory	9.7/N
45.	BISLERI INTERNATIONAL PVT LTD	10.3/N
46.	Brahans Rubber Factory	11.3/N
47.	Larsen & Toubro Limited	11.9/NNE
48.	CIPLA LIMITED	11.8/NNE
49.	Vitrum Glass Ltd	12.5/NNE
50.	Nitco Tiles Ltd	13.5/NNE
51.	Echjay Forgings Pvt. Ltd.	13.7/NNE
52.	Crompton Greaves Company, Transformer "T1" Plant	14.0/NNE
53.	BIRLA COMPANY	14.2/NNE
54.	JAI HIND OIL MILL	14.5/NNE
55.	Copper Rollers Pvt. Ltd.	15.0/NNE
56.	Laxmi Industrial Estate	13.5/NNW
57.	BM Industries	13.4/NNW
58.	NESCO	14.4/N
RIVER NALA WATER BODY		
1.	Ashish Pond	2.9/NE
2.	Teen Talao	3.9/NNE
3.	Sion Pond	3.0/NNW
4.	Bandra Talao	5.3/NW
5.	Chandivali Lake	10.9/NNE
6.	Bhavans Lake	12.1/NNW

ANNEXURE : X Contd..

Sl. No.	Name	Distance (km)/ Direction
7.	Sheetal Pond	7.0/N
8.	Mithi River	3.8/NNW
9.	Anushaktinagar Lake	4.8/ENE
10.	Vihar Lake	13.5/N
11.	Powai Lake	11.5/N
12.	Nitie Pond	13.3/N
13.	Deval Lake	11.2/N
14.	Lake Near Juhu	9.6/NW
15.	Ganesh Talao	5.1/NE
16.	Jai Ambe Nagar Pond	6.6/NE
17.	Lotus Pond	10.8/NW
18.	Lokhandwala Lake	14.8/NNW
19.	Mogara Nala	12.1/NNW
20.	Somaiya Nala	6.4/NW
21.	Bhabha Lake	5.1/ENE
ROAD		
1.	Eastern Freeway	WITHIN
2.	Sewri-Chembur Road	WITHIN
3.	Bandra-Worli Sea Link	5.7/W
4.	NH-8	4.5/NW
5.	Sion-Panvel Expy	4.6/NE
6.	Jeejabai Bhosle Marg	6.3/NE
7.	Palm Beach Road	13.8/E
8.	NH-4B	11.3/SE
9.	Bombay Port Trust Road	AD./E
10.	LBS Road	2.8/NNW
11.	Andheri-Ghatkopar Road	8.1/N
12.	Lady Jamshedji Road	3.3/W
13.	Rafi Ahmed Kidwai Marg	1.0/W
14.	Netaji Subhash Chandra Boss Road	9.2/SSW
15.	NH-3	3.7/N
16.	Dr. Ambedkar Road	2.2/W
17.	Link Road	13.9/NNW
RAILWAY LINE		
1.	Kurla To Sanpada	5.8/NE
2.	Kurla To Trombay	2.4/NE

ANNEXURE : X Contd..

Sl. No.	Name	Distance (km)/ Direction
3.	Nuapada To Chhatrapati Shivaji Terminus	2.3/W
4.	Mira Road To Mahim Jn.	3.1/NW
RAILWAY STATIONS		
1.	Wadala	1.1/W
2.	Dadar	2.7/W
3.	Mahim Jn.	3.4/NW
4.	Kurla	4.9/N
5.	Mumbai Central	7.4/SW
6.	Chhatrapati Shivaji Terminus	8.7/SSW
7.	Lokmanya Tilak Terminus	5.7/NNE
MONORAIL STATIONS NEAREST		
1.	Wadala	1.1/W
AIRPORTS		
1.	Chhatrapati Shivaji International Airport	7.5/N
2.	Juhu Airport	9.5/NW
DEFENCE INSTALLATION		
1.	Kalina Military Camp	6.6/N
2.	Lohegaon AFS	120/ESE
DISTRCT HEADQUARTER		
1.	Mumbai	10.6/SW
TOWN		
1.	SION	WITHIN
NATIONAL PARK AND SANCTUARY		
1.	Sanjay Gandhi National Park	14.0/N
2.	Karnala Bird Sanctuary	26/SE
3.	Tansa Wildlife Sanctuary	62.0/NE
FOREST		
1.	Mangrove Forest Near Mahul	0.3/E
2.	Mangrove Forest Near Dharavi	3.6/NW
3.	Mangrove Forest Near Bandra East	4.1/NNW
4.	Mangrove Forest Near Trombay	4.4/SE
5.	Mangrove Forest Near Pali Hill	7.1/NW
6.	Mangrove Forest Near Gharapuri	7.9/SE
7.	Mangrove Forest Near Mandala	8.1/NE

ANNEXURE : XI

SOURCE : IMAGE TERRA METRICS & EUROPA TECHNOLOGIES, 2014 (IMAGERY DATE :- MAY 05, 2014)

PROJECT BOUNDARY

0 2 4 6 8KM.
SCALE

CLIENT: CENTRAL PUBLIC WORKS DEPARTMENT		
PROJECT: CONSTRUCTION OF OFFICE COMPLEX AT CUSTOMS ENCLAVE, WADALA (EAST), MUMBAI		
TITLE: FORM–1 15KM. RADIUS ON GOOGLE IMAGE		
DRAWN BY: RANJEET K.	CHECKED BY: M. SHARMA	FIG. NO.
SCALE : AS SHOWN	DATE : 09–10–2014	

SAFETY AND DISASTER MANAGEMENT PLAN

1.0 INTRODUCTION

Disasters have always co-existed with civilization. With technological advancement, development initiatives resulted in the creation of many infrastructure and permanent assets.

Gradually material development detached man from nature on one hand and increased vulnerability of the human population on the other. The progressive increase in loss of life, property and deleterious effect on environment due to disasters moved the international community to look at Disaster Management in a new perspective, which transcends international barriers, anticipates possible threats and enables tackling of disasters from the pre-stage.

Greater Mumbai Disaster Management Action Plan, Risk Assessment and Response Plan, Maharashtra Emergency Earthquake Rehabilitation Programme, has been prepared by Government of Maharashtra, Mumbai, 2007

Natural disasters

- Earthquake
- Flood
- Cyclone
- Landslide
- Tsunami
- Drought

Manmade disasters

- Fire
- Chemical Hazard
- Accidents

2.0 PRECAUTIONS & MITIGATORY METHODS TO PREVENT DISASTERS

2.1 Natural disasters

2.1.1 Earthquake

As per the Seismic Zoning Map of India, Mumbai region falls under Seismic Zone-III. The structural design shall be certified as per IS code 875 and IS-1893-2002 for Seismic Zone – III of Mumbai. Therefore, at the time of designing and construction of the buildings, the design parameters have been considered in compliance with IS 1893-1984 (Criteria For Earthquake

Resistant Design of Structures) with due consideration of prevailing construction & development guidelines together with National Building Code.

The major earthquakes that have occurred in Mumbai region in the last 400 years are given below:

Year	Intensity (MMI)
1594	IV
1618	IX
1678	IV
1832	VI
1854	IV
1877	IV
1906	VI
1926	V
1933	V
1951	VIII
1963	IV
1966	V

The structure designing shall be done to make earthquake resistant building. The following Codes and Standards specify for earthquake resistance building:

- IS 1893:1984 Criteria for Earthquake Resistant Design of Structures
- IS 1893(Part 1):2002 `Criteria for Earthquake Resistant Design of Structures : Part 1 General provisions and Buildings'
- IS 1893 (Part 4):2005 `Criteria for Earthquake Resistant Design of Structures: Part 4 Industrial Structures Including Stack Like Structures
- IS 4326:1993 Earthquake Resistant Design and Construction of Buildings - Code of Practice
- IS 13827:1993 Improving Earthquake Resistance of Earthen Buildings – Guidelines
- IS 13828:1993 Improving Earthquake Resistance of Low Strength Masonry Buildings – Guidelines
- IS 13920:1993 Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces– Code of Practice
- IS 13935:1993 Repair and Seismic Strengthening of Buildings – Guidelines
- IS 6922:1973 Criteria for Safety and Design of Structures Subject to Underground Blasts
- IS 4991:1968 Criteria for Blast Resistant Design of Structures for Explosions Above Ground

Additional earthquake preparedness measures

- A common meeting point inside the custom office complex and a contact outside the complex will be identified and known to all employees.

- List important telephone numbers and torch, water, transistor, first-aid kit and non-perishable food will be kept at a designated place. An emergency kit shall be ready at all times.

- Train workers in basic first aid. Teams for first-aid; search and rescue etc. in will be formed in the area and preparedness drills will be conducted for what to do in case of an event.

Measures during an earthquake

In case of occurrence of the earthquake, every individual would be made aware of the following:

- Keep calm and help others to keep calm. Do not panic.

- If you are inside of a building: Protect yourself by ducking under a sturdy table, and staying there until the shaking stops. Turn off electricity and gas.

- If you are on the road in a built up area: Immediately move away from buildings, slopes, streetlights, power lines, hoardings, flyovers etc. Into open spaces. Do not run or wander; keep the roads free for movement.

- If you are driving: Stop the vehicle away from the buildings, slopes and electric cables; come out of the vehicle, hold it and stay by its side.

- Keep calm and expect aftershocks.

- Check if you or anyone else is hurt. Use first-aid and wait for medical help.

- Do not move seriously injured people.

- Do not turn-on electrical appliances and gas.

- Check your building for damages.

- Do not waste water and do not block telephone lines.

- Do not spread rumours and don’t panic.

- Volunteer to help.

- Keep the streets clear for emergency services.

- Do not use matches, lighters, camp stoves or electrical equipments, appliances until you are sure there are no gas leaks. They may create a spark that could ignite leaking gas and cause an explosion and fire.

- Do not use your telephone except for a medical or fire emergency. You could tie up the lines needed for emergency response. If the phone doesn't work send someone for help.

2.1.2 Cyclones/High Wind Speed

Being a coastal city, the coastal wards (facing the Arabian Sea) are prone to gusty winds and cyclonic impacts. Additionally, in most of the wards, a number of slums have also mushroomed along the coast. Given the quality of housing material used, these settlements are highly vulnerable and the possibility of their capacity to withstand the cyclonic storm is limited. The list of such settlements and dilapidated buildings prone to cyclonic impact in ward F/N are given below. These areas may require evacuation to temporary shelters or identified safe sites.

Ward	**Settlement vulnerable to cyclones**
F-North	1. Korba 2. Mithagar 3. Wadala 4. Antop Hill 5. Sangam Nagar 6. Chandani Agar

(Source: Greater Mumbai Disaster Management Action Plan, Risk Assessment and Response Plan, Maharashtra Emergency Earthquake Rehabilitation Programme, Government of Maharashtra, Mumbai, 2007)

Our site is located in Wadala (E). As per the above table, it is vulnerable to cyclones. In such an instance the employee would be advised to stay in the shelter in tightly secured windows and doors. The glass of windows etc. would be covered with paper/cardboard to avoid glass breaking due to flying objects outside. Also, people will be made alert after getting the warnings from IMD about forecast any such disaster.

2.1.3 Floods

Particularly in Mumbai, areas having poor drainage characteristic get flooded by accumulation of water from heavy rainfall. Following precautions would be taken by the project proponent to manage flood disasters:

a. Storm water system would be checked and cleaned periodically.

b. Mapping the areas within or leading in or out of the building that will be water logged, flooded or isolated due to the flood. The areas will be marked after completion of the project (as final ground levels etc. will be available after completion).

c. Vulnerability of basement would be mapped.

d. Dewatering pumps shall be installed at vulnerable locations.

Additionally, rainwater harvesting will be done, which will further reduce the risk of local flooding.

There a number of flooding points in the city which result in disruption of traffic and flooding of settlements.

List of Chronic Flooding Spots: City	
1	S.V.P. Low level
2	Sandhurst Road
3	Burhni College
4	Mumbai Central
5	Slatter Road
6	King Circle
7	Hindmata
8	Sakhubai Mohite Marg
9	Wadala Station
10	Maratha Mandir

Source: ***Greater Mumbai Disaster Management Action Plan, Risk Assessment and Response Plan, Maharashtra Emergency Earthquake Rehabilitation Programme, Government of Maharashtra, Mumbai, 2007***

Since our site is located in Wadala (E), the management measures will be as follows:

Responding to monsoon-related flooding in Greater Mumbai

The structure of the Standing Operation Procedures (SOP) is as follows:

Public agencies and their responsibilities:

- Municipal Corporation.
- Fire Brigade
- BEST
- MMRDA
- Police Commissionerate
- Traffic Police
- Home Guards and Civil Defence
- District Collectorates (City & Suburban).
- India Meteorological Department (Regional Office).
- Railways (Central & Western)
- M.T.N.L.
- Electric supply agencies.

Coordination and supervision mechanism:

There is a 3-tier institutional mechanism for responding to monsoon-related flooding. At the municipal ward level, the Assistant Municipal Commissioner in charge of the ward is the Ward Disaster Manager. The Ward Disaster Manager functions under the direction, control and supervision of the Municipal Commissioner, who is the Greater Mumbai Disaster Manager. He coordinates the activities of all public agencies in Greater Mumbai charged with the responsibility of responding to monsoon-related flooding. However, in cases of disasters of exceptionally large magnitude, which require co-ordination among a wide range of lateral agencies, including Central Government agencies, the Greater Mumbai Disaster Management Committee will coordinate disaster management in Greater Mumbai. In the months of April and May, regular meetings of the public agencies would be held at all these three levels to achieve adequate coordination in their pre-monsoon preparations

Pre-monsoon preparations:

- In order to be able to discharge its stipulated responsibilities effectively, every public agency will identify, assemble and train the required personnel and store adequate materials not later than 30th May.
- The names and office and residential addresses and telephone numbers of the key personnel identified by each public agency will be communicated to the Emergency Operations Centre at Mantralaya and the
- Municipal Commissioner by 30th April.
- Similarly, a complete inventory of the materials stocked by each public agency will be communicated to the Emergency Operations Centre at Mantralaya and the Municipal Commissioner by 30thApril.
- Where it is planned to use vehicles, equipment, etc. sourced from private agencies, each public agency will communicate to the Emergency Operations Centre at Mantralaya and the Municipal Commissioner, a list of these private suppliers, specifying what is to be sourced and the quantities thereof, by 30th April.
- Public-private partnership is a sine qua non for effectively responding to monsoon-related flooding. The best way to secure such partnership is to suitably involve Non-Government Organisations (NGOs) in the activities of public agencies. Each public agency will identify the Non-Government Organisations relevant to its responsibilities and establish a dialogue with them well in advance of the on-set of monsoon. A list of Non-Government Organisations thus identified, containing their names, addresses, telephone numbers and the names of their representative functionaries, will be prepared and communicated to the Emergency Operations Centre at Mantralaya and the Municipal Commissioner by 30thApril.
- A ward locations prone to monsoon-related flooding will be reviewed by the Municipal Commissioner and an updated list of such locations will be communicated to the Emergency Operations Centre at Mantralaya and the various public agencies by 30th April.

- Taking into consideration the monsoon-related flood-prone locations identified and the personnel and materials assembled, each public agency will formulate a detailed Action Plan, spelling out in particular the deployment of manpower and positioning of material resources and the modus operandi to be adopted.
- The Action Plan will be submitted for the review of the Greater Mumbai Disaster Management Committee by 30th April.

Monsoon period measures:

During the period from 1st June to 30th September, the Municipal Corporation will set up a Control Room. Similarly, the Fire Brigade, BEST, Municipal Health Department, MMRDA, Police Commisionerate, Traffic Police, Home Guards and Civil Defence Directorate, City Collectorate, Suburban District Collectorate, Central Railway, Western Railway, MTNL and electric supply agencies will set up separate Control Rooms. They will also depute their representatives to the Municipal Control Room, which will function as the Central Control Room.

During the period from 1st June to 30th September, the India Meteorological Department's Regional Office will submit reports of rainfall (actual and forecast) twice daily to the Emergency Operations Centre in Mantralaya and to the Municipal Control Room, BEST Control Room, MMRDA Control Room,

Police Control Room, Traffic Police Control Room, City Collectorate Control Room, Mumbai Suburban District Control Room, Central Railway Control Room and Western Railway Control Room. If IMD's assessment indicates heavy rainfall, IMD will submit reports of rainfall at 6-hour intervals (or sooner, if necessary).

The Deputy Director General, IMD will follow up these reports by telephone calls to the Additional Chief Secretary (Home), the Municipal Commissioner and the Police Commissioner.

Alert notification and subsequent action.

- If the I.M.D. report indicates rainfall of a magnitude likely to cause floods, the Municipal Control Room will alert all the relevant public agencies required to respond to the flood situation, whereupon the said agencies will take all necessary actions to discharge their stipulated responsibilities, for which they will be fully and solely accountable.
- On alert being sounded by the Municipal Control Room, the Control Rooms of the various public agencies will be in continuous communication link with the Municipal Control Room through their representatives located in the Municipal Control Room. These Control Rooms as well as the Municipal Control Room will also be in continuous communication with the Emergency Operations Centre in Mantralaya.

- On the notification of alert, the identified public agencies personnel will immediately report to their assigned workstations and remain on duty throughout the alert period. All non-medical leave of such personnel will stand automatically cancelled and no non-medical leave will be sanctioned during the alert period. General decisions of closure of offices/establishments, if any, will not apply to such personnel.
- During the alert period, the Municipal Control Room, Fire Brigade Control Room, BEST Control Room,
- Municipal Health Department Control Room, Police Control Room, Central Railway Control Room and Western
- Railway Control Room will submit to the Emergency Operations Centre at Mantralaya a daily report.
- The daily reports aforesaid will be consolidated by the Emergency Operations Centre at Mantralaya in the prescribed proforma and placed before the Greater Mumbai Disaster Management Committee for review and decision and directions as may be necessary.
- Quick dissemination of relevant and accurate information among the public is central to effective response to monsoon- related flooding. It is necessary to forge a mutually advantageous partnership with the media in this regard to set up an information centre to organise sharing of information with the media. This is a mandatory requirement. At the same time, in order to enable the media to secure information about different aspects of the management of disaster resulting from monsoon-related flooding from a single window, during the alert period, the Director General, Information and Public Relations will set up a Media Centre in Mantralaya.
- This Media Centre will be headed by the Director General and will work in conjunction with the Emergency Operations Centre in Mantralaya. It will be the responsibility of the Media Centre to pro-actively disseminate relevant and accurate information among the public through the media, including cable television, ham radio, etc.

2.2 Man Made Accidental Disaster

2.2.1 Fire Hazard

Fire could take place through various means; one of them is through electrical fire.

Precautions & safety measures proposed against fire hazards are:

1. Fire management plans will be kept in public place. Signage's to be an important part of evacuation plan.
2. These plans will be made for sites, buildings, public places and will be displayed prominently at various locations. Everyone will be made aware of the plans.
3. Building will have separate EXIT doors for emergency.

4. Fire safety will be taken into account and all the safety norms and regulations will be followed up, which have been provided by National Building Code and other related Indian Standards;
5. All exit doors will be made of fire retardant material in compliance with NBC norms and will be properly displayed as 'EXIT' doors.
6. These doors would be clear at all times. They would never be locked.
7. Fire alarms will be in place at various locations within the building for early detection of smoke.
8. Underground firewater compartment with 200,000 liters capacity will be kept in case of any emergency.
9. Adequate no's of sand bags and other fire extinguishers shall be provided.
10. People will be trained for fire safety drill. Fire safety drill to take place at least every 6 months.
11. One person to be trained as "Fire officer" within the premises.
12. In case of fire, first aid kit would be available at a safe place.

Following Fire fighting codes and standards shall be followed in the complex:

Title	Important Indian Standards for Fire Fighting Work
IS 1239-1968 (Part-I)	Specifications for mild steel tube, tubular and other steel pipe fittings.
IS 1239-1968 (Part-II)	Specifications for mild steel tube, tubular and other steel pipe fittings.
IS 1536-1976	Specification for centrifugally Cast (Spun) Iron pressure pipes with flanges for water, gas and sewage.
IS 1538 (Part 1 to 23)	Specification for Cast Iron fittings for pressure pipes for water, gas and sewage.
IS 1726-1960	Code for cast iron manhole frame and cover.
IS 3589-1981	Specification for electrically welded steel pipes for water, gas and sewage.
IS 4736-1986	Galvanizing G.I. Pipes
IS 636-1988	Non percolating flexible fire fighting delivery hose (third revision)
IS 694-1990	PVC insulated cables for working voltages upto and including 1.100 volts (third revision)
IS 778-1984	Copper alloy gate, globe and check valves for water works purposes (fourth revision) (Amendment 2)
IS 780-1984	Sluice valves for water works purposes (50 to 300 mm) size (sixth revision) (Amendment 3)
IS 884-1985	Specification for first-aid hose-reel for fire fighting (for fixed Installations) (first revision) (with Amendment 1)
IS 900-1992	Code of practice for installation and

Title	Important Indian Standards for Fire Fighting Work
	maintenance of induction motors (second revision)
IS 901-1988	Specification for couplings, double male and double female, instantaneous pattern for fire fighting (third revision)
IS 902-1992	Suction hose coupling for fire fighting of purposes (third revision)
IS 903-1984	Specification of fire hose delivery couplings branch pipe, nozzles and nozzle spanner (third revision) (Amendment 5)
IS 937-1981	Specification for washers for water fittings for fire fighting purposes (revised) (with Amendment 1)
IS 1520-1980	Horizontal centrifugal pumps for clear cold, fresh water (second revision)
IS 1536-1976	Horizontally cast iron pressure pipes for water, gas & sewage (first revision) (with Amendments 1 to 4)
IS 1554-1988	Part I PVC insulated (heavy duty) electric cables (working voltage upto and including 1100 volts (third revision)
IS 1554-1988	Part II PVC insulated (heavy duty) electric cables (working voltage from 3.3 KV upto and including 11 KV (second revision)
IS 1648-1961	Code of practice for fire safety of buildings (General) Fire fighting equipment and its maintenance (with Amendment 1)
IS 3624-1987	Pressure and vacuum gauges (Second revision)
IS 4736-1968	Hot-dip zinc coatings on steel tubes (with Amendment 1)
IS 5290-1983	Specification for landing valves (second revision) (with Amendments 6)
IS 5312- 1984	Part I Swing check type reflux (non return) valves Part I single door pattern (with Amendments 1 & 2)
IS 5312- 1986	Part II Swing check type reflux (non return) valves Part II Multi door pattern (with Amendments 1 & 2)
IS 7285	Seamless cylinders for storage of gas at high pressure
IS 2189-1962	Code of practice for Automatic Fire alarm system
IS 2195-1962	Specification for heat sensitive fire detectors
IS 732-1973	Code of practice for electrical wiring installation
UL 168	Underwriters Laboratory specification for smoke detector

Following Fire Alarm System codes and standards shall be followed in the complex as:

1) IS:2189 - 1962 Code of Practice for Automatic Fire Alarm System.
2) IS:2195 - 1962 Specifications for Heat sensitive Fire Detectors.
3) IS:732 - 1973 Code of practice for Electrical Wiring installation
4) UL 168 Under writers laboratory specifications for smoke detectors.

Fire safety and fire fighting devices, their upkeep and maintenance

The fire fighting system shall consist of jockey pump, Electrical Driven Fire Hydrants pump, Sprinkler pump, Water curtain & Fire hydrants (Internal & External), Air Vessel, associated instruments, cabling, piping, valves, control panel etc. has been provided as per NBC requirement. Jockey pump shall maintain pressure in all water line for hydrants & Sprinklers fully charged under pressure for full Automatic operation in case of fire.

The project has proposed to have a provision for underground firewater compartment of 200,000 liters capacity having 2-way fire brigade inlet connection. As the fire tenders of the Fire Department shall have lifting pumps installed to draw water from these tanks, these static fire tanks will have the necessary provisions of manholes where from suction pipes can be immersed to draw water. Besides these Fire Hydrants shall be provided on the water lines near all important installations and Multi-storeyed Buildings/ complexes to facilitate drawing of water directly from the water lines in the event of emergencies.

Ample stocks of first aid fire fighting gadgets will be provided in the sub-zonal control rooms in the form of different types of fire suppression equipments. The maintenance agency will have trained Fire Officers and Fire Men on their regular rolls, who will be conducting mock drills to educate the people about the fire preventive measures and keep a total watch on systems installed for this particular function and ensure that all systems are always in ready condition.

This activity shall be controlled and monitored from a centralized control room and will work in close co-ordination with local Fire Authorities.

The Building will be of G+22 storied with provision of 7 Nos. floors above and 3 Nos of basements for Parking. The total building height will be 90.3 m for G+22 and 117.6 m for G+29. The building falls under Category of Business Building with more than 30 M Height as per NBC 2005 Part IV table 23.The following provisions will be made in designing fire fighting system as per NBC/TAC guidelines.

1. Main Hydrant Pump 2850 LPM, Head 100 m.
2. Stand by Diesel Driven pump 2850 LPM, Head100 m.
3. Electric Driven Jockey pumps 180 LPM, Head 100 m.

4. Sprinkler pumps 2850 LPM, Head 100 m.
5. Fire Extinguishers, CO_2 and ABC Type.
6. Wet Riser with internal Hydrants in all Floors.
7. Yard Hydrants around the building and in terrace.
8. Automatic Sprinkler System in all floors & Basements.
9. Manual & Automatic Fire Detection system.
10. Gas based fire Fighting System.

Yard Hydrants & Internal Wet Risers:

The yard hydrant shall cover the entire building externally with Hydrant points at appropriate location with hose boxes, hoses etc in ground floor and Terrace. The internal hydrant system involving wet risers shall have landing valves, hoses, hose reels and branch pipes etc. in suitable hose cabinets at appropriate points on every floor.

Fire Brigade Inlet Connection:

Fire brigade inlet connection shall be of gun metal with four 63 mm dia instantaneous type inlets with proof built in type check valves and 150 mm dia flanged outlet connections feeding to main fire grid/UG water tank. The collecting head shall conform to IS – 904.

Sprinkler System:

The automatic sprinkler system shall be provided in the entire building and the sprinkler heads shall be distributed as per the TAC/ NBC so as to cover every 12 Sq. m area with each sprinkler head. The sprinkler pump shall be suitable for automatic operation when there is a drop of pressure in the system. Sprinkler shall be provided throughout the building with separate sprinkler risers as required, Installation control valves and a hydraulic alarm system in the basement shall be provided.

An electrical sensor flow switch shall be provided on each floor and connected to fire control panel so that it would be possible to identify the location and the affected floor immediately.

Non Wet Fire Fighting System:

For protecting electronic machinery items, Computers, UPS Micro film etc, gas based fire suppression system is proposed. CO2 FM–200, NAFS iii are some of the gases presently used as non wet fire fighting agent. Fire Detection will be achieved by using smoke detectors. Each zone will have independent discharge panel. Gas discharge panel activates through smoke detectors. In case of fire occurs in any zone. The panel actuate solenoid valve of gas cylinder & gas is released. Through Ceiling mounted spray nozzles of extinguish fire.

Fire Detection system:-

Each block of custom complex shall be provided with a standalone fire control panel. The entire stand alone fire alarm panel will be located in the Ground floor. Each fire panel with monitor smoke detectors, Manual call point, Hooters of that area. The detectors proposed will be multisensory (Smoke & Heat) type addressable detectors. Micro processor based intelligent fire panel will be controlled through computers for programming addressing and monitoring. The wiring will be carried out with 1.5 sq mm PVC insulated FRLS wires in steel conduit Fire survival cable will be laid above false ceiling on cable tray for detector, Hooters and Manual Call boxes etc. The cables will be capable of withstand temperature up to 950 degree C for 20 minutes. The system will be provided with monitor / control modules. (NO/ NC contacts) to shut off fresh air supply and actuation of smoke extraction fans in case of occurrence of fire. The capacity of fire panel will be decided considering 200 detectors/ devices in each loop.

Response Sequence During Fire:

i. Person noticing the fire would attempt to isolate and extinguish the fire with the available equipment and Inform or arrange to inform the security regarding the:

- Location of the fire
- Material of burning
- Extent of fire
- Callers name and number

"A proper code of communication shall be maintained wherein the caller makes sure that the message has been conveyed to the right person".

ii. Security or the coordinators will

- Respond to the scene of the incident.
- Arrange to send the necessary fire fighting equipment to the scene of the incident.
- Extinguish the fire with the available equipment.
- Ensure closure of gates immediately to regulate traffic in such a way that free movement of outside assistance like fire tenders, ambulance etc is available.
- Security will cordon off the area and local city fire fighting staff would be notified for further assistance.
- All the occupants will need to stop their operations/ work, switch off lights, fans, machines etc. People would assemble to refuge or designated area for fire and hazardous situation.

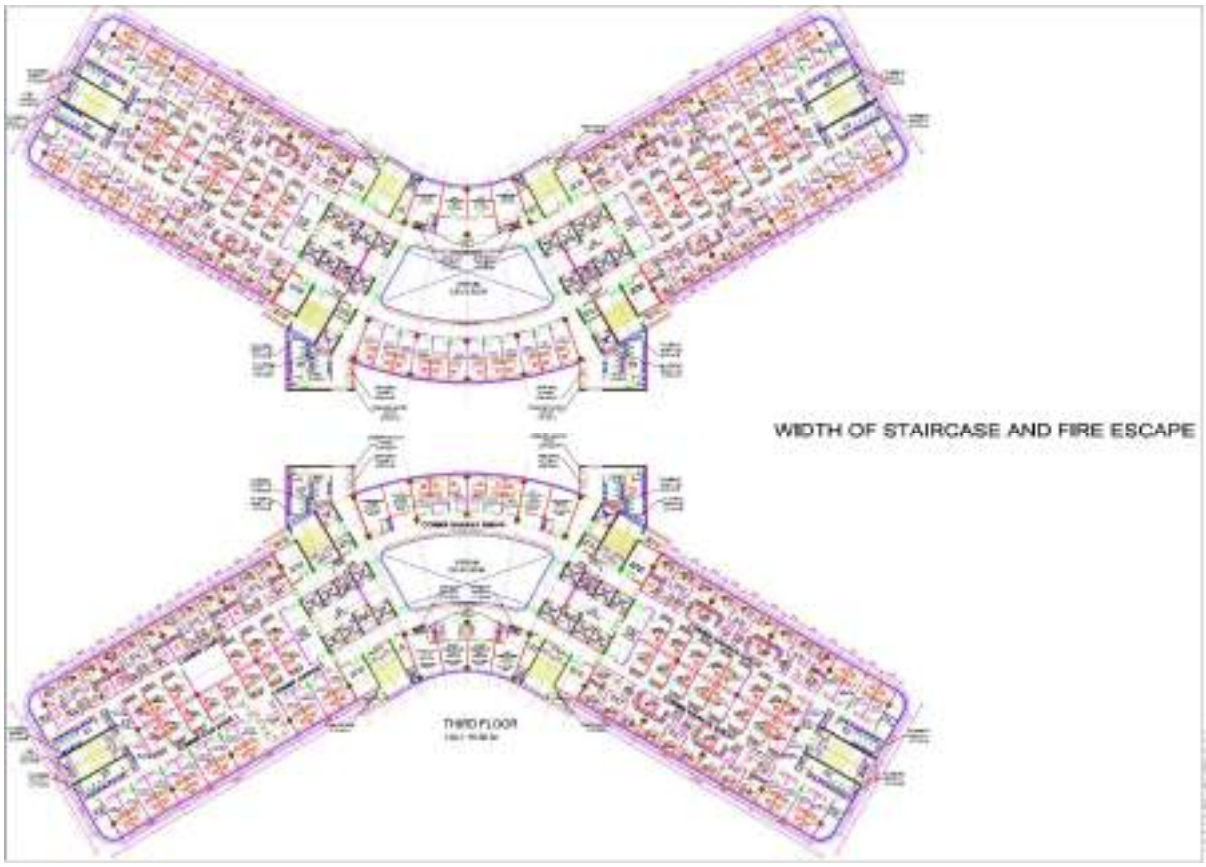
iii. Reporting and Follow up System

- All cases of fire occurrence, no matter how small, must be reported promptly to the Security for further action to avoid such incident.
- Fire extinguishing equipment once used, would not be returned to its location without it is being recharged/ certified fit by the security.
- All fire extinguishers after use would be laid horizontally to indicate that they have been exhausted.

Fire evacuation layout is given in **Fig 1.** Width of staircase and fire escape plan is shown in **Fig 2**.

FIG 1: FIRE FIGHTING LAYOUT

FIG 2: TYPICAL FLOOR PLAN SHOWING WIDTH OF STAIR CASE AND FIRE ESCAPE



In addition to many of the above measures an attempt will be made to add any site specific steps and manpower based instruction. Instruction would be in multiple languages including “Marathi and Hindi”. The communication equipment will be checked periodically to ensure that they are functional.

2.2.2 Electrical safety plans

- There will be color coding and labelling of high voltage electrical wires
- Sand bags/ wire bucket shall be placed near the electrical control/panel.
- Installation of electrical equipments shall be properly done like insulation, guarding and grounding.
- Work practices and handling of the electrical equipments shall be properly managed.
- Employees shall be trained for awareness of safe work practices and systems.
- Properly maintained equipments and tools will be used.
- Service of electrical equipments shall be done under the supervision of trained
- Live electrical terminals shall be shielded.
- Temporary connections made for experimental reasons shall be safe and properly insulated.

Electrical distribution

The Electrical Distribution for electric supply shall be with Compact Bus Duct of suitable capacity from transformer to LT Main Panel, DG set to LT panel and from LT panel to AC panel. XLPE insulated armoured Aluminium conductor cables are proposed from LT panel in ESS to individual buildings/ towers. Separate feeders have been proposed for power, lighting and AC.

In the individual buildings/ towers provision of separate distribution system for lighting & power loads with rising mains, floor panels and DB's etc has been considered. Air conditioning plant room will be fed directly from ESS through bus duct.

Earthing

Earthing stations with copper / GI Earth plate shall be provided for sub stations equipments, for Electrical boards of each building as per requirements of I.S code & Indian Electricity Rules. All three phase installations shall be provided with double Earth connection and single phase installations with one Earth connection. Earth Leakage circuit breakers shall be provided in the DBs for individual units.

Lighting Design

The illumination levels mentioned for the following areas are only desired levels however shall vary based on the type of light fittings and lamps used by the occupant.

- Office 300-350 Lux
- Record Room 200 Lux
- Corridor/ Common Areas 100 Lux

The indoor lighting envisaged shall be with energy efficient T-5, CFL and LED light fittings of recessed / surface type as per requirement to provide the required illumination level.

Lightening protection system

A standard lighting protection system will be provided in the building as per IS Standards, using single prone finials, horizontal and down comer conductors of standards size, terminating in Earth pits.

Power factor improvement

Automatic power factor compensating type multiple capacitor banks will be provided for maintaining average power factor of 0.95, well above the requirement of Local Electricity Supply Authorities.

Fire detection / alarm system

Intelligent Fire Detection and Alarm System with addressable smoke / heat detectors and hooters etc. as per requirement of the code and approval of Fire Authorities shall be provided in the new complex.

2.23 Accident

During construction: The workers will trained and made aware of risks and hazards. They shall be provided with personnel protective equipment like hard hat, safety boots, rubber boots, gloves, goggles, aprons, welders glass, ear muffs, etc as per requirement. Activity specific precautions during cutting and welding process, road making, working at heights, etc will be followed.

During operation: Proper arrangements shall be made at all identified accident-prone areas in terms of signal, signage, speed breaker and design consideration. They would be implemented with respect to rules and regulations of traffic movement.

3.0 DISASTER MANAGEMENT CELL

3.1 Disaster Management Cell

A disaster management cell will be established, which will take care of post disaster. It will be a volunteer kind of set-up and professionals can also be hired in case of eventuality. It will also help to promote awareness towards disaster management. Disaster mitigation and recovery resources will be invested to improve the quality of life in the areas of public health and safety, environmental stewardship and social and economic security. The maintenance agency will prepare an integrated, comprehensive emergency management plan that meets immediate needs and provides for long-term recovery and mitigation.

The disaster management cell have following members to share the responsibility:

I. Site Controller (Administrator of complex)
II. Incident Controller (Asstt. Administrator)
III. Personal Manager
IV. Communication Officer
V. Fire Officer
VI. Security Officer
VII. Engineering Incharge
VIII. Fire pump attendant
IX. First Aid Team

The disaster management plan identifies the risks to the building at site and addresses facility emergency response and recovery plans for building utilities, systems and services. This process includes:

- Risk Identification
- Risk Quantification
- Risk Mitigation
- Emergency Response
- Crisis Management
- Business Recovery
- Plan Exercising, Monitoring and Improving

The **Table 1** gives the potential hazard, its proposed control measures, additional control measures, recovery and time line.

TABLE 1
HAZARD IDENTIFICATION AND CONTROL MEASURES

Sl. No.	Type of Hazard (Internal/ External)	Hazard	Proposed Control Measures	Additional control Measures, if any	Recovery	Time Line
1	Internal	Widespread Building Fire	Fire Hydrants, Fire Extinguishers, Training and Awareness	Call for External Help from Fire Brigade	1. Work From Home Option 2. Find Back up site	1. Immediate 2. 3-4 Months
2	External	Power Failure External	Back -up power available - DG Sets		Run DG Sets	Immediate
3	Internal	Power Failure Internal	Preventive Maintenance Schedule and Dry Runs for Testing	Additional Potable DG Sets for running Critical Business operations	Arrange for Standby	One Day
4	Internal	Water Supply Domestic Use Failure	Adequate storage tank for 24 hrs supply	Arrange for Additional water supply through Tankers	Use Onsite Storage, Arrange Tankers	8 Hrs
5	Internal	Drinking Water Supply Failure	External Vendors are available locally		Opt with other vendors	8 Hrs
6	Internal	Fire protection system Burst-Sprinkler and Fire hydrant	Pressure testing, Preventive maintenance schedule	Controlled Hot work at site till rectified		8 Hrs
7	Internal	AHU Failure	Preventive Maintenance Schedule, Daily Checking and Corrections		Interconnect AHUs	8 hrs
8	Internal	Other AC Unit failures	Preventive Maintenance Schedule, Daily Checking and Corrections		Arrange for Standby	8 Hrs

Sl. No.	Type of Hazard (Internal/ External)	Hazard	Proposed Control Measures	Additional control Measures, if any	Recovery	Time Line
9	Internal	Chilling water system failure	Preventive Maintenance Schedule, Daily Checking and Pressure testing for piping in case of pipe leakage		Standby Available, Replace piping in case of piping burst	1 Day
10	Internal	structure	Structural Inspection		Find Backup Site	3-4 Months
11	External	Outbreak of Major Illness (e.g. Avian Flu etc)	Tie up with local Hospital, Minimal protective supplies available follows Global EHS Guidelines	Screening before entering facility, Control travelers	As per Global Guidelines for Screening and or shutdown if outbreak is national	Immediate
12	Internal	Chemical Accidents (employee exposure to chemicals)	Small Quantities in use for treatment, cleaning, etc, PPEs and administrative controls		Isolate, Decontaminate; Monitor residual presence & Health Surveillance of affected employee	1 Day
13	Internal	Toxic Spills (Alkali & Acids)	Limited use in isolated process only such as cleaning.		Isolate, Decontaminate; Monitor residual presence & Health Surveillance of affected employee if any	1Day
14	Internal	Hazardous contamination (air, water, soil)	Limited use, secondary contained.		Isolate, Decontaminate; Treatment ; Monitor residual presence	1Day
15	Internal	Gas Leaks (flammable)	Daily Checks on leakage, Bubble test, pressure test		Cutoff, forced ventilation.	Immediate
16	External	Terrorism	Tightened Security, Stringent security checks, Inform Local Police		NA	Immediate
17	External	Civil or Political disturbance	Tightened Security, Inform Local Police, Activate Crisis Management Team on site		NA	Immediate
18	External	Bomb Threat	Security procedures in place to asset	Inform and take Help from Police	If not recovered immediately,	1. Immediate 2. 3-4 Months

Sl. No.	Type of Hazard (Internal/ External)	Hazard	Proposed Control Measures	Additional control Measures, if any	Recovery	Time Line
			threats. Preparedness on Emergency situation, Evacuation and External help from Police		follow as for Hazard-1	
19	External	Earth Quake	Emergency Response plan activated, CMT Activated	Assessment of building for stability and operations to continue	If damage substantial, follow as for Hazard-1	1. Immediate 2. 3-4 Months
20	External	Rain/Cyclone	Adequate Drainage, Cleaning of storm drains		If damage substantial, follow as for Hazard-1	1. Immediate 2. 3-4 Months
21	Internal	Theft of Assets	Internal Control Procedures & Security Surveillance		NA	Immediate
22	External	Transport Accidents	Approved Vendors, GPS systems tracking of vehicles, Trained Drivers, Awareness programs	Inform Fleet helpline and WPS, Arrange for alternate transportation and hospitalization of injured		Less than 1 hour
23	Internal	Food Poisoning	1. Qualified vendor, 2. Checking food Quality- Bacteriological analysis 3. Awareness on Canteen hygiene 4. Medical checkup for food handlers		Alternate vendor arrangements	1Day
24	Internal	Fire in Kitchen	1. No use of flammable/ explosive material in kitchen 2. Shut off valves for LPG lines 3. Fire extinguishers in kitchen 4. Regular checking of kitchen		Alternate vendor /food arrangements	8 Hrs
25	External	Landslide	Our site is not close to landslide prone area			

3.2 Welfare and Safety Measures For Labours

All the employees will be provided with a safe, healthy and protected environment in all our projects. This shall be achieved through:

- Compliance of all applicable rules, regulations and legislations regarding safety, occupational health and hazard free environment and use of conforming work procedures, plant, machinery, equipment and material.
- Continuous monitoring of safety, occupational health and environmental standards, through inspection, audit and risk assessment.
- Regular training of the work force and other follow up actions, to make up for the shortfalls noted through monitoring.
- Review of the safety policy, whenever new procedures, articles, substances and techniques, having bearing upon safety, occupational health and environmental issues are adopted.

Precautions during cutting and welding process

The electric arc is a very powerful source of light, including visible, ultraviolet, and infrared. Protective clothing and equipment must be worn during all welding operations. During all gaseous welding and cutting proccesses, operators must use safety goggles to protect the eyes from heat, glare, and flying fragments of hot metals. During all electric welding processes, operators must use safety goggles and a hand shield or helmet equipped with a suitable filter glass to protect against the intense ultraviolet and infrared rays. When others are in the vicinity of the electric welding processes, the area must be screened so the arc cannot be seen either directly or by reflection from glass or metal.

3.3 Precautions during road making

Personal Protective Equipment

Bitumen is commonly handled as a liquid at temperatures above 100℃ and protective clothing is necessary to prevent burns by skin or eye contact. Personal protective equipment would be selected to suit the operations in question, but where hot bitumen is being transported or used, it would include:

- Overalls with close-fitting cuffs and leg-ends designed to shed splashes away from the body.
- Face and eye shields.
- Heat resistant gloves.
- Heat resistant heavy duty boots.
- If splashing is likely then additional requirements are:
- Full head and face protection.
- Neck cloth.

Another situation where the potential for exposure is higher is during maintenance work on equipment, tanks etc. This will require the preparation of defined systems of work incorporating the use of personal protective equipment and possibly respiratory protection. Depending on the circumstances it may be necessary to install local exhaust ventilation at the point of fume generation or provide some dilution ventilation to the worksite.

Personal Hygiene

Adoption of a very high standard of personal hygiene is essential in any operation where there is a risk of skin contact with bitumen products and/or condensed fume. Washing facilities with a non-solvent based skin cleaner, hot water and soap would be provided and used. It may be necessary to provide skin conditioning cream if contamination and washing is frequent.

Overalls would be changed frequently and dry cleaned. Grossly contaminated clothing would be changed immediately and contaminated rags would not be kept in overall pockets. The condition of gloves would be checked before use for signs of wear and internal contamination, and discarded if necessary.

Monitoring

Regular monitoring of work practices and hygiene procedures would be carried out, as well as checks on the condition of protective equipment. Whilst not being a control measure the importance of monitoring the environment, both by air sampling and observation, would not be underestimated. This provides the method by which it may be confirmed that control techniques are having the required effect.

3.4 Security Plan

An ISO 27001 and 27002, which are the international best practice information security management standards, defining and guiding Information Security Management System (ISMS) development shall be adopted. These will provide the necessary benchmarking for individual users to know the type of cover and the responsibilities that are defined and provided by that institution for its guests. Most importantly, training according to staff needs to be regularly imparted in dealing with such situations.

1. **Manual Checks:** At the gate the visitors and guest shall be manually checked and asked for ID's.
2. **CCTV:** At all important location with a remote viewing facility and record back up. With highest resolution and picture quality. DVR being the back bone, its recording and replaying capabilities will be considered.
3. **Central Control Room:** This will control the security system from inside.
4. **Communication Systems:** Proper communication system to security staff shall help them to coordinate better during emergencies.

3.5 Risk Assessment of nearby power plant & refineries

The industries in the 10 km radius of the project are listed in **Annexure X**. It can be seen that the nearest power plants and refineries are located at the following distances:

Sl. No.	Description	Distance (km)/ Direction
1.	Trombay Thermal Power Station (Tata Power)	3.1/SE
2.	The Hindustan Petroleum Refinery	2.8/E
3.	BPCL- Mumbai Refinery	2.1/E

It can be seen that none of the above are within 2 km distance of the proposed office complex. Referring to the extracts of the risk analysis from the respective EIA or other reports of the three projects, it is found that

- In case of Tata power, the maximum impact distance after assessing for various failures has been calculated as 2.89 km under stable weather conditions for chlorine tonner valve failure.
- In case of BPCL- Mumbai Refinery, QRA study for the entire refinery including CDU4 &ISOM establishes that individual risk of 1 x 10-5 per annum remains within refinery boundary and IR of 1 x 10-6 per annum marginally crosses refinery boundary at few locations which is well within ALARP region. Societal risk (F-N Curve) for off site is well within ALARP region.
- In case of HPCL, the executive summary of the EIA for construction of storage tanks & associated facilities at Mumbai Refinery-II was available in public domain.

ANNEXURE: XIII

OFFICE OF THE COMMISSIONER OF CUSTOMS (GENERAL)
CUSTOMS ENCLAVE CELL, NEW CUSTOM HOUSE
BALLARD ESTATE, MUMBAI-400 001.

Telephone No. 022-22757858 Fax No. 022-22757712

Vide F. No. S/43-123/14-15 CEC Date: 11/12/2014

TO WHOMSOEVER IT MAY CONCERN

Commissioner of Customs (Genral), Mumbai, has entrusted various works to Central Public Works Department (CPWD) in respect of "Construction of Office Complex at Customs Enclave (Suleman Shah Plot), C S No. 146, Salt Pan Div. Wadala (East), Mumbai". It is to certify that **Executive Engineer, Customs Project Div. CPWD** is authorized to do / perform all acts and deeds, sign documents / applications, attend presentation before concerned ministry/ Authority / Department (s) etc. for taking Environmental clearance, Consent to Establish and Consent to Operate.

Shampal

(SHAM PAL)
Asstt. Commissioner of Customs
CEC/Mumbai

(Signature of Authorized Signatory from CPWD with Name and Seal)

ANNEXURE : XIV

SITE PHOTOGRAPHS

ANNEXURE : XV

ENVIRONMENT MANAGEMENT PLAN FOR PROPOSED CONSTRUCTION OF OFFICE COMPLEX AT CUSTOMS ENCLAVE (SULEMAN SHAH PLOT), WADALA (EAST), MUMBAI

1.0 GENERAL

The environment management plan has been developed with a view to bring down the levels of adverse impacts within acceptable limits. In each of the areas for which impact assessment was performed, measures have been formulated to mitigate the adverse impacts and to enhance/augment the beneficial impacts so that the overall adverse impacts are reduced to as low a level as possible. In general, any release of pollutants into the environment shall conform to the standards laid down by the statutory agencies. All control and mitigative measures shall be incorporated at the design stage and during the construction phase to protect the environment from deterioration.

The formulation of EMP for the construction project is based on the following considerations:

i) Proposed project details;

ii) Air and water pollution control;

iii) Solid waste management;

iv) Management of excavated earth,

v) Control of noise;

vi) Tree Plantation and greening;

vii) Rain water harvesting

viii) Energy efficiency, etc.

It will not be out of place to mention that the construction project has a comparatively low potential for causing deterioration of the air environment during operation and with proper care, water and land environment can also be protected. The project is being located at C.S No. 146 of salt division, Customs Enclave Plot (Suleman Shah Plot), Wadala (East), Mumbai. Adequate green spaces have been identified to facilitate development of trees. Further, the ground coverage will be limited as per the bye laws for commercial projects. Adequate treated wastewater will be available for irrigation, which will facilitate healthy growth of trees and greenery. The

proposed project will be provided with roads for smooth movement of employees and other visitors.

2.0 CLIMATE AND METEOROLOGY

Climate changes are a long-term phenomenon, resulting from large scale and long term anthropogenic and natural activities. Considering the magnitude of the project, no major impact is anticipated on the climate and, therefore, no mitigation measures are proposed. Green house gases are of climatological concern.

Exhaust emissions due to use of personal transport vehicles (mostly cars and some two wheelers) by office goers working in the custom office will be restricted to short inward and outward journey periods. Since these vehicles are expected to be compliant to emission standards, adverse impact, if any, due to use of these vehicles on ambient air quality close to custom office site is expected to be minimal and the peak may last for a maximum of about 2 hours every working day, one hour in the office time during morning and one hour during evening, with visitors coming & going throughout the day regularly.

Vehicle owners will be encouraged to have the PUC certification of their vehicles done at periodic intervals. This will keep the CO and HC levels within permissible levels. Power supply is envisaged from State Electricity Board and CO2 contributing DG sets will operate only during power failure for complete backup. Hence, it is the government's prerogative to undertake uninterrupted supply of clean energy to combat global warming so that the need to operate CO2 generating DG sets does not arise.

The best practically applicable way to sequester this CO2 at present is plantation. Therefore, plantation of trees will be done within plot area as provided.

Micro climate and urban heat effect:

The climate of the district is characterized by an oppressive summer, dampness in the atmosphere nearly throughout the year and heavy south – west monsoon rainfall from June to September. The mean minimum temperature is 16.3°C and the mean maximum temperature is 32.2°C at Santacruze. The normal annual rainfall over the district varies from about 1800 mm to about 2400 mm. It is minimum in the central part of the district around Kurla (1804.9 mm). It gradually increases towards north and reaches a maximum around Santacruze (2382.0 mm). (*Source: http://cgwb.gov.in/District_Profile/Maharashtra/Greater%20Mumbai.pdf, accessed on 24.09.2014).*

Microclimate modification involves the best use of structural and landscape design elements to maximize or limit sunlight, shade and air movement. Structural modifications involve the design of the building and associated construction (driveway, walkways, fences, etc). Landscape modifications

involve the use of plants to further increase or decrease the impact of sun and wind upon the local environment. This will decrease the energy costs associated with maintaining interior comfort.

Solid surfaces such as concrete and asphalt, which absorb a great deal of heat, would be kept to a minimum. Brick and other alternative materials driveways build up less heat than either asphalt or concrete and produce fewer glares than concrete. Ground cover plants and organic mulches will be considered as options for covering large areas. Ground covers offer a cooling effect and are not energy intensive. Organic mulches reduce runoff, are inexpensive and an attractive alternative to pavements.

In order to reduce energy needs for summer cooling, the steps that will be take will be:

1. Maximizing the use of ground covers and limiting the amount of dark, paved areas.
2. Maximizing shading on the roof by the overhead canopy of trees near short height buildings (such as guard room, etc.)
3. Maximizing shading in the summer on east, west and south walls with shade trees. However, in the case of high rise, due to the presence of basements below the buildings as well as height of buildings being much higher than trees, tree plantation along building edges is not possible but will be carried out along the peripheral wall. Shadows on the south, southeast, and southwest exposures are shorter than shadows cast on west and east exposures.
4. Using passive architectural features to minimize the air conditioning requirement. In case of air conditioner usage, the following will be taken care of:
   - Shading the outside compressor unit from direct sun.
   - Selecting trees to block wind-driven air flow into the building through breaks in outside walls, such as windows, doors, and other openings. This feature will be able to have an impact only on the first one or two floors of the building as it will be directly proportional to the height of the tree.
   - Situate a windbreak, if required, at some distance from the building
5. To minimize energy needs for winter heating, it is proposed to :
   - Use native & deciduous trees, shrubs and vines on south, southeast and southwest locations
   - Create a windbreak for the north and northwestern exposures of the building using evergreen trees and shrubs in a multi-layered canopy, preferably in 2- to 5-foot rows. This feature will be able to have an impact only on the first one or two floors of the building as it will be directly proportional to the height of the tree.
6. Avoiding the use of solid foundation plantings that create a dead-air space on the south side.

3.0 AIR ENVIRONMENT

3.1 Construction phase

A. Impact

Construction phase would involve site clearances and preparation, infrastructure development, building construction and other related activities.

SOURCES OF AIR POLLUTION

- The building material carrying vehicles as well as the construction machinery generate emissions and pollute the environment
- Dusts include brick and silica dusts, wood dust from joinery and other woodworking and from earth moving and other vehicle movements within the site
- Construction machineries pose a special threat to air quality, if they are not PUC compliant. Construction machineries emit gaseous pollutants (NOx, SO_2) in addition to fine particulate matter (PM2.5).

ESTIMATION OF FUGITIVE EMISSIONS

Dust emissions from non-residential and commercial construction are a function of the total area of land disturbed and the duration of activities done. Based on field studies, the AP-42 (Compilation of Air Pollutant Emission Factors**,** US EPA, Section 13.2.3) gives the total suspended particulate emission factor estimate as 2.69 megagrams (Mg)/hectare/month of activity. Because the above emission factor is referenced to TSP (Total Suspended Particulate), use of this factor to estimate particulate matter (PM) no greater than 10 µm in aerodynamic diameter (PM-10) emissions will result in conservatively high estimates. Also, because derivation of the factor assumes that construction activity occurs 30 days per month, the above estimate is somewhat conservatively high for TSP as well. The ratio of PM2.5 to PM10, as documented in AP-42, is assumed to be 0.20.

B. Mitigation measures

Since the main air pollution will occur during the construction phase, therefore, the mitigation measures are also oriented towards construction phase. Dust particles and gases will be generated during construction activity. The following measures are to be taken up to control air pollution problems:

- Areas under excavation and grading as well as the routes of vehicles are prone to fugitive dust emission during construction stage. To avoid fugitive emissions, sprinkling of water shall be done regularly to stabilize these areas.

- Use of covering sheet to prevent dust dispersion at buildings and infrastructure sites, which are being constructed.

- Equipment and transport vehicle will be maintained periodically to avoid source emissions and spillage. Regular maintenance schedule will be adopted as per manufacturer's specifications;

- Preventive maintenance of all trucks, earthmovers and construction equipment shall be carried out at pre-determined intervals to ensure that exhaust emissions are maintained at the minimum practicable levels. Emissions from construction equipment and pay loaders shall be within norms due to PUC.

- Loading and unloading operations also contribute significant fugitive dust emissions. The fugitive dust during loading and unloading will be controlled by water spraying except in the case of raw materials like cement, which will adversely effect the properties of the raw material.

- Transportation of loose building materials to the construction site will be carried out in covered trucks to minimize fugitive dust.

- On-Road-Inspection would be done for black smoke generating machinery.

- Reducing the speed of a vehicle to 20 kmph can reduce emissions by a large extent. Thus, speed bumps will be used to ensure speed reduction.

- Roads will be made black topped/ concrete or paving done at the earliest and regularly maintained;

- Provision of tyre wash will be considered at the exit point from the plot so that dust stuck to tyres of exiting trucks is washed off and does not contribute to the fugitive emissions on the public roads.

- All DG sets would comply emission norms notified by MoEF.

- **Material storages/warehouses** – Care would be taken to keep all material storages adequately covered and contained so that they are not exposed to situations where winds on site could lead to dust / particulate emissions. Fabrics and plastics for covering piles of soils and debris will be used to reduce fugitive dust.

- As per AP-42 of US EPA, the recommended measures for various activities during construction phase are summarised in **Table 1**.

TABLE 1
RECOMMENDED MEASURES FOR CONTROL OF FUGITIVE EMISSIONS DURING CONSTRUCTION

Emission Source	**Recommended Control Method(s)**
Debris handling	Wind speed reduction, Wet suppression[#]
Truck transport[##]	Wet suppression, Paving

Emission Source	Recommended Control Method(s)
	Chemical stabilization^
Bulldozers	Wet suppression^^
Pan scrapers	Wet suppression of travel routes
Cut/fill material handling	Wind speed reduction, Wet suppression
Cut/fill haulage	Wet suppression, Paving Chemical stabilization
General construction	Wind speed reduction, Wet suppression Early paving of permanent roads

\# ***Dust control plans should contain precautions against watering programs that confound track out problems.***

\## ***Loads could be covered to avoid loss of material in transport, especially if material is transported offsite.***

^ ***Chemical stabilization usually cost-effective for relatively long-term or semi permanent unpaved roads.***

^^ ***Excavated materials may already be moist and not require additional wetting. Furthermore, most soils are associated with an "optimum moisture" for compaction.***

3.2 Operation phase

A. Impact

It is estimated that the proposed project will accommodate a population of about 11870 people (office goers & visitors). The complex comprises of block (comprising of records, kitchen, Auditorium for 400 people, Convention centre, Malkhana, Court rooms, Armoury, offices for various departments of customs). Activities associated with day-to-day life of the population, which may affect the air quality, is movement of vehicles and use of DG sets. Negligible emissions from sewage and solid waste handling and disposal are also likely to be there. The major impact due to DG set operation in the project has been discussed in subsequent paragraphs.

(i) Emission from stationary source

A total of 4 nos. DG sets of 1010 KVA capacity with canopies are proposed to be used as power back up for project site during power failure only. The DG set shall be provided with acoustic shields or enclosures to limit the sound level as per norms. The stack details of the DG sets are given in **Table 2** and the anticipated maximum ground level concentrations towards the three most predominant directions is summarized in **Table 3**. The details of the air quality prediction modeling are given in **Annexure XXIII**.

TABLE 2
STACK DETAILS

Sl. No	Stack name	Height (m)	Dia (m)	Temp (°C)	Exit gas Volume (m^3/s)	Exit vel. (m/s)	Emission rate (µg/s)				
							PM_{10}	$PM_{2.5}$	SO_2	NO_X	CO
1	DG1 (1010 KVA)	30	0.29	225	1.77	26.1	21836	12556	258111	446429	582299

Sl. No	Stack name	Height (m)	Dia (m)	Temp (°C)	Exit gas Volume (m^3/s)	Exit vel. (m/s)	Emission rate (µg/s)				
							PM_{10}	$PM_{2.5}$	SO_2	NO_X	CO
2	DG2 (1010 KVA)	30	0.29	225	1.77	26.1	21836	12556	258111	446429	582299
3	DG3 (1010 KVA)	30	0.29	225	1.77	26.1	21836	12556	258111	446429	582299
4	DG4 (1010 KVA)	30	0.29	225	1.77	26.1	21836	12556	258111	446429	582299

Note: Generic assumptions have been made based on configurations available from the standard manufacturers

TABLE 3
CALCULATED MAXIMUM GROUND LEVEL CONCENTRATION ($\mu g/m^3$)
(TOWARDS THREE MOST PREDOMINANT DOWN WIND DIRECTIONS)

Pollutant	Concentrations ($\mu g/m^3$)									
	PM_{10}		$PM_{2.5}$		SO_2		NOx		CO	
E	0.24	200-300m	0.14	300m	2.87	300m	4.96	300m	6.47	300m
W	0.28	300m	0.16	300m	3.30	300m	5.71	300m	7.45	300m
ESE	0.23	300m	0.13	300m	2.75	300m	4.76	300m	6.21	300m

The three most predominant wind directions observed during 24 hrs monitoring period are towards E, W and ESE directions for 10.44%, 9.67% and 8.17% (ex-calm) of time respectively. Above results show that the emissions from the project will increase pollution in the ambient air but it will still be far below the permissible limits. It can be inferred that for operation of DG set for less than 24 hours, the ground level concentrations (GLC) will reduce proportionately.

DG sets will be operated in the case of power failure only. Since low sulphur diesel will be used, the emissions will be temporary and reversible and the emissions of SO_2 will lead to GLCs within limits as seen in **Table 3**, hence no scrubbing devices will be required to be attached additionally for pollution control.

Maximum increase in ground level concentrations by superimposing on the highest ambient air quality observed in the study area has been given in **Table 4**.

TABLE 4
GROUND LEVEL CONCENTRATION AFTER INCREMENT
IN THE STUDY AREA ($\mu g/m^3$)

Pollutant	Maximum increment	Maximum Concentration Observed at project site	Resultant Concentration	Permissible limits, NAAQS 2009
PM10	0.28	145.2	145.48	100
PM2.5	0.16	74.5	74.66	60
SO_2	3.30	22.1	25.40	80
NOX	5.71	50.4	56.11	80

Although the contributory GLCs are low, the PM10 and PM2.5 levels in the atmosphere in and around the project site are already high and therefore, the resultant concentration is beyond permissible limits. Hence, mitigation measures such as maintenance of DG sets and use of low sulphur diesel have to be followed strictly to ensure that pollution does not increase further

(ii) Fugitive dust

During operation, the fugitive dust sources would be due to sweeping and due to movement of vehicles. The fugitive dust due to sweeping or internal movement of vehicles would not have any influence in areas further from the premises of the project. However, the fugitive emissions on public roads will not be under the control of the proponent.

B. Mitigation Measures

During operation phase, the air pollution component is relatively very low in comparison to the construction phase. The fugitive dust would not have any influence in areas further from the premises of the project. However, some measures have been incorporated in the project proposal as follows:

1. Conservation of present trees to the maximum possible extent and development of green areas as well as avenue plantation shall be carried out.

2. Plants are good absorbers of sulphur dioxide therefore development of green belt to attenuate air pollution. Pollutant resistant species of mainly evergreen trees will be chosen for plantation.

3. The use of solar energy for meeting part of the street lighting requirement.

4. PUC of vehicles during operation phase.

5. Provision of adequate stack height to DG sets as per the norms for dispersal of emissions.

6. The DG set shall be provided with acoustic shields or enclosures to limit the sound level as per norms.

7. Routine stack emission monitoring for particulate matter will be carried out as per the frequency prescribed by State Pollution Control Board;

8. **Monitoring & Sampling ports in DG set** - For the purpose of monitoring the emissions from the DG set stack, sampling port are proposed at an accessible height above the acoustic shield. The ports will be accessible by ladder arrangement. The final design and location of the sampling ports are subject to manufacturers specification.

4.0 WATER ENVIRONMENT

4.1 Construction phase

A. Impact

The impact on water resource and quality during construction phase will be due to:

(i) Consumption of water

(ii) Discharge of waste water

(iii) Contamination of runoff during rain

Source of water during construction phase

Water requirement during construction phase will be met through tankers. The project proponent will obtain necessary permission from the concerned authority. Domestic water supply for construction workers will be also be sourced through municipal supply.

Quantity of water required

The quantity of water required will be variable and will vary from day to day depending on the construction activities proposed and the number of manpower deployed on a particular day. Construction water consumption will be for dust settlement, consolidation, compaction, curing, plastering, at-site RCC, washing, etc. About 12,000 litres of water will be required for curing 100 square metres of slab surface. Water consumption will by labour as well, which shall be provisioned at the rate of 45 lpcd.

Sources of pollution

- Source of water pollution during construction phase has been identified as domestic sewage generated in canteen, washrooms and toilets used by construction work force.
- Most construction water will be absorbed during construction or evaporated during curing. Therefore, no major quantity of waste water is anticipated from construction activities.
- Runoff water during rains will carry suspended particulates which can pollute the downstream water

B. Mitigation Measures

- The waste water generated by the labour will be managed by providing pre fabricated portable toilets ultimately leading to septic tanks system for treatment. The septic tank will be periodically

evacuated for disposal. Modular impervious units will have to be used since the ground water table is very shallow.

- To minimize the flow of solids in the runoff, measures shall be taken as follows:
  - Carrying out major part of excavation and material handling in non monsoon season
  - Avoiding rainy days for material handling
  - Stabilizing any earth dumps with grass or covere with tarpaulin to minimize erosion
  - Undertake plantation within the premises at the earliest to minimize soil erosion
  - Provision of garland drains around excavation and temporary earth storage, followed by settling pond to settle suspended solids before release into the storm water drain
  - Provision of storm water drains with silt traps near anticipated high-silt areas
- To avoid wastage of curing water, following guidelines will be followed:
  - Curing water would be sprayed on concrete structures; free flow of water would not be allowed for curing.
  - After liberal curing on the first day, all concrete structures would be painted with curing chemical to save water. This will stop daily water curing hence save water.
  - Concrete structures would be covered with thick cloth/gunny bags and then water would be sprayed on them. This would avoid water rebound and will ensure sustained and complete curing.
  - Ponds would be made using cement and sand mortar to avoid water flowing away from the flat surface while curing.
  - Water ponding would be done on all sunken slabs.

4.2 Operation phase

A. Impact

The impact on water resource and quality during operation phase will be due to:

(i) Generation and discharge of waste water

(ii) Contamination of runoff during rain

4.2.1 Source of water during operation phase

The water shall be sourced from the following:

(i) Fresh water from Municipal Mains

(ii) Treated waste water from centralised Sewage Treatment Plant (STP) and Softener for HVAC & irrigation system.

Water treatment

The water from the raw water tanks would be passed through a Water Treatment Plant followed by chlorination. Also, it is envisaged to use treated water from Sewage Treatment Plant (STP) and Softener for HVAC & irrigation system.

4.2.2 Quantity of water required, sewage generation and reuse

Total fresh water demand of the commercial project will be 334 KLD. The basis of calculation of the water demand for the entire project is given in **Table 5**. Domestic water consumption has been considered as 45 lpcd on the basis of "Manual on norms and standards for environmental clearance of large construction projects" of MoEF. The water demand estimation has been tabulated in **Table 6**.

TABLE 5
PARAMETERS FOR WATER CONSUMPTION FOR DIFFERENT LAND USES

Sl. No.	Usage Type	Water Requirement (LPCD)
1.	Commercial	45
2.	Floating	15

TABLE 6
DEMAND ESTIMATE OF WATER CONSUMPTION IN DIFFERENT USES

Sl. No.	Use	Population	Water requirement (per unit, LPCD)	Water requirement (LPD)		
			Fresh	Fresh	Treated	Total
1	Office Goers	5935	45	267075	0	267075
2	Floating/Visitors	5935	15	89025	0	89025
	Total in litres	**11870**		**356100**	**0**	**356100**
	Total in KLD			**356.100 Say 356**	**0**	**356.100 Say 356**

Sl. No.	Use	Population	Water requirement (per unit, LPCD)	Water requirement (LPD)		
			Fresh	Fresh	Treated	Total
	Air-conditioning cooling tower makeup water requirement per day. (soft water), KLD			**52**	**231**	**283**
	Gardening/irrigation (Discharge from Softener-1), KLD			**6**	**0**	**6**
	Gardening/Irrigation (Discharge from Softener-2), KLD			**0**	**26**	**26**
	Total			**414**	**257**	**671**

It can be seen from **Table 6** and **Fig 1** that:

- Fresh water demand will be 356 KLD.
- Treated water of 283 KLD will be used for air-conditioning cooling tower makeup.
- Reject water of 6 KLD from softener-1 and 26 KLD from softener-2 will be used for irrigation purposes.
- Green covers in the complex works out to be 32 KLD which also will utilize treated waste water.

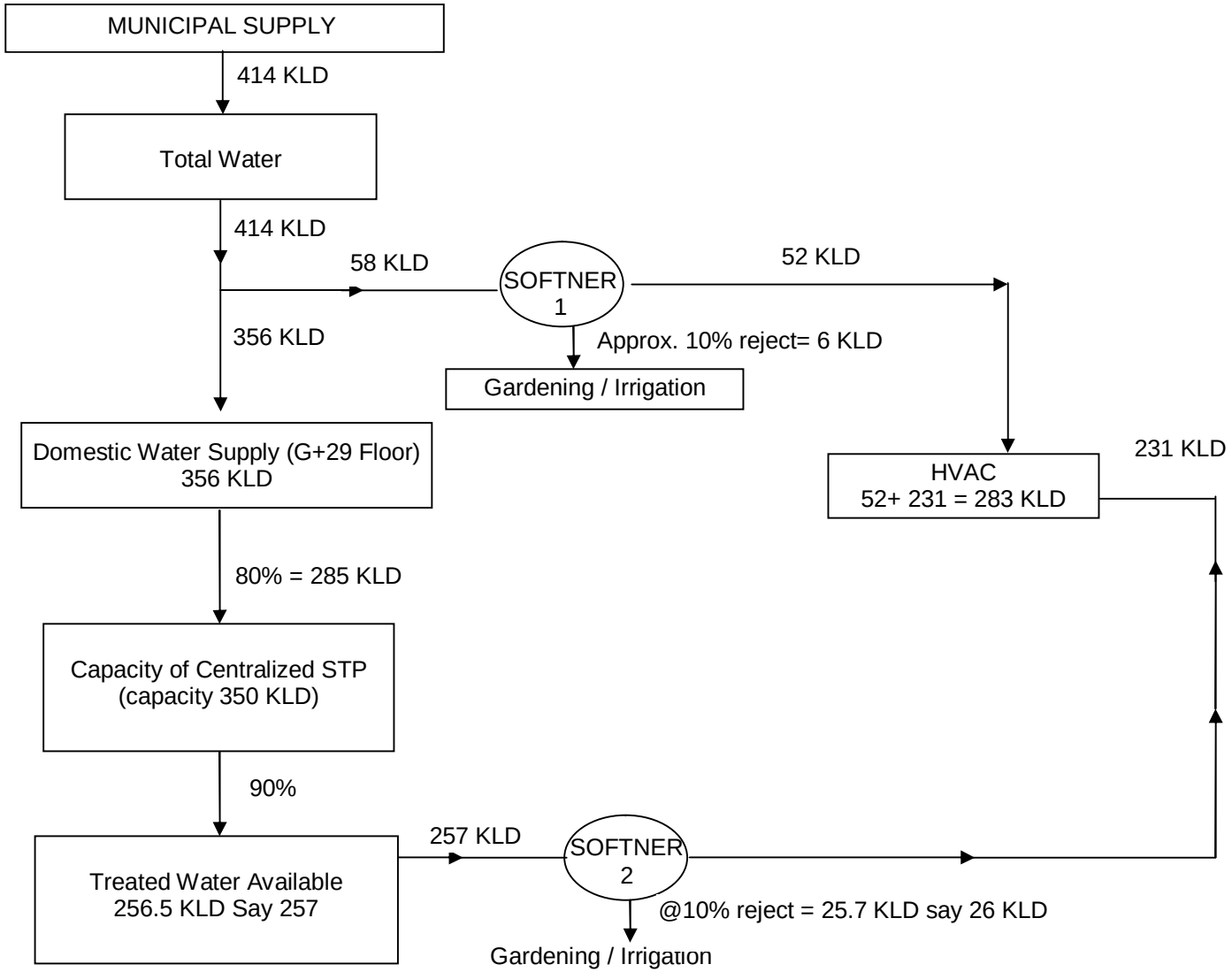
The water balance diagrams for the summer and winter has been shown in **Fig 1**.

Underground Storage Capacity

Underground water storage is proposed for which tanks shall be provided as follows:

Description	Capacity (in KL)	Remarks
Fire Tank	200	As per NBC-2005
Domestic water tank	300	One day requirement of total capacity
Drinking Water Tank	50	One day requirement of total capacity
Soft Water Tank	100	
Total	**650**	

FIG 1: WATER BALANCE DIAGRAM, KLD



Note: Total water used for gardening/irrigation will be 32 KLD, which will be discharged into the sewer during monsoon.

4.2.3 Water Supply Distribution System

Source of water considered shall be from the Municipal supply.

Domestic Water

For pumping and distribution of domestic water, the domestic water transfer pumps will be provided in the underground water tank pump room, and then transferred to overhead domestic tank. This process will be controlled by level controllers. The supply to overhead tanks by Pressurization pumps from centralized pump room. This process will be controlled by float valve placed in individual overhead tanks. Pressure-reducing valves shall be provided to maintain reasonable pressure in riser and down pipe. Booster pump shall be provided to maintain pressure for G+29 (initial proposal).

Overhead Storage

From main underground domestic water storage tank, supply will be pumped up to terrace level and water will be stored in overhead domestic tanks with 33% storage capacity. Overhead tanks for each toilet block have been proposed above terrace level.

Domestic Water Distribution System

Gravity Feed System: Water will be pumped from existing source to underground fire water tank, overflow to domestic water tank it will be transferred to overhead tank it will be distributed by gravity flow to various outlets. Pressurization is not required and distribution is accomplished by providing down takes to various fixtures.

The water distribution system for domestic and other usages will be through gravity feed. Piping sizing shall be based on fixture unit calculation as per NBC standard. However, the maximum velocity in the water supply piping shall not exceed 2.4 m/second. The irrigation water supply system comprising of pumping, piping, water supply nozzles and control equipment shall be designed as per landscape drawing.

Internal & External Water Supply Piping

It is proposed to use GI Medium duty pipes for all water requirements (Internal / External).

Soft (Treated) water

Soft water shall be supplied through separate transfer pumps to the Cooling Towers etc as per requirements. The pipe G.I medium duty shall be used.

The water supply network is shown in **Fig 2**.

4.2.4 Sewage Collection and Conveyance

Domestic wastewater comprising of wastewater generated from kitchens/ canteens/ pantry, washrooms and toilets has been identified as the major source of waste water from where the waste water will be collected through pipe system leading to the sewer system laid out for the project. Sewage generated from all the building shall be to the tune of about 285 KLD.

It is proposed that the sewage generated from all the building shall be treated in a sewage treatment plant, so that the treated effluent can be recycled for horticulture & soft water requirements of the site so that site will be ZERO discharge site.

The sewage network of the office complex has been shown in the **Fig 3**.

4.2.5 System Design and Sewage Treatment

System Design

- The sewerage system will be based on conventional water carriage system, in which soil and domestic waste generated by individual buildings/units will be collected into a collection chamber, through soil and waste piping system.
- The collection chamber from all units shall be connected to the nearest manhole on the external sewer line planned along the periphery of the building and as per site conditions.
- It is recommended that the domestic sewage shall finally be carried due to gravity to one disposal point for further treatment in the Sewage Treatment Plant.

Sewage Treatment

Sewage will be treated in advance MBBR technology based STP of 350 m^3/day capacity located in Custom Office. The location of the STP has been shown in the **Fig 3**.

The anticipated influent characteristic of the sewage is given in **Table 7**.

TABLE 7
ANTICIPATED CHARACTERISTICS OF WASTE WATER

Sl. No.	Parameter	Concentration (mg/l)
1.	pH	6.5-8.0
2.	Oil and grease	40-50
3.	Suspended solids	200-450
4.	BOD @ 20 degree C	200-300
5.	COD	600-800

(Source: Data Base Project Report of "Construction of Office Complex and Godown at Customs Enclave Plot", (Suleman Shah Plot), Wadala (East), Mumbai by Architect Suresh Goel & Associates)

FIG 2: WATER SUPPLY NETWORK

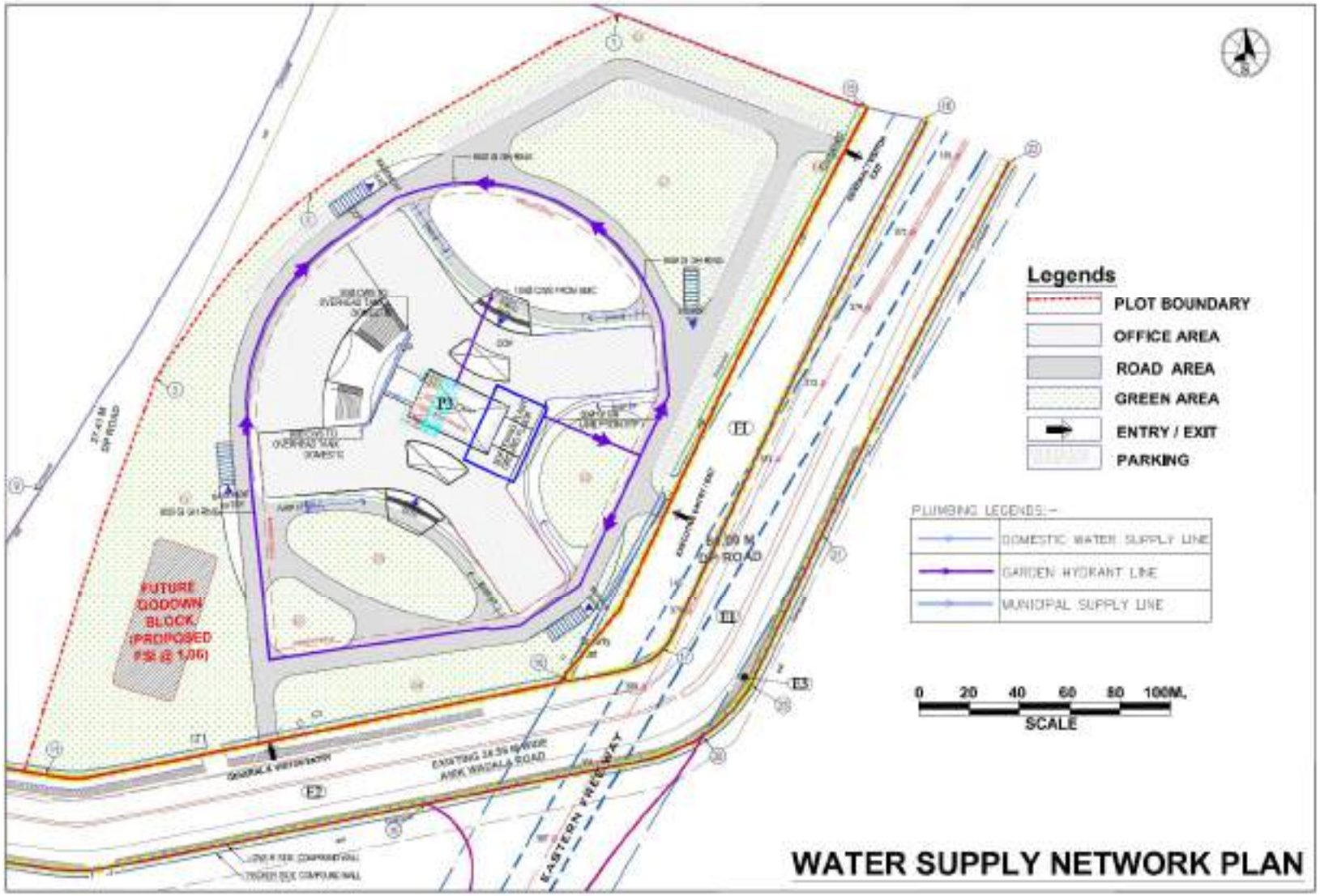
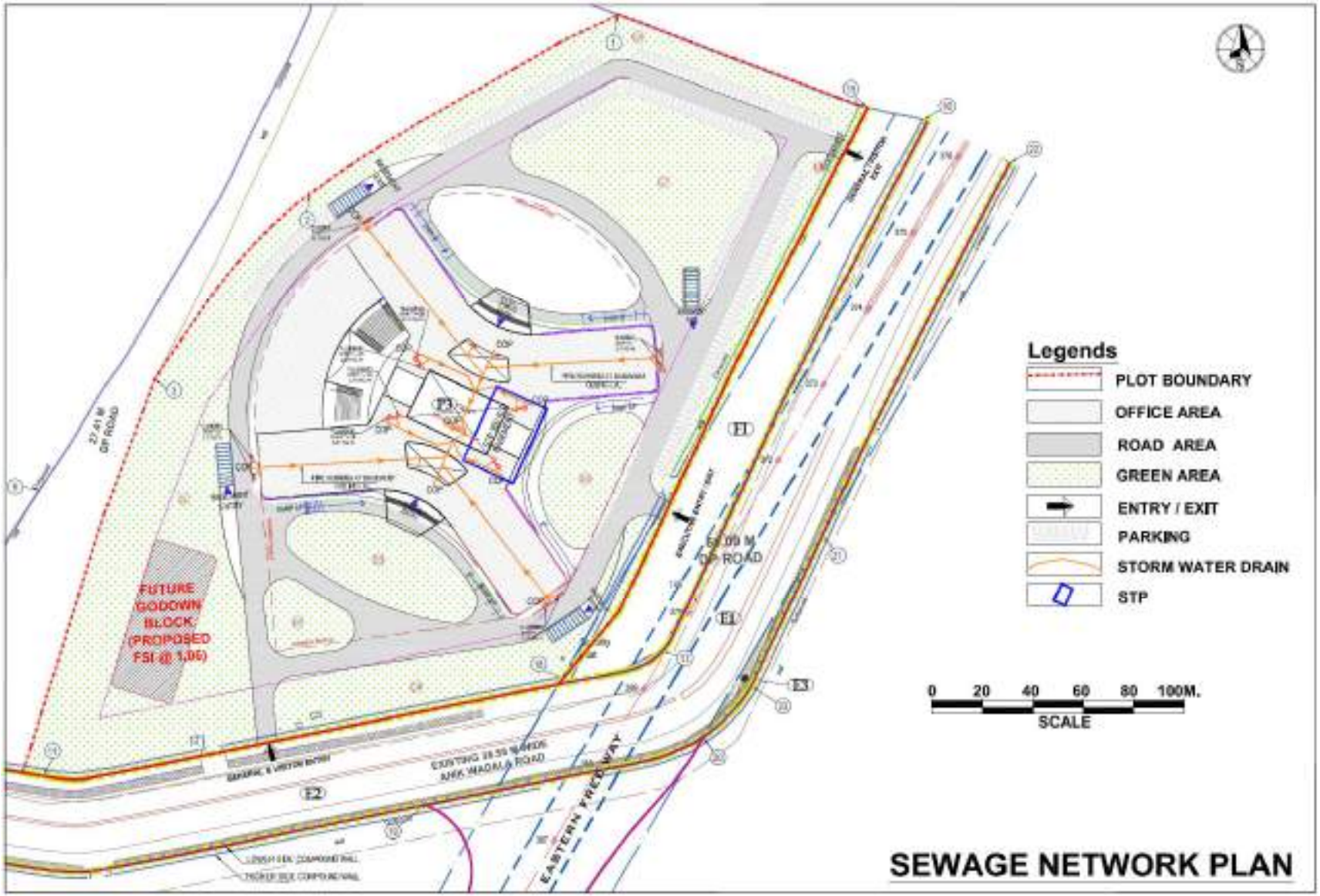


FIG 3: SEWAGE NETWORK



Final effluent characteristics desired (As obtained from the Secondary Clarifier, Advanced MBBR Treatment) would be BOD less than 30 mg/l, COD less than 80 mg/l and suspended solids less than 100 mg/l levels.

The characteristics of effluent will be within the norms specified by Ministry of Environment & Forest, Govt. of India or Central Pollution Control Board for safe disposal to green area.

Provision for safety against failure in the operation of waste water treatment facilities

Power arrangement through back up DG set has been proposed for STP to ensure uninterrupted operation during power failure. Arrangement for back up pumps and other parts as well as consumable stocks shall be made. A maintenance agency shall be doing preventive maintenance of the STP periodically as well ensuring its smooth maintenance. Regular R&M activities shall be carried out.

4.2.6 Discharge of treated waste water

Sewage from the building will be treated in the sewage treatment plant (STP) of Custom office which has provision of advance treatment so as to bring down parameters of treated water as per MoEF guidelines.

Treated effluent shall be filtered through “Dual Media Filter (DMF)” & Activated Carbon filter (ACF) and stored in an UG tank for use in Horticulture. Further entire treated water will be sent to the softener, 10% water will be discharged in softening process i.e 32 KLD which will be utilized for gardening and irrigation and rest 283 KLD softened water will be recycled for HVAC. There will be no discharge into the drains/ nalas outside the project except in the monsoon season which will be comprise of the rainfall runoff as well as the water unutilised in greenbelt watering (32 KLD).

Water conservation and augmentation

The following measures have been proposed to curtail the consumption of water, thus, conserving it:

a) Water conserving flushing fixtures operating on infrared sensors shall be used for Urinals.

b) Water demand meters shall be installed to monitor daily consumption patterns & regulate water flows to each area for the purpose of record.

d) Push back type pillar cocks in wash basins shall be installed.

e) Water conservation using Dual flow fixtures for plumbing cistern.

f) The water demand for horticulture at project site shall be met by recycling the treated effluent available from the water softening plant.

FIG 4: SURVEY PLAN AND NALAS AROUND PROJECT SITE

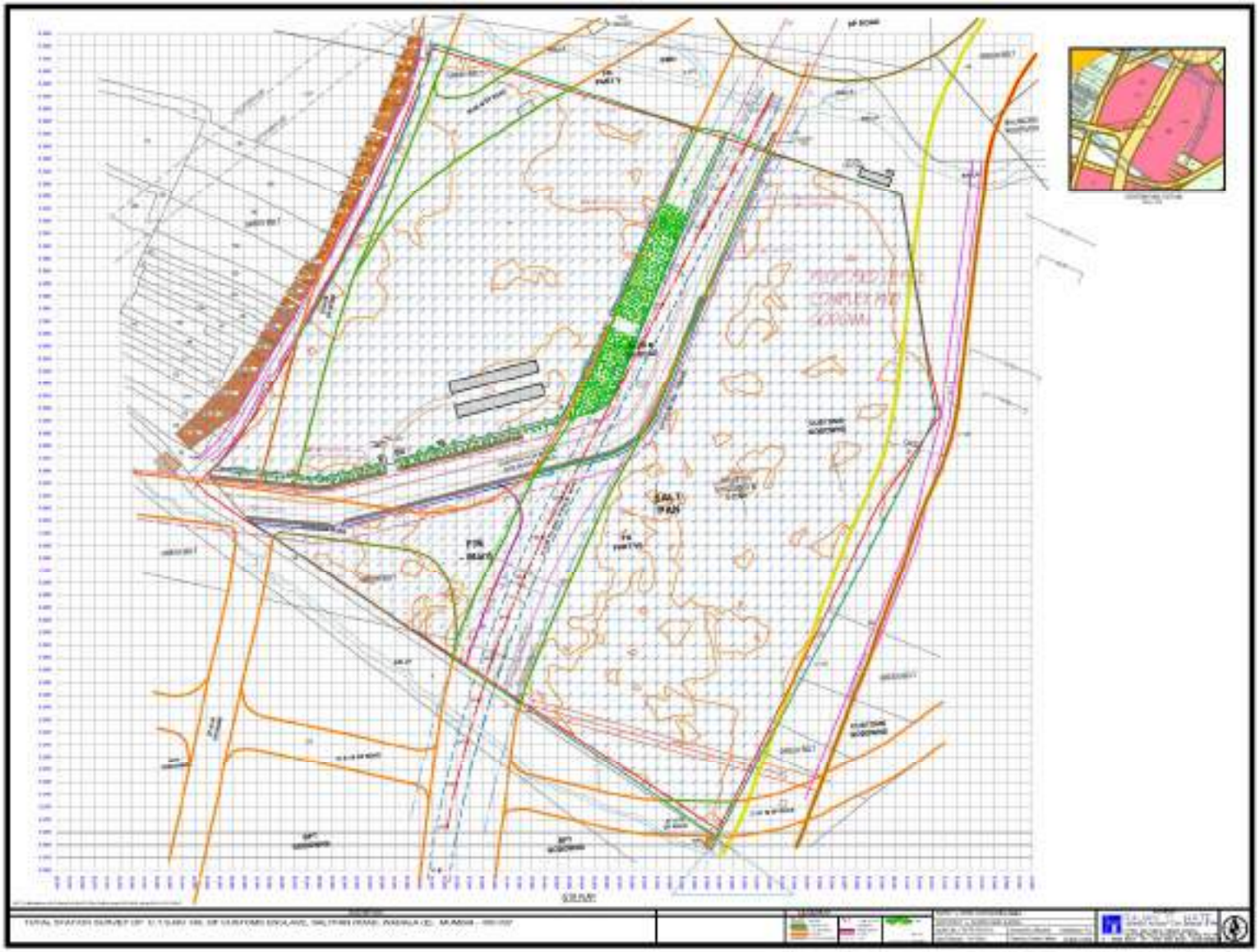
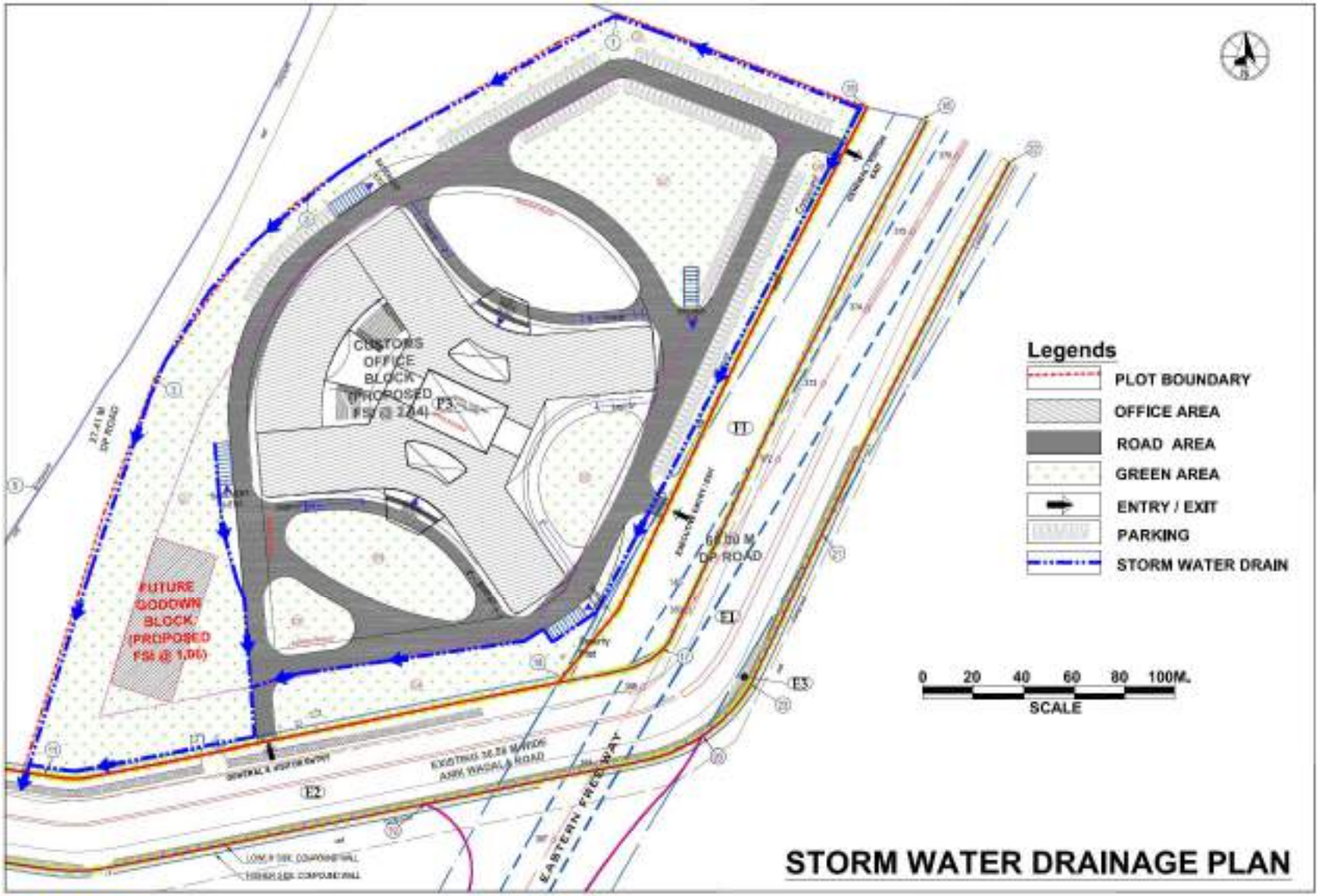


FIG 5: STORM WATER DRAINAGE PLAN



g) It is made compulsory in newly formed parks and open spaces to accomplish water storage and recharge through trenches.

h) Sprinklers/drip irrigation will be used.

i) The construction of solid slab pavements shall be avoided and instead porous or combination of solid and green areas will be used

j) Awareness plays a major role in water conservation. Public messages to be prominently displayed for water conservation.

k) Water leaks to be tracked and corrected regularly.

4.2.7 Rain water harvesting system and drainage

As per Geo-technical investigation report, ground water table observed between 0.8 to 1.7 M below ground level(bgl), which is very high. Seasonal and annual fluctuation in ground water levels can be expected. Therefore, no artificial recharging will be proposed.

Central Ground Water Board(CGWB) norms suggests that artificial recharging will not be done if the water table is less than 8 m.
(Source : Manual on norms and standards for environment clearance of large construction projects, MOEF,GOI, Chapter 2)

The storm water drain will be connected to the existing natural nala on south side of the project. The flow is observed to be approximately 5 to 7 m/s with a depth varying from 1.2-1.5 m. Currently also, the run off the plot is flowing towards the south side nala as per the contour map.

5.0 LAND DEGRADATION AND EROSION

5.1 Land use

The land use planned for the proposed project provides adequate areas for open space, roads, utility and services. Ground coverage identified for construction will be restricted as per the building byelaws. Thus, adequate control measures are incorporated at the design stage. The proposed land use is given in **Table 8**.

TABLE 8
PROPOSED LAND USE OF THE PROJECT

Sl. No.	Land use	Area Details in sq.m	
		Area	**%**
1	Office Building	19,930	35.26
2	Road Area	10,087	17.85
3	Surface parking	2,723	4.82
4	Green Area	23,783	42.08
	Total	**56,523.13**	**100.0**

5.2 Topography and drainage

A. Impact

Topography: The contours of the project site will change due to construction and landscaping. However, there will be no impact on topography of the areas outside the project site due to construction within the project.

Drainage: There is no natural nala passing through the site. There are drains outside the project site which will not be disturbed. Although no surface water body or seasonal stream is existing in the plot area, there shall be an impact on the sheet flow of the storm water runoff from the site. The water bodies present in the study area will not be affected due to the project.

B. Mitigation

Topography: As per MOEF's guidelines for new construction projects, it is essential to avoid disturbance to the site by retaining the natural topography of the site or design the landscape with at least 15% to 25% of the site area. In the said project, the landscaped area will be 42.08 %, thus, addressing the requirement.

This excludes the parking areas, walkways or landscaping over built structures such as roofs, basement etc. In addition to the dedicated green area, potted plants will also be considered. Turf design on site will be such so as to conserve water.

Drainage: All storm water drainage pipes are laid as per requirement of NBC and MMRDA. The plan will incorporate best management practices which will include following:

- Separate sewage conveyance systems
- The storm sewers have been proposed only on roadside
- The overflow, if any shall be directed towards the existing nearby natural drainage course, which will coincide with its flood level to avoid any chances of reverse flow.
- Regular inspection and cleaning of storm drains.
- Provision of slit traps in storm water drains
- Oil traps shall be installed in all the parking areas.
- Ensuring adequate cover for all waste storage areas.
- Avoid application of pesticides and herbicides before wet season.

Hence, the above management measures will ensure drainage and mitigate the changes in topography.

5.3 Land degradation and erosion

5.3.1 During construction

A. Impacts

During construction, the irreversible impact on land will be limited to the construction footprint. The area outside the footprint can be disturbed due to storage, movement of vehicles, etc but can be restored or improved after completion of construction. Some of the impacts due to construction shall be:

(i) Excavation of soil
(ii) Compaction of soils by earth moving equipment
(iii) Erosion and modification of surface
(iv) Deterioration of soil quality within the project site
(v) Contamination of soil due to spillages

Cutting & Filling

Cut and fill technology shall be adopted to the extent possible as this involves least disturbances to the natural ground. Construction waste will predominantly be earth work generated during cutting i.e. 267,635 cum, out of which 1,47,182 cum (55%) will be reused for filling at the project site. The balance volume i.e. 1,20,453 cum of earth works may be used in various land reclamation sites across Mumbai. The break up of excavated and utilised soil is given in **Table 9**.

TABLE 9
BREAK-UP OF EXCAVATED SOIL

Description			
Basement Area	21,411 sq.m.		
Basement Depth	12.5 m		
Effective Volume of Excavation	267,635 cum		
	Area, sq.m.	**Height of filling, m**	**Volume of Earth reutilised, cum**
Podium Area	19,930	1.5	29895
Terrace Floor Plate (Office Building)	6,716	0.5	3357.76
Internal Roads	10,087	0.5	5043.647
Green Area within Site	23,783	1.5	35675.08
Plot 2 Area(Residential Plot towards west of customs office)	95,693	0.5	47846.42
Plot 3 Area(Green Belt towards South)	7,466	1.5	11198.3
Green Belt Area	9,444	1.5	14165.98
	173,119		147,182
Balance Volume of Earth			**120,453**

Assessment of soil erosion: The project area is relatively flat and not prone to soil erosion. After plantation on it for landscaping, there will be negligible erosion.

Demolition and its waste management

There is a single storeyed store admeasuring 1367.58 sq m, the demolition and site clearance of the same should take about 30 days. 1,35,665 Bricks, approx. 50 tonnes of steel will be generated on demolition and the same shall be utilized in construction of site office, guard room and boundary wall at site. MCGM has a dumping ground at Gorai for construction and demolition waste.

B. Mitigation measures

Soil erosion is an important parameter which needs to be addressed during the construction phase. Some of the mitigation measures include:

- Removing vegetative cover only from the specific site on which construction is to take place and by disturbing the vegetation in adjacent areas as little as possible. This practice minimizes the amount of bare soil exposed to erosive forces.
- Land clearing activities will be kept to the absolute minimum and use crushed stone rather than asphalt or concrete for surfacing parking areas will be attempted.
- ***Preservation of topsoil :*** Stockpile of top soil shall be done so that it can be reuse later for landscaping purpose
- Measures such as mulching, silt fencing, sediment traps and sediment basins shall be implemented during construction.
- Open areas will be landscaped at the earliest and plantation started for green areas during construction itself.
- Paved areas will be installed with permeable paving.
- Grass swales will be made to serve as garland drains around the excavation and dumping sites, lead to sedimentation pond to settle silt.
- Excavation shall not be carried out in Monsoon.
- It will be scheduled in such a way that grass could be established prior to the onset of intense rain or windstorms.
- If grass is to be seeded, mulch of straw will help to protect the soil from less extreme erosive forces until vegetative and root development begins.
- Engineering plans will be drawn to reduce the area of earth cuts or fills below what might otherwise be acceptable, provide physical support for exposed soil or rock faces.

- The number, frequency and area of movement of heavy machinery will be restricted.
- Tyre wash will be provisioned.
- Cutting will be done, wherever possible, at higher contours to avoid pit formation and if unavoidable, then pits will be interconnected and ultimately drained into the natural drainage channel.
- The activity of establishing vegetation on open & unplanted land would be started during construction activity, at the earliest.

The reuse of demolition waste will be done as follows:

- CPWD Works Manual 2014 shall be followed for demolition
- The demolition of old buildings shall be in the scope of the same contractor who will undertake construction of the new buildings
- Furthermore, no heavy machinery (i.e. bull dozer/ JCB/ breaker) shall be used for demolition to ensure low noise and air pollution.
- Thus, maximum recovery of construction material shall be possible
- CPWD will grant permission to reuse demolished material in the new buildings subject to compliance to quality tests. For example, reuse of removed bricks, reuse of sand &aggregate in non structural elements, reuse of paver blocks, curbstones, etc.
- The wood, metal and glass will be permitted for sale to recyclers/ other users.
- In addition, any wastage from new construction material will also be reused.

5.3.2 During operation

A. Impact

Once the construction has been completed, the impact on land will start reversing partially and can be improved by improving the ground cover. The land use planned for the proposed project provides adequate areas for open space, roads, utility and services. Ground coverage identified for construction will be restricted as per the building byelaws. Thus, adequate control measures are incorporated at the design stage. The proposed land use is given in **Table 10.**

TABLE 10
PROPOSED LAND USE OF THE PROJECT

Sl. No.	Proposed Land use	Area Details in sq.m	
		Area	%
1	Office Building	19,930	35.26
2	Road Area	10,087	17.85

Sl. No.	Proposed Land use	Area Details in sq.m	
		Area	**%**
3	Surface parking	2,723	4.82
4	Green Area	23,783	42.08
	Total	**56523.13**	**100.00**

Regulatory measure in view of the environmental and social impacts of the project (such as unauthorized development in and around the area):

No additional regulatory measure to control unauthorized development in and around the area is required since the areas around the project are already developed. The undeveloped area across the Eastern Freeway and Anik Wadala road will be developed as per regulations only.

B. Mitigation

During operation phase, the soil erosion control measures will be continued selectively as applicable in addition to

- Growing of grass and trees in green areas
- Provision of dedicated horticulture and maintenance staff
- Provision of silt traps before rain water harvesting pits
- Porous paving in open area and parking area, to the extent possible.

6.0 ECOLOGY

6.1 Construction phase

Impact & Mitigation

The project site is covered with grasses and shrubs along with few trees on the boundary. There will be no requirement of disturbing the trees (cutting/ felling) since they are outside the building footprint area. In case, due to any unforeseen reason, a tree has to be cut, permission will be taken from the forest department and in lieu, for each tree 10 compensatory trees will be planted. Clearing of grasses and shrubs shall be carried out prior to construction and after construction, landscaping shall be done.

Mangrove Forests are present in study area. Due to mangrove forest, it attracts a relatively good diversity of bird species which included the long distance migrants. Since the project site is nearest to the Mangrove forest, hence, dust from construction activities can disturb the avifauna.

Hence, the measures for mitigating air pollution and noise pollution as discussed in Section 4.3.1, 4.3.2 and 4.9.2 will be required. Since no waste water discharge or solid waste disposal from the project site is anticipated to

or near the mangrove forests, the impacts due to those parameters will be nil.

Availability of water and food wastes during the day will attract some birds and animals towards the site. Thus, disposal of solid waste and waste water has to be done as per procedure to avoid man-animal conflict.

There will not be any long term irreversible negative impact on terrestrial eco-system comprising birds and animals. On the contrary, with progressive growth of greenery, terrestrial micro-habitats will develop in the long run.

6.2 Operation phase

Impact & Mitigation

Flora: As described earlier, 23,783 sq.m. of land (42.08% of the total project area) will be green area and shall be available for plantation,green belt, lawns, gardens.

The greenery will have the following features:

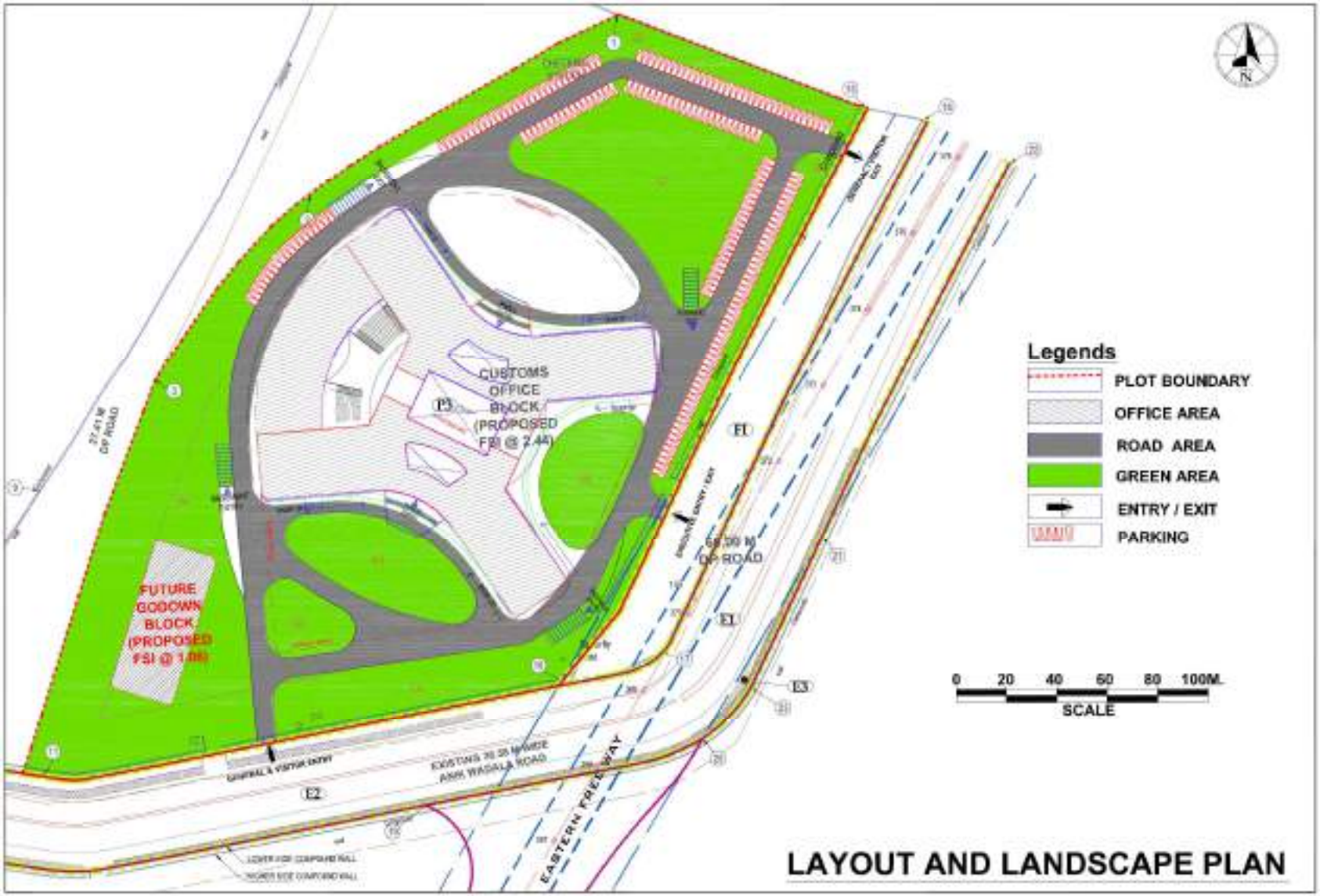
- Trees having higher potential of absorption of pollutants will be planted on the sides of roads.
- Flowering and fruit bearing trees, Medicinal and aromatic plants of economic values will be grown in landscaped areas.
- Native species, observed to prosper in the area, will be grown.
- Open green (park like areas) will have the mix of shrubs, hedge rows and large plants on periphery or as per landscape design.
- Discharge from softening plant will be used in gardening, thus, minimising fresh water consumption.
- Green areas will also aid in percolation of rain water to the sub-strata
- Augmentation of the greenery over time and maintenance of the same shall be continued during the operation stage with dedicated staff.

The above measures will impart a significant positive impact on the ecology. The location of the green areas is shown in **Fig 6**.

Time schedule for greenbelt development

All identified open spaces will be brought under tree plantation. Total 331 trees will be planted immediately after completion of construction, within 2 months.

FIG 6: LANDSCAPE PLAN



Species

The list of trees, shrubs and Herbs which will be planted are given below:

Sr. No.	Tress	Shrubs	Herbs
1.	*Albizia lebbeck*	Abutilon indicum	*Amaranthus viridis*
2.	*Azadirachta indica*	Bougainvillea spectabilis	*Argemone mexicana*
3.	*Anthocephalus chinensis*	Capparis zeylanica	*Boerhavia diffusa*
4.	*Bauhinia purpurea*	Calotropis gigantea,	*Catharanthus roseus*
5.	*Butea monosperma*	*Dendrophthoe falcata*	*Catharanthus roseus*
6.	*Cassia fistula*	*Hamelia patens*	*Cyperus difformis*
7.	*Cocos nucifera*	*Ipomoea carnea*	*Euphorbia thymifolia*
8.	*Delonix regia*	*Jasminum sambac*	*Grangea maderaspatana*
9.	*Ficus religiosa*	*Jatropha podagrica*	*Indigofera linnaei*
10.	*Lagestromia speciosa*	*Lawsonia inermis*	*Leucaena leucocephala*
11.	*Leucaena leucophylla*	*Taberneamontana divaricata*	*Mirabilis jalapa*
12.	*Muntingia calabura*	*Tecoma stans*	*Ricinus communis*
13.	*Mangifera indica*	*Thevetia peruviana*	*Sesuvium portulacastrum*
14.	*Millingtonia hortensis*	*Urena lobata*	*Typha angustata*
15.	*Murraya koenigii*		
16.	*Nyctanthes arbor-tristis*		
17.	*Plumeria alba*		
18.	*Phoenix dactylifera*		
19.	*Ricinus communis*		
20.	*Saraca asoca*		

Fauna *:* The development of greenbelt will serve as a micro habitat for small mammals like squirrels, mongoose, etc. Also the birds will find an additional place to roost and next. Fruit bearing trees will also provide fruit and seed to the birds. Some measures such as provision of bird feeders, bird houses, water bath for birds are suggested so further value addition can be done to the greenbelt. Thus, with the development of greenbelt around the building, the ecology will see an improvement over time.

6.3 Flamingo Habitat

Sewri-mahul mudflats (coordinates - 19.00N 72.86E) on eastern edge of Southern Mumbai are well known for housing flamingos during their annual migration in Mumbai. The Sewri mudflats are 2.3 km, SSW from the project site aerially. In 1996, the mangrove swamps of Sewri were declared a protected ecology. Sewri-Mahul mudflats and the shallows of the Creek are the foraging grounds for about 40000 thousand Lesser Flamingo and Greater Flamingos and, about half a million waders. The region has been identified as an Important Bird Area (IBA) by BNHS and BirdLife International. Flamingoes arrive at the mudflats from the months of October to March every year. (source : BNHS)

These mudflats are near the Sewri jetty. On the opposite bay, stand a chemical fertilizer factory, two oil refineries and a thermal power plant. It is alleged by environmental Also, there have been objections related to the proposed construction of the Mumbai Trans Harbour Link (MTHL) project, which involves building a 22-km bridge from Sewri to Nhava in Navi Mumbai which is posing a threat to the birds' habitat.

Impact & Mitiation

No impact due to the proposed project are anticipated on the Sewri mudflats, which are a flamingo habitat due to the following reasons:

1) The aerial distance between the project site and the flamingo habitat are 2.3 km.

2) Between the flamingo habitat and the project site lies various industries of Wadala and the major road- Eastern Expressway

3) There will not be any discharge of waste water from the project, which could eventually make its way to the Sewri mudflats to affect the flamingoes

4) The air quality prediction modelling of the DG set operation of the project show that the GLC's of the air pollutants due to the proposed project will not be felt at the Sewri mudflats

5) Noise from the project will also not reach the Sewri mudflats

6) Solid waste will be disposed at Deonar land fill site, which is further 7.5 km north east of the project site and thus, 9.8 km away from the Sewri flamingo habitat.

7) Traffic movement to and from the custom house is a function of the origin of the workers and visitors, which will be across Mumbai. All traffic will move on pre-established roads and no additional roads are proposed for the project.

Thus, no impact is anticipated due to the project on Sewri mudflats.

7.0 NOISE

7.1 Construction phase

A. Impact

During the construction phase of the site, the following source of noise pollution is expected:

- Earth handling and Construction equipment like JCBs, excavators, rollers, compressors, etc
- Construction activities such as welding, cutting, hammering, etc.
- Vehicular traffic due to bringing in of construction material in trucks,
- Tractors trolleys, etc.

Noise modelling

Noise propagation through mathematical model and impacts of noise with distance from source has been studied and brought out below.

As the construction equipment generate noise generally in the range of 100 dB(A) at source it can be safely assumed that the ambient noise levels on any point of boundary line of plot are not higher than 100 dB(A). It has, also been assumed that the area within the project site has an imaginary line running at a distance of 3-5 m (say) from noise generating machines, which will be termed as point noise source to avoid complication in the absence of availability of exact location of various noise generating units, their arrangements and shapes.

Taking extreme case of two machines each generating 100 dB(A) working at a point will add upto 103 dB(A) overall noise level. Such source noise level has been considered here for anticipating the impacts. Noise attenuation with distance in all directions over flat open bare ground is given by

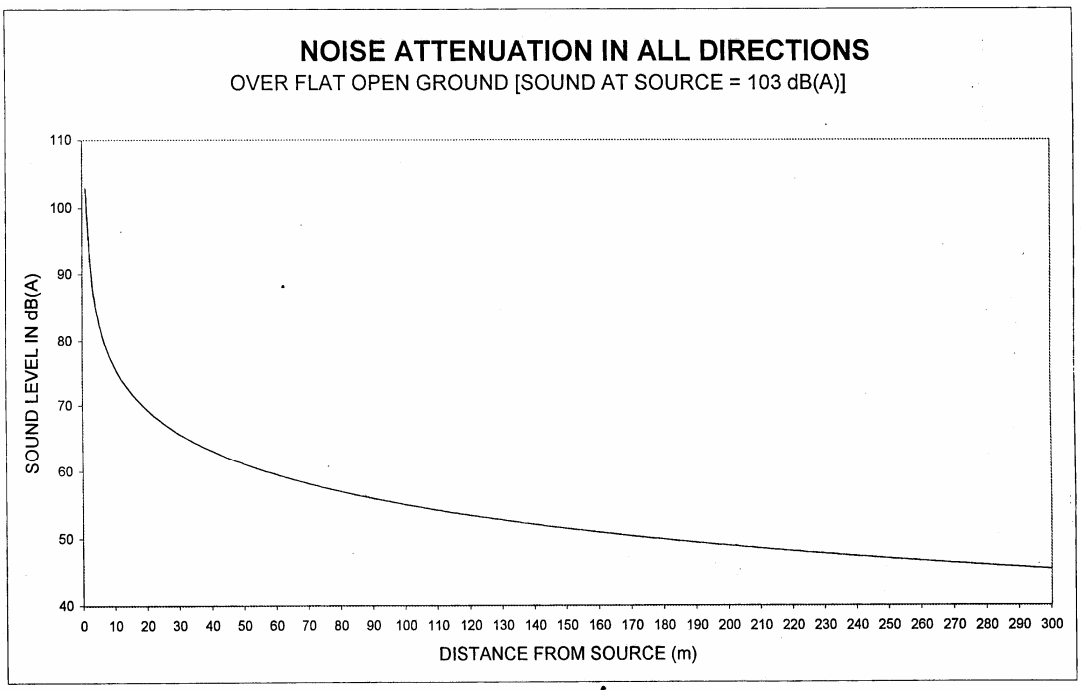
Sound level dB(A) = $Lw - 20 \log_{10} R - 8$

Where :

L_W = Sound level of source, dB(A) assumed 103 dB(A)

R = Source distance, m

The same has been plotted in the graph below, assuming source noise level as 103 dB(A).



A perusal of graph shows that the sound levels attenuate to value as shown in **Table 11**.

TABLE 11
NOISE ATTENUATION WITH DISTANCE ON FLAT BARE GROUND WITHOUT AND WITH GREEN BELT
COMBINED NOISE OF MORE THAN ONE SOURCE = 103 dB(A)

Distance from source (m)	Noise level reduced from 103 dB(A)	
	Without green belt, dB(A)	With green belt, dB(A)
20	70.0	68.5
60	60.0	55.5
100	56.0	49.0
150	52.0	41.0
180	50.0	33.0
300	45.0	<33.0

It means that after distance of about 300 m, the machine noise will merge into the background noise in the day time. This noise level is same as the limit [45 dB(A)] prescribed by GSR 742 (E) dt. 30th August 1990 at night time for residential areas. Due to plantation along the boundary of the project site, it will be possible to further lower the noise levels below the prescribed limits. It may be noted that the combined noise from all the three plants cannot be more than 103 dB(A) at any point considering the distance between their relative locations.

B. Mitigation

The following control and mitigation measures are proposed to keep the noise levels within the permissible limits:

1) Construction contract specification for use of equipment emitting noise shall spell out the permissible standards for noise with guaranteed levels of maximum noise emission in various zones.

2) Periodic maintenance and greasing of noise generating equipment and vehicles.

3) Operators of high noise generating equipment will be provided with earmuffs. Restricting the exposure time of individuals to higher noise levels.

4) Imposition of speed limits on Heavy Earth Moving Machinery and vehicles.

7.2 Operation phase

A. Impact

During operational phase the following sources of noise pollution is expected:

- Diesel generator operations
- Increase in transport noise from within the site from near by roads.

B. Mitigation

The mitigation measures shall comprise of the following:

- Plantation of trees on both sides of all roads as well as the green belt shall be developed for noise attenuation.
- Strong leafy trees will be chosen planted to act as noise baffles. Shrubs and creepers will also be planted for additional protection between tree trunks; artificial mounds will be evaluated for suitability and used where practicable.
- As little hard paving and as much grass as possible will be used.
- Diesel generator will have acoustic enclosure as per specifications to ensure that the noise from it is compliant to CPCB norms.

The distance of the project site from the free way is 0.02 km, E and the Sewri-Chembur road is adjoining the plot. Hence, it may be noted that the attempts at reducing noise level at site will not have any discernable impact on the present ambient noise level reduction due to the high traffic load on the adjoining roads.

8.0 SOCIO-ECONOMIC CONDITIONS

8.1 Construction phase

A. Impact

The land has been allotted to the project proponent. There are no land losers or displacees from the project. Since there are no residents nor land losers in the project area, thus, no SIA has been carried out.

During construction phase there will be an influx of workers in hundreds of numbers. Most of this labour force will be natives of the State, who will be paid their wages in cash. With increased money supply, those who will be able to provide goods and services to the work force will benefit economically. However, increased money supply may push up price of local commodities and services and the additional requirement may have to be met from nearby places. If precautions are not taken, unhygienic site sanitation facilities can cause damage to environment and to health of the construction workers.

B. Mitigation

The objective is to ensure health and safety of the workers during construction, with effective provisions for the basic facilities of sanitation, drinking water, safety of equipments or machinery etc. Following are some of the proposed measures which will be followed:

- Compliance with the safety procedures, norms and guidelines (as applicable) as outlined in the document Part 7 Constructional practices and safety, 2005, National Building code of India, Bureau of Indian Standards shall be done
- Clean drinking water will be provided to all workers
- Adequate number of decentralized latrines and urinals to construction workers will be provided
- Guarding all parts of dangerous machinery will be done
- Precautions for working on machinery will be taken by the operators.
- Maintaining hoists and lifts, lifting machines, chains, ropes, and other lifting tackles will be maintained in good condition.
- Durable and reusable formwork systems will be used instead of timber formwork and it will be ensured that formwork, where used, is properly maintained.
- It will be ensured that walking surfaces or boards at height are of sound construction and are provided with safety rails or belts.

- Preventive measures to protect against fires as well as provision of fire extinguishers and buckets of sand will be done in the fire-prone area and elsewhere.

- Sufficient and suitable light for working during night time will be provided.

Socio economic situation of surrounding areas

A perusal of the 500 m radius of the project shows that the there is no habitation adjoining the plot. All habitation is separated by atleast a road. The north east, east, south east, south and south west sides are devoid of any habitation. Urban settlements are there on western and northern side. These areas are already developed and inhabited and no additional contribution in terms of physical or social infrastructure development will occur in these areas due to the proposed customs house project.

8.2 O*peration* phase

A. Impact

The proposed project site is located at C.S No. 146 of salt division, Customs Enclave Plot (Suleman Shah Plot), Wadala (East), Mumbai. There would be addition in commercial development of the area, which will improve the economic growth at local and regional level. Additional employment for not just the skilled but also the semi skilled and unskilled workers such as helpers, cleaners, drivers and security guard etc. will be there. The project developer will also undertaking CSR activities which are leading to overall improvement as detailed in Chapter 8.

B. Mitigation Measures

Since the impact will predominantly be positive, mitigation measures as such will not be required.

8.2.1 Facilities for Physically Challenged

The concept of Barrier Free Environment has been conceived to facilitate the safe and comfortable movement of physically disabled people in various parts of the custom office. While designing and detailing, due care has been taken to make the following provisions as per the prevailing building byelaws.

- Color coding entrance / exit, parking, and other facilities on area map.
- Provision of comfortable movement area and ramps.
- Provision of proper signs/signals at required locations.
- Provision of utilities designed as per byelaws for physically disabled.
- Provision of railings or other safety measures.
- Provision of lifts in high rise buildings.

8.2.2 Land Acquisition, Rehabilitation and Resettlement

Site has been allotted by Mumbai Metropolitan Region Development Authority (MMRDA) for the construction of Custom Office. The proposed project does not involve any displacement of inhabitants, hence, issues like resettlement and rehabilitation does not figure in the project.

9.0 SOLID WASTE MANAGEMENT

9.1 Construction phase

A. Impact

The construction phase waste will comprise of

- Excavated and demolition material.
- Building construction leads to generation of sand, gravel, concrete, stone, bricks, wood, metal, glass, polythene sheets plastic, paper etc. as waste.
- Waste left over in concrete, steel and other metals, pallets, packaging and paper products, wood beams, joists, studs, baseboards, railings, brick, tiles, etc.
- Waste generated by the labour at site
- Hazardous waste (covered in detail in section 9.4)

B. Mitigation/ Management

The different types of wastes need to be handled as per their needs and regulatory requirements. It is not possible to dispose off all type of wastes onto the land and has to be dealt with depending upon their type and characteristics. The measures to be followed will be:

- Segregation of construction wastes into roadwork materials, structural building material, salvaged building parts and site clearance wastes will be done to facilitate reuse/ recycling.
- Waste recycling plans will be developed for construction, prior to beginning construction activity.
- The plans would identify wastes to be generated, and designate handling, recycling and disposal method to be followed.
- Handling of waste material would be done with special precautions such as personal protective equipment and special procedures to prevent the injury.
- Developers will operate safe methods for waste collection, storage, and disposal operations in a manner to protect the health and safety of

personnel, minimize environmental impact and promote material recovery and recycling.

- Solid waste generated by labour shall be managed by use of three colours of wheeled bins :- dark grey for inert waste, green for wood and ply w
- Aste and blue for hazardous waste can be used.

9.2 Operation Phase

A. Impact

The operation phase will have the following types of wastes:

- Municipal solid waste (MSW), i.e., biodegradable, recyclable and non-biodegradable waste
- Hazardous waste (covered in detail in section 9.4)
- E-waste (covered in detail in section 9.3)

The characteristics, quantification and management of municipal solid waste is given in subsequent paragraphs.

9.2.1 Composition of MSW

The composition of municipal solid waste in the commercial project is expected to be as follows:

- Organic waste: kitchen waste, leaves from sweeping
- Recyclable: paper&plastics(predominantly), glass, metals,
- Non recyclable: Cleaning cloth, rubber, polystrene, composite materials, etc.

9.2.2 Quantity of MSW

For Mumbai, it is found that the rate of generation of municipal solid waste is 1.8 TPD as illustrated in the Master Plan 2021. Accordingly, the solid waste has been calculated (for 8 hours occupancy @ 436 gm/day) and given in **Table 12.**

TABLE 12
SOLID WASTE GENERATION

Sl. No.	Particulars	Total Population	Rate of generation g/day/capita	Total waste, Kg/ day	Tonnes/ day
1	Office Staff	5935	150	890.25	0.9
2	Floating/ visitors	5935	150	890.25	0.9
	Total	**11870**		**1780.5**	**1.8**

Thus, total solid waste expected to be generated per day will be 1.8 T/day.

9.2.3 Characteristics of MSW

According to Table 3.4 of Manual on Municipal Solid Waste Management (First Edition), for the population ranging from 2 to 5 million, 56.67% of total waste can be composted and 4.73% of waste is recyclable. Anticipated solid waste characteristics are given in **Table 13.**

TABLE 13
ANTICIPATED SOLID WASTE CHARACTERISTICS (KG/DAY)

Sl. No.	Particulars	Compostable (56.67%)	Recyclable (4.73%)	Land filling (38.6%)	Total
1.	Customs Officials (G+29)	1009.00	84.21	687.27	1780.48
2.	Floating/ visitors, litres				
	Total	1009.00	84.21	687.27	1780.48

The other characteristics expected of the solid waste generated from the proposed project are given in **Table 14.**

TABLE 14
EXPECTED CHARACTERISTICS OF SOLID WASTE

Characteristics	Quantity
Total solid waste/day (in kg)	1780.5
Approx. volume (in cum) @ 300 kg/cum	5.93
Compost materials (in cum) @ 56.67% of volume	3.36
Recyclable waste (in cum) @ 4.73% of volume	0.28
Non-compost material (in cum)@ 38.6% of volume	2.29

B. Mitigation/ Management

9.2.4 Collection and transportation system

The MSW management system would be as follows:

- The garbage from all the office cabins shall be collected by sweepers through floor to floor collection in both buildings of the office complex.
- An arrangement to collect biodegradable, recyclable and non-biodegradable waste in separate bags from office cabins will apply.
- The officials shall be made responsible to keep waste in separate bins in their cabins and hand over to sweepers to carry them to the centralised bins available at the floor of the buildings.

- Three colours of wheeled bins: - dark grey for non-recyclable waste, green for kitchen food/ compostable garden waste and blue for recyclable materials will be provided.

- The compound would have bulk dustbin type container, with a general guide of one 1100 litre bin. One paper bin to three residual waste bins shall be provided.

- Total 6 movable bins of 1.5 cum capacity- 3 for biodegradable waste, 1 for non-biodegradable waste and 2 for recyclable waste are proposed.

- Access To and From Bin Storage Areas - ramps will be be provided, where required, for easy access by the collection vehicle which will be at least 1.2 metres wide with a maximum gradient of 1 in 10. The surface of the path would be smooth, continuous and hardwearing. The loading bay will be clearly earmarked with sufficient turning radius.

- Tippers or carriage vans will cart this waste from bins to management/ disposal point for treatment.

- A Maintenance Agency has been proposed to be manage the solid waste collection, storage and disposal.

- The expenses on account of solid waste management cartage from depots to disposal site shall be borne by Maintenance Agency which in turn will collect it from the concerned deptt. in office complex.

- Considering the aspect of bird menace, no storage or disposal shall be carried out in open.

9.2.5 Storage System

Garbage chutes will be established on each floor including 3 basements at convenient places. Organic waste shall be composted at the proposed composting site. Recyclable material shall be sold for recycling to authorized vendors. The non compostable and non recyclable material shall be put into designated landfill.

9.2.6 Disposal of Solid Waste

Segregation of biodegradable, non-biodegradable and recyclable waste at source will be practiced. Municipal waste, after collection, storage and segregation within the project premises shall be disposed off by a contractor of MCGM as per approved procedure. Waste shall be finally disposed at “Deonar” which is the largest and the oldest dumping ground of Mumbai operating since 1927. The location of dumping site as shown in **Fig 7**

9.3 E-Waste generation

Source of E-Waste

E-waste is anticipated in the operation phase. Electronic waste or e-waste includes discarded electrical or electronic devices. Used electronics which are destined for reuse, resale, salvage, recycling or disposal are also considered as e-waste. Various types of electrical and electronic wastes will get generated in the buildings of office complex as follows:

- Computers
- Electrical equipment
- Electronics devices
- Mobile phones
- Lights and fixtures, etc.

Quantity of E-Waste

E-waste generation varies between 0.01 to 1% of total MSW for India as per Guidelines for Environmentally Sound Management of E-Waste by MOEF & CPCB, March 2008. As per "e-Waste Assessment in India: Specific Focus on Delhi" by BIRD & GTZ, March 2007, 20,000 tonnes were generated annually. For a population of 1.5 crores estimated in 2007 (avg of 2011-1.2 crores, 2011-1.8 crores), it works out as 1.33 kg/capita/year for Delhi.

The national average is anticipated to be around 0.66 kg/capita/year based on CPCB projections of 8,00,000 tonnes/annum for the entire country in 2012. Assuming the same rate for the office goers in the said project, for 5935 persons, the e-waste works out to about 3.9 tonnes per annum.

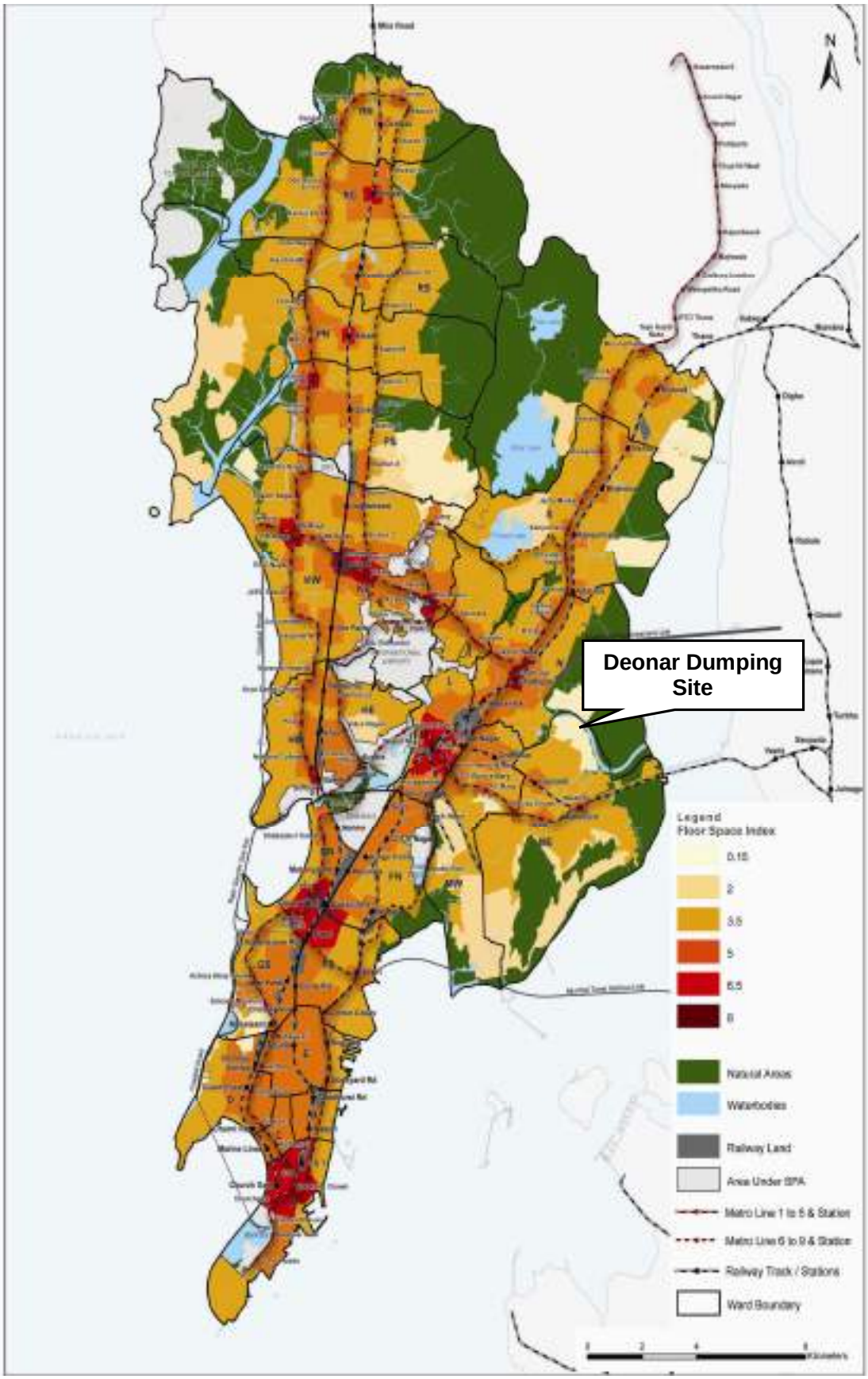
Management of E-Waste

There would also be provision for storage of these wastes in the building before transportation. Separate bin for e-waste will be provided at the waste disposal points. Isolated storage for these waste collected from e-waste bins of the whole custom office complex would be provided next to the main waste collection point. From there, the authorised recyclers shall collect the waste for further processing. CPCB & SPCBs have a list of authorized vendors for the e-waste management. A suitable vendor will be opted from the list.

E-waste management will also require cooperation from the occupants. Hence, through displays in the building, awareness will be created about the rule of three Rs (Reduce, Reuse, Recycle) as follows:

- **Reduce** – Less generation of e-waste by maintaining of the equipment – lifespan increased.
- **Reuse** – If functional, donate or sell it to the user
- **Recycle** – Components that can't be repaired

FIG 7: DUMPING SITE LOCATION



CFLs or any other mercury-containing products would never be thrown in the general garbage. For safe disposal, occupants would bring them to any of the hazardous waste collection events/ disposal points for proper handling.

9.4 Hazardous Waste generation & Disposal

9.4.1 Construction phase

List of Hazardous wastes from construction projects is given below. All wastes do not necessarily get generated.

- Hazardous wastes from construction activities are centering oil, formwork oil, tar and tar products (bitumen, felt, waterproofing compounds, etc.), wood dust from treated wood, lead containing products, chemical admixtures, sealants, adhesive solvents,
- Paints, pigments, dyes and primers, carbon black, pesticides
- Explosives and related products and equipment used in excavation, acrylics, and silica, etc.
- Product packaging (cement bags, cartons, containers, plastic covers etc.)
- Plastics, Acrylics, Silica, PVC
- Fluorescent Lamps Intact and Crushed, Halogen Lamps, Arc Lamps, UV Lamps, High Pressure Sodium Lamps, Neon Lamps, Incandescent Lamps
- Mercury Containing Lamps and Tubes, Mercury Vapour Lamps, Mercury Containing Devices – Mercury switches, relays, regulators, thermostats, thermometers, manometers and debris containing mercury
- All types of Batteries
- Electronic Ballasts, PCBs, Transformers, capacitors, switchgear, Lead Cable, Oil filled / gel filled cables
- Electronic Waste– computer products, circuit boards, CRTs, electronic parts, solder dross, weld waste.

For handling hazardous waste during construction, the following steps will be followed:

- Isolated storage for hazardous wastes released from the whole site would be provided on site.
- Source segregation of similar wastes will be done.
- Installation of fire extinguisher will be mandatory near storage of hazardous wastes.

- The dustbins for hazardous wastes would be made of durable materials like metal or even masonry if the projects spans for more than a year.

9.4.2 Operation phase

Products, such as paints, cleaners, oils, batteries, and pesticides that contain potentially hazardous ingredients require special care while disposal. Improper disposal of custom office hazardous wastes into drains or in trash will contaminate the environment. Hence, separate bin for hazardous waste shall be provided within the premises at a designated place. Officials will be made aware of the hazardous waste bin and the types of wastes that have to be disposed into it.

The other anticipated hazardous waste will be used oil from DG sets. The quantity of hazardous has been calculated taking reference from Cummins India Limited.

Capacity of DG set KVA	Used oil generated at one oil change (litres)	Time of oil change (hours)	No. of operation hours	Quantity of used oil per annum (litres)
4*1010	145	500	8	4 x 145 X 8X 365 /500 = 3388

(Source:http://www.cumminsindia.com).

An authorized service provider of Maharashtra Pollution Control Board/ Central Pollution Control Board, will be hired for disposal of hazardous waste at township level.

10.0 POWER REQUIREMENT

The Connected Electrical Load for the building in comprising of two towers of 29th floors works out 13499 KVA and Maximum Demand for electrical load considering diversity in load usage of 70% is 10000 KVA.

Electric Sub-station of capacity 5x2000 KVA is proposed to be established to meet the electric load requirement of 10000 KVA for the new Office Building. The main ESS shall be indoor Type Sub-Station complete with 33 KV panel board, dry type transformers, LT Switch gear, PLC panel for auto changeover and auto load management, Capacitor unit and all accessories as required. The substation shall be installed in the 1st basement of the building. Space for adding equipment in the sub station in future will be kept as required.

Electric supply for the complex shall be received from MSEB on 33 KV from the nearest Grid Sub- Station through overhead line /Underground Cable upto the 33 KV HT meter room proposed near the Gate Complex.

Four numbers of Diesel Generator sets each of capacity 1010 KVA have been proposed for the building.

11.0 ENERGY CONSERVATION

There is a need adopt energy efficient technologies for conservation of energy. Energy Conservation Building Code (ECBC) 2008 and the National Building Code 2005 serve as the guiding documents on energy conservation.

11.1 Construction phase

Energy conservation starts prior to construction at the design stage itself and the following considerations have been taken to minimise energy consumption:

1. Appropriate building form, which affects the solar access of the building.
2. Ensuring compactness of the building
3. Provision of green building has been made so as to reduce energy and water consumption.
4. Ensuring correct orientation of the building for ventilation and lighting optimisation, thus, the occupants will prefer natural draft and natural lighting, thus reducing energy consumption
5. The building envelope for all air conditioned buildings / spaces should try to comply with the ECBC code. The building is proposed to be four star rating.
6. Roofs and opaque walls would comply with the maximum assembly U factor or the minimum insulation R-value of the ECBC code. Mumbai comes under Warm & Humid climate zone. Hence, based on the ECBC norms, U Values and R values considered are given in **Table 15** and **16**.

TABLE 15
ROOF ASSEMBLY U-FACTOR AND INSULATION R-VALUE REQUIREMENTS

Climate Zone	Day time use buildings	
	Maximum U-factor of the overall assembly	Minimum R-Value of Insulation alone
	($W/m^{2-o}C$)	($m^{2-o}C/W$)
Warm & Humid	U-0.409	R-2.1

TABLE 16
OPAQUE WALL ASSEMBLY U-FACTOR AND INSULATION R-VALUE REQUIREMENTS

Climate Zone	Day time use buildings	
	Maximum U-factor of the overall assembly	Minimum R-Value of Insulation alone
	(W/m2-o C)	(m2-o C/W)
Warm & Humid	**U-0.440**	**R-2.10**

7. Passive solar design features have been considered as follows:

   - Site planning has been done considering the natural shading, land contours, gradient, water logging, solar radiation etc
   - Windows and doors: It is planned that 15-20% of the room wall area will be allocated to windows and doors, to ensure adequate ventilation and daylight which will help in reducing the demand for energy inside the buildings.

8. Reducing embodied energy in building materials by chosing the following:

   - Brick and block products with waste and recycled contents such as fly ash
   - Fly ash based lightweight aerated concrete blocks for walls
   - Brick panel with joists, Filler slab roofing, brick funicular shell roofing, RCC channel units or micro-concrete roofing tiles for roofing
   - Aluminum used from verified recycled content
   - Use of steel manufactured from recycled content
   - Alternatives for finishes which include Fly ash, Ceramic tiles, Terrazzo floors
   - Use of precast thin lintels, use of ferrocement-sunshade cum lintel etc

The use of the alternatives for building materials will help reduce the use of non-renewable resources and impact on natural resources.

Landscaping features

Soon after the construction work begins, the plantation of trees along the road alignment and around the parks will be started after the approval of the layout plan. Normally, it takes more than one year to actually get the designs approved and for the building construction to commence. During this period, the preparation for development of the green cover will be undertaken. Immediately after completion of construction, plantation will be completed. This has substantial advantages in terms of the local ambience and also in terms of the oxygen levels in the atmosphere. There are several instances where the green cover has been reported to reduce the ambient temperatures by about 2-3°.

11.2 Operation phase

The measures implementable at operation stage are as follows:

- The buildings have been designed so as to take advantage of day lighting and natural ventilation through natural drafts, to minimize energy requirements
- Users of the premises will use blinds or curtains for appropriate energy efficient operations.
- In the case of lighting, dimming control systems shall also be used to adjust for daylight available.
- Energy efficient appliances and devices shall be used. The building is proposed to be five star rating.
- Lighting loads will be reduced significantly by the use of latest lighting technologies that are available. Simple measures such as use of T-5, CFLs and LEDs can reduce the demand by upto 80%.
- The use of energy efficient motors for water pumping systems greatly reduces the demand for energy in the buildings.
- Automatic control systems are available to manage the energy demands inside the building and individual controls would ensure that the ducts are open when people are there, and shut when they are out.

Use of renewable energy sources

The 1000 KWP grid interactive solar power plant is proposed on terrace of building roof top with the objective of supporting the peak electrical load during the day light hours and to help reduce consumption of conventional AC power from the grid power supply.

The module layout will be proposed on the basis of clear open space available on the roof top. The charge controller and inventers will be loused in the centralized control room. There shall be noninterrupted grid power available during day time.

System Description

The photo voltaic Grid connected system consists of 3 components, The PV Array, Module mounting structure & power conditioning unit. PV Array convents light energy to DC power. The module mounting structure is used to hold the modules in position. The DC power will be converted to AC power through power conditioning unit which will be conncted to utility power grid.

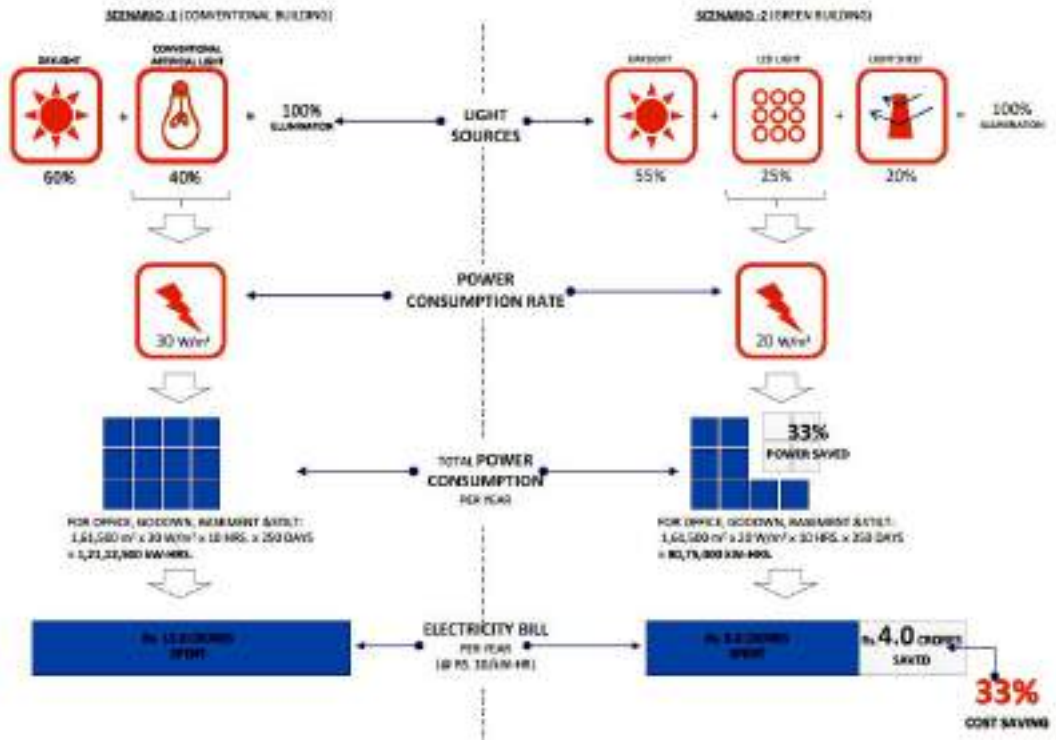
The Array structure of PV yard shall be grounded properly using adequate number of earthing to ensure safety of power plant. The system Proposed will be modular reliable with low maintenance. The life of proposed solar panels will be more than 20 years & can with staud high wind, high humidity. The clear open space of approx 10000 SQM will be made available on roof top considering 10 SQM area required for KWP load

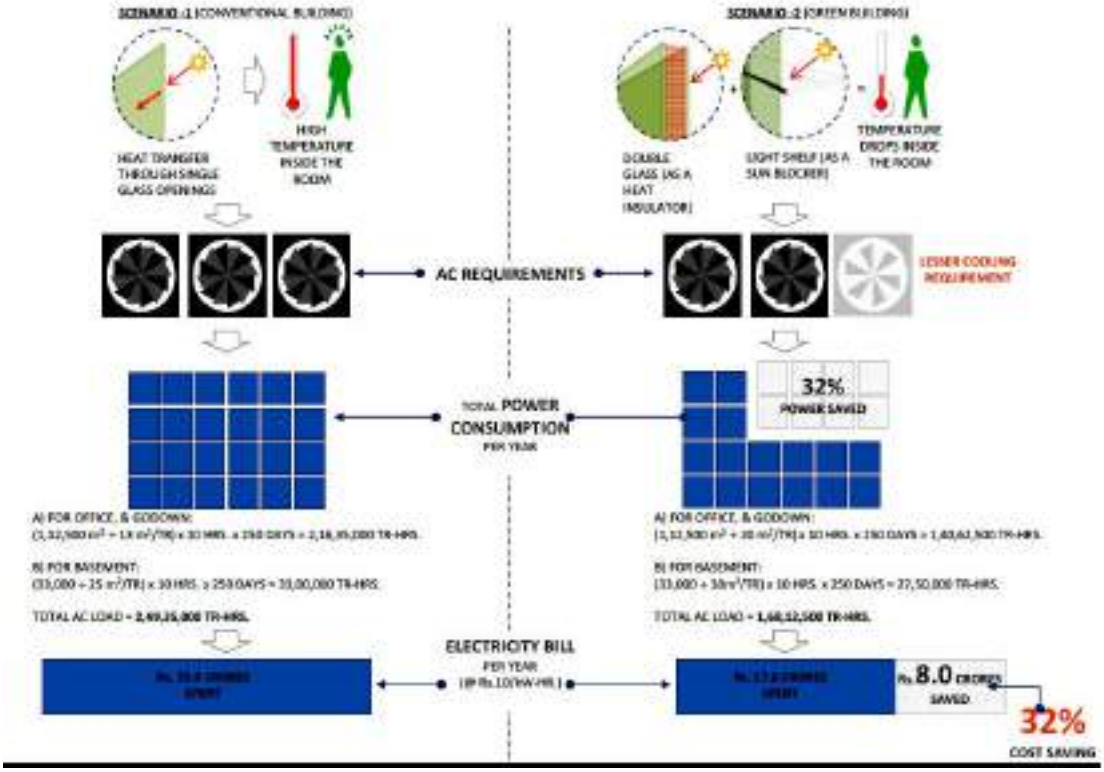
generator. The 430V AC output of isolation panel will fed to the grid. AC energy is then synchronized with grid & power is exported to the grid.

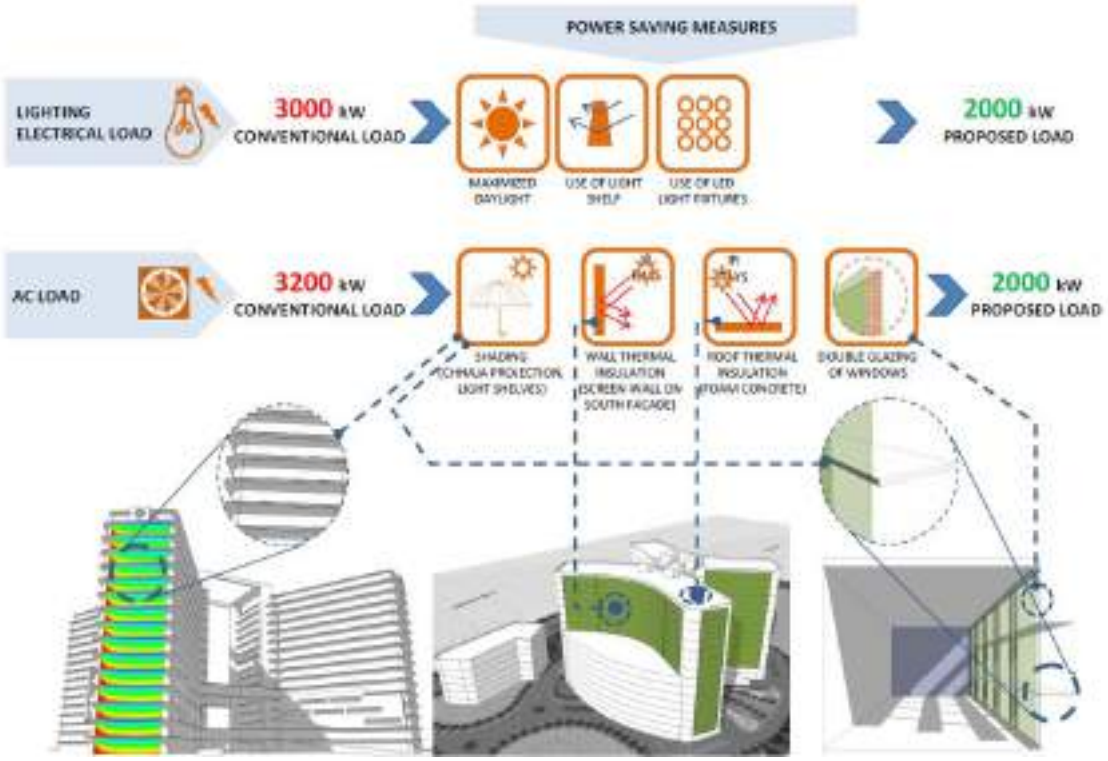
Landscape lighting by photo voltaic is estimated to save 58.3% of the street lighting power requirement based on the following calculations:

- Total length of road provided in the project is approximately = 1121 m.
- Street lights provided of 7.5 m height at the spacing of 23 m C/C.
- No. of street & Park lights = 1121/23 = 49
- Load of one LED light = 40 Watt
- Total load due to LED light= 49 x 40 = 2450 Watt or 2.45 KW
- Load of equivalent one conventional halogen light = 120 Watt
- Total load due to conventional street light = 49 X 120 = 5880 W or 5.8 KW
- Percentage energy savings by using photovoltaic landscape lights = 58.3%

Further calculations with respect to energy saving and subsequent cost saving is given in subsequent diagrams:







Solar water heating will be explored. Wind energy production, however, will not be possible at the proposed site.

12.0 TRAFFIC AND PARKING

12.1 Construction phase

A. Impact

During construction phase, large quantities of construction material will be transported to the site. This will add to increase in traffic in terms of trucks carrying construction material on the road connecting the site. It will lead to fugitive dust generation at site, emission from vehicles, noise due to movement, loading and unloading as well as congestion. Mobile construction machinery on the site also will serve as a source of pollution due to combustion of fossil fuel and fugitive emission due to movement as well as material handling.

An examination of the details of transport of tentatively estimated material for construction has been done as follows:

Sl. No.	Materials	Quantity	Units	Likely No. Of trucks over construction period
1	Bricks	25476356	Nos.	8,492 @3000/8T
2	Cement	13648048	Bags	34,120 @400/10 T
3	Steel	300.25	Tonne	30
4	Aggregate	200171.3	Cum	40,034
5	Sand	136480.5	Cum	20,472
	Road works			
6	Aggregate	18197.5	Cum	3640
7	Bitumen	145579	Kg	15

The source of the various raw materials mentioned above will be from Suppliers in Greater Mumbai district who will have sufficient availability to meet the requirement.

B. Mitigation

Since the impact of transportation is mostly on the ambient air quality, most of the following mitigation measures have already been discussed in the Section under ambient air quality but are listed below for easy co-relation with vehicular and mobile machinery use:

- During construction phase, the dust generated by transportation activities will be mitigated by sprinkling operations and the trucks shall be covered up to an optimum fill level;

- Routes of vehicles are prone to fugitive dust emission during construction stage. To avoid fugitive emissions, spraying of water shall be done regularly to stabilize these areas.

- Equipment and transport vehicle will be maintained periodically to avoid source emissions and spillage. Regular maintenance schedule will be adopted as per manufacturer's specifications;

- Preventive maintenance of all trucks, earthmovers and construction equipment shall be carried out at pre-determined intervals to ensure that exhaust emissions are maintained at the minimum practicable levels. Emissions from construction equipment and pay loaders shall be within norms due to PUC.

- Loading and unloading operations also contribute significant fugitive dust emissions. The fugitive dust during loading and unloading will be controlled by water spraying except in the case of raw materials like cement, which will adversely effect the properties of the raw material.

- Transportation of loose building materials to the construction site will be carried out in covered trucks to minimize fugitive dust.

- On-Road- Inspection would be done for black smoke generating machinery

- Reducing the speed of a vehicle to 20 kmph can reduce emissions by a large extent. Thus, speed bumps will be used to ensure speed reduction.

- Roads will be made black topped/ concrete or paving done at the earliest and regularly maintained;

- Provision of tyre wash will be considered at the exit point from the plot so that dust stuck to tyres of exiting trucks is washed off and does not contribute to the fugitive emissions on the public roads

Traffic poses risk of accidents, hence, precautions for minimising accidents are also proposed as follows:

- Trucks, vehicles and other machinery will require to have a mechanism of reversing horn so that any persons standing behind the vehicle gets prior warning.

- Drivers will be sensitised to the driving carefully and with full awareness of there surroundings so that risk of accident is minimised

- Drivers will be prohibited from drinking and driving

- Warning boards and signages will be put up at relevant places to warn both drivers and pedestrians for any safety measures and precautions to be taken, such as at crossings.

- The entry and exit of vehicles into the site will be recorded

- Whenever any high-accident risk unloading activity can take place such as unloading of large girders, etc., there shall be guards present around to redirect traffic and the area will be restricted to pedestrian access and movement

12.2 Operation phase

A. Impact

The impact of traffic during operation phase in terms of:

- Nature --> negative, since, there will be increase in traffic volume on public roads due to the project
- Duration--> short term but perennial. The impact will be experienced during day time only, peaking during morning & evening. However, the scenario will prevail on all working days of a year and therefore will be perennial
- Reversibility--> reversible, since, on non working days, impact will be non existent.
- Magnitude --> high since the contribution of traffic from custom house will be 72% of the total traffic on the Sewri Chembur road, which is neither a high number.

The movement of this population as well as transport of materials of daily consumption will add to the traffic. The increase in traffic will lead to increase in vehicular emissions causing air pollution. Assuming that the custom office will operate from 09:00 to 17:30 hours, use of transport vehicles by the staff will result in significant increase in traffic density during 9:00 AM in the morning and 17:30 PM in the evening, thereby causing short term impact. The office goers and floating/visitors would generate traffic during the two peak periods one in morning time and second one in evening time.

Traffic projections in future

About 11870 people are expected to travel to and from the custom office daily during operation phase. They will use various modes of transportation such as cars (approximately 40%), 2 wheelers (approximately 35%) and public transport (approximately 25%). Thus, the anticipated traffic to and from the site due to 4 & 2 wheelers in terms of equivalent Passenger Car Units are anticipated as follows:

Type of vehicle	**No. of vehicles**	**Conversion Factor**	**Equivalent PCU**	**Total traffic to & from site (in PCUs/day)**
Cars	4748	1	4748	9496
2 Wheelers	4155	0.5	2078	4156
Total				**13652**

Since the traffic originating or ending at custom house will be between approximately 9.00 am to 6.00 on i.e. 9 hours, the average hourly traffic load can be estimated as 13652 ÷ 9 = 1517 PCU/hr.

The approach road, the Anik - Wadala road, is a 4 lane divided (two way) road. As per table 2, IRC:106-1990 “guideline for capacity of urban roads in plain areas”. The recommended design service volume is 3600 PCUs per hour for arterial roads i.e roads with no frontage access but no standing vehicles and very little cross traffic. The above traffic (average 1517 PCU/hr) when added to the existing traffic load (average 2081 PCU/hr) is anticipated to be just within the carrying capacity of the road.

It was also observed that there is congestion on the road around the peak period at the junction of Salt Pan Road and Sewri-Chembur Road as well as near Bhakti Park Exit. Therefore, management of the same with the help of traffic police needs to be taken up by the project proponent as the problem will compound in future.

B. Parking provision

Parking will be provided as per norms of The Mumbai Metropolitan Region Development Authority(MMRDA). The estimated parking for the project is given in **Table 17.**

TABLE 17
PARKING CALCULATION

Sl. No.	Description	Area	Quantity
1	Upto 1500 Sqm 1 parking space every 75 Sqm.	1500	20
2	Remaining Area 1 Parking Space every 150 Sqm.	238848	1592
3	For Visitors @ 25% of 2+3		403
	Total required		**2015**
Details of Car Parking			
4	1st Basement		300
5	2nd Basement		800
6	3rd Basement		400
7	Podium		450
8	VIP Parking has been made as part of surface parking integrated with landscape garden		198
	Total		**2148**

Parking along the main arterial and interconnecting roads will be discouraged to avoid the congestion in movement. The surface and basement parking plan along with traffic management / movement has been shown in the **Fig 8** and **Fig 9.** Besides, there is also provision for 2-wheeler parking in the second basement podium level.

FIG 8: SURFACE PARKING & TRAFFIC MOVEMENT PLAN

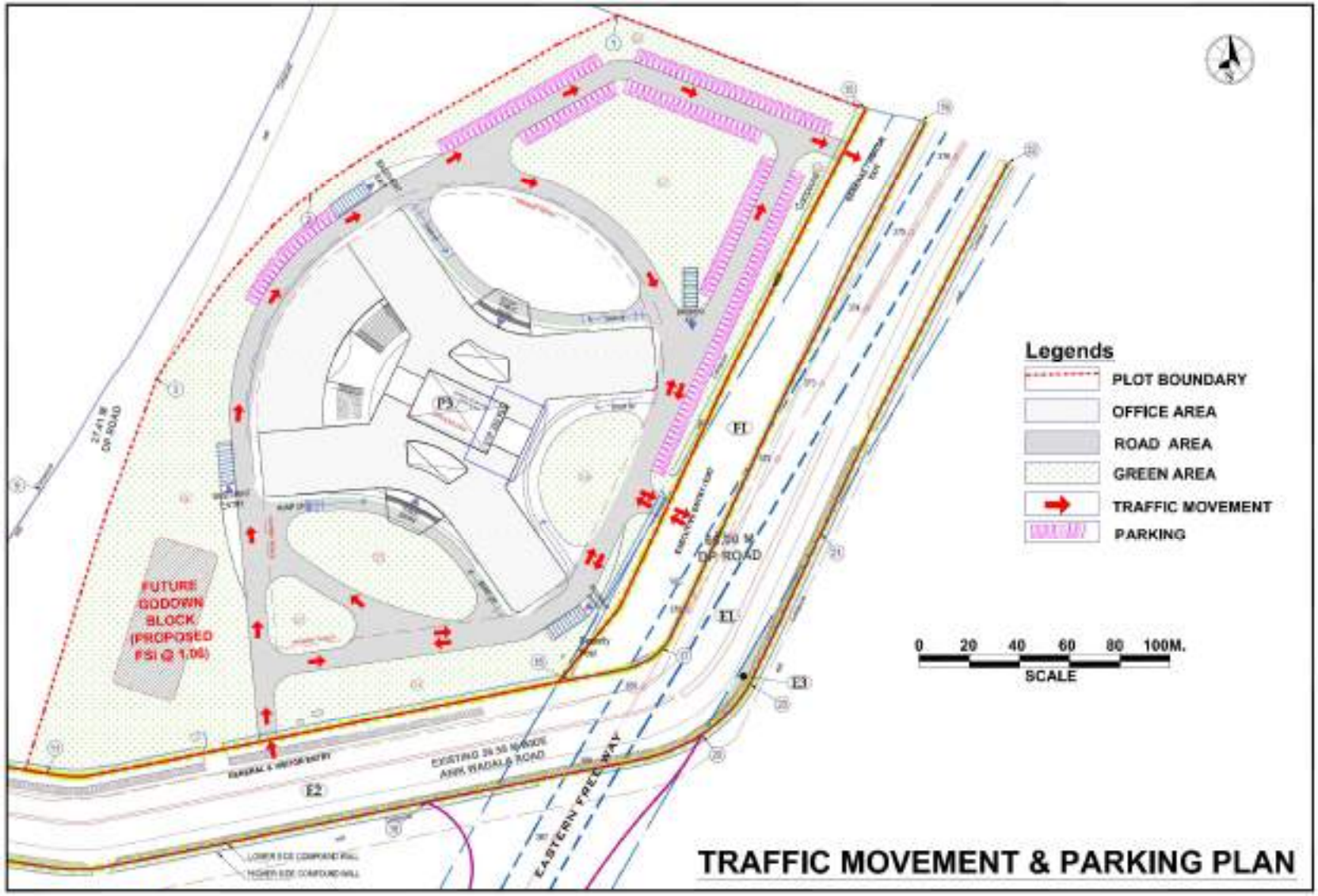
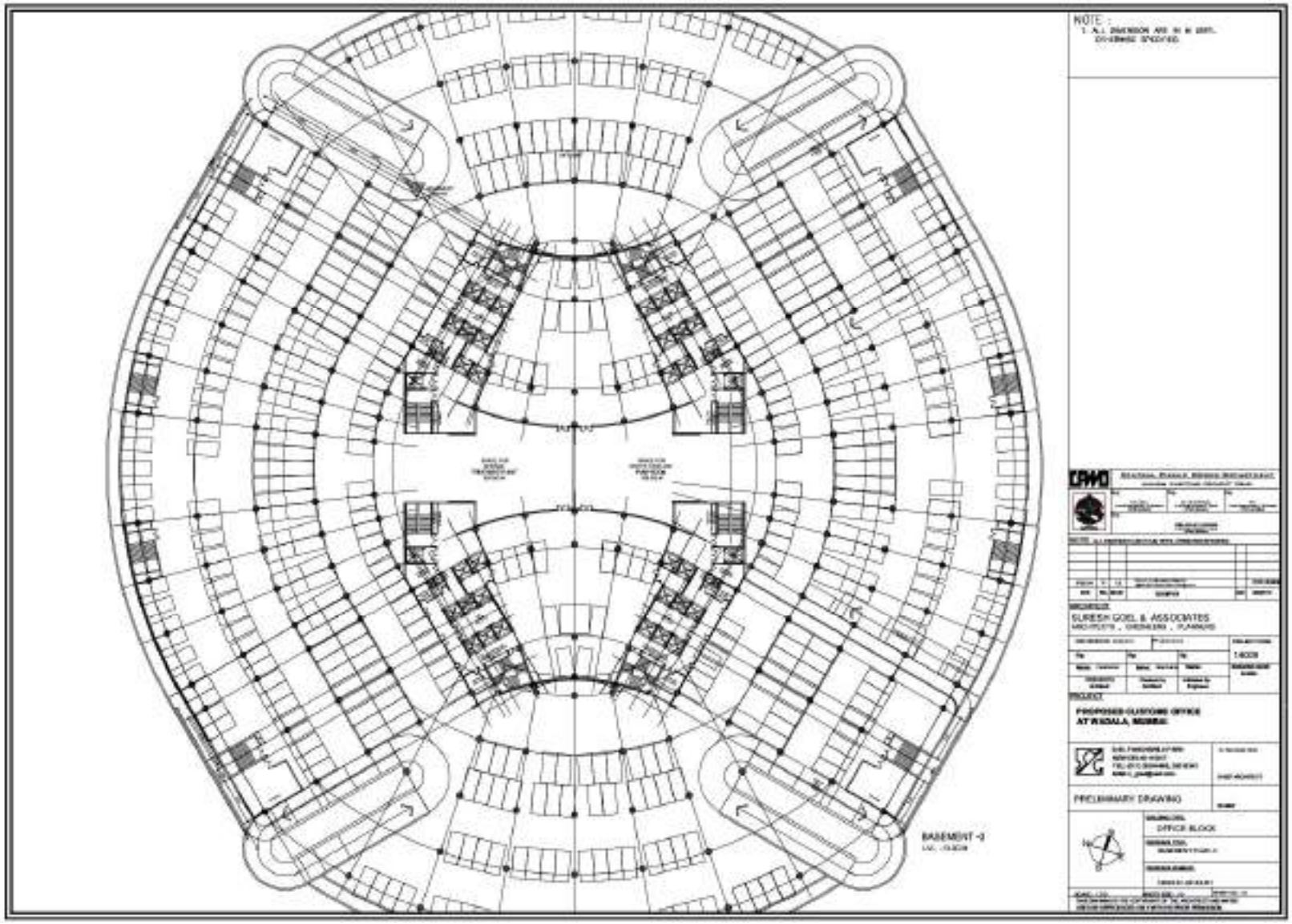


FIG 9: BASEMENT PARKING PLAN



A Comprehensive car parking management system is proposed with following facilities, the DBR:-

- Automatic counting of cars and LED display about available parking space on each parking level.
- Automatic detection of vehicular movements and audio announcement system.
- An automatic vehicular identification and Access control system based on long range radio frequency Identity.
- The system will have facility to interconnect with computer to be installed in security room with in built capability to upgrade the system.

12.2.1 Ventilation System in Basement Parking Area

As per ECBC/NBC, the ventilation has been considered in basement to meet the requirement of firefighting and maintaining the fresh air as required. In ventilation design the use of natural ventilation is incorporated and accordingly ventilation equipment is selected. The basic design for ventilation is based on “push-pull” system for fresh and exhaust air in the area. The system will be supported with CO sensor, BMS, fire control unit etc. for providing efficient ventilation. The concept is broadly out line that fresh air will be pumped through ramp naturally and mechanically by the help of suitable capacity of fans provided on the periphery of the basement and exhaust air will be thrown out with the help of ducted system for uniform ventilation in the area.

Basement is to be used for Housing the Building services like Air-conditioning plant, Pumps, substation etc. along with Car Parking Facility. The ventilation required for the location is design based on NBC-2005 guidelines and norms laid down for the area including fire department requirements etc. as required. The ventilation for basement 12 ACPH for normal condition & additional ventilation of 18 ACPH in case of fire condition providing 30 ACPH in total for the area to be used as car parking. The ventilation fan will be provided with CO sensors for controlling air quality and fire signal from fire panel at the location in the parking. The ventilation fans are VFD operated and BMS controlled for economical and efficient operation.

13.0 BUDGETARY PROVISION FOR ENVIRONMENTAL MANAGEMENT

13.1 Cost estimated for EMP

Adequate budgetary provisions have been made by the company for execution of Environment Management Plan. Expenditure on environmental matter during construction phase is given in **Table 18** and capital and

recurring cost for environmental protection during operation phase is given in **Table 19.**

TABLE 18
EXPENDITURE ON ENVIRONMENTAL MATTERS DURING CONSTRUCTION PHASE

Sl. No.	Description	Cost (Rs. lakhs)
1.	Water for Dust Suppression	28.0
2.	Site Sanitation	2.0
3.	Environmental Monitoring	3.0
4.	Disinfection	5.0
5.	Health Check Up	36.0
	Total	**74.0**

TABLE 19
CAPITAL AND RECURRING COST ESTIMATED FOR EMP

Sl. No.	Description	Cost (Rs. lakhs)	Operational & Maintenance Cost (Rs. Lakhs/year)
1.	STP	140	35
2.	Sewage and external & internal drainage system	600	60
3.	Fire fighting	0	30.0
4.	Solar lights	5.0	0.1
5.	Green belt	10.0	1.5
6.	Solid waste system	50.0	7.0
	Total	**805.0**	**133.6**

The above two tables on the cost incurred towards implementation of Environment Management Plan depicts that about Rupees 805.0 lakhs be initial capital investment and monthly the recurring cost will be approximately Rupees 133.6 lakhs.

PROJECT REPORT CUM CONCEPTUAL PLAN

1.0 INTRODUCTION

The Customs Department at Mumbai plans to build new Customs Office building to cater to various departments at Wadala, Mumbai. The proposed complex shall act as a landmark structure equipped with the latest amenities for a modern office building.

The total plot area is 56,523.13 sq.m. The proposal is envisaged to build the customs enclave in approx. 3,04,580.67 sq.m. of built-up area and all infrastructure and services are being planned for the same.The equipments and treatment facilities shall be augmented in a modular manner to cater to phase-I and II, as they are executed. Basement area will be 90,878.01 sq.m. The equipments and treatment facilities shall be augmented in a modular manner to cater to future expansion.

The complex comprises of block (comprising of records, kitchen, Auditorium for 400 people, Convention centre, Malkhana, Court rooms, Armoury, offices for various departments of customs). Basements will mainly be for parking purposes. 2nd Basement will have electric services including ESS DG set & HVAC. The 3rd basement will have STP, UG Tank, and Pump Room.

The block will have three basements, podium, ground and 29 floors above it.

Salient Features of the Project

Project Features	Description
Total plot area	56,523.13 sq.m
FSI area	2,13,702.66 sq.m
Non-FSI (Basement area)	90,878.01 sq.m
Proposed Total Built up area	3,04,580.67 sq.m
Number of Podium	1
Number of basements	3
Number of buildings	1
Number of Towers	2
Maximum height of the building	125.5
Number of parking provided	Total- 2148 198 – Surface 1500 – Basement 450 - Podium
Green area	23,783 sq.m
Ground coverage	19,930 sq.m
Area under roads	10,087 sq.m
Open space	36,593 sq.m.
Surface Parking	2,723 sq.m

Project Features	Description
Total Population	11,870
Total water requirement	671 KLD
Total fresh water requirement	414 KLD
Source of Water	Municipal Supply
Waste water generation	285 KLD
Capacity of STP, KLD	350 KLD
Total Power Demand	10000 KVA
Source of Power	MSEB
Emergency power Backup	4 x 1010 KVA DG sets
Solid waste	1.8 TPD
e-waste	3.9 Tonnes/ Year
Total Excavated soil	2,67,635.67 cum Filling of 147182 cum (Project Site) & 120453 cum (Outside the project site)
Project Cost	Rs. 1360 Crores approximately

Building comprises of the following functions:

The office complex is catering to 29 formations in 2 towers and having 5359 staff and an equal number of Trade users. The population is estimated to be:

Customs Officials	-	5935
Floating/ Visitors	-	5935
Total Users	**-**	**11870**

Proposed land use details of the project is given in **Table 1**.

TABLE 1
PROPOSED LAND USE OF AREA

Sl. No.	Land use	Area Details in sq.m	
		Area	**%**
1.	Office Building	19,930	35.26
2.	Road Area	10,087	17.85
3.	Surface parking	2,723	7.82
4.	Green Area	23,783	42.08
	Total	**56523.13**	**100.0**

2.0 POPULATION

The total population of the project is estimated as 11870 persons. Custom officials will be 5935 with 5935 visitors or floating

3.0 PARKING FACILITY

Parking facility will be provided as follows:

Location	Parking
VIP Parking has been made as part of surface Parking integrated with landscape garden	198
Podium level	450
Basement - 1 level	300
Basement - 2 level	800
Basement - 3 level	400
Total Parking Provided	**2148**

Besides, there is also provision for 2-wheeler parking in the second basement podium level.

4.0 WATER SOURCE

4.1 Construction phase

Water required for construction purpose shall be met by tankers. Domestic water supply for construction workers will be sourced through municipal supply.

Source of water pollution during construction phase has been identified as domestic sewage generated from washrooms and toilets used by construction work force. The waste water will be segregated and transferred to the mobile toilets connected to the laid out master plan sewage system. Most construction water will be absorbed during construction or evaporated during curing. Therefore, no major quantity of waste water is anticipated from construction activities.

4.2 Operation phase

Source of water considered shall be from the Municipal Mains. 414 KLD fresh water will be required for the project. Also, it is envisaged to use treated water from Sewage Treatment Plant (STP) and Softener for HVAC & irrigation system.

Water treatment

The water from the raw water tanks would be passed through a Water Treatment Plant followed by chlorination.

Underground Storage Capacity:

Description	Capacity (in KL)	Remarks

Description	Capacity (in KL)	Remarks
Fire Tank	200	As per NBC-2005
Domestic water tank	300	One day requirement of total capacity
Drinking Water Tank	50	One day requirement of total capacity
Soft Water Tank	100	
Total	**650**	

4.3 Water Supply Distribution System

Domestic Water

For pumping and distribution of domestic water, the domestic water transfer pumps will be provided in the underground water tank pump room, and then transferred to overhead domestic tank. This process will be controlled by level controllers. The supply to overhead tanks by Pressurization pumps from centralized pump room.

This process will be controlled by float valve placed in individual overhead tanks. Pressure-reducing valves shall be provided to maintain reasonable pressure in riser and down pipe. Booster pump shall be provided to maintain pressure for G+29.

Overhead Storage

From main underground domestic water storage tank, supply will be pumped up to terrace level and water will be stored in overhead domestic tanks with 33% storage capacity. Overhead tanks for each toilet block have been proposed above terrace level.

Domestic Water Distribution System

Gravity Feed System: water will be pumped from existing source to underground fire water tank, overflow to domestic water tank it will be transfers to overhead tank it will be distributed by gravity flow to various outlets. Pressurization is not required and distribution is accomplished by providing down takes to various fixtures.

The water distribution system for domestic and other usages will be through gravity feed. Piping sizing shall be based on fixture unit calculation as per NBC standard. However, the maximum velocity in the water supply piping shall not exceed 2.4 m/second. The irrigation water supply system comprising of pumping, piping, water supply nozzles and control equipment shall be designed as per landscape drawing.

Internal & External Water Supply Piping

It is proposed to use GI Medium duty pipes for all water requirements (Internal / External)

Soft (Treated) water

Soft water shall be supplied through separate transfer pumps to the Cooling Towers etc as per requirements. The pipe G.I medium duty shall be used.

5.0 SOLID WASTE MANAGEMENT

As per "Status Report on Municipal Solid Waste Management", Central Pollution Control Board, MoEF, the municipal solid waste generation in Mumbai during 2010-2011 is 6500TPD.
Source: Website:http://www.cpcb.nic.in/divisionsofheadoffice/pcp/MSW_Report.pdf

The population of Mumbai city as per Census 2011 is 12442373. Therefore, the rate of solid waste generation of Mumbai city is 0.522 kg/capita/day. Accordingly, the solid waste has been calculated (for 8 hours occupancy @ 436 gm/day) and given in **Table 2**.

TABLE 2
SOLID WASTE GENERATION

Sl. No.	Particulars	Total Population	Rate of generation kg/day/capita	Total waste, Kg/day	Tonnes/ day
1.	Customs Officials (G+29)	5935	150	890.25	0.9
2.	Floating/ Visitors	5935	150	890.25	0.9
	Total	**11870**		**1780.5**	**1.8**

6.0 ELECTRICAL INSTALLATIONS

All Electrical work shall be done as per code of practice for Electrical installations and meeting the requirements of Indian Electricity Rules/Act, applicable I.S.Codes/Rules and relevant I.S.

Specifications as below:

a) Indian Electricity act
b) Indian Electricity Rules
c) IS:732 Code of practice for Electrical Wiring Installations
d) IS:4648 Guide for Electrical Layout in residential building
e) CPWD Specifications for Internal Electrical Installation Works
f) Special requirements of MSEB.

a) Internal Electrical Installation work

It shall include the following items of work to be carried out simultaneously with the civil work within the buildings:

i) Wiring for light & Fan points.

ii) Wiring for 6A LP socket outlets.

iii) Wiring for 16A/20A Power socket outlets.

iv) L.T. Cables and Sub main wiring.

v) Rising Mains.

vi) M.V. panels and Distribution Boards.

vii) Supply and Installation of Light fittings, fans & fixtures.

viii) Earthing & lighting arrestor.

ix) Wiring for Telephones.

x) Wiring for computer networking.

xi) Fire detection and alarm system (Addressable).

xii) Occupation/ Movement sensors for lighting control.

xiii) CCTV & Access control System.

b) External Electrical Installation work

External Electrical Installation work includes:

i) 33 KV Cable from meter panel to ESS.

ii) 33 KV Panel board.

iii) 33 KV /433V Transformers.

iv) L.T. Panel with PLC Panel for Automatic Load Management.

v) D.G. Sets.

vi) Capacitor Panel.

vii) Earthing.

viii) Road Lighting.

ix) External /Compound Lighting.

x) L.T. Cables and Bus-Duct.

xi) Complete Electrical Distribution System from ESS to individual Towers/ buildings.

xi) Any other work required for complete electrification of the Complex.

xii) Façade Lighting.

c) Telephone Wiring

RJ-11 Telephone sockets outlets shall be provided in all office rooms and other areas of the buildings at convenient locations. Wiring with two pair telephone cable in recessed conduits from each telephone point shall be provided up to the telephone tag block at ground floor of each building/Block.

The telephone tag blocks shall be connected to the main tag block and EPABX through armoured telephone cables.

d) LAN/data wiring

RJ 45 data outlets points with 4 pair Cat-6 Wiring in recessed conduit or raceways are proposed in all the blocks / buildings up to the junction box at proposed switch/server location. Fibre / Cat 6 cable connection from server to Rack panels and other equipments for networking shall be provided by the specialized agency.

Electrical Power Requirement

The Connected Electrical Load for the building in comprising of two towers of 29th floors works out 13,499 KVA and Maximum Demand for electrical load considering diversity in load usage of 70% is 10,000 KVA.

Electric Sub-Station

Electric Sub-station of capacity 5x2000 KVA is proposed to be established to meet the electric load requirement of 10,000 KVA for the new Office Building. The main ESS shall be indoor Type Sub-Station complete with 33 KV panel board, dry type transformers, LT Switch gear, PLC panel for auto changeover and auto load management, Capacitor unit and all accessories as required. The substation shall be installed in the 1st basement of the building. Space for adding equipment in the sub station in future will be kept as required.

Source of Supply

Electric supply for the complex shall be received from MSEB on 33 KV from the nearest Grid Sub- Station through overhead line /Underground Cable upto the 33 KV HT meter room proposed near the Gate Complex.

D.G Set for Backup Supply

In case of Electricity failure DG Sets of following capacity have been proposed to be provided for back-up supply. The DG Sets shall be with Auto Load management, Auto synchronizing and Auto Load sharing PLC panel. Four numbers of Diesel Generator sets each of capacity 1010 KVA have been proposed for the building.

Following electrical loads shall be on DG supply in case of electricity failure.

a) All lights & fan

b) Lifts
c) Pumps
d) Compound lighting & ventilation.
e) AHUs
f) Other Emergency loads

Electrical Load Requirement for HVAC

Air Conditioning Load for 60,000 sq. metre area of the building to be air-conditioned will be 2100 TR considering a diversity of 70% in use.

The electrical load requirement for HVAC for the building is 2520 KW. This load requirement for HVAC has been considered and capacity of Sub-Station, DG set and other equipments has been decided accordingly.

TABLE 3
ELECTRICAL LOAD REQUIREMENT FOR CUSTOM OFFICE MUMBAI

Sl. No.	Description	L &F	Power	Total
1.	Basement	200	150	350
2.	Total covered area of upper floors	1187	3562	
a.	Carpet area	950		4749
b.	Common area			950
3.	Lift 28 x 15			420
4.	W/F pump			150
5.	Ext. Lighting			30
6.	A/C load - 5000 TR @ 1.1KW/TR			5500
	Total Load in KW	2337	3712	12149
	Total load in KVA (PF = 0.9)			13499
	Max Demand (Div. 0.7)			9449
	Say			**10000 KVA**
	ESS capacity proposed	**5x2000 KVA**		
	DG set			
1.	L & F			
a.	Basement			200
b.	Upper Floors			2137
2.	Ext Lighting			30

Sl. No.	Description	L &F	Power	Total
3.	Lifts			300
4.	Pumps			100
5.	Ventilation			100
6.	AHU's for air circulation			800
7.	1 No Chiller M/C 1000 TR			800
	Total Load in KW			**4467**
	Maximum demand in KW @Div 0.7			3127
	Maximum demand in KVA			3679
	Say			**3700 KVA**
	DG set capacity proposed			**4x1010 KVA EACH**

HVAC

The air conditioning is required for occupant's comfort cooling only. The total use full covered area excluding Basement is 2,13,702.66 Sq.mtrs. (G+29). The area require to be air-condition is 35% less to the total covered area excluding area for stair case, corridors, lift well, toilets etc.+2 floors(designated to be non-air-conditioned) and same are required to be ventilated as per NBC norms.

A central air conditioning system using chilled water circulation to air handling units and fan coil units is proposed.

The proposed Custom office building G+29 floors is to be centrally air conditioned for the covered area except stair cases, lift-well, Basement and Toilets etc. which are proposed to be Ventilated as required.

The pre estimated load for G+29 floor for 100% air-conditioning is works out to be 5000 TR(approx.) considering diversity @70% on total estimated load for the G+29 floors based on prediction for occupancy and utilization of the area.

To meet the present above Air-conditioning load for G+29, it is proposed to install the five nos. of Water-cooled 1000TR energy efficient microprocessor and VFD operated Centrifugal type chilling machines to take care redundancy and improve reliability of the system. These chilling machines shall work in conjunction with energy efficient VFD controlled Horizontal/Vertical Split Casing Centrifugal chilled water pump sets, various nos. of air handling units with automatic controls, MS "C" class, chilled water piping duly insulated with fittings & valves, main electrical panel with power cabling, control cabling etc. GI earthing, expansion tank and other

accessories including BMS control as shall be enumerated under detailed bill of quantities.

The water chilling machines, pump sets, electrical panel shall be installed in plant room. The cooling tower shall be located outside at ground floor along with makeup tank of suitable capacity or direct water supply from the overhead tank to cooling tower & closed type Expansion tank for makeup of water to chilled water system shall also be located on the terrace floor.

Basement Ventilation

As per ECBC/NBC, the ventilation has been considered in basement to meet the requirement of Fire fighting and maintaining the fresh air as required. In ventilation design the use of natural ventilation is incorporated and accordingly ventilation equipment is selected. The basic design for ventilation is based on “push-pull” system for fresh and exhaust air in the area. The system will be supported with CO sensor, BMS, fire control unit etc. for providing efficient ventilation. The concept is broadly out line that fresh air will be pumped through ramp naturally and mechanically by the help of suitable capacity of fans provided on the periphery of the basement and exhaust air will be thrown out with the help of ducted system for uniform ventilation in the area.

The ventilation for basement 12 ACPH for normal condition & additional ventilation of 18 ACPH in case of fire condition providing 30 ACPH in total for the area to be used as car parking. The ventilation fan will be provided with CO sensors for controlling air quality and fire signal from fire panel at the location in the parking. The ventilation fans are VFD operated and BMS controlled for economical and efficient operation.

6.1 CCTV & Access Control System

The CCTV surveillance system with varifocal box type day & night cameras to be provided in the basements. Fixed type & PTZ cameras (indoor) are proposed for entry points, corridor and stairs in each floor and in conference room. Pendent type PTZ (outdoor) cameras will be provided on poles and roof top for outdoor security. LCD monitors will be installed in security control room with other equipments for recording 30 days proceedings. The system will also provide the service for card access and alarm system for server room, record room & control centre. The system will be capable for integrating multi building functions including management & intrusion alarm for entry gates, godown, store etc.

Acoustic System for Conference Rooms, Auditoriums etc.

Sound reinforcement system will be provided in Auditorium to ensure good Quality, uniform sound distribution. The system will meet the multipurpose use of Auditorium & will support the following:-

a) Live performance on stage.

b) Lecture and seminars.

c) Audio & Video presentations.

The Sound system will have microphones, Single processing equipments, Power Amplifier and Speaker system. The committee Rooms will have wired conferencing system with sound reinforcement system having audio Recording facility table & podium microphones audio mixing console equipment rack etc. The video projection system will be proposed in Auditorium for laptop power point presentation, display of Photographs, paper notes etc. The video projection system for the committee rooms will be capable of providing clear picture from a wide range of such as laptop, Visual presenter, DVR etc. The projector will be flush mounted on ceiling. LCD type video projectors with motorized screen will be proposed. A podium of suitable design will be provided to accommodate Data Monitor, Visual presenter etc.

Public Address System

The PA system is proposed in the main building conference rooms, Auditorium and parking area to ensure uniform & good Quality sound distribution. The system will perform the

Following functions:-

a) Announcement from fire control room in case of fire.

b) Talk Back system for fire alarm system.

c) Pre-recorded announcement, Music play etc.

d) Announcement For car calling in Parking area.

The Rack mounted micro processor based control console, Amplifier and other hardware will be installed in Security / Control room. Sufficient wall & ceiling mounted speakers will be installed for uniform distribution of sound in the building. The wiring for speakers will be carried with twisted pair copper wire in recessed / surface conduit.

6.2 Data and voice networking

The G + 15 storied building will be provided with Data and voice network apart from direct telephone and internet connections.

The local area networking control station will be at ground floor. The telephone exchange and main server room will be connected to individual telephone/ computer outlets through multicore telephone cable and LAN cable. It is proposed to install patch panel and tag block in every floor. The main server will be connected to patch panel with fiber optic cable and RJ-45 computer outlets will be connected with cat – 6 LAN cable. Similarly, The Tag blocks will be connected to EPABX exchange with armored multicore telephone cables. Telephone outlets will be connected with unarmored

telephone cables drawn through metal conduits. The UPS power with 30 minute battery backup will be made available for both the system.

6.3 Building management system

The proposed Building Management System shall be a Direct Distribution Control (DDC) system. The system will be PC based. The microprocessor based DDC shall interface with sensors, actuators and environment control system, monitor for HVAC units, Chillers, AHUs, Pumps, Lifts, Substation equipments, DG sets etc. The central control station will be in ground floor control room with LCD monitor for viewing & Laser printer for monitoring the BMS system. The control wiring will be carried out with 2 core 1.5 sq m twisted pair shielded cable in PVC conduit.

6.4 Griha

Provision of green building has been made so as to reduce energy and water consumption. In the design of the building, provision has been made for following:

1. Sustainable site planning.
2. Water Management.
3. Energy Optimization.
4. Sustainable building materials.
5. Waste management.
6. Health & well being.
7. Building operations & maintenance.
8. Innovation.

The building is proposed to be four star rating.

GRIHA RATINGS

Low power consumption fixtures

Water conservation & recycling

Solar street lighting

Sewerage recycling and solid waste management

S.No.	Criteria No.	Description	Points
1	C-2	Preserve and Protect Landscape during Construction	5
2	C-4	Design to include existing site features	4
3	C-5	Reduce Hard Paving on Site	2
4	C-6	Enhance outdoor lighting system efficiency	3
5	C-7	Plan utilities efficiently and optimize on site circulation efficiency	3
6	C-10	Reduce Landscape Water Requirement	3
7	C-11	Reduce Building Water Use	2
8	C-13	Optimize building design to reduce conventional energy demand	8
9	C-14	Optimize Energy performance of building within specified comfort limits	16
10	C-15	Utilization of Fly-Ash in building structure	6
11	C-16	Reduce volume, weight and time of construction by adopting efficient technology, for example pre-cast systems, ready mix concrete and so on)	4
12	C-17	Use of Low Energy Materials in Interiors	4
13	C-18	Renewable Energy Utilization	5
14	C-20	Waste Water Treatment	2
15	C-21	Water recycle and reuse (including rainwater)	5
16	C-25	Resource recovery from waste	2
17	C-26	Use of low VOC paints/ adhesives/ sealants	3
18	C-27	Minimize Ozone depleting substances	1
19	C-28	Ensure Water Quality	2
20	C-29	Acceptable Outdoor and Indoor Noise Levels	2
21	C-30	Tobacco and Smoke Control	1
22	C-31	Universal accessibility	1
23	C-34	Innovation (beyond 100)	4
		Total	**88**

TOTAL GRIHA POINTS TO BE ACHIEVED = 88 POINTS
= **4 STAR RATING**

VIEW + AMBIENCE + USER COMFORT+ ENERGY OPTIMISATION

7.0 CONSTRUCTION SCHEDULE

Construction Of Custom Office,Mumbai

SH:Consultancy Planning Works

Date Of Start:23.06.2014

Sr.Nos. (1)	Stage (2)	Days (cumul) (3)	Months
			JUL.14 AUG.14 SEP.14 OCT.14 NOV.14 DEC.14 JAN.15 FEB.15 MAR.15 APR.15 MAY.15 JUN.15 JUL.15 JUN.16 JUL.16 JUN.17 JUL.17 OCT.17 NOV.17 DEC.17 JAN.18 JUN.18
A	**Preliminary Stage**		
A1	Submission of panel of sub-consultant & Model	30	
A2	Data Based Report	60	
A4	Preliminary estimate	60	
A5/A6	Submission to local body & Approval	180	
A8	Issue of Commencement Certificate from MMC	240	
B	**Working Drawings & Tendering Stage:**		
B1	Detailed Working drawings	150	
B2	DB/NIT/Press Notice	150	
B3	Structural Drawings upto Plinth	180	
B4	Structural drawings of Superstructure	270	
B5	Finalisation of Architectural drawings of Civil/Electrical Services	360	
B6	Finalisation of Interior Drawings	720	
C	**Construction Stage:**		
C0	Construction of Foundation	[240-360]	
C1	Approval at Plinth level from MMC	360	
C2	Execution Stage	1200	
D	**Completion Stage**		
D1	Submission of Completion drawings	1200	
D2	Obtaining completion certificates	1275	
D3	Obtaining occupation certificates	1275+60d	

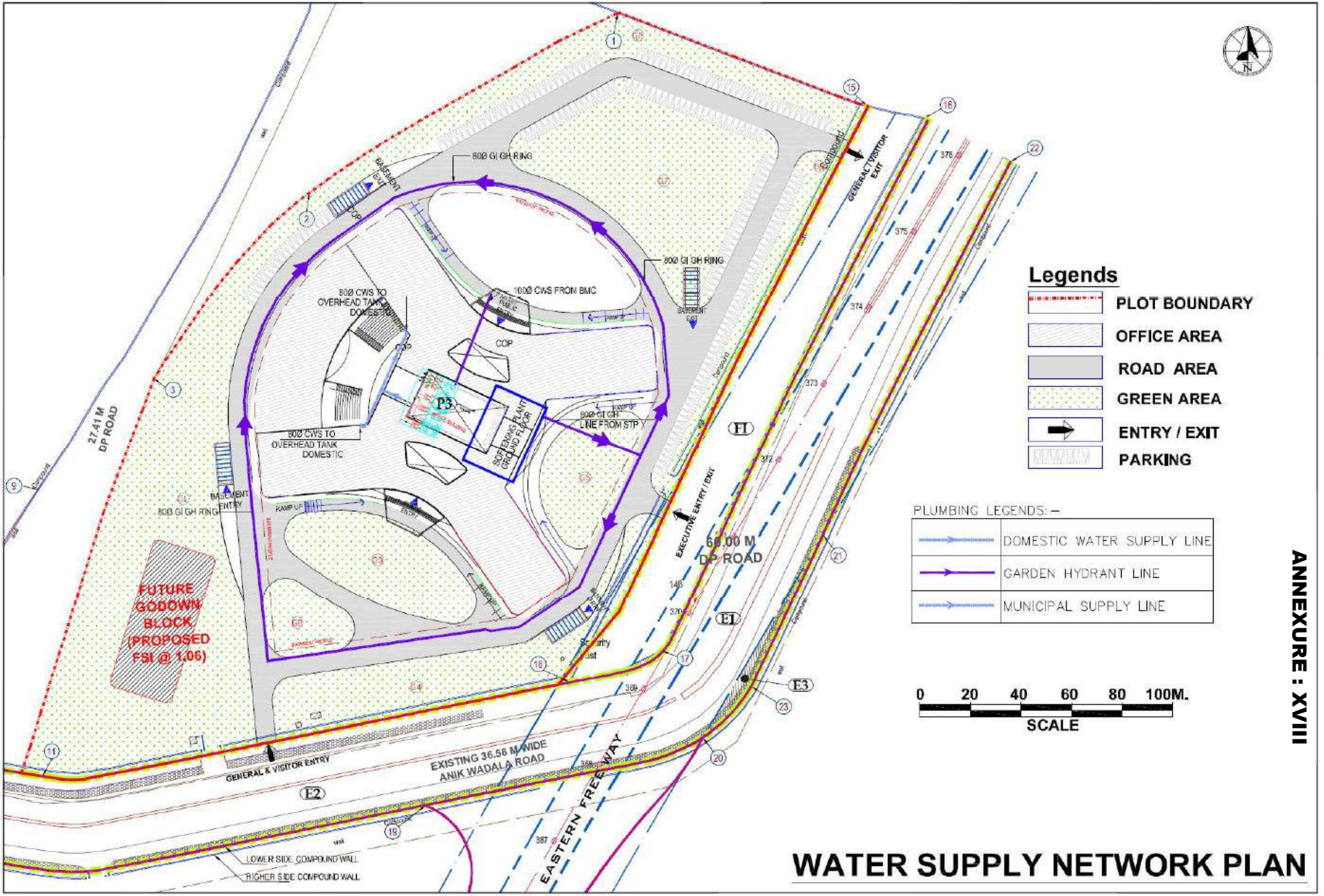
Legend:

Target

Achievement

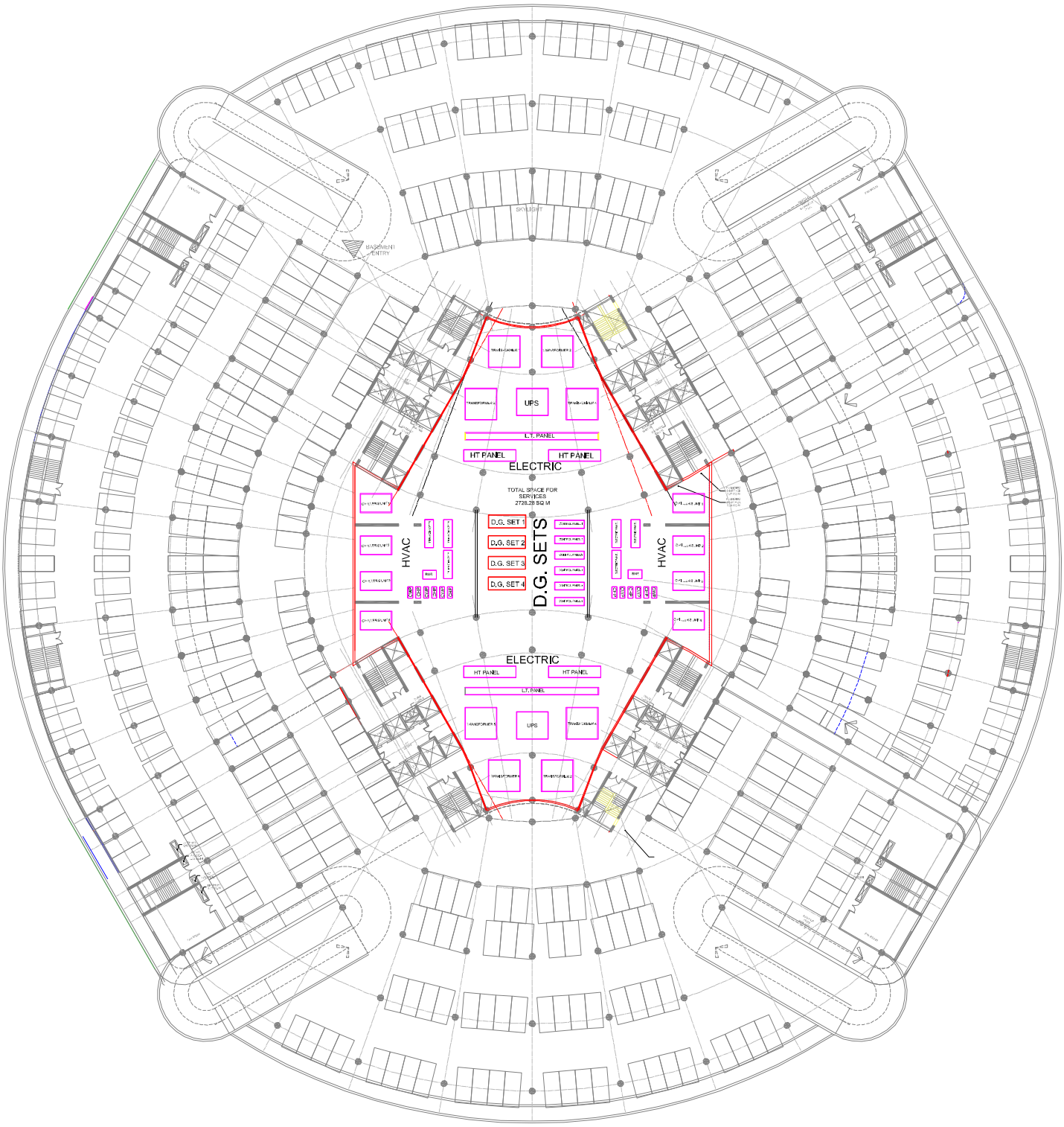
CLIENT:	CENTRAL PUBLIC WORKS DEPARTMENT
PROJECT:	CONSTRUCTION OF OFFICE COMPLEX AT CUSTOMS ENCLAVE, WADALA (EAST), MUMBAI
TITLE:	FORM–1
	SURFACE FEATURE WITHIN 500M. RADIUS
DRAWN BY: RANJEET K.	CHECKED BY: M. SHARMA
SCALE : AS SHOWN	DATE : 01–10–2014
FIG. NO.	

ANNEXURE : XVII

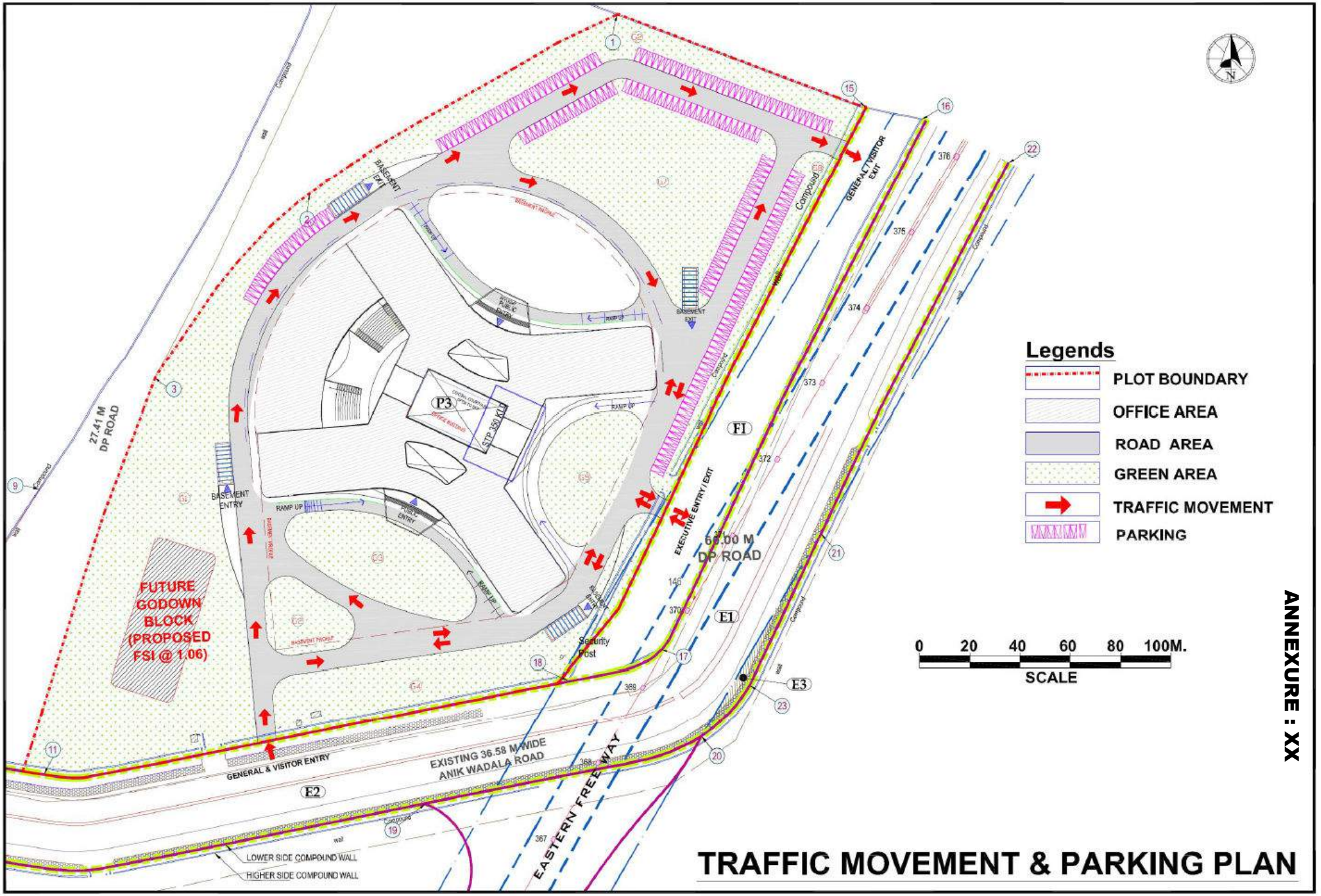


WATER SUPPLY NETWORK PLAN

ANNEXURE : XIX



LOCATION OF DG SETS IN BASEMENT 1



TRAFFIC MOVEMENT & PARKING PLAN

ANNEXURE : XX

ANNEXURE : XXI

FIRE PUMPS:–

F1	DIESEL ENGINE DRIVEN PUMP.
F2	FIRE HYDRANT ELECTRIC PUMP.
F3	SPRINKLER PUMP.
F4	JOCKEY PUMP.

FIRE FIGHTING LEGENDS:–

SL.NO.	DESCRIPTION	LEGEND
1	150øEXTERNAL FIRE MAIN RING	
2	SUCTION COUPLING	
3	TWO WAY FIRE BRIGADE INLET	
4	FOUR WAY FIRE BRIGADE INLET	
5	EXTERNAL FIRE HYDRANT	EFH

FIRE LEGEND:–

	FIRE HOSE CABINET
	150ø M.S FIRE PIPE
	BUTTER FLY VALVE
	NON–RETURN VALVE
F.B.C	FIRE BRIGADE CONNECTOIN
M.S	MILD STEEL
	FIRE BRIGADE INLET CONNECTION

0 20 40 60 80 100M.

SCALE

GREEN BELT

36.58 M DP ROAD

150Ø MS FIRE WET RISER

200Ø EXTERNAL FIRE RING MAIN

EFH

FHC

BASEMENT PROFILE

SETBACK LINE

SURFACE CAR PARK - 21NOS IN NOS

GENERAL / VISITOR EXIT

EXECUTIVE ENTRY / EXIT

200Ø FIRE HEDER EXTERNAL

4WAY FIRE BRIGADE INLET CONNECTION B.F.VALVE NON RETURN VALVE

27.41 M DP ROAD

RD 2

RD 6

CS NO 146

60.00 M DP ROAD

DP ROAD (Re - Aligned)

GENERAL & VISITOR ENTRY

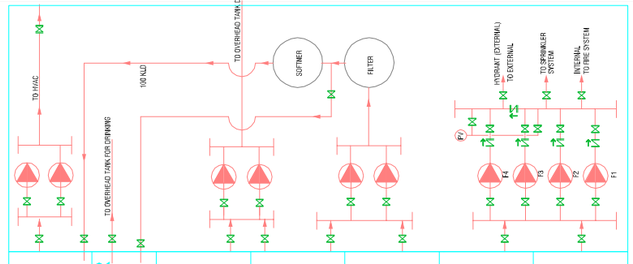
GR I

G1

G2

G5

UGT & PUMP ROOM ARRANGEMENT



FIRE FIGHTING PLAN

APPENDIX - I

'F' NORTH WARD

STATEMENT OF EXISTING AND PROPOSED PUBLIC AMENITIES IN THE SANCTIONED REVISED DEVELOPMENT PLAN 1981 - 2001

Sr. No.	Amenity	Existing Amenities		Amenities proposed in the revised sanctioned Development Plan		Total Proposed + Existing		Remarks
		No.	Area in sq. mts	No.	Area in sq. mts	No.	Area in sq. mts	
1.	**Open space**							
	a) Recreation Ground	39	227956	23	285170	62	513126	
	b) Parks	—	--	—	—	—	—	
	c) Play Grounds	22	140929	13	42309	35	183238	
	d) Stadia	1	7216	--	—	1	7216	
	e) Swimming Pools	—	--	1	10750	1	10750	
	f) Amenity Open Space	—	—	1	42242	1	42242	
	g) Gardens			2	6920	2	6920	
	h) Gymnasiums	2	6278	-	—	2	6278	
2.	**Education**							
	a. Municipal Primary Schools and Private Primary School	20	40518	12	43454	32	83972	
	b) Secondary School	28	107282	7	23037	35	130319	
	c) Colleges & Polytechnics	7	156399	2	14662	9	171061	
	d) Technical & Other	3	76501	1	36872	4	113373	
3.	**Medical Relief**							
	a) General Hospitals & Specific Hospital	1	78876	2	28343	3	107219	

P.N. 9

ANNEXURE : XXII

APPENDIX - I (Contd.) 'F' NORTH WARD

Sr. No	Amenity	Existing Amenities		Amenities proposed in the revised sanctioned Development Plan		Total Proposed - Existing		Remarks
		No	Area in sq. mts.	No.	Area in sq. mts.	No.	Area in sq. mts.	
	b) Maternity Home	2	6352	2	3996	4	9348	
	c) Dispensary	2	978	4	7958	6	8936	
	d) Medical Centre	1	296	1	2423	2	2719	
	e) Sanitoriums	2	38260	—	—	2	38260	
	f) Leprosy Home	1	61616	—	—	1	61616	
	g) Health Complex	—	—	1	20300	1	120300	
4.	Market	5	12915	7	41823	12	54738	
5.	Library	1	672	1	2006	2	2678	
6.	Welfare Centre	3	9146	3	5120	6	12266	
7.	Fire Brigade	1	1810	1	12276	2	14086	
8.	Cemeteries & Cremation Ground	5	61536	1	585	6	62121	
9	Housing							
	a) Municipal Housing	2	13196	3	17729	5	30925	
	b) Housing for dishoused	1	62310	15	136589	16	198899	
	c) Public Housing	7	78503	9	37872	16	116375	

APPENDIX - I (Cont.) **'F' NORTH WARD**

Sr. No.	Amenity	Existing Amenities		Amenities proposed in the revised sanctioned Development Plan		Total Proposed + Existing		Remarks
		No	Area in sq. mts	No.	Area in sq. mts.	No.	Area in sq. mts.	
d)	Other Housing such as							
	Institutional	—	—	1	17760	1	17760	
	Govt. Housing, Police Housing.	—	—	—	—	—	—	
	Court Housing, Dhobi Housing.	—	—	—	—	—	—	
	Telephone Housing	—	—	—	—	—	—	
10.	**Public Utility**							
A	WATER							
a)	Reservoirs (Low Level	—	—	1	26803	1	26803	
b)	H.Es land	—	—	—	—	—	—	
c)	Pump Houses - Stations			—	—	—	—	
d)	Water Works	—	—	—	—	—	—	
B	DRAINAGE							
a)	Drainage Purification Works	—	—	2	5976	2	5976	
b)	Balancing Reservoir	—	—	—	—	—	—	
c)	Lagoons	—	—	—	—	—	—	
d)	Pumping Stations	5	7641	—	—	5	7641	
C	REFUSE DISPOSAL							
a)	Night Soil Depot	—	—	—	—	—	—	
b)	Refuse Transfer Str	—	—	—	—	—	—	

F.N. 11

ANNEXURE : XXII Contd..

APPENDIX - I (Cont.) **'F' NORTH WARD**

Sr No.	Amenity	Existing Amenities		Amenities proposed in the revised sanctioned Development Plan		Total Proposed + Existing		Remarks
		No.	Area in sq. mts.	No.	Area in sq. mts	No.	Area in sq. mts	
	c) Refuse Sheds	—	—	—	—	—	—	
	d) Conservancy Chowkies / Ward Chowkies	—	—		-		—	
	D. ELECTRICITY							
	a) Receiving Stations - 2 (BEST)	1	1537	2	4925	3	6462	
	b) Sub-Stations	—	—	—	—	—	—	
	c) Tata Receiving Stn.	—	—	1	5980	1	5980	
	E POST & TELEGRAPH							
	a) Post Office	5	7591	—	—	5	7591	
	b) Telephone Exchange†	1	1388	1	5292	2	6680	
	c) Telephone Service Centre	—		—	—	—	—	
	F. POLICE STATIONS	1	7028	—	—	1	7028	
11.	Communications							
	a) Roads	—	—	—	—	—	—	
	b) Railways	—	—	—	—	—	—	
	c) BEST Depot	3	98911	2	6172	5	105083	
	d) Goods Truck Terminal	—	—	—	—	—	—	
	e) Parking Lots	2	5202	4	10463	6	15665	
	f) S.T. Depots etc	—	—	—	—	—	—	
	g) Transport Garage	—	—	—	—	—	—	
	h) Airport	—	—	—	—	—	—	
	i) Jetty's	—	—	—	—	—	—	

P/N - 12

ANNEXURE : XXII Contd..

APPENDIX - II (Cont.) **'F' NORTH WARD**

Sr No	Purpose of the Proposed reservation	Location	C.S. No.	Area in sq. mts	Remarks
1	2	3.	4	5	6.
2 (33)	Secondary School	Maturga, Near Gaun Hindu Cemetery, Shaikh Mistry Road	317 (p), 15/292 (p), 292 (p), 4/292 (p), 5/292 (p) 11/292 (p), 293 (p), 294 (p), 3/294 (p)	2725	
3 (53)	Secondary Schoo	Salt Pan Sion, C.P.W.D. Layout in Anik Wadala Scheme	88 (p)	5637	
4 (53)	Secondary Schoo	Salt Pan Sion, Salt Pan Area	2 (p)	2173	
5 (105)	Extn. to Secondary School	Sion Matunga Estate Scheme 6 (East) Road No. 29 & 20-A.	171, 172, 173, 189 190	1289	
6 (115)	Secondary School	Anik Wadala Anik Wadala Layout		6000	
7 (129)	Secondary School	Matunga Along proposed 70 ft. wide D.P. Road	1/298 (p), 146 (p), 1/145 (p), 143 (p)	1506	
8 (108)	Educational Complex	Sall Par, Sall Par Division	2 (p)	36,672	
9	Extn. to College	Sewri Wadala Estate Scheme 57, South Tilak Road	Plot No. 9	13,331	
10 (17)	College	Sion Matunga Estate Sch. 6 (West). Opp. Road No. 29. Sion Matunga Estate	Plot Nos. 71-72 & part of Muni land to the south of these plots	1331	

F/N - 20

ANNEXURE : XXII Contd..

APPENDIX - I (Cont.) **'F' NORTH WARD**

Sr. No.	Amenity	Existing Amenities		Amenities proposed in the revised sanctioned Development Plan		Total Proposed + Existing		Remarks
		No.	Area in sq. mts.	No.	Area in sq. mts.	No.	Area in sq. mts	
2.	**Miscellaneous**							
a)	Municipal Office	1	4812	1	5424	2	10236	
b)	Govt Offices Enquiry	1	809	2	1944	3	2752	
c)	Office Govt. (CPWD)	—	—	2	19668	2	19668	
d)	Dog Kennel	—	—	—	—	—	—	
e)	Cattle Ponds	—	—	—	—	—	—	
f)	Tanks	3	9413	—	—	3	9413	
g)	Road Depot & Chowky	—	—	1	557	1	557	
h)	Octroi Office	—	—	—	—	—	—	
i)	Community Centre	—	—	2	1944	2	1944	
j)	Cinema/Drama Theatres	2	3327	—	—	2	3327	
k)	Public Halls	1	4092	—	—	1	4092	
l)	Municipal Printing Press	—	—	—	—	—	—	
m)	Museums	—	—	—	—	—	—	
n)	Net Drying Yards and Fishing Activities	—	—	—	—	—	—	
o)	Shopping Centres	1	2121	1	1000	2	3121	
p)	Industrial Estate	—	—	—	—	—	—	
q)	Service Industrial Estate	—	—	—	—	—	—	
r)	Godowns / Spl. Godowns	—	—	—	—	—	—	
s)	Dharmashala & Students Hostel, Temple	1	5263	—	—	1	5263	

(Note : the areas mentioned above are tentative.)

F/N - 13

ANNEXURE : XXII Contd..

ANNEXURE : XXIII

DISPERSION MODEL FOR ANTICIPATING THE GROUND LEVEL CONCENTRATION (GLC'S) OF AIR POLLUTANTS FROM OPERATION OF 4 X 1010 KVA D.G. SETS IN CUSTOM HOUSE, MUMBAI

Ground Level Concentration (GLC) of SPM has been calculated for multi-stack dispersion modelling using double Gaussian diffusion equation : IS 8829-1978 and as per 'Assessment of Impact to Air Environment : Guidelines for Conducting Air Quality Modelling' by CPCB, Delhi, (PROBES/70/1997-98).

$$X_{(x,y,z)} = \frac{Q}{2\pi\sigma_y\sigma_z Up} \exp\left(-\frac{1}{2}\frac{(y^2)}{\sigma y^2}\right) \left[\exp\left\{-\frac{1}{2}\frac{(z-he)^2}{\sigma z^2}\right\}\right]+\left[\exp\left\{-\frac{1}{2}\frac{(z+he)^2}{\sigma z^2}\right\}\right]$$

Where :

$X_{(x, y, z)}$	=	Ground level concentration of pollutant in micro g/cum at the point with co-ordinates (x,y,z).
x	=	Down wind distance in m.
y	=	Cross wind distance in m.
z	=	Vertical distance in m.
he	=	Effective stack height in m.
Q	=	Pollutant emission rate in µg/sec.
σ_y	=	Standard deviation of pollutant plume width in cross wind direction in m.
σ_z	=	Standard deviation of pollutant plume width in vertical direction in m.
Up	=	Mean stack top wind speed in m/sec.

BASIC CONDITIONS

Diurnal variation of the hourly mixing height as per "ATLAS OF HOURLY MIXING HEIGHT AND ASSIMILATIVE CAPACITY OF ATMOSPHERE IN INDIA" published by Ministry of Earth Sciences, India Meteorological Department, Govt. of India, New Delhi from 07:00 hrs IST to 19:00 hrs IST as given in Table 1.

TABLE 1
HOURLY MIXING HEIGHT (M)

Hour	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00
Height	40-80	80-120	200-250	450-550	700-800	1000-1100	1250-1350	1400-1550	1300-1500	1250-1350	1100-1200	625-825	600-700

The stack details are given in Table 1 and the assumed receptors are given in Table 2. The stability classes are given in Table 3 for the monitored data of 24 hrs. The 24 hrs average Ground Level Concentrations has been calculated for PM_{10}, $PM_{2.5}$, SO_2, NOx and CO which are given in Table 4.

TABLE 1
STACK DETAILS

Sl No	Stack name	Height (m)	Dia (m)	Temp (℃)	Exit gas Volume (m^3/s)	Exit vel. (m/s)	Emission rate (µg/s)				
							PM_{10}	$PM_{2.5}$	SO_2	NO_X	CO
1	DG1 (1010 KVA)	30	0.29	225	1.77	26.1	21836	12556	258111	446429	582299
2	DG2 (1010 KVA)	30	0.29	225	1.77	26.1	21836	12556	258111	446429	582299
3	DG2 (1010 KVA)	30	0.29	225	1.77	26.1	21836	12556	258111	446429	582299
4	DG2 (1010 KVA)	30	0.29	225	1.77	26.1	21836	12556	258111	446429	582299

TABLE 2
DESCRIPTION OF ASSUMED RECEPTORS FROM THE STACK

Receptor name	Distance (m)	Direction (deg.)	Receptor name	Distance (m)	Direction (deg.)	Receptor name	Distance (m)	Direction (deg.)
N-1	100.0	0.00	ESE-6	600.0	112.50	SW-11	7000.0	225.00
N-2	200.0	0.00	ESE-7	800.0	112.50	SW-12	10000.0	225.00
N-3	300.0	0.00	ESE-8	1000.0	112.50	WSW-1	100.0	247.50
N-4	400.0	0.00	ESE-9	2000.0	112.50	WSW-2	200.0	247.50
N-5	500.0	0.00	ESE-10	5000.0	112.50	WSW-3	300.0	247.50
N-6	600.0	0.00	ESE-11	7000.0	112.50	WSW-4	400.0	247.50
N-7	800.0	0.00	ESE-12	10000.0	112.50	WSW-5	500.0	247.50
N-8	1000.0	0.00	SE-1	100.0	135.00	WSW-6	600.0	247.50
N-9	2000.0	0.00	SE-2	200.0	135.00	WSW-7	800.0	247.50
N-10	5000.0	0.00	SE-3	300.0	135.00	WSW-8	1000.0	247.50
N-11	7000.0	0.00	SE-4	400.0	135.00	WSW-9	2000.0	247.50
N-12	10000.0	0.00	SE-5	500.0	135.00	WSW-10	5000.0	247.50
NNE-1	100.0	22.50	SE-6	600.0	135.00	WSW-11	7000.0	247.50
NNE-2	200.0	22.50	SE-7	800.0	135.00	WSW-12	10000.0	247.50
NNE-3	300.0	22.50	SE-8	1000.0	135.00	W-1	100.0	270.00
NNE-4	400.0	22.50	SE-9	2000.0	135.00	W-2	200.0	270.00
NNE-5	500.0	22.50	SE-10	5000.0	135.00	W-3	300.0	270.00
NNE-6	600.0	22.50	SE-11	7000.0	135.00	W-4	400.0	270.00
NNE-7	800.0	22.50	SE-12	10000.0	135.00	W-5	500.0	270.00
NNE-8	1000.0	22.50	SSE-1	100.0	157.50	W-6	600.0	270.00
NNE-9	2000.0	22.50	SSE-2	200.0	157.50	W-7	800.0	270.00
NNE-10	5000.0	22.50	SSE-3	300.0	157.50	W-8	1000.0	270.00
NNE-11	7000.0	22.50	SSE-4	400.0	157.50	W-9	2000.0	270.00
NNE-12	10000.0	22.50	SSE-5	500.0	157.50	W-10	5000.0	270.00
NE-1	100.0	45.00	SSE-6	600.0	157.50	W-11	7000.0	270.00
NE-2	200.0	45.00	SSE-7	800.0	157.50	W-12	10000.0	270.00
NE-3	300.0	45.00	SSE-8	1000.0	157.50	WNW-1	100.0	292.50
NE-4	400.0	45.00	SSE-9	2000.0	157.50	WNW-2	200.0	292.50
NE-5	500.0	45.00	SSE-10	5000.0	157.50	WNW-3	300.0	292.50
NE-6	600.0	45.00	SSE-11	7000.0	157.50	WNW-4	400.0	292.50
NE-7	800.0	45.00	SSE-12	10000.0	157.50	WNW-5	500.0	292.50
NE-8	1000.0	45.00	S-1	100.0	180.00	WNW-6	600.0	292.50
NE-9	2000.0	45.00	S-2	200.0	180.00	WNW-7	800.0	292.50
NE-10	5000.0	45.00	S-3	300.0	180.00	WNW-8	1000.0	292.50
NE-11	7000.0	45.00	S-4	400.0	180.00	WNW-9	2000.0	292.50

ANNEXURE : XXIII Contd..

Receptor name	Distance (m)	Direction (deg.)	Receptor name	Distance (m)	Direction (deg.)	Receptor name	Distance (m)	Direction (deg.)
NE-12	10000.0	45.00	S-5	500.0	180.00	WNW-10	5000.0	292.50
ENE-1	100.0	67.50	S-6	600.0	180.00	WNW-11	7000.0	292.50
ENE-2	200.0	67.50	S-7	800.0	180.00	WNW-12	10000.0	292.50
ENE-3	300.0	67.50	S-8	1000.0	180.00	NW-1	100.0	315.00
ENE-4	400.0	67.50	S-9	2000.0	180.00	NW-2	200.0	315.00
ENE-5	500.0	67.50	S-10	5000.0	180.00	NW-3	300.0	315.00
ENE-6	600.0	67.50	S-11	7000.0	180.00	NW-4	400.0	315.00
ENE-7	800.0	67.50	S-12	10000.0	180.00	NW-5	500.0	315.00
ENE-8	1000.0	67.50	SSW-1	100.0	202.50	NW-6	600.0	315.00
ENE-9	2000.0	67.50	SSW-2	200.0	202.50	NW-7	800.0	315.00
ENE-10	5000.0	67.50	SSW-3	300.0	202.50	NW-8	1000.0	315.00
ENE-11	7000.0	67.50	SSW-4	400.0	202.50	NW-9	2000.0	315.00
ENE-12	10000.0	67.50	SSW-5	500.0	202.50	NW-10	5000.0	315.00
E-1	100.0	90.00	SSW-6	600.0	202.50	NW-11	7000.0	315.00
E-2	200.0	90.00	SSW-7	800.0	202.50	NW-12	10000.0	315.00
E-3	300.0	90.00	SSW-8	1000.0	202.50	NNW-1	100.0	337.50
E-4	400.0	90.00	SSW-9	2000.0	202.50	NNW-2	200.0	337.50
E-5	500.0	90.00	SSW-10	5000.0	202.50	NNW-3	300.0	337.50
E-6	600.0	90.00	SSW-11	7000.0	202.50	NNW-4	400.0	337.50
E-7	800.0	90.00	SSW-12	10000.0	202.50	NNW-5	500.0	337.50
E-8	1000.0	90.00	SW-1	100.0	225.00	NNW-6	600.0	337.50
E-9	2000.0	90.00	SW-2	200.0	225.00	NNW-7	800.0	337.50
E-10	5000.0	90.00	SW-3	300.0	225.00	NNW-8	1000.0	337.50
E-11	7000.0	90.00	SW-4	400.0	225.00	NNW-9	2000.0	337.50
E-12	10000.0	90.00	SW-5	500.0	225.00	NNW-10	5000.0	337.50
ESE-1	100.0	112.50	SW-6	600.0	225.00	NNW-11	7000.0	337.50
ESE-2	200.0	112.50	SW-7	800.0	225.00	NNW-12	10000.0	337.50
ESE-3	300.0	112.50	SW-8	1000.0	225.00	A2	1968.0	264.00
ESE-4	400.0	112.50	SW-9	2000.0	225.00	A3	3278.0	109.00
ESE-5	500.0	112.50	SW-10	5000.0	225.00	A4	6441.0	52.00

TABLE 3
HOURLY STABILITY FREQUENCY

HOUR	OCCURRENCE OF STABILITY CLASSES (in %)					
	A	B	C	D	E	F
0.00	0.00	0.00	0.00	1.15	4.60	94.25
1.00	0.00	0.00	0.00	1.20	7.23	91.57
2.00	0.00	0.00	0.00	2.41	9.64	87.95
3.00	0.00	0.00	0.00	1.23	14.81	83.95
4.00	0.00	0.00	0.00	3.53	10.59	85.88
5.00	0.00	0.00	0.00	3.70	7.41	88.89
6.00	0.00	0.00	0.00	6.98	5.81	87.21
7.00	0.00	62.20	32.93	4.88	0.00	0.00
8.00	0.00	58.44	36.36	5.19	0.00	0.00
9.00	30.88	63.24	4.41	1.47	0.00	0.00
10.00	21.43	72.86	5.71	0.00	0.00	0.00
11.00	50.00	42.11	7.89	0.00	0.00	0.00
12.00	33.33	56.00	10.67	0.00	0.00	0.00
13.00	20.24	59.52	20.24	0.00	0.00	0.00
14.00	15.85	56.10	28.05	0.00	0.00	0.00
15.00	4.88	63.41	25.61	6.10	0.00	0.00
16.00	0.00	2.44	68.29	29.27	0.00	0.00
17.00	0.00	0.00	79.76	20.24	0.00	0.00
18.00	0.00	6.25	86.25	7.50	0.00	0.00
19.00	0.00	0.00	0.00	2.38	52.38	45.24
20.00	0.00	0.00	0.00	0.00	36.90	63.10
21.00	0.00	0.00	0.00	0.00	19.05	80.95
22.00	0.00	0.00	0.00	2.41	9.64	87.95
23.00	0.00	0.00	0.00	2.41	6.02	91.57
AVERAGE	**6.83**	**21.53**	**16.91**	**4.32**	**7.91**	**42.50**

TABLE 4

24 HOURS AVERAGE GROUND LEVEL CONCENTRATIONS (µg/m^3) TOWARDS THREE PREDOMINANT DOWN WIND DIRECTIONS

Receptor	Distance from DG-1 (m)	Direction (deg)	24 hrs Maximum Ground Level Concentrations														
			PM_{10}			$PM_{2.5}$			SO_2			NOx			CO		
			E 10.8%	W 10.1%	ESE 8.76%	E 10.8%	W 10.1%	ESE 8.76%	E 10.8%	W 10.1%	ESE 8.76%	E 10.8%	W 10.1%	ESE 8.76%	E 10.8%	W 10.1%	ESE 8.76%
ENE-1	100.0	67.5	0.02	0.00	0.00	0.01	0.00	0.00	0.26	0.00	0.00	0.45	0.00	0.00	0.58	0.00	0.00
ENE-2	200.0	67.5	0.03	0.00	0.00	0.02	0.00	0.00	0.34	0.00	0.00	0.58	0.00	0.00	0.76	0.00	0.00
ENE-3	300.0	67.5	0.02	0.00	0.00	0.01	0.00	0.00	0.21	0.00	0.00	0.36	0.00	0.00	0.47	0.00	0.00
ENE-4	400.0	67.5	0.01	0.00	0.00	0.01	0.00	0.00	0.13	0.00	0.00	0.23	0.00	0.00	0.29	0.00	0.00
ENE-5	500.0	67.5	0.01	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.15	0.00	0.00	0.20	0.00	0.00
ENE-6	600.0	67.5	0.01	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.11	0.00	0.00	0.14	0.00	0.00
ENE-7	800.0	67.5	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.06	0.00	0.00	0.08	0.00	0.00
ENE-8	1000.0	67.5	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.04	0.00	0.00	0.05	0.00	0.00
ENE-9	2000.0	67.5	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00
E-1	100.0	90.0	0.14	0.00	0.01	0.08	0.00	0.01	1.60	0.00	0.17	2.77	0.00	0.29	3.61	0.00	0.38
E-2	200.0	90.0	0.24	0.00	0.02	0.13	0.00	0.01	2.78	0.00	0.25	4.81	0.00	0.43	6.28	0.00	0.56
E-3	300.0	90.0	0.24	0.00	0.01	0.14	0.00	0.01	2.87	0.00	0.15	4.96	0.00	0.26	6.47	0.00	0.34
E-4	400.0	90.0	0.18	0.00	0.01	0.10	0.00	0.00	2.15	0.00	0.09	3.72	0.00	0.16	4.85	0.00	0.21
E-5	500.0	90.0	0.13	0.00	0.01	0.07	0.00	0.00	1.52	0.00	0.06	2.63	0.00	0.11	3.43	0.00	0.14
E-6	600.0	90.0	0.09	0.00	0.00	0.05	0.00	0.00	1.12	0.00	0.04	1.94	0.00	0.08	2.53	0.00	0.10
E-7	800.0	90.0	0.06	0.00	0.00	0.04	0.00	0.00	0.73	0.00	0.02	1.25	0.00	0.04	1.64	0.00	0.05
E-8	1000.0	90.0	0.05	0.00	0.00	0.03	0.00	0.00	0.54	0.00	0.02	0.93	0.00	0.03	1.21	0.00	0.03
E-9	2000.0	90.0	0.02	0.00	0.00	0.01	0.00	0.00	0.25	0.00	0.00	0.43	0.00	0.01	0.57	0.00	0.01
E-10	5000.0	90.0	0.01	0.00	0.00	0.01	0.00	0.00	0.12	0.00	0.00	0.20	0.00	0.00	0.27	0.00	0.00
E-11	7000.0	90.0	0.01	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.16	0.00	0.00	0.21	0.00	0.00
E-12	10000.0	90.0	0.01	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.13	0.00	0.00	0.17	0.00	0.00
ESE-1	100.0	112.5	0.03	0.00	0.10	0.02	0.00	0.06	0.38	0.00	1.16	0.66	0.00	2.01	0.86	0.00	2.62
ESE-2	200.0	112.5	0.04	0.00	0.21	0.02	0.00	0.12	0.43	0.00	2.52	0.74	0.00	4.35	0.96	0.00	5.67
ESE-3	300.0	112.5	0.02	0.00	0.23	0.01	0.00	0.13	0.24	0.00	2.75	0.42	0.00	4.76	0.55	0.00	6.21
ESE-4	400.0	112.5	0.01	0.00	0.18	0.01	0.00	0.10	0.15	0.00	2.09	0.26	0.00	3.61	0.33	0.00	4.71
ESE-5	500.0	112.5	0.01	0.00	0.13	0.00	0.00	0.07	0.10	0.00	1.48	0.17	0.00	2.56	0.22	0.00	3.34
ESE-6	600.0	112.5	0.01	0.00	0.09	0.00	0.00	0.05	0.07	0.00	1.09	0.12	0.00	1.89	0.15	0.00	2.47
ESE-7	800.0	112.5	0.00	0.00	0.06	0.00	0.00	0.03	0.04	0.00	0.71	0.07	0.00	1.22	0.09	0.00	1.60
ESE-8	1000.0	112.5	0.00	0.00	0.04	0.00	0.00	0.02	0.02	0.00	0.52	0.04	0.00	0.90	0.05	0.00	1.17

ANNEXURE : XXIII Contd..

Receptor	Distance from DG-1 (m)	Direction (deg)	24 hrs Maximum Ground Level Concentrations														
			PM_{10}			$PM_{2.5}$			SO_2			NOx			CO		
			E 10.8%	W 10.1%	ESE 8.76%	E 10.8%	W 10.1%	ESE 8.76%	E 10.8%	W 10.1%	ESE 8.76%	E 10.8%	W 10.1%	ESE 8.76%	E 10.8%	W 10.1%	ESE 8.76%
ESE-9	2000.0	112.5	0.00	0.00	0.02	0.00	0.00	0.01	0.01	0.00	0.24	0.01	0.00	0.42	0.01	0.00	0.55
ESE-10	5000.0	112.5	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.12	0.00	0.00	0.20	0.00	0.00	0.26
ESE-11	7000.0	112.5	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.16	0.00	0.00	0.21
ESE-12	10000.0	112.5	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.13	0.00	0.00	0.17
SE-1	100.0	135.0	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.18	0.00	0.00	0.31	0.00	0.00	0.40
SE-2	200.0	135.0	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.26	0.00	0.00	0.44	0.00	0.00	0.58
SE-3	300.0	135.0	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.15	0.00	0.00	0.27	0.00	0.00	0.35
SE-4	400.0	135.0	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.17	0.00	0.00	0.22
SE-5	500.0	135.0	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.11	0.00	0.00	0.14
SE-6	600.0	135.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.08	0.00	0.00	0.10
SE-7	800.0	135.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.04	0.00	0.00	0.06
SE-8	1000.0	135.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.03	0.00	0.00	0.03
SE-9	2000.0	135.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01
SW-1	100.0	225.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.02	0.00
WSW-1	100.0	247.5	0.00	0.04	0.00	0.00	0.02	0.00	0.00	0.48	0.00	0.00	0.83	0.00	0.00	1.08	0.00
WSW-2	200.0	247.5	0.00	0.04	0.00	0.00	0.02	0.00	0.00	0.42	0.00	0.00	0.73	0.00	0.00	0.96	0.00
WSW-3	300.0	247.5	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.25	0.00	0.00	0.42	0.00	0.00	0.55	0.00
WSW-4	400.0	247.5	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.15	0.00	0.00	0.26	0.00	0.00	0.34	0.00
WSW-5	500.0	247.5	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.18	0.00	0.00	0.23	0.00
WSW-6	600.0	247.5	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.13	0.00	0.00	0.17	0.00
WSW-7	800.0	247.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.07	0.00	0.00	0.10	0.00
WSW-8	1000.0	247.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.05	0.00	0.00	0.06	0.00
WSW-9	2000.0	247.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.02	0.00
W-1	100.0	270.0	0.00	0.11	0.00	0.00	0.06	0.00	0.00	1.29	0.00	0.00	2.23	0.00	0.00	2.91	0.00
W-2	200.0	270.0	0.00	0.24	0.00	0.00	0.14	0.00	0.00	2.81	0.00	0.00	4.85	0.00	0.00	6.33	0.00
W-3	300.0	270.0	0.00	0.28	0.00	0.00	0.16	0.00	0.00	3.30	0.00	0.00	5.71	0.00	0.00	7.45	0.00
W-4	400.0	270.0	0.00	0.22	0.00	0.00	0.12	0.00	0.00	2.54	0.00	0.00	4.40	0.00	0.00	5.73	0.00
W-5	500.0	270.0	0.00	0.15	0.00	0.00	0.09	0.00	0.00	1.82	0.00	0.00	3.15	0.00	0.00	4.10	0.00
W-6	600.0	270.0	0.00	0.12	0.00	0.00	0.07	0.00	0.00	1.38	0.00	0.00	2.38	0.00	0.00	3.10	0.00
W-7	800.0	270.0	0.00	0.08	0.00	0.00	0.05	0.00	0.00	0.96	0.00	0.00	1.66	0.00	0.00	2.17	0.00

Receptor	Distance from DG-1 (m)	Direction (deg)	24 hrs Maximum Ground Level Concentrations														
			PM_{10}			$PM_{2.5}$			SO_2			NOx			CO		
			E	W	ESE	E	W	ESE	E	W	ESE	E	W	ESE	E	W	ESE
			10.8%	10.1%	8.76%	10.8%	10.1%	8.76%	10.8%	10.1%	8.76%	10.8%	10.1%	8.76%	10.8%	10.1%	8.76%
W-8	1000.0	270.0	0.00	0.06	0.00	0.00	0.04	0.00	0.00	0.75	0.00	0.00	1.30	0.00	0.00	1.70	0.00
W-9	2000.0	270.0	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.40	0.00	0.00	0.70	0.00	0.00	0.91	0.00
W-10	5000.0	270.0	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.20	0.00	0.00	0.35	0.00	0.00	0.46	0.00
W-11	7000.0	270.0	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.16	0.00	0.00	0.28	0.00	0.00	0.37	0.00
W-12	10000.0	270.0	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.13	0.00	0.00	0.22	0.00	0.00	0.29	0.00
WNW-1	100.0	292.5	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.34	0.00	0.00	0.58	0.00	0.00	0.76	0.00
WNW-2	200.0	292.5	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.35	0.00	0.00	0.61	0.00	0.00	0.79	0.00
WNW-3	300.0	292.5	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.22	0.00	0.00	0.37	0.00	0.00	0.49	0.00
WNW-4	400.0	292.5	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.14	0.00	0.00	0.24	0.00	0.00	0.31	0.00
WNW-5	500.0	292.5	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.16	0.00	0.00	0.21	0.00
WNW-6	600.0	292.5	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.12	0.00	0.00	0.15	0.00
WNW-7	800.0	292.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.07	0.00	0.00	0.09	0.00
WNW-8	1000.0	292.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.05	0.00	0.00	0.06	0.00
WNW-9	2000.0	292.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.02	0.00
A2	1968.0	264.0	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.32	0.00	0.00	0.55	0.00	0.00	0.72	0.00
A3	3278.0	109.0	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.16	0.01	0.00	0.27	0.01	0.00	0.35
A4	6441.0	52.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note : *The concentrations as calculated on other receptors are Nil.*

CONCLUSIONS : From Table 4, it can be observed that the 24 hours average GLC's will marginally increase air pollution as given below :

MAXIMUM GLC (µg/m^3) IN THREE PREDOMINANT WIND DIRECTIONS

Pollutants	PM_{10}	$PM_{2.5}$	SO_2	NO_X	CO
E	0.24 200-300 m	0.14 300 m	2.87 300 m	4.96 300 m	6.47 300 m
W	0.28 300 m	0.16 300 m	3.30 300 m	5.71 300 m	7.45 300 m
ESE	0.23 300 m	0.13 300 m	2.75 300 m	4.76 300 m	6.21 300 m

The location of assumed receptors are shown in Fig 1 and the GLC prediction have been shown with line contours for So2, Nox and CO in figure 2,3 and 4 respectively.

ANNEXURE : XXIV

U & R VALUES FOR BUILDING MATERIALS GIVEN IN TABLE WILL BE FOLLOWED FOR THE CONSTRUCTION OF THE BUILDINGS

Unrated vertical fenestration:

Frame type	Glazing type	Clear glass			Tinted glass		
		U-factor (W/m^2- ºC)	SHGC	VLT	U-factor (W/m^2- ºC)	SHGC	VLT
All frame type	Single glazing	7.1	0.82	0.76	7.1	0.70	0.58
Wood, vinyl, or fibre glass frame	Double glazing	3.3	0.59	0.64	3.4	0.42	0.39
Metal and other frame type	Double glazing	5.1	0.68	0.66	5.1	0.50	0.40

U-factors of roof construction

Thickness	R-value	U-factor (W/m^2- ºK)
15 mm (0.5'')	0.70	1.420
20 mm (0.75'')	1.06	0.946
25 mm (1.0'')	1.41	0.710
40 mm (1.5'')	2.11	0.568
50 mm (2.0'')	2.82	0.406
65 mm (2.5'')	3.52	0.284
75 mm (3.0'')	3.70	0.270

U-factors of wall construction

Thickness	R-value	U-factor (W/m^2- ºK)
15 mm (0.5'')	0.70	1.262
20 mm (0.75'')	1.06	0.874
25 mm (1.0'')	1.41	0.668
40 mm (1.5'')	2.11	0.454
50 mm (2.0'')	2.82	0.344
65 mm (2.5'')	3.52	0.277
75 mm (3.0'')	3.70	0.264

Building Envelop performance factor coefficient – Hot Humid Climate

	Daytime occupancy		24-hour occupancy	
	U-factor	SHGC	U-factor	SHGC
Mass walls	6.42	-	9.60	-
Curtains walls, other	14.77	-	19.71	-
Roofs	9.86	-	14.11	-
North windows	-1.58	34.95	-7.29	64.19
Non-north windows	-1.00	43.09	-6.48	76.83
Skylights	-96.11	305.45	-295.45	893.55

ANNEXURE : XXV

PROPOSED TERMS OF REFERENCE FOR EIA STUDIES

The EIA/EMP had been prepared. The history of the project is as follows:

(1) The document related to the proposal i.e. Form-1, 1A and EMP along with Annexures for the proposed project were submitted to SEAC, Maharashtra vide F.no. S/43-195/2012-CEC dated 07.01.2015. The proposed plot area was 61,171.87 sq. m. and proposed built up area was 299,345.98 sq.m.

(2) At the time of submission of Form 1, the plot area consideration was based on the PR card and was 61,177.87 sq.m. After conducting the actual ground survey, the plot area as per ground survey was found 56,523.13 sq.m There was reduction (61,177.87-56,523.13=4654.74 sq.m.) in the plot area. Accordingly, the built up area was reduced to 2,57,273.6 sq.m. This was presented in presentation held on 1st April 2015 to SEAC, Maharashtra. The TOR (Term of Reference) was issued on ground survey plot area i.e. 56,523.13 sq.m and built up area i.e. 2,57,273.6 sq.m vide minutes of 30th State Level Expert Appraisal Committee-2, dated 1st April 2015. Copy of same is given in ***Enclosure 1***.

(3) As per revised plan, there has been an increase in built up area in the same plot area which is now 3,04,580.67 sq.m. The request for amendment in TOR was submitted vide letter no. 23(J)/CPD/2016/40 dated 14.10.2016 online. Proposal no. SIA/MH/NCP/17644/2015 was generated (online receipt Copy of same is given in ***Enclosure 2)***. However, due to end of term of SEAC & SEIAA, Maharashtra, the project had not been considered at state level.

(4) Furthermore, due to the release of new notification dated 09.12.2016, the project will now be considered as category A and therefore application for amendment to TOR is now being made at MOEF, New Delhi

(5) The EIA/EMP had been prepared based on revised built up area i.e. 3,04,580.67 sq.m. and plot area of 56,523.13 sq.m. The same was uploaded to the environmentclearance.nic.in website. Proposal no. SIA/MH/NCP/17813/2015 was generated (online receipt Copy of same is given in ***Enclosure 3).***

(6) The baseline data has been collected by NABL accredited & MOEF recognised laboratory for Air at 4 locations (twice a week for three months), meteorological parameters (90 days continuous), water quality (3 locations), Soil (1 location), noise (4 locations) and traffic density on weekday & weekend at 2 locations.

Item No.06 Application for EC of proposed expansion within the campus premises of University of Mumbai on land bearing CTS No. 4094, Vidyanagari Campus, Kalina, Mumbai by **M/s University of Mumbai**

PP informed that they have undertaken construction of about 84,000 m^2 without prior EC.

During discussion following points emerged:

1. After deliberation, Committee in view of the OMs of MoEF dated 12/12/2012 & 27/6/2013 and order of NGT given in the appeal No. 72 of 2013 and 73 of 2013 dated 26/09/2013 decided that construction prior to EC is violation of the provisions of EIA Notification.

2. Hence, Environment Department/ SEIAA, after due verification, may initiate credible action for alleged violation under Environment (Protection) Act, 1986 as per the OM dated 12th December, 2012 and OM dated 27th June 2013 issued by MoEF. Further, the proposal will be appraised only after due examination and appropriate action taken by the SEIAA /Environment Department in accordance with OMs issued by MoEF.

In view of above, the proposal is referred for action on alleged violation as per the OMs of MoEF dated 12/12/2012 & 27/6/2013 and order of NGT given in appeal No. 72 of 2013 and 73 of 2013 dated 26/09/2013 to SEIAA/ Environment Department and shall be considered further after the above observations are addressed and submitted for reconsideration.

Item No.07 Application for expansion of existing project "CIDCO Exhibition Centre" by **M/s CIDCO Ltd.**

The PP was absent; hence the project is deferred.

Item No.08 Application for EC for the construction of Office Complex at Customs Enclave (Suleman Shah Plot), Wadala (East), Mumbai by **M/s Assistant Commissioner of Customs CEC/ Mumbai**

The proposal was discussed on the basis of the draft ToR as presented by the PP. All issues related to environment, including air, water, land, soil, ecology and biodiversity and social aspects were discussed. PP stated that total plot area is 56,523.13 m^2. Total construction area of the project is 2,57,273.6 m^2. Committee appraised the project under 8a (B1) category of EIA Notification, 2006.

After discussion, ToR presented by PP was approved subject to compliance of the following:

1. PP to submit distance of the project site from the freeway and measures to reduce noise and air pollution impacts of the traffic of freeway on the project
2. PP to submit details of the risk assessment and air quality modelling considering the oil refineries and TATA power project which are in vicinity. Identify hazards of this establishment on the proposed project.
3. PP to submit CRZ map superimposed with building layout plan. Further, PP to submit copy of prior recommendations of MCZMA
4. PP to submit impacts of proposed activities on flamingo's habitat at Sewri Wadala.
5. PP to submit details of the parking plan and parking space as per the NBC norms proposed in the project.
6. PP to ensure that width of the internal road should be of minimum 9 m.
7. PP to submit details of the ventilation system and air pollution control system in the parking basement.
8. PP to submit details of the time bound green belt development plan indicating type of the species.
9. PP to submit Disaster Management Plan approved from competent Authority.
10. PP to submit Waste water treatment and management plan.
11. PP to submit energy simulation studies for the project.
12. PP to submit details on renewable energy and energy saving calculations of the project. PP to also ensure that at least 20% of the energy source should be from the renewable energy.
13. PP to submit Environment Management Plan specific to the project.
14. PP to submit IOD, CC or any other permissions indicating that proposed development as per the prevailing development plan.
15. PP to submit measures to reduce carbon footprint & heat island effects.
16. PP to submit light and ventilation analysis for all buildings.
17. PP to leave clear cut side margin of 6 m from the boundary of the plot and open space and non-paved RG area should be on ground as per the orders of Hon'ble Supreme Court (Civil Appeal No. 11150 of 2013 and SLP (Civil) No. 33402/2012) dated 17th December 2013.
18. PP to also refer ToR attached as "Exhibit-A" in addition to above.

Annexure-A : Terms of references

Site analysis

(i) Examine in detail the present status of the project site, site clearance strategy, debris quantification, segregation of the demolition waste and quantification, disposal strategy in consonance with the prevailing rules.

(ii) Submit development strategy, phasing of the project along with infrastructure and facilities / utilities. Detailed total station map indication plot boundary, construction area boundary, green area boundary, etc

(iii) Submit excavation details, quantity of excavated material, top soil quantity and its preservation.

(iv) Examine in detail the site with reference to impact on infrastructure covering water supply, storm water drainage, sewerage, power, etc., and the disposal of treated/raw wastes from the complex on land/water body and into sewerage system.

(v) Examine in detail the carrying capacity of existing sewer line, drains etc.

(vi) Examine details of land use around 2 km radius of the project site. Analysis should be made based on latest satellite imagery for land use with raw images.

(vii) Study and submit details of environmentally sensitive places, rehabilitation of communities and present status of such activities.

(viii) Examine baseline environmental quality along with projected incremental load due to the project. Environmental data to be considered in relation to the community development would be (a) land, (b) groundwater, (c) surface water, (d) air, (e) bio-diversity, (f) noise due to the traffic, (g) socio economic and health etc.

(ix) Study the socio-economic situation of the project area and its surroundings and their impact on the project design and operation. Socio impact Assessment studies (SIA) shall be carried out specific to the project area. PP shall take into confidence / consent people residing in the project and surrounding area and objections / suggestions if any received may be submitted to SEIAA / SEAC-II.

(x) Examine topography rainfall pattern, soil characteristics, and soil erosion.

(xi) Study the hydrological and geo-hydrological conditions of the project area. Including a contour plan indicating slopes and showing drainage pattern and outfall. Examine in detail the carrying capacity of existing storm water drainage line. Possibility of flooding in and around the project site.

(xii) Storm water drainage and outfall may be described through contour map and slopes of the project area and its surroundings.

Water

(xiii) Examine the details of water requirement, use of treated waste water and prepare a water balance chart.

(xiv) Rain water harvesting proposals should be made with due safeguards for ground water quality, aquifer level, soil permeability, justification for suitable / appropriate rain water harvesting method and details of the selected option indicating locations on the project map.

(xv) Maximize recycling of water and utilization of rain water. Examine details.

(xvi) Examine soil characteristics and depth of ground water table for rainwater

harvesting.

(xvii) STP and water treatment plant should not be near each other. Indicate their locations with area details on the map. Also provide justification for the technology selected on the site and examine sustainable operation of the infrastructure.

Solid Waste Management

(xviii) Examine details of Solid waste generation, type and quantity, treatment and its disposal.

(xix) Common facilities for waste collection, treatment, recycling and disposal (all effluent, emission and refuse including MSW.)

(xx) Examine the location of solid waste treatment and disposal sites.

Flora and fauna

(xxi) Study the existing flora and fauna of the area and the impact of the project on them.

Energy

(xxii) Since the project is a building construction and area developmental activities, examine electrical load, energy conservation measures etc. and saving in energy.

(xxiii) Examine and submit details of use of solar energy and alternative source of energy to reduce the energy consumption.

(xxiv) 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.

(xxv) Provide for conservation of resources, energy efficiency and use of renewable sources of energy in the light of ECBC code. Application of renewable energy/alternate energy, such as solar energy, wind energy may be described with detailed analysis and exploring the possibility of such installations.

Traffic and transportation

(xxvi) A detailed traffic and transportation study should be made for existing and projected passenger and commercial traffic as the project is a mixed development including residential and commercial development.

(xxvii) Examine the details of transport of materials for construction which should include source and availability.

(xxviii) The evaluation of impacts should be analyzed depending upon the nature (positive and negative), duration (short term and long term) reversibility, and magnitude (negligible, low, medium, high), etc. of the impacts based the objective assessments.

(xxix) 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.

(xxx) Traffic management plan including parking areas may be described. Traffic survey should be carried out on week days and week end.

Air and Noise

(xxxi) Examine and submit details of Air quality monitoring as per latest National Ambient Air Quality standards as notified by the Ministry on 16th November, 2009.

(xxxii) Examine and submit the details of Noise modelling studies and mitigative measures.

(xxxiii) Examine noise levels - present and future with noise abatement measures.

(xxxiv) Noise pollution has always been a major concern for developmental projects during the construction and operational phase. It is suggested that noise monitoring should be carried out at critical locations at the surrounding areas may be incorporated in environmental monitoring programme during the whole operational phase of the project.

(xxxv) Natural and artificial noise barriers may be considered for critical locations.

(xxxvi) A thick green belt should be planned all around the project site to mitigate noise and vibrations to the nearby settlements. The identification of species/plants should be made based on the botanical studies.

(xxxvii) Landscape plan, green belts and open spaces may be described.

(xxxviii) Examine the details of afforestation measures indicating land and financial outlay.

Building materials

(xxxix) Use of local building materials should be described. The provisions of fly ash notification should be kept in view.

Disaster Management Plan

(xl) Risk assessment and disaster management plan should also include Fire, Earthquake, local floods, and any other natural disaster.

Environmental Management and monitoring Plan

(xli) Environmental Management Plan should be accompanied with Environmental Monitoring Plan and environmental cost and benefit assessment. Examine separately the details for construction and operation phases both for Environmental Management Plan and Environmental Monitoring Plan.

(xlii) Make assessment of any regulatory measure in view of the environmental and social impacts of the project (such as unauthorized development in and around the area).

Corporate Social Responsibility

(xliii) Submit the details of CSR activities. Provisions shall be made for education, health and vocational training programs.

Other details as indicated in Appendix III of EIA Notification 2006 should also be attended.

A detailed draft EIA/EMP report should be prepared as per the ToR and should be submitted to the SEIAA /SEAC, MMR as per the Notification.

Enclosure-2

APPENDIX I

(See Paragraph-6)

Note: If space provided against any parameter is inadequate,Kindly upload supporting document under 'Additional Attachments if any' at the last part of the Form1. Please note that all such Annexures must be part of single pdf document.

(I)Basic Informations

S.NO	ItemDetails	
1.	**Modification Category**	: Amendement
2.	**Subcategory**	: B2
3.	**Name of the Project**	: Construction of Office Complex at Customs Enclave (Suleman Shah Plot), Wadala (East), Mumbai
4.	**Project Sector**	: New Construction Projects and Industrial Estates
5.	**Location of the Project**	: Maharashtra
6.	**Proposal No.**	: SIA/MH/NCP/17644/2015
7.	**File Number**	: Nil
8.	**Previous TOR Letter**	: Annexure-Uploaded Previous TOR letter
9.	**Date of Previous TOR**	: 01 Jan 1900
10.	**Reason for applying for Extension of Validity**	: Change in built up area
11.	**Attach Document(if any)**	: N/A
12.	**Covering letter**	: Annexure-Uploaded Covering Letter
13.	**Amendment is required**	: In same plot area, there is revision in built up area from 257273.6 to 304580.67 sq.m.

*** This is a system generated email, please do not reply. ***

EC Report

Enclosure-3

1. Project Details

i. **Proposal No.** : SIA/MH/NCP/17813/2015

ii. **File No.** : SIA/MH/NCP/17813/2015

iii.**Short narrative of the project:** 959

iv. **Project Sector** : New Construction Projects and Industrial Estates

v. **Subcategory** : B1

vi. **Company/Proponent** : CENTRAL PUBLIC WORKS DEPARTMENT

vii.Details of State of the project

Details of State of the project			
S.no.	State Name	District Name	Tehsil Name
1.	Maharashtra	Mumbai City	Kurla

viii.**Date of TOR Granted** 01 Apr 2015

ix.**TOR letter issued by Ministry:** Annexure-TOR letter

Important Dates

Important Dates		
Accepted by SEIAA and forwarded to SEAC	Accepted by SEAC	EC Granted
N/A	N/A	N/A

2. Uploaded Documents of EIA/EMP,Risk Assessment,Public Hearing

i.**EIA/EMP:** Annexure-EIA/EMP

ii.**Risk Assessment:** Annexure-Risk Assessment

iii.**Public Hearing:** Annexure-Public Hearing

iv. **Date of Public Hearing:** 01 Nov 2016

ix. **Uploaded Cover Letter:** Annexure-Cover Letter

x. **Uploaded Additional Report/Study/Document as desired by Ministry/EAC:** Nil

CENTRAL PUBLIC WORKS DEPARTMENT

Custom Project Division, CPWD, Building No. 29,
Room No. 953, Ground Floor, Sector-7, CGS Colony, Antop Hill, Mumbai

FINAL
ENVIRONMENTAL IMPACT ASSESSMENT AND MANAGEMENT PLAN
FOR
PROPOSED CONSTRUCTION OF OFFICE COMPLEX AT CUSTOMS ENCLAVE (SULEMAN SHAH PLOT), WADALA (EAST), MUMBAI
(TOTAL PROJECT AREA – 56,523.13 SQ.M., TOTAL BUILT UP AREA – 3,04,580.67 SQM)

MARCH, 2017

Prepared by:

MIN MEC CONSULTANCY PVT. LTD.
A-121, Paryavaran Complex, IGNOU Road, New Delhi – 110 030
Ph : 29534777, 29532236, 29535891 ; Fax: 091-11-29532568
Email: min_mec@vsnl.com; Web site : www.minmec.co.in

Estb. 1983

An ISO 9001:2008 approved company

CENTRAL PUBLIC WORKS DEPARTMENT

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ISSUE 1 REV 0 SEPTEMBER, 2016 (Post TOR)
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ABBREVIATIONS

AMSL	:	Above Mean Sea Level
BDL	:	Below Detectable Limit
bgl	:	Below ground level
BOD	:	Bio-chemical oxygen demand
CGWB	:	Central Ground Water Board
Cm	:	Centi meter
CNC	:	Computer Numeric Control
COD	:	Chemical oxygen demand
CPCB	:	Central Pollution Control Board
DG	:	Diesel generator
dia	:	Diameter
DU	:	Dwelling unit
E	:	East
EIA	:	Environmental Impact Assessment
EMP	:	Environmental Management Plan
ETP	:	Effluent Treatment Plant
FAR	:	Floor area ratio
g	:	Gram
GLC	:	Ground Level Concentration
Ha	:	Hectare
Kcal	:	Kilo calorie
Kg	:	Kilogram
KL	:	Kilo litre
KLD	:	Kilo litre/day
KVA	:	Kilo volt ampere
KW	:	Kilo watt
KWH	:	Kilo watt hour
l	:	litres
lpd	:	Litres per day
m	:	Meter
m^2	:	Square meter
m^3	:	Cubic meter
MCM	:	Million cubic meter
MoEF&CC	:	Ministry of Environment, Forest and Climate Change
MT	:	Million Tonnes
MW	:	Mega watt
N	:	North
NH	:	National Highway
NOC	:	No objection certificate
Nos.	:	Numbers
RPM	:	Respirable Particulate Matter
S	:	South
SPM	:	Special Purpose Machine
SPM	:	Suspended Particulate Matter
STP	:	Sewage treatment plant
W	:	West

CHAPTER 1

INTRODUCTION

1.1 PURPOSE OF THE REPORT

The Customs Department at Mumbai plans to build a new Customs Office building to cater to various departments at Wadala, Mumbai. The proposed complex shall act as a landmark structure equipped with the latest amenities for a modern office building. The proposed building has been designed keeping in view scope for future expansion and addition of 7 floors in the building at a later date.

The total plot area of the project is 56,523 sq.m. The basement area 64,232.49 sq.m and superstructure area including podium is 2,40,348.18 sq.m. Thus, the total built up area will be 3,04,580.67 sq.m. The building will have three basements, podium and G+22 floors above it currently and 7 additional floors for future provision (G+29). All infrastructure and the space planning for the future expansion is being done currently for infrastructure and services. The equipments and treatment facilities shall be augmented in a modular manner to cater to future expansion.

Environmental clearance is a statutory requirement as per EIA Notification dated 14th September 2006. Since the built up area of the proposed project is more than 1,50,000 sq.m., it is covered under Serial No. 8(b) of the Schedule to EIA Notification 2006 and is of Category 'B'.

The State Level Expert Appraisal Committee (SEAC), Maharashtra was approached with the Form-1 and its annexures on 08.01.2015 for the proposed Terms of Reference (TOR) for preparation of EIA/EMP. The TOR was issued vide minutes of 30th meeting of State Level Expert Appraisal Committee 2, dated 01st April 2015, whereafter the EIA/EMP report has been prepared.

At the time of application of Form 1, the area considerations were based on the PR card, but after conducting the actual ground survey (November), there were variation in the plot area and as per the new Development Plan, further variation in the plot area occurred. Therefore the project area, land use area and built up area have been revised accordingly. The change in plot area was presented to the SEAC-2 on 1st April 2015. It was informed during presentation that the environmental baseline data collection has been carried out for the project during December 2014-February 2015.

1.2 IDENTIFICATION OF THE PROJECT

This project is the construction of Custom Office by Customs Department over an area of 56,523 sq.m of land at Wadala, Mumbai.

The project has been provisioned for total population of 11870 people, out of which Office goers will be 5935 and floating population will be 5935. The complex will comprise of building blocks (comprising of records, kitchen, Auditorium for 400 people, Convention centre, Malkhana, Court rooms, Armoury, offices for various departments of customs) and basements mainly for parking purposes. 2nd Basement will have electric services including ESS DG set & HVAC. The 3rd basement will have STP, UG Tank, and Pump Room.

The block will have three basements, podium, ground and 22 floors above it with provision for 7 additional floors above it for future expansion.

The project will have its independent waste water treatment plant but will depend upon the Mumbai authority for evacuation and disposal of solid waste. Water will be sourced from Municipal Supply for the supply of water and its usage.

Salient Features of the Project

The salient features of the proposed project is given in **Table 1.1**.

TABLE 1.1
SALIENT FEATURES OF THE PROJECT

Project Features	Description
Name of the Project	Construction of Office Complex Customs Enclave (Suleman Shah Plot), Wadala (East), Mumbai
Name, contact number & address of Proponent	Mr. P Shridhar Executive Engineer Central Public Works Department, CPWD, Building No. 29, Room No. 953, Ground Floor, Sector-7, CGS Colony, Antop Hill, Mumbai Email: mumeecustomspd.cpwd@nic.in
Name, contact number & address of Consultant	Min Mec Consultancy Pvt. Ltd. A-121, Paryavaran Complex, IGNOU Road, New Delhi Phone No. 011-29535891
Location of the project	C.S No. 146 of salt division, F-North ward of Greater Mumbai.
Total plot area	56,523 sq.m
FSI area	2,13,702.66 sq.m
Non-FSI (Basement area)	90878.01 sq.m
Total construction Built up area	3,04,580.67 sq.m
Number of Podium	1
Number of basements	3
Number of buildings	1
Number of Towers	2
Maximum height of the building	125.5 m

Project Features	Description
Number of parking provided	Total -2148 198 – Surface (over 2723 sq.m.) 1500 – Basement 450 - Podium
Green area	23,783 sq.m
Ground coverage	19,930 sq.m
Area under roads	10,087 sq.m
Surface parking	2,723 sq.m
Open space	36,593 sq.m
Total Population	Total - 11,870 Office goers - 5935 + floating/ visitors - 5935
Total water requirement	671 KLD
Total fresh water requirement	414 KLD
Source of Water	Municipal Supply
Waste water generation	285 KLD
Capacity of STP, KLD	350 KLD
Total Power Demand	10000 KVA
Source of Power	MSEB
Emergency power Backup	4 x 1010 KVA DG sets
Solid waste	1.8 TPD
e-waste	3.9 tonnes/ year
Total Excavated soil	267635.67 cum 55% will be used in filling
Project Cost	Rs. 1360 Crores approximately

1.3 ABOUT THE PROJECT PROPONENT

CPWD came into existence in July, 1854 when Lord Dalhousie established a central agency for execution of public works and set up Ajmer Provincial Division. It has now grown into a comprehensive construction management department, which provides services from project concept to completion, and maintenance management. It is headed by DG who is also the Principal Technical Advisor to the Government of India. The regions and Sub regions are headed by Special DGs and Additional DGs respectively, while the zones in all state capitals (except a few) are headed by Chief Engineers. With country wide presence, the strength of CPWD is its ability to undertake construction of complex projects even in difficult terrains and maintenance in post construction stage.
(Source: http://cpwd.gov.in/publication/About_CPWD.pdf)

1.4 BRIEF DESCRIPTION OF THE PROJECT

1.4.1 Nature of Project

The proposed project is a new construction project of Customs Office Complex.

1.4.2 Size

The project has been provisioned for population of 11870 people. Customs Office goers will be 5935 and floating/ visitors will be 5935. Total built up area will be 3,04,580.675 sq.m., while total plot area is 56,523 sq.m.

1.4.3 Location

The project is located at Customs Enclave (Suleman Shah Plot), Wadala (East), Mumbai. The coordinates of the project area are:

Latitude : 19°01'04" to 19°01'13" N
Longitude : 72°52'14" to 72°52'27" E

The location map is given as **Fig 1.1**.

1.4.4 Communication

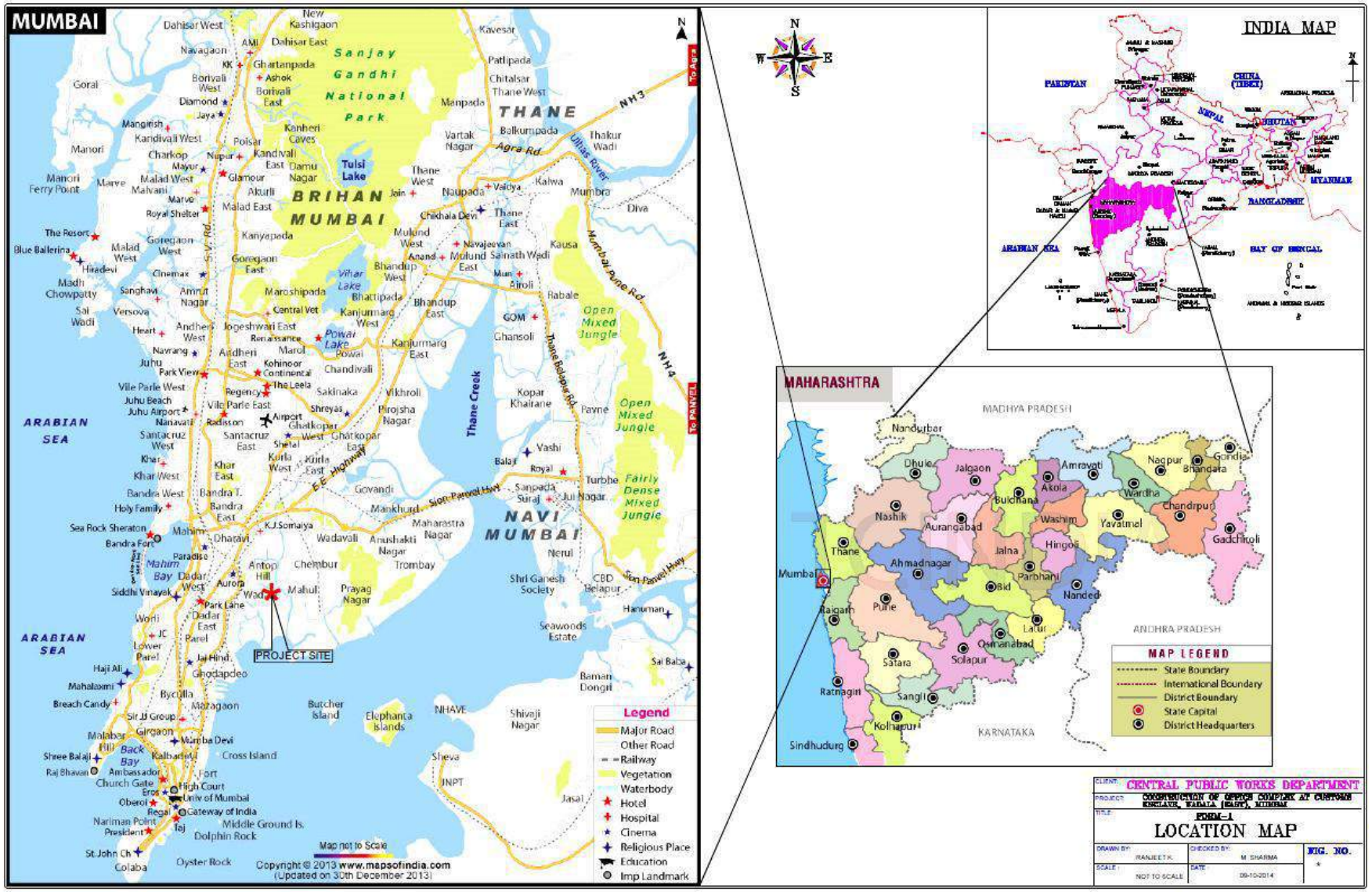
Road Link

The project site is situated at Customs Enclave (Suleman Shah Plot), Wadala (East), Mumbai. The proposed site is well connected to various places through various roads which are listed in **Table 1.2**.

TABLE 1.2
DISTANCE AND DIRECTION TO VARIOUS ROADS FROM THE PROJECT

Roads	Distance km, Direction
Eastern Freeway	Adjoining, E
Anik Wadala Road	Adjoining, S
Bandra-Worli Sea Link	5.7, W
NH-8	4.5, NW
Sion Panvel Expressway	4.6, NE
Jeejabai Bhosle Marg	6.3, NE
Palm Beach Road	14.0, E
NH-4B	11.6, SE
Bombay Port Trust Road	0.2 E
LBS Road	2.8, NNW
Andheri Ghatkopar Road	8.1, N
Lady Jamshedji Road	3.3, W
Rafi Ahmad Kidwai Marg	1.0, W
Netaji Subhash Chandra Bose Road	9.1, SSW
NH-3	3.7, N
Dr. Ambedkar Road	2.2, W
Link Road	13.9, NNW

FIG 1.1: LOCATION MAP



Rail link

The nearest railway station is Wadala at a distance of about 1.1 km, ENE direction from the proposed site. Besides, Dadar railway station is located at a distance of 2.7 km, W direction from the site. Mahim junction is located at a distance of 3.4 km, NW and Kurla railway station is located at a distance of 4.9 km, N. Mumbai central is at 7.4 km, SW, Chhatrapati Shivaji Terminus is at 8.7 km, SSW and Lokmanya Tilak Terminus is at 5.7 km, NNE from the site. Railway line exists are Kurla to Sanpada at 5.8 km, NE, Kurla to Trombay at 2.4 km, NE, Nuapada to Chhatrapati Shivaji Terminus at 2.3 km, W and Mira Road to Mahim Junction and 3.1 km, NW.

Air link

The nearest airport is Chhatrapati Shivaji International Airport at 7.5 Km, N from the site.

1.4.5 Importance to country & region

Customs are usually a major budget contributor, and sometimes the most important source of revenue for a country. Customs also have a unique observation position. They are at the crossroads between trade, the economy, fiscal and budget issues, crime interdiction, environmental preoccupations, and transport, to name but a few.

Customs all over the world are used to dealing with people across the border – so they are the first exposed to new products, activities, and even ideas. They cooperate far better with their foreign counterparts than any other border agency and have routine, non-judicial, access to sensitive commercial information. As an observer of the movement of goods, Customs can provide reliable trade statistics, and match them against other countries' records. They can work out revenue projections and simulations. Customs also keep records of movements and the people who initiate them. All this can be used not only to secure revenue, but also to protect society.

Traditionally, Customs has three major roles:

- To assess and collect revenue based on the characteristics of the goods
- To protect the country and the society by preventing smuggling
- To ensure that national legislation is applied to imported goods.

1.5 SCOPE OF STUDY- DETAILS OF REGULATORY SCOPING CARRIED OUT AS PER TERMS OF REFERENCE

The Environmental Impact Assessment and Environment Management Plan for the proposed new construction project addressing the environment

related issues are prepared in accordance with the requirements of terms of reference prescribed by State Level Expert Appraisal Committee 2, Maharashtra.

The study evaluates the prevailing environmental conditions. The adverse impacts have been identified and possible mitigation measures have been drawn in order to protect the environment. In order to carry out the study, a baseline environmental scenario has been established.

The main objectives of the present EIA study are briefly summarized below:

- To establish the baseline environmental scenario.
- To identify, predict and assess the impacts of proposed future project on the environment.
- To prepare a detailed action plan for implementation of mitigative measures.
- To suggest preventive measures to minimize adverse impacts and to maximize beneficial impacts.
- To suggest a monitoring programme to evaluate the effectiveness of mitigative measures.
- To suggest the formation of a core group responsible for implementation of the EMP.
- To prepare a capital cost estimate for environment management plan.
- To address the concerns of disaster management and CSR.

Any construction project is expected to cause environmental impacts near the project site during its operation phase. The type and intensity of impacts on various components of the environment vary depending upon the nature and size of the project as well as its geographical location. The net impacts from individual project can be quantified through Environmental Impact Assessment studies of various components of environment such as noise, air, water, land, biological and socio - economic aspects. EIA studies form a basis for preparing an Environment Management Plan (EMP) to conserve the environment of the area. The total EIA study for a particular project site can be divided into three phases. The first is identification of significant environmental parameters and then assessing the existing (pre-project) status within the impact zone with respect to environmental descriptors. The second phase is prediction of impacts from proposed project on identified environmental parameters based on experience of other projects. The third phase includes the evaluation of total impacts after superimposing the predicted impacts over baseline data. This helps in incorporating proper mitigation measures wherever necessary for preventing deterioration in environmental quality.

The scope of the present study is to conduct EIA covering all the disciplines of environment and field monitoring in relevant disciplines over one full season of 3 (three) months (excluding monsoon months). The EIA report has been prepared as per the Terms of Reference issued by State Expert Appraisal Committee 2, Maharashtra.

The project area is termed as "core zone". The area within 10 km radius around the periphery of the project boundary has been considered as the “buffer zone” for identifying and assessing impact with respect to air, water, noise, land use, ecology and socio-economic environment. The core zone and buffer zone together comprise the "study area".

The studies covering all individual components of environment are described in detail in subsequent chapters. An in-depth analysis of available information has been made for working out an effective environment management plan.

The TOR was issued vide 30th SEAC-II minutes of meeting dated 01.04.2015 (as given in ***Annexure I***). The compliance to the terms of reference has been given in Para 1.7.

The baseline environmental data was generated by Min Mec R&D Laboratory, (NABL accredited and MoEF&CC recognised) as given in **Table 1.3**.

TABLE 1.3
BASELINE DATA GENERATED

Description	No. of locations	Total No of samples
Air Ambient air monitoring (24 hourly samples), twice a week for 3 months for one season Parameters : PM 10, PM 2.5, SO_2, NOx	4 (one in core zone and 3 in buffer zone)	96
Meteorological parameters will be measured at hourly duration simultaneously at one air monitoring station for 3 months for Wind speed, direction, Relative humidity, Temperature, Cloudiness and Rainfall	1	90 days
Water Ground Water sample from buffer zone (10 km radius) and tested for physical and chemical parameters	3	3
Soil	1	1
Noise Hourly readings taken for 24 hours (Leq)	4	4 sets
Traffic density- on weekday & weekend	2	2 set

Secondary and primary data collection was done comprising of but not restricted to the following:

- Long Term Climatic data from Indian Meteorological Department (IMD) for available previous decade.
- Geo-hydrological aspects based on available data from various sources.
- Identification of water bodies, hills, roads etc. within 10 km radius from existing records.
- Details of fauna, flora, information in forests, major habitats, sanctuaries, sensitive places within a distance of 10 km from the project site (including forest details).
- Major industries within 10 km radius.
- Historical monuments and sanctuaries within 10 km radius.
- Land use pattern within core zone and buffer zone (10 km radius around the core zone), Cropping pattern.
- Demography and Socio-economic based on last available Census data for entire study area.

The preparation of the EIA/EMP was proposed as per the generic structure prescribed in EIA Notification dated 14th September 2006, as follows:

- **Chapter-1: Introduction** covering Purpose of the report, Identification of Project & Project proponent, Brief description of nature, size, location of the Project and its importance to the country, region and Scope of the study – details of regulatory scoping carried out (As per Terms of Reference).

- **Chapter-2: Project Description:-** (Based on study of the reports like Pre-feasibility Report or Techno-economic Feasibility Report, approved drawings, etc.)

  This includes Condensed description of those aspects of the project (based on project feasibility study), likely to cause environmental effects. Details such as type of project, project boundary & project site layout, size or magnitude of operation (incl. Associated activities required by or for the project), proposed schedule for approval and implementation, technology and process description.

- **Chapter-3: Description of the Environment:-** The base line data generated and collected, will be used to establish the present environmental scenario. This will cover the Study area, period, components & methodology, establishment of baseline for valued environmental components, as identified in the scope and base maps of applicable environmental components.

- **Chapter-4: Anticipated Environmental Impacts and Mitigation Measures:-** This section details with environmental impacts and the mitigation, avoidance and environmental enhancement measures to be included in the Environmental Management Plans for:

* Ambient Air Quality	* Surface and Ground Water Quality
* Noise levels	* Ecology
* Land use & soil	* Socio - economic conditions
* Traffic density	* Sensitive Places/Historical Monuments
* Topography & drainage	

Environmental Management plan suggesting the environmental safeguards, abatement technology and pollution control measures as follows:

- Air, water, noise pollution control measures.
- Solid waste management.
- Traffic management.
- Land use changes and mitigation.
- Pronounce the improvement in socio-economic conditions and benefits the people will get on implementation of the project. Outlining corporate social responsibility.
- Green belt development Plan.
- Environmental monitoring, implementation organization and feedback mechanism to effect mid course corrections.
- Cost for Environmental Protection measure.

- **Chapter-5: Analysis of Alternatives (Technology and site):-** In case, the scoping exercise results in need for alternatives then description of each alternative, summary of adverse impacts of each alternative, mitigation measures proposed for each alternative and selection of alternative is done. In this case, being an allotted plot, there are no alternatives to site.

- **Chapter-6: Environmental Monitoring Program:-** Technical aspects of monitoring the effectiveness of mitigation measures including measurement methodologies, frequency, location, data analysis, reporting schedules, detailed budget & procurement schedules.

- **Chapter-7: Additional Studies:-** This section will suggest the setup required, a reporting system and training needs to ensure timely Disaster Management.

- **Chapter-8: Project benefits:-** This comprises of the improvements in the physical infrastructure, improvements in the social infrastructure, employment potential–skilled; semi-skilled and unskilled and other tangible benefits.

- **Chapter-9: Environmental Cost Benefit Analysis:-** If recommended at the Scoping stage.

- **Chapter-10: EMP:-** Description of the administrative aspects of ensuring that mitigative measures are implemented and their effectiveness monitored, after approval of the EIA.

- **Chapter-11: Summary & Conclusion:-** This will constitute the summary of the EIA Report.

- **Chapter-12: Disclosure of Consultants engaged:-** The names of the Consultants engaged with their brief resume and nature of Consultancy rendered.

1.6 STATUS OF LITIGATIONS

There are no litigations/ court cases pending against the project as on 15.02.2016.

1.7 COMPLIANCE OF TERMS OF REFERENCE (TOR)

Table 1.4 gives the compliance of TOR issued by SEAC, Maharashtra for the project.

TABLE 1.4
TERMS OF REFERENCE
PART 1 - COMPLIANCE OF POINTS GIVEN IN MINUTES OF MEETING

Sl. No.	Conditions	Compliance
1.	PP to submit distance of the project site from the freeway and measures to reduce noise and air pollution impacts to the traffic of freeway on the project.	The distance of Eastern freeway from the project site is 0.02 km, E and the measures to reduce noise and air pollution impacts to the traffic of freeway on the project are given in Section 4.5, Chapter 4.
2.	PP to submit details of the risk assessment and air quality modelling considering the oil refineries and TATA power project which are in the vicinity. Identify hazards of this establishment on the proposed project.	➢ The air quality modelling of the existing oil refineries and power projects have been discussed in Section 4.3.2, Chapter 4. ➢ The risk assessment and hazards of the existing oil refineries and power project has been discussed in Section 7.2, Chapter 7.

Sl. No.	Conditions	Compliance
3.	PP to submit CRZ map superimposed with building layout plan. Further PP to submit copy of prior recommendations of MCZMA.	The CRZ map superimposed with building layout plan is given in Annexure XIII. The CRZ study has been completed by M/s Anna University and the application for CRZ clearance initiated. The recommendations of MCZMA shall be submitted as soon as available.
4.	PP to submit impacts of proposed activities on flamingo's habitat at Sewri Wadala.	The impact on Flamingo Habitat at Sewri Wadala is discussed in Section 4.8.3, Chapter 4.
5.	PP to submit details of parking plan and parking space as per the NBC norms proposed in the project.	The parking plan and space has been provided as per the NBC norms as given in Section 4.5.2, Chapter 4. The parking plan given in Fig 4.6 and 4.7.
6.	PP to ensure width of internal road should be of minimum 9 m.	Width of internal road has been provided as 9 m as can be seen in the traffic movement plan given in Fig 4.6, Chapter 4.
7.	PP to submit details of ventilation system and air pollution control system in the parking basement.	Details of ventilation system and air pollution control system in the parking basement is given in Section 4.5.2.1, Chapter 4.
8.	PP to submit the details of the time bound greenbelt development plan indicating type of species.	Details of the time bound greenbelt development plan indicating type of species is given in Section 4.8.2, Chapter 4.
9.	PP to submit Disaster Management Plan approved from competent authority.	Disaster management plan is given in chapter 7. The various aspects of Disaster management are verified by different authorities. For example, component of Fire fighting adequacy is granted NOC by "Maharashtra Fire & Emergency Services-Mumbai". Structural safety is certified by Structural Engineer. Similarly, High Rise Committee approves safety and disaster management plans amongst other things. Such NOCs / approvals will be applied for and taken at appropriate time.
10.	PP to submit Waste water treatment and management plan.	Waste water treatment and management plan is given in Section 4.4.2.2 & 4.4.2.5, Chapter 4

Sl. No.	Conditions	Compliance
11.	PP to submit energy simulation studies for the project.	The energy simulation study is underway.
12.	PP to submit details on renewable energy and energy saving calculations of the project. PP to also ensure that at least 20% of the energy source should be from the renewable energy.	Refer Section 4.12.2 of Chapter 4
13.	PP to submit Environment Management Plan specific to the project.	Environment management plan specific to the project is detailed in Chapter 9.
14.	PP to submit IOD, CC or any other permissions indicating that proposed development as per the prevailing development plan.	Urban Development Department Mantralaya, Mumbai, Government of Maharashtra has given permission for the construction of Customs office at the land bearing C.S No. 146. Refer ***Annexure II.***
15.	PP to submit measures to reduce carbon footprint & heat island effects.	Refer Section 4.12.1 of Chapter 4
16.	PP to submit light and ventilation analysis for all buildings.	Refer Section 4.12 & 4.5.2.1 of Chapter 4
17.	PP to leave clear cut side margin of 6 m from the boundary of the plot and open space and non paved RG area should be on the ground as per the orders of Hon'ble Supreme Court (Civil Appeal No. 11150 of 2013 and SLP (Civil) No. 33402/2012) dated 17th December 2013.	Refer to layout plant in **Fig 2.3**, Chapter 2
18.	PP also refer ToR attached as "Exhibit-A" in addition to above.	Yes, given in Part 2 below

PART 2 - COMPLIANCE OF POINTS GIVEN IN ANNEXURE-A "TERMS OF REFERENCES"

Sl. No.	Site analysis	
i.	Examine in detail the present status of the project site, site clearance strategy, debris quantification, segregation of the demolition waste and quantification, disposal strategy in consonance with the prevailing rules.	At present the land is open land with grasses and shrubs, few trees along boundary and with one existing ground structure, the debris and its management of which is given in Section 4.6.1.
ii.	Submit development strategy, phasing of the project along with infrastructure and facilities/utilities. Detailed total	The construction will be carried out for G+22 initially and additional 7 floors will be added in future. The bar chart

Sl. No.	Site analysis	
	station map indication plot boundary, construction area boundary, green area boundary, etc.	showing the phasing for construction of the proposed building is given in **Fig 2.4**. The layout map showing the plot boundary, construction area boundary, green area boundary, etc. is given in **Fig 2.3**.
iii.	Submit excavation details, quantity of excavated material, top soil quantity and its preservation.	Refer Section 4.6.1, Chapter 4
iv.	Examine in detail the site with reference to impact on infrastructure covering water supply, storm water drainage, sewerage, power, etc., and the disposal of treated/ raw wastes from the complex on land/ water body and into sewerage system.	The impact & mitigation have been assessed as follows: **Water Supply**: Refer Section 4.4.2.3, Chapter 4 **Storm Water Drainage**: Refer Section 4.4.2.7, Chapter 4 **Sewerage & reuse/ disposal of waste water:** Refer Section 4.4.2.4 to 4.4.2.6 **Power:** Power (as energy conservation) - Section 4.12, Chapter 4 & Section 2.5.3, Chapter 2 **Impact on existing infrastructure:** Refer Section 4.13, Chapter 4
v.	Examine in detail the carrying capacity of existing sewer line, drains etc.	Refer Section 4.13, Chapter 4
vi.	Examine details of land use around 2 km radius of the project site. Analysis should be made based on latest satellite imagery for land use with raw images.	Refer Section 3.9.2, Chapter 3
vii.	Study and submit details of environmentally sensitive places, rehabilitation of communities and present status of such activities.	River, nala, drain & water bodies in 10 km are listed in Table 3.1. The places of Historical/ Heritage/ Tourist Places importance and Places of Worship are listed in Table 3.24. Location of forests/ mangroves is given in Table 3.20 Sewri mudflats are 2.3 km, SSW from the project site aerially.
viii.	Examine baseline environmental quality along with projected incremental load due to the project. Environmental data to be considered in relation to the community	Environmental data has been given in Chapter 3. Projected incremental loads due to the project are given in Chapter 4.

Sl. No.	Site analysis	
	development would be (a) land, (b) groundwater, (c) surface water, (d) air, (e) bio-diversity, (f) noise due to the traffic, (g) socio economic and health etc.	
ix.	Study the socio-economic situation of the project area and its surroundings and their impact on the project design and operation. Socio impact Assessment studies (SIA) shall be carried out specific to the project area. PP shall take into confidence/consent people residing in the project and surrounding area and objections/suggestions if any received may be submitted to SEIAA/SEAC-II.	Refer Section 3.12, Chapter 3 & Section 4.10, Chapter 4. There are no residents nor land losers in the project area, thus, no SIA has been carried out.
x.	Examine topography, rainfall pattern, soil characteristics, and soil erosion.	Topography: Refer Section 3.2.1 Soil Characteristics: Refer Table 3.18, Section 3.10.3 Soil Erosion : Refer Section 4.6.1, Chapter 4
xi.	Study the hydrological and geo-hydrological conditions of the project area. Including a contour plan indicating slopes and showing drainage pattern and outfall. Examine in detail the carrying capacity of existing storm water drainage line. Possibility of flooding in and around the project site.	There is no natural drain in the plot. The drainage pass from outside the plot, which can be seen in Fig 4.4 while the drainage plan can be seen in Fig 4.5. The existing capacity of the drain has been given in Section 4.13. Hydrogeology has been discussed in section 3.6.2. Flooding has been discussed in detail in Section 7.2.1(B) in Chapter 7.
xii.	Storm water drainage and outfall may be described through contour map and slopes of the project area and its surroundings.	The contour maps and slopes of the project can be seen in Fig 4.4 while the drainage plan can be seen in Fig 4.5.
	Water	
xiii.	Examine the details of water requirement, use of treated waste water and prepare a water balance chart.	Refer section 4.4.2.1, Chapter 4
xiv.	Rain water harvesting proposals should be made with due safeguards for ground water quality, aquifer level, soil permeability, justification for suitable/ appropriate rain water harvesting method and details of the	Refer section 4.4.2.7, Chapter 4

Sl. No.	Site analysis	
	selected option indicating locations on the project map.	
xv.	Maximize recycling of water and utilization of rain water. Examine details.	Recycling is maximised as shown in water balance in Fig 4.1. Regarding rain water harvesting, the non-feasibility is given in section 4.4.2.7, Chapter 4
xvi.	Examine soil characteristics and depth of ground water table for rainwater harvesting.	Refer Table 3.18, Section 3.10.3 Refer section 4.4.2.7, Chapter 4
xvii.	STP and water treatment plant should not be near each other. Indicate their locations with area details on the map. Also provide justification for the technology selected on the site and examine sustainable operation of the infrastructure.	There is municipal water supply, hence, no water treatment plant is proposed. Only softening plant for HVAC water supply will be there on the ground floor. The location of the STP is in the basement and is given in Fig 4.3 while the water supply network is given in Fig 4.2.
	Solid Waste Management	
xviii.	Examine details of Solid waste generation, type and quantity, treatment and its disposal.	Refer section 4.11.2, Chapter 4
xix.	Common facilities for waste collection, treatment, recycling and disposal (all effluent, emission and refuse including MSW).	Refer section 4.11.2, Chapter 4
xx.	Examine the location of solid waste treatment and disposal sites.	Refer section 4.11.2.5, Chapter 4
	Flora and Fauna	
xxi.	Study the existing flora and fauna of the area and the impact of the project on them.	Refer section 3.11, Chapter 3 and section 4.8, Chapter 4
	Energy	
xxii.	Since the project is a building construction and area development activities, examine electrical load, energy conservation measures, etc. and saving in energy.	Power requirement is detailed in Section 2.5.3, Chapter 2 while energy conservation measures are given in Section 4.12, Chapter 4.
xxiii.	Examine and submit details of use of solar energy and alternative source of energy to reduce the energy consumption.	Refer Section 4.12, Chapter 4.
xxiv.	DG sets are likely to be used during construction and operational phase of	Section 4.3.2, Chapter 4.

Sl. No.	Site analysis	
	the project. Emissions from DG sets must be taken into consideration while estimating the impact on air environment. Examine and submit details.	
xxv.	Provide for conservation of resources, energy efficiency and use of renewable sources of energy in the light of ECBC code. Application of renewable energy/alternate energy, such as solar energy, wind energy may be described with detailed analysis and exploring the possibility of such installations.	Refer Section 4.12, Chapter 4.
	Traffic and transportation	
xxvi.	A detailed traffic and transportation study should be made for existing and projected passenger and commercial traffic as the project is a mixed development including residential and commercial development.	The project is only office building. There will not be any residential or commercial activities. Traffic study is given in Section 3.8.2, Chapter 3 and traffic projections made in Section 4.5.2, Chapter 4
xxvii.	Examine the details of transport of material for construction which should include source and availability.	Refer Section 4.5.1, Chapter 4.
xxviii.	The evaluation of impacts should be analyzed depending upon the nature (positive and negative), duration (short term and long term) reversibility, and magnitude (negligible, low, medium, high), etc. of the impacts based the objective assessments.	Has been done accordingly.
xxix.	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.	The road/ rail connectivity is seen in section 1.4.4, Chapter 4. The present traffic load has been assessed in Section 3.8.2 of Chapter 3. Refer Section 4.5.2, Chapter 4 for the impact due to traffic.
xxx.	Traffic management plan including parking areas may be described. Traffic survey should be carried out on	Traffic study is given in Section 3.8.2, Chapter 3 and traffic management plan in Section 4.5.2, Chapter 4

Sl. No.	Site analysis	
	week days and week end.	
	Air and Noise	
xxxi.	Examine and submit details of Air quality monitoring as per latest National Ambient Air Quality standards as notified by the Ministry on 16th November, 2009.	Refer Section 3.5, Chapter 3
xxxii.	Examine and submit the details of Noise modelling studies and mitigative measures.	Refer Section 4.9, Chapter 4.
xxxiii.	Examine noise levels-present and future with noise abatement measures.	Refer Section 3.8, Chapter 3 for present noise levels and noise abatement measures in future in Section 4.9, Chapter 4.
xxxiv.	Noise pollution has always been a major concern for developmental projects during the construction and operational phase. It is suggested that noise monitoring should be carried out at critical locations at the surrounding areas may be incorporated in environmental monitoring programme during the whole operational phase of the project.	The suggestion has been incorporated in the proposed monitoring program given in Table 6.1, Chapter 6
xxxv.	Natural and artificial noise barriers may be considered for critical locations.	Natural noise barrier in the form of greenbelt is available along the Anik Wadal (a.k.a. Sewri Chembur) road on the periphery of the project
xxxvi.	A thick green belt should be planned all around the project site to mitigate noise and vibrations to the nearby settlements. The identification of species/plants should be made based on the botanical studies.	Section 4.8.2, Chapter 4
xxxvii.	Landscape plan, green belts and open spaces may be described.	Refer Section 4.8.2, Chapter 4
xxxviii.	Examine the details of afforestation measures indications land and financial outlay.	Green belt plantation proposal is given in Section 4.8.2, Chapter 4 and financial outlay in Section 6.4, Chapter 6.
	Building materials	
xxxix.	Use of local building materials should be described. The provisions of fly ash notification should be kept in view.	Building material like steel, aggregate, sand, cement, glass, etc. shall be used which are of indigenous origin. These are not available locally but

Sl. No.	Site analysis	
		from various parts of the state and country. As far as practical, use of Fly ash blocks & bricks shall be done from local vendors.
	Disaster Management Plan	
xl.	Risk assessment and disaster management plan should also include Fire, Earthquake, local floods, and any other natural disaster.	Refer Section 7.2, Chapter 7
	Environmental Management and monitoring plan	
xli.	Environmental Management Plan should be accompanied with Environmental Monitoring Plan and environmental cost and benefit assessment. Examine separately the details for construction and operation phases both for Environmental Management Plan and Environmental Monitoring Plan.	The Environmental Management Plan has been separately examined for construction phase and operation phase as seen in Chapter 4. The Environmental Monitoring Plan has been separately proposed for construction phase and operation phase as seen in Table 6.1, Chapter 6.
xlii.	Make assessment of any regulatory measure in view of the environmental and social impacts of the project (such as unauthorized development in and around the area).	No additional regulatory measure to control unauthorized development in and around the area is required since the areas around the project are already developed. The undeveloped area across the Eastern Freeway and Anik Wadala road will be developed as per regulations only.
	Corporate Social Responsibility	
xliii.	Submit the details of CSR activities. Provision shall be made for education, health and vocational training programs.	Refer Section 8.1, Chapter 8
	Other details as indicated in Appendix III of EIA Notification 2006 should also be attended. A detailed draft EIA/EMP report should be prepared as per the TOR and should be submitted to the SEIAA/SEAC, MMR as per the Notification.	Yes, they have been accordingly included. EIA/EMP report has been prepared as per the TOR for submission to SEIAA/ SEAC.

CHAPTER 2

PROJECT DESCRIPTION

2.1 DESCRIPTION OF THE PROJECT

The proposed project is Custom office project located at Wadala, Mumbai. The site falls under “Industrial zone” as per development plan of Mumbai Metropolitan Regional Development Authority (MMRDA). Urban Development Department Mantralaya, Mumbai, Government of Maharashtra has given permission for the construction of Customs office at the land bearing C.S No. 146. Refer ***Annexure II.*** Mumbai Metropolitan Region Development Authority has allotted the land bearing C.S No. 146 to the “Additional Commissioner of Customs (PG)”, Custom Enclave Cell for the development of Custom Office. Refer ***Annexure III*** for land allotment letter.

2.2 PROJECT LOCATION

The project is located at C.S no. 146 Customs Enclave (Suleman Shah Plot), Wadala (East), Mumbai as already described in section 1.4.3 and 1.4.4 of Chapter 1 along with the road, rail and air communication. The location plan has been given in Fig 1.1.

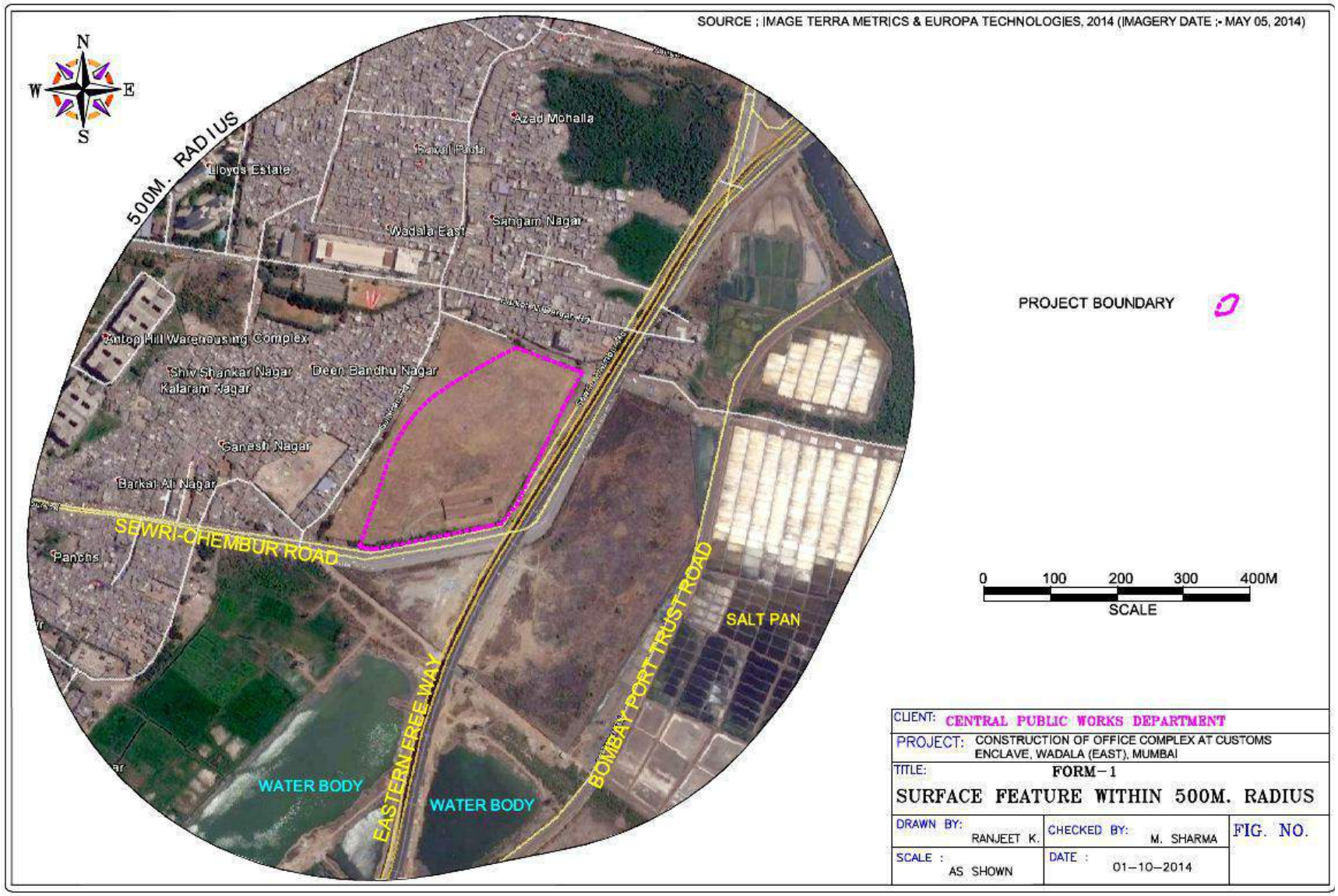
A panoramic view of the site is given in **Fig 2.1**.

FIG 2.1: SITE PHOTOGRAPHS

With respect to places of ecological importance, Sanjay Gandhi National Park is at a distance of 14.0 km, N direction. The distance and direction to various streams, drains, canals and water bodies is given in Table 3.1 of Chapter 3.

Surrounding features within 500 m radius as visible from satellite image is given in **Fig 2.2** while a 10 km radius map is given in Fig 3.1 of Chapter 3.

FIG 2.2: SURROUNDING FEATURES WITHIN 500 M RADIUS



2.3 PROPOSED LAYOUT AND FACILITIES

The complex comprises of block (comprising of records, kitchen, Auditorium for 400 people, Convention centre, Malkhana, Court rooms, Armoury, offices for various departments of customs). Basements will mainly be for parking purposes. 2nd Basement will have electric services including ESS DG set & HVAC. The 3rd basement will have STP, UG Tank and Pump Room.

The block will have three basements, podium, ground and 22 floors above it with provision for 7 additional floors further above it for future expansion.

The overriding prime objective of the proposed project is streamlining the functionary efficiency of the complex.

The layout plan of the integrated complex has been developed keeping in view of the following major design considerations:

- Meeting the projected spatial requirements for the entire complex as per the design brief and other guidelines.
- Fulfilling aspirations for developing a customs office with a conducive environment for customs functions.
- Design to be responsive, to the site parameters and the nature of building proposed.
- Creating an architecturally satisfying building complex which will stand out as a landmark in the vicinity.
- Adherence to the building bye-laws and master plan implications.

The population calculation of the proposed project is given in **Table 2.1.**

TABLE 2.1
POPULATION CALCULATION

Particulars	Population
Office Goers	5935
Floating/ visitors	5935
Total	**11870**

The proposed layout plan can be seen in **Fig 2.3** while the proposed break up of the land use is given in **Table 2.2**.

FIG 2.3: PROPOSED LAYOUT PLAN

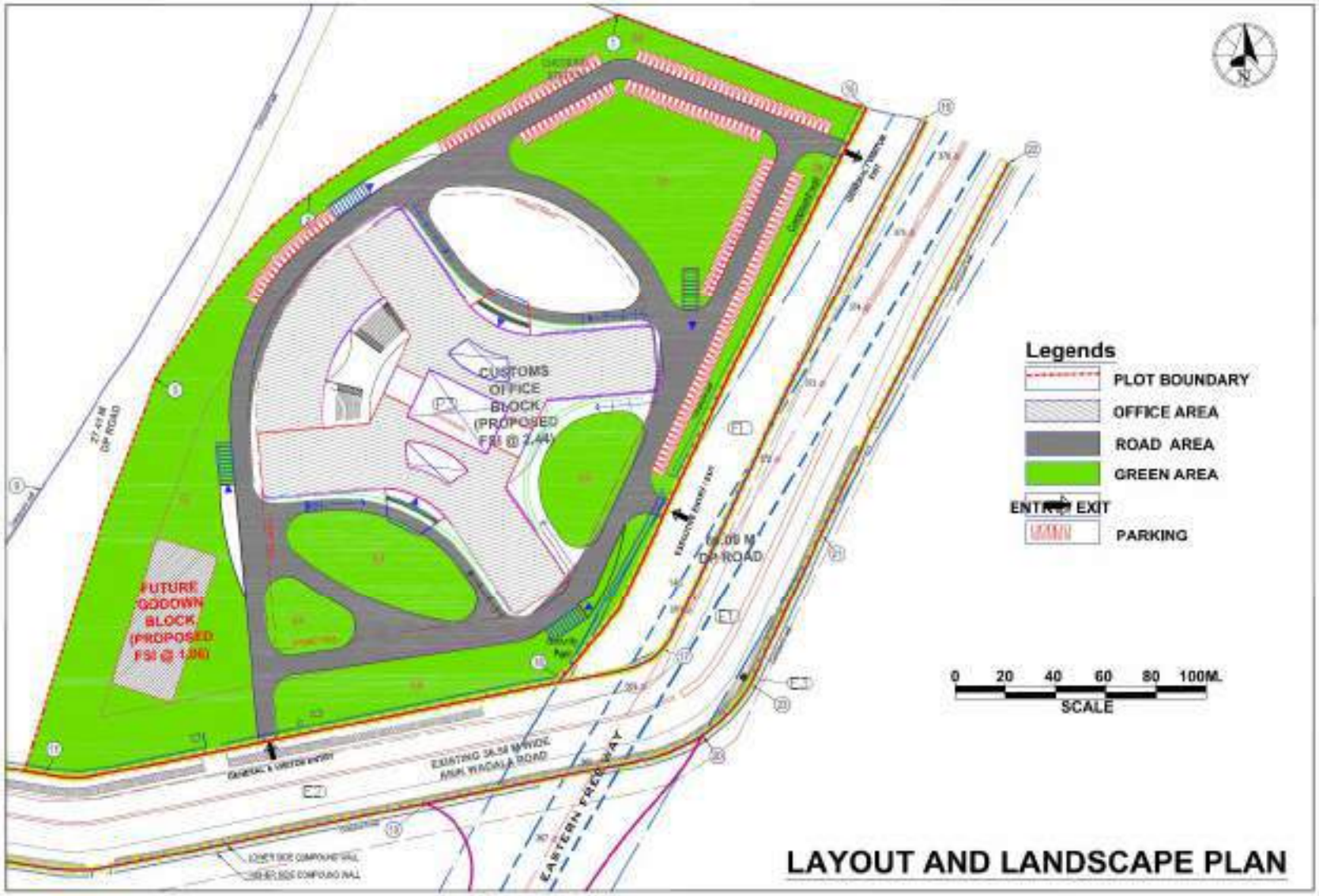


TABLE 2.2
BREAK UP OF LAND USE WITHIN PLOT

Sl. No.	Proposed Land use	Area Details in sq.m	
		Area	%
1.	Office Building	19930	35.26
2.	Road Area	10,087	17.85
3.	Surface parking	2,723	4.82
4.	Green Area	23,783	42.08
	Total	**56523.13**	**100.00**

2.4 TECHNOLOGY AND PROCESS DESCRIPTION

The construction will be carried out as per the standard technology for high rise buildings being followed in the country. It is costlier to make high-rise buildings because of the design factors: the vertical members like the columns have to be much stronger and as it raises the cost and time of transportation and scaffolding. Further the maintenance becomes very costly compared to a conventional low height building.

Many high rise building are being constructed in India in which different latest technology are used for construction and also the concept of green technology are being updated. Steel technology and reinforce cement concrete are mostly used for the construction of the high rise building. High strength cement are being used for the high rise building construction as against ordinary cement. In most of the high rise buildings, cement blocks are being used for wall construction. Different machines are being used for easy construction of high rise building. Ready mix concrete are being used. Machines like vdf (vaccum dewatering flooring) which is used for smoothening of the surface are used. Machines are used for the texturing of the exterior wall and for the cutting of the rigid pavement for the expansion groove cutting. Ground improvement techniques are applied for construction and also for increment of load bearing capacity. Different architectural concept are being applied for the construction.

Based on the distribution of the components of the primary lateral load-resisting system over the building, the structural system of high-rise buildings can be broadly classified as either Interior Structures or Exterior Structures. In interior structural system, the major part of the lateral load-resisting system is located within the interior of the building. Whereas in exterior structural system, the lateral loads resisting system, is located along the building perimeter.

The building will use reinforced cement concrete, light weight concrete brickwork, fly ash, steel, glass, insulation, etc.

2.5 PROJECT COMPONENTS

2.5.1 Water supply

Water requirement during construction phase will be met through tankers. The project proponent will obtain necessary permission from the concerned authority.

As per the initial estimation, the fresh water requirement for the proposed project will be 414 KLD during the operation phase. Fresh water requirement during the operation phase will be met from the Municipal Mains. The waste water after treatment shall be reused in the project. Thus, entire 285 KLD waste water generated will be treated and reused. After accounting for losses, 257 KLD waste water will be reused. Thus, total water required for the project will be 671 KLD.

Water conservation plan will be implemented as per guidelines to conserve the resources.

It is estimated that 200 KL of water will be reserved separately for fire fighting purpose in the premises.

The details of the water requirement and water supply and distribution system along with water supply network is given in section 4.4.2, Chapter 4 of EIA/EMP.

2.5.2 Sewerage and drainage

The sewage system is an essential part of human settlement to maintain cleanliness and to avoid unhygienic conditions in the project. It is found by experience that combined sewerage system suffers from the main disadvantage of sluggish flow during most period of the year leading to deposition of sewage solids creating foul & offensive conditions. These developments are experienced due to considering of higher value of quantity flow in designing which take place in some days of rainy season only. It leads to high construction cost as well as creates unhealthy conditions. Hence, sewage and drainage systems have been proposed separately.

It has been assumed that about 80% of the domestic water shall reach the sewer as sewage. Hence, the sewage generated from the project shall be to the tune of about 285 KLD, which shall be treated in the MBBR based sewage treatment plant of 350 KLD capacity that has been proposed for the project.

The details of the sewage generation, treatment and disposal along with sewerage network of the project is given in section 4.4.2, Chapter 4 of EIA/EMP.

2.5.3 Power requirement

The power load requirement shall be around 10000 KVA for conduction of all kinds of activities on different land uses. Power will be sourced from Maharashtra State Electricity board(MSEB). 4 x 1010 KVA DG sets have been proposed for power back up.

Details of load required

The details of loads are given in **Table 2.3.**

TABLE 2.3
ELECTRICAL LOAD REQUIREMENT FOR CUSTOM OFFICE MUMBAI

Sl. No.	Description	L &F	Power	Total
1.	Basement	200	150	350
2.	Total covered area of upper floors	1187	3562	
a.	Carpet area	950		4749
b.	Common area			950
3.	Lift 28 x 15			420
4.	W/F pump			150
5.	Ext. Lighting			30
6.	A/C load - 5000 TR @ 1.1KW/TR			5500
	Total Load in KW	2337	3712	12149
	Total load in KVA (PF = 0.9)			13499
	Max Demand (Div. 0.7)			9449
	Say			**10000 KVA**
	ESS capacity proposed	**5x2000 KVA**		
	DG set			
1.	L & F			
a.	Basement			200
b.	Upper Floors			2137
2.	Ext Lighting			30
3.	Lifts			300
4.	Pumps			100
5.	Ventilation			100
6.	AHU's for air circulation			800
7.	1 No Chiller M/C 1000 TR			800
	Total Load in KW			**4467**
	Maximum demand in KW @Div 0.7			3127
	Maximum demand in KVA			3679
	Say			**3700 KVA**
	DG set capacity proposed			**4x1010 KVA EACH**

2.5.4 Solid waste management

Total anticipated municipal solid waste generation from the project will be 1.8 TPD. For solid waste, collection and thereafter segregation at source will be done. Segregation of biodegradable, non-biodegradable and recyclable waste at source will be practiced.

The recyclable components will be sold to the authorized recycling vendors. The balance municipal waste shall be disposed off by a contractor of MCGM as per approved procedure. Waste shall be finally disposed at "Deonar" which is the largest and the oldest dumping ground of Mumbai operating since 1927.

The sewage discharge envisaged for the project is about 285 KLD as per MoEF norms and the sewage sludge envisaged is 0.42 tonnes/day (@ 35 gm/capita/day), which will be produced after its treatment in the STP provided within the project site. Dried weight will be 30-35%, which will be available as manure.

The details of the solid waste generation, collection, transport, treatment, storage and disposal is given in section 4.11, Chapter 4 of EIA/EMP.

E-Waste generation

The estimated quantity of e-waste, based on the present generation trend in India works out to be 0.66 kg/capita/year. Hence, for a total population of 5935, the e-waste works out to about 3.9 t/yr. Since the e-waste will comprise mostly of obsolete computers/ equipment in working condition, they will be sold as per project policy. Management of e-waste is given in section 4.11.3, chapter 4 of this EIA/EMP report.

2.5.5 Rain water harvesting

As per Geo-technical investigation report, ground water table observed between 0.8 to 1.7 M below ground level(bgl), which is very high. Seasonal and annual fluctuation in ground water levels can be expected. Therefore, no artificial recharging will be proposed.

Central Ground Water Board(CGWB) norms suggests that artificial recharging will not be done if the water table is less than 8 m.
(Source : Manual on norms and standards for environment clearance of large construction projects, MOEF,GOI, Chapter 2)

The rain water drainage is given in section 4.4.2.7, Chapter 4 of EIA/EMP.

2.5.6 Parking facilities

Surface parking, basement parking and parking on podium have been proposed. The total parking proposed is 2148 ECS.

The details of parking, traffic management along with surface, basement and building parking is given in section 4.5.2, Chapter 4 of EIA/EMP.

2.6 SPECIAL FEATURES ADOPTED FOR ENVIRONMENTALLY SUSTAINABLE PROJECT

Green Cover

There will be green belt in an area of 23,783 sq.m i.e. 42.08% of plot area which shall aid in enhancing the diversity of the area. Total 313 trees will be planted. Tree species proposed to be planted are *Lagerstroemia flos-reginae* (Pride of India, Queen's Crepe (Crape) Myrtle)*, Bauhinia blackeana* (Hong Kong Orchid Tree)*, Murraya paniculata* (Kamini)*, Michelia champaca* (Champak)*, Cassia fistula* (Amaltas)*, Saraca asoka* (Ashoka) *and Nyctanthes arbor-tristis* (Parijat)*.*

The landscape figure is given in **Fig 4.12**, **Chapter 4** of EIA/EMP.

Water Conservation System

Fresh water requirement will be met through water supplied by Municipal Supply. The following measures have been proposed to curtail the consumption of water, thus, conserving it:

a) Water conserving flushing fixtures operating on infrared sensors shall be used for Urinals.
b) Water demand meters shall be installed to monitor daily consumption patterns for the purpose of record.
c) Push back type pillar cocks in wash basins shall be installed.
d) Water conservation using Dual flow fixtures for plumbing cistern.

Principles & guidelines for energy efficient buildings

The details of energy conservation is given in section 4.12, Chapter 4 of EIA/EMP.

Building materials

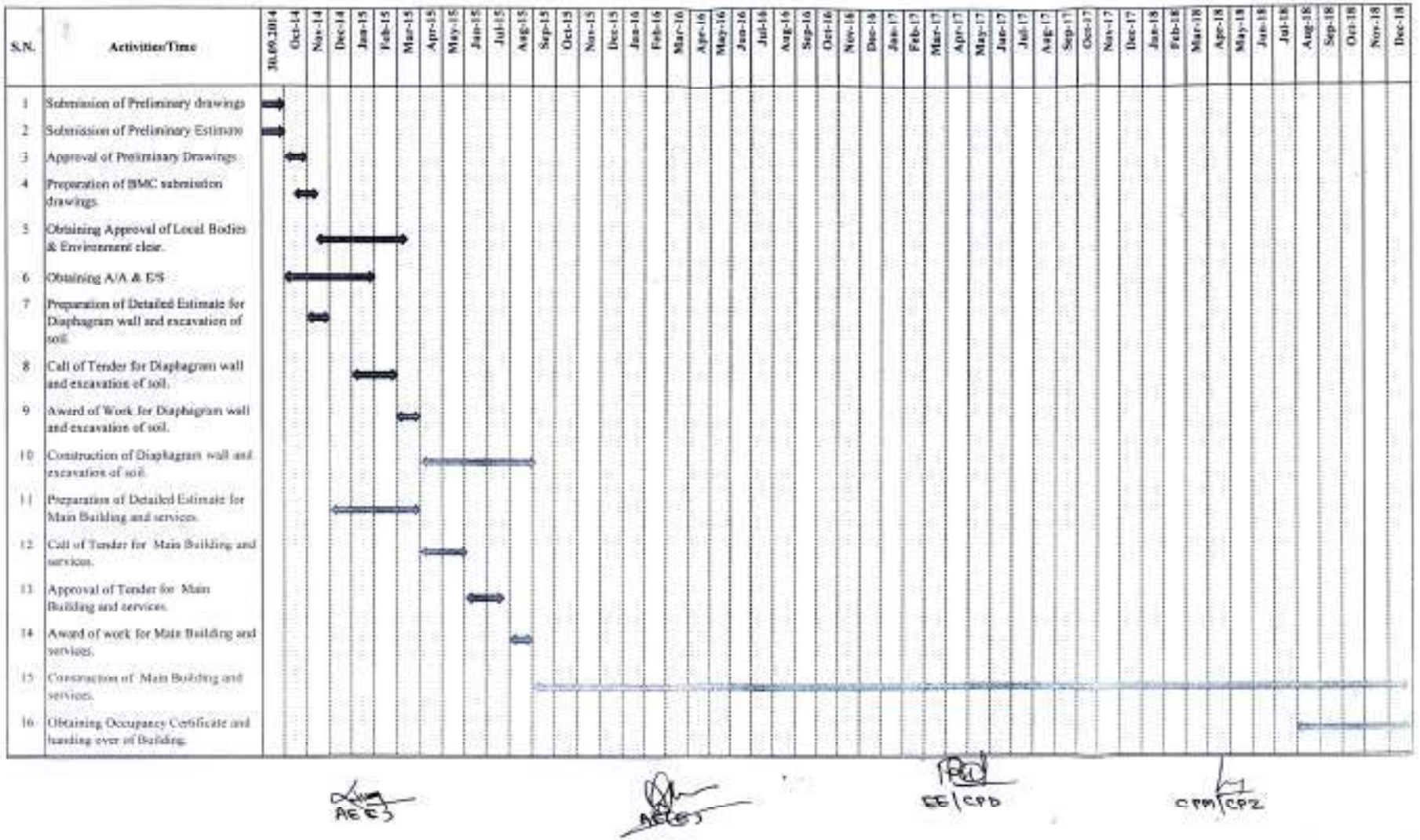
Building material like steel, aggregate, sand, cement, glass, etc. shall be used which are of indigenous origin. These are not available locally but from various parts of the state and country. As far as practical, use of Fly ash blocks & bricks shall be done from local vendors.

2.7 PHASING OF THE PROJECT

The block will have three basements, podium, ground and 22 floors above it with provision for 7 additional floors further above it for future expansion. The remaining seven floors shall be constructed within the allocated project schedule as bare shell. The bar chart showing the phasing for construction of the proposed building is given in **Fig 2.4**.

FIG 2.4: BAR CHART

Name of work : Construction of Office Complex at Customs Enclave Plot , Wadala (East), Mumbai.



CHAPTER 3

DESCRIPTION OF THE ENVIRONMENT

3.1 GENERAL

3.1.1 Sources of environmental data

The baseline information on micro-meteorological data, ambient air quality, water quality, noise levels, soil quality, ecology and traffic density have been collected by M/s Min Mec R&D Laboratory, New Delhi (NABL certificate no. T-1157 & MoEF Sl. No. 97). Long term meteorological data available from the nearest IMD station, Santa Cruz was collected. Apart from these, secondary data have been collected from Census 2011 data and other government & published sources. The generation of primary data as well as collection of secondary data and information from the site and surroundings was carried out during winter season from December 2014 to February 2015.

3.1.2 Study area

For the description of baseline environmental scenario, the project area has been considered as the core zone. The area falling within a distance of 10 km from the boundary of the core zone has been considered as the buffer zone. The core zone and the buffer zone together have been termed as “study area” in this study. The study area in this case falls in Wadala, District Greater Mumbai, Maharashtra. The area falls in “Industrial zone” as per development plan of MMRDA.

3.2 TOPOGRAPHY & DRAINAGE

The topography and drainage map of the 10 km radius of the project site has been represented by **Fig 3.1**.

3.2.1 Topography

Core zone: The ground elevation of the project area is minimum 28.314 m to 29.264 m with slope towards the southern side as per elevation shown in Survey Map.

Buffer zone: The elevation of the ground surface in buffer zone varies between 0 m to 295 m above mean sea level as per altitudes shown in Google Earth.

3.2.2 Drainage

Core zone: There is no drainage, stream or nala passing through the core zone.

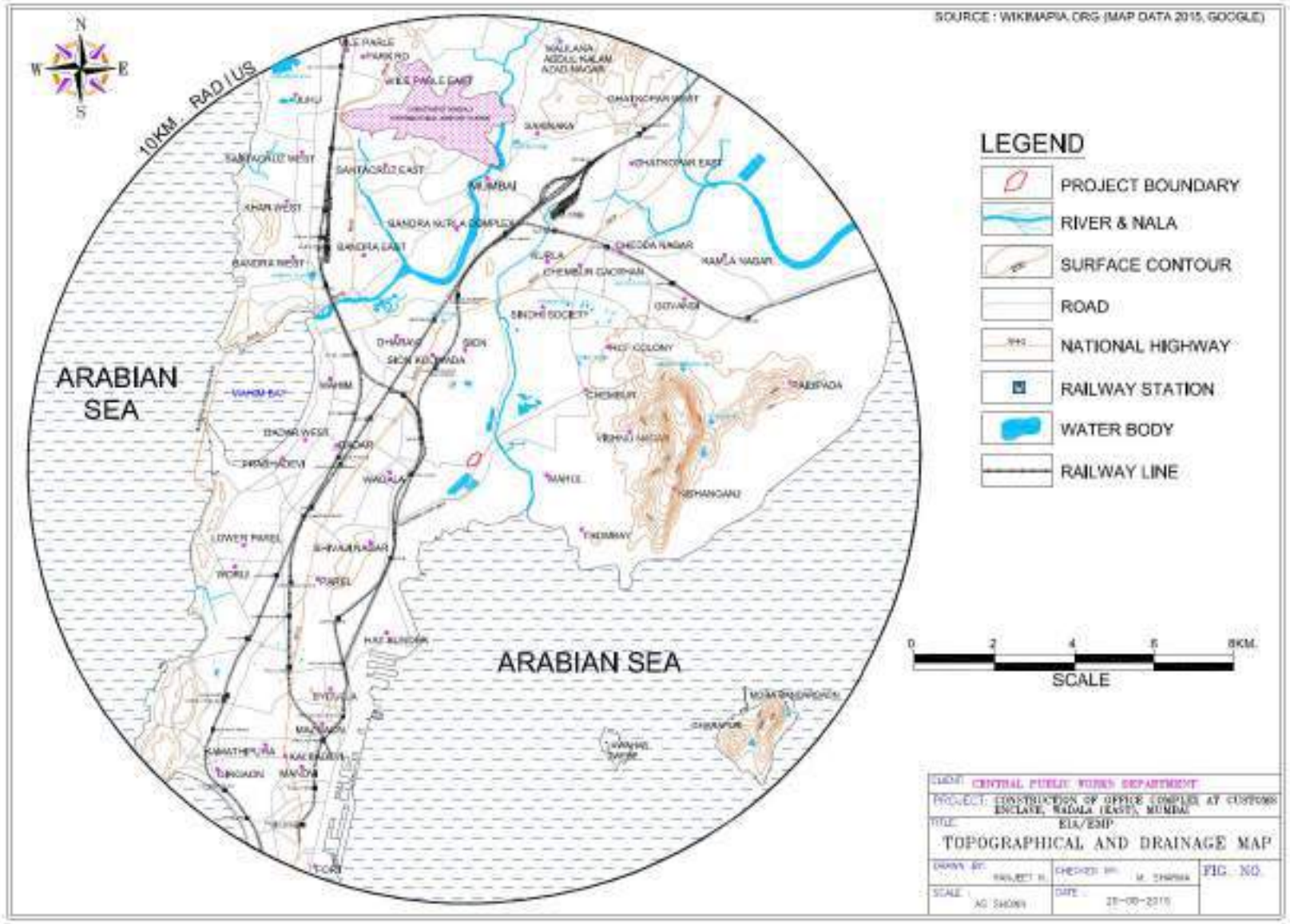
Buffer zone: The area of the sea in 10 km radius is approximately 172 sq.km. which is approximately 44% of the total study area. On land, there are many water bodies in the study area. Various water bodies present in the study area are given in **Table 3.1**.

TABLE 3.1
RIVER, NALA, DRAIN & WATER BODIES IN 10 KM

Sl. No.	Description of Feature	Distance (km)	Direction
	Sea		
1.	Arabian Sea	1.0	S
	Ponds/ Lakes		
2.	Pond, Wadavali Village	3.0	NE
3.	Sion Pond	3.0	NNW
4.	Teen Talao	3.9	NNE
5.	Anushaktinagar Lake	4.8	ENE
6.	Ghatala Pond	5.1	NE
7.	Bhabha Lake, near BARC	5.1	ENE
8.	Bandra Talao	5.3	NW
9.	Jai Ambe Nagar Pond, near CVSL Mankhurd stop	6.6	NE
10.	Pond, Bail Bazar	7.0	N
11.	Lake Near Juhu	9.6	NW
	Rivers/ Nalas		
1.	Mithi River	3.8	NNW
2.	Nala near India Oil	6.4	NE

A nala flows on the north as well as the south side of the project site. The nala on the south is at a distance of 60 m from the project boundary and the nala on the north is at a distance of 25 m from the project boundary as per the survey plan.

FIG 3.1: TOPOGRAPHY AND DRAINAGE MAP



3.3 CLIMATE

The climate of Mumbai is characterized by an oppressive summer, dampness in the atmosphere nearly throughout the year, and heavy south-west monsoon rainfall. The cold season from December to February is followed by the summer season from March to June. The period from June to about the end of September constitutes the south-west monsoon season, and October and November form the post-monsoon season.

The normal annual rainfall over the district varies from about 1800 mm to about 2400 mm. It is minimum in the central part of the district around Kurla (1804.9 mm). It gradually increases towards north and reaches a maximum around Santa Cruz (2382.0 mm).

(Source: http://cgwb.gov.in/District_Profile/Maharashtra/Greater%20Mumbai.pdf)

The nearest India Meteorological Department's (IMD) station is at Santa Cruz situated at a distance of approximately 11 km to the North North West of the project area. The different meteorological parameters, viz., temperature, rainfall and relative humidity were collected from Santa Cruz for the period 1961 to 1990 from Climatological Normals (1961 - 1990) IMD, Pune. The data in respect of various parameters are briefly discussed in the following paragraphs.

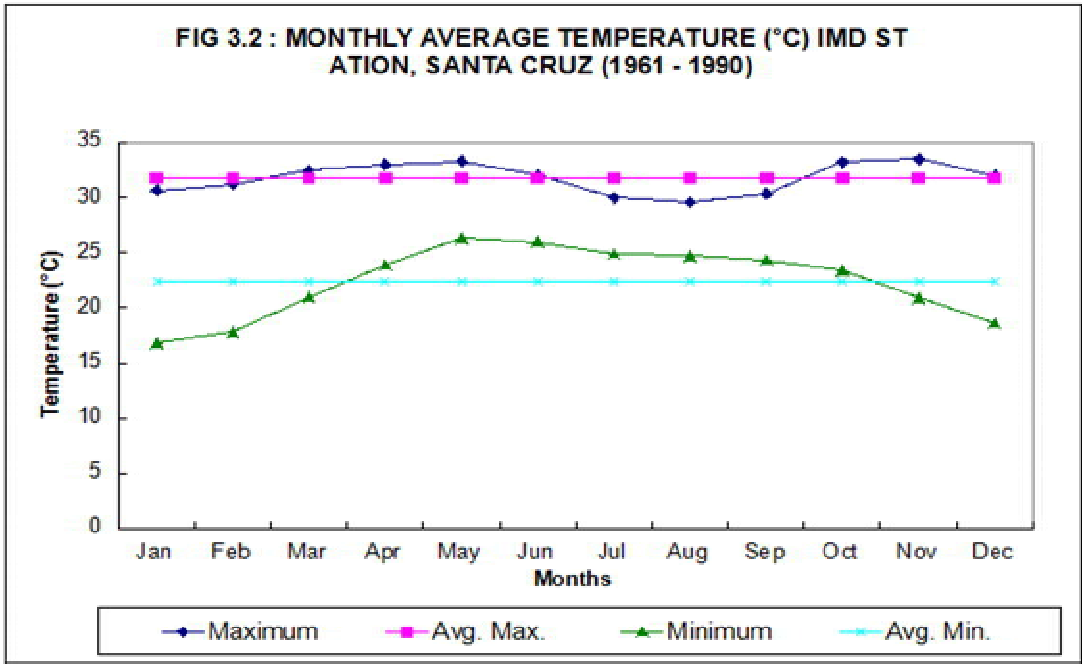
3.3.1 Temperature

The average monthly maximum and minimum temperatures during the period 1961 – 1990 have been furnished in **Table 3.2** and visualized in **Fig 3.2**.

TABLE 3.2
MONTHLY AVERAGE MAX & MIN TEMPERATURE
AT IMD STATION, SANTA CRUZ (1961 - 1990)

Months	Temperature (°C)	
	Maximum	Minimum
January	30.7	16.8
February	31.2	17.8
March	32.5	21.0
April	33.0	23.9
May	33.3	26.3
June	32.1	26.0
July	30.0	24.9
August	29.6	24.7
September	30.4	24.3
October	33.2	23.4
November	33.5	20.9
December	32.0	18.6
Mean	**31.8**	**22.4**

From the above table, it is observed that the average of minimum temperatures recorded ranges from 16.8°C in January to 26.3°C in May and the average of maximum temperature ranges from 29.6°C in August to 33.5°C in November.

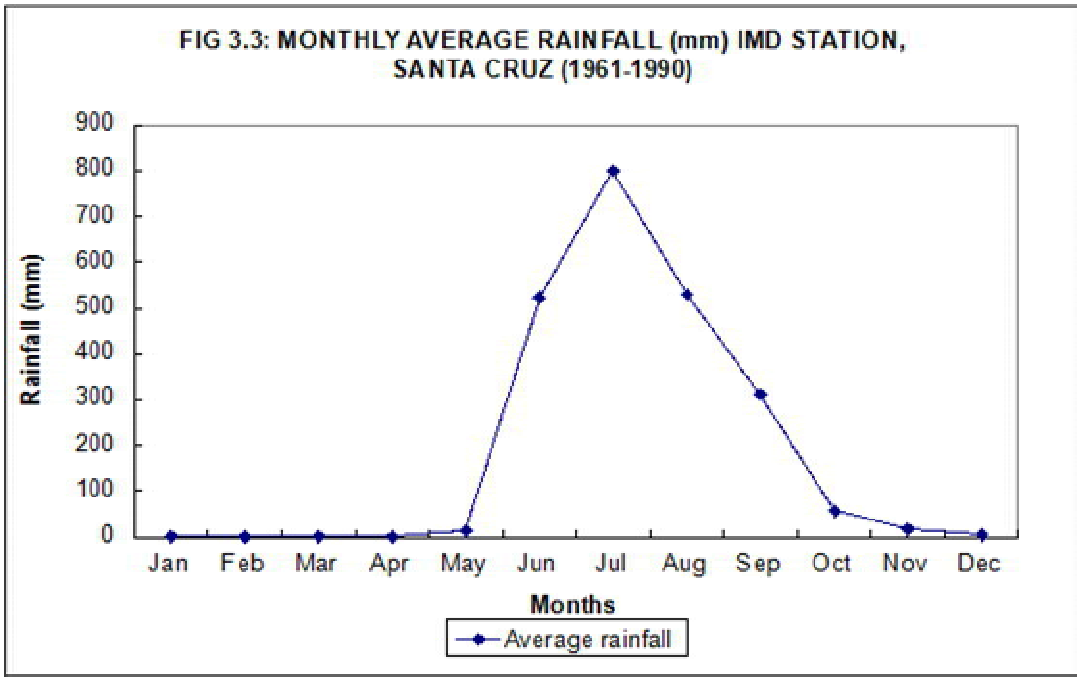


3.3.2 Rainfall

Bulk of rainfall in the core and study area is received during monsoon season between June to September. On an average, almost 90-95% of the rainfall is recorded in the months of June to September. The month wise average rainfall from 1961 to 1990 is given in **Table 3.3** and depicted graphically in **Fig 3.3**.

TABLE 3.3
MONTHLY AVERAGE RAINFALL (MM) AT IMD STATION, SANTA CRUZ (1961-1990)

Months	Rainfall (mm)
January	0.6
February	1.3
March	0.2
April	0.7
May	12.5
June	523.1
July	799.7
August	529.7
September	312.3
October	55.8
November	16.8
December	5.3
Average	**2258.0**



The rainfall data shows that the average monthly rainfall varies between 0.6 mm (January) to 799.7 mm (July). The average annual rainfall for the period from 1961 to 1990 was observed as 2258.0 mm.

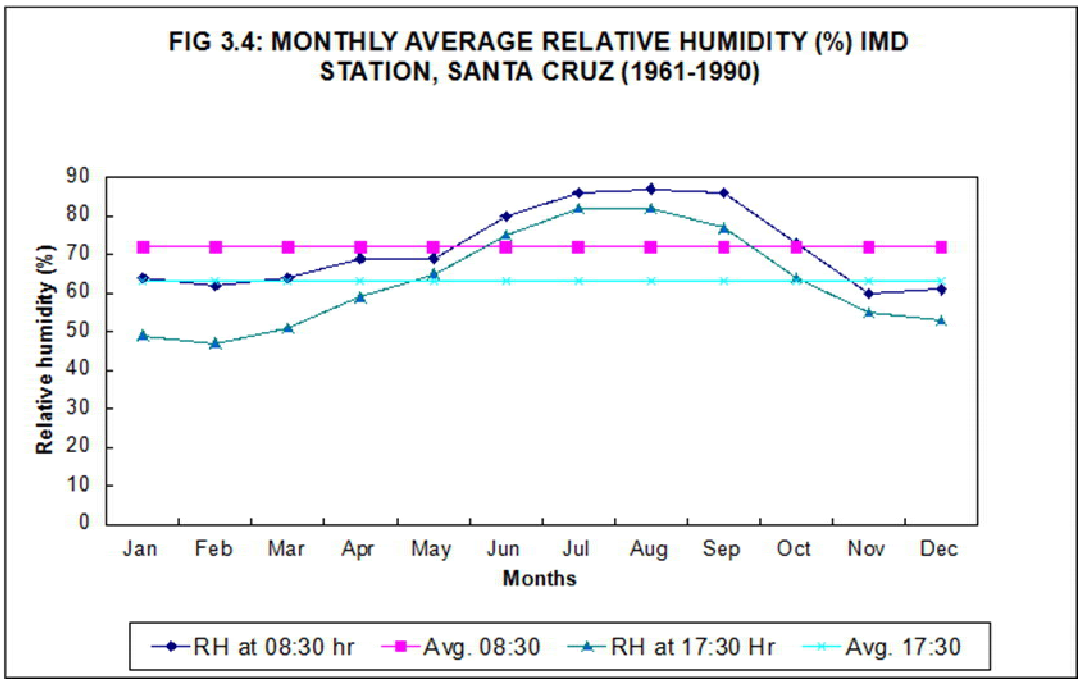
3.3.3 Relative humidity

The average monthly relative humidity data recorded at Santa Cruz IMD station during the period 1961-1990 is summarised in **Table 3.4** and graphically represented in **Fig 3.4**.

TABLE 3.4
AVERAGE MONTHLY RELATIVE HUMIDITY IMD STATION, SANTA CRUZ (1961-1990)

Months	Relative Humidity in %	
	8.30 Hrs	17.30 Hrs
January	64	49
February	62	47
March	64	51
April	69	59
May	69	65
June	80	75
July	86	82
August	87	82

Months	Relative Humidity in %	
	8.30 Hrs	17.30 Hrs
September	86	77
October	73	64
November	60	55
December	61	53
Average	**72**	**63**



The relative humidity data shows that the average monthly humidity at 08:30 hrs varies between 60% (November) to 87% (August) and 17:30 hrs it varies from 47% (February) to 82% (July and August). The average relative humidity at 0830 hrs and 1730 hrs was observed as 72% and 63% respectively.

3.3.4 Wind speed and windrose

To demonstrate the wind flow pattern of the study area, Windrose diagram of IMD station at Santa Cruz are given in **Fig 3.5** and **Fig 3.6** for 08:30 hrs and 17:30 hrs respectively as obtained for the data recorded for a period of 1961 to 1990. An observation of the morning and evening windrose shows that the predominant wind direction at 08:30 hrs is from West during May to September while it is from east from October to February. At 17:30 hrs predominant wind direction is from North West during September to April and from west during May to August.

FIG 3.5: WIND ROSE DIAGRAM OF DATA FROM MUMBAI/ SANTA CRUZ AT 08:30 HRS

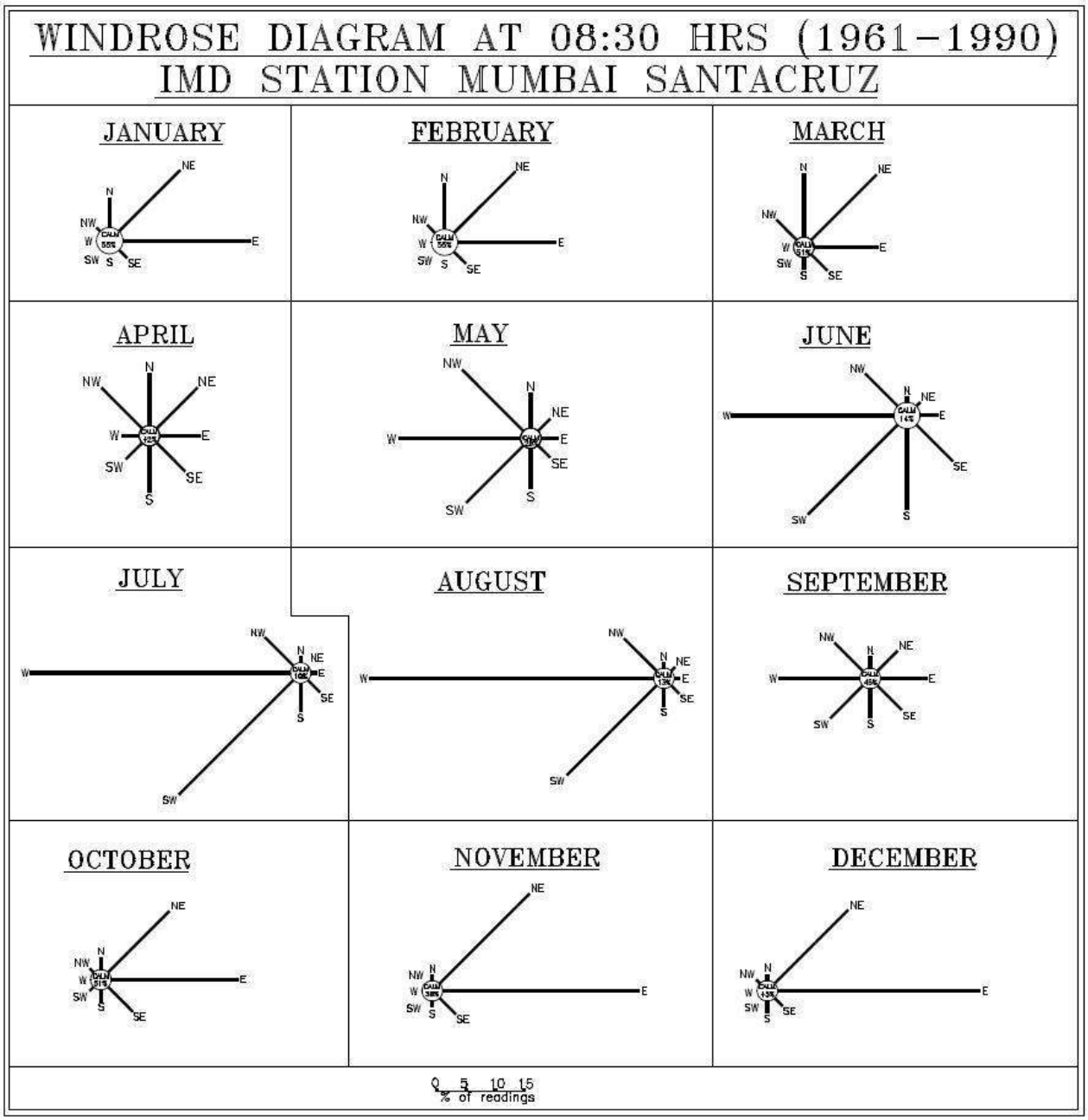
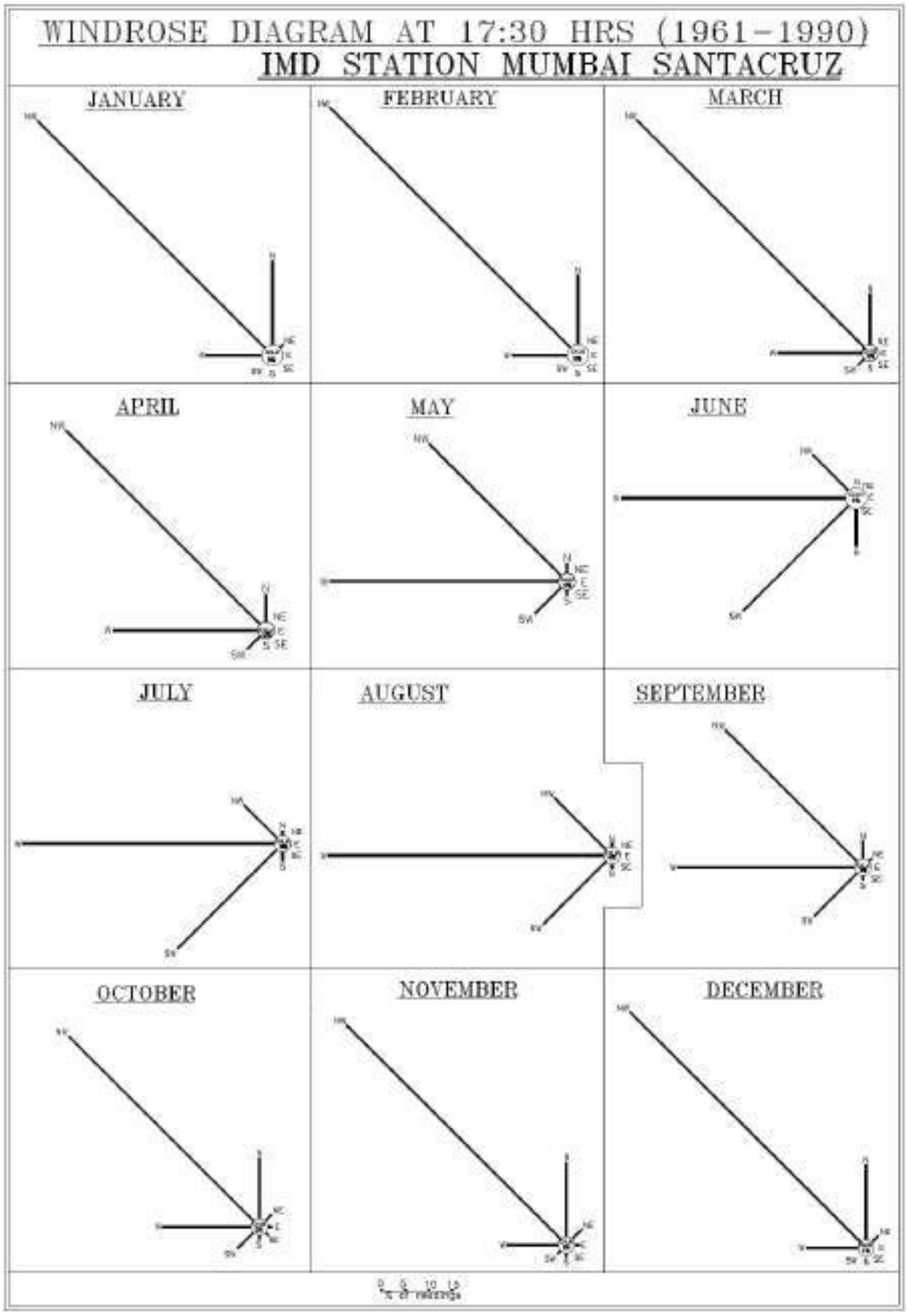


FIG 3.6: WIND ROSE DIAGRAM OF DATA FROM MUMBAI/ SANTA CRUZ AT 17:30 HRS



3.4 MICRO-METEOROLOGICAL SURVEY

Micro-meteorological survey was undertaken for monitoring wind speed, wind direction, ambient air temperature and relative humidity with an automatic weather station during winter season from December 2014 to February 2015. The meteorological station was set up at the project site. The monitored micro-meteorological data is given in ***Annexure IV*** and summarized in **Table 3.5**.

TABLE 3.5
SUMMARY OF MICRO-METEOROLOGICAL DATA
(DECEMBER 2014 TO FEBRUARY 2015)

Particulars	Maximum	Minimum	Average
Temperature (°C) (dry bulb)	38.5	19.1	26.56
Relative humidity (%)	100.0	14.3	53.44
Wind speed (km/hr)	24.1	Calm	8.5
Predominant wind direction	NNE (30.16% readings)		

The above table shows that temperature recorded at the site has a minimum value of 19.1°C, maximum value of 38.5°C and a mean value of 26.56°C, Relative humidity has a minimum value of 14.3%, maximum value of 100.0% and a mean value of 53.44% during the monitoring period. The wind speed varies between Calm to 24.1 km/hr with a mean wind speed of 8.5 km/hr and the observed predominant wind direction is from NNE with 30.16% of occurrences. The wind frequency is given in **Table 3.6** and the corresponding windrose diagram is shown in **Fig 3.8.**

TABLE 3.6
WIND FREQUENCY OF MONITORED DATA (01/12/2014 TO 28/02/2015)

Wind	% of readings in different ranges of wind speed (km/hr)							
direction	Calm	1.8-5	5-10	10-15	15-20	>20	Total	Ex-calm
from	DAY (6 hrs to 17 hrs)							
E	0.00	0.00	4.85	4.54	2.53	1.05	12.97	12.97
ENE	0.00	0.00	2.11	2.11	1.16	0.42	5.80	5.80
NE	0.00	0.00	2.11	1.16	0.21	0.11	3.59	3.59
NNE	13.71	0.00	4.54	1.27	0.32	0.00	19.84	6.13
N	0.00	0.00	2.22	1.05	0.00	0.00	3.27	3.27
NNW	0.00	0.00	1.05	0.63	0.11	0.00	1.79	1.79
NW	0.00	0.21	1.37	3.16	1.48	0.53	6.75	6.75
WNW	0.00	0.00	0.84	5.70	3.48	1.79	11.81	11.81
W	0.00	0.00	0.63	6.75	8.54	2.32	18.24	18.24
WSW	0.00	0.00	0.21	1.58	1.16	0.11	3.06	3.06
SW	0.00	0.00	0.32	0.42	0.00	0.00	0.74	0.74
SSW	0.00	0.00	0.21	0.21	0.11	0.00	0.53	0.53
S	0.00	0.00	1.05	0.32	0.00	0.00	1.37	1.37
SSE	0.00	0.00	2.53	0.32	0.00	0.00	2.85	2.85
SE	0.00	0.00	2.85	0.53	0.11	0.00	3.49	3.49
ESE	0.00	0.00	1.79	1.79	0.32	0.00	3.90	3.90
Total	**13.71**	**0.21**	**28.68**	**31.54**	**19.53**	**6.33**	**100.00**	**86.29**

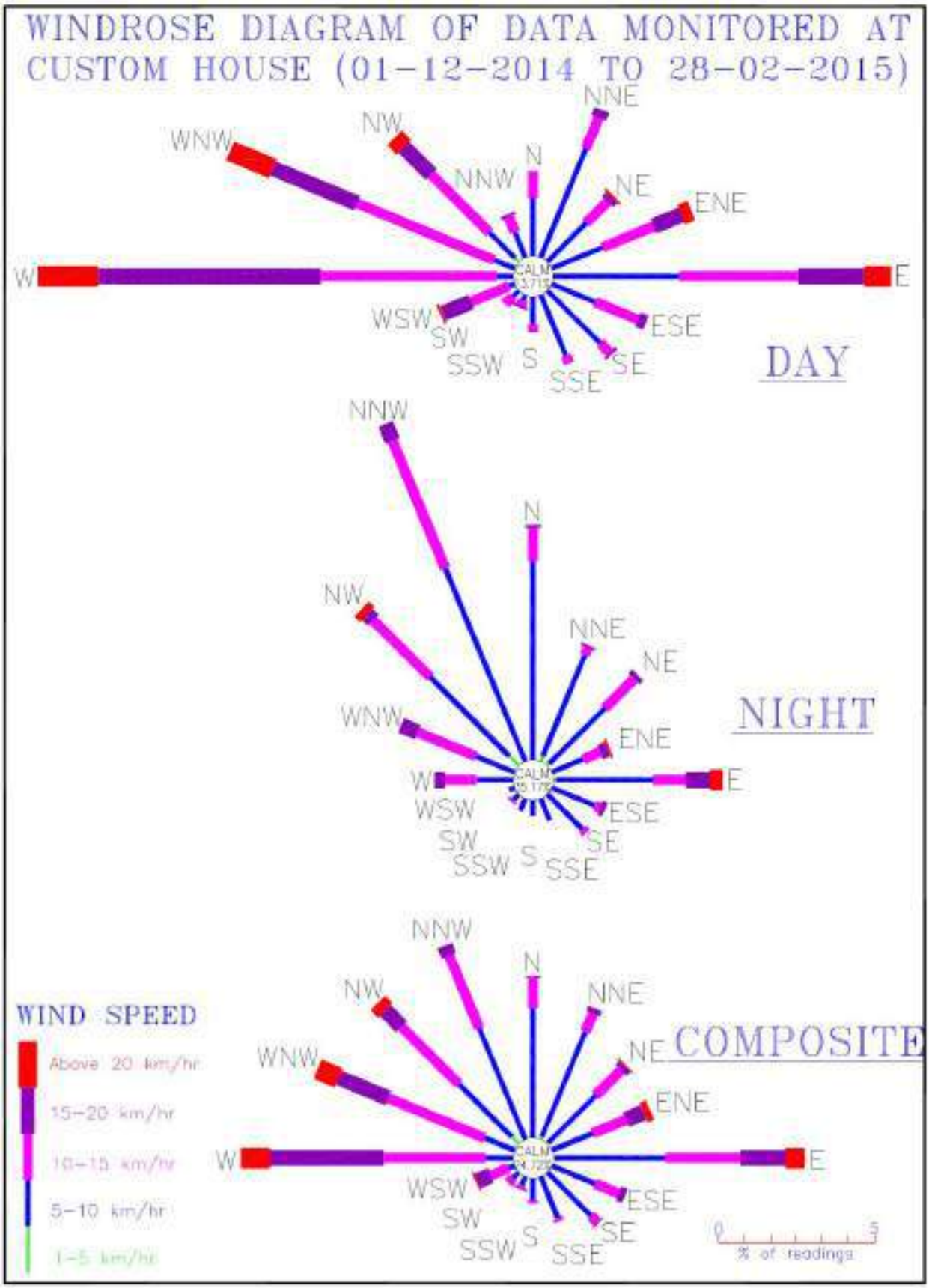
Wind	% of readings in different ranges of wind speed (km/hr)							
direction	Calm	1.8-5	5-10	10-15	15-20	>20	Total	Ex-calm
from	NIGHT (18 hrs to 5 hrs)							
E	0.00	0.10	3.71	1.30	0.90	0.50	6.51	6.51
ENE	0.00	0.00	1.30	0.70	0.30	0.10	2.40	2.40
NE	0.00	0.10	3.01	1.60	0.20	0.00	4.91	4.91
NNE	35.17	0.20	4.21	0.30	0.10	0.00	39.98	4.81
N	0.00	0.00	7.62	1.30	0.10	0.00	9.02	9.02
NNW	0.00	0.00	8.02	5.31	0.70	0.00	14.03	14.03
NW	0.00	0.50	4.31	3.11	0.30	0.30	8.52	8.52
WNW	0.00	0.00	1.60	2.40	0.70	0.00	4.70	4.70
W	0.00	0.00	1.40	1.20	0.40	0.00	3.00	3.00
WSW	0.00	0.00	0.20	0.00	0.00	0.00	0.20	0.20
SW	0.00	0.00	0.30	0.10	0.00	0.00	0.40	0.40
SSW	0.00	0.00	0.50	0.00	0.00	0.00	0.50	0.50
S	0.00	0.00	0.60	0.00	0.00	0.00	0.60	0.60
SSE	0.00	0.00	0.90	0.00	0.00	0.00	0.90	0.90
SE	0.00	0.00	1.90	0.20	0.00	0.00	2.10	2.10
ESE	0.00	0.00	1.80	0.20	0.20	0.00	2.20	2.20
Total	**35.17**	**0.90**	**41.38**	**17.72**	**3.90**	**0.90**	**100**	**64.80**
COMPOSITE								
E	0.00	0.05	4.27	2.88	1.70	0.77	9.67	9.67
ENE	0.00	0.00	1.70	1.39	0.72	0.26	4.07	4.07
NE	0.00	0.05	2.57	1.39	0.21	0.05	4.27	4.27
NNE	24.72	0.10	4.37	0.77	0.21	0.00	30.17	5.45
N	0.00	0.00	4.98	1.18	0.05	0.00	6.21	6.21
NNW	0.00	0.00	4.62	3.03	0.41	0.00	8.06	8.06
NW	0.00	0.36	2.88	3.13	0.87	0.41	7.65	7.65
WNW	0.00	0.00	1.23	4.01	2.06	0.87	8.17	8.17
W	0.00	0.00	1.03	3.91	4.37	1.13	10.44	10.44
WSW	0.00	0.00	0.21	0.77	0.57	0.05	1.60	1.60
SW	0.00	0.00	0.31	0.26	0.00	0.00	0.57	0.57
SSW	0.00	0.00	0.36	0.10	0.05	0.00	0.51	0.51
S	0.00	0.00	0.82	0.15	0.00	0.00	0.97	0.97
SSE	0.00	0.00	1.70	0.15	0.00	0.00	1.85	1.85
SE	0.00	0.00	2.36	0.36	0.05	0.00	2.77	2.77
ESE	0.00	0.00	1.80	0.98	0.26	0.00	3.04	3.04
Total	**24.72**	**0.56**	**35.21**	**24.46**	**11.53**	**3.54**	**100**	**75.30**

Note: Calm is cut off at wind speed <1.8 km/hr as per CPCB Guidelines

Wind direction and windrose diagram

This is also one of the important parameters in the dispersion of air pollutants since it determines the direction of transport of pollutants. Frequency of occurrence of winds from different wind directions under different wind speed ranges, also called wind rose pattern, have been computed from the hourly average values recorded continuously during the three months of summer season. Based on the data, wind roses have been drawn and presented in **Fig 3.7**.

FIG 3.7: WIND ROSE DIAGRAM OF MONITORED DATA



3.5 AMBIENT AIR QUALITY

The ambient air quality study has been carried out continuously for three months during the winter season of 2014-15 i.e. from December 2014 to February 2015.

3.5.1 Location of ambient air sampling stations

Four air sampling stations were established, one in the core and three in the buffer zone to study the present ambient air quality. The ambient air quality monitoring was conducted using Respirable Dust Sampler & Fine Particulate Sampler by Min Mec R&D Laboratory (NABL certificate no. T-1157 & MoEF Sl. No. 97). The sampling station locations are given in **Table 3.7** and the same are marked in **Fig 3.8**.

TABLE 3.7
LOCATION OF AIR SAMPLING STATIONS

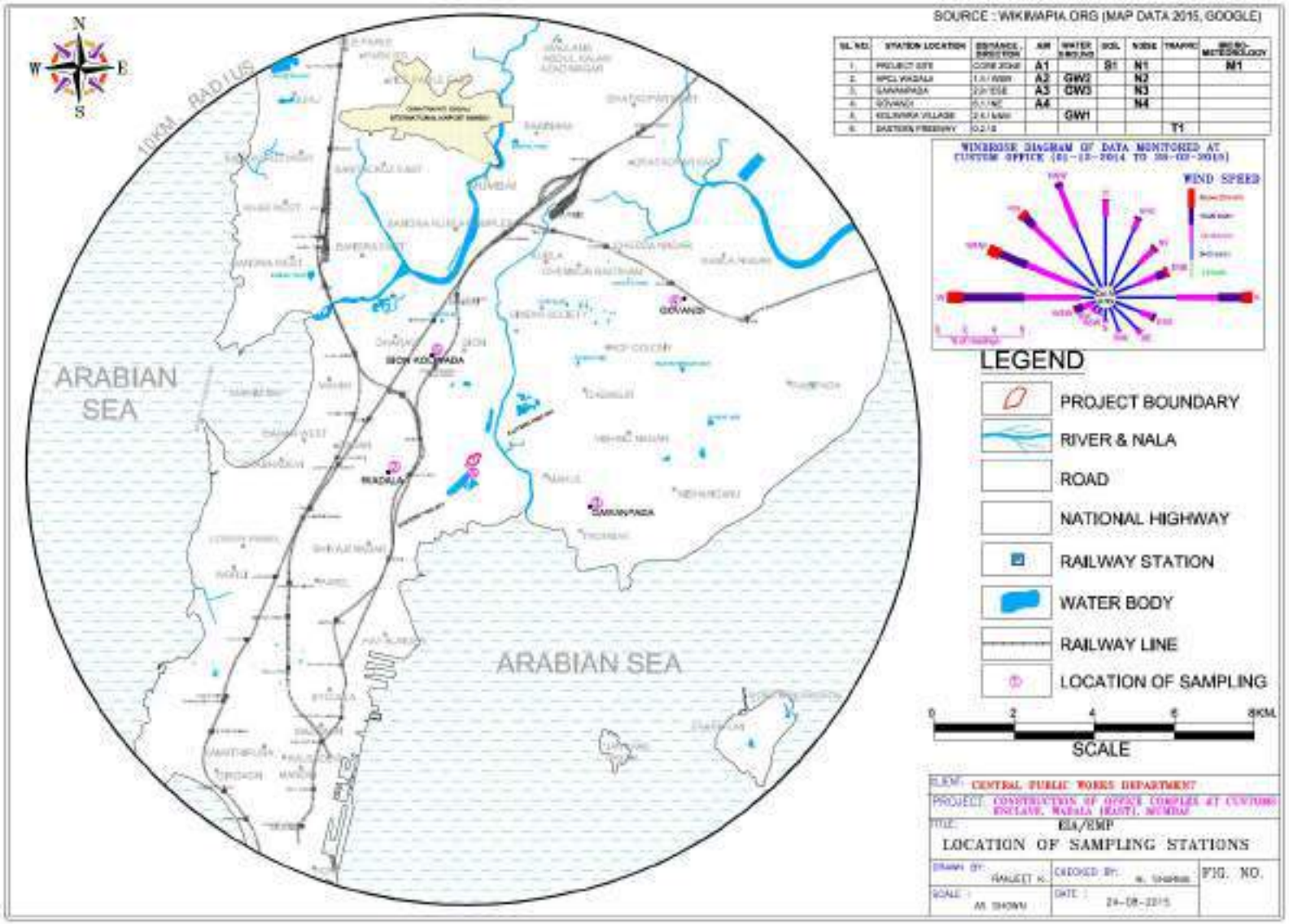
Station No.	Location	Distance wrt project site (km)	Direction wrt project site
BA 1	Core Zone	-	-
BA 2	HPCL Wadala	1.4	WSW
BA 3	Gavanpada	2.9	ESE
BA 4	Govandi	6.1	NE

3.5.2 Sampling schedule & parameters

The study was for 3 months with frequency of twice a week at each site. 24-hour average samples were collected from each station. These samples were analysed in laboratory by adopting the methods specified in National Ambient Air Quality Standards. The Respirable Particulate Matter (RPM or PM 10), Fine Particulate Matter (PM 2.5), Sulphur dioxide (SO_2) and Oxides of nitrogen (NOx) were determined for each sample. Carbon Monoxide (CO), Ozone, Benzene, Benzo(a)pyrene, Nickel, Arsenic, Lead and Ammonia were monitored in two samples of the core zone.

The sampling and testing of ambient air quality parameters were carried out as per relevant parts of IS 5182. The brief details of testing procedure adopted are given in **Table 3.8**.

FIG 3.8: LOCATION OF SAMPLING STATIONS



3.5.3 Methodology

The various procedures for determining the various air quality parameters are given in **Table 3.8**.

TABLE 3.8
PROCEDURE FOR DETERMINING VARIOUS AIR QUALITY PARAMETERS

Parameters	Testing Procedure
PM 10	Gravimetric method using Respirable Dust Sampler (RDS)
PM 2.5	Gravimetric method using Fine Particulate Sampler
SO_2	Improved West & Gaeke method
NOx	Modified Jacob & Hochheiser method
Carbon Monoxide	CO detector
Ozone	UV photometric
Ammonia	Indophenol blue method
Benzo (a) Pyrene (BaP)	Solvent extraction followed by GC analysis
Lead, Nickel and Arsenic	Sampling in EPM 2000 or equivalent filter paper followed by digestion and detection by ICP

3.5.4 Observations

The observations made have been presented in ***Annexure V*****.** A summary of the observations made during the air quality survey has been given in **Table 3.9**.

TABLE 3.9
SUMMARY OF AMBIENT AIR QUALITY TEST RESULTS (µg/m^3)

Location		PM10	PM2.5	SO_2	NOx
Core Zone	Minimum	90.1	50.3	11.1	35.6
	Maximum	145.2	74.5	22.1	50.4
	Average	116.0	60.1	16.6	42.9
	98% tile	144.2	73.6	21.9	50.0
HPCL Wadala	Minimum	94.1	51.8	11.5	37.4
	Maximum	150.4	76.3	23.1	55.8
	Average	128.1	62.3	16.8	45.5
	98% tile	150.2	75.2	22.0	54.1
Gavanpada	Minimum	102.3	44.4	12.4	32.3
	Maximum	149.5	62.9	21.6	47.3
	Average	122.0	51.7	16.5	41.3
	98% tile	147.1	61.9	21.4	47.3
Govandi	Minimum	108.1	59.0	14.5	36.0
	Maximum	156.2	75.2	25.1	61.3
	Average	125.2	64.7	18.7	47.4
	98% tile	155.1	75.0	24.1	61.2

(Source: Min Mec R&D Laboratory's test report no. MMA/03-15/17)

Twenty four hour average of PM_{10} was found to range from 90.1 to 156.2 µg/m^3, PM 2.5 was found to vary from 50.3 to 76.3 µg/m^3, SO_2 from 11.1 to 25.1 µg/m^3 and NOx from 32.3 to 61.3 µg/m^3. PM10 & PM 2.5 were found exceeding the limit due to industrial activities, urban activities and traffic.

Two samples from the core zone were analysed for CO, Ozone, Ammonia, Benzo-a-pyrene, Benzene, Lead, Arsenic and Nickel. The results are given in ***Annexure V.***

3.5.5 Air quality standards

The National Ambient Air Quality Standards dated 18th November 2009, which give the limits for industrial as well as residential & rural area is attached in ***Annexure VI***. Results of monitoring are compared with the standards laid down by Central Pollution Control Board in **Table 3.10**.

TABLE 3.10
STANDARD OF AMBIENT AIR QUALITY (CONCENTRATIONS IN µg/m^3)

Pollutants	Standard laid down by CPCB (18/11/2009)				Maximum values monitored in study area
	Industrial, Residential, Rural and other area		Ecologically Sensitive area (notified by Central Government)		
	Annual	(24 hrs. avg.)	Annual	(24 hrs. avg.)	
PM 10	60	100	60	100	156.2
PM 2.5	40	60	40	60	76.3
SO_2	50	80	20	80	25.1
NO_X	40	80	30	80	61.3

3.6 WATER RESOURCES

3.6.1 Surface water

Core zone: There are no surface water bodies or streams in the core zone.

Buffer zone: A nala flows on the north as well as the south side of the project site. The study area comprises of Arabian Sea, Thane Creek and Mahim bay. Arabian sea covers the entire south and some west side of the study area. The area of the sea in 10 km radius is approximately 172 sq.km. which is approximately 44% of the total study area. On land, there are many water bodies in the study area as listed in Table 3.1 earlier.

3.6.2 Ground water

Core zone: As per "Report on Geotechnical Investigation" by M/s DBM Geotechnics & Constructions Pvt. Ltd., ground water table in the core zone is 0.8-1.7 m bgl during November. The water level will decline during summer.

Buffer zone: The Central Ground Water Board periodically monitors 4 National Hydrograph Network Stations (NHNS) in Mumbai district, four times a year i.e. January, May (Pre-monsoon), August and November (Post-monsoon).

Trend of water levels for pre-monsoon and post-monsoon periods for ten years (1998-2007) was computed for 4 NHNS. Analysis of long term water level trend data indicated fall in water levels in all the 4 NHNS and it ranged between 0.11 m/year (Church Gate) and 0.38 m/year (A.M.C. Colony). During post-monsoon period rise in water level of 0.09 m/year was recorded at only 1 NHNS located at Mahroli (Chembur) while at 3 NHNS fall in water level was recorded and it ranged between 0.02 (Colaba (Dandi)) and 0.26 m/year (A.M.C. Colony). Thus, in major parts of the district, both during pre-monsoon and post-monsoon seasons declining water level trends were recorded. During pre-monsoon period entire district shows fall in water level trend of up to 20 cm/year, whereas during post-monsoon period rise in water level trend of up to 20 cm/year is observed in extreme northern part and central southern parts and the rest of the district shows fall in water level trend of up to 20 cm/year.

The yield of the wells varies with location, diameter and depth of wells. There are mainly two types of ground water structures i.e. dugwells and borewells in the area. The yield of the dugwells varied from 10 to 1000 m^3/day, whereas that of borewells ranged between 50 and 1000 m^3/day tapping the aquifer in the depth range of 60 to 80 m bgl, however, majority of the borewells were found to be low yielding and were fitted with hand pump. The variation in yield between pre-monsoon and post-monsoon was found to be quite high.
(***Source: Ground Water Information, Greater Mumbai District, Maharashtra by CGWB, Central Region, Nagpur, 2009).***

3.6.3 Water Quality Problems and Issues in the region

The pollution of ground water as well as surface water is the major problem in the district. The creeks in the region have become the dumping ground of sewage and industrial effluents. In addition to this, various industrial effluents from oil refineries, reactors, fertilizers plants at Chembur have polluted the sea water in eastern part and are hazardous to marine life. The data of Maharashtra Pollution Control Board (MPCB) indicate high concentration of Mercury (Hg) than the prescribed limit of 1.90 ppm. The alkali and dye industries are responsible for mercury pollution in the Thane creek. The higher Arsenic (As) concentration of more than 2.00 ppm and slightly more is observed in fishes from Thane and Chembur. The other heavy metals like Lead (0.60 ppm), Cadmium (12.60 ppm) and Copper (8.84 ppm) are also reported from creek water. Ground water exploitation for commercial purpose is carried out in entire district and the water is extracted from existing dugwells and borewells, even new borewells are also being drilled for this purpose. The ground water is used for construction purposes, hotel industry and for domestic purpose of the housing societies. Excessive ground water development in the beach and coastal areas can

lead to saline water intrusion as observed in some parts of Colaba, Dharavi and Khar from BMC data.
(***Source: Ground Water Information, Greater Mumbai District, Maharashtra by CGWB, Central Region, Nagpur, 2009).***

3.7 WATER QUALITY

3.7.1 Sampling stations

To evaluate the quality of water resources of the study area, ground water samples from 3 locations were collected. This includes three samples from buffer zone. Water samples were collected from the sources during monitoring period. Water samples were collected with the frequency of once in a season from all the identified sources. The location of sampling stations, as given in **Table 3.11** has been marked on map given as **Fig 3.8**. The detailed results are given in ***Annexure VII.***

TABLE 3.11
LOCATION OF WATER SAMPLING STATION

Station Code	Location	Distance from core zone(km)	Direction
GW1	Koliwara Village	2.5	NNW
GW2	HPCL Wadala	1.4	WSW
GW3	Gawanpada Village	2.9	ESE

3.7.2 Methodology of sampling

Samples from ground water sources were collected by grab-sampling method. The sample was filled into a polyethylene sampling bottle for physico-chemical parameters.

The physico-chemical quality of water samples was characterized by adopting the relevant parts of IS:3025, “Standard Methods for Water Analysis” and the methods prescribed under IS:10500. The permissible and desirable limits for drinking water are mentioned in the IS Standard and is given at ***Annexure VIII***. For analysis of parameters, the samples were brought to Min Mec R&D Laboratory, New Delhi, after addition of proper preservatives.

3.7.3 Analysis of results

The analysis results of water quality of the study area are presented in ***Annexure VII*** and the range of all parameters of water analysis for ground water are given in **Table 3.12.**

TABLE 3.12
WATER TEST RESULTS FOR GROUND WATER

Parameters	Limits (IS: 10500:2012)		Koliwara Village	Gawanpada Village	HPCL Wadala
	Desirable	Permissible			
Colour, hue			Colourless		
Odour	Agreeable	Agreeable	Agreeable		
Turbidity, NTU	1	5	2.5	4.3	1.8
pH value	6.5 to 8.5	6.5 to 8.5	6.6	6.7	6.8
Total Dissolved solids, mg/l	500	2000	173	649	399
Total hardness (as $CaCO_3$) mg/l	200	600	120	380	224
Total Alkalinity, mg/l	200	600	141	269	314
Chlorides (as Cl), mg/l	250	1000	20	174	30
Iron (as Fe), mg/l	1.0	1.0	0.2	0.7	0.1
Fluoride (as F), mg/l	1	1.5	0.38	0.44	0.46
Sulphate (as SO_4), mg/l	200	400	7	21	3
Nitrate (as NO_3), mg/l	45	100	0.4	4.7	0.7
Calcium (as Ca), mg/l	75	200	32	103	61
Magnesium (as Mg), mg/l	30	100	10	30	17
Copper (as Cu), mg/l	0.05	1.5	0.01	BDL	0.01
Manganese (as Mn), mg/l	0.1	0.3	0.06	0.04	0.05
Cadmium (as Cd), mg/l	0.003	0.003	BDL	BDL	BDL
Selenium (as Se), mg/l	0.01	0.01	0.01	0.01	BDL
Arsenic (as As), mg/l	0.01	0.01	BDL	BDL	BDL
Lead (as Pb), mg/l	0.01	0.01	BDL	0.01	BDL
Zinc (as Zn), mg/l	5	15	0.12	0.46	0.39
Chromium (as Cr), mg/l	0.05	0.05	BDL	BDL	BDL
Boron (as B), mg/l	0.5	1	0.52	0.45	0.50
Nickel (as Ni),mg/l	0.02	0.02	BDL	BDL	BDL
Aluminium (as Al), mg/l	0.03	0.2	0.15	BDL	0.08

(Source: Min Mec R&D Laboratory's test report no. MMW/02-15/13 dated 25/02/2015)
Note: BDL of Cu<0.008; Hg<0.0008; Cd<0.009; Se<0.069; As<0.069; Pb<0.014; Cr <0.013; Ni<0.017 mg/l; Al<0.069

The results show that:

- pH of water of buffer zone is near neutral;
- Turbidity, dissolved solids, hardness, alkalinity, chloride, fluoride, sulphate, calcium, copper, nitrate, magnesium and iron concentration of ground water is well within permissible limits for all ground water samples.
- Arsenic, Cadmium, Chromium and Nickel were found to be below detectable limits.
- Copper, Manganese, Selenium, Lead, Zinc, Aluminium and Boron concentration for all the samples were within desirable limit;

3.8 NOISE LEVEL & TRAFFIC DENSITY

3.8.1 Noise level

Monitoring locations

The noise level measurements have been made at one location within the core zone and 3 locations in the study area. The locations have been marked on the map and presented as **Fig 3.8**. The distance and directions of monitoring stations are given in **Table 3.13**.

TABLE 3.13
LOCATION OF NOISE SAMPLING STATIONS

Location	Distance w.r.t project site in km	Direction w.r.t project site
Project Site	-	-
Gawanpada	2.9	ESE
Govandi	6.1	NE
HPCL Wadala	1.4	WSW

Methodology

For measurement of ambient noise level, a Digital Sound Level Meter was used. The meter was calibrated with a standard Acoustic calibrator before using in the field. The measurements were carried out continuously for the 24-hour period to obtain hourly equivalent sound pressure level. From these values, day and night time as well as 24-hour Leq values were also calculated. The Leq is the equivalent continuous sound level, which is equivalent to the same sound energy as the fluctuating sound measured during observation period.

Observations

The observations made during the study have been presented in ***Annexure IX*** and summarised in **Table 3.14**.

TABLE 3.14
SUMMARISED RESULTS OF NOISE MONITORING

Location	Station Number	Noise Level {Leq in dB (A)}				
		Measured values			Permissible Limit	
		Day	Night	Avg.	Day	Night
Project Site	N1	81.70	69.40	77.00	75	70
HPCL Wadala	N2	80.10	68.50	75.70	75	70
Gawanpada	N3	60.80	53.00	57.90	55	45
Govandi	N4	60.20	51.30	56.90	55	45

(Source : MMRDL's test report no. MMN/03-15/16 dated 31/03/2015)

Based on the observations made during the studies, it is concluded that the noise levels observed at all stations exceeded the limits during day due to proximity to high traffic roads and day time activities. However, project site(N1) and HPLC Wadala(N2) have shown noise levels with in limits at night for industrial areas while Gawanpada(N3) and Govandi(N4) exceeded the limits for residential areas during night also.

The ambient air quality standard in respect of noise is given as ***Annexure X***. The maximum permissible exposure to sound under damage risk criteria for hearing loss occupational safety & health administration (OSHA is given in ***Annexure XI***).

3.8.2 Traffic density

Monitoring location

The traffic volume was monitored on Eastern Freeway as well as on Sewri Chembur road (also known as Anik Wadala road) on 15.02.2015 to 16.02.2015 (weekend) and 18.02.2015 to 19.02.2015 (weekday) simultaneously. The traffic monitoring station is shown in **Fig 3.8**.

Methodology

Traffic density measurements were made continuously for 24 hours by visual observation and counting of vehicles under four categories, viz., heavy motor vehicles, light motor vehicles, two/three wheelers and cycles.

Observations

The total number of vehicles per hour under the four categories was determined and is given in **Table 3.15** and detailed in ***Annexure XII***.

TABLE 3.15
TRAFFIC DENSITY

Traffic Vehicle	Eastern Free way (in nos.)					
	Weekend	Equivalency Factor	Equivalent PCU	Weekday	Equivalency Factor	Equivalent PCU
Mini Buses	228	3.0	684	59679	3.0	777
L.M.V	58128	1.0	58128	259	1.0	59679
Two/Three wheeler	Nil	0.5	Nil	Nil	0.5	Nil
Cycles	Nil	0.50	Nil	Nil	0.50	Nil
Others- Tractor, Trolley etc.	Nil	4.5	Nil	Nil	4.5	Nil
Total	**58356**		**58812**	**59938**		**60456**

Traffic Vehicle	Sewri-Chembur Road (Anik Wadala Road) (in nos.)					
	Weekend	Equivalency Factor	Equivalent PCU	Weekday	Equivalency Factor	Equivalent PCU
H.M.V	7392	3.0	22176	9243	3.0	27729
L.M.V	12387	1.0	12387	15482	1.0	15482
Two/Three wheeler	6465	0.5	3233	8082	0.5	4041
Cycles	2739	0.50	1369	5365	0.50	2683
Others- Tractor, Trolley etc.	Nil	4.5	Nil	Nil	4.5	Nil
Total	**28982**		**39165**	**38172**		**49935**

On the expressway, the total no. of vehicles on the road was found to be 58356 on weekend and 59939 on weekday, whereas after applying the equivalency factor, the equivalent PCUs (passenger car units) on the road was observed as 58812 on weekend and 60456 on weekday. The number of light motor vehicles is the maximum and is followed by mini buses.

On the Sewri-Chembur Road, the total no. of vehicles on the road was found to be 28982 on weekend and 38172 on weekday, whereas after applying the equivalency factor, the equivalent PCUs on the road was observed as 39165 on weekend and 49935 on weekday. The number of light motor vehicles is the maximum and is followed by heavy motor vehicles then two/three wheelers and cycles. It was also observed that there is congestion on the road around the peak period at the junction of Salt Pan Road and Sewri-Chembur Road as well as near Bhakti Park Exit.

3.9 LAND USE

3.9.1 Project area

The project area lies under Industrial zone (I3). Mumbai Metropolitan Region Development Authority has allotted the land of C.S No. 146 to the “Additional Commissioner of Customs (PG)”, Custom Enclave Cell for the development of Custom Office at the area. Urban Development Department Mantralaya, Mumbai, Government of Maharashtra has given permission for the construction of Customs office at the land of C.S No. 146. Copy of land allotment letter is attached as ***Annexure III.*** The land is currently unused, however, one existing structure admeasuring 1367.58 sqm., the demolition and site clearance of the same will be required before start of construction.

3.9.2 Study area

2 km radius: The details of land use around 2 km radius of the project site has been studied from the satellite image dated 24.02.2015 sourced from Google Earth. The satellite image is seen in **Fig 3.9** while the 2 km

interpreted image is given in **Fig 3.10**. The land use has been analysed and given in **Table 3.16**.

TABLE 3.16
LAND USE IN 2 KM RADIUS OF THE PROJECT

Sl. No.	Land use	Area (ha)	Percent
1.	Built up land	645.2	44.08
2.	Cultivation land	12.8	0.87
3.	Vegetation	62.5	4.27
4.	Mangrove Forest	273.6	18.69
5.	Scrub land	58.3	3.98
6.	Open land	49.3	3.37
7.	Industries	161.3	11.02
8.	Water body	155.6	10.63
9.	Salt pan	45.2	3.09
Total		**1463.8**	**100**

10 km radius: Land use pattern of study area has been extracted from 2011 Census data and give in **Table 3.17**.

TABLE 3.17
LANDUSE OF STUDY AREA, CENSUS 2011 (Ha.)

Town/ village code	Town/village name	Total area	Forest land	Area under Non-Agricultural Uses	Barren & Un-cultivable Land	Permanent Pastures and Other Grazing Land	Net Area Shown
District	**Mumbai Suburban**						
802794	Greater Mumbai (M Corp.) Part	19899.00	-	19899.00	-	-	-
District	**Mumbai**						
802794	Greater Mumbai (M Corp.) Part	0.00	-	N.A.	-	-	-
District	**Raigarh**						
Sub Distt.	**Uran**						
553291	Gharapuri	198.00	84.00	20.45	2.10	73.00	18.45
	GRAND TOTAL	**20097.00**	**84.00**	**19919.45**	**2.10**	**73.00**	**18.45**
	%	**100.00**	**0.42**	**99.12**	**0.01**	**0.36**	**0.09**

The study area comprises 3 districts namely Mumbai suburban, Mumbai and Raigarh and it can be seen the majority (99.12%) of the area is urban i.e. area under non-agricultural uses. There is one village in Raigarh district. There is no land under the Census landuse headings of Land Under Misc. Tree Crops etc., Culturable Waste Land, Fallows Land other than Current Fallows and Current Fallows.

The urban development can be seen in the Satellite imagery of the study area, which is given in **Fig 3.9.** The CRZ studies has been done by Institute of Remote Sensing (IRS), Anna University, Chennai and the maps given in ***Annexure XIII***.

FIG 3.9: SATELLITE IMAGE OF THE STUDY AREA

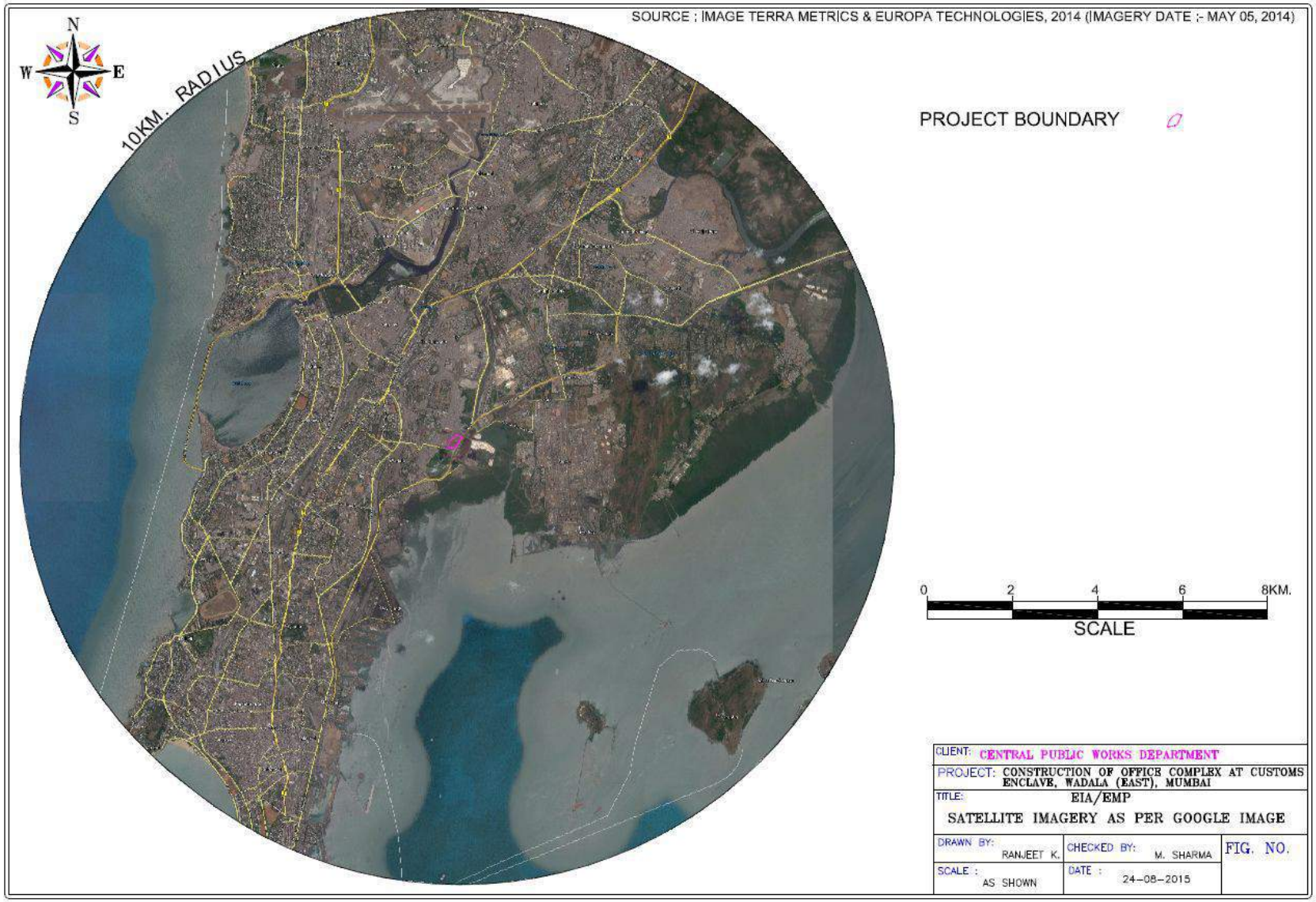
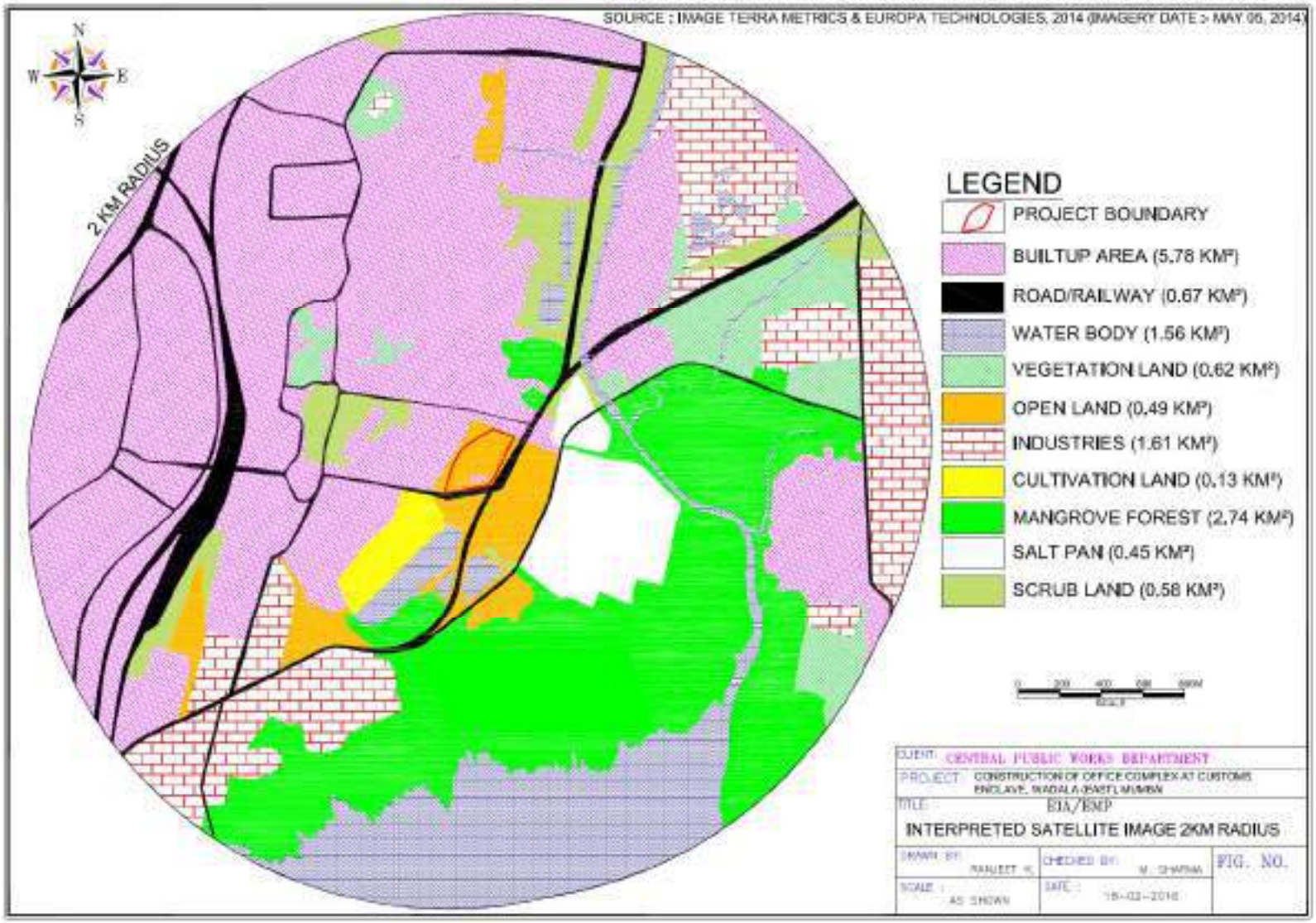


FIG 3.10: INTERPRETTED SATELLITE IMAGE OF 2 KM RADIUS AROUND PROJECT



3.10 SOIL QUALITY

To establish the baseline characteristics with respect to soil quality in the study area, characterization of soil sample from the area was performed during the winter season of year December 2014 to February 2015.

3.10.1 Location

One soil sample from core zone was collected and analysed in the Min Mec R&D Laboratory. Details of soil sampling station is given in **Table 3.18** and shown in **Fig 3.8**.

TABLE 3.18
LOCATION OF SOIL SAMPLING STATIONS

Location	Distance w.r.t project site in km	Direction w.r.t project site
Project Site	-	-

3.10.2 Methodology

Soil sample was collected by digging a pit of 50 cm depth at the appropriate location with the help of a spade and a 'Khurpi'. The excavated soil from each location was mixed thoroughly and about 2 kg of mixed sample was collected by 'Cone & Quartering method'. The sample was packed in a polyethylene bag, sealed and brought to the laboratory.

After drawing sample for moisture content, the remaining samples were air dried for few days. For chemical characteristics, air-dried samples were ground in an agate mortar with the help of a wooden hammer and passed through a 2-mm (10-mesh) sieve. The coarser materials were rejected and the sieved material was sampled by the standard 'cone and quartering' method. Characterization of soil samples was performed by adopting methods prescribed under relevant parts of IS:2720, "Indian Standard Methods of Test for Soils".

3.10.3 Observation

The analytical results, given in **Table 3.19** depict the following salient features:

TABLE 3.19
CHARACTERISTICS OF SOIL

Parameter	Units	Project site
pH	-	6.6
E.C	µmho/cm	920
$CaCO_3$	% by mass	19.5
Bulk Density	g/cm^3	1.20

Parameter	Units	Project site
Moisture	% by mass	17.9
Organic carbon	% by mass	0.3
Organic Matter	% by mass	0.48
Chloride	% by mass	8.5
Sulphate	% by mass	0.64
Phosphorous	ppm	0.98
Nitrate-Nitrogen	ppm	1.33
Iron	ppm	6.73
Sodium	% by mass	0.13
Potassium	% by mass	0.01

(Source : MMRDL's test report no. MMS/03-15/13 dated 31/03/2015)

The results depict the following salient features:

- pH of the soil is neutral, the conductivity is normal, it is deficient in organic carbon, phosphorous, nitrogen, iron and potassium.
- The grain size analysis has been carried out for the sample and it was found that it is predominantly medium sandy as per IS classification and sandy loam as per USPRA Classification.

3.11 ECOLOGY

The study area of Custom Office, Mumbai is predominantly urban. However, it has different kinds of habitats namely mangrove forest, tidal lagoon, mudflats, scrub, vegetation and roadside plantation also. Due to mangrove forest and mudflat region, it attracts a relatively good diversity of bird species which includes the long distance migrants coming from as far as north of Arctic Circle. Avian predator like Black Kite is sighted in fairly good numbers in such type of habitats probably because of availability of food in good quantities. The near by areas also have fodder grass fields, woodland, saltpans and marshy areas which also attract substantial population of shorebirds, gulls and terns, and other aquatic and terrestrial birds.

3.11.1 Forest

There are many mangrove forests near the core zone. The location of these forests along with their distance from core zone is given in **Table 3.20.**

TABLE 3.20
LOCATION OF FORESTS/MANGROVES

Sl. No.	Forest	Distance	Direction
1.	Mangrove forest near Mahul	0.3	E
2.	Mangrove forest near Dharavi	3.6	NW
3.	Mangrove forest near Bandra East	4.1	NNW

Sl. No.	Forest	Distance	Direction
4.	Mangrove forest near Trombay	4.4	SE
5.	Mangrove forest near Pali Hill	7.1	NW
6.	Mangrove forest near Gharapuri	7.9	SE
7.	Mangrove forest near Mandala	8.1	NE

Nearest National Park is Sanjay Gandhi National Park located at a distance of 14 km, N. There are over 1000 species of plants in the forest area of the national park.About 251 species of migratory, land and water birds are also found. The park has 50,000 species of insects and about 40 species of mammals. It provides shelter to 38 species of reptiles, 9 species of amphibians, 150 species of butterflies and a large variety of fish.

3.11.2 Flora

Project Site: The floristic survey reveals that project site is open land which is partly covered with *Typha angustata* grasses and some shrubs such as *Calotropis gigantea.* There are around six trees with in the project boundary, which are located on the southern and south western periphery. These are species of palm such as *Cocos nucifera*, *C.umbraculifera L.* and *Phoenix species* etc.

Area between project site and 500 m: Based on field survey and land use map, there is mangrove forest near the core zone at a distance of 0.3 km from the project site. The species found in the mangrove forest has been described in the subsequent section.

Area between 500 m and 10 km: The area covers Maharashtra Nature Park and Veer Jijamata Udyan within a 10 Km radius from the project boundary.

Mangrove Ecosystem

Altogether 19 species of mangroves and their associates were enumerated and identified in the study area. *Avicennia marina* are the most common while *Rhizophora mucronata* and *Excoecaria agallocha* were rare mangrove species. *Salvadora persica* was found in the mudflat areas which are frequently used by Mynas, Crows and Bulbuls. Among mangrove associates *Derris uliginosa, Sesuvium portulacastrum* and *Clerodendrum inerme* were prominent species found in the mangrove areas. The mangrove and their associate species found are *Acanthus ilicifolius* (Holy Mangrove), *Aeluropus lagopoides* (Shrubby Seablite), *Avicennia marina* (Grey Mangrove), *Avicennia officinallis* (Api-api), *Bruguiera cylindrica* (Bakau Putih), *Bruguiera gymnorrhiza* (Burma Mangrove), *Casuarina equisetifolia* (Australian Pine), *Clerodendrum inerme* (Clerodendrum), *Derris trifoliata* (Sea Derris), *Excoecaria agallocha* (Thillai), *Fimbristylis ferruginea* (Rusty Sedge), *Rhizophora mucronata* (Asiatic Mangrove), *Sesuvium*

portulacastrum (Shoreline Purslane)*, Sonneratia caseolaris* (Apple Mangrove) *and Typha angustata* (Small Reedmace).

Various species of plants and trees are found in the study area comprises of 56 species of trees, 21 species of shrubs, 26 species of Herbs, 9 species of climbers and 15 species of Mangrove. The plants along with their scientific name, common name and family are listed in ***Annexure XIV***. The same are listed below:

3.11.3 Fauna

Project Site: At the project site some species of butterflies, like common grass yellow, common Indian crow, grey pansy were found, while common birds like blue rock pigeon, black kites, house sparrow, house crow and Indian myna were dominant. Among mammals, common dog, rat and squirrel were observed.

Area between project site and 10 km: Field observations of avifauna in and around the project site within the study area were carried out. The commonly available fauna i.e. mammals, amphibians, reptiles, butterflies, dragonflies and damselflies in and around project site were enumerated.

Mammals

The mammals found are *Axis Axis* (Spotted Deer), *Bandicota bengalensis* (Lesser Bandicot rat), *Bandicota indica* (Bandicota indica), *Boselaphus tragocamelus* (Nilgai), *Bos Primigenius* (Cow), *Canis aureus indicus* (Jackal), *Canis lupus familiaris(common dog)*, *Bubalus bubalis* (Domestic Buffalo), *Funambulus palmarum* (Squirrel), *Herpestes edwardsii* (Mongoose), *Lepus nigricollis ruficaudatus* (Indian Hare), *Mus booduga* (Little Indian Field Mouse), *Rattus rattus* (Rat) and *Semnopithecus entellus* (Gray Langur)

Birds

Some of the birds found in the study area are as follows:

Acridotheres tristis (Bank Myna), *Bubulcus ibis* (Cattle Egret), *Casmerodius albus* (Large Egret), *Euploea core* (Common crow), *Eudynamys scolopacea* (Asian Koel), *Gelochelidon nilotica* (Gull-billed Tern), *Lonchura punctulata* (Black Redstart), *Pycnonotus cafer* (Red Vented Bulbul), *Tringa ochropus* (Green Sandpiper), *Vanellus indicus* (Red Wattled Lapwing). The complete list of birds is given in ***Annexure XIV.***

Butterflies

Pachliopta aristolochiae (Common Rose)*, Papilio polytes Linnaeus* (Common Mormon)*, Eurema hecabe Linnaeus* (Common Grass Yellow)*, Eurema brigitta Cramer* (Small Grass Yellow)*, Catopsilia crocale Cramer* (Common Emigrant)*, Delias eucharis Drury* (Common Jezebel)*, Junonia*

almana Linnaeus (Peacock Pansy)*, Danaus genutia Cramer* (Stripped Tiger)*, Danaus chrysippus Linnaeus* (Plain Tiger)*, Junonia atlites* (Grey Pansy) *and Tarucus nara Kollar* (Stripped Pierrot).

Fishes

Several species of fishes are available in the mangrove water and collected by local fisherman. Some of them are *Megalops sp.* (Indian Tarpon)*, Poecila reticulata* Guppy (Guppy)*, Siluriformes* (Catfish)*, Tilapia Oreochronis mossambicus* (Mozambique Tilapia)*, Mugil cephulus* (Flathead grey mullet) and *Periophthalmus sp.* (Mud-skipper) are common in the mangrove areas. They come along tidal water and also live in puddles in mangroves.

Reptiles and Amphibians

Calotes versicolar (Common Garden Lizard), *Cerberus rhynchops* (Dog faced water snake), *Chamaeleonidae* (Chameleon), *Daboia russelii* (Russel's Viper), *Mabuya carinata* (Common Skink), *Mabuya macularia* (Forest Skink), *Naja naja* (Cobra), *Oligodon arnensis* (Common Kukri snake), *Ptyas mucosus* (Common Rat Snake), *Bufo melanostictus* (Common Toad) and *Rana tigrina* (Indian bullfrog).

Flamingo Habitat

Sewri-mahul mudflats (coordinates - 19.00N 72.86E) on eastern edge of Southern Mumbai are well known for housing flamingos during their annual migration in Mumbai. The Sewri mudflats are 2.3 km, SSW from the project site aerially. In 1996, the mangrove swamps of Sewri were declared a protected ecology. Sewri-Mahul mudflats and the shallows of the Creek are the foraging grounds for about 40000 thousand Lesser Flamingo and Greater Flamingos and, about half a million waders.

The region has been identified as an Important Bird Area (IBA) by BNHS and Bird Life International. Flamingoes arrive at the mudflats from the months of October to March every year. (source : BNHS)

3.12 SOCIO-ECONOMIC CONDITION

3.12.1 Demography

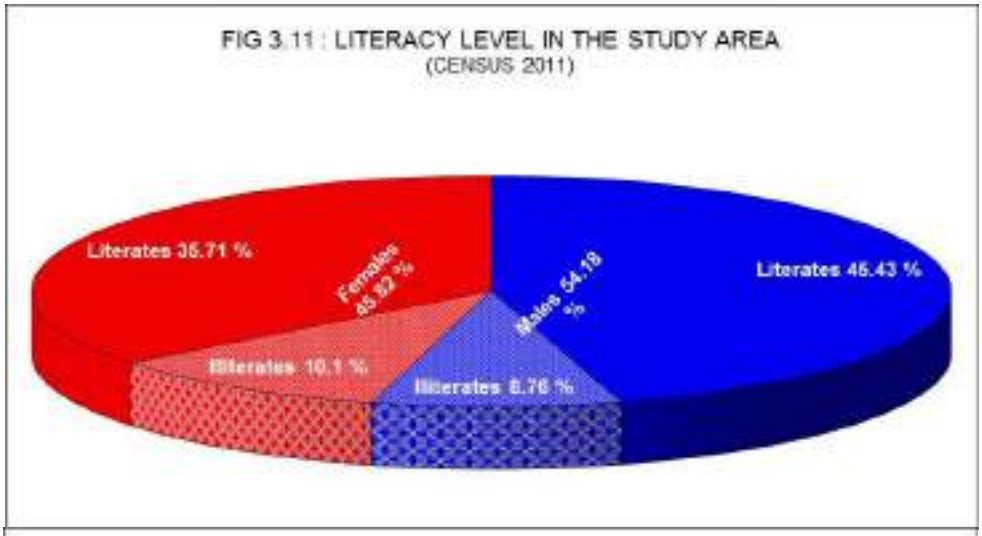
There is one ground structure existing at the project site which will be demolished prior to beginning of construction works.

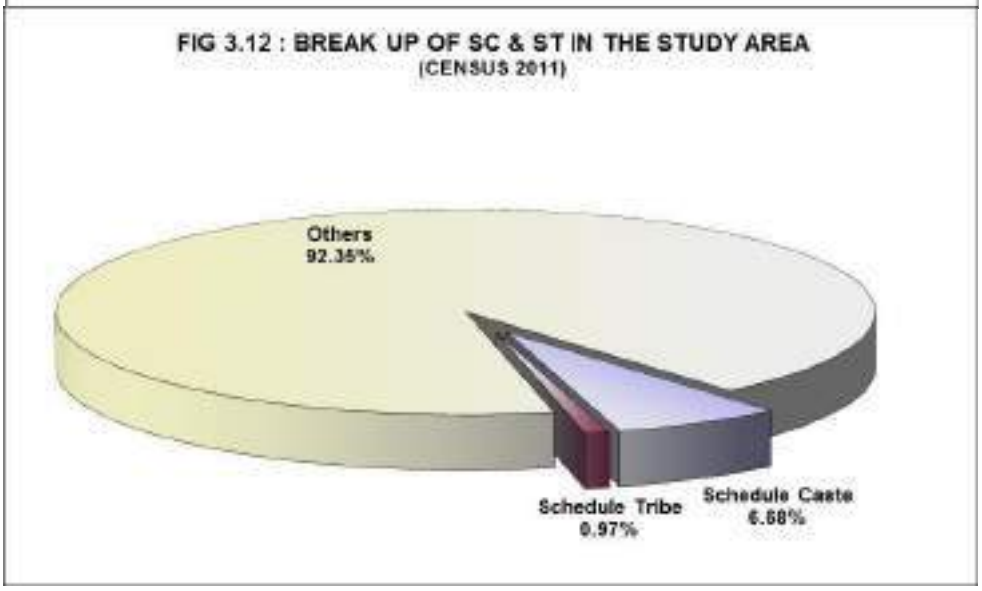
The study area comprises of commercial, public and semi-public, utility area, government land, recreational, industrial, urbanisable and residential area. The demographic profile of the study area as per the Census data of 2011 is given in ***Annexure XV*** and summarised in **Table 3.21.**

TABLE 3.21
DEMOGRAPHIC PROFILE OF STUDY AREA

Description	Total	Percentage
No of Households	1369343	
Total population	6173856	100.00
Male population	3345263	54.18
Female population	2828593	45.82
Schedule Castes	412425	6.68
Schedule tribes	59603	0.97
Total Literate	5009424	81.14
Male Literate	2804545	45.43
Female Literate	2204879	35.71

From the available demographic information, it is observed that the family size within the study area is 5 persons per family. The SC population is 6.68% of the total population, while ST population constitutes 0.97%. Female population is lower than male population. The overall literacy level is average (81.14%), out of which 45.43% are males and 35.71% are females. Literacy level and SC/ST pie diagram are shown in **Fig 3.11** and **Fig 3.12** respectively.





3.12.2 Employment & occupation

Employment pattern and occupation are the two main indicators of the economic profile and the same for the individual villages of the study area, based on 2011 Census data are presented in ***Annexure XV***. Pie diagrams showing employment pattern and occupation are depicted in **Fig 3.13**, **3.14 3.15** and **3.16** respectively. A summary of employment pattern and occupation for the study area is presented in **Table 3.22.**

TABLE 3.22
SUMMARY OF EMPLOYMENT AND OCCUPATION IN STUDY AREA

Description	Total	%
Total workers	2517424	40.78
Main workers	2370048	38.39
Marginal workers	147376	2.39
Non workers	3656432	59.22
Break up of Main Workers		
Cultivators	7349	0.31
Agricultural Labourers	10901	0.46
Household industries	75520	3.19
Other workers	2276278	96.04
Break up of Marginal workers		
Cultivators	4022	2.73
Agricultural Labourers	1684	1.14
Household industries	9326	6.33
Other workers	132344	89.80

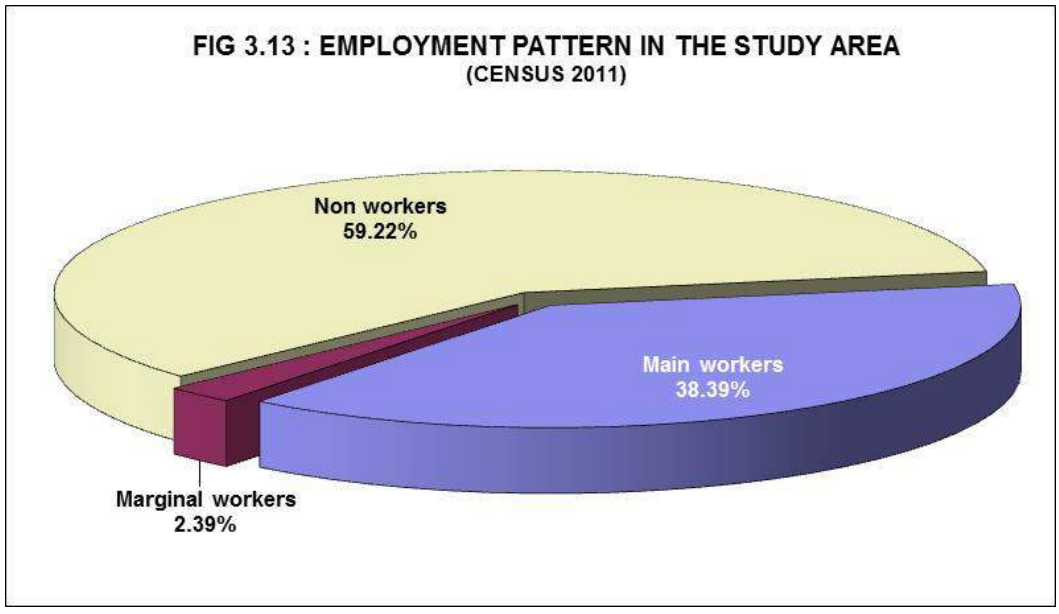


FIG 3.14 : BREAK UP OF TOTAL WORKERS (Main & Marginal) IN THE STUDY AREA
(CENSUS 2011)

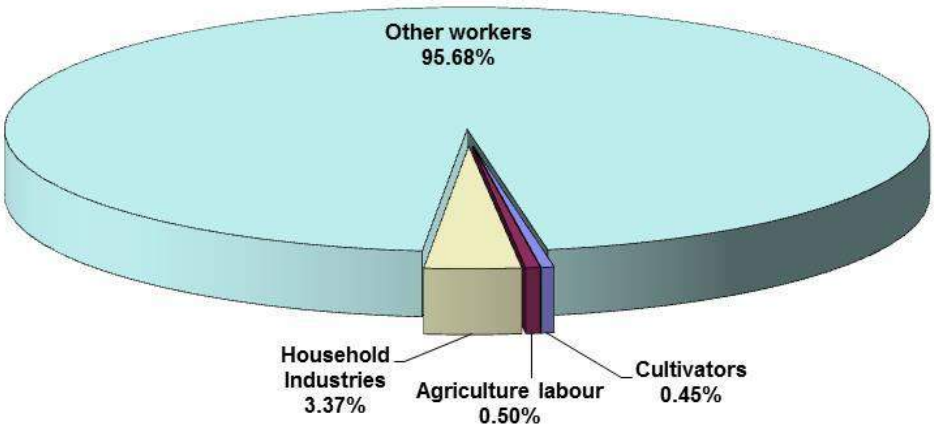


FIG 3.15 : BREAK UP OF MAIN WORKERS IN THE STUDY AREA
(CENSUS 2011)

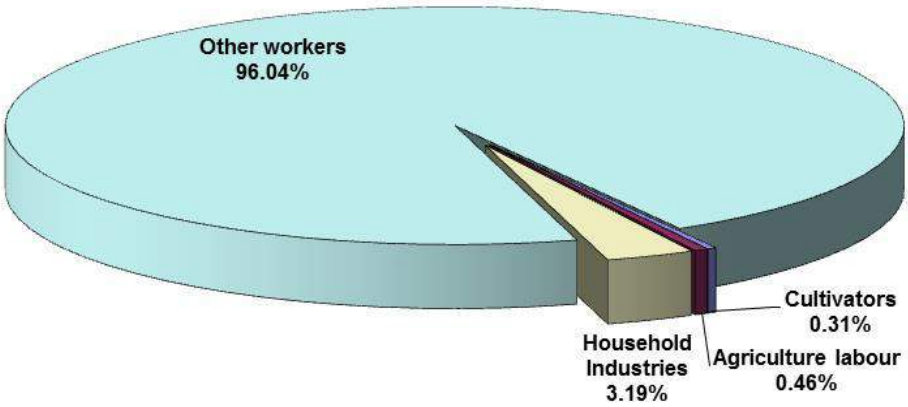
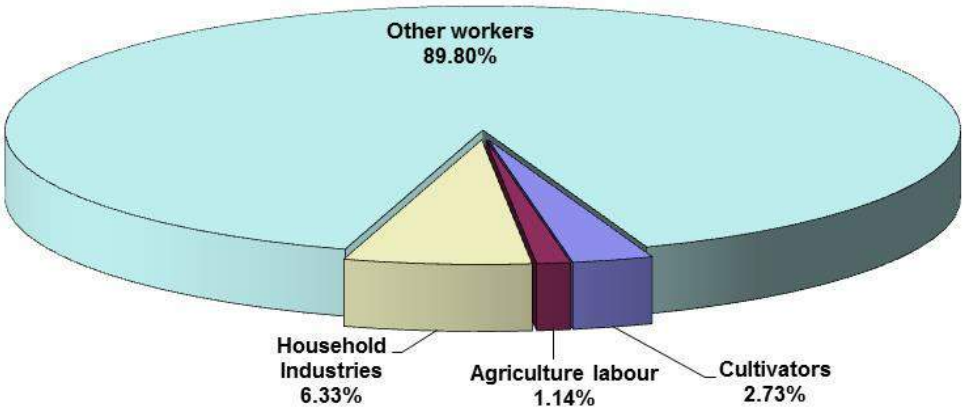


FIG 3.16 : BREAK UP OF MARGINAL WORKERS IN THE STUDY AREA
(CENSUS 2011)



It can be observed from the above pie charts that only a small fraction, i.e. 0.31% of the total main workers depend on agriculture and 96.04% of them depend on other sources for their livelihood. Thus, the economy of the study area is dependent mainly on different type of services under government, private and industrial activities, trade and commerce, transportation and other activities associated with urbanization.

3.12.3 Amenities

Substantial portion of the study area lies within the urban areas of Mumbai where all types of amenities are available. Details of amenities available in the villages are given in ***Annexure XVI***. A summary of the same is as follows:

- Educational facilities in the towns of the study area comprise of 824 government primary schools, 400 private primary schools, 848 government middle schools, 234 private middle schools, 517 government secondary schools, 277 private secondary schools, 147 government senior secondary schools, 86 private senior secondary schools, 19 government degree colleges (Art, Science and Commerce), 21 private degree colleges (Art, Science and Commerce), 3 government degree colleges (law), 7 private degree colleges (law), 1 government university, 7 private universities, 4 government medical colleges, 3 private medical colleges, 12 government engineering colleges, 4 private engineering colleges, 2 government management institutes, 6 private management institutes, 5 government polytechnics, 7 private polytechnics, 3 government shorthand and typewriting centres, 47 private shorthand and typewriting centres, 556 private MS-office, 1 private desk top publishing, 7 government vocational centres, 25 private vocational centres, 80 government non-formal education centres, 12 private non-formal education centres, 11 government special schools for disabled and 6 private special schools for disabled. Village of the study area comprises of 1 pre-primary school, 1 primary school, 1 middle school and 1 secondary school.

- There are 25 allopathic hospitals, 5 alternative medicine hospitals, 167 dispensaries/healthcare centres, 15 family welfare centres, 33 maternity and child welfare centres, 52 maternity homes, 10 T.B. hospitals, 6 nursing homes, 2 veterinary hospitals, 1 mobile health clinic, 176 non-government charitable hospitals and 1619 non-government medicine shops. There is 1 primary health sub-centre in the village of study area.

- The towns of study area have proper electricity connection. They comprise of 780023 domestic connections, 10640 industrial connections, 105683 commercial connections, 55867 road lighting connections and 63 other connections. The village has 1 power connection for agriculture use.

- As per the Census 2011 records the main sources of water supply within the study area is tap, well and tank. The village has 1 tap with treated water, 1 tap with untreated water, 1 spring, 1 uncovered well and 1 pond.

- Census data for post and telegraphic amenities in the village shows that there is 1 landline telephone and 1 mobile PCO.

- The towns have a total pucca road length of 669 kms. While there is 1 foot path in the village.

- There are 730 nationalised banks, 629 private commercial banks, 406 cooperative banks, 4 agricultural credit societies and 86 non agricultural credit societies in the towns. The village has 1 self help group, 1 public distribution system, 1 nutritional centre-ICDS, 1 nutritional anganwadi centre and 1 other nutritional centre.

- There are 50 government stadiums, 28 private stadiums, 14 government cinema halls, 65 private cinema halls, 25 government auditoriums, 71 private auditoriums, 9 government libraries, 13 private libraries, 8 government public reading rooms and 40 private public reading rooms in the towns of study area.

- The towns have 3 government orphanage homes, 4 private orphanage homes, 2 government working women's hostels, 154 private working women's hostels, 1 government old age home and 1 private old age home.

3.13 INDUSTRIES

Some of the prominent industries have been summarized in **Table 3.23** and their location can be seen in **Fig 3.17.**

TABLE 3.23
LIST OF INDUSTRIES IN THE 10 KM RADIUS

Sl. No.	Description	Distance (km)/Direction
1	HPCL Terminal, Wadala	1.0/SW
2	Godrej Food Product (Mumbai)	1.3/SW
3	BPCL Terminal Mumbai (Mumbai)	0.9/SW
4	IBP SEWRI Oil Terminal Mumbai	2.1/SW
5	BPCL Sewri Terminal	2.0/SW
6	IOCL Sewri Terminal	2.6/SW
7	Wintex Wire Industries	2.8/SW
8	Bharat Rice Mills Compound	4.3/SW
9	United India Mills	4.4/SW

Sl. No.	Description	Distance (km)/Direction
10	Jam Mill	4.7/SW
11	Digvijay Mill, Kalachowki	4.8/SW
12	India United Mills	4.7/SW
13	Mafatlal Mills	4.9/SW
14	Poddar Mills	5.2/SW
15	Sun Mill Compound	5.1/SW
16	Phoenix Mills	5.4/SW
17	Mathuradas Mill Compound	4.7/SW
18	Shreeram Mills	5.7/WSW
19	Phoenix Mills Limited	5.0/WSW
20	Kamala Mills Compound.	4.7/WSW
21	National Bicycle Corporation of India Ltd.	5.2/WSW
22	Century Mills	4.9/WSW
23	Tata Mills	3.3/WSW
24	Gold Mohur Mill	3.1/WSW
25	Kohinoor Mill	2.4/W
26	Hindustan Mills	4.3/W
27	India United Mills No 6	4.0/WNW
28	New City of Bombay Mills	5.0/SW
29	Sewri Dockyards	3.5/SW
30	Khatau Mill	6.4/SW
31	Mechwell Industries Limited	5.7/SSW
32	Trombay Thermal Power Station	3.1/SE
33	The Hindustan Petroleum Refinery	2.8/E
34	BPCL- Mumbai Refinery	2.1/E
35	Trombay Industrial Area	2.7/NNE
36	Swadeshi Mill	4.1/N
37	N.A.D - Ghatkopar	7.4/NNE
38	Capgemini India Pvt. Ltd.	9.5/NNE
39	Ghatkopar Industrial Estate	9.9/NNE
40	Mittal Industrial Estate	9.3/N
41	Parle Biscuit Factory	10.0/NNW
42	Chakala Cigarette factory	9.7/N

3.14 PLACES OF TOURIST/HISTORICAL/ARCHAEOLOGICAL/INDUSTRIAL IMPORTANCE

Sanjay Gandhi National Park is the nearest national park which is located at 14.0 km, N from the project site. There are various historical places, religious places or places of archaeological importance within 15 km radius. The list of these along with their distance and direction are given in **Table 3.24**.

TABLE 3.24
LIST OF PLACES OF HISTORICAL/ RELIGIOUS/ ARCHAEOLOGICAL IMPORTANCE

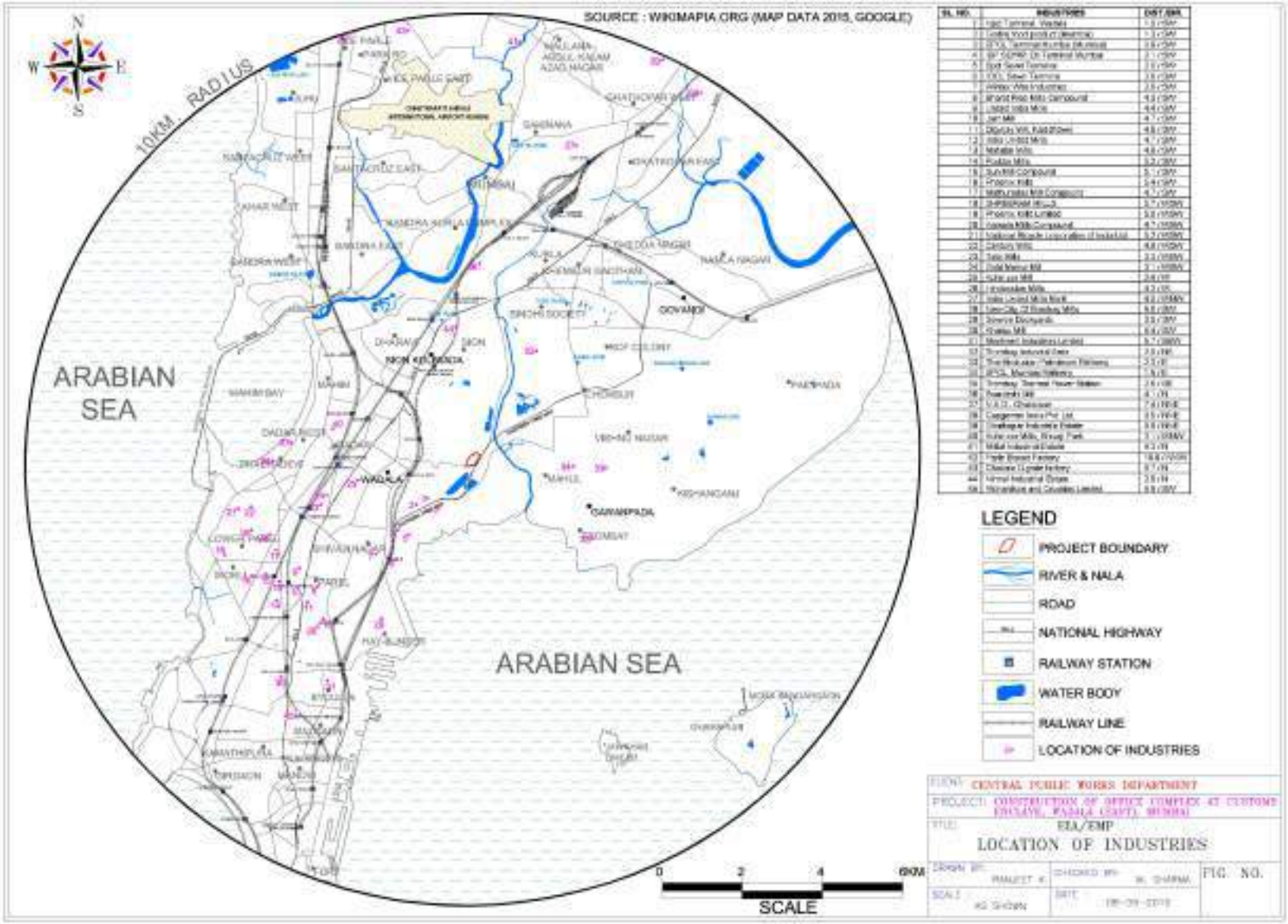
Sl. No.	Name	Distance (km)	Direction
	Historical/ Heritage/ Tourist Places		
1.	Asiatic society of Mumbai	10.1	SSW
2.	Bandra	5.8	NW
3.	Bandra Fort	6.2	WNW
4.	Basilica of Mount Mary Bandra	5.9	WNW
5.	Banganga	11.4	SW
6.	Bhuleshwar	8.1	SW
7.	Bombay Natural History Museum	10.8	SSW
8.	Bombay Stock Exchange	10.4	SSW
9.	Chhatrapati Shivaji Maharaj Vastu Sangrahalay formerly Prince of Wales Museum	10.7	SSW
10.	Chaityabhoomi dadar	3.9	WSW
11.	Chhatrapati Shivaji Terminus	9.4	SSW
12.	Cuffe Parade	12.8	SSW
13.	Chowpatty Beach	9.2	SW
14.	Crawford Market	8.7	SSW
15.	Dharavi	3.1	NW
16.	Dr. Bhau Daji Lad Museum formerly The Victoria and Albert Museum	5.7	SW
17.	Dhanraj Mahal	11.0	SSW
18.	Elephanta Caves	8.3	SE
19.	Fashion Street	9.7	SSW
20.	Film City	15.0	N
21.	Flora Fountain (now Hutatma Chowk)	10.2	SSW
22.	Gateway of India	11.1	SSW
23.	Hotel Taj Mahal Place	11.2	SSW
24.	Hanging Gardens	9.6	SW
25.	Hiranandini Gardens Garden Skyscraper City	11.5	NNE
26.	High Court	14.0	SSW
27.	The Imperial Towers Tallest Building in India	8.0	SW
28.	INS Vikrant	9.8	SSW
29.	Jehangir Art Gallery	10.6	SSW

Sl. No.	Name	Distance (km)	Direction
30.	Jijamata Udyaan	5.4	SW
31.	Juhu Beach	8.8	NW
32.	Kamala Nehru Park	9.7	SW
33.	Land's End, Bandra	6.0	NW
34.	Mahalaxmi Racecourse	6.1	SW
35.	Mani Bhavan Gandhi Museum	8.9	SW
36.	Marine Drive	9.4	SW
37.	India Government Mint	10.2	SSW
38.	Nehru Science Centre	6.2	SW
39.	Nehru Planetarium	6.6	SW
40.	Powai Lake	11.5	NNE
41.	Prithvi Theatre	10.6	NW
42.	Rajabai Tower	10.5	SSW
43.	Palais Royale Skyscraper	5.6	WSW
44.	Reserve Bank of India	9.9	SSW
45.	Taraporewala Aquarium	9.2	SW
46.	Vihar Lake	13.8	NNE
47.	Maharashtra Legislative Assembly	10.8	SSW
48.	University of Mumbai	10.2	SSW
49.	Worli Fort	5.6	W
50.	Worli Sea Face	5.8	WSW
51.	National Gallery of Modern Art	10.8	SSW
52.	Shivaji Park	3.4	WNW
53.	Ballard Bunder Gatehouse Navy Museum	9.7	SSW
54.	Sion Fort	2.9	NNW
	Places of Worship		
1.	Gurdwara Shree Guru Singh Sabha	3.4	NE
2.	Haji Ali Mosque	7.5	SW
3.	ISKCON Hare Krishna Temple	11.3	NNW
4.	Siddhivinayak Temple	4.2	W
5.	Mahalaxmi Temple	8.1	SW
6.	Fire Temple	7.7	SW
7.	Shri Swaminarayan Temple, Mumbai	2.7	W
8.	Mumba Devi Temple	8.3	SSW
9.	Shri Walkeshwar Temple	11.4	SW
10.	Keneseth Eliyahoo Synagogue	10.5	SSW
11.	Holy Name Cathedral	11.1	SSW
12.	Afghan Church	13.4	SSW
13.	St. Thomas Cathedral	10.1	SSW
14.	Babulnath Temple	9.2	SW
15.	Babu Amichand Panalal Adishwarji Jain Temple	10.7	SW

3.15 SEISMICITY

Earthquake can damage structures. The area has been classified as seismic zone III.

FIG 3.17: LOCATION OF INDUSTRIES AROUND PROJECT SITE



CHAPTER 4

ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.1 GENERAL

The environment management plan has been developed with a view to bring down the levels of adverse impacts within acceptable limits. In each of the areas for which impact assessment was performed, measures have been formulated to mitigate the adverse impacts and to enhance/ augment the beneficial impacts so that the overall adverse impacts are reduced to as low a level as possible. In general, any release of pollutants into the environment shall conform to the standards laid down by the statutory agencies. All control and mitigative measures shall be incorporated at the design stage and during the construction phase to protect the environment from deterioration.

The formulation of EMP for the construction project is based on the following considerations, as applicable:

i) Proposed project details;

ii) Air and water pollution control;

iii) Solid waste management;

iv) Management of excavated earth, comprising soil and boulders and control of erosion;

v) Control of noise;

vi) Tree Plantation and greening;

vii) Augmentation of ground water through rain water harvesting;

viii) Energy efficiency, etc.

It will not be out of place to mention that the construction project has a comparatively low potential for causing deterioration of the air environment during operation and with proper care, water and land environment can also be protected. The project is being located at C.S No. 146 of salt division, Customs Enclave Plot (Suleman Shah Plot), Wadala (East), Mumbai. Adequate green spaces have been identified to facilitate development of trees. Further, the ground coverage will be limited as per the bye laws for such projects. Adequate treated wastewater will be available for irrigation, which will facilitate healthy growth of trees and greenery. The proposed project will be provided with internal roads and adequate parking for smooth movement of employees and other visitors.

The anticipated population calculation has been done as given in **Table 4.1**.

TABLE 4.1
POPULATION CALCULATION

Particulars	Population
Office Goers	5935
Floating/ visitors	5935
Total	**11870**

4.2 CLIMATE AND METEOROLOGY

Climate changes are a long-term phenomenon, resulting from large scale and long term anthropogenic and natural activities. Considering the magnitude of the project, no major impact is anticipated on the climate and, therefore, no mitigation measures are proposed. Green house gases are of climatological concern.

Exhaust emissions due to use of personal transport vehicles (mostly cars and some two wheelers) by office goers working in the custom office will be restricted to short inward and outward journey periods. Since these vehicles are expected to be compliant to emission standards, adverse impact, if any, due to use of these vehicles on ambient air quality close to custom office site is expected to be minimal and the peak may last for a maximum of about 2 hours every working day, one hour in the office time during morning and one hour during evening, with visitors coming & going throughout the day regularly.

Vehicle owners will be encouraged to have the PUC certification of their vehicles done at periodic intervals. This will keep the CO and HC levels within permissible levels. Power supply is envisaged from State Electricity Board and CO_2 contributing DG sets will operate only during power failure for complete backup. Hence, it is the government's prerogative to undertake uninterrupted supply of clean energy to combat global warming so that the need to operate CO_2 generating DG sets does not arise.

The best practically applicable way to sequester this CO_2 at present is plantation. Therefore, plantation of trees will be done within plot area as provided.

Micro climate and urban heat island effect:

The climate of the district is characterized by an oppressive summer, dampness in the atmosphere nearly throughout the year and heavy south – west monsoon rainfall from June to September. The mean minimum temperature is 16.3°C and the mean maximum temperature is 32.2°C at Santacruze. The normal annual rainfall over the district varies from about 1800 mm to about 2400 mm. It is minimum in the central part of the district around Kurla (1804.9 mm). It gradually increases towards north and reaches a maximum around Santacruze (2382.0 mm). (*Source:*

http://cgwb.gov.in/District_Profile/Maharashtra/Greater%20Mumbai.pdf, accessed on 24.09.2014).

Microclimate modification involves the best use of structural and landscape design elements to maximize or limit sunlight, shade and air movement. Structural modifications involve the design of the building and associated construction (driveway, walkways, fences etc). Landscape modifications involve the use of plants to further increase or decrease the impact of sun and wind upon the local environment. This will decrease the energy costs associated with maintaining interior comfort.

Solid surfaces such as concrete and asphalt, which absorb a great deal of heat, would be kept to a minimum. Brick and other alternative materials driveways build up less heat than either asphalt or concrete and produce fewer glares than concrete. Ground cover plants and organic mulches will be considered as options for covering large areas. Ground covers offer a cooling effect and are not energy intensive. Organic mulches reduce runoff, are inexpensive and an attractive alternative to pavements.

In order to reduce energy needs for summer cooling, the steps that will be take will be:

1. Maximizing the use of ground covers and limiting the amount of dark, paved areas.
2. Maximizing shading on the roof by the overhead canopy of trees near short height buildings (such as guard room, etc.)
3. Maximizing shading in the summer on east, west and south walls with shade trees. However, in the case of high rise, due to the presence of basements below the buildings as well as height of buildings being much higher than trees, tree plantation along building edges is not possible but will be carried out along the peripheral wall. Shadows on the south, southeast, and southwest exposures are shorter than shadows cast on west and east exposures.
4. Using passive architectural features to minimize the air conditioning requirement. In case of air conditioner usage, the following will be taken care of:

    - Shading the outside compressor unit from direct sun.
    - Selecting trees to block wind-driven air flow into the building through breaks in outside walls, such as windows, doors, and other openings. This feature will be able to have an impact only on the first one or two floors of the building as it will be directly proportional to the height of the tree.
    - Situate a windbreak, if required, at some distance from the building

5. To minimize energy needs for winter heating, it is proposed to :

- Use native & deciduous trees, shrubs and vines on south, southeast and southwest locations

- Create a windbreak for the north and northwestern exposures of the building using evergreen trees and shrubs in a multi-layered canopy, preferably in 2- to 5-foot rows. This feature will be able to have an impact only on the first one or two floors of the building as it will be directly proportional to the height of the tree.

6. Avoiding the use of solid foundation plantings that create a dead-air space on the south side.

4.3 AIR ENVIRONMENT

4.3.1 Construction phases

A. Impact

Construction phase would involve site clearances and preparation, infrastructure development, building construction and other related activities.

Sources of air pollution

- The building material carrying vehicles as well as the construction machinery generate emissions and pollute the environment

- Dusts include brick and silica dusts, wood dust from joinery and other woodwork and from earth moving and other vehicle movements within the site

- Construction machineries pose a special threat to air quality, if they are not PUC compliant. Construction machineries emit gaseous pollutants (NOx, SO_2) in addition to fine particulate matter (PM2.5).

Estimation of fugitive emissions

Dust emissions from non-residential and commercial construction are a function of the total area of land disturbed and the duration of activities done. Based on field studies, the AP-42 (Compilation of Air Pollutant Emission Factors**,** US EPA, Section 13.2.3) gives the total suspended particulate emission factor estimate as 2.69 megagrams (Mg)/hectare/month of activity. Because the above emission factor is referenced to TSP (Total Suspended Particulate), use of this factor to estimate particulate matter (PM) no greater than 10 µm in aerodynamic diameter (PM-10) emissions will result in conservatively high estimates. Also, because derivation of the factor assumes that construction activity occurs 30 days per month, the above estimate is somewhat conservatively high for TSP as well. The ratio of PM2.5 to PM10, as documented in AP-42, is assumed to be 0.20.

B. Mitigation measures

Since the main air pollution will occur during the construction phase, therefore, the mitigation measures are also oriented towards construction phase. Dust particles and gases will be generated during construction activity. The following measures are to be taken up to control air pollution problems:

- Areas under excavation and grading as well as the routes of vehicles are prone to fugitive dust emission during construction stage. To avoid fugitive emissions, sprinkling of water shall be done regularly to stabilize these areas.

- Use of covering sheet to prevent dust dispersion at buildings and infrastructure sites, which are being constructed.

- Equipment and transport vehicle will be maintained periodically to avoid source emissions and spillage. Regular maintenance schedule will be adopted as per manufacturer's specifications;

- Preventive maintenance of all trucks, earthmovers and construction equipment shall be carried out at pre-determined intervals to ensure that exhaust emissions are maintained at the minimum practicable levels. Emissions from construction equipment and pay loaders shall be within norms due to PUC.

- Loading and unloading operations also contribute significant fugitive dust emissions. The fugitive dust during loading and unloading will be controlled by water spraying except in the case of raw materials like cement, which will adversely effect the properties of the raw material.

- Transportation of loose building materials to the construction site will be carried out in covered trucks to minimize fugitive dust.

- On-Road-Inspection would be done for black smoke generating machinery.

- Reducing the speed of a vehicle to 20 kmph can reduce emissions by a large extent. Thus, speed bumps will be used to ensure speed reduction.

- Roads will be made black topped/ concrete or paving done at the earliest and regularly maintained;

- Provision of tyre wash will be considered at the exit point from the plot so that dust stuck to tyres of exiting trucks is washed off and does not contribute to the fugitive emissions on the public roads.

- All DG sets would comply emission norms notified by MoEF.

- **Material storages/warehouses** – Care would be taken to keep all material storages adequately covered and contained so that they are not exposed to situations where winds on site could lead to dust /

particulate emissions. Fabrics and plastics for covering piles of soils and debris will be used to reduce fugitive dust.

- As per AP-42 of US EPA, the recommended measures for various activities during construction phase are summarised in **Table 4.2**.

TABLE 4.2
RECOMMENDED MEASURES FOR CONTROL OF FUGITIVE EMISSIONS DURING CONSTRUCTION

Emission Source	Recommended Control Method(s)
Debris handling	Wind speed reduction, Wet suppression[#]
Truck transport[##]	Wet suppression, Paving Chemical stabilization^
Bulldozers	Wet suppression^^
Pan scrapers	Wet suppression of travel routes
Cut/fill material handling	Wind speed reduction, Wet suppression
Cut/fill haulage	Wet suppression, Paving Chemical stabilization
General construction	Wind speed reduction, Wet suppression Early paving of permanent roads

\# ***Dust control plans should contain precautions against watering programs that confound track out problems.***

\## ***Loads could be covered to avoid loss of material in transport, especially if material is transported offsite.***

^ ***Chemical stabilization usually cost-effective for relatively long-term or semi permanent unpaved roads.***

^^ ***Excavated materials may already be moist and not require additional wetting. Furthermore, most soils are associated with an "optimum moisture" for compaction.***

4.3.2 Operation phase

A. Impact

It is estimated that the proposed project will accommodate a population of about 11870 people (office goers & visitors). The complex comprises of block (comprising of records, kitchen, Auditorium for 400 people, Convention centre, Malkhana, Court rooms, Armoury, offices for various departments of customs). Activities associated with day-to-day life of the population, which may affect the air quality, is movement of vehicles and use of DG sets. Negligible emissions from sewage and solid waste handling and disposal are also likely to be there. The major impact due to DG set operation in the project has been discussed in subsequent paragraphs.

(i) Emission from stationary source

Operation of custom office will not have any continuous source of gaseous emissions and, therefore, no adverse impact on ambient air quality in the

area is likely due to it. 4 X 1010 KVA of silent DG sets with canopies will be used as power back up for project site during power failure. Since power failure frequency is anticipated to be low, therefore, they are likely to be operated for few hours in a month only. Furthermore, exhaust gases from DG sets whenever operated will be discharged through a stack height of 30 m. Therefore, any adverse impact on ambient air quality due to operation of standby DG sets for power supply will be low as seen in **Table 4.4**.

Air quality prediction modelling has been carried out for the operation of DG sets for the worst case scenario of 24 hours, the details of which are given in ***Annexure XVII***. The stack details of the DG sets are given in **Table 4.3** and the anticipated maximum ground level concentrations towards the three most predominant directions is summarized in **Table 4.4**.

TABLE 4.3
STACK DETAILS

Sl No	Stack name	Height (m)	Dia (m)	Temp (°C)	Exit gas Volume (m^3/s)	Exit vel. (m/s)	Emission rate (µg/s)				
							PM_{10}	$PM_{2.5}$	SO_2	NO_X	CO
1	DG1 (1010 KVA)	30	0.29	225	1.77	26.1	21836	12556	258111	446429	582299
2	DG2 (1010 KVA)	30	0.29	225	1.77	26.1	21836	12556	258111	446429	582299
3	DG3 (1010 KVA)	30	0.29	225	1.77	26.1	21836	12556	258111	446429	582299
4	DG4 (1010 KVA)	30	0.29	225	1.77	26.1	21836	12556	258111	446429	582299

TABLE 4.4
CALCULATED MAXIMUM GROUND LEVEL CONCENTRATION ($\mu g/m^3$)
(TOWARDS THREE MOST PREDOMINANT WIND DIRECTIONS)

Pollutants	PM_{10}		$PM_{2.5}$		SO_2		NO_X		CO	
E	0.24	200-300 m	0.14	300 m	2.87	300 m	4.96	300 m	6.47	300 m
W	0.28	300 m	0.16	300 m	3.30	300 m	5.71	300 m	7.45	300 m
ESE	0.23	300 m	0.13	300 m	2.75	300 m	4.76	300 m	6.21	300 m

The three most predominant wind directions observed during 24 hrs monitoring period are towards E, W and ESE directions for 10.44%, 9.67% and 8.17% (ex-calm) of time respectively. Above results show that the emissions from the project will increase pollution in the ambient air but it will still be far below the permissible limits. It can be inferred that for operation of DG set for less than 24 hours, the ground level concentrations (GLC) will reduce proportionately.

DG sets will be operated in the case of power failure only. Since low sulphur diesel will be used, the emissions of SO_2 will lead to low GLCs as seen in **Table 4.4**, hence no scrubbing devices will be required to be attached additionally for pollution control. The stack height has been considered on the basis of CPCB guidelines for ensuring dispersal of pollutants, especially, SO_2.

Maximum increase in ground level concentrations by superimposing on the highest ambient air quality observed in the study area has been given in **Table 4.5**.

TABLE 4.5
GROUND LEVEL CONCENTRATION AFTER INCREMENT IN THE STUDY AREA FOR PROPOSED PROJECT (µG/M^3)

Pollutant	Maximum Increment	Maximum Concentration Observed at project site	Resultant Concentration	Permissible limits, NAAQS 2009
PM10	0.28	145.2	145.48	100
PM2.5	0.16	74.5	74.66	60
SO_2	3.30	22.1	25.40	80
NO_x	5.71	50.4	56.11	80

Although the contributory GLCs are low, the PM10 and PM2.5 levels in the atmosphere in and around the project site are already high and therefore, the resultant concentration is beyond permissible limits. Hence, mitigation measures such as maintenance of DG sets and use of low sulphur diesel have to be followed strictly to ensure that pollution does not increase further.

Cumulative impact of power projects & refineries near the proposed project

The industries in the 10 km radius of the project are listed in Table 3.23 of Chapter 3. It can be seen that the nearest power plants and refineries are located at the following distances:

Sl. No.	Description	Distance (km)/Direction
1	Trombay Thermal Power Station (Tata Power)	3.1/SE
2	The Hindustan Petroleum Refinery	2.8/E
3	BPCL- Mumbai Refinery	2.1/E

It can be seen that none of the above are within 2 km distance of the proposed office complex. Referring to the extracts of the air quality prediction impacts from the respective EIA or other reports of the three projects (as given in ***Annexure XVIII***), it is found that :

- In case of **Tata Power,** there are four stacks which have been assessed for the existing emissions as well as the proposed changes in the project. Two scenarios were developed for the modeling, Scenario 1 reflecting the existing mode of operation, with Units #5, #8 firing on coal, Unit #6 firing on oil, and Unit #7 on Natural Gas. Pollution dispersion calculation was done for PM, SO_2, and NO_x emission by using ISCST3 model for existing as well as future conditions, taking the Unit #6 modernization into account. The summary of the emissions shows that in the case Scenario 1, incremental PM shall be 2.4 µg/m^3, SO_2 shall be 3.914 µg/m^3 and NOx shall be 4.58 µg/m^3. In the case Scenario 2, incremental PM shall be 1.94 µg/m^3, SO_2

shall be 3.85 μg/m^3 and NOx shall be 4.43 μg/m^3. The GLCs will reduce by -0.3, -0.06 and -0.15 μg/m^3. A perusal of the isopleths shows that the custom house project is on the leeward side and not impacted by the emissions from the Tata Power project.

- In case of **BPCL- Mumbai Refinery (**Conversion Of Catalytic Reforming Unit (CRU) To Isomerisation Unit And Revamp Of Existing Naphtha Hydro Desulphurization Unit (NHDS)**)**, there are five stacks which have been assessed for the replacement due to the changes proposed in the project. The SO2 values post ISOM project will remain the same with respect to post-ongoing CCR & CDU-4 projects while the NOx value will increase by 0.11 MT/D. Based on prediction exercise, the SO2 GLC are anticipated as 7.05 μg/m^3 in post project scenario while NOx is estimated as 5.45 μg/m^3.

- In case of **BPCL- Mumbai Refinery (**proposed diesel hydrotreating unit (DHT) project for production of BS-IV HSD), there are two stacks which have been assessed for the changes proposed in the project. No net SO2 emissions are anticipated while the NOx value will increase by 7.01μg/m^3. A perusal of the isopleths shows that the custom house project is on the leeward side and not impacted by the emissions from the Tata Power project.

- In case of **HPCL**, although the executive summary of the EIA for construction of storage tanks & associated facilities at Mumbai Refinery-II was available in public domain, there is no quantitative information pertaining to air emissions.

(ii) Fugitive dust

During operation, the fugitive dust sources would be due to sweeping and due to movement of vehicles. The fugitive dust due to sweeping or internal movement of vehicles would not have any influence in areas further from the premises of the project. However, the fugitive emissions on public roads will not be under the control of the proponent.

B. Mitigation Measures

During operation phase, the air pollution component is relatively very low in comparison to the construction phase. However, some measures have to be taken in the project proposal as follows:

1. Conservation of present trees to the maximum possible extent and development of green areas as well as avenue plantation shall be carried out.

2. Plants are good absorbers of pollutants therefore development of green belt to attenuate air pollution. Pollutant resistant species of mainly evergreen trees will be chosen for plantation.

3. The use of solar energy for meeting part of the street lighting requirement.

4. PUC of vehicles during operation phase.

5. Provision of adequate stack height to DG sets as per the norms for dispersal of emissions.

6. The DG set shall be provided with acoustic shields or enclosures to limit the sound level as per norms.

7. Routine stack emission monitoring for particulate matter will be carried out as per the frequency prescribed by State Pollution Control Board;

8. Sprinkling of water to minimise fugitive dust from premises

9. ***Monitoring & Sampling ports in DG set -*** For the purpose of monitoring the emissions from the DG set stack, Sampling port are proposed of 0.2 m dia at a height of 10 m and 25 m. The ports will be accessible by ladder arrangement. The final design and location of the sampling ports are subject to manufacturers specification.

4.4 WATER ENVIRONMENT

4.4.1 Construction phase

A. Impact

The impact on water resource and quality during construction phase will be due to:

(i) Consumption of water
(ii) Discharge of waste water
(iii) Contamination of runoff during rain

Source of water during construction phase

Water requirement during construction phase will be met through tankers. The project proponent will obtain necessary permission from the concerned authority. Domestic water supply for construction workers will be also be sourced through municipal supply.

Quantity of water required

The quantity of water required will be variable and will vary from day to day depending on the construction activities proposed and the number of manpower deployed on a particular day. Construction water consumption will be for dust settlement, consolidation, compaction, curing, plastering, at-site RCC, washing, etc. About 12,000 litres of water will be required for curing 100 square metres of slab surface. Water consumption will by labour as well, which shall be provisioned at the rate of 45 lpcd.

Sources of pollution

- Source of water pollution during construction phase has been identified as domestic sewage generated in canteen, washrooms and toilets used by construction work force.
- Most construction water will be absorbed during construction or evaporated during curing. Therefore, no major quantity of waste water is anticipated from construction activities.
- Runoff water during rains will carry suspended particulates which can pollute the downstream water

B. Mitigation Measures

- The waste water generated by the labour will be managed by providing pre fabricated portable toilets ultimately leading to septic tanks system for treatment. The septic tank will be periodically evacuated for disposal. Modular impervious units will have to be used since the ground water table is very shallow.
- To minimize the flow of solids in the runoff, measures shall be taken as follows:
    - Carrying out major part of excavation and material handling in non monsoon season
    - Avoiding rainy days for material handling
    - Stabilizing any earth dumps with grass or covere with tarpaulin to minimize erosion
    - Undertake plantation within the premises at the earliest to minimize soil erosion
    - Provision of garland drains around excavation and temporary earth storage, followed by settling pond to settle suspended solids before release into the storm water drain
    - Provision of storm water drains with silt traps near anticipated high-silt areas
- To avoid wastage of curing water, following guidelines will be followed:
    - Curing water would be sprayed on concrete structures; free flow of water would not be allowed for curing. ·
    - After liberal curing on the first day, all concrete structures would be painted with curing chemical to save water. This will stop daily water curing hence save water. ·
    - Concrete structures would be covered with thick cloth/gunny bags and then water would be sprayed on them. This would avoid water rebound and will ensure sustained and complete curing. ·

- Ponds would be made using cement and sand mortar to avoid water flowing away from the flat surface while curing.
- Water ponding would be done on all sunken slabs.

4.4.2 Operation phase

A. Impact

The impact on water resource and quality during operation phase will be due to:

(i) Generation and discharge of waste water
(ii) Contamination of runoff during rain

4.4.2.1 Source of water during operation phase

The water shall be sourced from the following:

(i) Fresh water from Municipal Mains
(ii) Treated waste water from centralised Sewage Treatment Plant (STP) and Softener for HVAC & irrigation system.

Water treatment

The water from the raw water tanks would be passed through a Water Treatment Plant followed by chlorination. Also, it is envisaged to use treated water from Sewage Treatment Plant (STP) and Softener for HVAC & irrigation system.

4.4.2.2 Quantity of water required, sewage generation and reuse

Total fresh water demand of the commercial project will be 334 KLD. The basis of calculation of the water demand for the entire project is given in **Table 4.6**. Domestic water consumption has been considered as 45 lpcd on the basis of "Manual on norms and standards for environmental clearance of large construction projects" of MoEF. The water demand estimation has been tabulated in **Table 4.7**.

TABLE 4.6
PARAMETERS FOR WATER CONSUMPTION FOR DIFFERENT LAND USES

Sl. No.	Usage Type	Water Requirement (LPCD)
1.	Commercial	45
2.	Floating	15

TABLE 4.7
DEMAND ESTIMATE OF WATER CONSUMPTION IN DIFFERENT USES

Sl. No.	Use	Population	Water requirement	Water requirement		
			(per unit, LPCD)	(LPD)		
			Fresh	Fresh	Treated	Total
1	Office Goers	5935	45	267075	0	267075
2	Floating/Visitors	5935	15	89025	0	89025
	Total in litres	**11870**		**356100**	**0**	**356100**
	Total in KLD			**356.100 Say 356**	**0**	**356.100 Say 356**
	Air-conditioning cooling tower makeup water requirement per day. (soft water), KLD			**52**	**231**	**283**
	Gardening/irrigation (Discharge from Softener-1), KLD			**6**	**0**	**6**
	Gardening/Irrigation (Discharge from Softener-2), KLD			**0**	**26**	**26**
	Total			**414**	**257**	**671**

It can be seen from **Table 4.7** and **Fig 4.1** that:

- Fresh water demand will be 356 KLD.
- Treated water of 283 KLD will be used for air-conditioning cooling tower makeup.
- Reject water of 6 KLD from softener-1 and 26 KLD from softener-2 will be used for irrigation purposes.
- Green covers in the complex works out to be 32 KLD which also will utilize treated waste water.

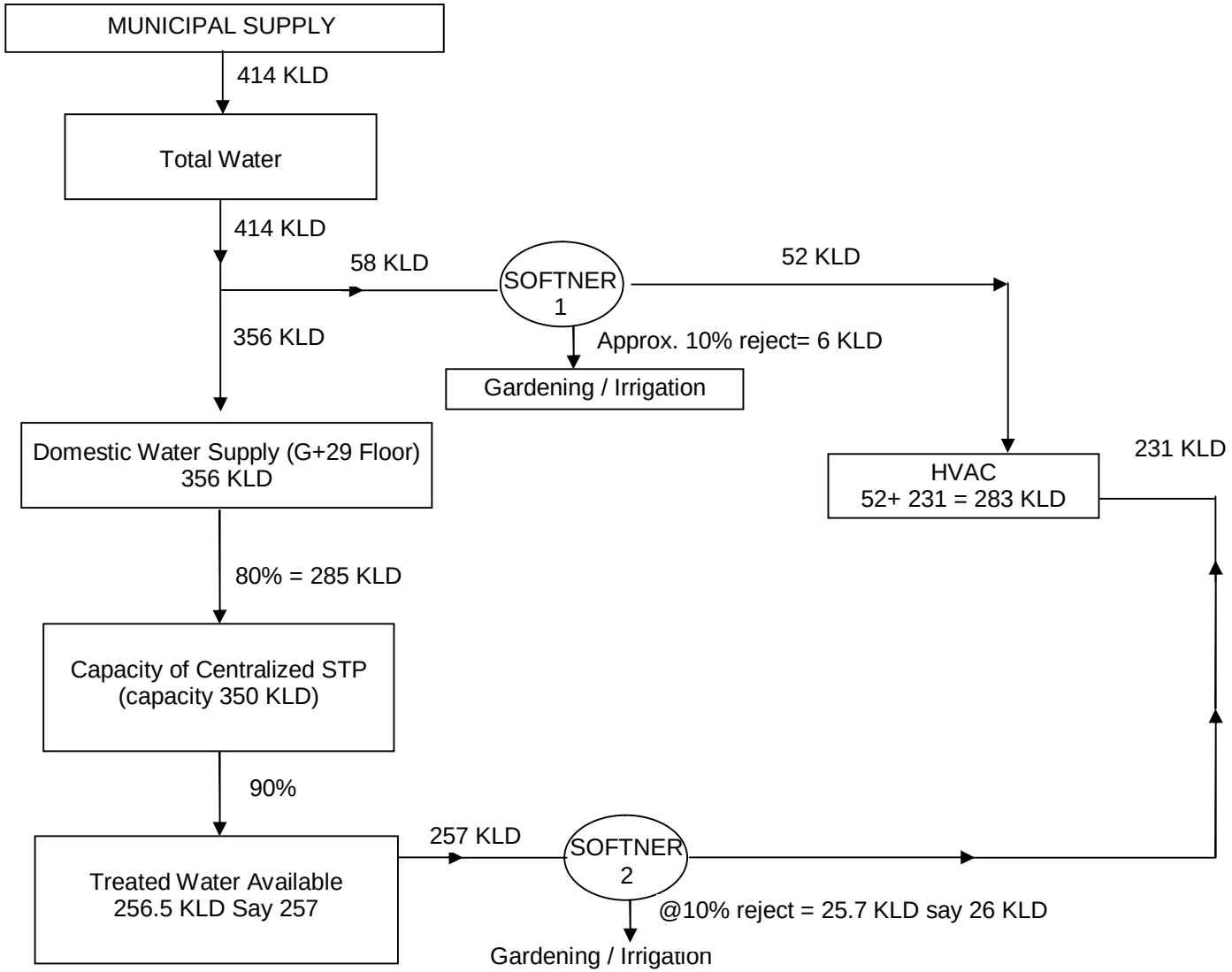
The water balance diagrams for the summer and winter has been shown in Fig 4.1.

Underground Storage Capacity

Underground water storage is proposed for which tanks shall be provided as follows:

Description	Capacity (in KL)	Remarks
Fire Tank	200	As per NBC-2005
Domestic water tank	300	One day requirement of total capacity
Drinking Water Tank	50	One day requirement of total capacity
Soft Water Tank	100	
Total	**650**	

FIG 4.1: WATER BALANCE DIAGRAM, KLD



Note: Total water used for gardening/irrigation will be 32 KLD, which will be discharged into the sewer during monsoon.

4.4.2.3 Water Supply Distribution System

Source of water considered shall be from the Municipal supply.

Domestic Water

For pumping and distribution of domestic water, the domestic water transfer pumps will be provided in the underground water tank pump room, and then transferred to overhead domestic tank. This process will be controlled by level controllers. The supply to overhead tanks by Pressurization pumps from centralized pump room. This process will be controlled by float valve placed in individual overhead tanks. Pressure-reducing valves shall be provided to maintain reasonable pressure in riser and down pipe. Booster pump shall be provided to maintain pressure for G+29 (initial proposal).

Overhead Storage

From main underground domestic water storage tank, supply will be pumped up to terrace level and water will be stored in overhead domestic tanks with 33% storage capacity. Overhead tanks for each toilet block have been proposed above terrace level.

Domestic Water Distribution System

Gravity Feed System: Water will be pumped from existing source to underground fire water tank, overflow to domestic water tank it will be transferred to overhead tank it will be distributed by gravity flow to various outlets. Pressurization is not required and distribution is accomplished by providing down takes to various fixtures.

The water distribution system for domestic and other usages will be through gravity feed. Piping sizing shall be based on fixture unit calculation as per NBC standard. However, the maximum velocity in the water supply piping shall not exceed 2.4 m/second. The irrigation water supply system comprising of pumping, piping, water supply nozzles and control equipment shall be designed as per landscape drawing.

Internal & External Water Supply Piping

It is proposed to use GI Medium duty pipes for all water requirements (Internal / External).

Soft (Treated) water

Soft water shall be supplied through separate transfer pumps to the Cooling Towers etc as per requirements. The pipe G.I medium duty shall be used.

The water supply network is shown in **Fig 4.2**.

4.4.2.4 Sewage Collection and Conveyance

Domestic wastewater comprising of wastewater generated from kitchens/ canteens/ pantry, washrooms and toilets has been identified as the major source of waste water from where the waste water will be collected through pipe system leading to the sewer system laid out for the project. Sewage generated from all the building shall be to the tune of about 285 KLD.

It is proposed that the sewage generated from all the building shall be treated in a sewage treatment plant, so that the treated effluent can be recycled for horticulture & soft water requirements of the site so that site will be ZERO discharge site.

The sewage network of the office complex has been shown in the **Fig 4.3**.

4.4.2.5 System Design and Sewage Treatment

System Design

- The sewerage system will be based on conventional water carriage system, in which soil and domestic waste generated by individual buildings/units will be collected into a collection chamber, through soil and waste piping system.
- The collection chamber from all units shall be connected to the nearest manhole on the external sewer line planned along the periphery of the building and as per site conditions.
- It is recommended that the domestic sewage shall finally be carried due to gravity to one disposal point for further treatment in the Sewage Treatment Plant.

Sewage Treatment

Sewage will be treated in advance MBBR technology based STP of 350 m^3/day capacity located in Custom Office. The location of the STP has been shown in the **Fig 4.3**.

The anticipated influent characteristic of the sewage is given in **Table 4.8**.

TABLE 4.8
ANTICIPATED CHARACTERISTICS OF WASTE WATER

Sl. No.	Parameter	Concentration (mg/l)
1.	pH	6.5-8.0
2.	Oil and grease	40-50
3.	Suspended solids	200-450
4.	BOD @ 20 degree C	200-300
5.	COD	600-800

(Source: Data Base Project Report of "Construction of Office Complex and Godown at Customs Enclave Plot", (Suleman Shah Plot), Wadala (East), Mumbai by Architect Suresh Goel & Associates)

FIG 4.2: WATER SUPPLY NETWORK

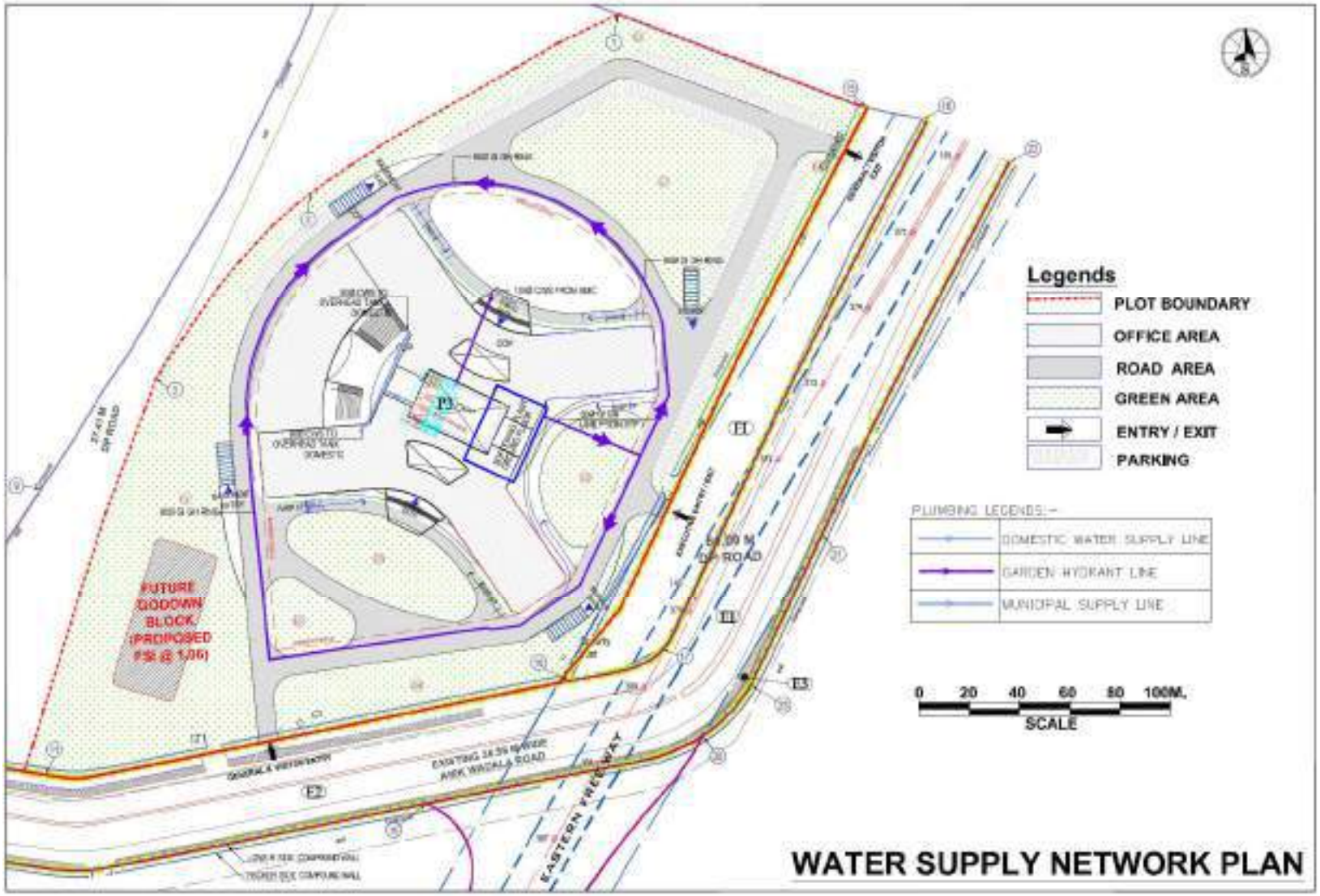
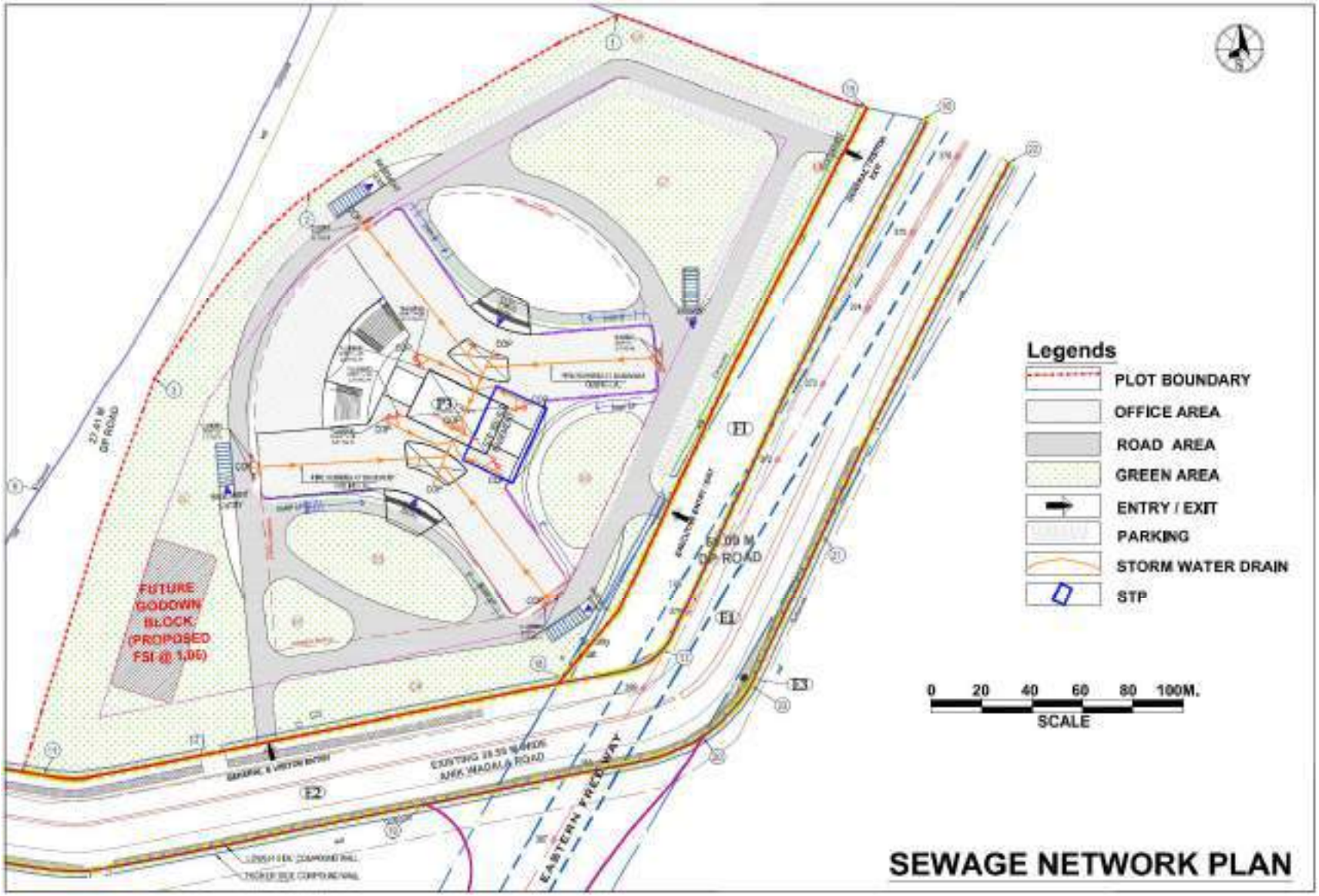


FIG 4.3: SEWAGE NETWORK



Final effluent characteristics desired (As obtained from the Secondary Clarifier, Advanced MBBR Treatment) would be BOD less than 30 mg/l, COD less than 80 mg/l and suspended solids less than 100 mg/l levels.

The characteristics of effluent will be within the norms specified by Ministry of Environment & Forest, Govt. of India or Central Pollution Control Board for safe disposal to green area.

Provision for safety against failure in the operation of waste water treatment facilities

Power arrangement through back up DG set has been proposed for STP to ensure uninterrupted operation during power failure. Arrangement for back up pumps and other parts as well as consumable stocks shall be made. A maintenance agency shall be doing preventive maintenance of the STP periodically as well ensuring its smooth maintenance. Regular R&M activities shall be carried out.

4.4.2.6 Discharge of treated waste water

Sewage from the building will be treated in the sewage treatment plant (STP) of Custom office which has provision of advance treatment so as to bring down parameters of treated water as per MoEF guidelines.

Treated effluent shall be filtered through “Dual Media Filter (DMF)” & Activated Carbon filter (ACF) and stored in an UG tank for use in Horticulture. Further entire treated water will be sent to the softener, 10% water will be discharged in softening process i.e 32 KLD which will be utilized for gardening and irrigation and rest 283 KLD softened water will be recycled for HVAC. There will be no discharge into the drains/ nalas outside the project except in the monsoon season which will be comprise of the rainfall runoff as well as the water unutilised in greenbelt watering (32 KLD).

Water conservation and augmentation

The following measures have been proposed to curtail the consumption of water, thus, conserving it:

a) Water conserving flushing fixtures operating on infrared sensors shall be used for Urinals.

b) Water demand meters shall be installed to monitor daily consumption patterns & regulate water flows to each area for the purpose of record.

d) Push back type pillar cocks in wash basins shall be installed.

e) Water conservation using Dual flow fixtures for plumbing cistern.

f) The water demand for horticulture at project site shall be met by recycling the treated effluent available from the water softening plant.

FIG 4.4: SURVEY PLAN AND NALAS AROUND PROJECT SITE

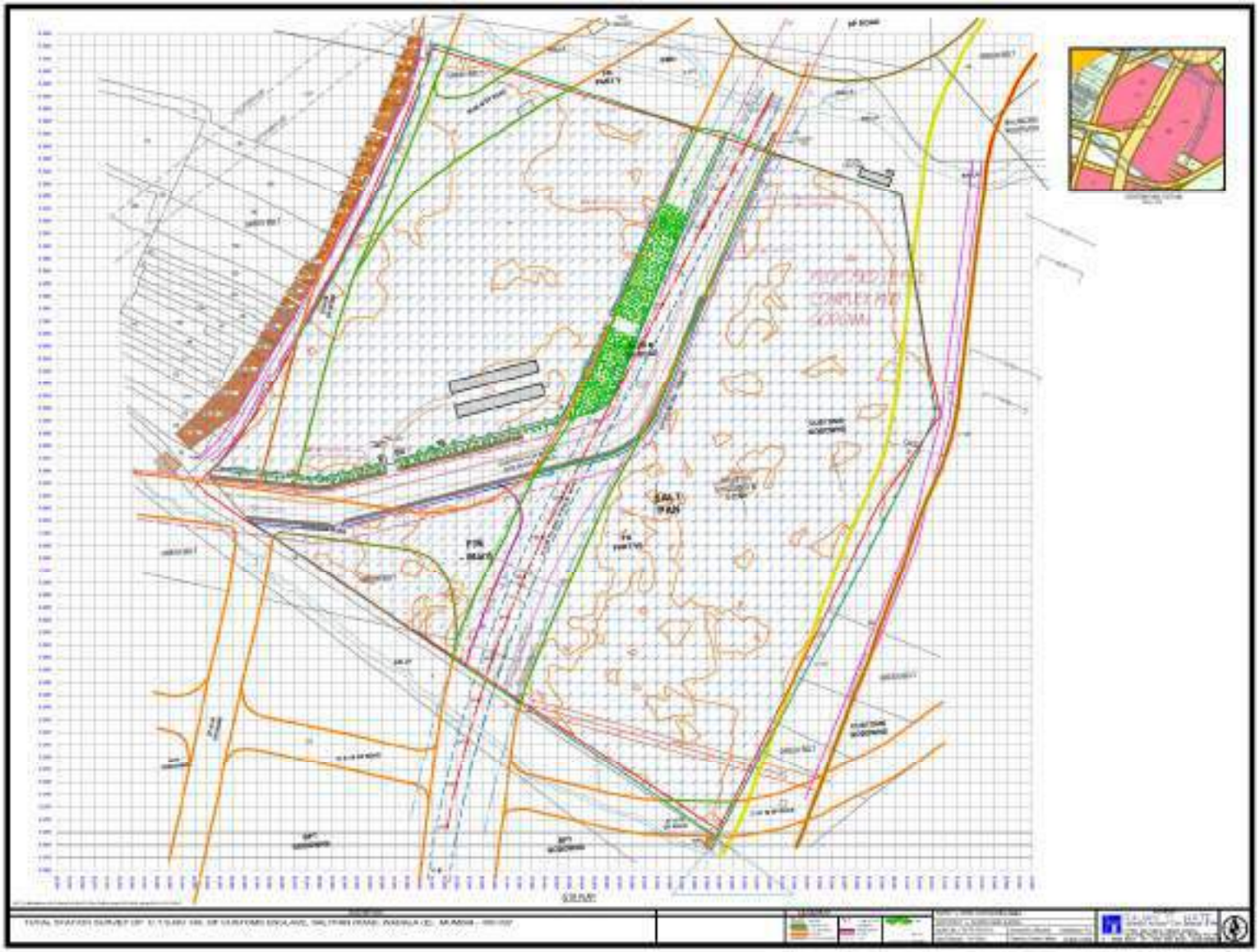
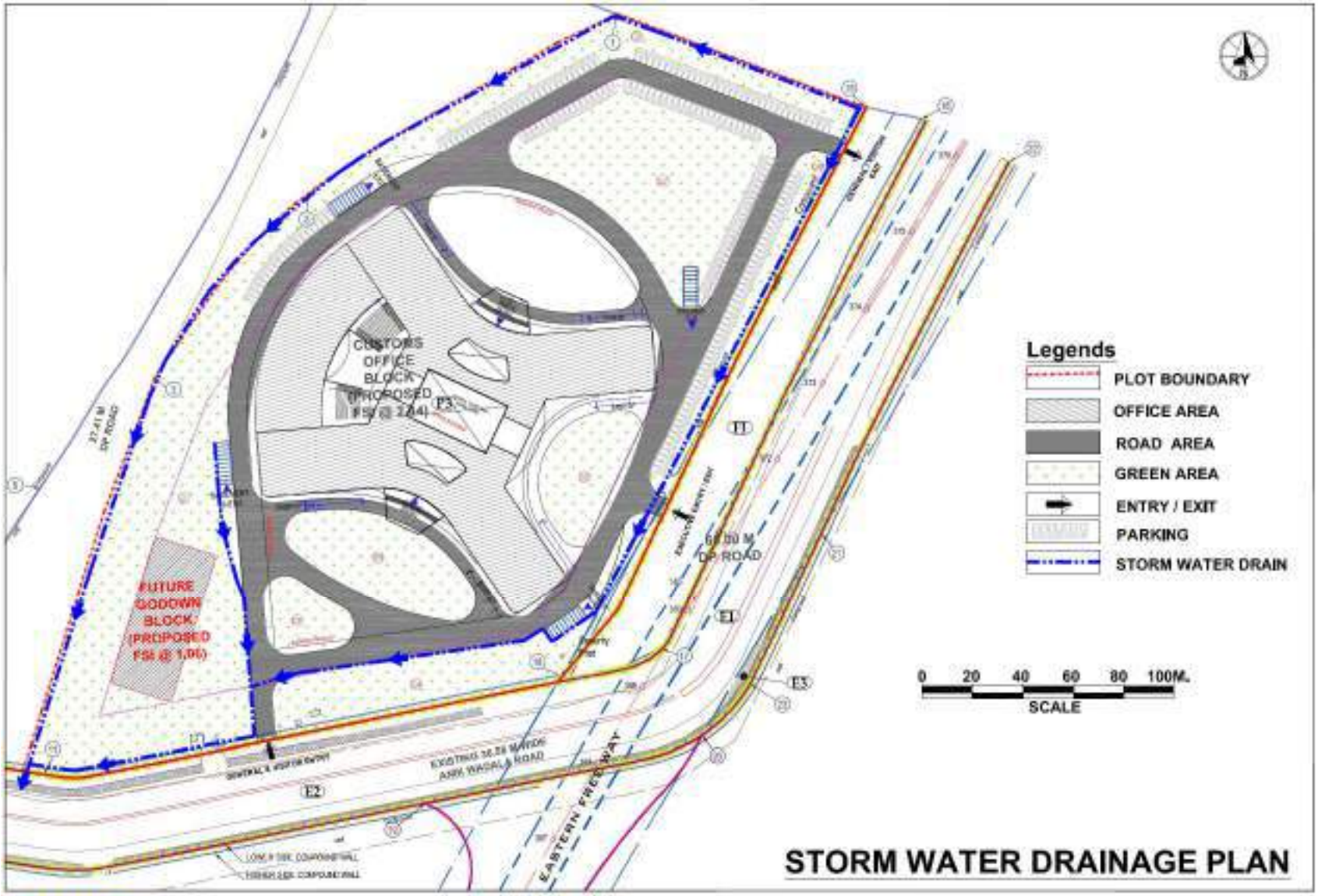


FIG 4.5: STORM WATER DRAINAGE PLAN



g) It is made compulsory in newly formed parks and open spaces to accomplish water storage and recharge through trenches.

h) Sprinklers/drip irrigation will be used.

i) The construction of solid slab pavements shall be avoided and instead porous or combination of solid and green areas will be used

j) Awareness plays a major role in water conservation. Public messages to be prominently displayed for water conservation.

k) Water leaks to be tracked and corrected regularly.

4.4.2.7 Rain water harvesting system and drainage

As per Geo-technical investigation report, ground water table observed between 0.8 to 1.7 M below ground level(bgl), which is very high. Seasonal and annual fluctuation in ground water levels can be expected. Therefore, no artificial recharging will be proposed.

Central Ground Water Board(CGWB) norms suggests that artificial recharging will not be done if the water table is less than 8 m.
(Source : Manual on norms and standards for environment clearance of large construction projects, MOEF,GOI, Chapter 2)

The storm water drain will be connected to the existing natural nala on south side of the project. The flow is observed to be approximately 5 to 7 m/s with a depth varying from 1.2-1.5 m. Currently also, the run off the plot is flowing towards the south side nala as per the contour map.

4.5 TRAFFIC AND PARKING

4.5.1 Construction phase

A. Impact

During construction phase, large quantities of construction material will be transported to the site. This will add to increase in traffic in terms of trucks carrying construction material on the road connecting the site. It will lead to fugitive dust generation at site, emission from vehicles, noise due to movement, loading and unloading as well as congestion. Mobile construction machinery on the site also will serve as a source of pollution due to combustion of fossil fuel and fugitive emission due to movement as well as material handling.

An examination of the details of transport of tentatively estimated material for construction has been done as follows:

Sl. No.	Materials	Quantity	Units	Likely No. Of trucks over construction period
1	Bricks	25476356	Nos.	8,492 @3000/8T
2	Cement	13648048	Bags	34,120 @400/10 T
3	Steel	300.25	Tonne	30
4	Aggregate	200171.3	Cum	40,034
5	Sand	136480.5	Cum	20,472
	Road works			
6	Aggregate	18197.5	Cum	3640
7	Bitumen	145579	Kg	15

The source of the various raw materials mentioned above will be from Suppliers in Greater Mumbai district who will have sufficient availability to meet the requirement.

B. Mitigation

Since the impact of transportation is mostly on the ambient air quality, most of the following mitigation measures have already been discussed in the Section under ambient air quality but are listed below for easy co-relation with vehicular and mobile machinery use:

- During construction phase, the dust generated by transportation activities will be mitigated by sprinkling operations and the trucks shall be covered up to an optimum fill level;
- Routes of vehicles are prone to fugitive dust emission during construction stage. To avoid fugitive emissions, spraying of water shall be done regularly to stabilize these areas.
- Equipment and transport vehicle will be maintained periodically to avoid source emissions and spillage. Regular maintenance schedule will be adopted as per manufacturer's specifications;
- Preventive maintenance of all trucks, earthmovers and construction equipment shall be carried out at pre-determined intervals to ensure that exhaust emissions are maintained at the minimum practicable levels. Emissions from construction equipment and pay loaders shall be within norms due to PUC.
- Loading and unloading operations also contribute significant fugitive dust emissions. The fugitive dust during loading and unloading will be controlled by water spraying except in the case of raw materials like cement, which will adversely effect the properties of the raw material.
- Transportation of loose building materials to the construction site will be carried out in covered trucks to minimize fugitive dust.

- On-Road- Inspection would be done for black smoke generating machinery

- Reducing the speed of a vehicle to 20 kmph can reduce emissions by a large extent. Thus, speed bumps will be used to ensure speed reduction.

- Roads will be made black topped/ concrete or paving done at the earliest and regularly maintained;

- Provision of tyre wash will be considered at the exit point from the plot so that dust stuck to tyres of exiting trucks is washed off and does not contribute to the fugitive emissions on the public roads

Traffic poses risk of accidents, hence, precautions for minimising accidents are also proposed as follows:

- Trucks, vehicles and other machinery will require to have a mechanism of reversing horn so that any persons standing behind the vehicle gets prior warning.

- Drivers will be sensitised to the driving carefully and with full awareness of there surroundings so that risk of accident is minimised

- Drivers will be prohibited from drinking and driving

- Warning boards and signages will be put up at relevant places to warn both drivers and pedestrians for any safety measures and precautions to be taken, such as at crossings.

- The entry and exit of vehicles into the site will be recorded

- Whenever any high-accident risk unloading activity can take place such as unloading of large girders, etc., there shall be guards present around to redirect traffic and the area will be restricted to pedestrian access and movement

4.5.2 Operation phase

A. Impact

The impact of traffic during operation phase in terms of :

- Nature --> negative, since, there will be increase in traffic volume on public roads due to the project
- Duration--> short term but perennial. The impact will be experienced during day time only, peaking during morning & evening. However, the scenario will prevail on all working days of a year and therefore will be perennial
- Reversibility--> reversible, since, on non working days, impact will be non existent.
- Magnitude --> high since the contribution of traffic from custom house will be 72% of the total traffic on the Sewri Chembur road, which is neither a high number.

Examination of road/rail connectivity to the project site has been done in Section 1.4.4 of Chapter 1 earlier. The present traffic load has been assessed in Section 3.8.2 of Chapter 3. The future traffic assessment has been done subsequently.

The movement of this population as well as transport of materials of daily consumption will add to the traffic. The increase in traffic will lead to increase in vehicular emissions causing air pollution. Assuming that the custom office will operate from 09:00 to 17:30 hours, use of transport vehicles by the staff will result in significant increase in traffic density during 9:00 AM in the morning and 17:30 PM in the evening, thereby causing short term impact. The office goers and floating/visitors would generate traffic during the two peak periods one in morning time and second one in evening time.

Traffic projections in future

About 11870 people are expected to travel to and from the custom office daily during operation phase. They will use various modes of transportation such as cars (approximately 40%), 2 wheelers (approximately 35%) and public transport (approximately 25%). Thus, the anticipated traffic to and from the site due to 4 & 2 wheelers in terms of equivalent Passenger Car Units are anticipated as follows:

Type of vehicle	**No. of vehicles**	**Conversion Factor**	**Equivalent PCU**	**Total traffic to & from site (in PCUs/day)**
Cars	4748	1	4748	9496
2 Wheelers	4155	0.5	2078	4156
Total				**13652**

Since the traffic originating or ending at custom house will be between approximately 9.00 am to 6.00 on i.e. 9 hours, the average hourly traffic load can be estimated as 13652 ÷ 9 = 1517 PCU/hr.

The approach road, the Anik - Wadala road, is a 4 lane divided (two way) road. As per table 2, IRC:106-1990 “guideline for capacity of urban roads in plain areas”. The recommended design service volume is 3600 PCUs per hour for arterial roads i.e roads with no frontage access but no standing vehicles and very little cross traffic. The above traffic (average 1517 PCU/hr) when added to the existing traffic load (average 2081 PCU/hr) is anticipated to be just within the carrying capacity of the road.

It was also observed that there is congestion on the road around the peak period at the junction of Salt Pan Road and Sewri-Chembur Road as well as near Bhakti Park Exit. Therefore, management of the same with the help of

traffic police needs to be taken up by the project proponent as the problem will compound in future.

B. Parking provision

Parking will be provided as per norms of The Mumbai Metropolitan Region Development Authority(MMRDA). The estimated parking for the project is given in Table 4.9.

TABLE 4.9
PARKING CALCULATION

S. No.	Description	Area	Quantity
1	Upto 1500 Sqm 1 parking space every 75 Sqm.	1500	20
2	Remaining Area 1 Parking Space every 150 Sqm.	238848	1592
3	For Visitors @ 25% of 2+3		403
	Total required		**2015**
Details of Car Parking			
4	1st Basement		300
5	2nd Basement		800
6	3rd Basement		400
7	Podium		450
8	VIP Parking has been made as part of surface parking integrated with landscape garden		198
	Total		**2148**

Parking along the main arterial and interconnecting roads will be discouraged to avoid the congestion in movement. The surface and basement parking plan along with traffic management / movement has been shown in the **Fig 4.6** and **Fig 4.7.** Besides, there is also provision for 2-wheeler parking in the second basement podium level.

A Comprehensive car parking management system is proposed with following facilities, the DBR:-

- Automatic counting of cars and LED display about available parking space on each parking level.
- Automatic detection of vehicular movements and audio announcement system.
- An automatic vehicular identification and Access control system based on long range radio frequency Identity.
- The system will have facility to interconnect with computer to be installed in security room with in built capability to upgrade the system.

FIG 4.6: SURFACE PARKING & TRAFFIC MOVEMENT PLAN

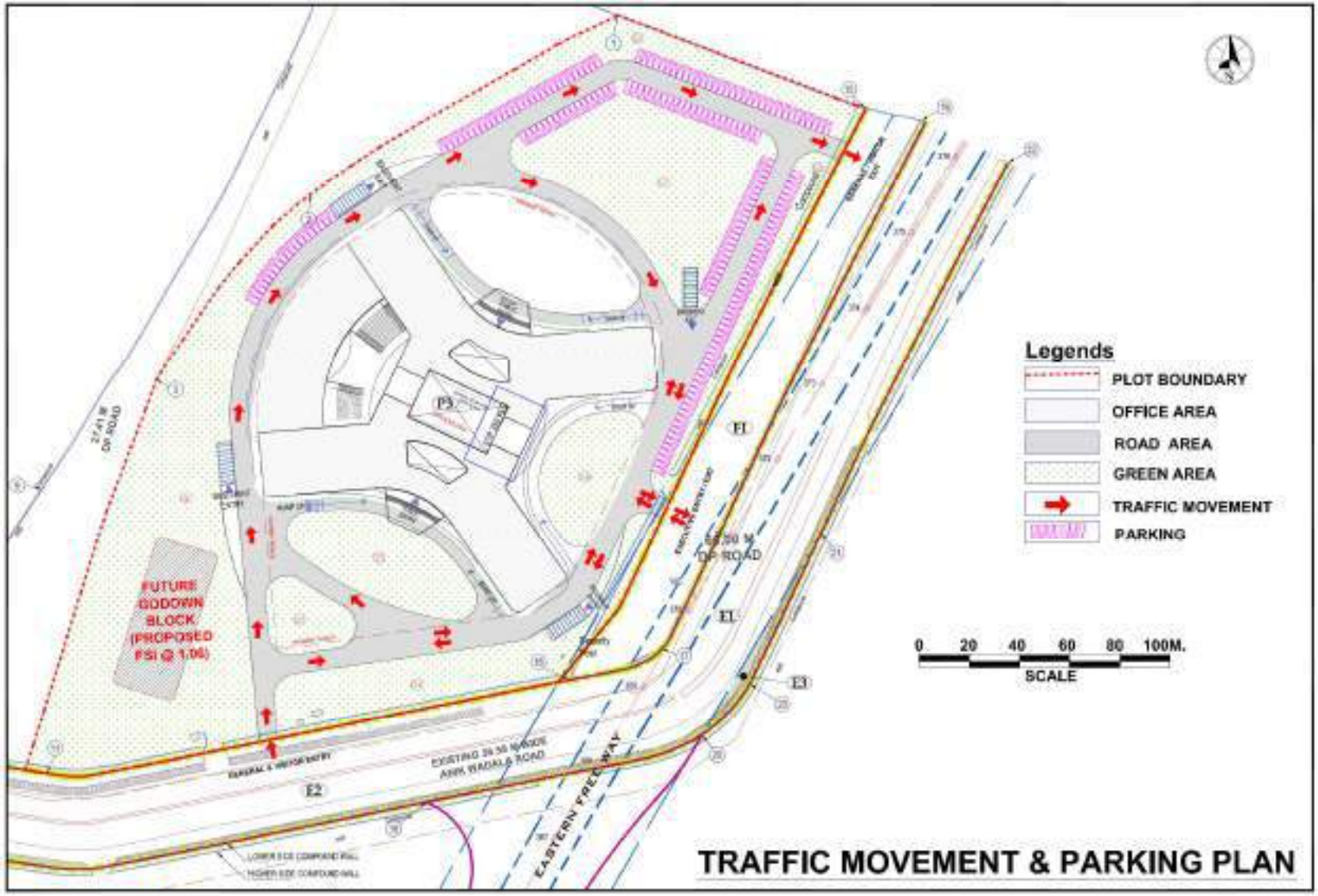
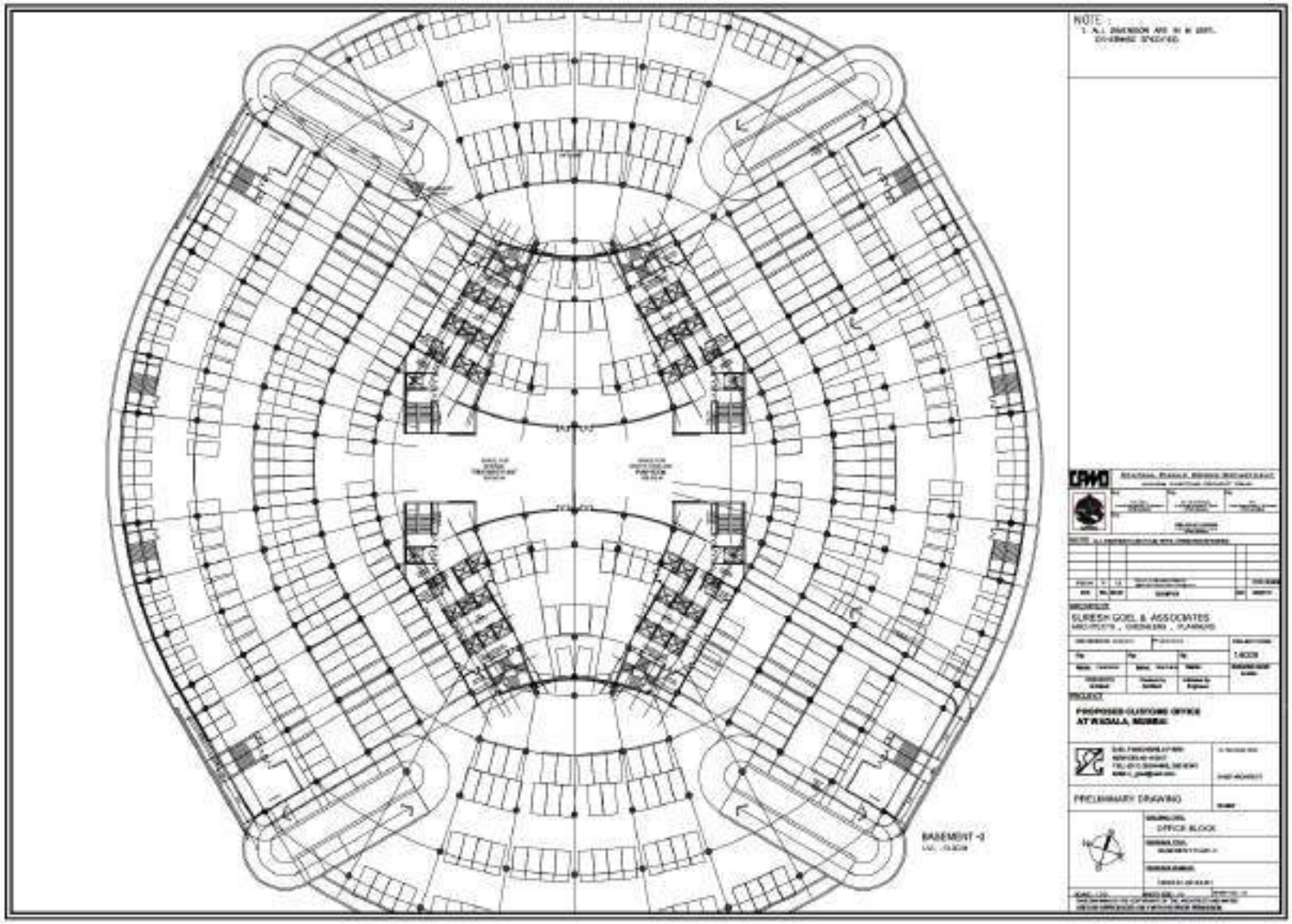


FIG 4.7: BASEMENT PARKING PLAN



4.5.2.1 Ventilation System in Basement Parking Area

As per ECBC/NBC, the ventilation has been considered in basement to meet the requirement of firefighting and maintaining the fresh air as required. In ventilation design the use of natural ventilation is incorporated and accordingly ventilation equipment is selected. The basic design for ventilation is based on “push-pull” system for fresh and exhaust air in the area. The system will be supported with CO sensor, BMS, fire control unit etc. for providing efficient ventilation. The concept is broadly out line that fresh air will be pumped through ramp naturally and mechanically by the help of suitable capacity of fans provided on the periphery of the basement and exhaust air will be thrown out with the help of ducted system for uniform ventilation in the area.

Basement is to be used for Housing the Building services like Air-conditioning plant, Pumps, substation etc. along with Car Parking Facility. The ventilation required for the location is design based on NBC-2005 guidelines and norms laid down for the area including fire department requirements etc. as required. The ventilation for basement 12 ACPH for normal condition & additional ventilation of 18 ACPH in case of fire condition providing 30 ACPH in total for the area to be used as car parking. The ventilation fan will be provided with CO sensors for controlling air quality and fire signal from fire panel at the location in the parking. The ventilation fans are VFD operated and BMS controlled for economical and efficient operation.

4.6 LAND DEGRADATION AND EROSION

4.6.1 During construction

A. Impacts

During construction, the irreversible impact on land will be limited to the construction footprint. The area outside the footprint can be disturbed due to storage, movement of vehicles, etc but can be restored or improved after completion of construction. Some of the impacts due to construction shall be :

(i) Excavation of soil

(ii) Compaction of soils by earth moving equipment ·

(iii) Erosion and modification of surface

(iv) Deterioration of soil quality within the project site

(v) Contamination of soil due to spillages

Cutting & Filling

Cut and fill technology shall be adopted to the extent possible as this involves least disturbances to the natural ground. Construction waste will

predominantly be earth work generated during cutting i.e. 267,635 cum, out of which 1,47,182 cum (55%) will be reused for filling at the project site. The balance volume i.e. 1,20,453 cum of earth works may be used in various land reclamation sites across Mumbai. The break up of excavated and utilised soil is given in **Table 4.10**.

TABLE 4.10
BREAK-UP OF EXCAVATED SOIL

Description			
Basement Area	21,411 sq.m.		
Basement Depth	12.5 m		
Effective Volume of Excavation	267,635 cum		
	Area, sq.m.	**Height of filling, m**	**Volume of Earth reutilised, cum**
Podium Area	19,930	1.5	29895
Terrace Floor Plate (Office Building)	6,716	0.5	3357.76
Internal Roads	10,087	0.5	5043.647
Green Area within Site	23,783	1.5	35675.08
Plot 2 Area(Residential Plot towards west of customs office)	95,693	0.5	47846.42
Plot 3 Area(Green Belt towards South)	7,466	1.5	11198.3
Green Belt Area	9,444	1.5	14165.98
	173,119		147,182
Balance Volume of Earth			**120,453**

Assessment of soil erosion : The project area is relatively flat and not prone to soil erosion. After plantation on it for landscaping, there will be negligible erosion.

Demolition and its waste management

There is a single storeyed store admeasuring 1367.58 sq m, the demolition and site clearance of the same should take about 30 days. 1,35,665 Bricks, approx. 50 tonnes of steel will be generated on demolition and the same shall be utilized in construction of site office, guard room and boundary wall at site. MCGM has a dumping ground at Gorai for construction and demolition waste.

B. Mitigation measures

Soil erosion is an important parameter which needs to be addressed during the construction phase. Some of the mitigation measures include:

- Removing vegetative cover only from the specific site on which construction is to take place and by disturbing the vegetation in adjacent areas as little as possible. This practice minimizes the amount of bare soil exposed to erosive forces.
- Land clearing activities will be kept to the absolute minimum and use crushed stone rather than asphalt or concrete for surfacing parking areas will be attempted.
- ***Preservation of topsoil :*** Stockpile of top soil shall be done so that it can be reuse later for landscaping purpose·
- Measures such as mulching, silt fencing, sediment traps and sediment basins shall be implemented during construction. ·
- Open areas will be landscaped at the earliest and plantation started for green areas during construction itself.
- Paved areas will be installed with permeable paving. ·
- Grass swales will be made to serve as garland drains around the excavation and dumping sites, lead to sedimentation pond to settle silt.
- Excavation shall not be carried out in Monsoon.
- It will be scheduled in such a way that grass could be established prior to the onset of intense rain or windstorms.
- If grass is to be seeded, mulch of straw will help to protect the soil from less extreme erosive forces until vegetative and root development begins.
- Engineering plans will be drawn to reduce the area of earth cuts or fills below what might otherwise be acceptable, provide physical support for exposed soil or rock faces.
- The number, frequency and area of movement of heavy machinery · will be restricted.
- Tyre wash will be provisioned.
- Cutting will be done, wherever possible, at higher contours to avoid pit formation and if unavoidable, then pits will be interconnected and ultimately drained into the natural drainage channel.

- The activity of establishing vegetation on open & unplanted land would be started during construction activity, at the earliest.

The reuse of demolition waste will be done as follows:

- CPWD Works Manual 2014 shall be followed for demolition
- The demolition of old buildings shall be in the scope of the same contractor who will undertake construction of the new buildings
- Furthermore, no heavy machinery (i.e. bull dozer/ JCB/ breaker) shall be used for demolition to ensure low noise and air pollution.
- Thus, maximum recovery of construction material shall be possible
- CPWD will grant permission to reuse demolished material in the new buildings subject to compliance to quality tests. For example, reuse of removed bricks, reuse of sand &aggregate in non structural elements, reuse of paver blocks, curbstones, etc.
- The wood, metal and glass will be permitted for sale to recyclers/ other users.
- In addition, any wastage from new construction material will also be reused.

4.6.2 During operation

A. Impact

Once the construction has been completed, the impact on land will start reversing partially and can be improved by improving the ground cover. The land use planned for the proposed project provides adequate areas for open space, roads, utility and services. Ground coverage identified for construction will be restricted as per the building byelaws. Thus, adequate control measures are incorporated at the design stage. The proposed land use is given in **Table 4.11.**

TABLE 4.11
PROPOSED LAND USE OF THE PROJECT

Sl. No.	Proposed Land use	Area Details in sq.m	
		Area	%
1	Office Building	19,930	35.26
2	Road Area	10,087	17.85
3	Surface parking	2,723	4.82
4	Green Area	23,783	42.08
	Total	**56523.13**	**100.00**

Regulatory measure in view of the environmental and social impacts of the project (such as unauthorized development in and around the area):

No additional regulatory measure to control unauthorized development in and around the area is required since the areas around the project are already developed. The undeveloped area across the Eastern Freeway and Anik Wadala road will be developed as per regulations only.

B. Mitigation

During operation phase, the soil erosion control measures will be continued selectively as applicable in addition to

- Growing of grass and trees in green areas
- Provision of dedicated horticulture and maintenance staff
- Provision of silt traps before rain water harvesting pits
- Porous paving in open area and parking area, to the extent possible.

4.7 TOPOGRAPHY AND DRAINAGE

A. Impact

Topography : The contours of the project site will change due to construction and landscaping. However, there will be no impact on topography of the areas outside the project site due to construction within the project.

Drainage : There is no natural nala passing through the site. There are drains outside the project site which will not be disturbed. Although no surface water body or seasonal stream is existing in the plot area, there shall be an impact on the sheet flow of the storm water runoff from the site. The water bodies present in the study area will not be affected due to the project.

B. Mitigation

Topography: As per MOEF's guidelines for new construction projects, it is essential to avoid disturbance to the site by retaining the natural topography of the site or design the landscape with at least 15% to 25% of the site area. In the said project, the landscaped area will be 42.08 %, thus, addressing the requirement.

This excludes the parking areas, walkways or landscaping over built structures such as roofs, basement etc. In addition to the dedicated green area, potted plants will also be considered. Turf design on site will be such so as to conserve water.

Drainage: All storm water drainage pipes are laid as per requirement of NBC and MMRDA. The plan will incorporate best management practices which will include following:

- Separate sewage conveyance systems
- The storm sewers have been proposed only on roadside
- The overflow, if any shall be directed towards the existing nearby natural drainage course, which will coincide with its flood level to avoid any chances of reverse flow.
- Regular inspection and cleaning of storm drains.
- Provision of slit traps in storm water drains
- Oil traps shall be installed in all the parking areas.
- Ensuring adequate cover for all waste storage areas.
- Avoid application of pesticides and herbicides before wet season.

Hence, the above management measures will ensure drainage and mitigate the changes in topography.

4.8 IMPACT ON ECOLOGY AND ITS MITIGATION

4.8.1 Construction phase

Impact & Mitigation

The project site is covered with grasses and shrubs along with few trees on the boundary. There will be no requirement of disturbing the trees (cutting/ felling) since they are outside the building footprint area. In case, due to any unforeseen reason, a tree has to be cut, permission will be taken from the forest department and in lieu, for each tree 10 compensatory trees will be planted. Clearing of grasses and shrubs shall be carried out prior to construction and after construction, landscaping shall be done.

Mangrove Forests are present in study area. Due to mangrove forest, it attracts a relatively good diversity of bird species which included the long distance migrants. Since the project site is nearest to the Mangrove forest, hence, dust from construction activities can disturb the avifauna.

Hence, the measures for mitigating air pollution and noise pollution as discussed in Section 4.3.1, 4.3.2 and 4.9.2 will be required. Since no waste water discharge or solid waste disposal from the project site is anticipated to or near the mangrove forests, the impacts due to those parameters will be nil.

Availability of water and food wastes during the day will attract some birds and animals towards the site. Thus, disposal of solid waste and waste water has to be done as per procedure to avoid man-animal conflict.

There will not be any long term irreversible negative impact on terrestrial eco-system comprising birds and animals. On the contrary, with progressive growth of greenery, terrestrial micro-habitats will develop in the long run.

4.8.2 Operation phase

Impact & Mitigation

Flora: As described earlier, 23,783 sq.m. of land (42.08% of the total project area) will be green area and shall be available for plantation,green belt, lawns, gardens.

The greenery will have the following features:

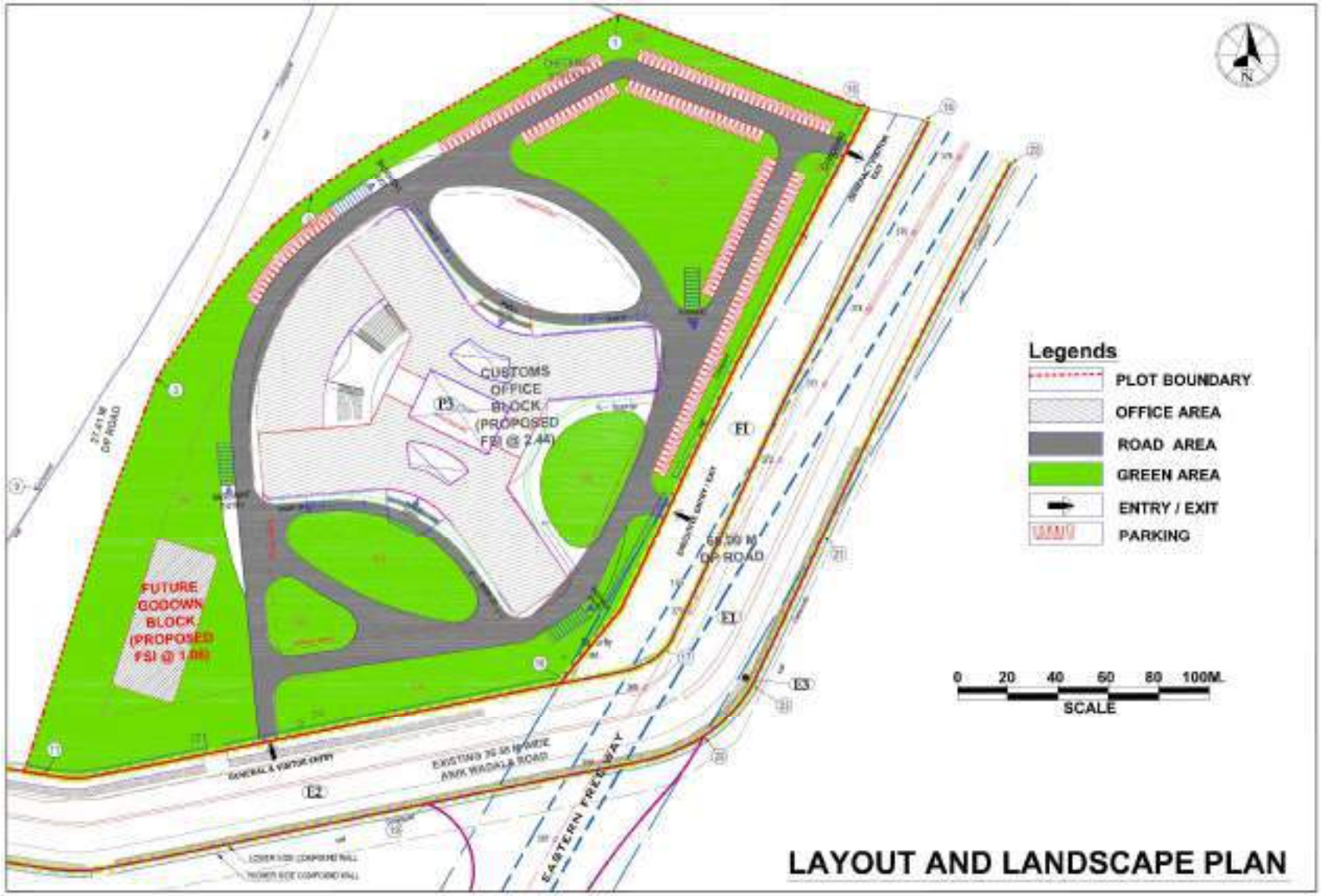
- Trees having higher potential of absorption of pollutants will be planted on the sides of roads.
- Flowering and fruit bearing trees, Medicinal and aromatic plants of economic values will be grown in landscaped areas.
- Native species, observed to prosper in the area, will be grown.
- Open green (park like areas) will have the mix of shrubs, hedge rows and large plants on periphery or as per landscape design.
- Discharge from softening plant will be used in gardening, thus, minimising fresh water consumption.
- Green areas will also aid in percolation of rain water to the sub-strata
- Augmentation of the greenery over time and maintenance of the same shall be continued during the operation stage with dedicated staff.

The above measures will impart a significant positive impact on the ecology. The location of the green areas is shown in **Fig 4.8**.

Time schedule for greenbelt development

All identified open spaces will be brought under tree plantation. Total 331 trees will be planted immediately after completion of construction, within 2 months.

FIG 4.8: LANDSCAPE PLAN



Species

The list of trees, shrubs and Herbs which will be planted are given below:

Sr. No.	Tress	Shrubs	Herbs
1.	*Albizia lebbeck*	Abutilon indicum	*Amaranthus viridis*
2.	*Azadirachta indica*	Bougainvillea spectabilis	*Argemone mexicana*
3.	*Anthocephalus chinensis*	Capparis zeylanica	*Boerhavia diffusa*
4.	*Bauhinia purpurea*	Calotropis gigantea,	*Catharanthus roseus*
5.	*Butea monosperma*	*Dendrophthoe falcata*	*Catharanthus roseus*
6.	*Cassia fistula*	*Hamelia patens*	*Cyperus difformis*
7.	*Cocos nucifera*	*Ipomoea carnea*	*Euphorbia thymifolia*
8.	*Delonix regia*	*Jasminum sambac*	*Grangea maderaspatana*
9.	*Ficus religiosa*	*Jatropha podagrica*	*Indigofera linnaei*
10.	*Lagestromia speciosa*	*Lawsonia inermis*	*Leucaena leucocephala*
11.	*Leucaena leucophylla*	*Taberneamontana divaricata*	*Mirabilis jalapa*
12.	*Muntingia calabura*	*Tecoma stans*	*Ricinus communis*
13.	*Mangifera indica*	*Thevetia peruviana*	*Sesuvium portulacastrum*
14.	*Millingtonia hortensis*	*Urena lobata*	*Typha angustata*
15.	*Murraya koenigii*		
16.	*Nyctanthes arbor-tristis*		
17.	*Plumeria alba*		
18.	*Phoenix dactylifera*		
19.	*Ricinus communis*		
20.	*Saraca asoca*		

Fauna *:* The development of greenbelt will serve as a micro habitat for small mammals like squirrels, mongoose, etc. Also the birds will find an additional place to roost and next. Fruit bearing trees will also provide fruit and seed to the birds. Some measures such as provision of bird feeders, bird houses, water bath for birds are suggested so further value addition can be done to the greenbelt. Thus, with the development of greenbelt around the building, the ecology will see an improvement over time.

4.8.3 Flamingo Habitat

Sewri-mahul mudflats (coordinates - 19.00N 72.86E) on eastern edge of Southern Mumbai are well known for housing flamingos during their annual migration in Mumbai. The Sewri mudflats are 2.3 km, SSW from the project site aerially. In 1996, the mangrove swamps of Sewri were declared a protected ecology. Sewri-Mahul mudflats and the shallows of the Creek are the foraging grounds for about 40000 thousand Lesser Flamingo and Greater Flamingos and, about half a million waders. The region has been identified as an Important Bird Area (IBA) by BNHS and BirdLife International. Flamingoes arrive at the mudflats from the months of October to March every year. (source : BNHS)

These mudflats are near the Sewri jetty. On the opposite bay, stand a chemical fertilizer factory, two oil refineries and a thermal power plant. It is alleged by environmental Also, there have been objections related to the proposed construction of the Mumbai Trans Harbour Link (MTHL) project, which involves building a 22-km bridge from Sewri to Nhava in Navi Mumbai which is posing a threat to the birds' habitat.

Impact & Mitiation

No impact due to the proposed project are anticipated on the Sewri mudflats, which are a flamingo habitat due to the following reasons:

1) The aerial distance between the project site and the flamingo habitat are 2.3 km.

2) Between the flamingo habitat and the project site lies various industries of Wadala and the major road- Eastern Expressway

3) There will not be any discharge of waste water from the project, which could eventually make its way to the Sewri mudflats to affect the flamingoes

4) The air quality prediction modelling of the DG set operation of the project show that the GLC's of the air pollutants due to the proposed project will not be felt at the Sewri mudflats

5) Noise from the project will also not reach the Sewri mudflats

6) Solid waste will be disposed at Deonar land fill site, which is further 7.5 km north east of the project site and thus, 9.8 km away from the Sewri flamingo habitat.

7) Traffic movement to and from the custom house is a function of the origin of the workers and visitors, which will be across Mumbai. All traffic will move on pre-established roads and no additional roads are proposed for the project

Thus, no impact is anticipated due to the project on Sewri mudflats.

4.9 NOISE

4.9.1 Construction phase

A. Impact

During the construction phase of the site, the following source of noise pollution is expected:

- Earth handling and Construction equipment like JCBs, excavators, rollers, compressors, etc
- Construction activities such as welding, cutting, hammering, etc.
- Vehicular traffic due to bringing in of construction material in trucks,
- Tractors trolleys, etc.

Noise modelling

Noise propagation through mathematical model and impacts of noise with distance from source has been studied and brought out below.

As the construction equipment generate noise generally in the range of 100 dB(A) at source it can be safely assumed that the ambient noise levels on any point of boundary line of plot are not higher than 100 dB(A). It has, also been assumed that the area within the project site has an imaginary line running at a distance of 3-5 m (say) from noise generating machines, which will be termed as point noise source to avoid complication in the absence of availability of exact location of various noise generating units, their arrangements and shapes.

Taking extreme case of two machines each generating 100 dB(A) working at a point will add upto 103 dB(A) overall noise level. Such source noise level has been considered here for anticipating the impacts. Noise attenuation with distance in all directions over flat open bare ground is given by

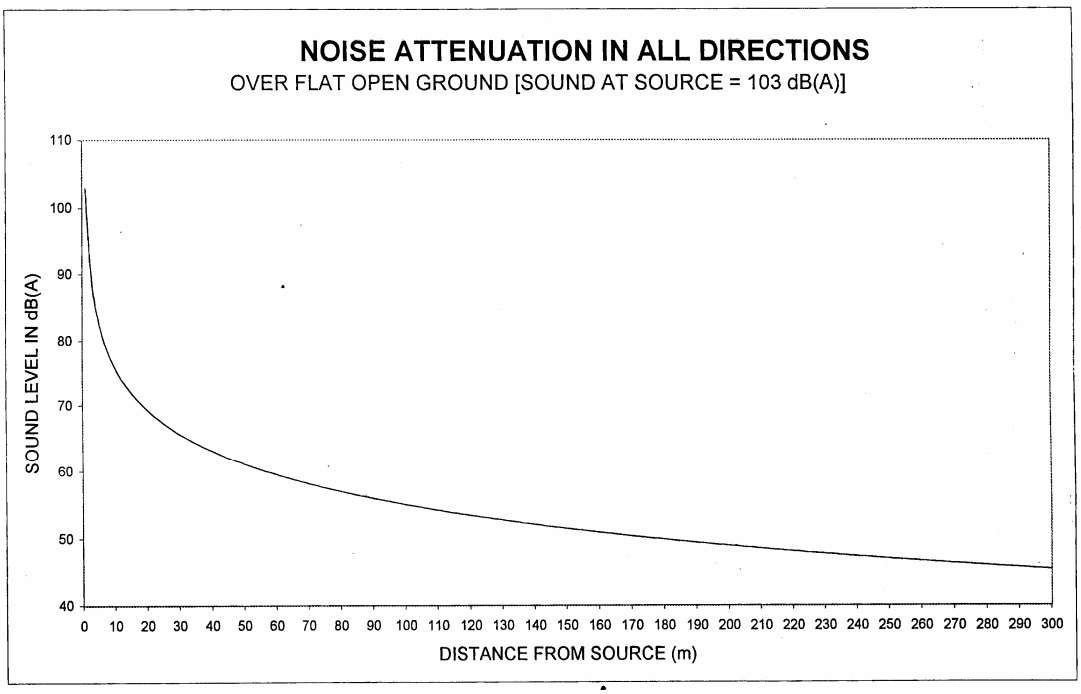
Sound level dB(A) = $Lw - 20 \log_{10} R - 8$

Where :

L_W = Sound level of source, dB(A) assumed 103 dB(A)

R = Source distance, m

The same has been plotted in the graph below, assuming source noise level as 103 dB(A).



A perusal of graph shows that the sound levels attenuate to value as shown in **Table 4.12**.

TABLE 4.12
NOISE ATTENUATION WITH DISTANCE ON FLAT BARE GROUND WITHOUT AND WITH GREEN BELT
COMBINED NOISE OF MORE THAN ONE SOURCE = 103 dB(A)

Distance from source (m)	Noise level reduced from 103 dB(A)	
	Without green belt, dB(A)	With green belt, dB(A)
20	70.0	68.5
60	60.0	55.5
100	56.0	49.0
150	52.0	41.0
180	50.0	33.0
300	45.0	<33.0

It means that after distance of about 300 m, the machine noise will merge into the background noise in the day time. This noise level is same as the limit [45 dB(A)] prescribed by GSR 742 (E) dt. 30th August 1990 at night time for residential areas. Due to plantation along the boundary of the project site, it will be possible to further lower the noise levels below the prescribed limits. It may be noted that the combined noise from all the three plants cannot be more than 103 dB(A) at any point considering the distance between their relative locations.

B. Mitigation

The following control and mitigation measures are proposed to keep the noise levels within the permissible limits:

1) Construction contract specification for use of equipment emitting noise shall spell out the permissible standards for noise with guaranteed levels of maximum noise emission in various zones.

2) Periodic maintenance and greasing of noise generating equipment and vehicles.

3) Operators of high noise generating equipment will be provided with earmuffs. Restricting the exposure time of individuals to higher noise levels.

4) Imposition of speed limits on Heavy Earth Moving Machinery and vehicles.

4.9.2 Operation phase

A. Impact

During operational phase the following sources of noise pollution is expected:

- Diesel generator operations
- Increase in transport noise from within the site from near by roads.

B. Mitigation

The mitigation measures shall comprise of the following:

- Plantation of trees on both sides of all roads as well as the green belt shall be developed for noise attenuation.
- Strong leafy trees will be chosen planted to act as noise baffles. Shrubs and creepers will also be planted for additional protection between tree trunks; artificial mounds will be evaluated for suitability and used where practicable.
- As little hard paving and as much grass as possible will be used.
- Diesel generator will have acoustic enclosure as per specifications to ensure that the noise from it is compliant to CPCB norms.

The distance of the project site from the free way is 0.02 km, E and the Sewri-Chembur road is adjoining the plot. Hence, it may be noted that the attempts at reducing noise level at site will not have any discernable impact on the present ambient noise level reduction due to the high traffic load on the adjoining roads.

4.10 IMPACT AND MANAGEMENT OF SOCIO-ECONOMIC CONDITIONS

4.10.1 Construction phase

A. Impact

The land has been allotted to the project proponent. There are no land losers or displacees from the project. Since there are no residents nor land losers in the project area, thus, no SIA has been carried out.

During construction phase there will be an influx of workers in hundreds of numbers. Most of this labour force will be natives of the State, who will be paid their wages in cash. With increased money supply, those who will be able to provide goods and services to the work force will benefit economically. However, increased money supply may push up price of local commodities and services and the additional requirement may have to be met from nearby places. If precautions are not taken, unhygienic site sanitation facilities can cause damage to environment and to health of the construction workers.

B. Mitigation

The objective is to ensure health and safety of the workers during construction, with effective provisions for the basic facilities of sanitation, drinking water, safety of equipments or machinery etc. Following are some of the proposed measures which will be followed:

- Compliance with the safety procedures, norms and guidelines (as applicable) as outlined in the document Part 7 Constructional practices and safety, 2005, National Building code of India, Bureau of Indian Standards shall be done
- Clean drinking water will be provided to all workers ·
- Adequate number of decentralized latrines and urinals to construction workers will be provided
- Guarding all parts of dangerous machinery will be done
- Precautions for working on machinery will be taken by the operators.
- Maintaining hoists and lifts, lifting machines, chains, ropes, and other lifting tackles will be maintained in good condition. ·
- Durable and reusable formwork systems will be used instead of timber formwork and it will be ensured that formwork, where used, is properly maintained. ·
- It will be ensured that walking surfaces or boards at height are of sound construction and are provided with safety rails or belts.

- Preventive measures to protect against fires as well as provision of fire extinguishers and buckets of sand will be done in the fire-prone area and elsewhere.

- Sufficient and suitable light for working during night time will be provided.

Socio economic situation of surrounding areas

A perusal of the 500 m radius of the project in Fig 2.2 shows that the there is no habitation adjoining the plot. All habitation is separated by atleast a road. The north east, east, south east, south and south west sides are devoid of any habitation. Urban settlements are there on western and northern side. These areas are already developed and inhabited and no additional contribution in terms of physical or social infrastructure development will occur in these areas due to the proposed customs house project.

4.10.2 O*peration* phase

A. Impact

The proposed project site is located at C.S No. 146 of salt division, Customs Enclave Plot (Suleman Shah Plot), Wadala (East), Mumbai. There would be addition in commercial development of the area, which will improve the economic growth at local and regional level. Additional employment for not just the skilled but also the semi skilled and unskilled workers such as helpers, cleaners, drivers and security guard etc. will be there. The project developer will also undertaking CSR activities which are leading to overall improvement as detailed in Chapter 8.

B. Mitigation Measures

Since the impact will predominantly be positive, mitigation measures as such will not be required.

4.10.2.1 Facilities for Physically Challenged

The concept of Barrier Free Environment has been conceived to facilitate the safe and comfortable movement of physically disabled people in various parts of the custom office. While designing and detailing, due care has been taken to make the following provisions as per the prevailing building byelaws.

- Color coding entrance / exit, parking, and other facilities on area map.
- Provision of comfortable movement area and ramps.
- Provision of proper signs/signals at required locations.
- Provision of utilities designed as per byelaws for physically disabled.

- Provision of railings or other safety measures.
- Provision of lifts in high rise buildings.

4.10.2.2 Land Acquisition, Rehabilitation and Resettlement

Site has been allotted by Mumbai Metropolitan Region Development Authority (MMRDA) for the construction of Custom Office. The proposed project does not involve any displacement of inhabitants, hence, issues like resettlement and rehabilitation does not figure in the project.

4.11 SOLID WASTE MANAGEMENT

4.11.1 Construction phase

A. Impact

The construction phase waste will comprise of

- Excavated and demolition material.
- Building construction leads to generation of sand, gravel, concrete, stone, bricks, wood, metal, glass, polythene sheets plastic, paper etc. as waste.
- Waste left over in concrete, steel and other metals, pallets, packaging and paper products, wood beams, joists, studs, baseboards, railings, brick, tiles, etc.
- Waste generated by the labour at site
- Hazardous waste (covered in detail in section 4.11.4)

B. Mitigation/ Management

The different types of wastes need to be handled as per their needs and regulatory requirements. It is not possible to dispose off all type of wastes onto the land and has to be dealt with depending upon their type and characteristics. The measures to be followed will be:

- Segregation of construction wastes into roadwork materials, structural building material, salvaged building parts and site clearance wastes will be done to facilitate reuse/ recycling.
- Waste recycling plans will be developed for construction, prior to beginning construction activity.
- The plans would identify wastes to be generated, and designate handling, recycling and disposal method to be followed.
- Handling of waste material would be done with special precautions such as personal protective equipment and special procedures to prevent the injury.

- Developers will operate safe methods for waste collection, storage, and disposal operations in a manner to protect the health and safety of personnel, minimize environmental impact and promote material recovery and recycling.
- Solid waste generated by labour shall be managed by use of three colours of wheeled bins :- dark grey for inert waste, green for wood and ply w
- Aste and blue for hazardous waste can be used.

4.11.2 Operation Phase

A. Impact

The operation phase will have the following types of wastes:

- Municipal solid waste (MSW), i.e., biodegradable, recyclable and non-biodegradable waste
- Hazardous waste (covered in detail in section 4.11.4)
- E-waste (covered in detail in section 4.11.5)

The characteristics, quantification and management of municipal solid waste is given in subsequent paragraphs.

4.11.2.1 Composition of MSW

The composition of municipal solid waste in the commercial project is expected to be as follows:

- Organic waste: kitchen waste, leaves from sweeping
- Recyclable: paper&plastics(predominantly), glass, metals,
- Non recyclable: Cleaning cloth, rubber, polystrene, composite materials, etc.

4.11.2.2 Quantity of MSW

For Mumbai, it is found that the rate of generation of municipal solid waste is 1.8 TPD as illustrated in the Master Plan 2021. Accordingly, the solid waste has been calculated (for 8 hours occupancy @ 436 gm/day) and given in **Table 4.13.**

TABLE 4.13
SOLID WASTE GENERATION

Sl. No.	Particulars	Total Population	Rate of generation g/day/capita	Total waste, Kg/ day	Tonnes/ day
1	Office Staff	5935	150	890.25	0.9
2	Floating/ visitors	5935	150	890.25	0.9
	Total	**11870**		**1780.5**	**1.8**

Thus, total solid waste expected to be generated per day will be 1.8 T/day.

4.11.2.3 Characteristics of MSW

According to Table 3.4 of Manual on Municipal Solid Waste Management (First Edition), for the population ranging from 2 to 5 million, 56.67% of total waste can be composted and 4.73% of waste is recyclable. Anticipated solid waste characteristics are given in **Table 4.14**.

TABLE 4.14
ANTICIPATED SOLID WASTE CHARACTERISTICS (KG/DAY)

Sl. No.	Particulars	Compostable (56.67%)	Recyclable (4.73%)	Land filling (38.6%)	Total
1.	Customs Officials (G+29)	1009.00	84.21	687.27	1780.48
2.	Floating/ visitors, litres				
	Total	1009.00	84.21	687.27	1780.48

The other characteristics expected of the solid waste generated from the proposed project are given in **Table 4.15.**

TABLE 4.15
EXPECTED CHARACTERISTICS OF SOLID WASTE

Characteristics	Quantity
Total solid waste/day (in kg)	1780.5
Approx. volume (in cum) @ 300 kg/cum	5.93
Compost materials (in cum) @ 56.67% of volume	3.36
Recyclable waste (in cum) @ 4.73% of volume	0.28
Non-compost material (in cum)@ 38.6% of volume	2.29

B. Mitigation/ Management

4.11.2.4 Collection and transportation system

The MSW management system would be as follows:

- The garbage from all the office cabins shall be collected by sweepers through floor to floor collection in both buildings of the office complex.
- An arrangement to collect biodegradable, recyclable and non-biodegradable waste in separate bags from office cabins will apply.
- The officials shall be made responsible to keep waste in separate bins in their cabins and hand over to sweepers to carry them to the centralised bins available at the floor of the buildings.

- Three colours of wheeled bins: - dark grey for non-recyclable waste, green for kitchen food/ compostable garden waste and blue for recyclable materials will be provided.

- The compound would have bulk dustbin type container, with a general guide of one 1100 litre bin. One paper bin to three residual waste bins shall be provided.

- Total 6 movable bins of 1.5 cum capacity- 3 for biodegradable waste, 1 for non-biodegradable waste and 2 for recyclable waste are proposed.

- Access To and From Bin Storage Areas - ramps will be be provided, where required, for easy access by the collection vehicle which will be at least 1.2 metres wide with a maximum gradient of 1 in 10. The surface of the path would be smooth, continuous and hardwearing. The loading bay will be clearly earmarked with sufficient turning radius.

- Tippers or carriage vans will cart this waste from bins to management/ disposal point for treatment.

- A Maintenance Agency has been proposed to be manage the solid waste collection, storage and disposal.

- The expenses on account of solid waste management cartage from depots to disposal site shall be borne by Maintenance Agency which in turn will collect it from the concerned deptt. in office complex.

- Considering the aspect of bird menace, no storage or disposal shall be carried out in open.

4.11.2.5 Storage System

Garbage chutes will be established on each floor including 3 basements at convenient places. Organic waste shall be composted at the proposed composting site. Recyclable material shall be sold for recycling to authorized vendors. The non compostable and non recyclable material shall be put into designated landfill.

4.11.2.6 Disposal of Solid Waste

Segregation of biodegradable, non-biodegradable and recyclable waste at source will be practiced. Municipal waste, after collection, storage and segregation within the project premises shall be disposed off by a contractor of MCGM as per approved procedure. Waste shall be finally disposed at “Deonar” which is the largest and the oldest dumping ground of Mumbai operating since 1927. The location of dumping site as shown in **Fig 4.9**

4.11.3 E-Waste generation

Source of E-Waste

E-waste is anticipated in the operation phase. Electronic waste or e-waste includes discarded electrical or electronic devices. Used electronics which are destined for reuse, resale, salvage, recycling or disposal are also considered as e-waste. Various types of electrical and electronic wastes will get generated in the buildings of office complex as follows:

- Computers
- Electrical equipment
- Electronics devices
- Mobile phones
- Lights and fixtures, etc.

Quantity of E-Waste

E-waste generation varies between 0.01 to 1% of total MSW for India as per Guidelines for Environmentally Sound Management of E-Waste by MOEF & CPCB, March 2008. As per "e-Waste Assessment in India: Specific Focus on Delhi" by BIRD & GTZ, March 2007, 20,000 tonnes were generated annually. For a population of 1.5 crores estimated in 2007 (avg of 2011-1.2 crores, 2011-1.8 crores), it works out as 1.33 kg/capita/year for Delhi.

The national average is anticipated to be around 0.66 kg/capita/year based on CPCB projections of 8,00,000 tonnes/annum for the entire country in 2012. Assuming the same rate for the office goers in the said project, for 5935 persons, the e-waste works out to about 3.9 tonnes per annum.

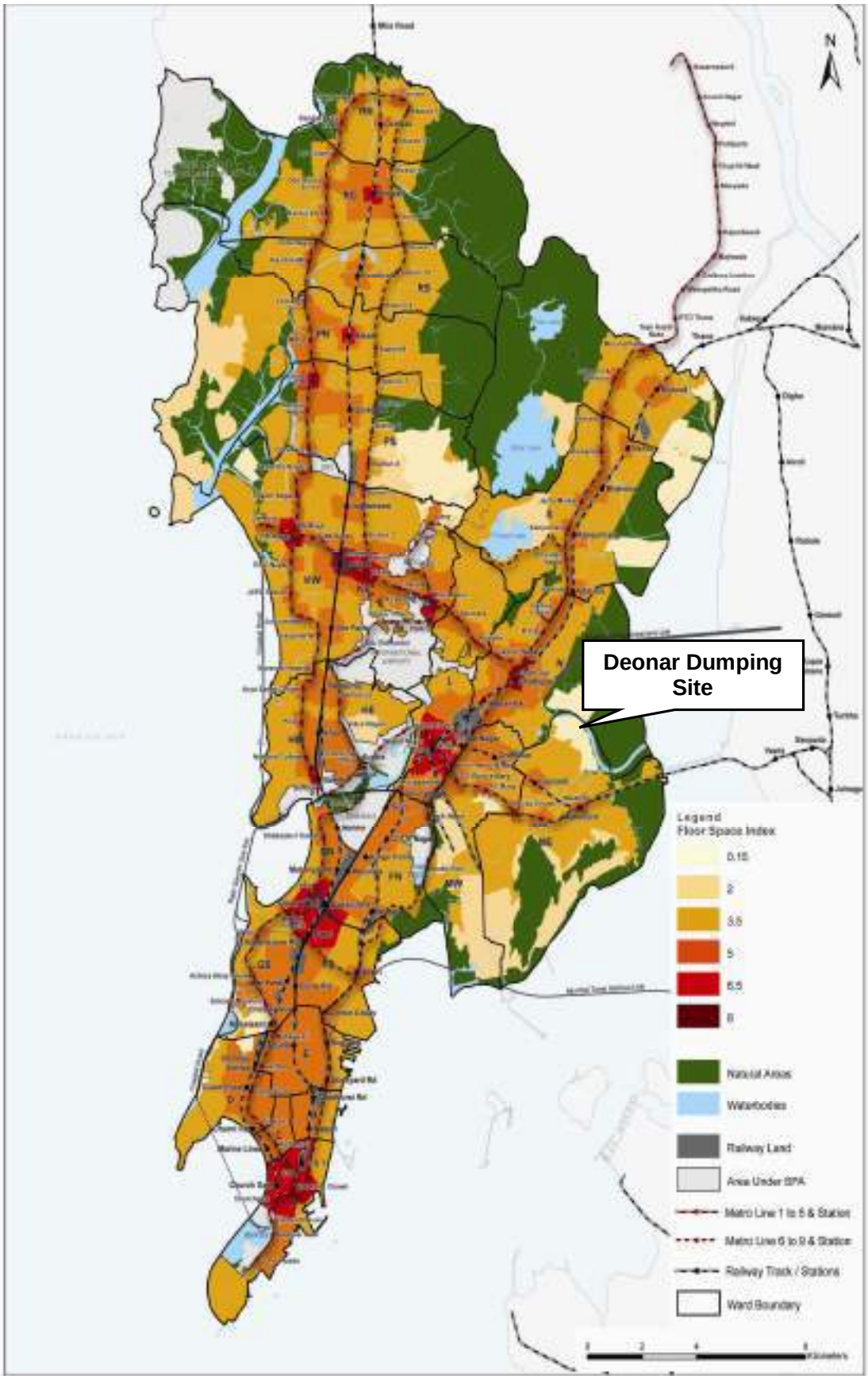
Management of E-Waste

There would also be provision for storage of these wastes in the building before transportation. Separate bin for e-waste will be provided at the waste disposal points. Isolated storage for these waste collected from e-waste bins of the whole custom office complex would be provided next to the main waste collection point. From there, the authorised recyclers shall collect the waste for further processing. CPCB & SPCBs have a list of authorized vendors for the e-waste management. A suitable vendor will be opted from the list.

E-waste management will also require cooperation from the occupants. Hence, through displays in the building, awareness will be created about the rule of three Rs (Reduce, Reuse, Recycle) as follows:

- **Reduce** – Less generation of e-waste by maintaining of the equipment – lifespan increased.
- **Reuse** – If functional, donate or sell it to the user
- **Recycle** – Components that can't be repaired

FIG 4.9: DUMPING SITE LOCATION



CFLs or any other mercury-containing products would never be thrown in the general garbage. For safe disposal, occupants would bring them to any of the hazardous waste collection events/ disposal points for proper handling.

4.11.4 Hazardous Waste generation & Disposal

4.11.4.1 Construction phase

List of Hazardous wastes from construction projects is given below. All wastes do not necessarily get generated.

- Hazardous wastes from construction activities are centering oil, formwork oil, tar and tar products (bitumen, felt, waterproofing compounds, etc.), wood dust from treated wood, lead containing products, chemical admixtures, sealants, adhesive solvents,
- Paints, pigments, dyes and primers, carbon black, pesticides ·
- Explosives and related products and equipment used in excavation, acrylics, and silica, etc.
- Product packaging (cement bags, cartons, containers, plastic covers etc.)
- Plastics, Acrylics, Silica, PVC
- Fluorescent Lamps Intact and Crushed, Halogen Lamps, Arc Lamps, UV Lamps, High Pressure Sodium Lamps, Neon Lamps, Incandescent Lamps
- Mercury Containing Lamps and Tubes, Mercury Vapour Lamps, Mercury Containing Devices – Mercury switches, relays, regulators, thermostats, thermometers, manometers and debris containing mercury
- All types of Batteries
- Electronic Ballasts, PCBs, Transformers, capacitors, switchgear, Lead Cable, Oil filled / gel filled cables
- Electronic Waste– computer products, circuit boards, CRTs, electronic parts, solder dross, weld waste.

For handling hazardous waste during construction, the following steps will be followed:

- Isolated storage for hazardous wastes released from the whole site would be provided on site. ·
- Source segregation of similar wastes will be done. ·
- Installation of fire extinguisher will be mandatory near storage of hazardous wastes.
- The dustbins for hazardous wastes would be made of durable materials like metal or even masonry if the projects spans for more than a year.

4.11.4.2 Operation phase

Products, such as paints, cleaners, oils, batteries, and pesticides that contain potentially hazardous ingredients require special care while disposal. Improper disposal of custom office hazardous wastes into drains or in trash will contaminate the environment. Hence, separate bin for hazardous waste shall be provided within the premises at a designated place. Officials will be made aware of the hazardous waste bin and the types of wastes that have to be disposed into it.

The other anticipated hazardous waste will be used oil from DG sets. The quantity of hazardous has been calculated taking reference from Cummins India Limited.

Capacity of DG set KVA	Used oil generated at one oil change (litres)	Time of oil change (hours)	No. of operation hours	Quantity of used oil per annum (litres)
4*1010	145	500	8	4 x 145 X 8X 365 /500 = 3388

(Source:http://www.cumminsindia.com).

An authorized service provider of Maharashtra Pollution Control Board/ Central Pollution Control Board, will be hired for disposal of hazardous waste at township level.

4.12 ENERGY CONSERVATION

There is a need adopt energy efficient technologies for conservation of energy. Energy Conservation Building Code (ECBC) 2008 and the National Building Code 2005 serve as the guiding documents on energy conservation.

4.12.1 Construction phase

Energy conservation starts prior to construction at the design stage itself and the following considerations have been taken to minimise energy consumption:

1. Appropriate building form, which affects the solar access of the building.
2. Ensuring compactness of the building
3. Provision of green building has been made so as to reduce energy and water consumption.
4. Ensuring correct orientation of the building for ventilation and lighting optimisation, thus, the occupants will prefer natural draft and natural lighting, thus reducing energy consumption

5. The building envelope for all air conditioned buildings / spaces should try to comply with the ECBC code. The building is proposed to be four star rating.

6. Roofs and opaque walls would comply with the maximum assembly U factor or the minimum insulation R-value of the ECBC code. Mumbai comes under Warm & Humid climate zone. Hence, based on the ECBC norms, U Values and R values considered are given in **Table 4.16** and **4.17**.

TABLE 4.16
ROOF ASSEMBLY U-FACTOR AND INSULATION R-VALUE REQUIREMENTS

Climate Zone	Day time use buildings	
	Maximum U-factor of the overall assembly	Minimum R-Value of Insulation alone
	(W/m^{2-o} C)	(m^{2-o} C/W)
Warm & Humid	U-0.409	R-2.1

TABLE 4.17
OPAQUE WALL ASSEMBLY U-FACTOR AND INSULATION R-VALUE REQUIREMENTS

Climate Zone	Day time use buildings	
	Maximum U-factor of the overall assembly	Minimum R-Value of Insulation alone
	(W/m2-o C)	(m2-o C/W)
Warm & Humid	**U-0.440**	**R-2.10**

7. Passive solar design features have been considered as follows:

   - Site planning has been done considering the natural shading, land contours, gradient, water logging, solar radiation etc
   - Windows and doors: It is planned that 15-20% of the room wall area will be allocated to windows and doors, to ensure adequate ventilation and daylight which will help in reducing the demand for energy inside the buildings.

8. Reducing embodied energy in building materials by chosing the following:

   - Brick and block products with waste and recycled contents such as fly ash
   - Fly ash based lightweight aerated concrete blocks for walls
   - Brick panel with joists, Filler slab roofing, brick funicular shell roofing, RCC channel units or micro-concrete roofing tiles for roofing
   - Aluminum used from verified recycled content

- Use of steel manufactured from recycled content
- Alternatives for finishes which include Fly ash, Ceramic tiles, Terrazzo floors
- Use of precast thin lintels, use of ferrocement-sunshade cum lintel etc

The use of the alternatives for building materials will help reduce the use of non-renewable resources and impact on natural resources.

Landscaping features

Soon after the construction work begins, the plantation of trees along the road alignment and around the parks will be started after the approval of the layout plan. Normally, it takes more than one year to actually get the designs approved and for the building construction to commence. During this period, the preparation for development of the green cover will be undertaken. Immediately after completion of construction, plantation will be completed. This has substantial advantages in terms of the local ambience and also in terms of the oxygen levels in the atmosphere. There are several instances where the green cover has been reported to reduce the ambient temperatures by about 2-3°.

4.12.2 Operation phase

The measures implementable at operation stage are as follows:

- The buildings have been designed so as to take advantage of day lighting and natural ventilation through natural drafts, to minimize energy requirements
- Users of the premises will use blinds or curtains for appropriate energy efficient operations.
- In the case of lighting, dimming control systems shall also be used to adjust for daylight available.
- Energy efficient appliances and devices shall be used. The building is proposed to be five star rating.
- Lighting loads will be reduced significantly by the use of latest lighting technologies that are available. Simple measures such as use of T-5, CFLs and LEDs can reduce the demand by upto 80%.
- The use of energy efficient motors for water pumping systems greatly reduces the demand for energy in the buildings.
- Automatic control systems are available to manage the energy demands inside the building and individual controls would ensure that the ducts are open when people are there, and shut when they are out.

Use of renewable energy sources

The 1000 KWP grid interactive solar power plant is proposed on terrace of building roof top with the objective of supporting the peak electrical load during the day light hours and to help reduce consumption of conventional AC power from the grid power supply.

The module layout will be proposed on the basis of clear open space available on the roof top. The charge controller and inventers will be loused in the centralized control room. There shall be noninterrupted grid power available during day time.

System Description

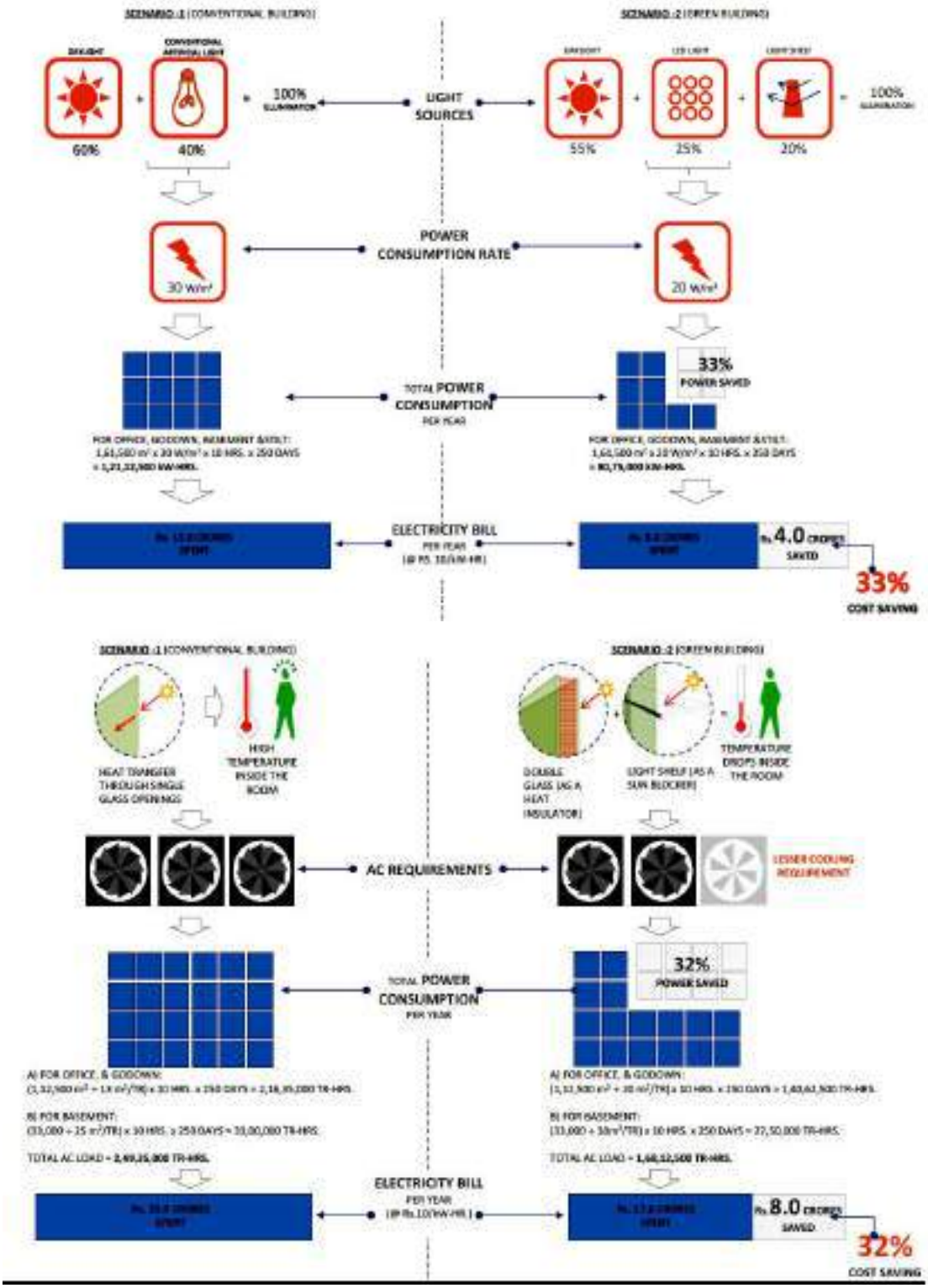
The photo voltaic Grid connected system consists of 3 components, The PV Array, Module mounting structure & power conditioning unit. PV Array convents light energy to DC power. The module mounting structure is used to hold the modules in position. The DC power will be converted to AC power through power conditioning unit which will be conncted to utility power grid.

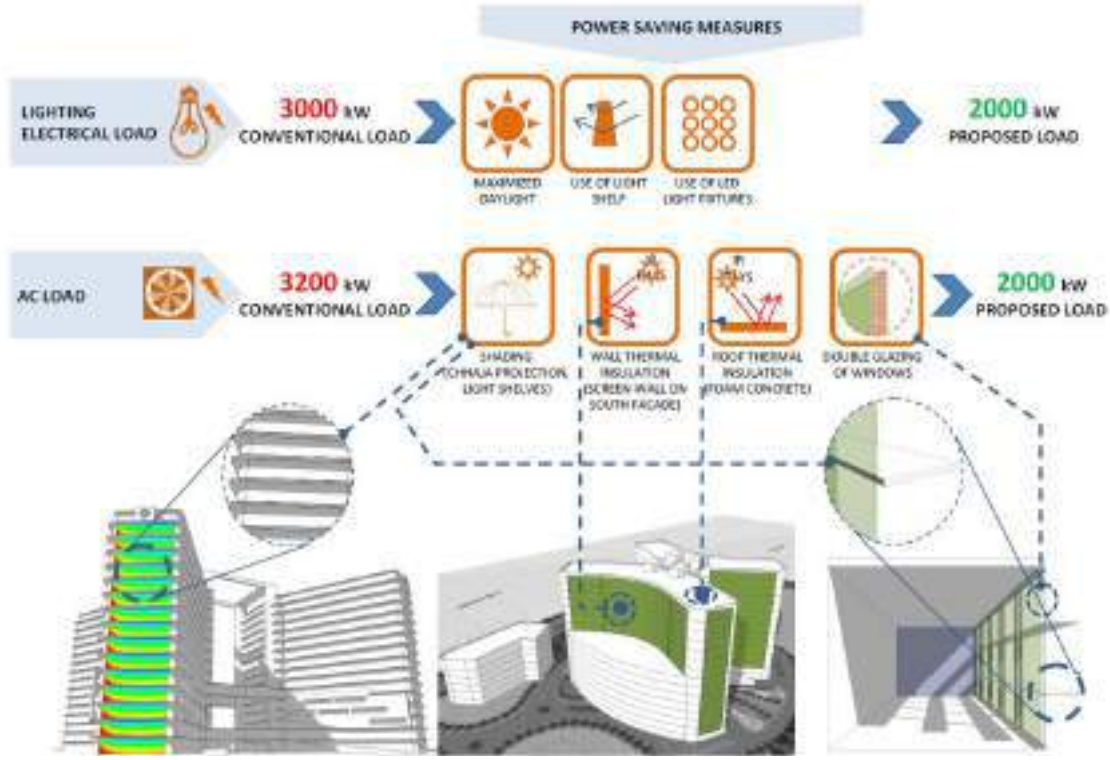
The Array structure of PV yard shall be grounded properly using adequate number of earthing to ensure safety of power plant. The system Proposed will be modular reliable with low maintenance. The life of proposed solar panels will be more than 20 years & can with staud high wind, high humidity. The clear open space of approx 10000 SQM will be made available on roof top considering 10 SQM area required for KWP load generator. The 430V AC output of isolation panel will fed to the grid. AC energy is then synchronized with grid & power is exported to the grid.

Landscape lighting by photo voltaic is estimated to save 58.3% of the street lighting power requirement based on the following calculations:

- Total length of road provided in the project is approximately = 1121 m.
- Street lights provided of 7.5 m height at the spacing of 23 m C/C.
- No. of street & Park lights = 1121/23 = 49
- Load of one LED light = 40 Watt
- Total load due to LED light= 49 x 40 = 2450 Watt or 2.45 KW
- Load of equivalent one conventional halogen light = 120 Watt
- Total load due to conventional street light = 49 X 120 = 5880 W or 5.8 KW
- Percentage energy savings by using photovoltaic landscape lights = 58.3%

Further calculations with respect to energy saving and subsequent cost saving is given in subsequent diagrams:


SCENARIO -1 (CONVENTIONAL BUILDING)
SCENARIO -2 (GREEN BUILDING)
DAYLIGHT
CONVENTIONAL ARTIFICIAL LIGHT
60%
40%
100% ILLUMINATION
LIGHT SOURCES
DAYLIGHT
LED LIGHT
LIGHT SHELF
55%
25%
20%
100% ILLUMINATION
POWER CONSUMPTION RATE
30 W/m²
20 W/m²
TOTAL POWER CONSUMPTION PER YEAR
33% POWER SAVED
FOR OFFICE, GODOWN, BASEMENT &ETC.:
1,61,500 m² x 30 W/m² x 10 HRS. x 250 DAYS
= 1,21,22,500 kW-HRS.
FOR OFFICE, GODOWN, BASEMENT &ETC.:
1,61,500 m² x 20 W/m² x 10 HRS. x 250 DAYS
= 80,75,000 kW-HRS.
ELECTRICITY BILL
PER YEAR
(@ Rs. 10/kW-HR)
Rs. 4.0 CRORES SAVED
33%
COST SAVING
SCENARIO -1 (CONVENTIONAL BUILDING)
SCENARIO -2 (GREEN BUILDING)
HEAT TRANSFER THROUGH SINGLE GLASS OPENINGS
HIGH TEMPERATURE INSIDE THE ROOM
DOUBLE GLASS (AS A HEAT INSULATOR)
LIGHT SHELF (AS A SUN BLOCKER)
TEMPERATURE DROPS INSIDE THE ROOM
AC REQUIREMENTS
LESSER COOLING REQUIREMENT
TOTAL POWER CONSUMPTION PER YEAR
32% POWER SAVED
A) FOR OFFICE, & GODOWN:
(1,32,500 m² ÷ 1.5 m²/TR) x 10 HRS. x 250 DAYS = 2,18,95,000 TR-HRS.
B) FOR BASEMENT:
(33,000 ÷ 25 m²/TR) x 10 HRS. x 250 DAYS = 33,00,000 TR-HRS.
TOTAL AC LOAD = 2,69,25,000 TR-HRS.
A) FOR OFFICE, & GODOWN:
(1,32,500 m² ÷ 30 m²/TR) x 10 HRS. x 250 DAYS = 1,43,62,500 TR-HRS.
B) FOR BASEMENT:
(33,000 ÷ 30 m²/TR) x 10 HRS. x 250 DAYS = 27,50,000 TR-HRS.
TOTAL AC LOAD = 1,68,12,500 TR-HRS.
ELECTRICITY BILL
PER YEAR
(@ Rs.10/kW-HR.)
Rs. 8.0 CRORES SAVED
32%
COST SAVING



Solar water heating will be explored. Wind energy production, however, will not be possible at the proposed site.

4.13 IMPACT ON EXISTING INFRASTRUCTURE

The proposed site has been examined in detail with reference to impact on existing infrastructure covering water supply, storm water drainage, sewerage, power etc. and the disposal of treated/ raw wastes from the project on land and ground water or sewerage system. The following are the findings:

- **Water supply:** The water supply is envisaged from municipal mains, Mumbai. No ground water will be withdrawn, thus, there will not be any impact on the underground water. Since the green area watering requirement and the

- **Storm water drainage & sewerage:** Looking at the natural drainage system and their capability, the infrastructure facilities and the storm water drainage system as well as the sewerage system, etc. have been designed accordingly.

  The sewer system will evacuate to the STP within the project and the treated waste water will be reused. Thus, the sewer network outside the project site and its carrying capacity is of no consideration in this project.

  The storm water drain will be connected to the existing natural nala on south side of the project. The flow is observed to be

approximately 5 to 7 m/s with a depth varying from 1.2-1.5 m. Currently, the run off the plot is flowing towards the south side nala as per the contour map. The volume of water, after construction of project, will increase by approximately double, since the current runoff coefficient in 0.25 on an average. After construction, the average run off coefficient will be nearer to 0.5 considering the following calculations:

Land use	%age area	Run off co-efficient	Coefficient X area	Weighted average coefficient
Office Building	35.26	0.75	26.4	0.49, say, 0.50
Road Area	17.85	0.65	11.6	
Surface parking	4.82	0.6	2.8	
Green Area	42.08	0.2	8.4	
Total	100		49.3	

- **Power:** Power line will be drawn from the nearest sub station. Standby DG sets shall be installed for emergency lighting in public areas, operation of water pumping, fire fighting, STP, common lighting in important public places, etc.

- **Disposal of solid waste:** Segregation of biodegradable, non-biodegradable and recyclable waste at source will be practiced. The recyclable components, like E-waste will be sold to authorized recycling vendors, while municipal waste, after collection, storage and segregation within the project premises shall be disposed off by a contractor of MCGM as per approved procedure. Waste shall be finally disposed at “Deonar” which is the largest and the oldest dumping ground of Mumbai operating since 1927.

CHAPTER 5

ANALYSIS OF ALTERNATIVES

5.1 SITE ALTERNATIVES

The Customs Department at Mumbai plans to build a new Customs Office building to cater to various departments at Wadala, Mumbai. The proposed complex shall act as a landmark structure equipped with the latest amenities for a modern office building. The proposed building has been designed keeping in view scope for future expansion and addition of 7 floors in the building at a later date. No alternate sites have been examined and considered as the site has been allotted by Mumbai Metropolitan Region Development Authority (MMRDA) for the construction of Custom Office.

The proposed site for the office complex of the custom department has the following advantages:

1. The site is in “Industrial zone” as per development plan of MMRDA.

2. Urban Development Department Mantralaya, Mumbai, Government of Maharashtra has given permission for the construction of Customs office at the land bearing C.S No. 146.

3. Mumbai Metropolitan Region Development Authority has allotted the land bearing C.S No. 146 to the “Additional Commissioner of Customs (PG)”, Custom Enclave Cell for the development of Custom Office.

4. The site is located within Municipal Corporation of Greater Mumbai and well connected by road, railway and airport. Anik Wadala Road is adjoining to the proposed site and Bandra-Worli Sea Link is at a distance of 5.7 km, W. Wadala Railway station is at a distance of 1.1 km, W and Mumbai Central Railway station is at a distance of 7.4 km from the proposed site. Chhatrapati Shivaji International Airport is present at a distance of 7.5 Km, N. Thus, the transportation network is sufficient to cater the needs of the plant. Proximity to Eastern Freeway is also advantageous in terms for transport.

5.2 TECHNOLOGY ALTERNATIVES

The environment friendly technological alternatives will be considered for the given project with regard to construction material, layout, orientation, cooling, heating, vertical fenestrations, etc. The construction will also comply to the norms of MoEF and GRIHA.

Section 2.4 in Chapter 2 has described the technology alternatives available along with the selected alternative.

5.2.1 Building Materials

The conventional practice of clay, brick consumes large quantity of energy in terms of coal and other fuels which are primarily non-renewable and highly polluting. Water requirements of building industry are also very high. Steel which is used in the construction process is manufactured by nonrenewable resource. Normally conventional materials used for construction are non-renewable sources.

Thus, to minimize the impact of the project, use of alternative technologies for each component of the buildings of envelope, superstructure, finishes and the road and surrounding areas are proposed as follows:-

- Brick and block products of fly ash
- Fly ash based lightweight aerated concrete blocks for walls.
- Perforated bricks can be used for wall structures.
- Brick panel with joists, Filler slab roofing, brick funicular shell roofing,
- RCC channel
- Units, micro-concrete roofing tiles are some of the alternative techniques for roofing, one of which will be finalized on finalization of engineering drawings.

Some of the alternate materials for openings in construction are proposed as follows:-

- Use of renewable timber for doors and windows
- Use of steel manufactured from recycled content
- Aluminium from verified recycled content
- PVC doors and windows in select places in the complex
- Finishes using Ceramic tiles or Terrazzo floors at select locations

The use of the alternatives for building materials will help reduce the use of non-renewable resources and impact on natural resources. Other aspects which will aid are:

- Minimal disturbance to landscapes and site condition.
- Use of Recycled and Environmental Friendly Building Materials.
- Efficient use of Water and Water Recycling.

- Use of Energy Efficient and Eco-Friendly Equipment.
- Use of Renewable Energy.
- Effective Controls and Building Management Systems.
- The building are aimed towards a green building design.

There is a need to adopt energy efficient technologies for conservation of energy. Therefore, the recommendations of the Energy Conservation Building Code and the National Building Code 2005 on energy conservation are being followed in the proposed project. The general lighting systems shall comply with the ECBC code and apply to the following:-

(a) Interior spaces of buildings,

(b) Exterior building features, including facades, illuminated roofs, architectural features, entrances, exits, loading docks, and illuminated canopies, and,

(c) Exterior building grounds lighting that is provided through the building's electrical service.

5.2.2 Design element

The concept of ***passive solar design*** has been emphasized in the architectural design approaches that minimize building energy consumption by integrating conventional energy-efficient devices, such as mechanical and electrical pumps, fans, lighting fixtures, and other equipment, with passive design elements, such as building siting, an efficient envelope, appropriate amounts of fenestration, increased day lighting design, and thermal mass. The basic idea of passive solar design is to allow daylight, heat, and airflow into a building only when beneficial. Landscaping will be aesthetic while also provide critical shading or direct air flow. Window shades are both a shading device and part of the interior design scheme. Masonry floors store heat and also provide a durable walking surface. Sunlight bounced around a room provides a bright space and task light. Day-lighting brings light into a building interior and distributing it in a way that provides more desirable and better quality illumination than artificial light sources. This reduces the need for electrical light sources, thus, cutting down on electricity use and its associated costs and pollution.

CHAPTER 6

ENVIRONMENTAL MONITORING PROGRAM

6.1 INTRODUCTION

The success of any environment management programme depends upon the efficiency of the organizational set up responsible for implementation of the programme. Regular monitoring of various environmental parameters is also necessary to evaluate the effectiveness of the management programme so that necessary corrective measures can be taken in case there are some shortcomings in the proposed programme. Since environmental quality parameters are also important for maintaining safety, the monitoring work forms part of safety measures also.

To ensure incorporation of control and mitigation measures at design and construction stages and for the purpose of making mid-term correction of deviations, an organization will be available at the construction site for

- Monitoring the implementation of control and mitigation measures;
- Monitoring the quality characteristics of physical environment such as air quality, water quality, noise levels, soil erosion, solid waste management;
- Plantation of trees in the open spaces as well as on both sides of the roads, their augmentation and maintenance;
- Operation, maintenance and surveillance of the sewage treatment plant;
- Routine maintenance and clearing of side drains and culvert.

6.2 PROPOSED SET-UP AND FUNCTIONS

Construction phase: To ensure incorporation of control and mitigation measures at construction stage, the requirements for ensuring environmental friendly and pollution free construction will be incorporated in the contractors contract, who will have to demonstrate compliance to the clauses to the Project Manager.

Operation phase: For compliance and for the purpose of making mid-term correction of any deviations found, CPWD will be monitoring the compliance status to the conditions in the environmental clearance that will be granted to the project by the SEIAA.

For either of the above phases, CPWD shall undertake the following functions:

- Monitoring the implementation of control and mitigation measures by contractor/ maintenance agency.

- Monitoring the characteristics of physical environment of water quality, soil quality, noise levels, air quality and emissions from DG sets through a third party laboratory.

- Submission of the six monthly compliance report to the environment clearance along with the entire data collected to the regulatory agencies.

The main functions of the CPWD/ maintenance agency shall be to look after:

i. Security of buildings, installations within the complex;

ii. Water supply network and its related installations, operations and maintenance;

iii. Sewage disposal networks, their operation and maintenance;

iv. Drainage system maintenance;

v. Solid waste management;

vi. Maintenance of roads and their riding surfaces along with side walks;

vii. Electrical supply network and electric installation upkeep, maintenance and their safety aspects;

viii. Maintenance and upkeep of telecom facilities;

ix. Maintenance of landscape; Ensuring plantation of trees in the open spaces as well as on both sides of the roads, their augmentation and maintenance;

x. Fire safety and fire fighting devices, upkeep and maintenance;

xi. Public health and hygiene of the persons visiting the complex;

xii. Regulation, maintenance and upkeep of social infrastructure provided in the complex.

xiii. Maintenance of public health and hygiene of the complex by spreading awareness, use of smoke generators, self propelled disinfectant sprays, Man-pack spray guns to spray insecticides etc. particularly during monsoon.

6.3 MONITORING SCHEDULE AND PARAMETERS

To evaluate the effectiveness of environment management programme, regular monitoring of the important environmental parameters will be taken up. The schedule, frequency and parameters to be monitored are shown in **Table 6.1**.

TABLE 6.1
MONITORING SCHEDULE AND PARAMETERS

Sl. No.	Description of parameters	Nos. & Location of monitoring	Method of sampling & analysis	Schedule and duration of monitoring	
				Construction phase	Operation phase
1.	Drinking water quality as per parameters specified in IS 10500:2012 "Drinking Water Standards"	One- Water supply borewell or inlet pipe	IS 3025/ APHA	3 monthly or as specified by SEIAA/ MPCB	3 monthly or as specified by SEIAA/ MPCB
2.	Waste water/ sewage for pH, Temperature, BOD, COD, TSS, TDS, Oil & Grease against limits specified in Schedule VI of Environment Protection Rules	One- Overflow of septic tank system, if occurring	IS 3025/ APHA	3 monthly or as specified by SEIAA/ MPCB	Not applicable as STP will be centralised
3.	Air quality monitoring (PM2.5, PM10, SO_2 & NOx) and compliance checked against National Ambient Air Quality Standards 2009	One- Within project site	IS 5182/ CPCB guidelines	3 monthly except monsoon or as specified by SEIAA/ MPCB	3 monthly except monsoon or as specified by SEIAA/ MPCB
4.	Noise levels in Leq for 24 hours, compliance checked against Noise Pollution (Regulation and Control) Rules 2000	Four- Within project site, nearest habitation, nearest group housing in NW, nearest mangrove	CPCB guidelines	3 monthly or as specified by SEIAA/ MPCB	3 monthly or as specified by SEIAA/ MPCB
5.	Soil Quality for texture, pH, EC, $CaCO_3$, Bulk density, moisture, organic carbon, organic matter, chloride, sulphate, phosphorous, nitrate, iron, sodium & potassium	One in greenbelt area	IS 2720	3 monthly or as specified by SEIAA/ MPCB	3 monthly or as specified by SEIAA/ MPCB

Sl. No.	Description of parameters	Nos. & Location of monitoring	Method of sampling & analysis	Schedule and duration of monitoring	
				Construction phase	Operation phase
6.	Stack monitoring for PM, SO_2, NOx, CO & NMHC and compared against Standards (EPA 1986	Two- of each DG set	IS 11255/ EPA methods/ CPCB guidelines	3 monthly or as specified by SEIAA/ MPCB	3 monthly or as specified by SEIAA/ MPCB
7.	Inventory of flora (tree plantation, survival etc.) in the complex	Entire complex	-	6 monthly	Annual

Note: The above is subject to change as per SPCB/ MoEF guidelines/ directives which are released from time to time

6.4 BUDGETARY PROVISION FOR ENVIRONMENTAL MANAGEMENT

Adequate budgetary provisions have been made by the project proponent for execution of Environment Management Plan. Expenditure on environmental matter during construction phase is given in **Table 6.2** and capital and recurring cost for environmental protection during operation phase is given in **Table 6.3.**

TABLE 6.2
EXPENDITURE ON ENVIRONMENTAL MATTERS DURING CONSTRUCTION PHASE

Sl. No.	Description	Cost (Rs. lakhs)
1.	Water for Dust Suppression	28.0
2.	Site Sanitation	2.0
3.	Environmental Monitoring	3.0
4.	Disinfection	5.0
5.	Health Check Up	36.0
	Total	**74.0**

TABLE 6.3
CAPITAL AND RECURRING COST ESTIMATED FOR EMP

Sl. No.	Description	Cost (Rs. Lakhs)	Operational & Maintenance Cost (Rs. Lakhs/year)
1.	STP	140	35
2.	Sewage and external & internal drainage system	600	60
3.	Fire fighting	0	30

Sl. No.	Description	Cost (Rs. Lakhs)	Operational & Maintenance Cost (Rs. Lakhs/year)
4.	Solar lights	5.0	0.1
5.	Green belt	10.0	1.5
6.	Solid waste system	50.0	7.0
	Total	**805.0**	**133.6**

The above two tables on the cost incurred towards implementation of Environment Management Plan depicts that about Rupees 805.0 lakhs be initial capital investment and monthly the recurring cost will be approximately Rupees 133.6 lakhs.

CHAPTER 7

ADDITIONAL STUDIES

7.1 INTRODUCTION

This chapter covers Risk Assessment Studies for the construction and operation phase, the safety precautions that have to be taken during construction phase and the Disaster Management Plan.

7.1.1 Disaster management plan

Disasters have always co-existed with civilization. With technological advancement, development initiatives resulted in the creation of many infrastructure and permanent assets.

Gradually material development detached man from nature on one hand and increased vulnerability of the human population on the other. The progressive increase in loss of life, property and deleterious effect on environment due to disasters moved the international community to look at Disaster Management in a new perspective, which transcends international barriers, anticipates possible threats and enables tackling of disasters from the pre-stage.

Greater Mumbai Disaster Management Action Plan, Risk Assessment and Response Plan, Maharashtra Emergency Earthquake Rehabilitation Programme, has been prepared by Government of Maharashtra, Mumbai, 2007.

This chapter requires the Risk Assessment to be covered. The risks assessed for the project are with respect to the occurrence of disasters as follows:

Natural disasters

- Earthquake
- Flood
- Cyclone
- Landslide
- Tsunami
- Drought

Manmade disasters

- Fire
- Chemical Hazard
- Accidents

Thus, disaster management has been covered in detail in the subsequent sections.

7.2 DISASTER PREVENTION AND MANAGEMENT

7.2.1 Natural disasters

(A) Earthquake

Designing for earthquake resistance

As per the Seismic Zoning Map of India, Mumbai region falls under Seismic Zone-III. The structural design shall be certified as per IS code 875 and IS-1893-2002 for Seismic Zone – III of Mumbai. Therefore, at the time of designing and construction of the buildings, the design parameters have been considered in compliance with IS 1893-1984 (Criteria For Earthquake Resistant Design of Structures) with due consideration of prevailing construction & development guidelines together with National Building Code.

The major earthquakes that have occurred in Mumbai region in the last 400 years have been in 1594 (intensity IV), 1618 (IX), 1678 (IV), 1832 (VI), 1854 (IV), 1877 (IV), 1906 (VI), 1926 (V), 1933 (V), 1951 (VIII), 1963 (IV) and 1966 (V).

The building structure designing shall be done to make earthquake resistant building. The following Codes and Standards specify for earthquake resistance building:

- IS 1893:1984 Criteria for Earthquake Resistant Design of Structures
- IS 1893(Part 1):2002 “Criteria for Earthquake Resistant Design of Structures : Part 1 General provisions and Buildings”
- IS 1893 (Part 4):2005 “Criteria for Earthquake Resistant Design of Structures: Part 4 Industrial Structures Including Stack Like Structures
- IS 4326:1993 Earthquake Resistant Design and Construction of Buildings - Code of Practice
- IS 13827:1993 Improving Earthquake Resistance of Earthen Buildings – Guidelines
- IS 13828:1993 Improving Earthquake Resistance of Low Strength Masonry Buildings – Guidelines

- IS 13920:1993 Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces– Code of Practice
- IS 13935:1993 Repair and Seismic Strengthening of Buildings – Guidelines
- IS 6922:1973 Criteria for Safety and Design of Structures Subject to Underground Blasts
- IS 4991:1968 Criteria for Blast Resistant Design of Structures for Explosions Above Ground

Additional earthquake preparedness measures

- A common meeting point inside the custom office complex and a contact outside the complex will be identified and known to all employees.
- List important telephone numbers and torch, water, transistor, first-aid kit and non-perishable food will be kept at a designated place. An emergency kit shall be ready at all times.
- Train workers in basic first aid. Teams for first-aid; search and rescue etc. in will be formed in the area and preparedness drills will be conducted for what to do in case of an event.

Measures during an earthquake

In case of occurrence of the earthquake, every individual would be made aware of the following:

- Keep calm and help others to keep calm. Do not panic.
- If you are inside of a building: Protect yourself by ducking under a sturdy table, and staying there until the shaking stops. Turn off electricity and gas.
- If you are on the road in a built up area: Immediately move away from buildings, slopes, streetlights, power lines, hoardings, flyovers etc. Into open spaces. Do not run or wander; keep the roads free for movement.
- If you are driving: Stop the vehicle away from the buildings, slopes and electric cables; come out of the vehicle, hold it and stay by its side
- Keep calm and expect aftershocks.
- Check if you or anyone else is hurt. Use first-aid and wait for medical help.
- Do not move seriously injured people.
- Do not turn-on electrical appliances and gas.
- Check your building for damages.

- Do not waste water and do not block telephone lines.
- Do not spread rumours and don't panic.
- Volunteer to help.
- Keep the streets clear for emergency services.
- Do not use matches, lighters, camp stoves or electrical equipments, appliances until you are sure there are no gas leaks. They may create a spark that could ignite leaking gas and cause an explosion and fire.
- Do not use your telephone except for a medical or fire emergency. You could tie up the lines needed for emergency response. If the phone doesn't work send someone for help.

(B) Floods

Particularly in Mumbai, areas having poor drainage characteristic get flooded by accumulation of water from heavy rainfall. Following precautions would be taken by the project proponent to manage flood disasters:

a. Storm water system would be checked and cleaned periodically.

b. Mapping the areas within or leading in or out of the building that will be water logged, flooded or isolated due to the flood. The areas will be marked after completion of the project (as final ground levels etc. will be available after completion).

c. Vulnerability of basement would be mapped.

d. Dewatering pumps shall be installed at vulnerable locations.

There a number of flooding points in the city which result in disruption of traffic and flooding of settlements.

List of Chronic Flooding Spots: City	
1	S.V.P. Low level
2	Sandhurst Road
3	Burhni College
4	Mumbai Central
5	Slatter Road
6	King Circle
7	Hindmata
8	Sakhubai Mohite Marg
9	Wadala Station
10	Maratha Mandir

Source: ***Greater Mumbai Disaster Management Action Plan, Risk Assessment and Response Plan, Maharashtra Emergency Earthquake Rehabilitation Programme, Government of Maharashtra, Mumbai, 2007***

To respond to monsoon-related flooding in Greater Mumbai, the following public agencies who have been designated responsibilities are as follows:

- Municipal Corporation.
- Fire Brigade
- BEST
- MMRDA
- Police Commissionerate
- Traffic Police
- Home Guards and Civil Defence
- District Collectorates (City & Suburban)
- India Meteorological Department (Regional Office)
- Railways (Central & Western)
- M.T.N.L.
- Electric supply agencies.

Coordination and supervision mechanism is as follows:

There is a 3-tier institutional mechanism for responding to monsoon-related flooding. At the municipal ward level, the Assistant Municipal Commissioner in charge of the ward is the Ward Disaster Manager. The Ward Disaster Manager functions under the direction, control and supervision of the Municipal Commissioner, who is the Greater Mumbai Disaster Manager. He coordinates the activities of all public agencies in Greater Mumbai charged with the responsibility of responding to monsoon-related flooding. However, in cases of disasters of exceptionally large magnitude, which require co-ordination among a wide range of lateral agencies, including Central Government agencies, the Greater Mumbai Disaster Management Committee will coordinate disaster management in Greater Mumbai. In the months of April and May, regular meetings of the public agencies would be held at all these three levels to achieve adequate coordination in their pre-monsoon preparations.

Pre-monsoon preparations:

- In order to be able to discharge its stipulated responsibilities effectively, every public agency will identify, assemble and train the required personnel and store adequate materials not later than 30th May.

- The names and office and residential addresses and telephone numbers of the key personnel identified by each public agency will be communicated to the Emergency Operations Centre at Mantralaya and the

- Municipal Commissioner by 30th April.

- Similarly, a complete inventory of the materials stocked by each public agency will be communicated to the Emergency Operations Centre at Mantralaya and the Municipal Commissioner by 30thApril.

- Where it is planned to use vehicles, equipment, etc. sourced from private agencies, each public agency will communicate to the Emergency Operations Centre at Mantralaya and the Municipal Commissioner, a list of these private suppliers, specifying what is to be sourced and the quantities thereof, by 30th April.

- Public-private partnership is a sine qua non for effectively responding to monsoon-related flooding. The best way to secure such partnership is to suitably involve Non-Government Organisations (NGOs) in the activities of public agencies. Each public agency will identify the Non-Government Organisations relevant to its responsibilities and establish a dialogue with them well in advance of the on-set of monsoon. A list of Non-Government Organisations thus identified, containing their names, addresses, telephone numbers and the names of their representative functionaries, will be prepared and communicated to the Emergency Operations Centre at Mantralaya and the Municipal Commissioner by 30thApril.

- A ward location prone to monsoon-related flooding will be reviewed by the Municipal Commissioner and an updated list of such locations will be communicated to the Emergency Operations Centre at Mantralaya and the various public agencies by 30th April.

- Taking into consideration the monsoon-related flood-prone locations identified and the personnel and materials assembled, each public agency will formulate a detailed Action Plan, spelling out in particular the deployment of manpower and positioning of material resources and the modus operandi to be adopted.

- The Action Plan will be submitted for the review of the Greater Mumbai Disaster Management Committee by 30th April.

Monsoon period measures:

During the period from 1stJune to 30th September, the Municipal Corporation will set up a Control Room. Similarly, the Fire Brigade, BEST, Municipal Health Department, MMRDA, Police Commisionerate, Traffic Police, Home Guards and Civil Defence Directorate, City Collectorate, Suburban District Collectorate, Central Railway, Western Railway, MTNL and electric supply agencies will set up separate Control Rooms. They will also depute their representatives to the Municipal Control Room, which will function as the Central Control Room.

During the period from 1stJune to 30th September, the India Meteorological Department's Regional Office will submit reports of rainfall (actual and forecast) twice daily to the Emergency Operations Centre in Mantralaya and

to the Municipal Control Room, BEST Control Room, MMRDA Control Room,

Police Control Room, Traffic Police Control Room, City Collectorate Control Room, Mumbai Suburban District Control Room, Central Railway Control Room and Western Railway Control Room. If IMD's assessment indicates heavy rainfall, IMD will submit reports of rainfall at 6-hour intervals (or sooner, if necessary).

The Deputy Director General, IMD will follow up these reports by telephone calls to the Additional Chief Secretary (Home), the Municipal Commissioner and the Police Commissioner.

Alert notification and subsequent action:

- If the I.M.D. report indicates rainfall of a magnitude likely to cause floods, the Municipal Control Room will alert all the relevant public agencies required to respond to the flood situation, whereupon the said agencies will take all necessary actions to discharge their stipulated responsibilities, for which they will be fully and solely accountable.
- On alert being sounded by the Municipal Control Room, the Control Rooms of the various public agencies will be in continuous communication link with the Municipal Control Room through their representatives located in the Municipal Control Room. These Control Rooms as well as the Municipal Control Room will also be in continuous communication with the Emergency Operations Centre in Mantralaya.
- On the notification of alert, the identified public agencies personnel will immediately report to their assigned workstations and remain on duty throughout the alert period. All non-medical leave of such personnel will stand automatically cancelled and no non-medical leave will be sanctioned during the alert period. General decisions of closure of offices/establishments, if any, will not apply to such personnel.
- During the alert period, the Municipal Control Room, Fire Brigade Control Room, BEST Control Room,
- Municipal Health Department Control Room, Police Control Room, Central Railway Control Room and Western.
- Railway Control Room will submit to the Emergency Operations Centre at Mantralaya a daily report.
- The daily reports aforesaid will be consolidated by the Emergency Operations Centre at Mantralaya in the prescribed proforma and placed before the Greater Mumbai Disaster Management Committee for review and decision and directions as may be necessary.
- Quick dissemination of relevant and accurate information among the public is central to effective response to monsoon- related flooding. It is necessary to forge a mutually advantageous partnership with the media in this regard to set up an information centre to organise sharing

of information with the media. This is a mandatory requirement. At the same time, in order to enable the media to secure information about different aspects of the management of disaster resulting from monsoon-related flooding from a single window, during the alert period, the Director General, Information and Public Relations will set up a Media Centre in Mantralaya.

- This Media Centre will be headed by the Director General and will work in conjunction with the Emergency Operations Centre in Mantralaya. It will be the responsibility of the Media Centre to pro-actively disseminate relevant and accurate information among the public through the media, including cable television, ham radio, etc.

(C) Cyclones/High Wind Speed

Being a coastal city, the coastal wards (facing the Arabian Sea) are prone to gusty winds and cyclonic impacts. Additionally, in most of the wards, a number of slums have also mushroomed along the coast. Given the quality of building material used, these settlements are highly vulnerable and the possibility of their capacity to withstand the cyclonic storm is limited. The list of such settlements and dilapidated buildings prone to cyclonic impact in ward F/N are given below. These areas may require evacuation to temporary shelters or identified safe sites.

Ward	Settlement vulnerable to cyclones
F-North	1. Korba 2. Mithagar 3. Wadala 4. Antop Hill 5. Sangam Nagar 6. Chandani Agar

(***Source: Greater Mumbai Disaster Management Action Plan, Risk Assessment and Response Plan, Maharashtra Emergency Earthquake Rehabilitation Programme, Government of Maharashtra, Mumbai, 2007)***

Our site is located in Wadala (E). As per the above table, it is vulnerable to cyclones. In such an instance the employee would be advised to stay in the shelter in tightly secured windows and doors. The glass of windows etc. would be covered with paper/cardboard to avoid glass breaking due to flying objects outside. Also, people will be made alert after getting the warnings from IMD about forecast any such disaster.

(D) Landslide

Greater Mumbai also faces the risk of Landslides With pressure on land, many vacant sites on hill slopes or bottoms of hills have turned into inhabited area and thereby become vulnerable to landslides. Most cases of landslides occur during heavy rain associated with high velocity winds. It sometimes results in loss of human lives and damage to structure.

The sites vulnerable to landslides in F/N ward are as follows:

Ward	Landslide Location
F/N ward (Dadar-Matunga/East)	Salamati Hill (M.A road, H.M. road)
F/N ward (Dadar-Matunga/East)	Rawali camp hill, (Reservoir)
F/N ward (Dadar-Matunga/East)	Walchand Bunglow Hill (Indira Nagar, Near Antop Hill Post Office)
F/N ward (Dadar-Matunga/East)	Barkat Ali Hill

(Source: Greater Mumbai Disaster Management Action Plan, Risk Assessment and Response Plan, Maharashtra Emergency Earthquake Rehabilitation Programme, Government of Maharashtra, Mumbai, 2007)

Since our project is located in Wadala, it is not vulnerable to the landslides.

7.2.2 Man made accidental disasters

(A) Fire Hazard

Fire could take place through various means; one of them is through electrical fire.

Precautions & safety measures proposed against fire hazards are:

1. Fire management plans will be kept in public place. Signage's to be an important part of evacuation plan.
2. These plans will be made for sites, buildings, public places and will be displayed prominently at various locations. Everyone will be made aware of the plans.
3. Building will have separate EXIT doors for emergency.
4. Fire safety will be taken into account and all the safety norms and regulations will be followed up, which have been provided by National Building Code and other related Indian Standards;
5. All exit doors will be made of fire retardant material in compliance with NBC norms and will be properly displayed as 'EXIT' doors.
6. These doors would be clear at all times. They would never be locked.
7. Fire alarms will be in place at various locations within the building for early detection of smoke.
8. Underground firewater compartment with 200,000 liters capacity will be kept in case of any emergency.
9. Adequate no's of sand bags and other fire extinguishers shall be provided.
10. People will be trained for fire safety drill. Fire safety drill to take place at least every 6 months.
11. One person to be trained as "Fire officer" within the premises.
12. In case of fire, first aid kit would be available at a safe place.

Following Fire fighting codes and standards shall be followed in the complex:

Title	Important Indian Standards for Fire Fighting Work
IS 1239-1968 (Part-I)	Specifications for mild steel tube, tubular and other steel pipe fittings.
IS 1239-1968 (Part-II)	Specifications for mild steel tube, tubular and other steel pipe fittings.
IS 1536-1976	Specification for centrifugally Cast (Spun) Iron pressure pipes with flanges for water, gas and sewage.
IS 1538 (Part 1 to 23)	Specification for Cast Iron fittings for pressure pipes for water, gas and sewage.
IS 1726-1960	Code for cast iron manhole frame and cover.
IS 3589-1981	Specification for electrically welded steel pipes for water, gas and sewage.
IS 4736-1986	Galvanizing G.I. Pipes
IS 636-1988	Non percolating flexible fire fighting delivery hose (third revision)
IS 694-1990	PVC insulated cables for working voltages upto and including 1.100 volts (third revision)
IS 778-1984	Copper alloy gate, globe and check valves for water works purposes (fourth revision) (Amendment 2)
IS 780-1984	Sluice valves for water works purposes (50 to 300 mm) size (sixth revision) (Amendment 3)
IS 884-1985	Specification for first-aid hose-reel for fire fighting (for fixed installations) (first revision) (with Amendment 1)
IS 900-1992	Code of practice for installation and maintenance of induction motors (second revision)
IS 901-1988	Specification for couplings, double male and double female, instantaneous pattern for fire fighting (third revision)
IS 902-1992	Suction hose coupling for fire fighting of purposes (third revision)
IS 903-1984	Specification of fire hose delivery couplings branch pipe, nozzles and nozzle spanner (third revision) (Amendment 5)
IS 937-1981	Specification for washers for water fittings for fire fighting purposes (revised) (with Amendment 1)
IS 1520-1980	Horizontal centrifugal pumps for clear cold, fresh water (second revision)

Title	Important Indian Standards for Fire Fighting Work
IS 1536-1976	Horizontally cast iron pressure pipes for water, gas & sewage (first revision) (with Amendments 1 to 4)
IS 1554-1988	Part I PVC insulated (heavy duty) electric cables (working voltage upto and including 1100 volts (third revision)
IS 1554-1988	Part II PVC insulated (heavy duty) electric cables (working voltage from 3.3 KV upto and including 11 KV (second revision)
IS 1648-1961	Code of practice for fire safety of buildings (General) Fire fighting equipment and its maintenance (with Amendment 1)
IS 3624-1987	Pressure and vacuum gauges (Second revision)
IS 4736-1968	Hot-dip zinc coatings on steel tubes (with Amendment 1)
IS 5290-1983	Specification for landing valves (second revision) (with Amendments 6)
IS 5312- 1984	Part I Swing check type reflux (non return) valves Part I-single door pattern (with Amendments 1 & 2)
IS 5312- 1986	Part II Swing check type reflux (non return) valves Part II-Multi door pattern (with Amendments 1 & 2)
IS 7285	Seamless cylinders for storage of gas at high pressure
IS 2189-1962	Code of practice for Automatic Fire alarm system
IS 2195-1962	Specification for heat sensitive fire detectors
IS 732-1973	Code of practice for electrical wiring installation
UL 168	Underwriters Laboratory specification for smoke detector

Following Fire Alarm System codes and standards shall be followed in the complex as:

(1) IS:2189 - 1962 Code of Practice for Automatic Fire Alarm System.

(2) IS:2195 - 1962 Specifications for Heat sensitive Fire Detectors.

(3) IS:732 - 1973 Code of practice for Electrical Wiring installation

(4) UL 168 Under writers laboratory specifications for smoke detectors.

Fire safety and fire fighting devices, their upkeep and maintenance

The fire fighting system shall consist of jockey pump, Electrical Driven Fire Hydrants pump, Sprinkler pump, Water curtain & Fire hydrants (Internal & External), Air Vessel, associated instruments, cabling, piping, valves, control panel etc. has been provided as per NBC requirement. Jockey pump

shall maintain pressure in all water line for hydrants & Sprinklers fully charged under pressure for full Automatic operation in case of fire.

The project has proposed to have a provision for underground firewater compartment of 200,000 liters capacity having 2-way fire brigade inlet connection. As the fire tenders of the Fire Department shall have lifting pumps installed to draw water from these tanks, these static fire tanks will have the necessary provisions of manholes where from suction pipes can be immersed to draw water. Besides these Fire Hydrants shall be provided on the water lines near all important installations and Multi-storeyed Buildings/ complexes to facilitate drawing of water directly from the water lines in the event of emergencies.

Ample stocks of first aid fire fighting gadgets will be provided in the sub-zonal control rooms in the form of different types of fire suppression equipments. The maintenance agency will have trained Fire Officers and Fire Men on their regular rolls, who will be conducting mock drills to educate the people about the fire preventive measures and keep a total watch on systems installed for this particular function and ensure that all systems are always in ready condition.

This activity shall be controlled and monitored from a centralized control room and will work in close co-ordination with local Fire Authorities.

The Building will be of G+22 storied with provision of 7 Nos. floors above and 3 Nos of basements for Parking. The total building height will be 125.5 m for G+29. The building falls under Category of Business Building with more than 30 M Height as per NBC 2005 Part IV table 23. The following provisions will be made in designing fire fighting system as per NBC/TAC guidelines.

1. Main Hydrant Pump 2850 LPM, Head 100 m.
2. Stand by Diesel Driven pump 2850 LPM, Head100 m.
3. Electric Driven Jockey pumps 180 LPM, Head 100 m.
4. Sprinkler pumps 2850 LPM, Head 100 m.
5. Fire Extinguishers, CO_2 and ABC Type.
6. Wet Riser with internal Hydrants in all Floors.
7. Yard Hydrants around the building and in terrace.
8. Automatic Sprinkler System in all floors & Basements.
9. Manual & Automatic Fire Detection system.
10. Gas based fire Fighting System.

Yard Hydrants & Internal Wet Risers:

The yard hydrant shall cover the entire building externally with Hydrant points at appropriate location with hose boxes, hoses etc in ground floor and Terrace. The internal hydrant system involving wet risers shall have landing valves, hoses, hose reels and branch pipes etc. in suitable hose cabinets at appropriate points on every floor.

Fire Brigade Inlet Connection:

Fire brigade inlet connection shall be of gun metal with four 63 mm dia instantaneous type inlets with proof built in type check valves and 150 mm dia flanged outlet connections feeding to main fire grid/UG water tank. The collecting head shall conform to IS – 904.

Sprinkler System:

The automatic sprinkler system shall be provided in the entire building and the sprinkler heads shall be distributed as per the TAC/ NBC so as to cover every 12 Sq. m area with each sprinkler head. The sprinkler pump shall be suitable for automatic operation when there is a drop of pressure in the system. Sprinkler shall be provided throughout the building with separate sprinkler risers as required, Installation control valves and a hydraulic alarm system in the basement shall be provided.

An electrical sensor flow switch shall be provided on each floor and connected to fire control panel so that it would be possible to identify the location and the affected floor immediately.

Non Wet Fire Fighting System:

For protecting electronic machinery items, Computers, UPS Micro film etc, gas based fire suppression system is proposed. CO2 FM–200, NAFS iii are some of the gases presently used as non wet fire fighting agent. Fire Detection will be achieved by using smoke detectors. Each zone will have independent discharge panel. Gas discharge panel activates through smoke detectors. In case of fire occurs in any zone. The panel actuate solenoid valve of gas cylinder & gas is released. Through Ceiling mounted spray nozzles of extinguish fire.

Fire Detection system:

Each block of custom complex shall be provided with a standalone fire control panel. The entire stand alone fire alarm panel will be located in the Ground floor. Each fire panel with monitor smoke detectors, Manual call point, Hooters of that area. The detectors proposed will be multisensory (Smoke & Heat) type addressable detectors. Micro processor based intelligent fire panel will be controlled through computers for programming addressing and monitoring. The wiring will be carried out with 1.5 sq mm PVC insulated FRLS wires in steel conduit Fire survival cable will be laid

above false ceiling on cable tray for detector, Hooters and Manual Call boxes etc. The cables will be capable of withstand temperature up to 950 degree C for 20 minutes. The system will be provided with monitor / control modules. (NO/ NC contacts) to shut off fresh air supply and actuation of smoke extraction fans in case of occurrence of fire. The capacity of fire panel will be decided considering 200 detectors/ devices in each loop.

Response Sequence During Fire:

i. Person noticing the fire would attempt to isolate and extinguish the fire with the available equipment and Inform or arrange to inform the security regarding the:

- Location of the fire
- Material of burning
- Extent of fire
- Callers name and number

"A proper code of communication shall be maintained wherein the caller makes sure that the message has been conveyed to the right person".

ii. Security or the coordinators will

- Respond to the scene of the incident.
- Arrange to send the necessary fire fighting equipment to the scene of the incident.
- Extinguish the fire with the available equipment.
- Ensure closure of gates immediately to regulate traffic in such a way that free movement of outside assistance like fire tenders, ambulance etc is available.
- Security will cordon off the area and local city fire fighting staff would be notified for further assistance.
- All the occupants will need to stop their operations/ work, switch off lights, fans, machines etc. People would assemble to refuge or designated area for fire and hazardous situation.

iii. Reporting and Follow up System

- All cases of fire occurrence, no matter how small, must be reported promptly to the Security for further action to avoid such incident.
- Fire extinguishing equipment once used, would not be returned to its location without it is being recharged/ certified fit by the security.
- All fire extinguishers after use would be laid horizontally to indicate that they have been exhausted.

Fire evacuation layout is given in **Fig 7.1**. Width of staircase and fire escape plan is shown in **Fig 7.2.**

FIG 7.1: FIRE FIGHTING LAYOUT

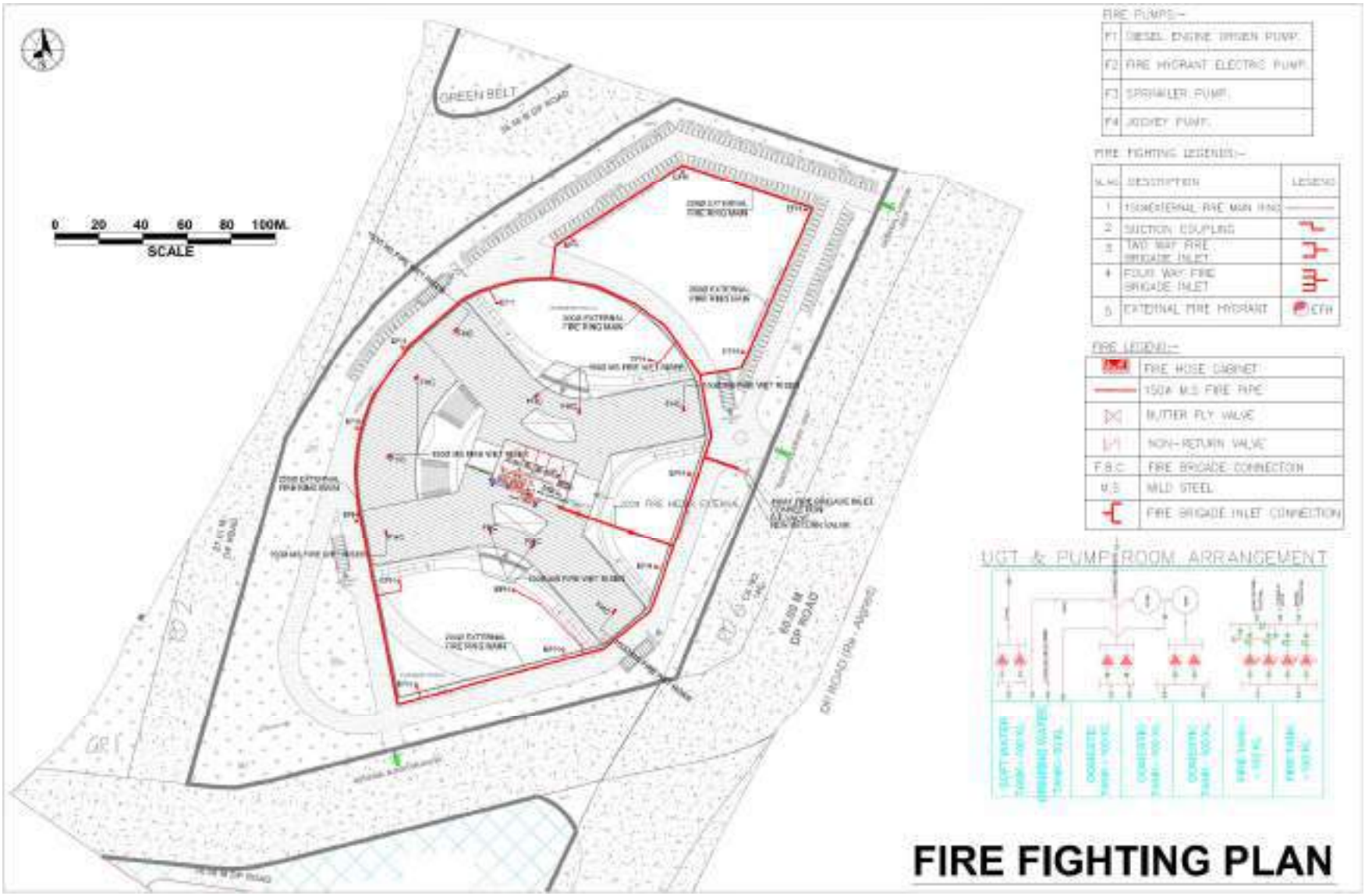
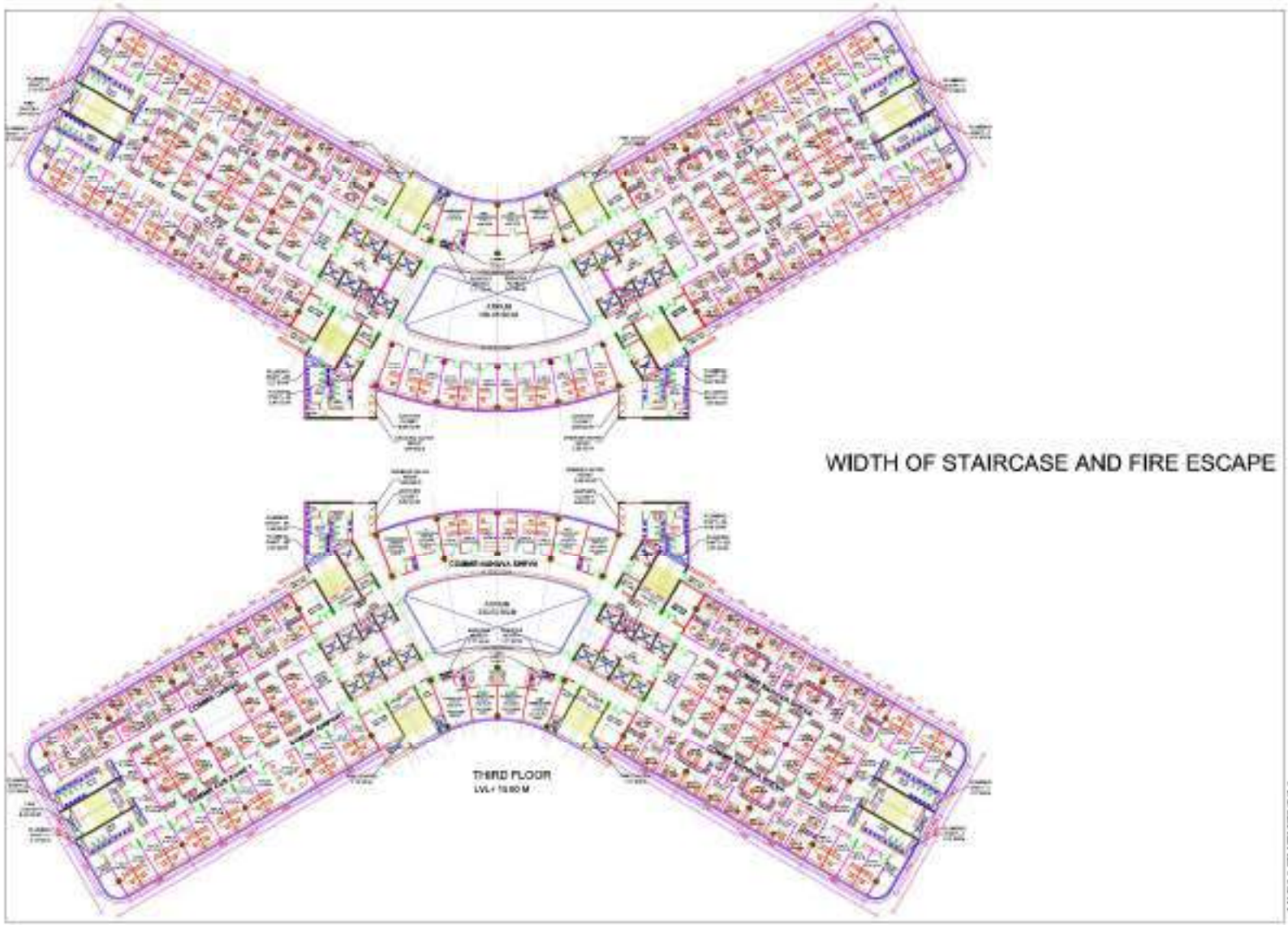


FIG 7.2: TYPICAL FLOOR PLAN SHOWING WIDTH OF STAIR CASE AND FIRE ESCAPE



In addition to many of the above measures an attempt will be made to add any site specific steps and manpower based instruction. Instruction would be in multiple languages including “Marathi and Hindi”. The communication equipment will be checked periodically to ensure that they are functional.

(B) Electrical safety plans

- There will be color coding and labelling of high voltage electrical wires
- Sand bags/ wire bucket shall be placed near the electrical control/panel
- Installation of electrical equipments shall be properly done like insulation, guarding and grounding.
- Work practices and handling of the electrical equipments shall be properly managed.
- Employees shall be trained for awareness of safe work practices and systems.
- Properly maintained equipments and tools will be used.
- Service of electrical equipments shall be done under the supervision of trained
- Live electrical terminals shall be shielded.
- Temporary connections made for experimental reasons shall be safe and properly insulated.

Electrical distribution

The Electrical Distribution for electric supply shall be with Compact Bus Duct of suitable capacity from transformer to LT Main Panel, DG set to LT panel and from LT panel to AC panel. XLPE insulated armoured Aluminium conductor cables are proposed from LT panel in ESS to individual buildings/ towers. Separate feeders have been proposed for power, lighting and AC.

In the individual buildings/ towers provision of separate distribution system for lighting & power loads with rising mains, floor panels and DB’s etc has been considered. Air conditioning plant room will be fed directly from ESS through bus duct.

Earthing

Earthing stations with copper / GI Earth plate shall be provided for sub stations equipments, for Electrical boards of each building as per requirements of I.S code & Indian Electricity Rules. All three phase installations shall be provided with double Earth connection and single

phase installations with one Earth connection. Earth Leakage circuit breakers shall be provided in the DBs for individual units.

Lighting Design

The illumination levels mentioned for the following areas are only desired levels however shall vary based on the type of light fittings and lamps used by the occupant.

- Office 300-350 Lux
- Record Room 200 Lux
- Corridor/ Common Areas 100 Lux

The indoor lighting envisaged shall be with energy efficient T-5, CFL and LED light fittings of recessed / surface type as per requirement to provide the required illumination level.

Lightening protection system

A standard lighting protection system will be provided in the building as per IS Standards, using single prone finials, horizontal and down comer conductors of standards size, terminating in Earth pits.

Power factor improvement

Automatic power factor compensating type multiple capacitor banks will be provided for maintaining average power factor of 0.95, well above the requirement of Local Electricity Supply Authorities.

Fire detection / alarm system

Intelligent Fire Detection and Alarm System with addressable smoke / heat detectors and hooters etc. as per requirement of the code and approval of Fire Authorities shall be provided in the new complex.

(C) Accidents

During construction: The workers will trained and made aware of risks and hazards. They shall be provided with personnel protective equipment like hard hat, safety boots, rubber boots, gloves, goggles, aprons, welders glass, ear muffs, etc as per requirement. Activity specific precautions during cutting and welding process, road making, working at heights, etc will be followed.

During operation: Proper arrangements shall be made at all identified accident-prone areas in terms of signal, signage, speed breaker and design consideration. They would be implemented with respect to rules and regulations of traffic movement.

7.2.3 Disaster Management Cell

A disaster management cell will be established, which will take care of post disaster. It will be a volunteer kind of set-up and professionals can also be hired in case of eventuality. It will also help to promote awareness towards disaster management. Disaster mitigation and recovery resources will be invested to improve the quality of life in the areas of public health and safety, environmental stewardship and social and economic security. The maintenance agency will prepare an integrated, comprehensive emergency management plan that meets immediate needs and provides for long-term recovery and mitigation.

The disaster management cell have following members to share the responsibility:

I Site Controller (Administrator of complex)

II Incident Controller (Asstt. Administrator)

III Personal Manager

IV Communication Officer

V Fire Officer

VI Security Officer

VII Engineering Incharge

VIII Fire pump attendant

IX First Aid Team

7.2.4 Disaster Management Cell

The disaster management plan identifies the risks to the building at site and addresses facility emergency response and recovery plans for building utilities, systems and services. This process includes:

- Risk Identification
- Risk Quantification
- Risk Mitigation
- Emergency Response
- Crisis Management
- Business Recovery
- Plan Exercising, Monitoring and Improving

The **Table 7.1** gives the potential hazard, its proposed control measures, additional control measures, recovery and time line.

TABLE 7.1
HAZARD IDENTIFICATION AND CONTROL MEASURES

Sl. No.	Type of Hazard (Internal/ External)	Hazard	Proposed Control Measures	Additional control Measures, if any	Recovery	Time Line
1	Internal	Widespread Building Fire	Fire Hydrants, Fire Extinguishers, Training and Awareness	Call for External Help from Fire Brigade	1. Work From Home Option 2. Find Back up site	1. Immediate 2. 3-4 Months
2	External	Power Failure External	Back -up power available - DG Sets		Run DG Sets	Immediate
3	Internal	Power Failure Internal	Preventive Maintenance Schedule and Dry Runs for Testing	Additional Potable DG Sets for running Critical Business operations	Arrange for Standby	One Day
4	Internal	Water Supply Domestic Use Failure	Adequate storage tank for 24 hrs supply	Arrange for Additional water supply through Tankers	Use Onsite Storage, Arrange Tankers	8 Hrs
5	Internal	Drinking Water Supply Failure	External Vendors are available locally		Opt with other vendors	8 Hrs
6	Internal	Fire protection system Burst-Sprinkler and Fire hydrant	Pressure testing, Preventive maintenance schedule	Controlled Hot work at site till rectified		8 Hrs
7	Internal	AHU Failure	Preventive Maintenance Schedule, Daily Checking and Corrections		Interconnect AHUs	8 hrs
8	Internal	Other AC Unit failures	Preventive Maintenance Schedule, Daily Checking and Corrections		Arrange for Standby	8 Hrs
9	Internal	Chilling water system failure	Preventive Maintenance Schedule, Daily Checking and Pressure testing for piping in case of pipe leakage		Standby Available, Replace piping in case of piping burst	1 Day
10	Internal	structure	Structural Inspection		Find Backup Site	3-4 Months
11	External	Outbreak of Major Illness (e.g. Avian	Tie up with local Hospital, Minimal protective supplies	Screening before entering facility, Control	As per Global Guidelines for Screening and	Immediate

Sl. No.	Type of Hazard (Internal/ External)	Hazard	Proposed Control Measures	Additional control Measures, if any	Recovery	Time Line
		Flu etc)	available follows Global EHS Guidelines	travelers	or shutdown if outbreak is national	
12	Internal	Chemical Accidents (employee exposure to chemicals)	Small Quantities in use for treatment, cleaning, etc, PPEs and administrative controls		Isolate, Decontaminate; Monitor residual presence & Health Surveillance of affected employee	1 Day
13	Internal	Toxic Spills (Alkali & Acids)	Limited use in isolated process only such as cleaning.		Isolate, Decontaminate; Monitor residual presence & Health Surveillance of affected employee if any	1Day
14	Internal	Hazardous contamination (air, water, soil)	Limited use, secondary contained.		Isolate, Decontaminate; Treatment ; Monitor residual presence	1Day
15	Internal	Gas Leaks (flammable)	Daily Checks on leakage, Bubble test, pressure test		Cutoff, forced ventilation.	Immediate
16	External	Terrorism	Tightened Security, Stringent security checks, Inform Local Police		NA	Immediate
17	External	Civil or Political disturbance	Tightened Security, Inform Local Police, Activate Crisis Management Team on site		NA	Immediate
18	External	Bomb Threat	Security procedures in place to asset threats. Preparedness on Emergency situation, Evacuation and External help from Police	Inform and take Help from Police	If not recovered immediately, follow as for Hazard-1	1. Immediate 2. 3-4 Months
19	External	Earth Quake	Emergency Response plan activated, CMT Activated	Assessment of building for stability and operations to continue	If damage substantial, follow as for Hazard-1	1. Immediate 2. 3-4 Months

Sl. No.	Type of Hazard (Internal/ External)	Hazard	Proposed Control Measures	Additional control Measures, if any	Recovery	Time Line
20	External	Rain/Cyclone	Adequate Drainage, Cleaning of storm drains		If damage substantial, follow as for Hazard-1	1. Immediate 2. 3-4 Months
21	Internal	Theft of Assets	Internal Control Procedures & Security Surveillance		NA	Immediate
22	External	Transport Accidents	Approved Vendors, GPS systems tracking of vehicles, Trained Drivers, Awareness programs	Inform Fleet helpline and WPS, Arrange for alternate transportation and hospitalization of injured		Less than 1 hour
23	Internal	Food Poisoning	1. Qualified vendor, 2. Checking food Quality- Bacteriological analysis 3. Awareness on Canteen hygiene 4. Medical checkup for food handlers		Alternate vendor arrangements	1Day
24	Internal	Fire in Kitchen	1. No use of flammable/ explosive material in pantry/ canteen 2. Shut off valves for LPG lines 3. Fire extinguishers in kitchen 4. Regular checking of kitchen		Alternate vendor/ food arrangements	8 Hrs
25	External	Landslide	Our site is not close to landslide prone area.			

7.2.5 Welfare and Safety Measures For Labours

All the employees will be provided with a safe, healthy and protected environment in all our projects. This shall be achieved through:

- Compliance of all applicable rules, regulations and legislations regarding safety, occupational health and hazard free environment and use of conforming work procedures, plant, machinery, equipment and material.

- Continuous monitoring of safety, occupational health and environmental standards, through inspection, audit and risk assessment.
- Regular training of the work force and other follow up actions, to make up for the shortfalls noted through monitoring.
- Review of the safety policy, whenever new procedures, articles, substances and techniques, having bearing upon safety, occupational health and environmental issues are adopted.

Precautions during cutting and welding process

The electric arc is a very powerful source of light, including visible, ultraviolet, and infrared. Protective clothing and equipment must be worn during all welding operations. During all gaseous welding and cutting proccesses, operators must use safety goggles to protect the eyes from heat, glare, and flying fragments of hot metals. During all electric welding processes, operators must use safety goggles and a hand shield or helmet equipped with a suitable filter glass to protect against the intense ultraviolet and infrared rays. When others are in the vicinity of the electric welding processes, the area must be screened so the arc cannot be seen either directly or by reflection from glass or metal.

7.2.6 Precautions during road making

Personal Protective Equipment

Bitumen is commonly handled as a liquid at temperatures above 100°C and protective clothing is necessary to prevent burns by skin or eye contact. Personal protective equipment would be selected to suit the operations in question, but where hot bitumen is being transported or used, it would include:

- Overalls with close-fitting cuffs and leg-ends designed to shed splashes away from the body.
- Face and eye shields.
- Heat resistant gloves.
- Heat resistant heavy duty boots.
- If splashing is likely then additional requirements are:
- Full head and face protection.
- Neck cloth.

Another situation where the potential for exposure is higher is during maintenance work on equipment, tanks etc. This will require the preparation of defined systems of work incorporating the use of personal protective equipment and possibly respiratory protection. Depending on the

circumstances it may be necessary to install local exhaust ventilation at the point of fume generation or provide some dilution ventilation to the worksite.

Personal Hygiene

Adoption of a very high standard of personal hygiene is essential in any operation where there is a risk of skin contact with bitumen products and/or condensed fume. Washing facilities with a non-solvent based skin cleaner, hot water and soap would be provided and used. It may be necessary to provide skin conditioning cream if contamination and washing is frequent.

Overalls would be changed frequently and dry cleaned. Grossly contaminated clothing would be changed immediately and contaminated rags would not be kept in overall pockets. The condition of gloves would be checked before use for signs of wear and internal contamination, and discarded if necessary.

Monitoring

Regular monitoring of work practices and hygiene procedures would be carried out, as well as checks on the condition of protective equipment. Whilst not being a control measure the importance of monitoring the environment, both by air sampling and observation, would not be underestimated. This provides the method by which it may be confirmed that control techniques are having the required effect.

7.2.7 Security Plan

An ISO 27001 and 27002, which are the international best practice information security management standards, defining and guiding Information Security Management System (ISMS) development shall be adopted. These will provide the necessary benchmarking for individual users to know the type of cover and the responsibilities that are defined and provided by that institution for its guests. Most importantly, training according to staff needs to be regularly imparted in dealing with such situations.

1. **Manual Checks:** At the gate the visitors and guest shall be manually checked and asked for ID's.

2. **CCTV:** At all important location with a remote viewing facility and record back up. With highest resolution and picture quality. DVR being the back bone, its recording and replaying capabilities will be considered.

3. **Central Control Room:** This will control the security system from inside.

4. **Communication Systems:** Proper communication system to security staff shall help them to coordinate better during emergencies.

7.2.8 Risk Assessment of nearby nearby power plant & refineries

The industries in the 10 km radius of the project are listed in Table 3.23 of Chapter 3. It can be seen that the nearest power plants and refineries are located at the following distances:

Sl. No.	Description	Distance (km)/Direction
1	Trombay Thermal Power Station (Tata Power)	3.1/SE
2	The Hindustan Petroleum Refinery	2.8/E
3	BPCL- Mumbai Refinery	2.1/E

It can be seen that none of the above are within 2 km distance of the proposed office complex. Referring to the extracts of the risk analysis from the respective EIA or other reports of the three projects, it is found that :

- In case of Tata power, the maximum impact distance after assessing for various failures has been calculated as 2.89 km under stable weather conditions for chlorine tonner valve failure.

- In case of BPCL- Mumbai Refinery, QRA study for the entire refinery including CDU4 &ISOM establishes that individual risk of 1×10^{-5} per annum remains within refinery boundary and IR of 1×10^{-6} per annum marginally crosses refinery boundary at few locations which is well within ALARP region. Societal risk (F-N Curve) for off site is well within ALARP region.

- In case of HPCL, the executive summary of the EIA for construction of storage tanks & associated facilities at Mumbai Refinery-II was available in public domain and the extract from same has been given in **Annexure XIX**.

CHAPTER 8

PROJECT BENEFITS

This chapter comprises of employment potential, the improvements in the physical infrastructure, improvements in the social infrastructure and other tangible benefits. The outline of corporate social responsibility is covered.

8.1 EMPLOYMENT POTENTIAL

During construction phase, unskilled, semi -skilled and skilled labour will be getting employing throughout the construction period. In addition to them, there shall be transportation and material handling staff such as drivers, helpers, loaders and unloaders. There shall be maintenance and housekeeping staff, food stuff provisioners, kiosk operators, supervisors, store keepers, security persons, etc. It will be preferred that majority of unskilled and semi-skilled persons are local so that benefits can extend to the local or natives of the State. There shall be no displacement due to this project.

During operation phase, persons will get directly employed in the office as well as service providers to the office.

8.2 PHYSICAL & SOCIAL INFRASTRUCTURE DEVELOPMENT

The physical and social infrastructure is already developed in the surroundings. Hence, additional development is not proposed.

8.3 CSR BUDGET

The CSR budget will be as per the annual Budget Allocation of the Customs Office, Mumbai.

8.4 CORPORATE SOCIAL RESPONSIBILITY

The construction and maintenance agency for the project is CPWD. They have a CPWD OFFICERS WIVES ASSOCIATION, which is a socio-cultural organization run by the wives of the officers of Central Public Works Department. This association reaches out not only to the employees and their families but also to the workers/staff temporarily engaged by the department. This is a cohesive and dynamic organization where the ladies work diligently, under the leadership of the incumbent President, to aid the under privileged and disadvantaged sections of society. It provides aid in times of any national calamity and also helps other welfare organizations. A glimpse of the various activities of the association:

- Providing creches at construction sites.
- Vocational training programmes for women empowerment.
- Providing scholarships to needy and deserving children of employees.
- Relief and welfare of families of employees and aid to other welfare organisations.
- Spreading knowledge and awareness in the field of science, culture and art among employees and their families.
- Running a nursery, play school and a day care centre.
- The Association also runs a 'NURSERY AND PLAY SCHOOL' for children aged 3-5 years. The fee structure is kept very nominal so that children from a lower economic background can have access to quality education.
- The 'DAY CARE CENTRE' caters to children of working parents. Here children between ages 6 months to 12 years can be enrolled, at a very nominal fee. Under the manager, a supervisor and a few ayahs are employed, who look after the children.
- Vocational Training Centre was established with the purpose of training and empowering women. A diploma course in Tailoring and embroidery(affiliated to Usha Sewing School) is conducted at the premises. Short term hobby classes are also conducted from time to time. Ladies who have been trained here have won a few prizes and are doing well.
- Bal Basera (creche) is run by the association since 1984, for the children of labourers that are engaged by the contractors at various construction sites. These creches provide informal education, nutrition, medical care and a safe environment to children aged 1-7 years. These children, especially girls, are also encouraged to pursue formal education and are helped with their school admissions.
- Cultural and recreational activities are conducted for the purpose of bringing the CPWD family closer and for disseminating information such as Lectures on topics of common interest by eminent persons or specialists like computer science, Yoga, Health, Naturopathy etc.; Demonstrations like cooking, flower arrangements, tie and dye, painting etc.; Felicitation of eminent persons; Celebrations of occasions like Teej, Holi and New Year; Annual family get togethers on Diwali, Picnic, Fete and Musical Evenings.

CHAPTER 9

ENVIRONMENTAL MANAGEMENT PLAN

The details of the environmental management plan have been covered comprehensively in the mitigation measures given for various aspects of the project & environment in Chapter 4 in detail and the environmental protection budget given in Chapter 6. The same are summarized in **Table 9.1** along with the administrative roles of the personnel involved.

TABLE 9.1
ENVIRONMENT MANAGEMENT MEASURES

Parameter	Potential impacts	Mitigation measures	Administrative Aspect		Monitoring Parameters
I.	**Construction Phase**		**Implementation**	**Monitoring**	
	1. Leveling of site and disposal of surplus earth, debris and refuse 2. Construction and erection of buildings, etc. 3. Emission from equipments in operation. 4. Dismantling of unwanted existing structures 5. Site clearance 6. Storage and haulage of construction materials 7. Use of large quantities of water in curing 8. Noise level due to heavy earth moving machinery and vehicles, drilling and other construction	1. The site is already levelled and as such, the requirement for levelling is negligible. Digging of approximately 267635 cum of earth will be done out of which 147,182 cum will be used for filling 2. The construction of 3,04,580.67 sq.m built up area will take place and due precautions during construction shall take place as described in Chapter 4. 3. Vehicles shall be kept under PUC checks and DG sets shall be monitored, periodic maintenance shall be done as per the schedule prescribed by the manufacturer 4. There is one ground structure	Civil contractor	Project Manager	● Measurement of material handling ● Verification of construction ● Measurement of air emissions ● Dismantling BOQ and evidence for disposal ● Installation of storage areas ● Ensuring contractor is following water conservation during curing by periodic inspections ● Monitoring of noise levels ● Log of fly ash

Parameter	Potential impacts	Mitigation measures	Administrative Aspect		Monitoring Parameters
	activities 9. Compaction of soils by earth moving equipment 10. Erosion and modification of surface	existing at the project site which will be demolished and components recycled, sold or disposed as per plan. 5. The site is covered with grasses and shrubs which will be cleared. No trees are to be intended to be cleared. 6. The storage of construction material shall be done in designated areas 7. Curing water would be sprayed on concrete structures; free flow of water would not be allowed for curing. Concrete structures would be covered with thick cloth/gunny bags and then water would be sprayed on them. This would avoid water rebound and will ensure sustained and complete curing. 8. Workers will be provided with necessary protective equipment e.g. ear plug, earmuffs. The machinery will have to be kept well maintained to minimise noise generation. Provision of green belt and plantation would further help in attenuating noise. 9. The soil will be stabilised and planted with grass, shrubs and trees			utilisation

Parameter	Potential impacts	Mitigation measures	Administrative Aspect		Monitoring Parameters
		10. The modification of the surface due to landscape will improve the aesthetics of the project site and the erosion will be arrested by planting grass, shrubs and trees.			
II.	***Operational Phase***				
Topography and drainage	• Construction of buildings and services will change topography permanently and obstruct sheet flow of rainwater • Modification of surface due to landscaping	• The construction of scientifically designed storm water drainage system will ensure rain water evacuation without water logging. • Landscaping will give an aesthetic look to the project and will be planted with grass, shrubs and trees. There will be green belt in an area of 23,783 sq.m of plot area which shall aid in enhancing the diversity of the area.	Civil contractor	Project Manager	● Verification of construction of surface drainage & landscaping ● Verification of nos. Of trees
Water resource, quality	• Use during the operational phase by occupants for routine activities • Generation of sewage water	• The total water requirement shall be met through fresh water supplied from Municipal Corporation as well as treated waste water. Thus, reuse and recycling of water will significantly reduce the water demand • STP shall be constructed	➢ Water supply maintenance in-charge ➢ STP operators	Project Manager	➢ Quality parameters ➢ Log books ➢ Inspection ➢ Water meters
Noise	• Diesel generator operations	• Equipment to be kept in well maintained condition to keep the	Electrician/ DG Operator	Project Manager	➢ Noise level ➢ Verification of PPE

Parameter	Potential impacts	Mitigation measures	Administrative Aspect		Monitoring Parameters
	• Increase in transport noise from within the site from near by roads.	noise level within 90 dB(A). Provision of acoustic enclosures • Trees with heavy foliage planted on both sides of carriage way help slightly muffle the noise. Alternatively, use of noise deflectors can also help in reducing the noise.			such as cotton plugs ➢ Inspection of acoustic enclosure of DG set
Terrestrial ecology	• Clearing of vegetation, • Habitat disturbance, • Emissions from transport vehicles and equipments impacting ecology	• The site is covered with grasses and shrubs which will be cleared. No trees are to be intended to be cleared. • The mangrove forest is at 0.3 km, E. • Plantation and landscaping will be ensured in the construction areas especially on periphery, along roads and in green areas. The plantation will serve as a micro-habitat to small species of mammals, insects and birds.	➢ Horticultural staff	Project Manager	➢ Verification of trees planted. ➢ Inspection of boundary wall ➢ Height and girth to be annually measured
Green belt	Air and noise pollution due to emissions from stack and noise levels due to the equipment.	Green Belt will be provided all along the periphery of the project area and vacant areas in the plant, along roads etc. Part of the treated waste water from the plant will be used for greenbelt development.	Horticultural staff STP operator & water supply incharge	Project Manager	➢ Verification of trees planted. ➢ Reuse of Waste water ➢ Log books
Air quality	• emission from vehicular movement and diesel generators, • and negligible emissions	• Maintenance of roads and transportation vehicles under Pollution Under Check. Diesel generator to be maintained	➢ Maintenance Staff of various departments.	Project Manager	➢ Monitoring in stack for PM, SO2, NOx, etc by flue gas analyzer. ➢ Third party periodical

Parameter	Potential impacts	Mitigation measures	Administrative Aspect		Monitoring Parameters
	from sewage and solid waste handling and disposal	periodically as per manufacturers specifications and stack height to be maintained as per CPCB/ SPCB norms. Provision of trees along periphery and along roads. • Workers will be provided with personal protective equipment(PPE) including masks to safeguard them during handling.			ambient air quality monitoring for PM2.5, PM10, SO2, NOx, etc ➢ Verification of cover of trucks, dust suppression measures & plantation
Traffic impacts	• Risk of accidents due to traffic movement • Congestion due to improper circulation and insufficient parking • impact on air quality and noise due to automobile movement	• Provision of circulation pattern and parking as per norms on surface, basement and building. • Maintenance of roads and transportation vehicles under Pollution Under Check.	Security staff trained in traffic regulation	Project Manager	Verification by observation
Demography and socio-economics	• Positive- job creation, infrastructure development and benefits to local population by way of CSR activities. • Negative impacts include impacts on cultural aspects and well being.	• Jobs will be available in the project site as sweepers, security men, maintenance men, housekeeping staff, service providers like stationary supplier, food material supplier, etc. As the authority allots the project and as the projects start developing, infrastructure will also improve. • There will be positive impact on the society.	➢ HR Manager	Project Manager	➢ Employment and domicile records ➢ CSR compliances

Parameter	Potential impacts	Mitigation measures	Administrative Aspect		Monitoring Parameters
Fire and Safety	Accidents/disasters related to fire and safety	• Prepare and implement Disaster Management Plan (DMP). • A well-laid fire fighting system and fire extinguishers will be installed as per fire safety norms. • Regular fire safety training and mock drills will be conducted.	Fire/ Safety Incharge	Project Manager	➢ Verification of approvals from factory inspector ➢ Fire fighting approvals ➢ Training and mock drill records
Solid Waste	There will be generation of : • Municipal waste, i.e., biodegradable, recyclable and non-recyclable waste • Hazardous waste, • E-waste	The waste management shall be as follows : 1. The recyclable components will be sold to authorized recycling vendors 2. Non biodegradable, non recyclables shall be disposed off by a contractor of MCGM as per approved procedure. Waste shall be finally disposed at “Deonar” which is the largest and the oldest dumping ground of Mumbai operating since 1927. 3. Biodegradable waste shall be composted 4. E waste generated (3.9 t/yr) shall be stored separately and disposed of to the recyclers authorized by MPCB. 5. Hazardous waste like used oil from transformers will be generated intermittently and quantity shall be low. They shall be stored separately and sold to	Administrative manager	Project Manager	➢ Log of solid waste handling and disposal ➢ Log books of STP ➢ Verification by observation

Parameter	Potential impacts	Mitigation measures	Administrative Aspect		Monitoring Parameters
		the recyclers authorized by MPCB.			
Public Health and Safety	• Injury • Disease	• Provision of proper circulation pattern within the complex will prevent accidents. • No food or degradable waste will be openly disposed to prevent any outbreak of vector borne disease. Water stagnation will be avoided to prevent the breeding of mosquitoes. Fogging and other control measures shall be undertaken periodically	Administrative manager	Project Manager	➢ Examination records ➢ Training records Maintenance ➢ First Aid Facilities

CHAPTER 10

ENVIRONMENTAL COST BENEFIT ANALYSIS

The scope of the EIA/EMP has been prescribed vide the Terms of Reference issued by State Level Expert Appraisal Committee vide the minutes of SEAC meeting dated 01.04.2015. (**Annexure I**) in which the cost benefit analysis has not been prescribed.

CHAPTER 11

SUMMARY AND CONCLUSION

11.1 INTRODUCTION

11.1.1 General Background

The Customs Department at Mumbai plans to build a new Customs Office building to cater to various departments at Wadala, Mumbai. The total plot area of the project is 56,523 sq.m. The basement area 64,232.49 sq.m and superstructure area including podium is 2,40,348.18 sq.m. Thus, the total built up area will be 3,04,580.67 sq.m. The building will have three basements, podium and G+22 floors above it currently and 7 additional floors for future provision (G+29). All infrastructure and the space planning for the future expansion is being done currently for infrastructure and services. The equipments and treatment facilities shall be augmented in a modular manner to cater to future expansion.

Environmental clearance is a statutory requirement as per EIA Notification dated 14th September 2006. Since the built up area of the proposed project is more than 1,50,000 sq.m., it is covered under Serial No. 8(b) of Schedule and Category 'B' of SO 1533 Notification.

The State Level Expert Appraisal Committee (SEAC), Maharashtra was approached with the Form-1 and its annexures on 08.01.2015 for the proposed Terms of Reference (TOR) for preparation of EIA/EMP. The TOR was issued vide minutes of 30th meeting of State Level Expert Appraisal Committee 2, dated 01st April 2015, whereafter the EIA/EMP report has been prepared.

11.1.2 Location & Communication

The project is located at Customs Enclave (Suleman Shah Plot), Wadala (East), Mumbai. The location is shown in Fig 1.1 of Chapter 1.

Road Link : The proposed site is well connected to various places through various roads such as Eastern Freeway and Anik Wadala road, both of which are adjoining the plot.

Rail Link : The nearest railway station is Wadala at a distance of about 1.1 km, ENE direction from the proposed site. Besides, Dadar railway station is located at a distance of 2.7 km, W direction from the site.

Air Link : The nearest airport is Chhatrapati Shivaji International Airport at 7.5 Km, N from the site.

11.2 PROJECT DESCRIPTION

11.2.1 Proposed layout and Facilities

The complex comprises of block (comprising of records, kitchen, Auditorium for 400 people, Convention centre, Malkhana, Court rooms, Armoury, offices for various departments of customs). Basements will mainly be for parking purposes. 2nd Basement will have electric services including ESS DG set & HVAC. The 3rd basement will have STP, UG Tank and Pump Room. The block will have three basements, podium, ground and 22 floors above it with provision for 7 additional floors further above it for future expansion.

The Office Building will cover 35.26%, Road Area 17.85%, Surface parking 4.82% and green area 42.08%. Project is estimated to have 5935 residential & 5935 floating population, a total of 11870. The layout plan of the project is given in **Fig 2.6 of Chapter 2**. Surface, Stilt and Basement Parking have been proposed. The parking proposed are for 2148 cars.

The construction will be carried out as per the standard technology for high rise buildings being followed in the country. The building will use reinforced cement concrete, light weight concrete brickwork, fly ash, steel, glass, insulation, etc. Building material like steel, aggregate, sand, cement, glass, etc. shall be used which are of indigenous origin.

11.2.2 Power and water Requirement

The power load requirement shall be around 10000 KVA for conduction of all kinds of activities on different land uses. Power will be sourced from Maharashtra State Electricity board(MSEB). 4 x 1010 KVA DG sets have been proposed for power back up.

Water requirement during construction phase will be met through tankers. Domestic water supply for construction workers will be also be sourced through municipal supply.

As per the initial estimation, the fresh water requirement for the proposed project will be 414 KLD during the operation phase. Fresh water requirement during the operation phase will be met from the Municipal Mains. The waste water after treatment shall be reused in the project. Thus, entire 285 KLD waste water generated will be treated and reused. After accounting for losses, 257 KLD waste water will be reused. Thus, total water required for the project will be 671 KLD.

11.2.3 Fire Fighting

Fire safety shall be taken into account and will follow all the safety norms and regulations which are provided by National Building Code and other related Indian Standards. All electrical cables will be underground and sophisticated modern electrical distribution system will be used, which will

further reduce risk of fire. It is estimated that 200 KL of water will be reserved separately for fire fighting purpose in the premises.

11.2.4 Sewerage, Drainage and solid waste

It has been assumed that about 80% of the domestic water shall reach the sewer as sewage. Hence, the sewage generated from the building shall be to the tune of about 285 KLD, which shall be treated in one of the centralized sewage treatment plant in the project.

Total municipal solid waste generation from the project has been estimated as 1.8 TPD. Solid waste segregation at source will be done in recyclable, biodegradable and non biodegradable solid waste. The recyclable waste shall be sold to recycling vendors while the organic and non biodegradable component shall be sent to the existing landfill site at Deonar.

The estimated quantity of e-waste, based on the present generation trend in India works out to be 0.66 kg/capita/year. Hence, for a total population of 5935, the e-waste works out to about 3.9 tonnes per year.

11.3 PRESENT ENVIRONMENTAL SCENARIO

The project area or core zone forms area of land acquired for the proposed project and includes the area covered by the proposed facilities. The 10 km radius around the proposed project forms the buffer zone i.e. the anticipated area of impact. The core zone and the buffer zone together have been termed as “study area” in this study. The study area in this case falls within Wadala, District Greater Mumbai, Maharashtra. The area falls in “Industrial zone” as per development plan of MMRDA.

11.3.1 Topography and Drainage

The ground elevation of the project area is minimum 28.314 m to 29.264 m with slope towards the southern side as per altitudes shown in Google Earth. The elevation of the ground surface in buffer zone varies between 0 m to 295 m above mean sea level as per altitudes shown in Google Earth.

There is no drainage, stream or nala passing through the core zone. A nala flows on the north as well as the south side of the project site at 25 m & 60 m, respectively. The area of the sea in 10 km radius is approximately 172 sq.km. which is approximately 44% of the total study area. On land, there are many water bodies in the study area.

11.3.2 Climate

The climate of Mumbai is characterized by an oppressive summer, dampness in the atmosphere nearly throughout the year, and heavy south-west monsoon rainfall. The cold season from December to February is followed by the summer season from March to June. The period from June to about the end of September constitutes the south-west monsoon season,

and October and November form the post-monsoon season. The normal annual rainfall over the district varies from about 1800 mm to about 2400 mm. The nearest India Meteorological Department's (IMD) station is at Santa Cruz situated at a distance of approximately 11 km to the North North West of the project area. Based on the data from there, it is observed that the average of minimum temperatures recorded ranges from 16.8°C in January to 26.3°C in May and the average of maximum temperature ranges from 29.6°C in August to 33.5°C in November. The rainfall data shows that the average monthly rainfall varies between 0.6 mm (January) to 799.7 mm (July). The average annual rainfall for the period from 1961 to 1990 was observed as 2258.0 mm. The relative humidity data shows that the average monthly humidity at 08:30 hrs varies between 60% (November) to 87% (August) and 17:30 hrs it varies from 47% (February) to 82% (July and August). The average relative humidity at 0830 hrs and 1730 hrs was observed as 72% and 63% respectively.

11.3.3 Micro meteorology

The micro-meteorology was monitored at site from Dec 2014 to February 2015. Temperature recorded at the site has a minimum value of 19.1°C, maximum value of 38.5°C and a mean value of 26.56°C, Relative humidity has a minimum value of 14.3%, maximum value of 100.0% and a mean value of 53.44% during the monitoring period. The wind speed varies between Calm to 24.1 km/hr with a mean wind speed of 8.5 km/hr and the observed predominant wind direction is from NNE with 30.16% of occurrences.

11.3.4 Ambient air quality

Ambient air quality was studied at four locations, one in the core and three in the buffer zone, namely HPCL Wadala, Gavanpada and Govandi. Twenty four hour average of PM_{10} was found to range from 90.1 to 156.2 µg/m^3, PM 2.5 was found to vary from 50.3 to 76.3 µg/m^3, SO_2 from 11.1 to 25.1 µg/m^3 and NOx from 32.3 to 61.3 µg/m^3. PM10 & PM 2.5 were found exceeding the limit due to industrial activities, urban activities and traffic.Two samples from the core zone were analysed for CO, Ozone, Ammonia, Benzo-a-pyrene, Benzene, Lead, Arsenic and Nickel.

11.3.5 Water environment and quality

There are no surface water bodies or streams in the core zone. Nalas flow on the north as well as the south side of the project site. The study area comprises of Arabian Sea, Thane Creek and Mahim bay. Arabian sea covers the entire south and some west side of the study area. The area of the sea in 10 km radius is approximately 172 sq.km. which is approximately 44% of the total study area. On land, there are many water bodies in the study area.

As per “Report on Geotechnical Investigation” by M/s DBM Geotechnics & Constructions Pvt. Ltd., ground water table in the core zone is 0.8-1.7 m bgl during November. The water level will decline during summer.

Water samples were collected from 3 ground water sources (Koliwara Village, HPCL Wadala, Gawanpada Village) in the study area. The analysis indicates that almost all the parameters in ground and surface water are within the permissible limit for drinking water (IS 10500).

11.3.6 Noise and traffic density

Noise levels (Leq. values) at the four monitoring stations (1 within the core area and 3 within study area) were observed in the range from 60.2 to 81.7 dB (A) during day and 51.3 to 69.4 dB (A) during night time. Noise levels observed at all stations exceeded the limits during day due to proximity to high traffic roads and day time activities. The traffic density survey was conducted on Eastern Freeway as well as on Sewri Chembur road (also known as Anik Wadala road) a weekend and a weekday. Total numbers of Passenger Car Units were found as 59938 and 38172, respectively on a weekday.

11.3.7 Land Use and soil quality

The land is currently unused, however, one existing structure admeasuring 1367.58 sqm., the demolition and site clearance of the same will be required before start of construction. The project area lies under Industrial zone (I3). Mumbai Metropolitan Region Development Authority has allotted the land of C.S No. 146 to the “Additional Commissioner of Customs (PG)”, Custom Enclave Cell for the development of Custom Office at the area.

The study area comprises 3 districts namely Mumbai suburban, Mumbai and Raigarh and it can be seen the majority (99.12%) of the area is urban i.e. area under non-agricultural uses. There is one village in Raigarh district. There is no land under the Census landuse headings of Land Under Misc. Tree Crops etc., Culturable Waste Land, Fallows Land other than Current Fallows and Current Fallows.

One top soil sample was collected and analysed from core zone. pH of the soil is neutral, the conductivity is normal, it is deficient in organic carbon, phosphorous, nitrogen, iron and potassium. he grain size analysis has been carried out for the sample and it was found that it is predominantly medium sandy as per IS classification and sandy loam as per USPRA Classification.

11.3.8 Ecology

The study area of Custom Office, Mumbai is predominantly urban. However, it has different kinds of habitats namely mangrove forest, tidal lagoon, mudflats, scrub, vegetation and roadside plantation also. Due to mangrove forest and mudflat region, it attracts a relatively good diversity of bird species which includes the long distance migrants coming from as far as

north of Arctic Circle. Avian predator like Black Kite is sighted in fairly good numbers in such type of habitats probably because of availability of food in good quantities. The near by areas also have fodder grass fields, woodland, saltpans and marshy areas which also attract substantial population of shorebirds, gulls and terns, and other aquatic and terrestrial birds.

There are many mangrove forests near the core zone, the nearest one being at 0.3 km. Nearest National Park is Sanjay Gandhi National Park located at a distance of 14 km, N.

The floristic survey reveals that project site is open land which is partly covered with *Typha angustata* grasses and some shrubs such as *Calotropis gigantea.* There are around six trees with in the project boundary, which are located on the southern and south western periphery. These are species of palm such as *Cocos nucifera*, *C.umbraculifera L.* and *Phoenix species* etc.

At the project site some species of butterflies, like common grass yellow, common Indian crow, grey pansy were found, while common birds like blue rock pigeon, black kites, house sparrow, house crow and Indian myna were dominant. Among mammals, common dog, rat and squirrel were observed.

11.3.9 Socio Economic Condition

The study area comprises of predominantly urban area with commercial, public and semi-public, utility area, government land, recreational, industrial, and residential area. As per Census 2011, the total population of study area is 6173856 that include 2828593 (45.82%) females and 3345263 males (54.18%). SC population is 412425 (6.68%) while ST population is 59603 (0.97%). Female population is lower than male population and there are 846 females per 1000 males. The overall literacy level is average (81.14%), out of which 45.43% are males and 35.71% are females.The average family size is 4 to 5 persons per family. only a small fraction, i.e. 0.31% of the total main workers depend on agriculture and 96.04% of them depend on other sources for their livelihood. Thus, the economy of the study area is dependent mainly on different type of services under government, private and industrial activities, trade and commerce, transportation, and other activities associated with urbanization.

11.3.10 Industries and Other Places of archaeological/Historical/Tourist/ Religious Importance

There are some 42 industrial establishments in the 10 km radius of the project. The nearest important establishments are Trombay Thermal Power Station (3.1 km, SE), BPCL- Mumbai Refinery (2.1 km, E) and the Hindustan Petroleum Refinery (2.8 km, E). There are 54 Historical/ Heritage/ Tourist Places and 15 popular places of worship in 10 km radius.

11.4 ENVIRONMENTAL IMPACT ASSESSMENT

11.4.1 Air environment

Impact: Dust emissions from non-residential and commercial construction are a function of the total area of land disturbed and the duration of activities done. Based on field studies, the AP-42 (Compilation of Air Pollutant Emission Factors***,*** US EPA, Section 13.2.3) gives the total suspended particulate emission factor estimate as 2.69 megagrams (Mg)/ hectare/ month of activity. During operation phase, sources of air pollution have been identified as vehicular traffic, DG sets, cooking and commercial activities. The highest ground level concentrations anticipated due to operation of DG sets are 0.28, 0.16, 3.30 and 5.71 µg/m^3 for PM10, PM2.5, SO_2 and NO_X, respectively, at a distance of 300 m from the DG stacks in W.

Mitigation: During construction phase, the dust generated by transportation activities will be mitigated by sprinkling, regular maintenance and prevention of spillage. Trucks shall be covered and optimally loaded. Roads will be made black topped/ concrete at the earliest and regularly maintained. During operation phase, routine stack emission monitoring for particulate matter will be carried out. Development of green belt to attenuate air pollution, conservation of present trees to the maximum possible extent and use of solar energy for meeting part of the street lighting requirement etc. will be done.

11.4.2 Water Environment

Impact: During construction phase, source of water pollution has been identified as domestic sewage generated from canteen, washrooms and toilets used by construction work force. During the construction phase, the excavated soil may be washed off during rainy season causing water pollution. However, this phenomenon of adverse impact will be short-lived and reversible. During operation phase, domestic wastewater comprising of wastewater generated from canteen, washrooms and toilets are the major source of water pollution.

Mitigation: During construction, the waste water generated by the labour will be managed by providing pre fabricated portable toilets ultimately leading to septic tank system for treatment. The septic tank will be periodically evacuated for disposal. To minimise the flow of solids in the runoff, major part of excavation and material handling will be done in non monsoon season and provision of garland drains and storm water drains with silt traps will be done. Therefore, no major quantity of waste water is anticipated from construction activities. During operation, sewage will be treated in centralised advance MBBR technology based STP located in the basement. Treated water will be used for softening and thereafter in HVAC. The reject from softening plan will be used in watering the green areas. Rain water harvesting is not feasible due to shallow water table. Measures for conservation of water have been proposed.

11.4.3 Land Environment

Impact: During construction, the irreversible impact on land will be limited to the construction footprint. The area outside the footprint can be disturbed due to storage, movement of vehicles, etc but can be restored or improved after completion of construction. On completion of the construction phase, the site will be converted into a well-planned modern office building with roads, planned green areas and parking. The proposed ground coverage evaluated for the office building purpose is 19,930 sq.m., which is 35.26% of the total plot area, green area will be about 42%, surface parking area will be 4.82% while roads will be 17.85%.

Mitigation: During construction phase, cut and fill technology shall be adopted to the extent possible. Excavated earth shall be utilized for filling within the project site and surplus shall be used for various land reclamation sites across Mumbai. Wherever possible, vegetative cover shall be immediately established on cut/ fill slopes.

11.4.4 Topography and drainage

Impact: The change in topography and drainage is unavoidable due to construction, landscaping and drainage lay-outing. Although no surface water body or seasonal stream is existing in the plot area, there shall be an impact on the sheet flow of the storm water runoff from the site.

Mitigation: The drainage of group housing shall be through scientifically designed storm water network system that will terminate into the existing natural nala outside the complex. The appurtenance works, such as manholes of convenient internals and gully pits at suitable locations have also been proposed. The storm sewers have been proposed only alongside the roads.

11.4.5 Ecology

Impact: The project site is covered with grasses and shrubs along with few trees on the boundary. There will be no requirement of disturbing the trees (cutting/ felling) since they are outside the building footprint area. Clearing of grasses and shrubs shall be carried out prior to construction and after construction, landscaping shall be done. No impact due to the proposed project are anticipated on the Sewri mudflats, which are a flamingo habitat. Since the project site is nearest to the Mangrove forest, hence, dust from construction activities can disturb the avifauna. Hence, the measures for mitigating air pollution and noise pollution have to be followed.

Mitigation: 23,783 sq.m. of land, which comprises about 42.08% of the total project area will be green area and shall be available for plantation, green belt and gardens. Also, areas along the roads within the project side shall be used for plantation of trees. Softening plant reject, in adequate quantity and suitable quality, will be available for watering the plantation. Fast growing, shady and fruit-bearing native species will be developed.

Total 331 trees will be planted immediately after completion of construction, within 2 months. Some species planned to be adopted for the proposed project are Gulmohar, Neem, etc. This will impart a significant positive impact on the ecology. Some measures such as provision of bird feeders, bird houses, water bath for birds are suggested so further value addition can be done to the greenbelt.

11.4.6 Noise

Impact: During construction phase, the noise will be generated due to operation of construction equipments. During operation phase, impact on noise level will be limited and increase mainly due to increased vehicular traffic.

Mitigation: During construction phase, mitigation measures proposed to keep the noise levels within the permissible limits include periodic maintenance and greasing of noise generating equipment and vehicles, provision of earmuffs to operators of high noise generating equipment, restricting the exposure time of individuals to higher noise levels, etc. During operation phase, plantation of trees on both sides of all roads as well as the green belt shall be developed for noise attenuation.

11.4.7 Traffic density

Impact: During construction phase, large quantities of construction material will be transported to the site. This will add to increase in traffic in terms of trucks carrying construction material on the road connecting the site. During operation phase, about 11870 people are expected to move in and out from the complex on daily basis. The movement of this population as well as transport of materials of daily consumption will add to the traffic.

Mitigation: There would be provision of different gates for entry and exit, parking on surface and basement with efficient movement pattern and sufficient space. Parking along the main arterial and sub arterial roads will be discouraged to avoid the congestion in movement.

11.4.8 Socio Economic Condition

The land has been allotted to the project proponent. There are no land losers or displacees from the project. Since there are no residents nor land losers in the project area.

During construction phase there will be an influx of workers in hundreds of numbers. Most of this labour force will be from the State, who will be paid their wages in cash. To ensure health and safety of the workers during construction, effective provisions for the basic facilities of sanitation, drinking water, safety of equipments or machinery etc. shall be made.

During operation, proponent will also undertake CSR activities which are leading to overall improvement.

11.4.9 Solid Waste

Impact: During construction phase, material from excavation of the basement, roads and underground services, will be there. During operational phase, the expected total domestic solid waste generation will be around 1.8 tonnes/day.

Mitigation: Almost 55% of the cut material shall be used for filling within the project site itself. The balance may be used in various land reclamation sites across Mumbai. Recyclable waste, such as iron will be sold to recycling vendors. Remaining waste shall be collected and disposed off in designated land fill site. In operation phase, solid waste generated from the buildings will be collected by sweepers of the maintenance agency by going from room to room. Storage system of solid waste will include the movable bins of 1.5 cum capacity. Out of the total waste about 57% will be compostable, 5% will be recyclable waste (sold to recycling vendors) and 38% of waste will be sent to landfill site. Various types of hazardous and e-waste (3.9 tonnes per year) will be collected separately for transportation to the authorized recyclers approved by the state/ central pollution control boards.

11.4.10 Energy conservation

Lighting and natural ventilation in the buildings and dwelling units during day time shall be ensured by sunlight through designs and orientation. Solar photo voltaic lighting shall be provided for street/ road lighting. Landscape lighting by photo voltaic is estimated to save 58% of the street lighting power requirement. Users of the premises will use blinds or curtains for appropriate energy efficient operations. In the case of lighting, dimming control systems can also be used to adjust for daylight available. Energy efficient appliances and devices shall be used. They shall be with higher star ratings from BEE.

11.5 ALTERNATIVE TECHNOLOGIES

Since the plot is an allotted one, alternative site analysis has not been carried out. The proposed site is well connected through road and rail to the rest of the city. Provision for drainage facilities and potable water is there. The environment friendly technological alternatives has been considered for the given project with regard to construction material, layout, orientation, cooling, heating, vertical fenestrations, etc. The proponent will also comply to the norms of MoEF. Use of alternative technologies for each component of the buildings of envelope, superstructure, finishes and the road and surrounding areas are proposed which includes Brick and block products of fly ash, micro-concrete roofing tiles, use of renewable timber for doors and windows, steel manufactured from recycled content, aluminium from verified recycled content, PVC doors and windows in select places in the complex, finishes using Ceramic tiles or Terrazzo floors at select locations.

11.6 ENVIRONMENTAL MONITORING PROGRAMME

To evaluate the effectiveness of environment management programme, regular monitoring of the important environmental parameters will be taken up. The capita cost likely to be incurred towards implementation of Environment Management Plan depicts will be Rs. 805.0 lakhs and monthly the recurring cost will be approximately Rs 133.6 lakhs.

11.7 ADDITIONAL STUDIES

R&R action plan is also not applicable for this project as the land has been allotted. There is no displacement.

The risks assessed for the project with respect to the occurrence of disasters includes natural disasters like earthquake, flood, cyclone, landslide, tsunami and drought and manmade disasters like fire, chemical hazard, accidents. The study area falls within seismic zone III as per seismic zone map of Indian Standard IS 1893-1984. Therefore, at the time of designing and construction of the buildings, the design parameters shall be considered in compliance with IS 1893-1984 (Criteria For Earthquake Resistant Design of Structures) with due consideration of prevailing housing construction & development guidelines together with National Building Code. Several areas in Mumbai are prone to floods. Fire safety will be taken into account and all the safety norms and regulations which are provided by National Building Code and other related Indian Standards will be followed. All electrical cables will be underground and sophisticated modern electrical distribution system will be used, which will further reduce risk of fire.

During construction, workers shall be provided with personnel protective equipment like hard hat, safety boots, rubber boots, gloves, goggles, aprons, welders glass, ear muffs, etc as per requirement. During operation, proper arrangements shall be made at all identified accident-prone areas in terms of signal, signage, speed breaker and design consideration. A disaster management cell will be established, which will take care of post disaster. The disaster management plan identifies the risks to the building at site and addresses facility emergency response and recovery plans for building utilities, systems and services.

11.8 PROJECT BENEFITS

The main benefit of the project will be in terms of provision of a modern office complex for easier operations of the Custom House. The other benefits envisaged are employment for work force required for construction and operation of the proposed project. Direct employment during operation phase will include service providers like cleaners, sweepers, maintenance people for various aspects of the project, etc. in addition to highly skilled employees attending office everyday. During operation phase, indirect employment will be created by the project for supply of daily goods. The proponent will also undertake corporate social responsibility activities.

11.9 CONSULTANTS

The consultants engaged for the preparation of the EIA/EMP of the project are Min Mec Consultancy Pvt. Ltd. Company. It was registered in July 1983 with the Registrar of Companies, Delhi & Haryana, India. In 1994, Min Mec established a modern R & D laboratory. Min Mec is ISO 9001: 2008 certified under ANZ-JAS. In June 2006, the laboratory received accreditation from NABL, which has been renewed as per procedure since. In 2012, it has been recognized under Environment Protection Act (EPA) by Ministry of Environment & Forests, Government of India. M/s SGA Design Lab, New Delhi are the architect-planners and have prepared the Design Basis Report. “Report on Geotechnical Investigation” has been prepared by M/s DBM Geotechnics & Constructions Pvt. Ltd. CRZ survey has been done and maps & report prepared by Institute of Remote Sensing, Anna University, Chennai.

CHAPTER 12

DISCLOSURE OF CONSULTANTS ENGAGED

The consultant engaged for preparation of EIA/EMP of the project are Min Mec Consultancy Pvt. Ltd. The information about the company is as follows:

Introduction

Min Mec provides services in the field of environmental impact assessment and management for all types of industries (chemical, petrochemical, hazardous industries, power stations, infrastructure projects, on-shore and off shore, cement and mines), risk analysis, disaster management, environmental health and safety auditing, socio-economic studies, mine planning and engineering software development. Min Mec conducts studies of international standard such as those for IFC (World Bank) and CIDA sponsored projects and of national standards of MoEF.

Min Mec Consultancy Pvt. Ltd was registered in July 1983 with the Registrar of Companies, Delhi & Haryana, India. In 1994, Min Mec established a modern R&D laboratory. On 02.02.2003, Min Mec received ISO 9001 certification under ANZ-JAS. In June 2006, the in-house laboratory 'Min Mec R&D Laboratory' received certification from NABL (Certificate No. T-1157). In 2012, lab has been recognised under Environment Protection Act (EPA) by Ministry of Environment and Forests, Government of India (Sl. No. 97).

Services and expertise

Services are provided to the following sectors

- Infrastructure projects such as new construction projects, jetties, highways, water supply pipelines projects, power stations, canals, minor dams, etc.
- Industries such as cement plants, smelters, chemicals, pharmaceuticals, petrochemicals, salt works, pesticides and other hazardous and polluting industries.
- Mines- surface and under ground for all minerals and metals

As on 31.12.2014, the following projects have been executed:

Studies	Numbers
EIA, EMP & Environmental Studies	355
RA & DMP	17
EHS	4

Studies	Numbers
Socio Economics	13
Feasibility studies (sponge iron & power plants)	40
Pre Feasibility studies (coal blocks)	43
Market surveys	8
Mine Planning and Detailed Project Report	114
Regional Studies	2
Hydro- geological & hydrological studies	56
Others (due diligence, land acquisition study, forest proposal, compliances, softwares etc.)	21

Personnel

Min Mec has a strong team of in-house & panel experts in EIA, EMP, DMP, RA, EHS, mining, socio economics and software development. The team of experts is supported by a panel of experts comprising of over twenty specialists in various fields with an average experience of over 30 years.

Team engaged

Role	Expert Name	Qualifications	Experience
Team leader & EC Core FAE- WP, SE, SHW, SC Supporting FAE- AP, AQ, LU, NV, HG	Dr. Marisha Sharma	Ph.D., M. Plan (Env.), BE (Civil),	Since 2001, experienced in preparation of EIA/EMP for mines, thermal power plants, steel plants, new construction projects, townships, etc. Certified Energy auditor & visiting faculty to School of Planning & Architecture. Expertise provided in water balance, water budgeting, water conservation, waste water treatment, supervising water and waste water sample collection and analysis, impact on water resources, overseeing census data processing, site surveys, R&R planning (if applicable), impact on soil and its management, municipal and industrial solid waste management. Guidance in land use analysis, mathematical modelling of air, hydrogeological studies, impact on noise and air.

Role	Expert Name	Qualifications	Experience
Core FAE- AP, AQ, HG, RH Supporting FAE- SHW, NV, GEO	B. D. Sharma	M. Tech (Hons), B. Tech (Min.), PG Diploma (Env. & Ecology)	Since, 1973 active in mining sector and allied activities (washeries, beneficiations, pit head industries like cement, power, etc.) with 29 years in environmental impact assessment, management and planning with over 300 projects executed. Identifying and assessing quantum of emissions and guiding computer based modelling, impact on ground water, water budgetting, water balancing, identification of hazards and hazardous substances, risk analysis and preparation of on-site emergency preparedness plan.
Core FAE- EB, AP, WP Supporting FAE- SHW, NV	Rashmi Gupta	M.Sc. (Environment)	Since 2006, experienced in ecology and biodiversity, ecological surveys and preparation of flora - fauna lists, wildlife conservation plan (if required), environmental data interpretation and preparation of EIA/EMP report.
Core FAE- AP, AQ, NV Supporting FAE- EB	M.S. Yadav	M. Sc. (Environment)	Since 1995, experienced in survey data processing, Census data analysis, identifying and assessing quantum of emissions, computer based impact prediction modelling for air (including GLC mapping), noise modelling, meteorological data processing, etc.
FAE- GEO, LU, HG	Puneet Shukla	M.Sc. (Geology)	Since 2012, experienced in geological mapping, assisting in mines operation, quality control, document updation of running mines, hydrogeological monitoring and landuse interpretation and mapping.

Role	Expert Name	Qualifications	Experience
FAE-WP, AP, LU, NV, RH	Jyoti Kumar	B. E. (Biotech), M. Tech (Energy & Env. Management), PGD in Industrial Safety & Management	Since 2011, experience in preparation of documentation for environmental clearance, selection of monitoring stations, water sampling & analysis, air sampling & analysis, landuse interpretation, Noise measurements and impact prediction, assisting in risk analysis and hazard assessment, etc.
FAA- AP, WP, AQ	Piyush Gupta	B.Tech (Biotechnology), M. Tech (Env. Engineering), Diploma Industrial Safety	Since 2014, assisting in preparation of documentation for environmental clearance, water quality data analysis, air quality data analysis, selection of air quality stations, air quality modelling, water resource calculations, coordination with laboratory, etc.

As per Circular no. F. No. J-11013/77/2004-IA II (I), dated 30th September 2011 of MoEF&CC, Min Mec is listed at serial no. 7 in List 'B. Min Mec is preparing and presenting reports as per the High Court of Delhi orders dated 03.02.2014, 14.03.2014, 13.05.2014, 14.08.2014, 13.11.2014, 06.02.2015, 25.05.2015, 04.09.2015, 01.12.2015, 23.02.2016, 11.07.2016 in LPA 110/2014 and CM No.2175/2014 (stay) & order dated 03.05.2016 & 12.08.2016 in WP(C)3665/2016 (Copy given in **Annexure XIX**).

Other Agencies/ Consultants involved

1. M/s Min Mec R&D Laboratory has collected baseline data through primary surveys for micro-meteorology, air quality, water quality, soil quality, noise levels and traffic density. The laboratory is accredited by NABL (Certificate No. T-1157) and recognised under Environment Protection Act (EPA) by Ministry of Environment and Forests, Government of India (Sl. No. 97). Copies of Certificates given in **Annexure XX**.
2. M/s SGA Design Lab are the architect-planners and have prepared the Design Basis Report.
3. "Report on Geotechnical Investigation" has been prepared by M/s DBM Geotechnics & Constructions Pvt. Ltd.
4. CRZ survey has been done and maps & report prepared by Institute of Remote Sensing, Anna University, Chennai.

ANNEXURES

Item No.06 Application for EC of proposed expansion within the campus premises of University of Mumbai on land bearing CTS No. 4094, Vidyanagari Campus, Kalina, Mumbai by **M/s University of Mumbai**

PP informed that they have undertaken construction of about 84,000 m^2 without prior EC.

During discussion following points emerged:

1. After deliberation, Committee in view of the OMs of MoEF dated 12/12/2012 & 27/6/2013 and order of NGT given in the appeal No. 72 of 2013 and 73 of 2013 dated 26/09/2013 decided that construction prior to EC is violation of the provisions of EIA Notification.

2. Hence, Environment Department/ SEIAA, after due verification, may initiate credible action for alleged violation under Environment (Protection) Act, 1986 as per the OM dated 12th December, 2012 and OM dated 27th June 2013 issued by MoEF. Further, the proposal will be appraised only after due examination and appropriate action taken by the SEIAA /Environment Department in accordance with OMs issued by MoEF.

In view of above, the proposal is referred for action on alleged violation as per the OMs of MoEF dated 12/12/2012 & 27/6/2013 and order of NGT given in appeal No. 72 of 2013 and 73 of 2013 dated 26/09/2013 to SEIAA/ Environment Department and shall be considered further after the above observations are addressed and submitted for reconsideration.

Item No.07 Application for expansion of existing project "CIDCO Exhibition Centre" by **M/s CIDCO Ltd.**

The PP was absent; hence the project is deferred.

Item No.08 Application for EC for the construction of Office Complex at Customs Enclave (Suleman Shah Plot), Wadala (East), Mumbai by **M/s Assistant Commissioner of Customs CEC/ Mumbai**

The proposal was discussed on the basis of the draft ToR as presented by the PP. All issues related to environment, including air, water, land, soil, ecology and biodiversity and social aspects were discussed. PP stated that total plot area is 56,523.13 m^2. Total construction area of the project is 2,57,273.6 m^2. Committee appraised the project under 8a (B1) category of EIA Notification, 2006.

After discussion, ToR presented by PP was approved subject to compliance of the following:

1. PP to submit distance of the project site from the freeway and measures to reduce noise and air pollution impacts of the traffic of freeway on the project
2. PP to submit details of the risk assessment and air quality modelling considering the oil refineries and TATA power project which are in vicinity. Identify hazards of this establishment on the proposed project.
3. PP to submit CRZ map superimposed with building layout plan. Further, PP to submit copy of prior recommendations of MCZMA
4. PP to submit impacts of proposed activities on flamingo's habitat at Sewri Wadala.
5. PP to submit details of the parking plan and parking space as per the NBC norms proposed in the project.
6. PP to ensure that width of the internal road should be of minimum 9 m.
7. PP to submit details of the ventilation system and air pollution control system in the parking basement.
8. PP to submit details of the time bound green belt development plan indicating type of the species.
9. PP to submit Disaster Management Plan approved from competent Authority.
10. PP to submit Waste water treatment and management plan.
11. PP to submit energy simulation studies for the project.
12. PP to submit details on renewable energy and energy saving calculations of the project. PP to also ensure that at least 20% of the energy source should be from the renewable energy.
13. PP to submit Environment Management Plan specific to the project.
14. PP to submit IOD, CC or any other permissions indicating that proposed development as per the prevailing development plan.
15. PP to submit measures to reduce carbon footprint & heat island effects.
16. PP to submit light and ventilation analysis for all buildings.
17. PP to leave clear cut side margin of 6 m from the boundary of the plot and open space and non-paved RG area should be on ground as per the orders of Hon'ble Supreme Court (Civil Appeal No. 11150 of 2013 and SLP (Civil) No. 33402/2012) dated 17th December 2013.
18. PP to also refer ToR attached as "Exhibit-A" in addition to above.

Annexure-A : Terms of references

Site analysis

(i) Examine in detail the present status of the project site, site clearance strategy, debris quantification, segregation of the demolition waste and quantification, disposal strategy in consonance with the prevailing rules.

(ii) Submit development strategy, phasing of the project along with infrastructure and facilities / utilities. Detailed total station map indication plot boundary, construction area boundary, green area boundary, etc

(iii) Submit excavation details, quantity of excavated material, top soil quantity and its preservation.

(iv) Examine in detail the site with reference to impact on infrastructure covering water supply, storm water drainage, sewerage, power, etc., and the disposal of treated/raw wastes from the complex on land/water body and into sewerage system.

(v) Examine in detail the carrying capacity of existing sewer line, drains etc.

(vi) Examine details of land use around 2 km radius of the project site. Analysis should be made based on latest satellite imagery for land use with raw images.

(vii) Study and submit details of environmentally sensitive places, rehabilitation of communities and present status of such activities.

(viii) Examine baseline environmental quality along with projected incremental load due to the project. Environmental data to be considered in relation to the community development would be (a) land, (b) groundwater, (c) surface water, (d) air, (e) bio-diversity, (f) noise due to the traffic, (g) socio economic and health etc.

(ix) Study the socio-economic situation of the project area and its surroundings and their impact on the project design and operation. Socio impact Assessment studies (SIA) shall be carried out specific to the project area. PP shall take into confidence / consent people residing in the project and surrounding area and objections / suggestions if any received may be submitted to SEIAA / SEAC-II.

(x) Examine topography rainfall pattern, soil characteristics, and soil erosion.

(xi) Study the hydrological and geo-hydrological conditions of the project area. Including a contour plan indicating slopes and showing drainage pattern and outfall. Examine in detail the carrying capacity of existing storm water drainage line. Possibility of flooding in and around the project site.

(xii) Storm water drainage and outfall may be described through contour map and slopes of the project area and its surroundings.

Water

(xiii) Examine the details of water requirement, use of treated waste water and prepare a water balance chart.

(xiv) Rain water harvesting proposals should be made with due safeguards for ground water quality, aquifer level, soil permeability, justification for suitable / appropriate rain water harvesting method and details of the selected option indicating locations on the project map.

(xv) Maximize recycling of water and utilization of rain water. Examine details.

(xvi) Examine soil characteristics and depth of ground water table for rainwater

harvesting.

(xvii) STP and water treatment plant should not be near each other. Indicate their locations with area details on the map. Also provide justification for the technology selected on the site and examine sustainable operation of the infrastructure.

Solid Waste Management

(xviii) Examine details of Solid waste generation, type and quantity, treatment and its disposal.

(xix) Common facilities for waste collection, treatment, recycling and disposal (all effluent, emission and refuse including MSW.)

(xx) Examine the location of solid waste treatment and disposal sites.

Flora and fauna

(xxi) Study the existing flora and fauna of the area and the impact of the project on them.

Energy

(xxii) Since the project is a building construction and area developmental activities, examine electrical load, energy conservation measures etc. and saving in energy.

(xxiii) Examine and submit details of use of solar energy and alternative source of energy to reduce the energy consumption.

(xxiv) 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.

(xxv) Provide for conservation of resources, energy efficiency and use of renewable sources of energy in the light of ECBC code. Application of renewable energy/alternate energy, such as solar energy, wind energy may be described with detailed analysis and exploring the possibility of such installations.

Traffic and transportation

(xxvi) A detailed traffic and transportation study should be made for existing and projected passenger and commercial traffic as the project is a mixed development including residential and commercial development.

(xxvii) Examine the details of transport of materials for construction which should include source and availability.

(xxviii) The evaluation of impacts should be analyzed depending upon the nature (positive and negative), duration (short term and long term) reversibility, and magnitude (negligible, low, medium, high), etc. of the impacts based the objective assessments.

(xxix) 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.

(xxx) Traffic management plan including parking areas may be described. Traffic survey should be carried out on week days and week end.

Air and Noise

(xxxi) Examine and submit details of Air quality monitoring as per latest National Ambient Air Quality standards as notified by the Ministry on 16th November, 2009.

(xxxii) Examine and submit the details of Noise modelling studies and mitigative measures.

(xxxiii) Examine noise levels - present and future with noise abatement measures.

(xxxiv) Noise pollution has always been a major concern for developmental projects during the construction and operational phase. It is suggested that noise monitoring should be carried out at critical locations at the surrounding areas may be incorporated in environmental monitoring programme during the whole operational phase of the project.

(xxxv) Natural and artificial noise barriers may be considered for critical locations.

(xxxvi) A thick green belt should be planned all around the project site to mitigate noise and vibrations to the nearby settlements. The identification of species/plants should be made based on the botanical studies.

(xxxvii) Landscape plan, green belts and open spaces may be described.

(xxxviii) Examine the details of afforestation measures indicating land and financial outlay.

Building materials

(xxxix) Use of local building materials should be described. The provisions of fly ash notification should be kept in view.

Disaster Management Plan

(xl) Risk assessment and disaster management plan should also include Fire, Earthquake, local floods, and any other natural disaster.

Environmental Management and monitoring Plan

(xli) Environmental Management Plan should be accompanied with Environmental Monitoring Plan and environmental cost and benefit assessment. Examine separately the details for construction and operation phases both for Environmental Management Plan and Environmental Monitoring Plan.

(xlii) Make assessment of any regulatory measure in view of the environmental and social impacts of the project (such as unauthorized development in and around the area).

Corporate Social Responsibility

(xliii) Submit the details of CSR activities. Provisions shall be made for education, health and vocational training programs.

Other details as indicated in Appendix III of EIA Notification 2006 should also be attended.

A detailed draft EIA/EMP report should be prepared as per the ToR and should be submitted to the SEIAA /SEAC, MMR as per the Notification.

ANNEXURE : II

Maharashtra Regional and
Town planning Act, 1966.

Development plan of
F/North ward of Greater
Mumbai,1991.
Deletion of reservation
Under section 50 of the.....

GOVERNMENT OF MAHARASHTRA
Urban Development Department
Mantralaya ,Mumbai 400 032.
Dated 14th March 2005.

NOTIFICATION

Read : -

1. Chief Commissioner of Customs letter No. F.No. S/43-91/82 Bldgs/ Pt. E dt. 16/03/2004
2. Asstt. Commissioner of Custom's letter No. F.No. S/43-91/82 Building (Pt. E) dt 5/01/2005.

No. TPB-4304/608/CR 308/2004/UD-11

Whereas the Development Plan of "F/North" ward of Greater Mumbai(hereinafter referred to as "the said plan") has been sanctioned by the Government under section 31(I) of the Maharashtra Regional and Town Planning Act, 1966(hereinafter referred to as "the said Act") vide Urban Development Department's Notification no. TPB 4391/2361/CR-130/91/UD-11/RDR dated 2/1/1992 to come in to force with effect from 17/2/1992.

And whereas, the land bearing C.S. No. 146 of Salt Division (herein after referred to as " the said land) is partly reserved for the public purpose of "Custom Godowns" and partly earmarked as green Belt (2 location) (hereinafter referred to as " the said reservation") in the said plan.

And whereas, the Customs Department, the owner of the said land vide their above letter requested Government that on the said lands Department is in need to construct office as well as residential accommodation in addition to the Godown wing to acute shortage being faced by the customs department. The mixed land uses are not permissible due to the reservation of Custom Godowns therefore requested Government to delete the part reservation of the Custom Godown.

In view of the above fax Government find of necessary to delete the said lands from the said reservation (mode specifically shown on the plan appended hereto) in view of the power vested under section 50 of the said act, the Government hereby.

A) Sanctions the proposal of deletion thereby deleting the reservation of "Customs Godowns" save land as mark A-B-C-D-E-A in the plan appended hereto.

B) The land deleted from reservation shall be developed for the Construction of office and residential accommodation for the Custom Department as per the development control regulation for Greater Mumbai with due approval of concerned authority /department .

C) Fixes the date of publication of this notification in the official Gazette(Ordinary)as the date of coming in to force of this modification .

D) Directs the said corporation that in schedule of modification sanctioning the said plan after the last entry the above referred (A) shall be added.

By order and in the name of the Governor of Maharashtra

(S.R. Kini)
Under Secretary to Government

Note : This Notification is also available on Gov. Web site www.urban maharashtra .gov.in

MUMBAI METROPOLITAN REGION DEVELOPMENT AUTHORITY

ENGG/MUIP/JNNURM/EFW/ [illegible] /10

Engineering Division
Date: 16/04/2010

To,
Additional Commissioner of Customs (PG)
Custom Enclave Cell
New Custom House
Ballard Estate,
Mumbai – 400 001.

Sir,

Sub.: Handing over the land of C. S. No 146 Custom Enclave plot for Eastern Freeway project from Prince of Wales Museum to Anik Junction (Start of APER)

Ref.: 1) Joint Metropolitan Commissioner's D.O. letter no. ENGG/MUIP/JNNURM/EFW/63/10 dated 10/2/2010.

2) Addl. Commissioner of Customs (PG) Mumbai's letter no. F. No.S/43-91/82 Bldg (MMRDA) dated 24/02/2010.

3) Addl. Commissioner of Customs (PG) Mumbai's letter no. F. No. S/43-91/82-Bldg. (MMRDA) dated 11/03/2010.

4) Commissioner of Customs (General), Mumbai's letter no. F. No. S/43-91/82-Bldg (MMRDA) dated Nil (Fax received on 24/03/10)

At the out set, let me express may gratitude for allowing us to develop the strip of land in Customs area for stacking of segments. The reply to the demands put forth by the Customs including methodology of granting and issuing TDR/F.S.I. is given vide letter under reference no.1. Further clarification to the queries made vide letter under reference no.2, 3 & 4 is as under.

As informed earlier, the area of Customs land required for Eastern Freeway project is 11936.69 sqmt. for 60m D.P width. Meanwhile, it is communicated by Customs vide letter under reference no. 4, that triangular plot area admeasuring 12764.548 Sqm. cannot be utilized for huge departmental construction project. Further it is asked to examine possibility of shifting of alignment or otherwise to handover equivalent area adjacent to Customs land.

Regarding shifting of alignment of Eastern Freeway to avoid Customs plot, various alternatives are tried upon, but it is found that, in any case it is not possible to shift the alignment outside Customs area. All the alternative alignments were discussed in various meetings with Customs officials and finally it was concluded that

the existing alignment [illegible] is the most [illegible] and efficient alignment. Therefore, at this juncture it is not feasible to shift the proposed freeway from Customs land to other place.

As far as handing over of equivalent land near Customs plot is concerned, it is to clarify that, there is no land which belongs to MMRDA adjacent to Customs area or in the vicinity.

However, the MMRDA has given thought to minimize the requirement of land in Customs area by way of reducing strip of land to 38.2 m width instead of 60 m width. Thus the area required in the Customs land works out to be 8375sq m instead of original 11946.69sq.m. The area of the remaining triangular portion now becomes 14152.84 Sqm as against 12764.548 Sq m. This area will be adequate for utilization and MMRDA will recommend MCGM to revise D.P width in Customs area from 60 m to 38.2 m.

As property/land under reference is falling in E-North ward i.e. in Island City and as per the D.C. Regulation No.32 of Greater Mumbai – 1991, the permissible F.S.I. for island city is 1.33. Hence, the compensation i.e. F.S.I. to be granted will be 1.33 times area acquired for construction of Eastern Freeway subject to the land use as per D.C. Rules and permissible F.S.I. specified for the land use. Therefore, the compensation to be given in terms of F.S.I. will be 1.33 times of the land acquired for construction. The F.S.I. will be released by MCGM as per MMRDA's recommendation.

Here, I would like to reiterate that, as per existing procedure, MMRDA recommends to grant the requisite F.S.I. to the MCGM, who are authorized to grant the F.S.I., as the Planning Authority. MMRDA will recommend MCGM to grant you the F.S.I. as soon as the land is transferred to MMRDA. This F.S.I. can be utilized by the Customs department in the surrounding land belonging to them. With the grant of equivalent F.S.I., effectively there will not be any loss to the Customs department in terms of availability of constructable land.

The preferred mode of compensation adopted by MMRDA as per the R & R policy being followed for various infrastructure projects in the region is granting of F.S.I. equivalent to the land area required for the project unless the entire land is acquired and no land is available for consumption of F.S.I. so generated. Since, MMRDA requires only a small portion of the total land belonging to Customs, we

F.S.I. generated on account of transfer of this land can be very much utilized in the remaining land keeping the utility of the land in tact.

There is a facility of conversion of the said F.S.I. into T.D.R. which is saleable in the market. The department can consider either of these options as per their requirement.

I hope this brings adequate clarity in the matter.

I, once again, request you to clear the proposal at the earliest as the work of Eastern Freeway is in full swing and likely to be completed by targeted date. I also request to allow contractor's vehicles for transportation of segments through Customs gate for stacking the same in the land strip required for Eastern Freeway as agreed upon by the Commissioner, Customs in the recent past.

The drawing showing revised areas is enclosed herewith for perusal and record.

Thanking you,

(Ashwini Bhide)
Joint Metropolitan Commissioner
MMRDA.

Encl. One drawing

DAILY AVERAGE OF MICRO-METEOROLOGICAL MONITORED DATA (1 DECEMBER, 2014 TO 28 FEBRUARY, 2015)

DATE	CALM	<---------- DIRECTION WISE AVERAGE WIND SPEED (km/hr) EXCLUDING CALM ---------->															TEMP.	REL_HUM
	<1.8kmph	E	ENE	NE	NNE	N	NNW	NW	WNW	W	WSW	SW	SSW	S	SSE	SE	ESE	(øC)	(%)
01/12/2014	0.00	12.99	6.83	0.00	9.27	8.67	0.00	11.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.00	28.85	39.00
02/12/2014	0.00	11.12	9.30	5.60	6.50	5.60	7.40	0.00	16.70	14.85	0.00	0.00	0.00	0.00	0.00	9.30	11.15	29.15	41.00
03/12/2014	0.00	7.43	7.45	0.00	0.00	9.30	9.75	14.80	12.97	0.00	0.00	0.00	0.00	5.60	5.60	0.00	11.10	29.10	49.00
04/12/2014	0.00	8.92	9.30	8.35	0.00	8.67	8.35	7.40	7.40	18.55	0.00	0.00	0.00	0.00	0.00	0.00	6.50	29.04	52.00
05/12/2014	0.00	7.97	7.40	0.00	0.00	5.60	11.10	11.10	16.70	14.80	0.00	0.00	0.00	0.00	0.00	11.10	10.23	29.65	41.00
06/12/2014	0.00	10.50	5.60	12.05	0.00	10.65	9.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.60	7.40	14.80	29.20	45.00
07/12/2014	0.00	7.43	7.40	5.60	0.00	0.00	9.25	0.00	0.00	12.95	19.45	0.00	0.00	0.00	7.40	6.50	7.40	28.52	46.00
08/12/2014	0.00	9.30	0.00	0.00	7.40	0.00	9.25	10.20	11.10	14.80	0.00	0.00	0.00	5.60	7.45	7.45	7.40	28.58	46.00
09/12/2014	0.00	0.00	7.40	7.40	6.80	0.00	9.25	0.00	12.97	13.00	0.00	0.00	0.00	0.00	9.30	7.40	0.00	28.28	51.00
10/12/2014	0.00	5.60	0.00	0.00	7.43	6.80	0.00	9.27	13.00	14.80	13.00	0.00	0.00	0.00	0.00	9.30	0.00	28.42	59.00
11/12/2014	0.00	0.00	0.00	5.60	0.00	5.60	0.00	0.00	8.35	11.13	0.00	0.00	13.00	5.60	0.00	7.45	5.60	28.41	64.00
12/12/2014	0.00	4.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.86	14.20	7.40	0.00	0.00	9.30	0.00	6.20	28.47	80.00
13/12/2014	0.00	9.27	0.00	0.00	0.00	7.40	5.60	8.83	11.10	14.80	0.00	14.80	0.00	11.10	11.10	7.40	11.10	26.97	79.00
14/12/2014	0.00	0.00	9.30	0.00	6.83	8.33	13.45	11.86	19.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.89	50.00
15/12/2014	0.00	7.40	0.00	12.05	10.20	9.03	5.60	13.00	13.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.76	38.00
16/12/2014	0.00	18.26	14.13	14.35	11.10	0.00	7.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.57	36.00
17/12/2014	0.00	18.32	16.94	16.07	9.30	0.00	7.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.73	40.00
18/12/2014	0.00	15.09	12.05	9.25	9.90	9.30	10.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.40	0.00	13.90	25.49	39.00
19/12/2014	0.00	16.65	12.70	14.20	13.00	9.87	9.30	14.80	9.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.97	34.00
20/12/2014	0.00	12.35	0.00	7.43	0.00	5.60	0.00	7.43	0.00	9.30	0.00	0.00	0.00	0.00	0.00	0.00	7.40	26.20	46.00
21/12/2014	0.00	9.90	13.00	9.30	0.00	9.27	0.00	7.40	12.97	17.60	0.00	0.00	0.00	0.00	0.00	0.00	5.60	26.71	48.00
22/12/2014	0.00	7.90	11.10	7.40	7.40	0.00	8.03	7.40	13.00	10.50	0.00	0.00	0.00	0.00	0.00	6.50	7.40	26.33	49.00
23/12/2014	0.00	5.60	0.00	0.00	5.60	0.00	6.50	8.35	14.80	14.83	11.10	0.00	0.00	5.60	0.00	0.00	0.00	25.68	54.00
24/12/2014	0.00	5.60	11.10	7.40	0.00	0.00	7.45	11.10	14.85	10.20	14.80	0.00	0.00	0.00	0.00	0.00	0.00	25.65	60.00
25/12/2014	0.00	0.00	0.00	6.50	6.50	0.00	8.07	0.00	11.15	13.90	0.00	0.00	0.00	5.60	5.60	7.40	13.00	26.35	59.00
26/12/2014	0.00	12.53	8.67	8.67	7.40	5.60	14.80	14.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.75	48.00
27/12/2014	0.00	18.30	19.77	0.00	7.40	0.00	7.45	0.00	13.90	0.00	0.00	0.00	0.00	0.00	0.00	10.20	14.80	25.86	39.00
28/12/2014	0.00	11.50	9.30	9.30	0.00	6.50	8.35	9.30	0.00	16.70	0.00	0.00	0.00	0.00	0.00	8.35	14.83	25.40	42.00
29/12/2014	0.00	11.10	14.80	7.40	13.00	5.60	5.60	11.10	12.53	13.90	0.00	0.00	0.00	0.00	5.60	0.00	0.00	25.88	44.00
30/12/2014	0.00	5.60	0.00	0.00	0.00	0.00	0.00	5.60	11.10	15.53	11.10	7.40	0.00	0.00	5.60	7.40	7.40	24.51	67.00
31/12/2014	0.00	7.40	0.00	0.00	8.35	14.80	13.57	14.80	14.23	18.50	14.80	0.00	0.00	0.00	0.00	0.00	0.00	24.76	57.00
01/01/2015	0.00	7.40	5.60	0.00	6.05	0.00	0.00	5.60	12.62	13.60	0.00	0.00	0.00	0.00	0.00	7.40	7.45	24.25	53.00
02/01/2015	0.00	0.00	7.40	5.60	8.07	0.00	9.30	11.10	12.05	14.80	13.00	11.10	0.00	0.00	0.00	0.00	7.40	24.26	66.00
03/01/2015	0.00	0.00	0.00	7.40	0.00	9.30	9.90	7.40	13.00	15.28	16.70	0.00	0.00	0.00	0.00	9.30	0.00	24.72	66.00
04/01/2015	0.00	5.60	12.37	0.00	7.43	9.73	13.90	14.80	17.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.90	62.00
05/01/2015	0.00	20.38	16.68	11.73	10.68	8.35	9.30	11.13	16.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.27	53.00
06/01/2015	0.00	0.00	0.00	8.35	0.00	5.60	0.00	4.65	12.37	12.53	0.00	0.00	0.00	5.60	0.00	0.00	7.40	26.55	59.00
07/01/2015	0.00	0.00	0.00	0.00	5.60	5.60	12.50	13.90	14.80	14.83	0.00	0.00	0.00	0.00	5.60	5.60	0.00	25.95	55.00
08/01/2015	0.00	9.30	0.00	0.00	7.40	0.00	6.50	9.30	12.05	13.00	0.00	0.00	0.00	5.60	6.50	0.00	7.40	25.64	46.00
09/01/2015	0.00	16.68	11.10	12.98	0.00	0.00	14.83	11.10	15.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.00	27.05	31.00
10/01/2015	0.00	9.87	9.30	7.40	7.45	9.30	9.30	0.00	12.95	17.60	0.00	0.00	0.00	0.00	0.00	11.10	0.00	25.76	39.00
11/01/2015	0.00	0.00	5.60	0.00	5.60	5.60	9.30	0.00	13.60	16.65	16.70	0.00	0.00	0.00	0.00	0.00	0.00	25.45	44.00
12/01/2015	0.00	5.60	0.00	9.30	5.60	9.30	8.35	13.00	14.80	15.28	0.00	0.00	0.00	0.00	7.40	7.40	11.10	25.70	47.00
13/01/2015	0.00	7.43	0.00	0.00	7.40	0.00	13.00	13.00	18.50	17.30	0.00	0.00	0.00	5.60	11.10	6.98	6.50	25.75	45.00
14/01/2015	0.00	5.60	0.00	0.00	7.40	8.35	9.30	11.13	13.57	10.50	13.00	0.00	0.00	7.40	0.00	9.30	0.00	24.78	52.00
15/01/2015	0.00	0.00	0.00	12.05	0.00	8.03	9.30	7.40	10.50	14.80	13.00	0.00	0.00	0.00	0.00	5.60	0.00	25.13	54.00

ANNEXURE : IV

DAILY AVERAGE OF MICRO-METEOROLOGICAL MONITORED DATA (1 DECEMBER, 2014 TO 28 FEBRUARY, 2015)

DATE	CALM	<---------- DIRECTION WISE AVERAGE WIND SPEED (km/hr) EXCLUDING CALM ---------->															TEMP.	REL_HUM
	<1.8kmph	E	ENE	NE	NNE	N	NNW	NW	WNW	W	WSW	SW	SSW	S	SSE	SE	ESE	(øC)	(%)
16/01/2015	0.00	0.00	0.00	11.10	0.00	6.20	9.30	10.68	0.00	14.80	16.70	0.00	7.40	0.00	0.00	0.00	0.00	25.46	51.00
17/01/2015	0.00	0.00	0.00	9.30	11.13	11.15	16.65	14.85	0.00	14.85	0.00	0.00	0.00	0.00	0.00	5.60	5.60	25.74	50.00
18/01/2015	0.00	7.40	7.40	5.60	9.30	0.00	5.60	12.33	11.10	16.70	0.00	0.00	0.00	0.00	5.60	9.30	0.00	25.74	50.00
19/01/2015	0.00	5.60	0.00	0.00	5.60	0.00	0.00	0.00	16.70	14.29	13.00	0.00	0.00	0.00	5.60	0.00	7.40	24.75	66.00
20/01/2015	0.00	7.06	0.00	0.00	0.00	7.40	7.45	7.40	13.00	12.33	0.00	0.00	0.00	0.00	5.60	0.00	8.35	25.25	69.00
21/01/2015	0.00	0.00	0.00	0.00	6.50	0.00	9.30	13.00	21.30	18.50	18.50	11.10	0.00	5.60	0.00	0.00	0.00	25.48	54.00
22/01/2015	0.00	0.00	0.00	7.40	7.45	11.10	16.65	18.50	16.70	18.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.04	64.00
23/01/2015	0.00	11.10	13.00	9.30	11.15	12.24	10.50	14.20	17.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.35	59.00
24/01/2015	0.00	7.40	5.60	0.00	9.30	7.45	13.90	13.57	14.80	17.93	0.00	0.00	0.00	0.00	0.00	0.00	5.60	25.31	59.00
25/01/2015	0.00	0.00	0.00	0.00	0.00	7.40	0.00	16.30	16.67	0.00	0.00	6.50	0.00	0.00	0.00	5.60	0.00	25.67	61.00
26/01/2015	0.00	9.30	0.00	0.00	0.00	6.98	12.70	12.37	19.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.06	58.00
27/01/2015	0.00	0.00	0.00	0.00	13.00	8.07	11.59	16.70	14.83	0.00	0.00	0.00	0.00	0.00	9.30	0.00	0.00	23.75	58.00
28/01/2015	0.00	0.00	0.00	0.00	11.10	8.35	8.37	7.40	15.75	15.75	0.00	0.00	0.00	0.00	0.00	9.30	0.00	25.13	65.00
29/01/2015	0.00	0.00	5.60	0.00	0.00	6.32	10.20	11.10	0.00	16.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.14	63.00
30/01/2015	0.00	13.58	19.13	11.10	16.70	0.00	9.25	9.30	13.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.66	47.00
31/01/2015	0.00	13.39	13.00	0.00	0.00	11.10	13.00	11.10	0.00	18.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.70	38.00
01/02/2015	0.00	0.00	0.00	5.60	9.30	5.60	7.45	7.40	12.33	15.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.17	49.00
02/02/2015	0.00	9.30	0.00	5.60	0.00	7.40	7.40	13.00	13.60	16.23	16.70	0.00	0.00	0.00	5.60	0.00	0.00	25.99	58.00
03/02/2015	0.00	0.00	0.00	7.40	9.30	0.00	10.20	12.05	13.90	14.83	0.00	0.00	0.00	0.00	7.40	0.00	5.60	26.73	47.00
04/02/2015	0.00	9.30	7.40	5.60	7.40	7.40	11.10	10.20	0.00	15.30	0.00	0.00	0.00	0.00	0.00	7.45	13.90	28.24	47.00
05/02/2015	0.00	10.02	0.00	5.60	0.00	0.00	0.00	3.70	7.45	14.20	0.00	0.00	0.00	10.20	5.60	0.00	9.25	28.18	47.00
06/02/2015	0.00	0.00	0.00	0.00	4.33	0.00	9.30	9.30	0.00	15.75	14.80	0.00	5.60	9.75	0.00	5.60	0.00	27.31	49.00
07/02/2015	0.00	0.00	7.40	5.60	0.00	5.60	10.20	3.70	15.75	16.93	0.00	7.40	7.40	0.00	0.00	5.60	0.00	25.77	66.00
08/02/2015	0.00	16.70	0.00	5.60	7.43	7.40	11.10	14.80	8.35	17.90	0.00	0.00	7.40	0.00	7.40	5.60	0.00	26.02	59.00
09/02/2015	0.00	0.00	0.00	9.30	9.30	0.00	11.10	11.15	16.68	0.00	16.70	0.00	0.00	0.00	5.60	5.60	0.00	26.29	49.00
10/02/2015	0.00	9.81	11.10	5.60	0.00	9.30	0.00	5.60	14.80	18.50	0.00	9.30	0.00	0.00	0.00	0.00	0.00	27.68	53.00
11/02/2015	0.00	0.00	0.00	7.40	0.00	0.00	0.00	13.00	15.75	14.83	0.00	0.00	0.00	0.00	5.60	0.00	0.00	27.33	56.00
12/02/2015	0.00	0.00	0.00	0.00	7.06	9.30	7.40	11.13	17.60	18.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.20	48.00
13/02/2015	0.00	7.40	0.00	0.00	5.60	0.00	7.40	5.57	11.10	16.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.70	55.00
14/02/2015	0.00	0.00	7.40	0.00	0.00	0.00	8.03	7.80	13.00	14.83	16.70	0.00	0.00	0.00	10.20	7.40	7.40	27.40	55.00
15/02/2015	0.00	0.00	0.00	7.40	0.00	7.43	0.00	16.70	16.70	17.04	14.80	0.00	0.00	0.00	5.60	0.00	0.00	26.66	58.00
16/02/2015	0.00	0.00	0.00	8.35	5.60	6.20	11.10	14.85	17.60	13.00	0.00	0.00	0.00	0.00	9.30	0.00	0.00	26.90	60.00
17/02/2015	0.00	0.00	0.00	0.00	0.00	5.60	5.60	14.85	13.43	18.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.34	63.00
18/02/2015	0.00	0.00	5.60	0.00	5.60	7.40	6.50	5.60	14.83	18.50	14.80	0.00	0.00	0.00	0.00	0.00	0.00	26.86	70.00
19/02/2015	0.00	6.20	0.00	11.10	0.00	7.40	8.35	7.40	11.10	19.77	18.50	0.00	0.00	0.00	0.00	0.00	0.00	26.97	68.00
20/02/2015	0.00	0.00	0.00	11.10	0.00	8.35	11.10	10.53	12.37	16.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.85	63.00
21/02/2015	0.00	18.50	0.00	14.83	7.40	7.40	5.60	0.00	0.00	14.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.68	49.00
22/02/2015	0.00	9.30	0.00	11.10	0.00	0.00	0.00	0.00	15.28	14.80	0.00	0.00	0.00	0.00	0.00	10.40	9.27	31.93	32.00
23/02/2015	0.00	5.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.22	0.00	11.10	0.00	0.00	9.30	5.60	7.40	29.64	55.00
24/02/2015	0.00	0.00	0.00	0.00	0.00	7.40	0.00	0.00	12.37	14.35	9.30	0.00	5.60	0.00	7.40	0.00	14.80	28.42	66.00
25/02/2015	0.00	0.00	0.00	6.50	7.40	6.50	12.33	15.02	17.30	7.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.60	67.00
26/02/2015	0.00	0.00	0.00	5.60	9.73	8.90	10.50	12.05	17.99	18.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.68	63.00
27/02/2015	0.00	0.00	5.60	0.00	5.60	6.50	5.60	8.35	7.40	19.75	7.40	0.00	0.00	0.00	0.00	9.30	0.00	25.04	62.00
28/02/2015	0.00	5.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.20	13.00	14.80	6.50	7.45	10.23	16.07	23.85	80.00

Note : Daily data has been summarised from hourly readings

ANNEXURE : IV Contd.

MIN MEC R&D LABORATORY, NEW DELHI
AIR QUALITY TEST RESULTS
OFFICE COMPLEX AT CUSTOMS ENCLAVE OF M/S CPWD, MUMBAI

Sl. No.	Date of sampling	24 hrly concentrations (in µg/m3)																	
		PM_{10}	$PM_{2.5}$	SO_2	NOx	PM_{10}	$PM_{2.5}$	SO_2	NOx	Date of sampling	PM_{10}	$PM_{2.5}$	SO_2	NOx	PM_{10}	$PM_{2.5}$	SO_2	NOx
	LOCATION :	**Core Zone (CA1)**				**Gavanpada (BA2)**					**HPCL Wadala (BA1)**				**Govandi (BA3)**			
1	1 - 12/2/2014	103.2	51.5	14.6	43.8	131.3	60.2	16.9	43.6	2 - 12/3/2014	141.2	66.4	12.1	47.6	137.0	71.1	21.8	55.3
2	4 - 12/5/2014	97.0	50.5	19.6	36.1	108.9	44.9	21.2	35.7	5 - 12/6/2014	149.9	58.6	18.0	44.4	123.1	61.8	21.9	39.9
3	9 - 12/10/2014	132.1	65.9	16.7	41.0	128.2	54.8	18.6	39.7	10 - 12/11/2014	124.1	74.0	20.2	49.9	113.1	60.7	22.9	42.1
4	12 - 12/13/2014	105.9	53.2	11.4	39.5	128.7	55.1	16.4	44.8	13 - 12/14/2014	94.6	70.4	11.7	37.4	131.5	66.4	25.1	38.0
5	16 - 12/17/2014	92.0	52.8	15.9	49.3	109.3	44.4	15.6	46.7	17 - 12/18/2014	143.7	55.9	12.2	52.2	116.6	60.0	17.4	39.8
6	19 - 12/20/2014	142.7	68.8	13.0	43.7	126.3	54.3	12.4	47.3	20 - 12/21/2014	124.9	64.0	19.3	49.7	137.4	71.0	14.5	58.4
7	24 - 12/25/2014	119.8	63.4	18.3	46.0	119.4	50.6	18.6	44.2	25 - 12/26/2014	150.4	70.3	19.0	41.8	145.4	74.8	18.3	61.3
8	27 - 12/28/2014	91.5	52.2	20.2	38.4	122.4	55.6	16.3	34.7	28 - 12/29/2014	133.5	53.1	17.8	55.8	115.8	61.3	17.1	36.0
9	1 - 1/2/2015	119.2	60.8	16.7	40.7	116.8	49.1	13.7	35.7	2 - 1/3/2015	108.5	55.6	11.8	41.8	114.6	60.0	14.9	49.8
10	4 - 1/5/2015	93.1	50.3	12.2	43.1	121.0	48.4	19.3	41.8	5 - 1/6/2015	131.7	70.5	11.5	48.1	113.8	62.3	22.1	56.9
11	8 - 1/9/2015	124.6	59.0	19.3	49.3	107.9	44.7	18.9	46.9	9 - 1/10/2015	94.1	52.0	16.5	46.4	116.9	59.4	14.5	48.8
12	11 - 1/12/2015	111.4	58.1	19.7	40.9	138.2	59.5	14.2	44.1	12 - 1/13/2015	123.4	61.6	18.7	39.8	117.6	59.2	19.3	52.5
13	15 - 1/16/2015	137.4	74.5	19.8	47.0	119.7	51.1	21.6	42.3	16 - 1/17/2015	148.8	57.4	13.2	49.5	156.2	75.2	18.9	39.1
14	18 - 1/19/2015	99.8	51.1	21.7	38.0	102.8	45.5	16.9	36.3	19 - 1/20/2015	124.0	51.8	20.2	43.1	132.0	63.3	20.3	45.5
15	22 - 1/23/2015	143.0	72.6	22.1	46.2	149.5	62.9	14.2	45.2	23 - 1/24/2015	140.0	71.7	14.1	40.7	108.1	62.2	20.7	37.8
16	25 - 1/26/2015	100.7	51.5	12.2	41.0	119.4	52.8	16.0	44.5	26 - 1/27/2015	145.6	57.5	17.9	37.9	122.3	64.5	15.0	45.6
17	29 - 1/30/2015	90.1	54.6	18.9	45.2	121.4	48.7	13.2	33.9	30 - 1/31/2015	97.8	53.9	20.7	44.3	115.7	59.0	22.1	39.3
18	1 - 2/2/2015	128.3	69.9	13.1	41.7	136.7	53.8	15.6	47.3	2 - 2/3/2015	145.9	67.6	19.3	42.5	113.2	59.8	16.0	53.1
19	5 - 2/6/2015	119.3	57.1	14.5	35.6	103.6	45.0	15.0	46.3	6 - 2/7/2015	149.0	56.4	17.0	44.5	129.7	64.6	15.6	55.1
20	9 - 2/10/2015	103.1	51.4	15.1	35.7	130.1	55.5	18.3	32.3	10 - 2/11/2015	112.7	56.6	16.5	51.2	153.8	73.8	20.2	43.1
21	13 - 2/14/2015	122.8	65.7	11.1	50.4	121.9	48.1	18.4	34.7	14 - 2/15/2015	109.9	55.4	23.1	48.6	140.0	70.0	20.1	48.0
22	17 - 2/18/2015	121.3	66.6	19.3	49.5	144.2	60.8	17.1	40.6	18 - 2/19/2015	121.1	76.3	16.5	47.4	108.4	67.4	14.7	61.0
23	21 - 2/22/2015	139.4	69.3	13.3	38.9	117.2	49.3	13.9	46.5	22 - 2/23/2015	123.1	73.3	16.1	42.7	119.5	60.2	21.1	52.9
24	25 - 2/26/2015	145.2	72.5	20.6	49.0	102.3	45.4	14.2	35.0	26 - 2/27/2015	137.4	65.5	20.8	44.7	123.7	64.3	14.7	37.2
	Minimum	**90.1**	**50.3**	**11.1**	**35.6**	**102.3**	**44.4**	**12.4**	**32.3**		**94.1**	**51.8**	**11.5**	**37.4**	**108.1**	**59.0**	**14.5**	**36.0**
	Maximum	**145.2**	**74.5**	**22.1**	**50.4**	**149.5**	**62.9**	**21.6**	**47.3**		**150.4**	**76.3**	**23.1**	**55.8**	**156.2**	**75.2**	**25.1**	**61.3**
	Average	**116.0**	**60.1**	**16.6**	**42.9**	**122.0**	**51.7**	**16.5**	**41.3**		**128.1**	**62.3**	**16.8**	**45.5**	**125.2**	**64.7**	**18.7**	**47.4**
	98 percentile	**144.2**	**73.6**	**21.9**	**50.0**	**147.1**	**61.9**	**21.4**	**47.3**		**150.2**	**75.2**	**22.0**	**54.1**	**155.1**	**75.0**	**24.1**	**61.2**

Note : * Instant readings; BDL for SO2 = <7 µg/m3, NOx = <6 µg/m3

Source: Min Mec R&D Laboratory's test report no. MMA/03-15/17

ANNEXURE : V

AMBIENT AIR QUALITY TEST RESULTS

Sl. No	Date of Sampling	Location	CO (mg/m^3)	O_3 ($\mu g/m^3$)	NH3 ($\mu g/m^3$)	BaP (ng/m^3)	C_6H_6 ($\mu g/m^3$)	Pb ($\mu g/m^3$)	As (ng/m^3)	Ni (ng/m^3)
1	20-21/02/2015	Core Zone	1.125	8.8	58.4	<5	2.04	0.015	0.84	0.41
2	25-26/01/2014	Core Zone	1.0	7.4	56.8	<5	1.88	0.014	1.45	0.4
PROTOCOL			**IS 5182 (Part 10)**	**UV Photometric**	**Indo-phenol Blue Method**	**Gas Chromatography**	**Gas Chromatography**	**ICP Method**	**ICP Method**	**ICP Method**
			National Ambient Air Quality Standards 24 hours (2009)							
Industrial, Residential, Rural & Other areas			**2.0**	**100***	**400**	**01****	**05****	**1.0**	**06****	**20****

**** 8 hr, **Annual Values.***

Test Report No. : MMA/03-15/12

NATIONAL AMBIENT AIR QUALITY STANDARDS

CENTRAL POLLUTION CONTROL BOARD

NOTIFICATION

Delhi, the 18th November, 2009

No.B-29016/20/90/PCI-I.— In exercise of the powers conferred by Sub-section (2) (h) of section 16 of the Air (Prevention and Control of Pollution) Act, 1981 (Act No.14 of 1981), and in supersession of the Notification No(s). S.O. 384(E), dated 11th April, 1994 and S.O. 935(E), dated 14th October, 1998, the Central Pollution Control Board hereby notify the National Ambient Air Quality Standards with immediate effect, namely:-

NATIONAL AMBIENT AIR QUALITY STANDARDS

S. No.	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
(1)	(2)	(3)	(4)	(5)	(6)
1	Sulphur Dioxide (SO_2), $\mu g/m^3$	Annual*	50	20	- Improved West and Gaeke
		24 hours**	80	80	-Ultraviolet fluorescence
2	Nitrogen Dioxide (NO_2), $\mu g/m^3$	Annual*	40	30	- Modified Jacob & Hochheiser (Na-Arsenite)
		24 hours**	80	80	- Chemiluminescence
3	Particulate Matter (size less than 10µm) or PM_{10} $\mu g/m^3$	Annual*	60	60	- Gravimetric - TOEM
		24 hours**	100	100	- Beta attenuation
4	Particulate Matter (size less than 2.5µm) or $PM_{2.5}$ $\mu g/m^3$	Annual*	40	40	- Gravimetric - TOEM
		24 hours**	60	60	- Beta attenuation
5	Ozone (O_3) $\mu g/m^3$	8 hours**	100	100	- UV photometric - Chemilminescence
		1 hour**	180	180	- Chemical Method
6	Lead (Pb) $\mu g/m^3$	Annual*	0.50	0.50	- AAS /ICP method after sampling on EPM 2000 or equivalent filter paper - ED-XRF using Teflon filter
		24 hours**	1.0	1.0	
7	Carbon Monoxide (CO) mg/m^3	8 hours**	02	02	- Non Dispersive Infra Red (NDIR) spectroscopy
		1 hour**	04	04	

(1)	(2)	(3)	(4)	(5)	(6)
8	Ammonia (NH_3) $\mu g/m^3$	Annual* 24 hours**	100 400	100 400	-Chemiluminescence -Indophenol blue method
9	Benzene (C_6H_6) $\mu g/m^3$	Annual*	05	05	- Gas chromatography based continuous analyzer - Adsorption and Desorption followed by GC analysis
10	Benzo(a)Pyrene (BaP) - particulate phase only, ng/m^3	Annual*	01	01	- Solvent extraction followed by HPLC/GC analysis
11	Arsenic (As), ng/m^3	Annual*	06	06	- AAS /ICP method after sampling on EPM 2000 or equivalent filter paper
12	Nickel (Ni), ng/m^3	Annual*	20	20	- AAS /ICP method after sampling on EPM 2000 or equivalent filter paper

* Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.

** 24 hourly or 08 hourly or 01 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

Note. — Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation.

SANT PRASAD GAUTAM, Chairman
[Advt-III/4/184/09/Exty.]

Note: The notifications on National Ambient Air Quality Standards were published by the Central Pollution Control Board in the Gazette of India, Extraordinary vide notification No(s). S.O. 384(E), dated 11th April, 1994 and S.O. 935(E), dated 14th October, 1998.

An ISO 9001:2008
Certified Company

Min Mec R&D Laboratory

(A DIVISION OF MIN MEC CONSULTANCY PVT. LTD.)
A-121, Paryavaran Complex,IGNOU Road, New Delhi – 110 030
Phone :29534777, 29532236, 29535891; Fax : 91-11-29532568
Email : lab.minmec@gmail.com ; Visit us at :http://www.minmec.co.in

ANNEXURE : VII

TEST REPORT

NAME AND ADDRESS OF CUSTOMER	**SAMPLE PARTICULARS**		
Suresh Goel & Associates, C-85, Shivalik New Delhi-110017	Type of Sample	:	Ground Water
	Work Order No.	:	SGA/MMCPL/E003
	Sampling Location	:	As per Table
	Sampling Procedure	:	IS 3025 (Part -1)
	Sample Volume/Quantity	:	1 Ltr
	Sampling Team	:	MMRDL (Ravikant)
	Sample Reg. No.	:	MMW/01-15/3.9-3.16
	Date of Sampling	:	25/01/2015
	Date of Receipt	:	27/01/2015
	Date of Testing	:	27/01/2015 to 10/02/2015
	Date of Report	:	25/02/2015
	Test Report No.	:	MMW/02-15/13
	Page	:	1 of 1

Parameters	**Limits (IS: 10500:2012)**		**Koliwara Vill**	**Gawanpada Vill**	**HPCL Wadala**	**Protocol**
	Desirable	Permissible				
Colour, Hue	5	15	Colour less	Colourless	Colour less	IS3025(P- 4)
Odour	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	IS3025(P-5)
Turbidity, NTU	1	5	2.5	4.3	1.8	IS3025(P-10)
pH	6.5-8.5	-	6.6	6.7	6.8	IS3025(P-11)
Total Dissolved solids,mg/l	500	2000	173	649	399	IS3025(P-16)
Total hardness (as CaCO3),mg/l	200	600	120	380	224	IS3025(P-21)
Total Alkalinity,mg/l	200	600	141	269	314	IS3025(P-23)
Chlorides (as Cl),mg/l	250	1000	20	174	30	IS3025(P-32)
Iron (as Fe),mg/l	0.3	-	0.2	0.7	0.1	IS3025(P-53)
Fluoride (as F),mg/l	1.0	1.5	0.38	0.44	0.46	APHA4500D
Sulphate (as SO4),mg/l	200	400	7	21	3	IS3025(P-24)
Nitrate (as NO3),mg/l	45	-	0.4	4.7	0.7	APHA4500B)
Calcium (as Ca),mg/l	75	200	32	103	61	IS3025(P-40)
Magnesium (as Mg),mg/l	30	100	10	30	17	IS3025(P-46)
Copper (as Cu),mg/l	0.05	1.5	0.01	BDL	0.01	IS3025(P-2)
Manganese (as Mn),mg/l	0.1	0.3	0.06	0.04	0.05	IS3025(P-2)
Cadmium (as Cd),mg/l	0.003	-	BDL	BDL	BDL	IS3025(P-2)
Selenium (as Se),mg/l	0.01	-	0.01	0.01	BDL	IS3025(P-2)
Total Arsenic (as As),mg/l	0.01	0.05	BDL	BDL	BDL	IS3025(P-2)
Lead (as Pb), mg/l	0.01	-	BDL	0.01	BDL	IS3025(P-2)
Zinc (as Zn),mg/l	5	15	0.12	0.46	0.39	IS3025(P-2)
Total Chromium (as Cr),mg/l	0.05	-	BDL	BDL	BDL	IS3025(P-2)
Boron (as B),mg/l	0.5	1.0	0.52	0.45	0.50	IS3025(P-2)
Nickel (as Ni),mg/l	0.02	-	BDL	BDL	BDL	IS3025(P-2)
Aluminium (as Al), mg/l	0.03	0.2	0.15	BDL	0.08	IS3025(P-2)

Note: BDL of Cu<0.008; Hg<0.0008; Cd<0.009; Se<0.069; As<0.069; Pb<0.014; Cr <0.013; Ni<0.017 mg/l; Al<0.069

Prepared by
Rashmi Gupta
Administrative Manager

Checked by
Dr. Marisha Sharma
Quality Manager

-end of report-

NOTES :

- ***The results indicated only refer to the tested samples and listed parameters and do not endorse any product***
- ***Total liability of the laboratory is limited to the invoice amount***
- ***This certificate shall not be reproduced wholly or in P without prior written consent of the laboratory***
- ***Unused balance of samples received shall be destroyed after one month from the date of issue of test report, unless other wise specified***
- ***This report shall not be used in any advertising media or as evidence in the court of law without prior written consent of the laboratory***

Indian Standard

DRINKING WATER — SPECIFICATION

(Second Revision)

1 SCOPE

This standard prescribes the requirements and the methods of sampling and test for drinking water.

2 REFERENCES

The standards listed in Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

3 TERMINOLOGY

For the purpose of this standard the following definition shall apply.

3.1 Drinking Water — Drinking water is water intended for human consumption for drinking and cooking purposes from any source. It includes water (treated or untreated) supplied by any means for human consumptions.

4 REQUIREMENTS

Drinking water shall comply with the requirements given in Tables 1 to 4. The analysis of pesticide residues given in Table 3 shall be conducted by a recognized laboratory using internationally established test method meeting the residue limits as given in Table 5.

Drinking water shall also comply with bacteriological requirements (*see* **4.1**), virological requirements (*see* **4.2**) and biological requirements (*see* **4.3**).

4.1 Bacteriological Requirements

4.1.1 *Water in Distribution System*

Ideally, all samples taken from the distribution system including consumers' premises, should be free from coliform organisms and the following bacteriological quality of drinking water collected in the distribution system, as given in Table 6 is, therefore specified when tested in accordance with IS 1622.

4.2 Virological Requirements

4.2.1 Ideally, all samples taken from the distribution

Table 1 Organoleptic and Physical Parameters
(*Foreword* and *Clause* 4)

Sl No.	Characteristic	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	Method of Test, Ref to Part of IS 3025	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Colour, Hazen units, *Max*	5	15	Part 4	Extended to 15 only if toxic substances are not suspected in absence of alternate sources
ii)	Odour	Agreeable	Agreeable	Part 5	a) Test cold and when heated b) Test at several dilutions
iii)	pH value	6.5-8.5	No relaxation	Part 11	—
iv)	Taste	Agreeable	Agreeable	Parts 7 and 8	Test to be conducted only after safety has been established
v)	Turbidity, NTU *Max*	1	5	Part 10	—
vi)	Total dissolved solids, mg/l *Max*	500	2 000	Part 16	—

NOTE — It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under 'acceptable' render the water not suitable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under 'permissible limit in the absence of alternate source' in col 4, above which the sources will have to be rejected.

Table 2 General Parameters Concerning Substances Undesirable in Excessive Amounts
(*Foreword* and *Clause* 4)

Sl No.	Characteristic	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	Method of Test, Ref to	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Aluminium (as Al), mg/l, *Max*	0.03	0.2	IS 3025 (Part 55)	—
ii)	Ammonia (as total ammonia-N), mg/l, *Max*	0.5	No relaxation	IS 3025 (Part 34)	—
iii)	Anionic detergents (as MBAS) mg/l, *Max*	0.2	1.0	Annex K of IS 13428	—
iv)	Barium (as Ba), mg/l, *Max*	0.7	No relaxation	Annex F of IS 13428* or IS 15302	—
v)	Boron (as B), mg/l, *Max*	0.5	1.0	IS 3025 (Part 57)	—
vi)	Calcium (as Ca), mg/l, *Max*	75	200	IS 3025 (Part 40)	—
vii)	Chloramines (as Cl_2), mg/l, *Max*	4.0	No relaxation	IS 3025 (Part 26)* or APHA 4500-Cl G	—
viii)	Chloride (as Cl), mg/l, *Max*	250	1 000	IS 3025 (Part 32)	—
ix)	Copper (as Cu), mg/l, *Max*	0.05	1.5	IS 3025 (Part 42)	—
x)	Fluoride (as F) mg/l, *Max*	1.0	1.5	IS 3025 (Part 60)	—
xi)	Free residual chlorine, mg/l, *Min*	0.2	1	IS 3025 (Part 26)	To be applicable only when water is chlorinated. Tested at consumer end. When protection against viral infection is required, it should be minimum 0.5 mg/l
xii)	Iron (as Fe), mg/l, *Max*	0.3	No relaxation	IS 3025 (Part 53)	Total concentration of manganese (as Mn) and iron (as Fe) shall not exceed 0.3 mg/l
xiii)	Magnesium (as Mg), mg/l, *Max*	30	100	IS 3025 (Part 46)	—
xiv)	Manganese (as Mn), mg/l, *Max*	0.1	0.3	IS 3025 (Part 59)	Total concentration of manganese (as Mn) and iron (as Fe) shall not exceed 0.3 mg/l
xv)	Mineral oil, mg/l, *Max*	0.5	No relaxation	Clause 6 of IS 3025 (Part 39) Infrared partition method	—
xvi)	Nitrate (as NO_3), mg/l, *Max*	45	No relaxation	IS 3025 (Part 34)	—
xvii)	Phenolic compounds (as C_6H_5OH), mg/l, *Max*	0.001	0.002	IS 3025 (Part 43)	—
xviii)	Selenium (as Se), mg/l, *Max*	0.01	No relaxation	IS 3025 (Part 56) or IS 15303*	—
xix)	Silver (as Ag), mg/l, *Max*	0.1	No relaxation	Annex J of IS 13428	—
xx)	Sulphate (as SO_4) mg/l, *Max*	200	400	IS 3025 (Part 24)	May be extended to 400 provided that Magnesium does not exceed 30
xxi)	Sulphide (as H_2S), mg/l, *Max*	0.05	No relaxation	IS 3025 (Part 29)	—
xxii)	Total alkalinity as calcium carbonate, mg/l, *Max*	200	600	IS 3025 (Part 23)	—
xxiii)	Total hardness (as $CaCO_3$), mg/l, *Max*	200	600	IS 3025 (Part 21)	—
xxiv)	Zinc (as Zn), mg/l, *Max*	5	15	IS 3025 (Part 49)	—

NOTES

1 In case of dispute, the method indicated by '*' shall be the referee method.

2 It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under 'acceptable' render the water not suitable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under 'permissible limit in the absence of alternate source' in col 4, above which the sources will have to be rejected.

Table 3 Parameters Concerning Toxic Substances

(*Foreword* and *Clause* 4)

Sl No.	Characteristic	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	Method of Test, Ref to	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Cadmium (as Cd), mg/l, *Max*	0.003	No relaxation	IS 3025 (Part 41)	—
ii)	Cyanide (as CN), mg/l, *Max*	0.05	No relaxation	IS 3025 (Part 27)	—
iii)	Lead (as Pb), mg/l, *Max*	0.01	No relaxation	IS 3025 (Part 47)	—
iv)	Mercury (as Hg), mg/l, *Max*	0.001	No relaxation	IS 3025 (Part 48)/ Mercury analyser	—
v)	Molybdenum (as Mo), mg/l, *Max*	0.07	No relaxation	IS 3025 (Part 2)	—
vi)	Nickel (as Ni), mg/l, *Max*	0.02	No relaxation	IS 3025 (Part 54)	—
vii)	Pesticides, µg/l, *Max*	See Table 5	No relaxation	See Table 5	—
viii)	Polychlorinated biphenyls, mg/l, *Max*	0.000 5	No relaxation	ASTM 5175* or APHA 6630	—
ix)	Polynuclear aromatic hydrocarbons (as PAH), mg/l, *Max*	0.000 1	No relaxation	APHA 6440	—
x)	Total arsenic (as Ars mg/l, *Max*	0.01	0.05	IS 3025 (Part 37)	—
xi)	Total chromium (as Cr), mg/l, *Max*	0.05	No relaxation	IS 3025 (Part 52)	—
xii)	Trihalomethanes:				
	a) Bromoform, mg/l, *Max*	0.1	No relaxation	ASTM D 3973-85* or APHA 6232	—
	b) Dibromochloromethane, mg/l, *Max*	0.1	No relaxation	ASTM D 3973-85* or APHA 6232	—
	c) Bromodichloromethane, mg/l, *Max*	0.06	No relaxation	ASTM D 3973-85* or APHA 6232	—
	d) Chloroform, mg/l, *Max*	0.2	No relaxation	ASTM D 3973 85* or APHA 6232	—

NOTES

1 In case of dispute, the method indicated by '*' shall be the referee method.

2 It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under 'acceptable' render the water not suitable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under 'permissible limit in the absence of alternate source' in col 4, above which the sources will have to be rejected.

Table 4 Parameters Concerning Radioactive Substances

(*Foreword* and *Clause* 4)

Sl No.	Characteristic	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	Method of Test, Ref to Part of IS 14194	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Radioactive materials:				
	a) Alpha emitters Bq/l, *Max*	0.1	No relaxation	Part 2	—
	b) Beta emitters Bq/l, *Max*	1.0	No relaxation	Part 1	—

NOTE — It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under 'acceptable' render the water not suitable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under 'permissible limit in the absence of alternate source' in col 4, above which the sources will have to be rejected.

AMENDMENT NO. 1 JUNE 2015
TO
IS 10500 : 2012 DRINKING WATER — SPECIFICATION

(Second Revision)

[*Page* 2, *Table* 2, *Sl No.* xii), *col* 3] — Substitute '1.0' *for* '0.3'.

[*Page* 3, *Table* 3, *Sl No.* x) , *col* 4] — Substitute 'No relaxation' *for* '0.05'.

(FAD 14)

Publication Unit, BIS, New Delhi, India

ANNEXURE : IX

NOISE LEVELS WITHIN THE STUDY AREA [Leq in dB(A)]
OFFICE COMPLEX AT CUSTOMS ENCLAVE, MUMBAI

Hours	Core zone (N1)	HPCL Wadala (N2)	Gawanpada (N3)	Govandi (N4)
Date of monitoring	**05-06/01/2015**	**06-07/01/2015**	**07-08/01/2015**	**08-09/01/2015**
1.00	71.03	68.09	51.83	53.75
2.00	69.51	66.89	51.83	50.53
3.00	65.33	66.89	52.53	50.53
4.00	68.89	67.31	54.61	50.53
5.00	71.91	68.71	52.53	51.23
6.00	68.55	71.27	55.05	53.69
7.00	81.91	78.09	60.71	60.29
8.00	82.07	82.39	61.59	59.41
9.00	83.89	78.09	60.39	57.89
10.00	82.69	82.51	57.53	60.03
11.00	83.31	78.09	57.53	61.82
12.00	78.89	76.35	63.21	59.09
13.00	79.83	81.27	66.33	62.27
14.00	78.89	81.75	61.05	61.82
15.00	83.19	78.41	61.59	60.29
16.00	83.31	81.75	61.83	57.89
17.00	82.55	81.75	61.05	60.29
18.00	81.54	82.63	60.71	60.53
19.00	82.07	80.55	61.83	60.29
20.00	80.33	78.41	57.53	60.53
21.00	80.33	78.75	59.61	60.29
22.00	68.89	71.11	55.39	50.53
23.00	69.83	67.31	51.83	50.53
24.00	70.33	69.03	51.83	50.53
Day time Leq.	**81.70**	**80.10**	**60.80**	**60.20**
Night time Leq.	**69.40**	**68.50**	**53.00**	**51.30**
Average Leq.	**77.00**	**75.70**	**57.90**	**56.90**
Permissible (Day)	**75**	**75**	**55**	**55**
Permissible (Night)	**70**	**70**	**45**	**45**

Source: Min Mec R&D Laboratory's test report no. MMN/03-15/16

ANNEXURE : X

THE NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000

SCHEDULE

[See Rule 3(1) and 4(1)]

Ambient Air Quality Standards in respect of Noise

Error! No bookmark name given.**Area Code**	**Category of Area/Zone**	**Limits in dB(A) Leq***	
		Day Time	**Night Time**
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence Zone	50	40

Note :

1. Day time shall mean from 6.00 a.m. to 10.00 p.m.

2. Night time shall mean from 10.00 p.m. to 6.00 a.m.

[a][3. Silence zone is an area comprising not less than 100 metres around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority].

4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

* dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale 'A' which is relatable to human hearing.

A "decibel" is a unit in which noise is measured.

"A", in dB(A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

Leq : It is an energy mean of the noise level over a specified period.

SOURCE : Pollution Control Acts, Rules and Notifications Issued Thereunder, Pollution Control Law Series : PCLS/02/1992 (Fourth Edition) of Central Pollution Control Board, September 2001, pp 711

[a] Substituted by Rule 4 of the Noise Pollution (Regulation and Control) (Amendment) Rules, 2000 notified vide S.O. 1046(E), dated 22.11.2000.

ANNEXURE : XI

DAMAGE RISK CRITERIA FOR HEARING LOSS OCCUPATIONAL SAFETY & HEALTH ADMINISTRATION (OSHA)

MAXIMUM ALLOWABLE DURATION PER DAY, hour	NOISE LEVEL dB(A) (SLOW RESPONSE)
8	90
6	92
4	95
3	97
2	100
1.5	102
1.0	105
0.5	110
0.25 or Less	115

MAXIMUM PERMISSIBLE EXPOSURE TO SOUND UNDER OCCUPATIONAL HEALTH AND SAFETY IN INDIA

SOUND LEVEL, dB(A)	MAXIMUM EXPOSURE HOURS
90	8
93	4
96	2
99	1
102	½
105	¼
108	1/8 or 7.5 min

TRAFFIC DENSITY ON EASTERN EXPRESSWAY

Hours	LMV	Mini Buses	HMV	2 wheelers	Cycles	Total		LMV	Mini Buses	HMV	2 wheelers	Cycles	Total
	Date of monitoring : 15-16/02/2015 (Weekend)							Date of monitoring : 18-19/02/2015 (Weekday)					
7.00 - 8.00	2105	45	0	0	0	2150		2187	56	0	0	0	2243
8.00 - 9.00	2729	37	0	0	0	2766		2855	50	0	0	0	2905
9.00 - 10.00	3199	9	0	0	0	3208		3292	8	0	0	0	3300
10.00 - 11.00	2925	7	0	0	0	2932		2838	5	0	0	0	2843
11.00 - 12.00	2744	2	0	0	0	2746		2920	4	0	0	0	2924
12.00 - 13.00	3377	7	0	0	0	3384		3476	8	0	0	0	3484
13.00 - 14.00	2633	1	0	0	0	2634		2774	2	0	0	0	2776
14.00 - 15.00	2450	5	0	0	0	2455		2483	7	0	0	0	2490
15.00 - 16.00	2716	14	0	0	0	2730		2802	8	0	0	0	2810
16.00 - 17.00	3009	34	0	0	0	3043		3076	28	0	0	0	3104
17.00 - 18.00	3722	14	0	0	0	3736		3648	17	0	0	0	3665
18.00 - 19.00	2673	9	0	0	0	2682		2762	7	0	0	0	2769
19.00 - 20.00	2999	11	0	0	0	3010		3135	16	0	0	0	3151
20.00 - 21.00	3424	14	0	0	0	3438		3586	20	0	0	0	3606
21.00 - 22.00	3092	5	0	0	0	3097		3217	9	0	0	0	3226
22.00 - 23.00	2317	3	0	0	0	2320		2451	2	0	0	0	2453
23.00 - 24.00	1827	0	0	0	0	1827		1733	0	0	0	0	1733
0.00 - 1.00	1472	0	0	0	0	1472		1395	1	0	0	0	1396
1.00 - 2.00	1109	1	0	0	0	1110		1191	0	0	0	0	1191
2.00 - 3.00	777	3	0	0	0	780		895	0	0	0	0	895
3.00 - 4.00	1241	0	0	0	0	1241		1283	2	0	0	0	1285
4.00 - 5.00	1774	1	0	0	0	1775		1852	2	0	0	0	1854
5.00 - 6.00	1574	2	0	0	0	1576		1486	5	0	0	0	1491
6.00 - 7.00	2240	4	0	0	0	2244		2342	2	0	0	0	2344
TOTAL	**58128**	**228**	**0**	**0**	**0**	**58356**		**59679**	**259**	**0**	**0**	**0**	**59938**

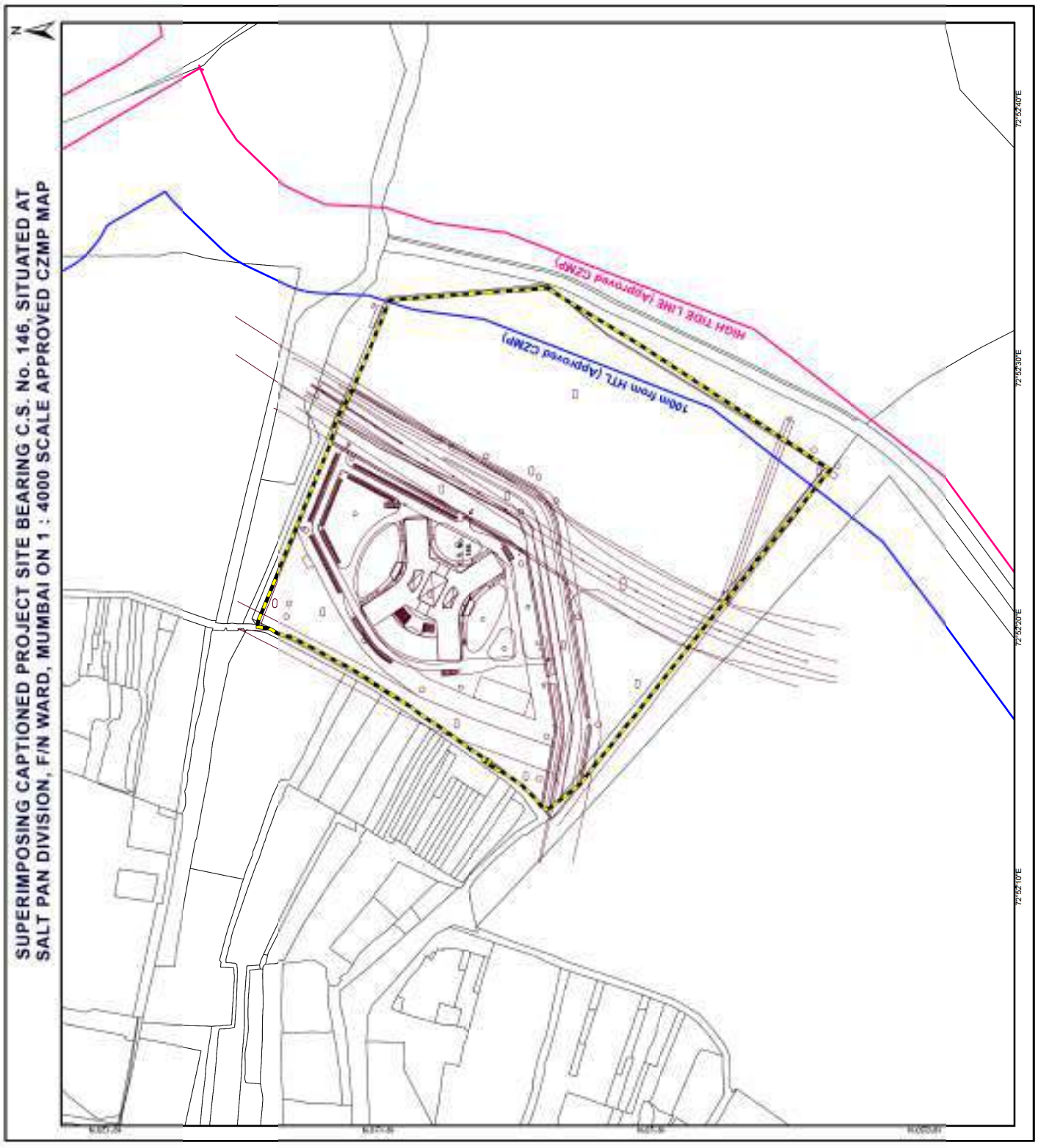
ANNEXURE : XII

TRAFFIC DENSITY ON SEWRI CEHMBUR ROAD (ANIK WADALA ROAD)

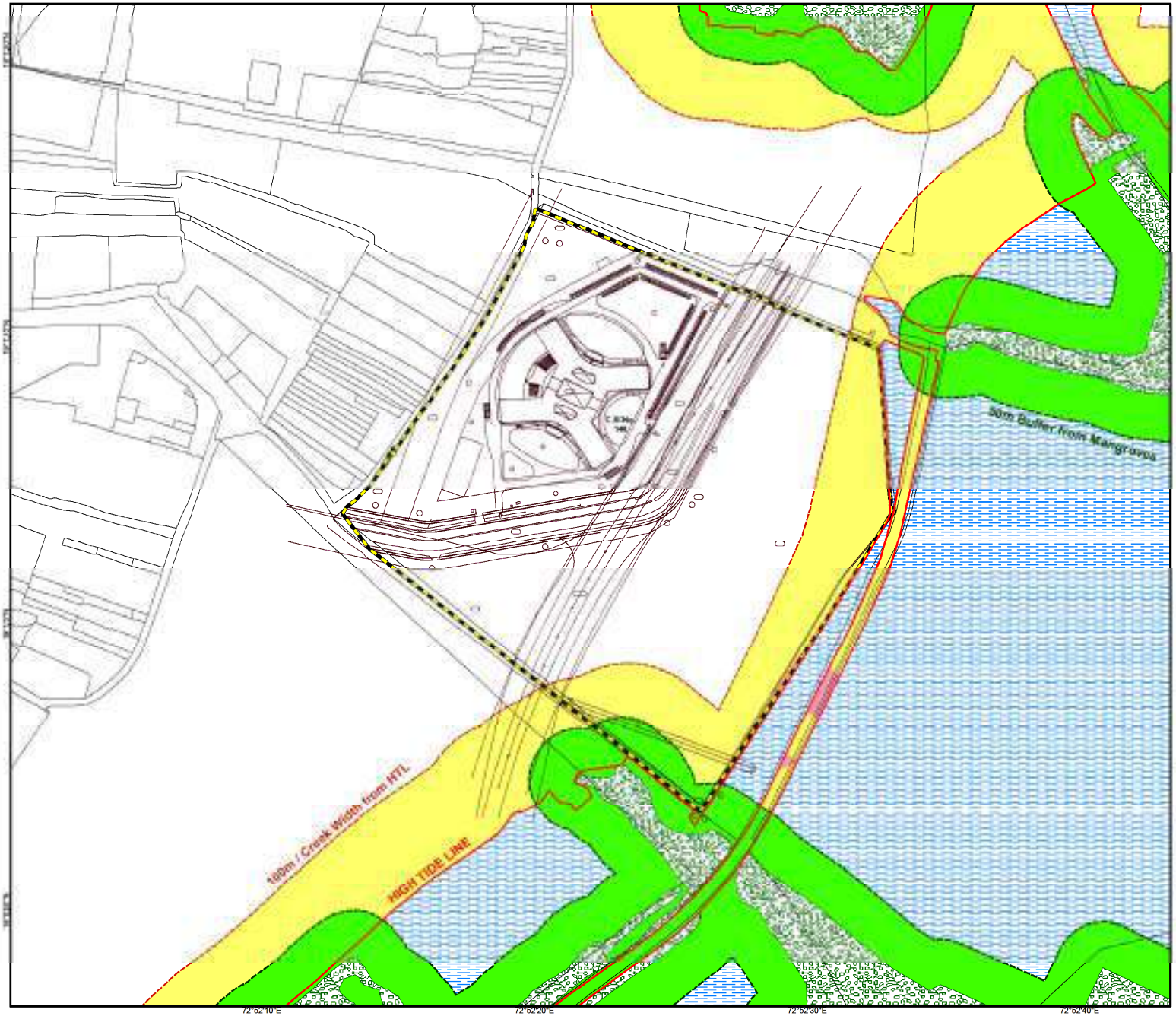
Hours	LMV	HMV	2 wheelers	Cycles	Total		LMV	HMV	2 wheelers	Cycles	Total
	Date of monitoring : 15-16/02/2015 (Weekend)						Date of monitoring : 18-19/02/2015 (Weekday)				
7.00 - 8.00	826	242	298	273	**1639**		1032	303	373	437	**2145**
8.00 - 9.00	790	197	340	264	**1591**		987	246	425	352	**2010**
9.00 - 10.00	848	231	378	198	**1655**		1060	289	472	274	**2095**
10.00 - 11.00	941	288	307	174	**1710**		1176	360	384	248	**2168**
11.00 - 12.00	864	154	384	166	**1568**		1080	192	480	208	**1960**
12.00 - 13.00	587	233	347	189	**1356**		734	291	434	486	**1945**
13.00 - 14.00	678	126	316	167	**1287**		847	158	395	459	**1859**
14.00 - 15.00	538	192	268	72	**1070**		673	240	335	126	**1374**
15.00 - 16.00	311	451	185	4	**951**		389	564	231	17	**1201**
16.00 - 17.00	165	526	118	0	**809**		206	658	148	6	**1018**
17.00 - 18.00	116	526	34	0	**676**		145	658	43	0	**846**
18.00 - 19.00	129	543	21	0	**693**		161	679	26	0	**866**
19.00 - 20.00	114	600	23	0	**737**		142	750	29	0	**921**
20.00 - 21.00	104	530	30	0	**664**		130	663	37	0	**830**
21.00 - 22.00	128	438	66	0	**632**		160	548	83	0	**791**
22.00 - 23.00	228	380	132	0	**740**		285	475	165	5	**930**
23.00 - 24.00	274	422	229	7	**932**		343	527	286	89	**1245**
0.00 - 1.00	522	306	441	63	**1332**		653	383	551	457	**2044**
1.00 - 2.00	714	208	606	248	**1776**		893	260	758	685	**2596**
2.00 - 3.00	606	150	520	195	**1471**		757	188	650	369	**1964**
3.00 - 4.00	750	141	444	174	**1509**		937	176	555	217	**1885**
4.00 - 5.00	654	144	335	181	**1314**		817	180	419	226	**1642**
5.00 - 6.00	702	138	294	114	**1248**		878	173	367	268	**1686**
6.00 - 7.00	798	226	349	249	**1622**		997	282	436	436	**2151**
TOTAL	**12387**	**7392**	**6465**	**2738**	**28982**		**15482**	**9243**	**8082**	**5365**	**38172**

ANNEXURE : XII Contd.

ANNEXURE : XIII



DEMARCATION OF HIGH TIDE LINE AND COASTAL REGULATION ZONE FOR THE PROJECT SITE BEARING C.S. No. 146, SALT PAN DIVISION, F/N WARD, MUMBAI



N

LEGEND

(As per Approved CZMP)

- High Tide Line (HTL)
- 100m from HTL

(As per CRZ Notification 2011)

- HTL Reference Points
- High Tide Line (HTL)
- 100m / Creek Width from HTL
- Mangroves
- 50m Buffer from Mangroves
- CRZ - IB
- CRZ - II

SOURCE: Client

- Project Site Details
- Project Site Boundary

SOURCE: CZMP, Govt. of Maharastra

- Development Plan - F/N Ward Boundary of Municipal Corp. of Greater Mumbai

SCALE 1:4000

0 30 60 120 180 240 Meters

Prepared by
Institute of Remote Sensing,
Anna University,
Chennai - 600 025.

For
Chief Engineer (CPM), Customs Project Zone
Central Public Works Department
CGS Colony, Mumbai - 400 037.

PREPARED BY	
VERIFIED BY	
APPROVED BY	DRAFT

ANNEXURE : XIII Contd..

ANNEXURE : XIV

LIST OF FLORA OBSERVED IN STUDY AREA

Sl. No.	Botanical Name	Common Name	Family
	Trees		
1.	*Acacia auriculiformis*	Earleaf acacia	Fabaceae
2.	*Acacia nilotica*	Babul	Fabaceae
3.	*Aegle marmelos*	Bengal Quince	Rutaceae
4.	*Alstonia scholaris*	Blackboard tree	Apocynaceae
5.	*Anthocephalus chinensis*	Kadam	Rubiaceae
6.	*Artocarpus heterophyllus*	Jackfruit	Moraceae
7.	*Azadirachta indica*	Neem	Meliaceae
8.	*Barringtonia acutangula*	Indian Oak	Lecythidaceae
9.	*Bauhinia purpurea*	Kaniar	Leguminosae
10.	*Bombax ceiba*	Cotton tree	Malvaceae
11.	*Borassus flabellifer*	Sugar Palm	Arecaceae
12.	*Callistemon citrinus*	Lemon Bottle brush	Myrtaceae
13.	*Caryota urens*	Wine Palm	Arecaceae
14.	*Cassia fistula*	Golden Shower tree	Fabaceae
15.	*Cassia siamea*	Kassod	Fabaceae
16.	*Ceiba pentandra*	Kapok	Malvaceae
17.	*Cocos nucifera*	Coconut	Arecaceae
18.	*Cordia macleodii*	Dahipalas	Boraginaceae
19.	*Cordia sebestena*	Geiger tree	Boraginaceae
20.	*Couroupita guianensis*	Cannonball tree	Lecythidaceae
21.	*Dalbergia sisoo*	Indian Rosewood	Fabaceae
22.	*Delonix elata*	White Gulmohar	Caesalpiniaceae
23.	*Delonix regia*	Gulmohar	Fabaceae
24.	*Erythrina indica*	Indian Coral tree	Fabaceae
25.	*Ficus benghalensis*	Banyan tree	Moraceae
26.	*Ficus hispida*	Hairy fig tree	Moraceae
27.	*Ficus racemosa*	Gular	Moraceae
28.	*Ficus religiosa*	Peepal	Moraceae
29.	*Gliricidia sepium*	Quickstick	Fabaceae
30.	*Grevillea robusta*	Silky oak	Proteaceae
31.	*Kigelia africana*	Sausage tree	Bignoniaceae
32.	*Lagerstroemia reginae*	Jarul	Lythraceae
33.	*Leucaena leucocephala*	White lead tree	Fabaceae
34.	*Mangifera indica*	Mango tree	Anacardiaceae
35.	*Melia azedarach*	White Cedar	Meliaceae
36.	*Millingtonia hortensis*	Tree Jasmine	Bignoniaceae

Sl. No.	Botanical Name	Common Name	Family
37.	*Mimusops elengi*	Medlar	Sapotaceae
38.	*Moringa oleifera*	Drumstick tree	Moringaceae
39.	*Murraya koenigii*	Curry leaf tree	Rutaceae
40.	*Nyctanthes arbor-tristis*	Coral jasmine	Oleaceae
41.	*Peltophorum pterocarpum*	Copperpod tree	Fabaceae
42.	*Phoenix sylvestris*	Silver Date Palm	Arecaceae
43.	*Pithecellobium dulce*	Manila tamarind	Fabaceae
44.	*Plumeria rubra*	Red jasmine	Apocynaceae
45.	*Polyalthia longifolia*	False Ashok	Annonaceae
46.	*Pongamia pinnata*	Indian Beech tree	Fabaceae
47.	*Roystonea regia*	Royal Palm	Arecaceae
48.	*Samanea saman*	Rain tree	Fabaceae
49.	*Sonneratia apetala*	Sonneratia Mangrove	Lythraceae
50.	*Spathodea campanulata*	Fountain tree	Bignoniaceae
51.	*Syzygium cumini*	Jamun tree	Myrtaceae
52.	*Tamarindus indica*	Tamarind	Fabaceae
53.	*Terminalia arjuna*	Arjun tree	Combretaceae
54.	*Thespesia populnea*	Indian Tulip tree	Malvaceae
55.	*Wrightia tinctoria*	Sweet Indrajao	Apocynaceae
56.	*Zizyphus mauritiana*	Indian Plum	Rhamnaceae
	Shrubs		
1.	*Abutilon indicum*	Indian Mallow	Malvaceae
2.	*Bougainvillea spectabilis*	Bougainvillea	Nyctaginaceae
3.	*Capparis sepiaria*	Wild caper bush	Capparaceae
4.	*Capparis zeylanica*	Indian Caper	Capparaceae
5.	*Cassia tora*	Sickle Pod	Fabaceae
6.	*Croton bonplandianum*	Ban Tulsi	Euphorbiaceae
7.	*Dendrophthoe falcata*	Honey Suckle Mistletoe	Loranthaceae
8.	*Ficus elastica*	Rubber plant	Moraceae
9.	*Hamelia patens*	Firebush	Rubiaceae
10.	*Holarrhena pubescens*	Bitter Oleander	Apocynaceae
11.	*Ipomoea carnea*	Pink Morning Glory	Convolvulaceae
12.	*Jasminum sambac*	Arabian Jasmine	Oleaceae
13.	*Jatropha podagrica*	Bottleplant	Euphorbiaceae
14.	*Lantana camara*	Lantana	Verbenaceae
15.	*Lawsonia inermis*	Henna	Lythraceae
16.	*Mussenda frondosa*	Flag Bush	Rubiaceae
17.	*Salvadora persica*	Meswak	Salvadoraceae

Sl. No.	Botanical Name	Common Name	Family
18.	*Taberneamontana divaricata*	Pinwheel flower	Apocynaceae
19.	*Tecoma stans*	Trumpetbush	Bignoniaceae
20.	*Thevetia peruviana*	Mexican oleander	Apocynaceae
21.	*Urena lobata*	Caesarweed	Malvaceae
	Herbs		
1.	*Alternanthera pungens*	Kunth	Amaranthaceae
2.	*Alternanthera sessilis*	Dwarf Copperleaf	Amaranthaceae
3.	*Amaranthus spinosus*	Spiny Amaranth	Amaranthaceae
4.	*Amaranthus viridis*	Green Amaranth	Amaranthaceae
5.	*Argemone mexicana*	Mexican Prickly Poppy	Papaveraceae
6.	*Boerhavia diffusa*	Punarnava	Nyctaginaceae
7.	*Catharanthus roseus*	Madagascar periwinkle	Apocynaceae
8.	*Celosia argentea*	Plumed Cockscomb	Amaranthaceae
9.	*Commelina benghalensis*	Benghal dayflower	Commelinaceae
10.	*Commelina diffusa*	Climbing dayflower	Commelinaceae
11.	*Cycas revoluta*	Sago palm	Cycadaceae
12.	*Cyperus difformis*	Small flower umbrella-sedge	Cyperaceae
13.	*Cyperus distans*	Slender cyperus	Cyperaceae
14.	*Cyperus iria*	Rice flatsedge	Cyperaceae
15.	*Cyperus rotundus*	Coco-grass	Cyperaceae
16.	*Euphorbia thymifolia*	Laghududhika	Euphorbiaceae
17.	*Grangea maderaspatana*	Madras Carpet Flower	Asteraceae
18.	*Heliotropium indicum*	Indian heliotrope	Boraginaceae
19.	*Indigofera linnaei*	True indigo	Fabaceae
20.	*Lagera aurita*	Sticky Blumea	Asteraceae
21.	*Leucaena leucocephala (F)*	White popinac	Fabaceae
22.	*Mirabilis jalapa*	Marvel of Peru	Nyctaginaceae
23.	*Ricinus communis*	Castor Bean plant	Euphorbiaceae
24.	*Sida acuta*	Wireweed	Malvaceae
25.	*Tridax procumbens*	Tridax daisy	Asteraceae
26.	*Triumfetta rhomboidea*	Chinese bur	Malvaceae
	Climbers		
1)	*Antigonon leptopus*	Mexican creeper	Polygonaceae
2)	*Clitoria ternatea*	Butterfly pea	Fabaceae
3)	*Ipomoea obscura*	Obscure morning glory	Convolvulaceae
4)	*Ipomoea pes-tigridis*	Tiger foot Morning Glory	Convolvulaceae
5)	*Ipomoea quamoclit*	Cypress vine	Convolvulaceae
6)	*Merremia turpethum*	Indian Jalap	Convolvulaceae

Sl. No.	Botanical Name	Common Name	Family
7)	*Momordica dioica*	Spiny gourd	Cucurbitaceae
8)	*Pentatropis capensis*	Ambarvel	Asclepiadaceae
9)	*Trichosanthes cucumerina*	Chichinda	Cucurbitaceae
	Mangrove Species		
1.	*Acanthus ilicifolius*	Holy Mangrove	Acanthaceae
2.	*Aeluropus lagopoides*	Shrubby Seablite	Chenopodiaceae
3.	*Avicennia marina*	Grey Mangrove	Acanthaceae
4.	*Avicennia officinallis*	Api-api	Acanthaceae
5.	*Bruguiera cylindrica*	Bakau Putih	Rhizophoraceae
6.	*Bruguiera gymnorrhiza*	Burma Mangrove	Rhizophoraceae
7.	*Casuarina equisetifolia*	Australian Pine	Casuarinaceae
8.	*Clerodendrum inerme*	Clerodendrum	Verbenaceae
9.	*Derris trifoliata*	Sea Derris	Fabaceae
10.	*Excoecaria agallocha*	Thillai	Euphorbiaceae
11.	*Fimbristylis ferruginea*	Rusty Sedge	Cyperaceae
12.	*Rhizophora mucronata*	Asiatic Mangrove	Rhizophoraceae
13.	*Sesuvium portulacastrum*	Shoreline Purslane	Aizoaceae
14.	*Sonneratia caseolaris*	Apple Mangrove	Lythraceae
15.	*Typha angustata*	Small Reedmace	Typhaceae

LIST OF FAUNA OBSERVED IN STUDY AREA

Sl. No.	Zoological Name	Common Name	Schedule
	Mammals		
1.	*Axis axis*	Spotted Deer	III
2.	*Boselaphus tragocamelus*	Nilgai	III
3.	*Canis aureus indicus*	Jackal	II
4.	Funambulus palmarum	Squirrel	IV
5.	*Herpestes edwardsii*	Mongoose	IV
6.	*Lepus nigricollis ruficaudatus*	Indian Hare	IV
7.	*Mus booduga*	Little Indian Field Mouse	IV
8.	*Rattus rattus*	Rat	V
9.	*Semnopithecus entellus*	Gray Langur	II
10.	*Bandicota indica*	Bandicota indica	V
11.	*Bandicota bengalensis*	Lesser Bandicot rat	V
12.	*Canis lupus familiaris*	Common dog	
13.	*Bos primigenius*	Cow	
14.	*Bubalus bubalis*	Domestic buffalo	
15.	*Capra hircus aegagrus*	Goat	
	Reptiles		
16.	*Calotes versicolar*	Common Garden Lizard	IV
17.	*Naja naja*	Cobra	II
18.	*Oligodon arnensis*	Common Kukri snake	IV
19.	*Chamaeleonidae*	Chameleon	III
20.	*Cerberus rhynchops*	Dog faced water snake	II
21.	*Daboia russelii*	Russel’s Viper	II
22.	*Ptyas mucosus*	Common Rat Snake	II
23.	*Mabuya macularia*	Forest Skink	Not Listed
24.	*Mabuya carinata*	Common Skink	Not Listed
	Amphibians		
25.	*Bufo melanostictus*	Common Toad	IV
26.	*Rana tigrina*	Indian bullfrog	IV

Sl. No.	Zoological Name	Common Name	Schedule
	Fishes		
27.	*Megalops cyprinoides*	Indian Tarpon	Not Listed
28.	*Poecilia reticulata*	Guppy Guppy	Not Listed
29.	*Siluriformes*	Catfish	Not Listed
30.	*Tilapia Oreochronis mossambicus*	Mozambique tilapia	Not Listed
31.	*Mullet Mugil cephulus*	Flathead grey mullet	Not Listed
32.	*Periophthalmus sp.*	Common Mud-skipper	Not Listed
	Aves		
1.	*Eudynamys scolopacea*	Asian Koel	IV
2.	*Prinia socialis*	Ashy Prinia	IV
3.	*Acridotheres tristis (Linn.)*	Bank Myna	IV
4.	*Lonchura punctulata*	Black Redstart and the Spotted	IV
5.	*Columba livia (Gmelin)*	Blue Rock Pigeon	IV
6.	*Bubulcus ibis (Linn.)*	Cattle Egret	IV
7.	*Merops orientalis (Latham)*	Small Bee Eater	IV
8.	*Corvus splendens (Vieillot)*	House Crow	V
9.	*Copsychus saularis*	Oriental Magpie-Robin	IV
10.	*Psittacula krameri manillensis (Bechstein)*	Rose Ringed Parakeet	IV
11.	*Pycnonotus cafer (Linn.)*	Red Vented Bulbul	IV
12.	*Vanellus indicus (Boddaert)*	Red Wattled Lapwing	IV
13.	*Ploceus philippinus*	Baya Weaver	IV
14.	*Himantopus himantopus*	Black-winged Stilt	IV
15.	*Turdoides caudatus*	Common Babbler	IV
16.	*Actitis hypoleucos*	Common Sandpiper	IV
17.	*Tringa ochropus*	Green Sandpiper	IV
18.	*Mesophoyx intermedia*	Median Egret	IV
19.	*Casmerodius albus*	Large Egret	IV
20.	*Egretta garzetta*	Little Egret	IV

Sl. No.	Zoological Name	Common Name	Schedule
21.	*Threskiornis Malanocephalus*	Oriental White Ibis	IV
22.	*Ardeola grayii*	Indian Pond Heron	IV
23.	*Chidonias hybridus*	Whiskered Tern	IV
24.	*Ardea cinerea*	Grey Heron	IV
25.	*Gelochelidon nilotica*	Gull-billed Tern	IV
26.	*Alcedo atthis*	Small Blue Kingfisher	IV
27.	*Lanius schach*	Rufous-backed Shrike	IV
28.	*Cypsiurus balasiensis*	Asian Palm Swift	------
29.	*Charadrius dubius*	Little Ringed - Plover	IV
30.	*Euploea core*	Common Crow	V
	Butterflies		
31.	*Pachliopta aristolochiae Fabricius*	Common Rose	Not Listed
32.	*Papilio polytes Linnaeus*	Common Mormon	Not Listed
33.	*Eurema hecabe Linnaeus*	Common Grass yellow	III
34.	*Eurema brigitta Cramer*	Small Grass Yellow	Not Listed
35.	*Catopsilia crocale Cramer*	Common Emigrant	Not Listed
36.	*Delias eucharis Drury*	Common Jezebell	Not Listed
37.	*Junonia almana Linnaeus*	Peacock Pansy	Not Listed
38.	*Danaus genutia Cramer*	Striped Tiger	Not Listed
39.	*Danaus chrysippus Linnaeus*	Plain Tiger	III
40.	*Junonia atlites*	Grey Pansy	III
41.	*Tarucus nara Kollar*	*Striped pierrot*	Not Listed

VILLAGE WISE POPULATION AND LITERACY WITHIN THE STUDY AREA (CENSUS 2011)

PROJECT : CUSTOM OFFICE IN MUMBAI

Town/ village code	Town/village name	No. of house-holds	Population break-up			Population (0-6 years)			Schedule Caste	Schedule Tribe	Literacy level		
			Total	Male	Female	Total	Male	Female			Total literates	Male literates	Female literates
District	**Mumbai Suburban**												
802794	Greater Mumbai (M Cor	694850	3087798	1660337	1427461	307192	160610	146582	192490	34505	2499910	1393600	1106310
District	**Mumbai**												
802794	Greater Mumbai (M Cor	674339	3085411	1684608	1400803	272886	142566	130320	219934	25093	2509022	1410680	1098342
District	**Raigarh**												
Sub distt.	**Uran**												
553291	Gharapuri	154	647	318	329	38	16	22	1	5	492	265	227
	GRAND TOTAL	**1369343**	**6173856**	**3345263**	**2828593**	**580116**	**303192**	**276924**	**412425**	**59603**	**5009424**	**2804545**	**2204879**
	Percentage		**100.00**	**54.18**	**45.82**	**9.40**	**4.91**	**4.49**	**6.68**	**0.97**	**81.14**	**45.43**	**35.71**

ANNEXURE : XV

VILLAGE WISE EMPLOYMENT PATTERN IN THE STUDY AREA (CENSUS 2011)
PROJECT : CUSTOM OFFICE IN MUMBAI

Town/ village code	Town/village name	Employment pattern											
		Total workers	Main workers					Marginal workers					Non workers
			Total	Cultivators	Agri. Labours	HH ind.	Others	Total	Cultivators	Agr. Labours	HH ind.	Others	
District	**Mumbai Suburban**												
802794	Greater Mumbai (M Cor	1232557	1160255	3431	5815	34583	1116426	72303	1878	1024	4626	64775	1855240
District	**Mumbai**												
802794	Greater Mumbai (M Cor	1284396	1209334	3907	5086	40839	1159502	75062	2144	659	4699	67560	1801015
District	**Raigarh**												
Sub distt.	**Uran**												
553291	Gharapuri	470	459	11	0	98	350	11	0	1	1	9	177
	GRAND TOTAL	**2517423**	**2370048**	**7349**	**10901**	**75520**	**2276278**	**147376**	**4022**	**1684**	**9326**	**132344**	**3656432**
	Percentage	**40.78**	**38.39**	**0.31**	**0.46**	**3.19**	**96.04**	**2.39**	**2.73**	**1.14**	**6.33**	**89.80**	**59.22**

ANNEXURE : XV CONTD.

ANNEXURE : XVI

SUMMARY OF AMENITIES AVAILABLE (CENSUS 2011) IN VILLAGES WITHIN THE STUDY AREA OF CUSTOM OFFICE IN MUMBAI

AMENITIES	NOS.	AMENITIES	NOS.	AMENITIES	NOS.
EDUCATION FACILITIES		**DRINKING WATER FACILITY**		**APPROACH TO VILLAGE**	
PPS (Pre-Primary School)	1	TWT (Tap Water-Treated)	1	NH (National Highway)	0
PS (Primary school)	1	TWUT (Tap Water Untreated)	1	SH (State Highway)	0
MS (Middle school)	1	CW (Covered Well)	0	MDR (Major District Road)	0
SS (Secondary school)	1	UW (Uncovered Well)	1	ODR (Other District Road)	0
SSS (Sr. Sec. School)	0	HP (Hand Pump)	0	BTPR (Black Topped (pucca) Road)	0
DCAS (Deg. College Arts & Science only)	0	TW/ BW (Tube Wells/Borehole)	0	GCR (Gravel (kuchha) Roads)	0
EC (Engg. College)	0	S (Spring)	1	WBM (Water Bounded Macadam)	0
MC (Medicine College)	0	R/C (River/Canal)	0	AWR (All Weather Road)	0
MI (Management Institute)	0	T/P (Tank/Pond/Lake)	1	NWR/C (Navigable Waterways (River/Canal))	1
P (Polytechnic)	0	WO (Others)	0	FP (Foot Path)	1
VTS/ITI (Vocational Trg School/ITI)	0				
NFTC (Non Formal Training Centre)	0	**COMMUNICATION SYSTEM**		**BANKS AND COMMERCIAL SOCIETIES**	
SFD (School For Disabled)	0	PO (Post Office)	0	ATM (ATM)	0
EO (Others)	0	SPO (Sub Post Office)	0	CB (Commercial bank)	0
		P&T (Post & Telegraph office)	0	COB (Co-operative bank)	0
MEDICAL FACILITIES		PIN (Village PIN code)	1	ACS (Agricultural Crredit Societies)	0
CHC (Community Health Centres)	0	T (Telephone (landline))	1	SHG (Self-Help Group (SHG))	1
PHC (Primary Health Centre)	0	PCO (Public Call Office/Mobile PCO)	1	PDS (Public Distribution System (PDS))	1
PHSC (Primary Health Sub-Centre)	1	MPC (Mobile phone coverage)	1	M/RM (Mandis/Regular Market)	0
MCWC (Maternity And Child Welfare Centre)	0	IC/CSC (Internet Cafes/Common Service Centre)	0	WH (Weekly Haat)	0
TBC (TB Clinic)	0	PCF (Private Courier Facility)	0	AMS (Agricultural Marketing Society)	0
HA (Hospital Allopathic)	0			NCICDS (Nutritional Centres-ICDS)	1
HAM (Hospiltal Alternative Medicine)	0	**TRANSPORT SYSTEM**		NCAC (Nutritional Centres-Anganwadi Centre)	1
D (Dispensary)	0	PBS (Public Bus Service)	0	NCO (Nutritional Centres-Others)	1
VH (Veterinary Hospital)	0	PvtBS (Private Bus Service)	0	ASHA (ASHA)	0
MHC (Mobile Health Clinic)	0	RS (Railway station)	0	CC-TV (Community Centre with/without TV)	0
FWC (Family Welfare Centre)	0	MA (Auto/Modified Autos)	0		
NGMF-OP (Non Govt. Med. facilities Out Patient)	0	Taxi (Taxi)	0	**SPORTS AND ENTERTAINMENT**	
NGMF-IOP (Non Govt. Med. facilities In And Out Patient)	0	Van (Vans)	0	SF (Sports Field)	0
NGMF-C (Non Govt. Med. facilities Charitable)	0	T (Tractors)	0	SC/RC (Sports Club/Recreation Centre)	0
NGMF-MBBS (Non Govt. Med. facilities Medical Prctitioner with MBBS Degree)	0	CPR-Man (Cycle-pulled Rickshaws (manual driven))	0	C/VH (Cinema/Video Hall)	0
		CPR-Mec (Cycle-pulled Rickshaws (machine driven))	0	PL (Public Library)	0
NGMF-OD (Non Govt. Med. facilities Medical Prctitioner with other Degree)	0	CDA (Carts Drivens by Animals)	0	PRR (Public Reading Room)	0
		S/R/FS (Sea/River/Ferry Service)	1	DNS (Daily Newspaper Supply)	0
NGMF-ND (Non Govt. Med. facilities Medical Practitioner with no Degree)	0			APS (Assembly Polling Station)	0
		POWER SUPPLY		BDRO (Birth and Death Registration Office)	0
NGMF-TPFH (Non Govt. Med. facilities Traditional Practitioner and Faith Healer)	0	PSDU (Power Supply For Domestic Use)	1		
		PSIAU (Power Supply ForAgriculture Use)	1		
NGMF-MS (Non Govt. Med. facilities Medicine Shop)	0	PSCU (Power Supply For Commercial Use)	0		
NGMF-O (Non Govt. Med. facilities Others)	0	PSALL (Power Supply For All Users)	0		

ANNEXURE : XVI CONTD.

SUMMARY OF AMENITIES AVAILABLE (CENSUS 2011) IN TOWNS WITHIN THE STUDY AREA OF CUSTOM OFFICE IN MUMBAI

AMENITIES	NOS.	AMENITIES	NOS.	AMENITIES	NOS.
EDUCATION		Private-MS Office (Nos.)	556	**WATER SUPPLY AND SANITATION**	
Govt. Primary School (Nos.)	824	Govt.-Desk Top Publishing (Nos.))	0	Latrines-Pit (Nos.)	10
Private Primary School (Nos.)	400	Private-Desk Top Publishing (Nos.)	1	Latrines-Flush/Pour Flush (Nos.)	543754
Govt. Middle School (Nos.)	848	Govt.-Vocational(Others) (Nos.))	7	Latrines-Service (Nos.)	0
Private Middle School (Nos.)	234	Private-Vocational(Others) (Nos.)	25	Latrines-Others (Nos.)	1627
Govt. Secondary School (Nos.)	517	Govt.-Non Formal Education (Nos.))	80	Protected Water Supply Source-1	0
Private Secondary School (Nos.)	277	Private-Non Formal Education (Nos.)	12	Capacity Source-1 (KL)	641807
Govt. Senior Secondary School (Nos.)	147	Govt.-Special School for Disabled (Nos.))	11	Protected Water Supply Source-2	0
Private Senior Secondary School (Nos.)	86	Private-Special School for Disabled (Nos.)	6	Capacity Source-2 (KL)	0
Govt. Degree College-Art Only (Nos.)	0	Govt.-Others(Specify) (Nos.))	1	Protected Water Supply Source-3	0
Private Degree College-Art Only (Nos.)	0	Private-Others(Specify) (Nos.)	34	Capacity Source-3 (KL)	0
Govt. Degree College-Science Only (Nos.)	0	**MEDICAL**		Protected Water Supply Source-4	0
Private Degree College-Science Only (Nos.)	0	Hospital Allopathic (Nos.)	25	Capacity Source-4 (KL)	0
Govt. Degree College-Commerce Only (Nos.))	0	Hospital Alternative Medicine (Nos.)	5	Protected Water Supply Source-5	0
Private Degree College-Commerce Only (Nos.)	0	Dispensary/Health Centre (Nos.)	167	Capacity Source-5 (KL)	0
Govt. Degree College-Art and Science Only (Nos.))	0	Family Welfare Centre (Nos.)	15	**TRANSPORT**	
Private Degree College-Art and Science Only (Nos.)	0	Maternity and Child Welfare Centre (Nos.)	33	Bus Route Road Distance (in kms.)	0
Govt. Degree College-Art and Commerce Only (Nos.))	0	Maternity Home (Nos.)	52	Pucca Road Length (in kms.)	669.0
Private Degree College-Art and Commerce Only (Nos.)	0	Maternity Home Nearest facility Distance (in kms.)	0	Kutcha Road Length (in kms.)	0
Govt. Degree College-Art,Science and Commerce (Nos.))	19	T.B. Hospital/ Clinic (Nos.)	10	**ENTERTAINMENT AND COMMODITY**	
Private Degree College-Art,Science and Commerce (Nos.)	21	Nursing Home (Nos.)	6	Govt.-Stadium (Nos.))	50
Govt. Degree College-Law (Nos.))	3	Veterinary Hospital (Nos.)	2	Private-Stadium (Nos.)	28
Private Degree College-Law (Nos.)	7	Mobile Health Clinic (Nos.)	1	Govt.-Cinema Theatre (Nos.))	14
Govt. Degree College-University (Nos.))	1	Others (Nos.)	0	Private-Cinema Theatre (Nos.)	65
Private Degree College-University (Nos.)	7	Non-Government Out-Patient (Nos.)	669	Govt.-Auditorium/Community Hall (Nos.))	25
Govt. Degree College-Others (Nos.))	0	Non-Government In and Out Patient (Nos.)	313	Private-Auditorium/Community Hall (Nos.)	71
Private Degree College-Others (Nos.)	0	Non-Government Charitable-Hospital/Nursing Home (No	176	Govt.-Public Library (Nos.))	9
Govt.-Medical College (Nos.))	4	Non-Government Medicine Shop (Nos.)	1619	Private-Public Library (Nos.)	13
Private-Medical College (Nos.)	3	**ELECTRICITY**		Govt.-Public Reading Room (Nos.))	8
Govt.-Engineering College (Nos.))	12	Electricity-Domestic Connection (Nos.)	780023	Private-Public Reading Room (Nos.)	40
Private-Engineering College (Nos.)	4	Electricity-Industrial Connection (Nos.)	10640	Manufactured Commodity (First)	0
Govt.-Management Institute (Nos.))	2	Electricity-Commercial Connection (Nos.)	105683	Manufactured Commodity (Second)	0
Private-Management Institute (Nos.)	6	Electricity-Road Lighting Connection (Nos.)	55867	Manufactured Commodity (Third)	0
Govt.-Polytechnic (Nos.))	5	Electricity-Others Connection (Nos.)	63	**HELP HOMES**	
Private-Polytechnic (Nos.)	7	**FINANCIAL**		Govt.-Orphanage Home (Nos.))	3
Govt.-Shorthand (Nos.))	0	Nationalised Bank (Nos.)	730	Private-Orphanage Home (Nos.)	4
Private-Shorthand (Nos.)	0	Private Commercial Bank (Nos.)	629	Govt.-Working Women's Hostel (Nos.))	2
Govt.-Typewriting (Nos.))	0	Co-operative Bank (Nos.)	406	Private-Working Women's Hostel (Nos.)	154
Private-Typewriting (Nos.)	0	Agricultural Credit Society (Nos.)	4	Govt.-Old Age Home (Nos.))	1
Govt.-Shorthand and Typewriting (Nos.))	3	Non-Agricultural Credit Society (Nos.)	86	Private-Old Age Home (Nos.)	1
Private-Shorthand and Typewriting (Nos.)	47	**FIRE FIGHTING**			
Govt.-MS Office (Nos.))	0	Fire Fighting Service (Status A(1)/NA(2))	0		

ANNEXURE : XVII

DISPERSION MODEL FOR ANTICIPATING THE GROUND LEVEL CONCENTRATION (GLC'S) OF AIR POLLUTANTS FROM OPERATION OF 4 X 1010 KVA D.G. SETS IN CUSTOM HOUSE, MUMBAI

Ground Level Concentration (GLC) of SPM has been calculated for multi-stack dispersion modelling using double Gaussian diffusion equation : IS 8829-1978 and as per 'Assessment of Impact to Air Environment : Guidelines for Conducting Air Quality Modelling' by CPCB, Delhi, (PROBES/70/1997-98).

$$X_{(x,y,z)} = \frac{Q}{2\pi\sigma_y\sigma_z Up} \exp\left(-\frac{1}{2}\frac{(y^2)}{\sigma y^2}\right) \left[\exp\left\{-\frac{1}{2}\frac{(z-he)^2}{\sigma z^2}\right\}\right] + \left[\exp\left\{-\frac{1}{2}\frac{(z+he)^2}{\sigma z^2}\right\}\right]$$

Where :

$X_{(x, y, z)}$	=	Ground level concentration of pollutant in micro g/cum at the point with co-ordinates (x,y,z).
x	=	Down wind distance in m.
y	=	Cross wind distance in m.
z	=	Vertical distance in m.
he	=	Effective stack height in m.
Q	=	Pollutant emission rate in µg/sec.
σ_y	=	Standard deviation of pollutant plume width in cross wind direction in m.
σ_z	=	Standard deviation of pollutant plume width in vertical direction in m.
Up	=	Mean stack top wind speed in m/sec.

BASIC CONDITIONS

Diurnal variation of the hourly mixing height as per "ATLAS OF HOURLY MIXING HEIGHT AND ASSIMILATIVE CAPACITY OF ATMOSPHERE IN INDIA" published by Ministry of Earth Sciences, India Meteorological Department, Govt. of India, New Delhi from 07:00 hrs IST to 19:00 hrs IST as given in Table 1.

TABLE 1
HOURLY MIXING HEIGHT (M)

Hour	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00
Height	40-80	80-120	200-250	450-550	700-800	1000-1100	1250-1350	1400-1550	1300-1500	1250-1350	1100-1200	625-825	600-700

The stack details are given in Table 1 and the assumed receptors are given in Table 2. The stability classes are given in Table 3 for the monitored data of 24 hrs. The 24 hrs average Ground Level Concentrations has been calculated for PM_{10}, $PM_{2.5}$, SO_2, NOx and CO which are given in Table 4.

TABLE 1
STACK DETAILS

Sl No	Stack name	Height (m)	Dia (m)	Temp (℃)	Exit gas Volume (m^3/s)	Exit vel. (m/s)	Emission rate (µg/s)				
							PM_{10}	$PM_{2.5}$	SO_2	NO_X	CO
1	DG1 (1010 KVA)	30	0.29	225	1.77	26.1	21836	12556	258111	446429	582299
2	DG2 (1010 KVA)	30	0.29	225	1.77	26.1	21836	12556	258111	446429	582299
3	DG2 (1010 KVA)	30	0.29	225	1.77	26.1	21836	12556	258111	446429	582299
4	DG2 (1010 KVA)	30	0.29	225	1.77	26.1	21836	12556	258111	446429	582299

TABLE 2
DESCRIPTION OF ASSUMED RECEPTORS FROM THE STACK

Receptor name	Distance (m)	Direction (deg.)	Receptor name	Distance (m)	Direction (deg.)	Receptor name	Distance (m)	Direction (deg.)
N-1	100.0	0.00	ESE-6	600.0	112.50	SW-11	7000.0	225.00
N-2	200.0	0.00	ESE-7	800.0	112.50	SW-12	10000.0	225.00
N-3	300.0	0.00	ESE-8	1000.0	112.50	WSW-1	100.0	247.50
N-4	400.0	0.00	ESE-9	2000.0	112.50	WSW-2	200.0	247.50
N-5	500.0	0.00	ESE-10	5000.0	112.50	WSW-3	300.0	247.50
N-6	600.0	0.00	ESE-11	7000.0	112.50	WSW-4	400.0	247.50
N-7	800.0	0.00	ESE-12	10000.0	112.50	WSW-5	500.0	247.50
N-8	1000.0	0.00	SE-1	100.0	135.00	WSW-6	600.0	247.50
N-9	2000.0	0.00	SE-2	200.0	135.00	WSW-7	800.0	247.50
N-10	5000.0	0.00	SE-3	300.0	135.00	WSW-8	1000.0	247.50
N-11	7000.0	0.00	SE-4	400.0	135.00	WSW-9	2000.0	247.50
N-12	10000.0	0.00	SE-5	500.0	135.00	WSW-10	5000.0	247.50
NNE-1	100.0	22.50	SE-6	600.0	135.00	WSW-11	7000.0	247.50
NNE-2	200.0	22.50	SE-7	800.0	135.00	WSW-12	10000.0	247.50
NNE-3	300.0	22.50	SE-8	1000.0	135.00	W-1	100.0	270.00
NNE-4	400.0	22.50	SE-9	2000.0	135.00	W-2	200.0	270.00
NNE-5	500.0	22.50	SE-10	5000.0	135.00	W-3	300.0	270.00
NNE-6	600.0	22.50	SE-11	7000.0	135.00	W-4	400.0	270.00
NNE-7	800.0	22.50	SE-12	10000.0	135.00	W-5	500.0	270.00
NNE-8	1000.0	22.50	SSE-1	100.0	157.50	W-6	600.0	270.00
NNE-9	2000.0	22.50	SSE-2	200.0	157.50	W-7	800.0	270.00
NNE-10	5000.0	22.50	SSE-3	300.0	157.50	W-8	1000.0	270.00
NNE-11	7000.0	22.50	SSE-4	400.0	157.50	W-9	2000.0	270.00
NNE-12	10000.0	22.50	SSE-5	500.0	157.50	W-10	5000.0	270.00
NE-1	100.0	45.00	SSE-6	600.0	157.50	W-11	7000.0	270.00
NE-2	200.0	45.00	SSE-7	800.0	157.50	W-12	10000.0	270.00
NE-3	300.0	45.00	SSE-8	1000.0	157.50	WNW-1	100.0	292.50
NE-4	400.0	45.00	SSE-9	2000.0	157.50	WNW-2	200.0	292.50
NE-5	500.0	45.00	SSE-10	5000.0	157.50	WNW-3	300.0	292.50
NE-6	600.0	45.00	SSE-11	7000.0	157.50	WNW-4	400.0	292.50
NE-7	800.0	45.00	SSE-12	10000.0	157.50	WNW-5	500.0	292.50
NE-8	1000.0	45.00	S-1	100.0	180.00	WNW-6	600.0	292.50
NE-9	2000.0	45.00	S-2	200.0	180.00	WNW-7	800.0	292.50
NE-10	5000.0	45.00	S-3	300.0	180.00	WNW-8	1000.0	292.50
NE-11	7000.0	45.00	S-4	400.0	180.00	WNW-9	2000.0	292.50

ANNEXURE : XVII Contd..

Receptor name	Distance (m)	Direction (deg.)	Receptor name	Distance (m)	Direction (deg.)	Receptor name	Distance (m)	Direction (deg.)
NE-12	10000.0	45.00	S-5	500.0	180.00	WNW-10	5000.0	292.50
ENE-1	100.0	67.50	S-6	600.0	180.00	WNW-11	7000.0	292.50
ENE-2	200.0	67.50	S-7	800.0	180.00	WNW-12	10000.0	292.50
ENE-3	300.0	67.50	S-8	1000.0	180.00	NW-1	100.0	315.00
ENE-4	400.0	67.50	S-9	2000.0	180.00	NW-2	200.0	315.00
ENE-5	500.0	67.50	S-10	5000.0	180.00	NW-3	300.0	315.00
ENE-6	600.0	67.50	S-11	7000.0	180.00	NW-4	400.0	315.00
ENE-7	800.0	67.50	S-12	10000.0	180.00	NW-5	500.0	315.00
ENE-8	1000.0	67.50	SSW-1	100.0	202.50	NW-6	600.0	315.00
ENE-9	2000.0	67.50	SSW-2	200.0	202.50	NW-7	800.0	315.00
ENE-10	5000.0	67.50	SSW-3	300.0	202.50	NW-8	1000.0	315.00
ENE-11	7000.0	67.50	SSW-4	400.0	202.50	NW-9	2000.0	315.00
ENE-12	10000.0	67.50	SSW-5	500.0	202.50	NW-10	5000.0	315.00
E-1	100.0	90.00	SSW-6	600.0	202.50	NW-11	7000.0	315.00
E-2	200.0	90.00	SSW-7	800.0	202.50	NW-12	10000.0	315.00
E-3	300.0	90.00	SSW-8	1000.0	202.50	NNW-1	100.0	337.50
E-4	400.0	90.00	SSW-9	2000.0	202.50	NNW-2	200.0	337.50
E-5	500.0	90.00	SSW-10	5000.0	202.50	NNW-3	300.0	337.50
E-6	600.0	90.00	SSW-11	7000.0	202.50	NNW-4	400.0	337.50
E-7	800.0	90.00	SSW-12	10000.0	202.50	NNW-5	500.0	337.50
E-8	1000.0	90.00	SW-1	100.0	225.00	NNW-6	600.0	337.50
E-9	2000.0	90.00	SW-2	200.0	225.00	NNW-7	800.0	337.50
E-10	5000.0	90.00	SW-3	300.0	225.00	NNW-8	1000.0	337.50
E-11	7000.0	90.00	SW-4	400.0	225.00	NNW-9	2000.0	337.50
E-12	10000.0	90.00	SW-5	500.0	225.00	NNW-10	5000.0	337.50
ESE-1	100.0	112.50	SW-6	600.0	225.00	NNW-11	7000.0	337.50
ESE-2	200.0	112.50	SW-7	800.0	225.00	NNW-12	10000.0	337.50
ESE-3	300.0	112.50	SW-8	1000.0	225.00	A2	1968.0	264.00
ESE-4	400.0	112.50	SW-9	2000.0	225.00	A3	3278.0	109.00
ESE-5	500.0	112.50	SW-10	5000.0	225.00	A4	6441.0	52.00

TABLE 3
HOURLY STABILITY FREQUENCY

HOUR	OCCURRENCE OF STABILITY CLASSES (in %)					
	A	B	C	D	E	F
0.00	0.00	0.00	0.00	1.15	4.60	94.25
1.00	0.00	0.00	0.00	1.20	7.23	91.57
2.00	0.00	0.00	0.00	2.41	9.64	87.95
3.00	0.00	0.00	0.00	1.23	14.81	83.95
4.00	0.00	0.00	0.00	3.53	10.59	85.88
5.00	0.00	0.00	0.00	3.70	7.41	88.89
6.00	0.00	0.00	0.00	6.98	5.81	87.21
7.00	0.00	62.20	32.93	4.88	0.00	0.00
8.00	0.00	58.44	36.36	5.19	0.00	0.00
9.00	30.88	63.24	4.41	1.47	0.00	0.00
10.00	21.43	72.86	5.71	0.00	0.00	0.00
11.00	50.00	42.11	7.89	0.00	0.00	0.00
12.00	33.33	56.00	10.67	0.00	0.00	0.00
13.00	20.24	59.52	20.24	0.00	0.00	0.00
14.00	15.85	56.10	28.05	0.00	0.00	0.00
15.00	4.88	63.41	25.61	6.10	0.00	0.00
16.00	0.00	2.44	68.29	29.27	0.00	0.00
17.00	0.00	0.00	79.76	20.24	0.00	0.00
18.00	0.00	6.25	86.25	7.50	0.00	0.00
19.00	0.00	0.00	0.00	2.38	52.38	45.24
20.00	0.00	0.00	0.00	0.00	36.90	63.10
21.00	0.00	0.00	0.00	0.00	19.05	80.95
22.00	0.00	0.00	0.00	2.41	9.64	87.95
23.00	0.00	0.00	0.00	2.41	6.02	91.57
AVERAGE	**6.83**	**21.53**	**16.91**	**4.32**	**7.91**	**42.50**

TABLE 4

24 HOURS AVERAGE GROUND LEVEL CONCENTRATIONS (µg/m^3) TOWARDS THREE PREDOMINANT DOWN WIND DIRECTIONS

Receptor	Distance from DG-1 (m)	Direction (deg)	24 hrs Maximum Ground Level Concentrations														
			PM_{10}			$PM_{2.5}$			SO_2			NOx			CO		
			E 10.8%	W 10.1%	ESE 8.76%	E 10.8%	W 10.1%	ESE 8.76%	E 10.8%	W 10.1%	ESE 8.76%	E 10.8%	W 10.1%	ESE 8.76%	E 10.8%	W 10.1%	ESE 8.76%
ENE-1	100.0	67.5	0.02	0.00	0.00	0.01	0.00	0.00	0.26	0.00	0.00	0.45	0.00	0.00	0.58	0.00	0.00
ENE-2	200.0	67.5	0.03	0.00	0.00	0.02	0.00	0.00	0.34	0.00	0.00	0.58	0.00	0.00	0.76	0.00	0.00
ENE-3	300.0	67.5	0.02	0.00	0.00	0.01	0.00	0.00	0.21	0.00	0.00	0.36	0.00	0.00	0.47	0.00	0.00
ENE-4	400.0	67.5	0.01	0.00	0.00	0.01	0.00	0.00	0.13	0.00	0.00	0.23	0.00	0.00	0.29	0.00	0.00
ENE-5	500.0	67.5	0.01	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.15	0.00	0.00	0.20	0.00	0.00
ENE-6	600.0	67.5	0.01	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.11	0.00	0.00	0.14	0.00	0.00
ENE-7	800.0	67.5	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.06	0.00	0.00	0.08	0.00	0.00
ENE-8	1000.0	67.5	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.04	0.00	0.00	0.05	0.00	0.00
ENE-9	2000.0	67.5	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00
E-1	100.0	90.0	0.14	0.00	0.01	0.08	0.00	0.01	1.60	0.00	0.17	2.77	0.00	0.29	3.61	0.00	0.38
E-2	200.0	90.0	0.24	0.00	0.02	0.13	0.00	0.01	2.78	0.00	0.25	4.81	0.00	0.43	6.28	0.00	0.56
E-3	300.0	90.0	0.24	0.00	0.01	0.14	0.00	0.01	2.87	0.00	0.15	4.96	0.00	0.26	6.47	0.00	0.34
E-4	400.0	90.0	0.18	0.00	0.01	0.10	0.00	0.00	2.15	0.00	0.09	3.72	0.00	0.16	4.85	0.00	0.21
E-5	500.0	90.0	0.13	0.00	0.01	0.07	0.00	0.00	1.52	0.00	0.06	2.63	0.00	0.11	3.43	0.00	0.14
E-6	600.0	90.0	0.09	0.00	0.00	0.05	0.00	0.00	1.12	0.00	0.04	1.94	0.00	0.08	2.53	0.00	0.10
E-7	800.0	90.0	0.06	0.00	0.00	0.04	0.00	0.00	0.73	0.00	0.02	1.25	0.00	0.04	1.64	0.00	0.05
E-8	1000.0	90.0	0.05	0.00	0.00	0.03	0.00	0.00	0.54	0.00	0.02	0.93	0.00	0.03	1.21	0.00	0.03
E-9	2000.0	90.0	0.02	0.00	0.00	0.01	0.00	0.00	0.25	0.00	0.00	0.43	0.00	0.01	0.57	0.00	0.01
E-10	5000.0	90.0	0.01	0.00	0.00	0.01	0.00	0.00	0.12	0.00	0.00	0.20	0.00	0.00	0.27	0.00	0.00
E-11	7000.0	90.0	0.01	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.16	0.00	0.00	0.21	0.00	0.00
E-12	10000.0	90.0	0.01	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.13	0.00	0.00	0.17	0.00	0.00
ESE-1	100.0	112.5	0.03	0.00	0.10	0.02	0.00	0.06	0.38	0.00	1.16	0.66	0.00	2.01	0.86	0.00	2.62
ESE-2	200.0	112.5	0.04	0.00	0.21	0.02	0.00	0.12	0.43	0.00	2.52	0.74	0.00	4.35	0.96	0.00	5.67
ESE-3	300.0	112.5	0.02	0.00	0.23	0.01	0.00	0.13	0.24	0.00	2.75	0.42	0.00	4.76	0.55	0.00	6.21
ESE-4	400.0	112.5	0.01	0.00	0.18	0.01	0.00	0.10	0.15	0.00	2.09	0.26	0.00	3.61	0.33	0.00	4.71
ESE-5	500.0	112.5	0.01	0.00	0.13	0.00	0.00	0.07	0.10	0.00	1.48	0.17	0.00	2.56	0.22	0.00	3.34
ESE-6	600.0	112.5	0.01	0.00	0.09	0.00	0.00	0.05	0.07	0.00	1.09	0.12	0.00	1.89	0.15	0.00	2.47
ESE-7	800.0	112.5	0.00	0.00	0.06	0.00	0.00	0.03	0.04	0.00	0.71	0.07	0.00	1.22	0.09	0.00	1.60
ESE-8	1000.0	112.5	0.00	0.00	0.04	0.00	0.00	0.02	0.02	0.00	0.52	0.04	0.00	0.90	0.05	0.00	1.17

Receptor	Distance from DG-1 (m)	Direction (deg)	24 hrs Maximum Ground Level Concentrations														
			PM_{10}			$PM_{2.5}$			SO_2			NOx			CO		
			E 10.8%	W 10.1%	ESE 8.76%	E 10.8%	W 10.1%	ESE 8.76%	E 10.8%	W 10.1%	ESE 8.76%	E 10.8%	W 10.1%	ESE 8.76%	E 10.8%	W 10.1%	ESE 8.76%
ESE-9	2000.0	112.5	0.00	0.00	0.02	0.00	0.00	0.01	0.01	0.00	0.24	0.01	0.00	0.42	0.01	0.00	0.55
ESE-10	5000.0	112.5	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.12	0.00	0.00	0.20	0.00	0.00	0.26
ESE-11	7000.0	112.5	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.16	0.00	0.00	0.21
ESE-12	10000.0	112.5	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.13	0.00	0.00	0.17
SE-1	100.0	135.0	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.18	0.00	0.00	0.31	0.00	0.00	0.40
SE-2	200.0	135.0	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.26	0.00	0.00	0.44	0.00	0.00	0.58
SE-3	300.0	135.0	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.15	0.00	0.00	0.27	0.00	0.00	0.35
SE-4	400.0	135.0	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.17	0.00	0.00	0.22
SE-5	500.0	135.0	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.11	0.00	0.00	0.14
SE-6	600.0	135.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.08	0.00	0.00	0.10
SE-7	800.0	135.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.04	0.00	0.00	0.06
SE-8	1000.0	135.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.03	0.00	0.00	0.03
SE-9	2000.0	135.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01
SW-1	100.0	225.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.02	0.00
WSW-1	100.0	247.5	0.00	0.04	0.00	0.00	0.02	0.00	0.00	0.48	0.00	0.00	0.83	0.00	0.00	1.08	0.00
WSW-2	200.0	247.5	0.00	0.04	0.00	0.00	0.02	0.00	0.00	0.42	0.00	0.00	0.73	0.00	0.00	0.96	0.00
WSW-3	300.0	247.5	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.25	0.00	0.00	0.42	0.00	0.00	0.55	0.00
WSW-4	400.0	247.5	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.15	0.00	0.00	0.26	0.00	0.00	0.34	0.00
WSW-5	500.0	247.5	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.18	0.00	0.00	0.23	0.00
WSW-6	600.0	247.5	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.13	0.00	0.00	0.17	0.00
WSW-7	800.0	247.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.07	0.00	0.00	0.10	0.00
WSW-8	1000.0	247.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.05	0.00	0.00	0.06	0.00
WSW-9	2000.0	247.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.02	0.00
W-1	100.0	270.0	0.00	0.11	0.00	0.00	0.06	0.00	0.00	1.29	0.00	0.00	2.23	0.00	0.00	2.91	0.00
W-2	200.0	270.0	0.00	0.24	0.00	0.00	0.14	0.00	0.00	2.81	0.00	0.00	4.85	0.00	0.00	6.33	0.00
W-3	300.0	270.0	0.00	0.28	0.00	0.00	0.16	0.00	0.00	3.30	0.00	0.00	5.71	0.00	0.00	7.45	0.00
W-4	400.0	270.0	0.00	0.22	0.00	0.00	0.12	0.00	0.00	2.54	0.00	0.00	4.40	0.00	0.00	5.73	0.00
W-5	500.0	270.0	0.00	0.15	0.00	0.00	0.09	0.00	0.00	1.82	0.00	0.00	3.15	0.00	0.00	4.10	0.00
W-6	600.0	270.0	0.00	0.12	0.00	0.00	0.07	0.00	0.00	1.38	0.00	0.00	2.38	0.00	0.00	3.10	0.00
W-7	800.0	270.0	0.00	0.08	0.00	0.00	0.05	0.00	0.00	0.96	0.00	0.00	1.66	0.00	0.00	2.17	0.00

ANNEXURE : XVII Contd..

Receptor	Distance from DG-1 (m)	Direction (deg)	24 hrs Maximum Ground Level Concentrations														
			PM_{10}			$PM_{2.5}$			SO_2			NOx			CO		
			E	W	ESE	E	W	ESE	E	W	ESE	E	W	ESE	E	W	ESE
			10.8%	10.1%	8.76%	10.8%	10.1%	8.76%	10.8%	10.1%	8.76%	10.8%	10.1%	8.76%	10.8%	10.1%	8.76%
W-8	1000.0	270.0	0.00	0.06	0.00	0.00	0.04	0.00	0.00	0.75	0.00	0.00	1.30	0.00	0.00	1.70	0.00
W-9	2000.0	270.0	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.40	0.00	0.00	0.70	0.00	0.00	0.91	0.00
W-10	5000.0	270.0	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.20	0.00	0.00	0.35	0.00	0.00	0.46	0.00
W-11	7000.0	270.0	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.16	0.00	0.00	0.28	0.00	0.00	0.37	0.00
W-12	10000.0	270.0	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.13	0.00	0.00	0.22	0.00	0.00	0.29	0.00
WNW-1	100.0	292.5	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.34	0.00	0.00	0.58	0.00	0.00	0.76	0.00
WNW-2	200.0	292.5	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.35	0.00	0.00	0.61	0.00	0.00	0.79	0.00
WNW-3	300.0	292.5	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.22	0.00	0.00	0.37	0.00	0.00	0.49	0.00
WNW-4	400.0	292.5	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.14	0.00	0.00	0.24	0.00	0.00	0.31	0.00
WNW-5	500.0	292.5	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.16	0.00	0.00	0.21	0.00
WNW-6	600.0	292.5	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.12	0.00	0.00	0.15	0.00
WNW-7	800.0	292.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.07	0.00	0.00	0.09	0.00
WNW-8	1000.0	292.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.05	0.00	0.00	0.06	0.00
WNW-9	2000.0	292.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.02	0.00
A2	1968.0	264.0	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.32	0.00	0.00	0.55	0.00	0.00	0.72	0.00
A3	3278.0	109.0	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.16	0.01	0.00	0.27	0.01	0.00	0.35
A4	6441.0	52.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note : *The concentrations as calculated on other receptors are Nil. The total calm has been divided in all directions and added to the percentage ex-calm in case of wind direction*

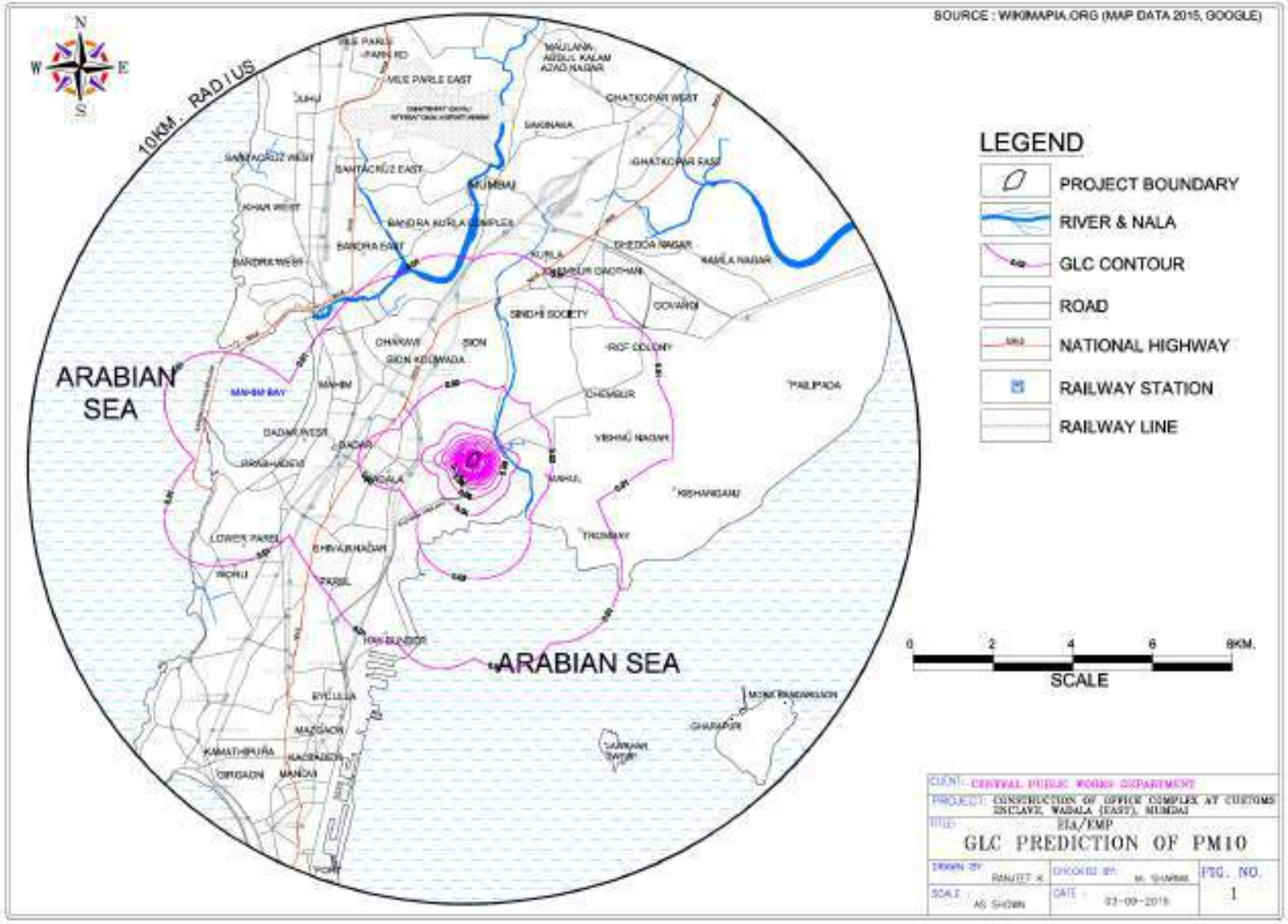
CONCLUSIONS : From Table 4, it can be observed that the 24 hours average GLC's will marginally increase air pollution as given below :

MAXIMUM GLC (µg/m^3) IN THREE PREDOMINANT WIND DIRECTIONS

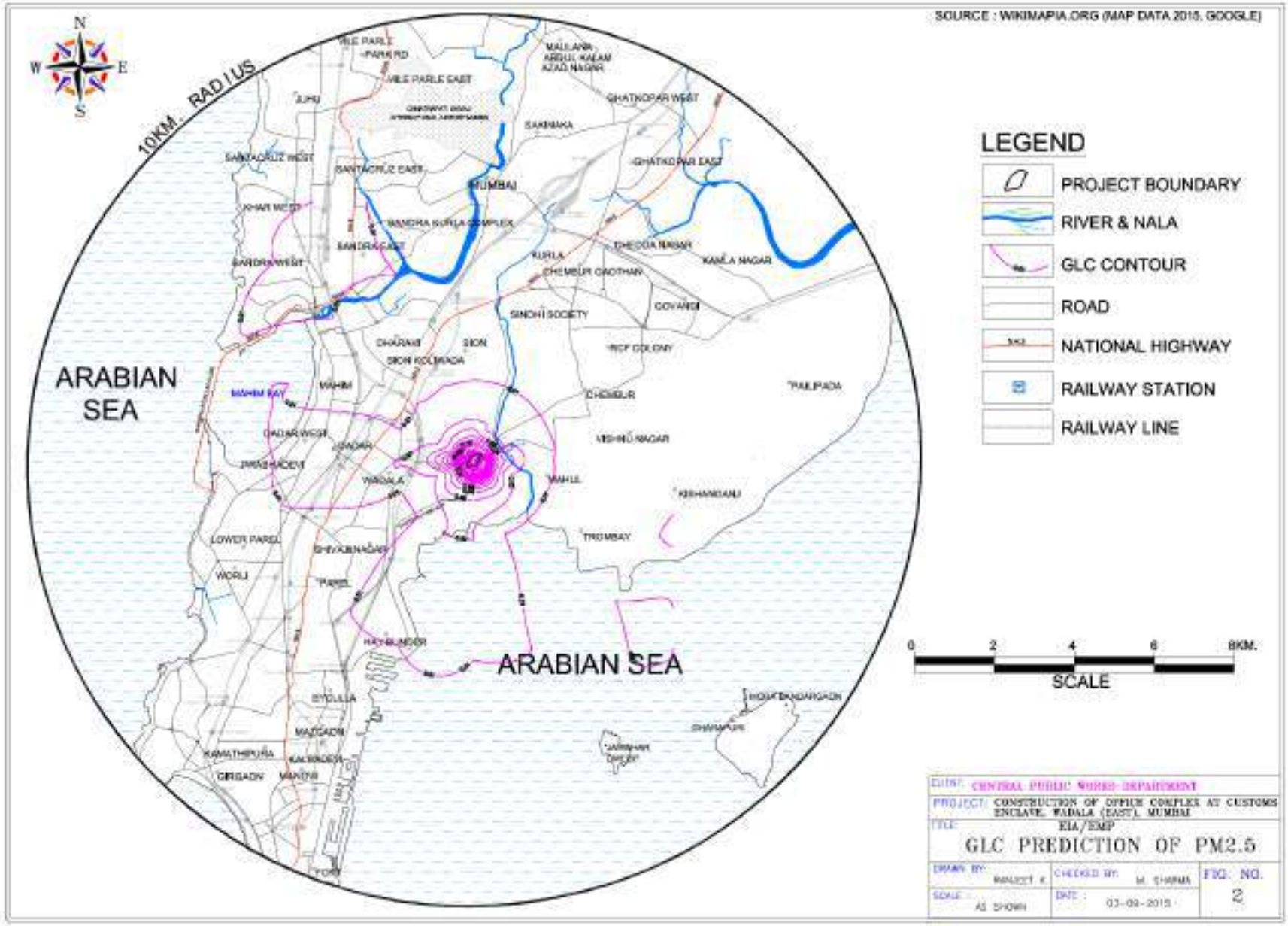
Pollutants	PM_{10}	$PM_{2.5}$	SO_2	NO_X	CO
E	0.24 200-300 m	0.14 300 m	2.87 300 m	4.96 300 m	6.47 300 m
W	0.28 300 m	0.16 300 m	3.30 300 m	5.71 300 m	7.45 300 m
ESE	0.23 300 m	0.13 300 m	2.75 300 m	4.76 300 m	6.21 300 m

The GLC prediction have been shown with line contours for PM_{10}, $PM_{2.5}$, SO_2, NOx and CO in figure 1, 2, 3, 4 and 5 respectively and location of assumed receptors are shown in Fig 6..

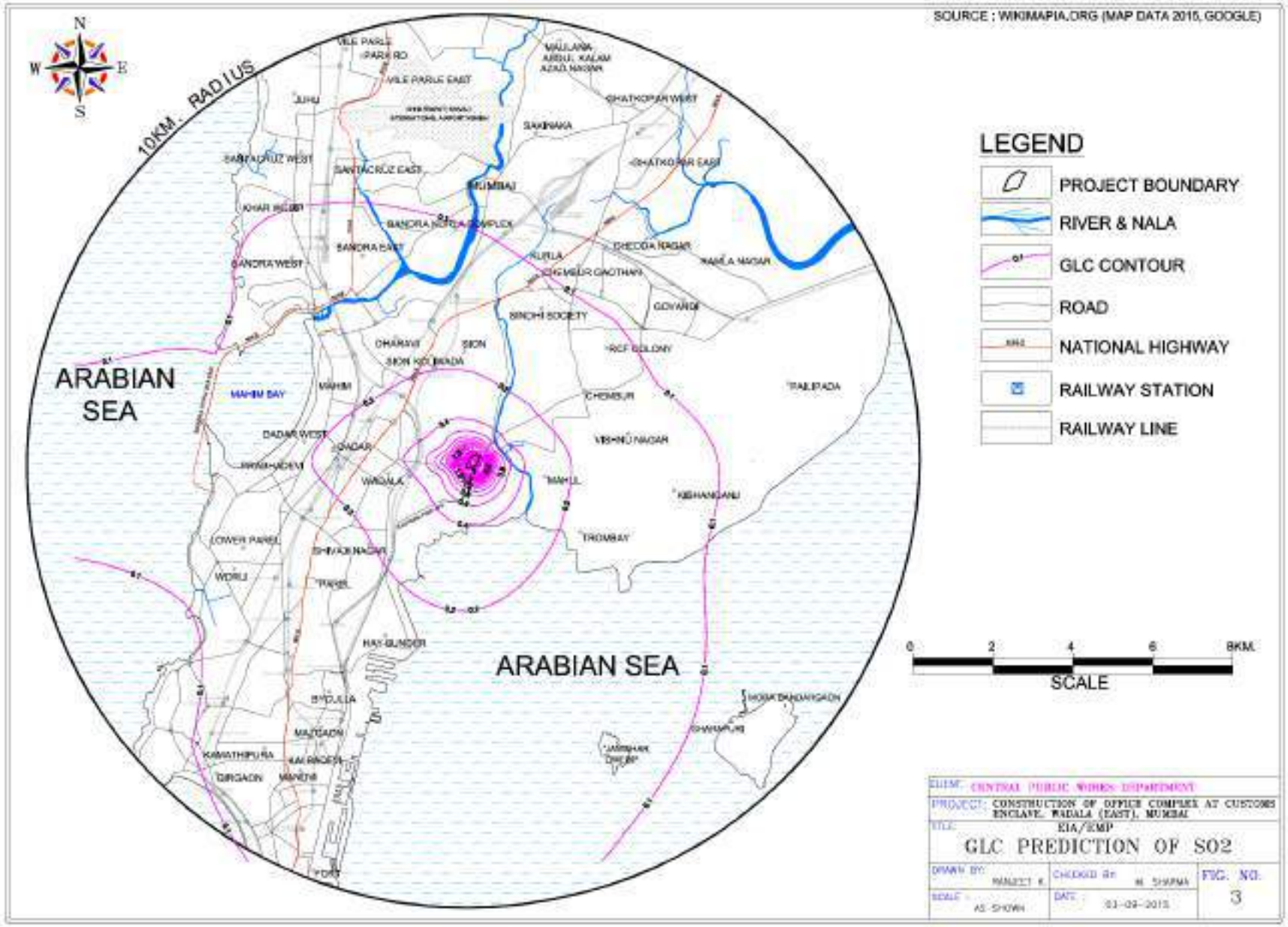
ANNEXURE : XVII Contd..



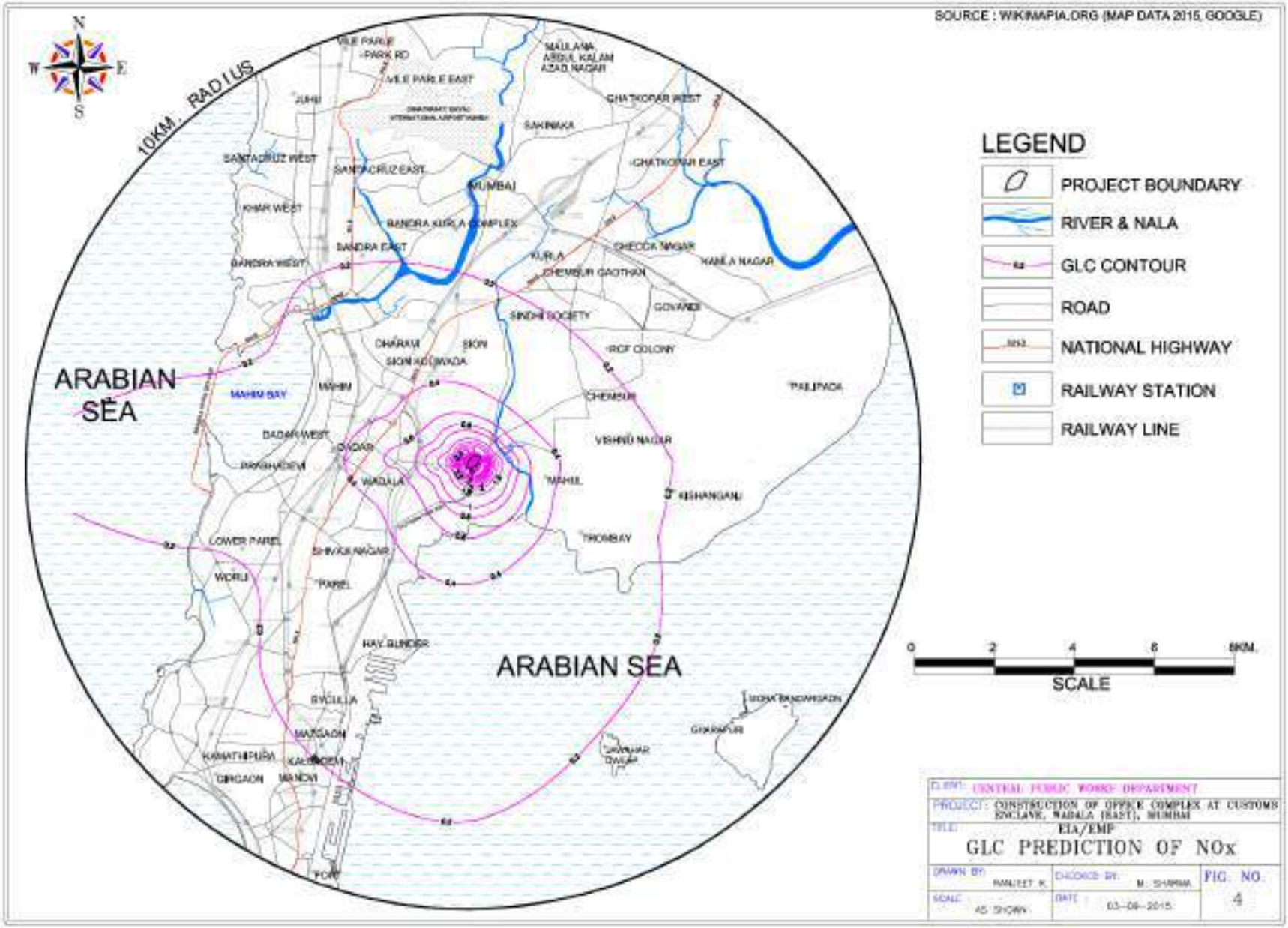
ANNEXURE : XVII Contd..



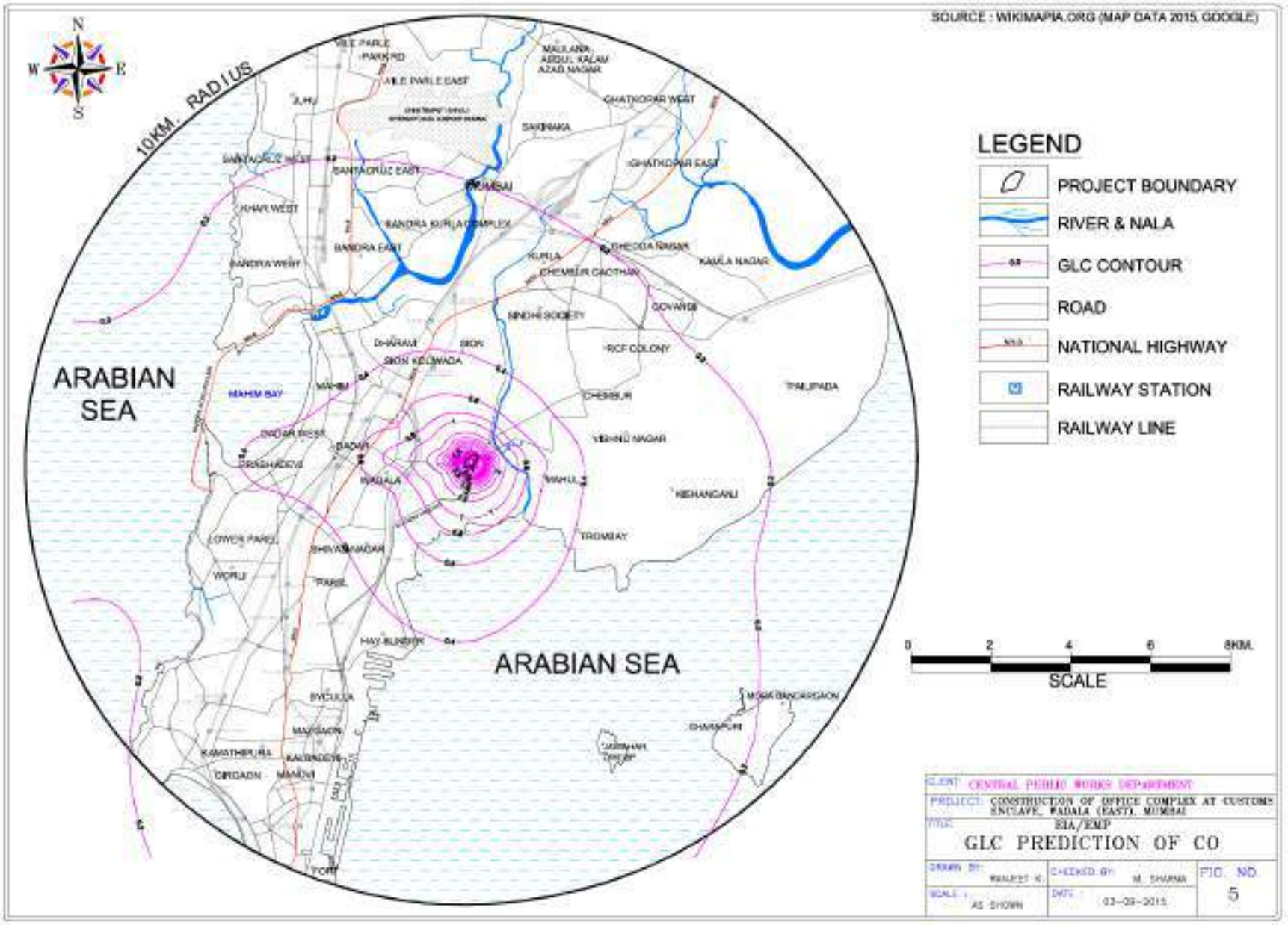
ANNEXURE : XVII Contd..

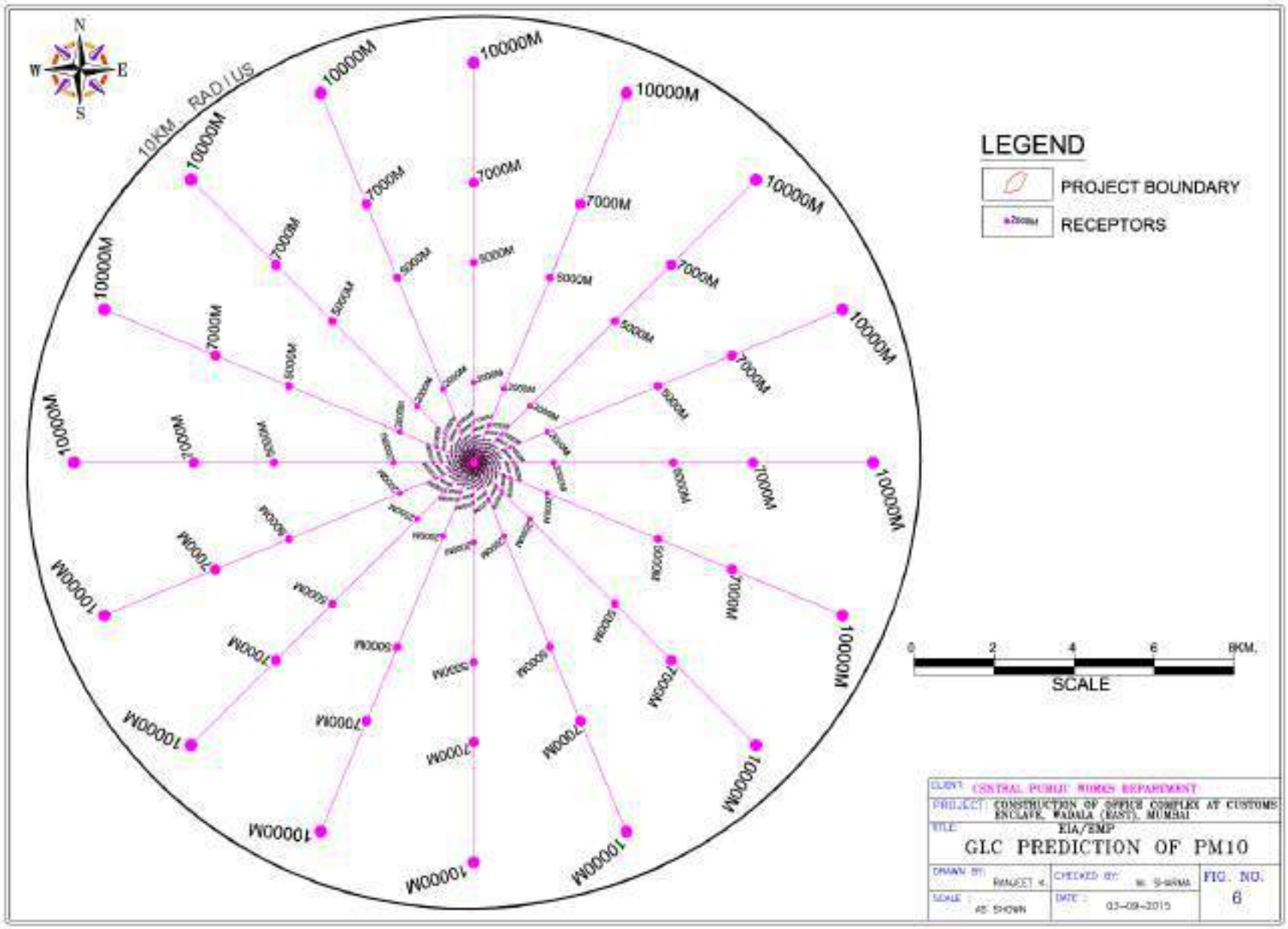


ANNEXURE : XVII Contd..



ANNEXURE : XVII Contd..


SOURCE : WIKIMAPIA.ORG (MAP DATA 2015, GOOGLE)
10KM. RADIUS
ARABIAN SEA
ARABIAN SEA
LEGEND
PROJECT BOUNDARY
RIVER & NALA
GLC CONTOUR
ROAD
NATIONAL HIGHWAY
RAILWAY STATION
RAILWAY LINE
0 2 4 6 8KM.
SCALE
CLIENT : CENTRAL PUBLIC WORKS DEPARTMENT
PROJECT : CONSTRUCTION OF OFFICE COMPLEX AT CUSTOMS ENCLAVE, WADALA (EAST), MUMBAI
TITLE : EIA/EMP
GLC PREDICTION OF CO
DRAWN BY : RANJEET K.
CHECKED BY : M. SHARMA
SCALE : AS SHOWN
DATE : 03-09-2015
FIG. NO. 5


N
W
E
S
10KM RADIUS
LEGEND
PROJECT BOUNDARY
RECEPTORS
0 2 4 6 8KM.
SCALE
CLIENT: CENTRAL PUBLIC WORKS DEPARTMENT
PROJECT: CONSTRUCTION OF OFFICE COMPLEX AT CUSTOMS ENCLAVE, WADALA (EAST), MUMBAI
TITLE: EIA/EMP
GLC PREDICTION OF PM10
DRAWN BY: RANJEET K.
CHECKED BY: M. SHARMA
SCALE: AS SHOWN
DATE: 03-09-2015
FIG. NO. 6

ANNEXURE : XVIII

IMPACT ON AIR QUALITY OF OTHER POWER PROJECTS & REFINERIES

Extract From Final Environment Impact Assessment Report for The Proposed Modernisation of Existing Unit #6 (500 MW) by change of fuel at Trombay Thermal Power Station of Tata Power Company Limited, April 2013

4.3 IMPACT DURING OPERATION PHASE

4.3.1 AIR QUALITY

Air emissions have no boundaries and can migrate from one area to another depending upon the wind direction and speed. The sources of air emission can be grouped into three categories, i.e. point and area:

a. A point source is a single source of emission with an identified location, such as the power plant stack, process stack etc.

b. An area source is when multiple point sources of emission are widely distributed that has a collective significance. The coal storage area can be grouped in this category. Fugitive emissions are also expected during storage and handling of raw materials within the project site. However such windblown emissions will principally arise only if the raw material dumps are not kept wet or covered. Also the impacts will be limited by spatial spread and are not likely to cause any considerable impacts outside the project boundaries.

4.3.1.1 Methodology

The proposed coal based thermal power station will have pollutant emission in the form of PM, SO_2 and NO_x from flue gas of the stacks. Air pollution dispersion modeling has been carried out for PM, SO_2 and NO_x. These emissions will disperse in the atmosphere depending on the atmospheric conditions. The atmospheric conditions that affect the dispersion of pollutants are:

- Wind direction and wind speed

The predominant wind directions during the study period were from NW to SE with calm wind less than 0.44 m/sec for about 33.9% of the total time.

- Ambient temperature

Minimum and maximum temperature recorded during summer season is 21.4^{0}C and 39.4^{0}C.

- Atmospheric stability:

Atmospheric stability depends on the wind speed and solar radiation intensity or cloud cover. During night time the cloud cover, wind speeds are considered for the stability calculation. More unstable condition will lead to better dispersion and stable condition will have less dispersion.

- Micro-meteorology

Surface meteorological parameters for the site were measured from 1st March to 31st May 2012 for use in dispersion modelling. In general, the atmospheric conditions that affect the dispersion of pollutants are explained in the following sections with respect to the proposed project site.

- Extrapolation of Wind Speed

The Wind speed measurement are normally carried out at a height of 10 meters, in order to use these measurements for modelling purposes, the wind speed need to be extrapolated to the effective height release. It is recommended that for extrapolation, an empirical power law as given by Irwin (1979) be used. This power law is described below: Irwins' Wind Scaling Law

$U1 = U2 (Z1 / Z2)^n$

Where U1 and U2 are wind speed at heights Z1 and Z2 respectively and n is an exponent that is a function of stability class.

- Mixing Height

Mixing height is the region between the bottom of the inversion layer and the ground. The inversion layer is a dynamic region, which changes depending on the atmospheric condition. The mixing height can be calculated based on the vertical temperature profile of the atmosphere. Mixing height for Delhi, Bombay and Calcutta are published by Central Pollution Control Board. Indian Meteorological Department (IMD) is regularly monitoring the vertical temperature profiles at 35 locations. This data can be used for calculating the mixing height at any specific location. However, site-specific mixing height data is not available. Mixing height data available for morning and evening time at nearest observatory at Mumbai has been used for present study. Mixing height data of the project area has been taken from CPCB publication named "**Spatial Distribution of Hourly Mixing Depth over Indian Region**". As per CPCB reports the maximum mixing height over the region during summer season is 1600m. The mixing height data for summer season is shown in **Annexure – XII**.

4.3.1.2 Modelling Assumptions

For this project, the ISCST-3 model was set up to calculate maximum ground-level concentrations of PM, SO_2 and NO_x on an hourly basis. Concentrations were calculated based on the receptor points in an area of 15 x 15 km, at 250 meters intervals, in all the 16 wind directions with the plant as the centre of origin.

Air Dispersion Model Used

Modeling Procedure

US-Environmental Protection Agency's (US-EPA) Industrial Source Complex Short Term (ISCST-3) was used for the air quality dispersion analysis.

Description of Model

ISCST-3 model provides options to model emissions from a wide range of sources that might be present in a typical industrial source complex. The basis of the model is a straight line, steady state Gaussian plume equation, which is used with some modifications, to model simple point source emissions from stacks.

The ISCST-3 model accepts hourly meteorological data (MET Data) records to define the conditions for plume rise, transport, diffusion, and deposition. The model estimates the concentration or deposition values for each source and receptor combination for each hour of input meteorology, and calculates user selected short

term averages. For a steady-state Gaussian plume, the hourly concentration at downwind distance x (meters) and crosswind distance y (meters) is given by:

$$\chi = \frac{QKVD}{2\pi u_s \sigma_y \sigma_z} \exp\left[-0.5\left(\frac{y}{\sigma_y}\right)^2\right]$$

Where,

Q =	Pollutant emission rate (mass per unit time)
K =	A scaling coefficient to convert calculated concentrations to desired units (default value of 1×10^9 for Q in g/s and concentration in $\mu g/m^3$)
V =	Vertical term
D =	Decay term
σ_y, σ_z =	Standard deviation of lateral and vertical concentration distribution (m)
u_s =	Mean wind speed (m/s) at release height.

The Vertical Term includes the effects of source elevation, receptor elevation, plume rise, limited mixing in the vertical, and the gravitational settling and dry deposition of particulate matter (with diameters greater than about 0.1 microns).

The ISCST-3 model uses either a polar or a Cartesian receptor network as specified by the user. In the Cartesian coordinate system, the X-axis is positive to the east of the user specified origin and the Y-axis is positive to the north.

The wind power law is used to adjust the observed wind speed, u_{met}, from a reference measurement height, z_{met}, to the stack or release height, h_s, using power law equation.

The plume height is used in the calculation of the Vertical Term"V". This is the effective release height of the contaminant. This is made up of physical stack height and plume rise due to buoyancy or momentum.

Appropriate plume rise formulations have been used in this model. The effective plume rise for various weather conditions and wind speed are used. The atmospheric stability height signifies the extent and rate of dispersion. This stability class is dependent on wind speed and temperature and forms an input for the MET Data that is required to complete dispersion modelling.

The infinite series term in the above equation accounts for the effects of the restriction on vertical plume growth at the top of the mixing layer. The Equation assumes that the mixing height in rural and urban areas is known for all stability categories. The ISCST-3 models currently assume unlimited vertical mixing under stable conditions, and therefore delete the infinite series term in the Equation for the E and F stability categories.

Pollutants travelling downwind will be reflected at the ground. The elevated inversion layer (mixing height) will also reflect the pollutant. At long downwind distances the plume concentration will be fully mixed vertically. This effect has also been built up in the program (model) formulation.

The impacts of primary air pollutants are predicted using ISCST-3 model, which has been selected keeping in view the flat terrain around the proposed project site. This model is widely recognized as a predictive tool in impact assessment for air environment. The ISCST-3 model has been applied with flat terrain, gradual plume rise and buoyancy induced dispersion options in the present study.

ISCST-3 Model with the following options has been employed to predict the cumulative ground level concentrations due to the Unit #6 fuel conversion.

- Area being rural, rural dispersion parameters was considered.
- Predictions have been carried out to estimate concentration values over radial distance of 10 km around the sources.
- Emission rates from the point sources were considered as constant during the entire period.
- Calm winds recorded during the study period were also taken into consideration.

An option for creation of data files giving 1st high 24 hr average ground level concentrations for the mean meteorological data of the study period has been used for post processing in SURFER – 7 graphics package.

Post-processor module is used for graphing the output data and/or plotting the area impacted by the air pollutants on maps. The plots of areas impacted may also include isopleths showing areas of minimal to high concentrations that define areas of the highest health risk. The isopleths plots are useful in determining protective actions for the public and responders.

4.3.1.3 Inputs to ISCST3 Model

Pollution dispersion calculation was done for PM, SO_2 and NO_x emission by using ISCST3 model for existing as well as future conditions, taking the Unit #6 modernization into account. The area has been divided into 250m grid and the ground level concentration of the pollutant at each grid point was calculated. Total area for calculation of incremental GLC's has been considered as 15,000m X 15,000m.

Two scenarios were developed for the modeling. Scenario 1 reflecting the existing mode of operation, with Units #5, #6 firing on coal, Unit #6 firing on oil, and Unit #7 on Natural Gas.

Scenario 2 is the future case, Units #5, #6 and #8 firing on coal and Unit #7 on natural gas. Stack details after proposed modernization are given in Table IV.1 Emission rates of pollutants for the two scenarios are contained in Tables IV.2 and IV.3

Table IV.1

Stack Details after Proposed Modernization at TTPS

Sr. No.	Particular	Stack Height in meter	Stack Diameter in meter	Flue gas exit velocity m/s	Exit Flue gas temp °K
1	Unit #5	152.4	7.32	25	413
2	Unit #6	275	7.32	25	413
3	Unit #7	60	6.5	19	383
4	Unit #8	220	6.4	25	413

Table IV.2

Pollutant Emission Rates for Scenario 1 – Current Operations

Details		Unit #5	Unit #6	Unit #7	Unit #8	Total
Capacity	**MW**	**500**	**500**	**180**	**250**	
Fuel		Coal	Oil	Natural Gas	Coal	
Sulphur	%	0.2	0.17	-	0.2	
FGD efficiency	%	67	-	-	67	
Fuel consumption	TPD	6000	2800	700	3000	
SO_2 emission	TPD	24	10	-	12	
SO_2 emission After FGD	TPD	9.5	9.5	-	4.8	24 TPD
	Existing Emission Rate					
SO_2 emission	g/s	110	110	-	55	
NOx emission	g/s	129	99	19	64	
PM emission	g/s	70	49	-	38	

Table IV.3

Pollutant Emission Rates for Scenario 2 – After Unit #6 Modernization

Details		Unit #5	Unit #6	Unit #7	Unit #8	Total
Capacity	MW	**500**	**500**	**180**	**250**	
Fuel		Coal	Coal	Natural Gas	Coal	
Sulphur	%	0.28	0.28	-	0.28	
FGD efficiency	%	67	90	-	67	
Fuel consumption	TPD	6000	6000	700	3000	
SO_2 emission	TPD	34	34	-	17	
SO_2 emission After FGD	TPD	13.3	3.4	-	6.7	24 TPD
	After Unit #6 Modernization Emission Rate					
SO_2 emission	g/s	154	39	-	77	
NOx emission	g/s	129	97	19	64	
PM emission	g/s	70	29	-	38	

4.3.1.4 Results of the Air Quality modeling

Concentration contour plots of the pollutant PM, SO_2 and NOx, overlain on a map of the area 24-hour average concentrations are given below..

1. Sulfur dioxide (SO_2)

This predicts cumulative GLC of SO_2 emission from all stacks at existing plant. The isopleths of maximum GLC's for SO_2 emission before and after Unit #6 modernization is shown in **Figure IV.1** and **Figure IV.2**.

After Unit #6 modernization the maximum predicted concentration of SO_2 (3.8 $\mu g/m^3$) occur at a distance of about 4.5 km towards south- east direction from the plant.

Figure IV.1

Isopleths of Maximum GLC's for SO_2 Emission in $\mu g/m^3$ (Existing Operations)

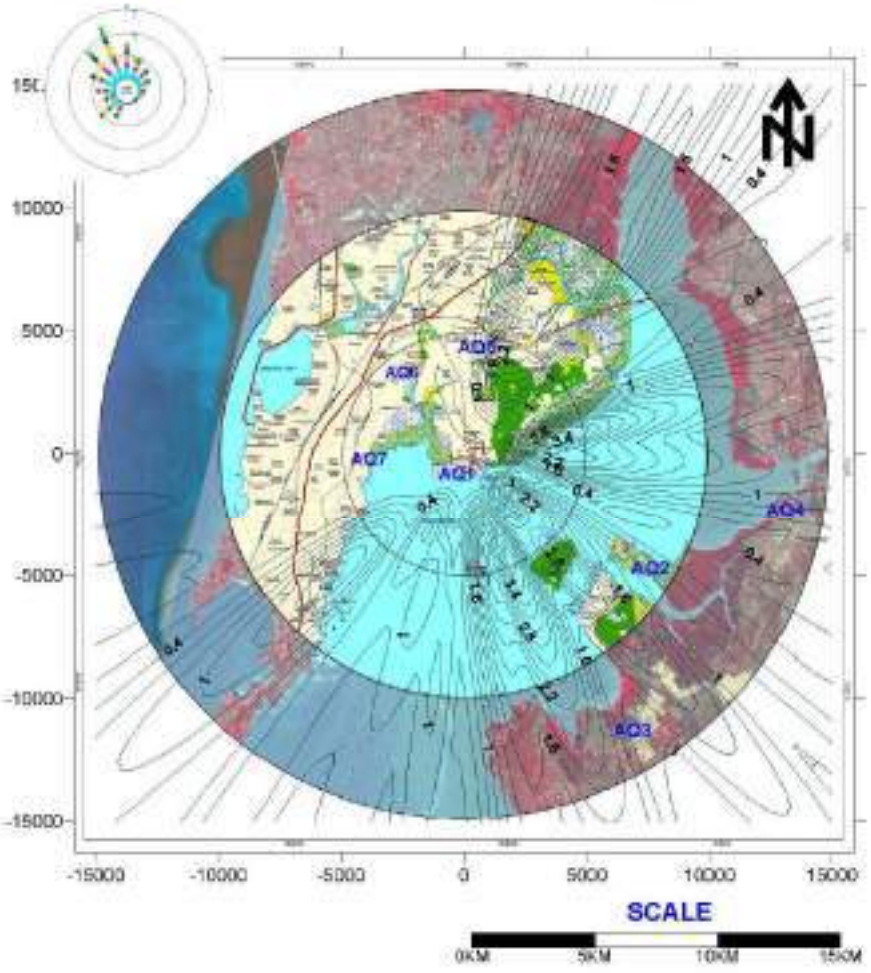
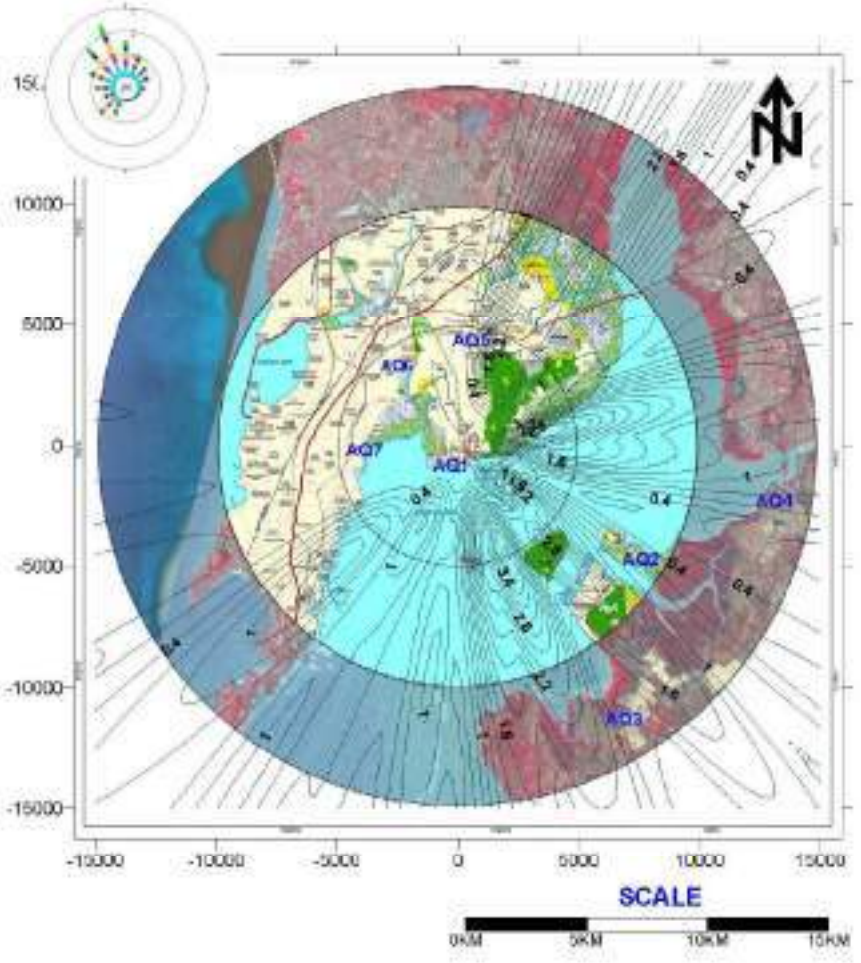


Figure IV.2

Isopleths of Maximum GLC's for SO_2 Emission in µg/m³ (After Unit #6 Modernization)



Nitrogen Oxide (NOx)

After Unit #6 modernization the maximum predicted cumulative concentration of NO_x (4.5µg/m^3) occurred at a distance of about 4.5 km towards south- east direction from the plant. The isopleths of maximum GLC's for NO_x emission existing and after Unit #6 modernization is shown in the **Figure IV.3** and **Figure IV.4.**

Figure IV.3

Isopleths of Maximum GLC's for NOx Emission in µg/m^3 (Existing operations)

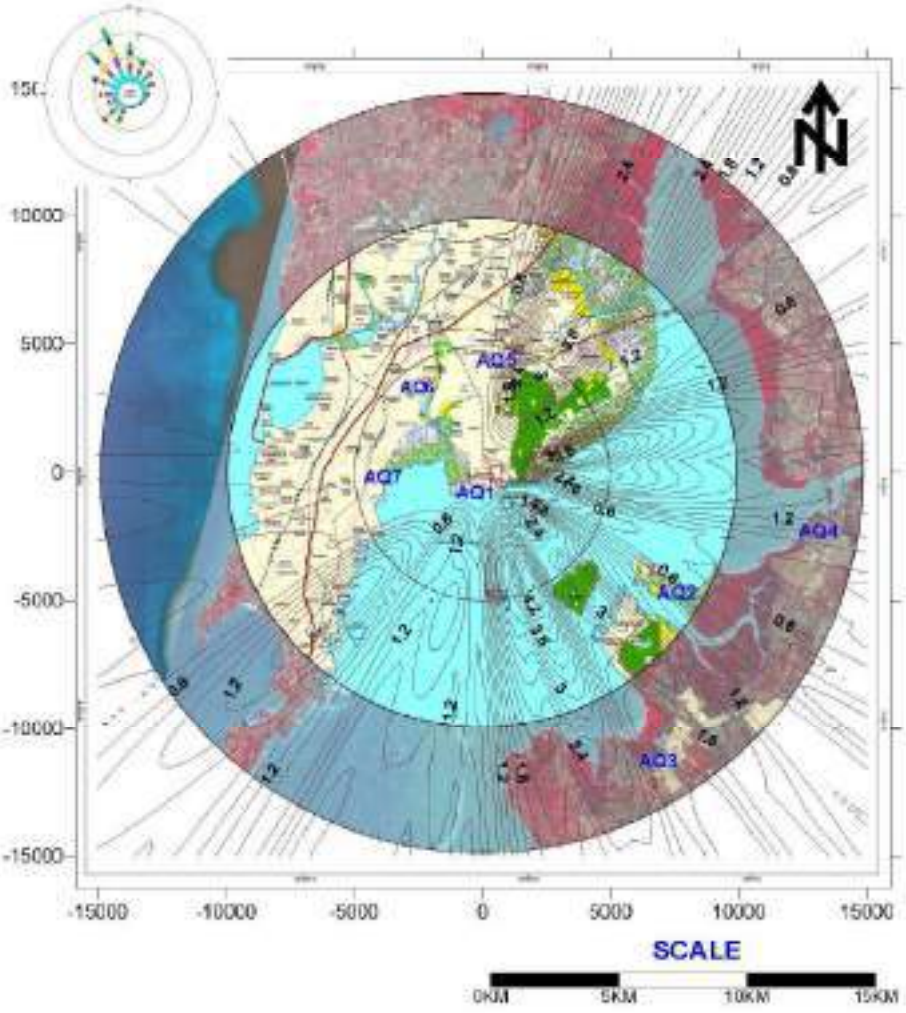
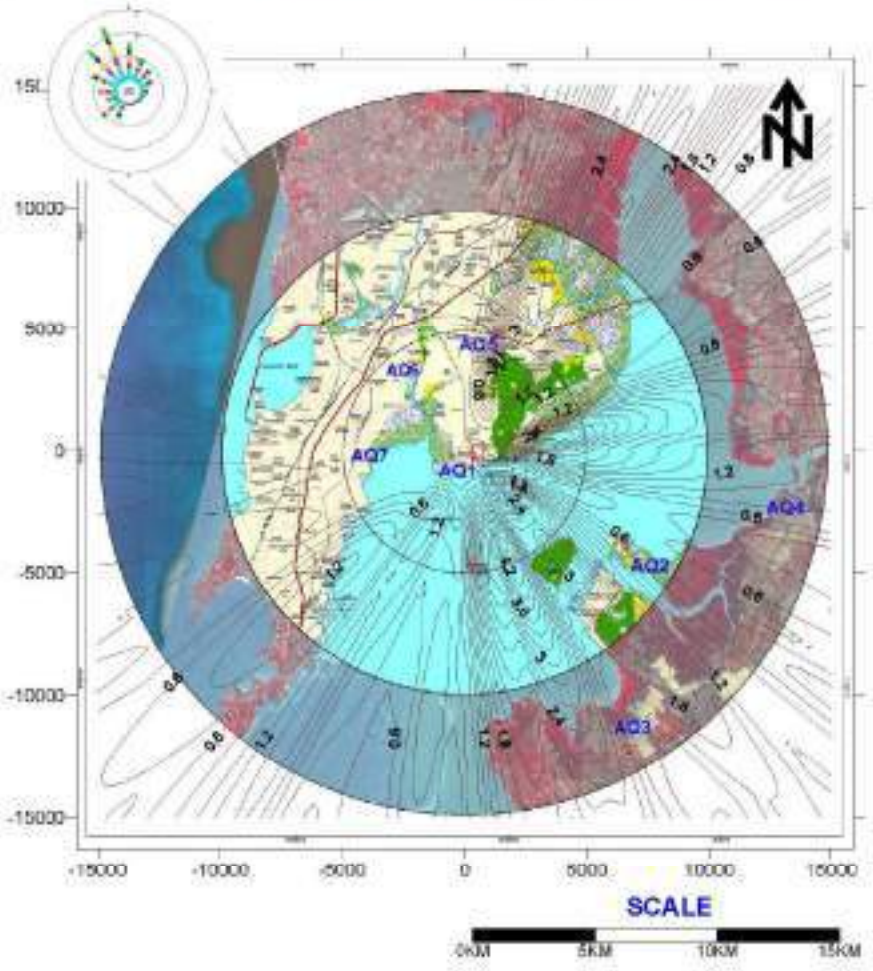


Figure IV.4

Isopleths of Maximum GLC's for NOx Emission in $\mu g/m^3$ (After Unit #6 Modernization)



Particulate Matter

The predicted cumulative maximum GLC for PM emissions from all stacks during before and after Unit #6 modernization are shown in **Figure IV.5** and **IV.6** . After Unit #6 modernization the maximum predicted cumulative concentration of PM (1.96µg/m^3) occurred at a distance of about 4.5 km towards south-east direction from the plant.

Figure IV.5

Isopleths of Maximum GLC's for PM Emission in µg/m3 (Existing Operations)

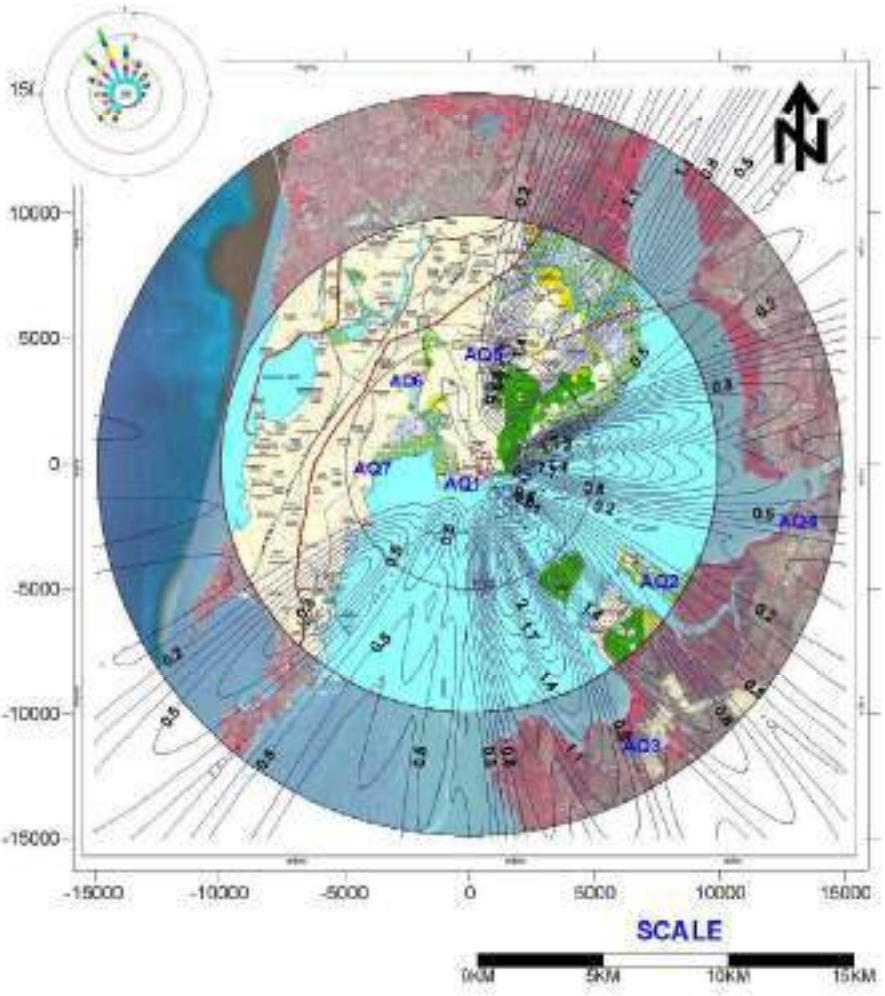
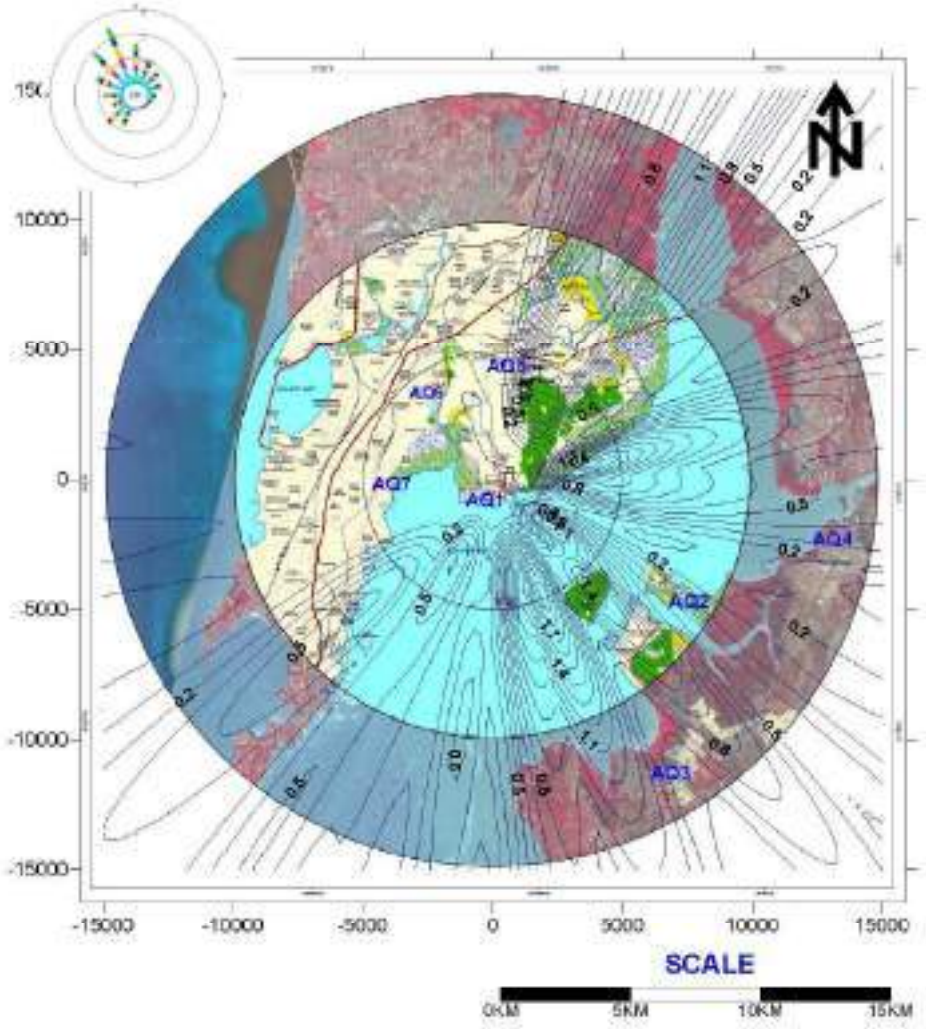


Figure IV.6

Isopleths of Maximum GLC's for PM Emission in µg/m³ (After Unit #6 Modernization)



Conclusion

The results of the modeling for the two scenarios- present case and future case are summarized. The maximum modeled ground level concentrations of pollutants at any point in the modeled domain are shown in the **Table IV.4**.

Table IV.4

Summary of Results of Air Quality Impact Assessment – Worst case scenario

Particulars	PM (µg/m^3)	SO_2 (µg/m^3)	NOx (µg/m^3)
Scenario 1	2.24	3.91	4.58
Scenario 2	1.94	3.85	4.43
Change	-0.3	-0.06	-0.15
Change %	-13.4	-1.5	-3.3

The air quality simulation result shows that the scenario 2 (after Unit #8 modernization) results have lower ground level concentrations for PM, SO_2 and NOx from TTPS than the current operations. The worst case maximum GLC's of all the pollutants is predicated in south east direction at about 4.5 km from the project site. The reduction in pollution load is attributed to use of pollution control devices such as ESP, FGD and low NOx burners after the proposed modernization of Unit #8. There is reduction of 13.4%, 1.5% and 3.3% for PM, SO_2 and NOx respectively due to the proposed modernization project.

The maximum GLC for all parameters is observed near JNPT (The JNPT area is represented by Nhava village, where baseline monitoring was carried out) The base line concentration of the pollutants at Nhava Village are meeting NAAQ standards except PM-10 due to various ongoing construction activities. It is observed that for scenario 2 (after Unit #8 modernization), all GLC resulting from TTPS will comply with the NAAQS by substantial margins. Thus, proposed Unit #8 modernization will not have any negative impact in local air quality in the Mumbai area, whilst continuing to comply with the daily emission limit of 24 tonnes of SO_2.

Regular monitoring of all the air emission parameters will be carried out as per the Environmental monitoring plan after modernization of Unit #8.

Further to the initiatives taken by different industries in the area, Government has also taken several initiatives to reduce RSPM concentration in Mumbai. These initiatives are listed below:

1) Implementation of stricter emission norms, Bharat –IV which will bring down vehicular emission further.
2) All Autos and Taxis in Mumbai are being converted to CNG.
3) Preparation and implementation of action plan for Industrial area in city through Maharashtra State Pollution Control Board.
4) Focus on increase in public transport facility like Mumbai local, Metro rail and Monorail projects. Implementation of these projects will help in reducing privet cars on roads and will bring down pollution levels in Mumbai further.

ANNEXURE : XVIII Contd..

Extract From TOR to EC of Environmental Impact Assessment Study For Proposed Conversion Of Catalytic Reforming Unit (CRU) To Isomerisation Unit And Revamp Of Existing Naphtha Hydro Desulphurization Unit (NHDS) project at BPCL- Mumbai Refinery, Maharashtra

1.2.6 SOIL ENVIRONMENT

For establishing the baseline status of soil within the probable impact zone, Soil Samples were collected at 10 locations in and around the BPCL-Mumbai refinery for the following soil parameters: pH, Bulk Density, Specific Gravity, Electrical Conductivity, Porosity, Sodium Adsorption Ratio, Organic Matter, Total Nitrogen, Phosphate, Potassium. Sodium Adsorption Ratio of the soil samples ranges from 0.02-0.72. Total Nitrogen of the soil samples ranges from 111.3-338.6 mg/kg. Organic Matter of the soil samples ranges from 7.8-12.2 %.

1.2.7 BIOLOGICAL ENVIRONMENT

There is no national park / wild life sanctuary / eco sensitive area/ reserve forest is within 10 Km from BPCL Mumbai Refinery.

1.2.8 SOCIO-ECONOMIC ENVIRONMENT

Socio-economic profile of human settlements around 10 km radius area of BPCL-Mumbai Refinery has been collected and presented in sec 3.9 of chapter-3 in this EIA study report.

1.3. Anticipated Environmental Impacts and Mitigation measures

1.3.1 Ambient Air Environment

In the proposed ISOM project, due to the increase in steam demand and decrease in direct fuel, pollutant load on Boiler (HEB 1, HEB 2, HEB 3) and furnaces (CRU B1, HDS H101 & HDS H102) will be changed. Total quantity in NO_x will be increased by 0.11 MT/D while the total SO_2 quantity will remain same with respect to Pre-ISOM project (Post CDU-IV). Existing stacks of CRU and NHDS units will be used for proposed ISOM unit and revamped NHDS unit. Stack emission details for ISOM project, facilities discontinued and net impact are given below in **Table 5**:

Table- 5: Details of stack emissions Post proposed ISOM project

Emission for existing stacks (Post-CDU-4 project/ Pre-ISOM project)---(A)						
S. No.	Furnace	Flue Gas Flow	NO_x	NO_x	SO_2	SO_2
		Nm^3/Hr	mg/Nm^3	MT/D	mg/Nm^3	MT/D
				5.14		**10.44**

Stack Emissions to be discontinued due to Proposed ISOM project---(B)

S. No.	Furnace	Flue Gas Flow	NO_x	NO_x	SO_2	SO_2
		Nm^3/Hr	mg/Nm^3	MT/D	mg/Nm^3	MT/D
1	HEB 1	33647	156	0.126	257	0.207
2	HEB 2	34022	81	0.066	332	0.271
3	HEB 3	32010	117	0.090	336	0.258
4	CRU B1	64688	56.7	0.09	393	0.61
5	HDS H101	1790	125	0.01	130	0.01
	HDS H102	3020	125	0.01	130	0.01
	Total			**0.38**		**1.36**

Addition of stack Emissions due to proposed ISOM project---(C)

S. No.	Furnace	Flue Gas Flow	NO_x	NO_x	SO_2	SO_2
		Nm^3/Hr	mg/Nm^3	MT/D	mg/Nm^3	MT/D
1	HEB-1	52715	156	0.197	360	0.46
2	HEB-2	53433	81	0.103	360	0.46
3	HEB-3	51305	117	0.144	360	0.44
4	CRU B1	8439	57	0.011	0	0.000
5	HDS H101 & HDS H102	10850	125	0.033	0	0.000
	Total			**0.49**		**1.36**

Total net Emission Post proposed ISOM project---(A)-(B)+(C)

			5.25		**10.44**

Note: HEB 1, HEB 2, HEB 3, CRU B1, HDS H101, HDS H102 stacks will remain same. Only the flue gas quantities will be changed due to the proposed ISOM project.

The SO2 value of Post proposed ISOM project will remain same with respect to Post-ongoing CCR & CDU-4 projects. While the NOX value of Post proposed ISOM project will be increased by 0.11 MT/D with respect to Post- ongoing CCR & CDU-4 projects. The stack emission with respect to SO_2 and NO_X is summarized in the below **Table-6**

Table 6: Summary of NO_X & SO_2 Emission from Refinery

	NOx (MT/D)	SO_2 (MT/D)
Emission for existing stacks (Post-CDU-4 project/ Pre-ISOM project)---(A)	5.14	10.44
Stack Emissions to be discontinued due to Proposed ISOM project---(B)	0.38	1.36
Addition of stack Emissions due to proposed ISOM project---(C)	0.49	1.36
Total net Emission Post proposed ISOM project---(A)-(B)+(C)	5.25	10.44

Ambient Air Quality Prediction (SO_2)

Air quality modeling was done and the isopleths generated in ISCST-3 software for 24 hourly maximum average for SO_2 is shown in **Table 7** below:

Table 7– Predicted values of GLC for SO_2

		SO_2 (24 hourly maximum)				
		Maximum 24 hr GLC $\mu g/m^3$	**Maximum GLC From BPCL Main Gate House (0,0) Co-ordinates (m)**	**Distance from the plant boundary (m)**	**Maximum 98 Percentile Baseline Value (within 10 km radius) $\mu g/m^3$**	**Resultant 98 Percentile Value $\mu g/m^3$**
CASE-1	Emission for Pre-ISOM project scenario	6.95	**600,200**	Within the refinery boundary	13.91	20.86
CASE-2	Emission for Post-ISOM project scenario	7.05	**600,200**	Within the refinery boundary	13.91	20.96

From the Table 7, SO_2 value (maximum 24 hr Ground Level Concentration (GLC)) of Pre-ISOM project scenario **(CASE-1)** is predicted as 6.95 $\mu g/m^3$ and SO_2 value (maximum 24 hr Ground Level Concentration (GLC)) of Post-ISOM project scenario **(CASE-2)** is predicted as 7.05 $\mu g/m^3$. The maximum GLC for SO_2 occurs inside the Plant boundary at 632.5 m NE from North-West side Refinery boundary for both **CASE-1** & **CASE-2**.

By superimposing the same with background SO_2 level (i.e. 98 percentile maximum baseline collected value), the maximum resultant GLC observed is 20.86 $\mu g/m^3$ **(CASE-1)** and 20.96 $\mu g/m^3$ **(CASE-2)**.

In both the cases the SO_2 value is well within the standard limit of 80 $\mu g/m^3$ for 24 hourly average for industrial and residential areas.

Ambient Air Quality Prediction (NO_X)

Air quality modeling was done and the isopleths generated in ISCST-3 software for 24 hourly maximum average for NO_X is shown in **Table-8**.

Table 8– Predicted values of GLC for NO_X

		NO_X(24 hourly maximum)				
		Maximum 24 hr GLC $\mu g/m^3$	**Maximum GLC From BPCL Main Gate House (0,0) Co-ordinates (m)**	**Distance from the plant boundary (m)**	**Maximum 98 Percentile Baseline Value (within 10 km radius) $\mu g/m^3$**	**Resultant 98 Percentile Value $\mu g/m^3$**
CASE-1	Emission for Pre-ISOM project scenario	5.00	**600,1000**	Within the refinery boundary	21.77	26.77
CASE-2	Emission for Post-ISOM project scenario	5.45	**600,1000**	Within the refinery boundary	21.77	27.22

From the table 8, NO_X value (maximum 24 hr Ground Level Concentration (GLC)) of pre ISOM project scenario **(CASE-1)** is predicted as 5.00 $\mu g/m^3$ and NO_X value (maximum 24 hr Ground Level Concentration (GLC)) of post ISOM project scenario **(CASE-2)** is predicted as 5.45 $\mu g/m^3$. The maximum GLC for NO_X occurs inside the Plant boundary at 632.5 m NE from North-West side Refinery boundary for both **CASE-1** & **CASE-2**.

By superimposing the same with background NO_X level (i.e. 98 percentile maximum baseline collected value), the maximum resultant GLC observed is 26.77 $\mu g/m^3$ **(CASE-1)** and 27.22 $\mu g/m^3$ **(CASE-2)**. In both the cases the NO_X value is well within the standard limit of 80 $\mu g/m^3$ for 24 hourly average for industrial and residential areas.

ANNEXURE : XVIII Contd..

Extract from Executive Summary
TOR TO EC
ENVIRONMENTAL IMPACT ASSESSMENT STUDY FOR PROPOSED DIESEL HYDROTREATING UNIT (DHT) PROJECT FOR PRODUCTION OF BS-IV HSD AT
BPCL-MUMBAI REFINERY, MAHARASHTRA

1.3. Anticipated Environmental Impacts and Mitigation measures

1.3.1 Ambient Air Environment

Stack-wise emission in DHT project is given below in Table 6:

Table 6: Stack Emissions details for proposed DHT project

Stack	Physical Height of Stack from Ground Level (m)	Stack Tip Dia. (m)	Exit Temp. (°C)	Flue Gas Flow (m^3/Hr)	Volumetric flow rate (mg/m3)	NOx MT/D	SO_2 MT/D
DHT Furnace	60	2	150	36495	161.67	0.14	0
GT+HRSG	60	3.5	150	350000	142.85	1.2	0
Total						**1.34**	**0**

Total emission from refinery in Pre-DHT & Post-DHT case is given in Table 7.

Table 7: Summary of NO_x & SO_2 Emission from Refinery

	NOx (MT/D)	SO_2 (MT/D)
Emission from stacks (Post-ISOM project/ Pre-DHT project)---(A)	5.25	10.44
Addition of stack Emissions due to proposed DHT project---(B)	1.34	0
Emission from stacks (Post-DHT project)---(C)	6.59	10.44

Ambient Air Quality Prediction (SO_2)

Air quality modeling was done and the isopleths generated in ISCST-3 software for 24 hourly maximum average for SO_2 is shown in **Table 8** below

Table 8– Predicted values of GLC for SO_2

		Maximum 24 hr GLC $\mu g/m^3$	Maximum GLC From BPCL Main Gate House (0,0) Co-ordinates (m)	Distance from the plant boundary (m)	Maximum 98 Percentile Baseline Value (within 10 km radius) $\mu g/m^3$	Resultant 98 Percentile Value $\mu g/m^3$
CASE-1	Emission for Post-ISOM project scenario	7.05	**600,200**	Within the refinery boundary	13.91	20.96
CASE-2	Emissions from proposed DHT project scenario	No net SO2 emission from DHT project				

From the Table 8, SO_2 value (maximum 24 hr Ground Level Concentration (GLC) of post ISOM project scenario **(CASE-1)** is predicted as 7.05 $\mu g/m^3$ and by superimposing the same with background SO_2 level (i.e. 98 percentile maximum baseline collected value), the maximum resultant GLC observed is 20.96 $\mu g/m^3$ **(CASE-1).** This SO_2 value is well within the standard limit of 80 $\mu g/m^3$ for 24 hourly average for industrial and residential areas. There will be no SO_2 emission from proposed DHT project scenario **(CASE-2).**

Ambient Air Quality Prediction (NO_X)

Air quality modeling was done and the isopleths generated in ISCST-3 software for 24 hourly maximum average for NO_X is shown in **Table-9**.

Table 9– Predicted values of GLC for NO_x

		NOX(24 hourly maximum)				
		Maximum 24 hr GLC $\mu g/m^3$	Maximum GLC From BPCL Main Gate House (0,0) Co-ordinates (m)	Distance from the plant boundary (m)	Maximum 98 Percentile Baseline Value (within 10 km radius) $\mu g/m^3$	Resultant 98 Percentile Value $\mu g/m^3$
CASE-1	Emission for Post-ISOM project scenario	5.45	**600,1000**	Within the refinery boundary	21.77	27.22
CASE-2	Emissions from proposed DHT project scenario	7.01	**200,1400**	Within the refinery boundary	27.22 (GLC of Post DHT project)	34.23

From the Table 9, NO_x value (maximum 24 hr Ground Level Concentration (GLC) of post ISOM project scenario **(CASE-1)** is predicted as 5.45 $\mu g/m^3$ and the maximum GLC for proposed DHT project scenario **(Case-2)** is predicted as 7.01 $\mu g/m^3$.

By superimposing the same with background NOX level (i.e. 98 percentile maximum baseline collected value), the maximum resultant GLC observed is 27.22 $\mu g/m^3$ **(CASE-1)** and 34.23 $\mu g/m^3$ **(CASE-2)**.

In both the cases the NO_x value is well within the standard limit of 80 $\mu g/m^3$ for 24 hourly average for industrial and residential areas.

Mitigation Measures for Minimizing Air Emission Impact

In order to minimize the impact of the project on the environment, due attention is given for implementing effective pollution control measures. SO_2 and NO_x are the main air pollutants from the point source emissions. Various steps taken by BPCL to monitor and control the emission of SO_2 and NO_x are summarized below:

- Use of gaseous or liquid fuels in all the furnaces / heaters / boilers to minimize emission of particulate matter.
- Low sulfur fuel oil, nil H2S amine treated refinery fuel gas, Regassified Liquified Natural Gas (R LNG) with nil sulfur is used as fuel for control of SO2 emission.
- Use of Sulfur Recovery Unit (SRU) with > 99% efficiency to minimize SO_2 emission from the refinery complex.

Figure 4.1 – Predicted GLC for 24hour Maximum Concentration values of SO2 due to emissions from the emission sources in Post-ISOM project scenario (CASE-1)

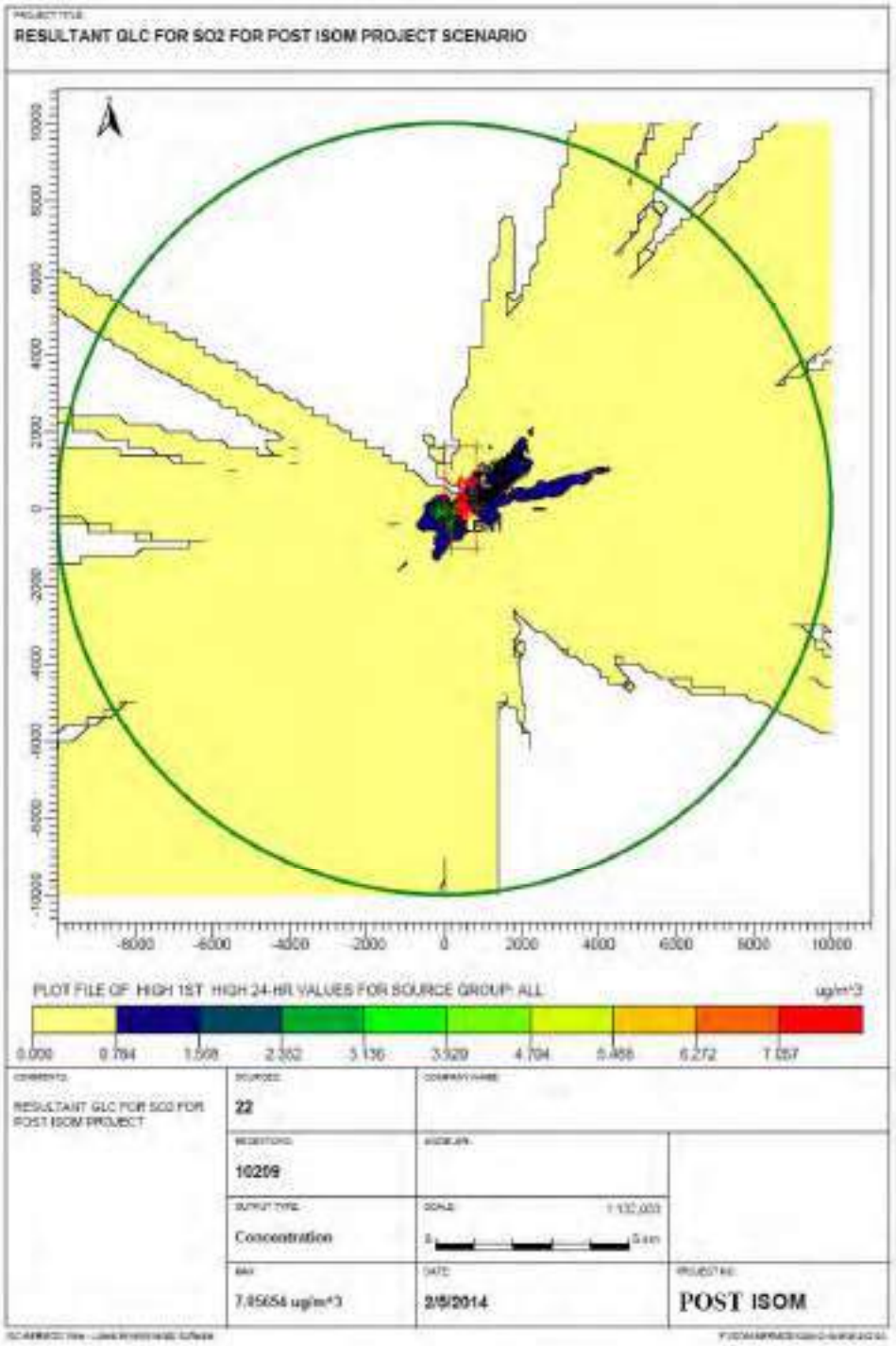


Figure 4.2: Predicted GLC for 24hour Maximum Concentration values of NO2 due to emissions from the emission sources in Post-ISOM project scenario (CASE-1)

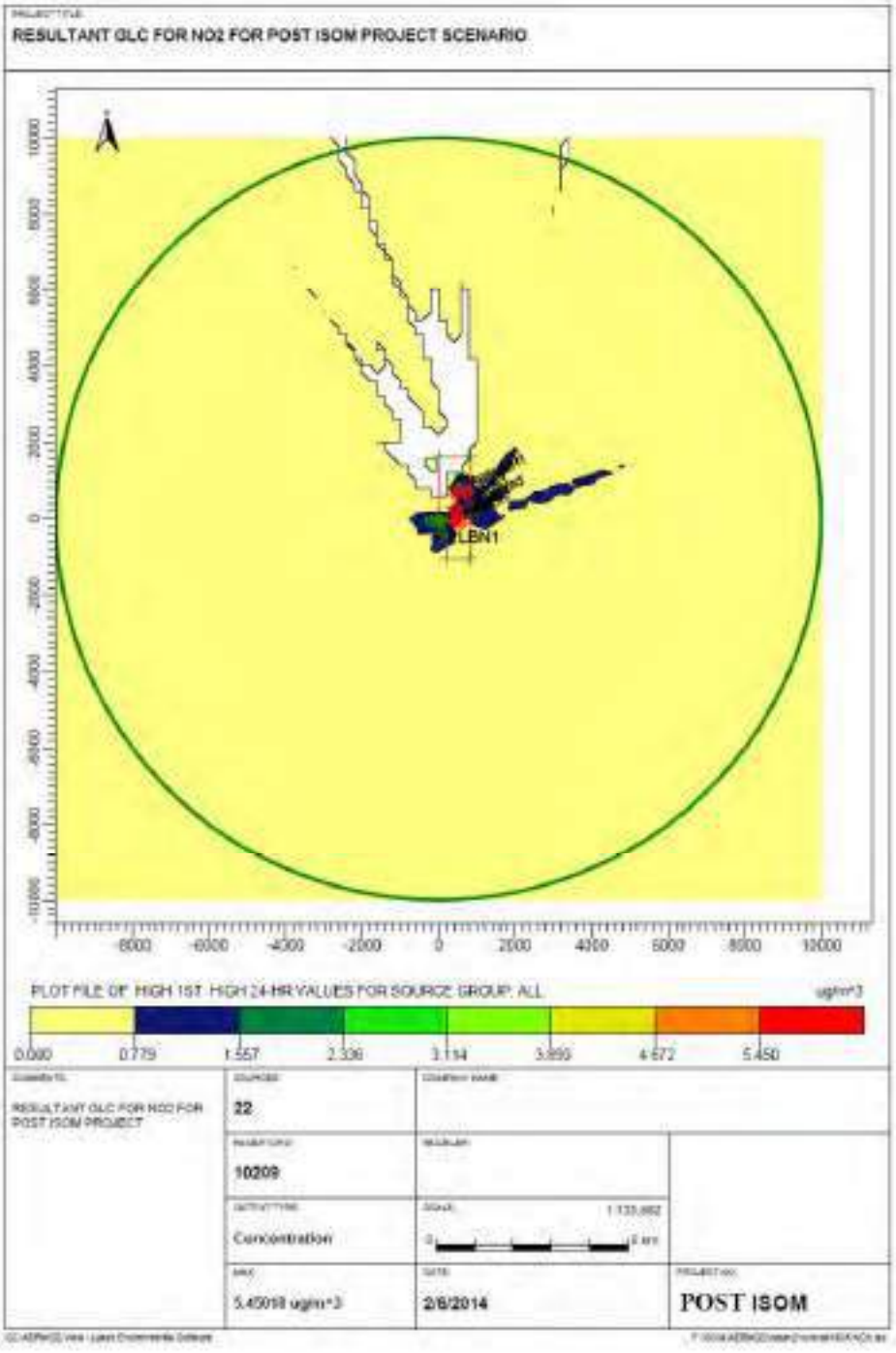


Figure 4.3: Predicted GLC for 24hour Maximum Concentration values of NO2 due to emissions from the emission sources in proposed DHT scenario (CASE-2)

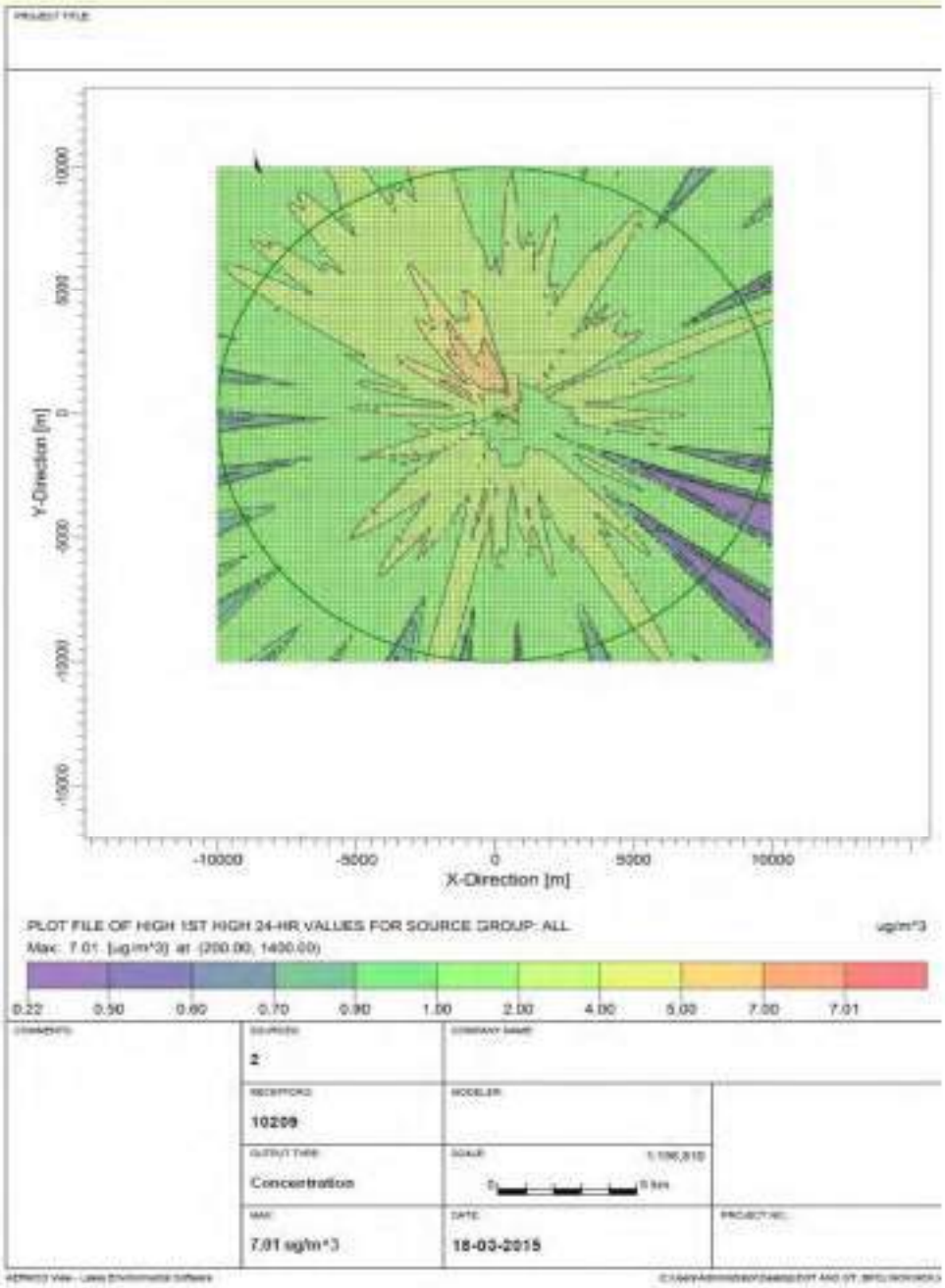


Table VII.7

Damage Produced by Blast (Clancey, 1972)

Pressure (Bar)	Pressure (psig)	Damage
0.001	0.02	Annoying nose (137dB), if of low frequency (10-15 Hz)
0.002	0.03	Occasional breaking of large glass windows already under strain
0.003	0.04	Loud noise (143 dB). Sonic boom glass failure
0.0068	0.1	Breakage of windows, small, under strain
0.010	0.15	Typical pressure for glass failure
0.020	0.3	"Safe distance" (probability 0.95 no serious damage beyond this value) Some damage to house ceilings; 10% window glass broken
0.030	0.4	Limited minor structural damage
0.034	0.5	Large and small windows usually shattered; occasional damage to window frames
0.05	0.7	Minor damage to house structures
0.068	1.0	Partial demolition of houses, made uninhabitable
0.089	1.3	Steel frame of clad building slightly distorted
0.138	2	Partial collapse of walls and roofs of houses
0.172	2.5	50% destruction of brickwork of house
0.207	3	Heavy machines (3000 lb) in industrial building suffered little damage. Steel frame building distorted and pulled away from foundations.
0.275	4	Cladding of light industrial buildings ruptured
0345	5	Wooden utilities poles (telegraph, etc.) snapped. Tall hydraulic press (40000 lb) in building slightly damaged.
0.482	7	Loaded train wagons overturned
0.620	9	Loaded train box-cars completely demolished
0.689	10	Probable total destruction buildings. Heavy (7000 lb) machine tools moved and badly damaged. Very heavy (12000 lb) machine tools survived.

7.2.7 CONSEQUENCE ANALYSIS RESULTS

Consequence analysis was carried out for identified selected failure cases. Consequence analysis quantifies vulnerable zones. For the selected accidental scenarios, after vulnerable zone is defined, measures can be proposed to minimise damages caused. The results are computed separately for both day and night weathers and the same were analyzed for the fire, explosion and toxic effect.

7.2.7.1 Jet Fires

The damage distances due to jet fire from LSHS release were found to be very minimal spreading only upto 2m with less than 20 kW/m^2 radiation intensity considering the release to be down impinging on the ground. The same has been found for hydrogen release also with very low radiation intensity around 3.9 kW/m^2 covering distance of only 4.9 m considering the vertical release due to cylinder's relief valve failure. Hence, consequences due to jet fire have not been reported as they have no significant effect to the surroundings. However, it is proposed that clear region of at least 1m from both sides of the pipeline from main tank to Day-oil tanks shall be necessary. Also, Hydrogen cylinders shall be stored inside a storage room with no other material present in surrounding area for at least 5 m.

7.2.7.2 Flash Fires

The flash fire due to hydrogen release in case of failure of a relief valve was found negligible with LFL fraction of flammable cloud covering only a distance of 3.91 m under D 5m/s weather condition. Hence there will not be any significant danger from flash fires. However, release of hydrogen from all the cylinders at a time is unlikely to occur, so the same has not been considered for modeling.

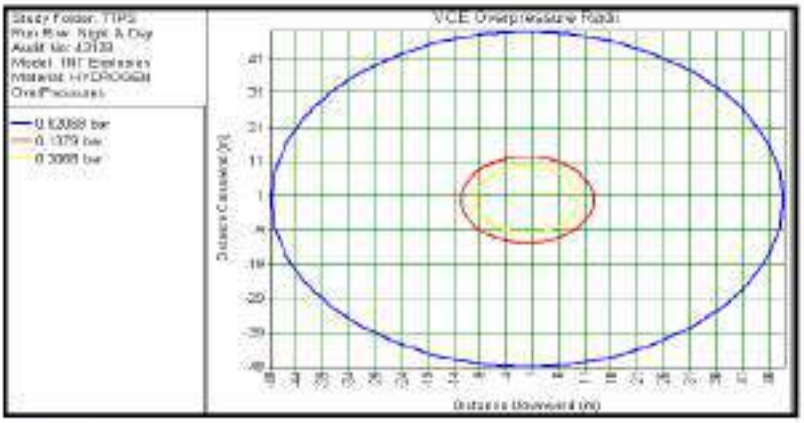
7.2.7.3 Explosions

Though the effects of flash fire from hydrogen release found to be negligible, its confined explosion was likely to be considered. The TNT explosion model was considered for assessing damage distance due to pressure waves from Vapor Cloud Explosion (VCE). **Figure VII.6** shows the damage distance due to pressure wave created from confined VCE because of hydrogen release. The pressure of 0.02 bar which is known as "Safe Distance" (probability 95% no serious damage beyond this value, little damage to house ceilings may be; chances of 10% window glass broken) was found to be till 48.88m from the center of explosion event. Personnel within this boundary are likely to suffer some injuries depending upon how near they are to the point of accident. The pressure of 0.138 bar which is sufficient to cause partial collapse of walls and roofs was found upto 12.66m while 0.2 bar pressure radii which is sufficient to cause little damage to heavy machines was reached only upto 9.7m. It is proposed to store the hydrogen cylinders for at least 15 m away from any machinery areas.

At TTPS, the hydrogen will be stored away from the sources of ignition. Vent pipe is exposed to atmosphere at a safe distance.

Figure VII.6

Pressure Wave Distance Radii Due to VCE



7.2.7.4 Pool Fires

The pool fire will be confined to the dike area only. However, the effects of radiation may be felt to larger area depending upon the size of the pool and quantity of material involved.

It has been observed that the wind speed affects the flame parameters in two ways, namely flame length and flame tilt. At a low wind speed, the flame length is more, which reduces with increase in wind speed, whereas the tilting of the flame in the direction of wind increases with higher wind speed. Hence a largely tilted flame intensifies radiation at any point in the direction of wind and on the contrary large flame length poses greater threat at any point from radiation point of view. As a result, the effect distances at 5 m/s wind speed are significantly larger than those distances at 2 m/s wind speed. This is due to tilting of flame under higher wind speeds.

LSHS tank at the plant site is located in the tank farm area. Radiation distances under different weather conditions for all the failure cases considered are provided in the **Table VII.8.** The distance of occurrence of 4.0 kW/m^2 radiation intensity, sufficient to cause first degree burn, has been calculated as 179.15m under D-5m/s weather condition for LSHS storage tank rupture. Plant personnel not involved in fire fighting shall remain beyond this distance.

The radiation level of 37.5 kW/m^2, sufficient to cause damage to the process equipments was not been observed for any of the failure scenarios under any of the weather condition considered. However, the radiation level 12.5 kW/m^2, sufficient to cause piloted ignition of wood or melting of plastic tubing has been observed as 88.15m under D-5m/s weather condition for LSHS storage tank rupture. Personnel within this zone will have severe impact if they fail to achieve rapid escape within 5 seconds.

The figure number **Figure VII.7** to **Figure VII.14** gives the 4 kW/m^2 intensity radii on graphs and hazard zones on the map due to pool fire for different failure cases under each weather conditions.

7.2.7.5 Toxic Effects

Table VII.9 gives the distances for IDLH concentration of 10ppm occurred due to the failure of the Chlorine tonner valve. It was observed that the maximum IDLH concentration distance was observed as 2893.7m during night under F3m/s weather condition. The F3m/s weather condition is a stable weather with low wind speed which favours longer toxic dispersion distances.

However, the majority in weather condition for study area was found be of neutral weather with the stability class D. The stability class D during 'Day' time indicates 'Little Sun & High Wind', while during 'Night' time indicates 'Overcast or Windy Night'. The applicable wind speeds are considered for stability class D for both day and night. The distance for IDLH concentration of 10ppm occurred due to the failure of the Chlorine tonner valve during night time under D3m/s was found to be 909.51m and the same during day time under D5m/s was found to be around 733.64. It was observed that the toxic effects of chlorine dispersion were higher during night than the day time. Personnel within these ranges of IDLH concentration of 10ppm shall not be exposed longer than 30min. Individuals located near an accidental release of chlorine may be exposed to high concentrations of this gas through inhalation, skin contact, and eye contact if the toxic cloud travels in their direction. The Chlorine leakage should be immediately contained with the application of emergency kit. It should be ensured that after attending the leak, the chlorine is emptied slowly in process or neutralizing system. **Figure VII.15** shows the different IDLH concentration distances due to toxic chlorine release from tonner under all weather conditions considered.

Table VII.8

Distances of Occurrence of Various Thermal Radiation Intensities

Failure Case	Radiation (kW/m^2)	Pool Fire Radiation Distance for all Weathers (m)			
		Day		Night	
		D 5m/s	A/B 2m/s	D 3m/s	F 3m/s
LSHS Tank Rupture	4	179.15	132.78	152.83	168.03
	12.5	88.15	65.38	74.93	90.13
	37.5	Not Reached	Not Reached	Not Reached	Not Reached
LSHS Tank Connection Leak	4	149.4	124.83	135.33	135.33
	12.5	58.39	57.43	57.43	57.43
	37.5	Not Reached	Not Reached	Not Reached	Not Reached
LSHS Pipeline Rupture	4	104.412	86.51	94.36	94.55
	12.5	37.62	36.77	36.74	36.84
	37.5	Not Reached	Not Reached	Not Reached	Not Reached

Failure Case	Radiation (kW/m^2)	Pool Fire Radiation Distance for all Weathers (m)			
		Day		Night	
		D 5m/s	A/B 2m/s	D 3m/s	F 3m/s
LSHS	4	101.92	84.64	92.28	92.78
Pipeline	12.5	36.51	35.8	35.83	36.01
Leak	37.5	Not Reached	Not Reached	Not Reached	Not Reached

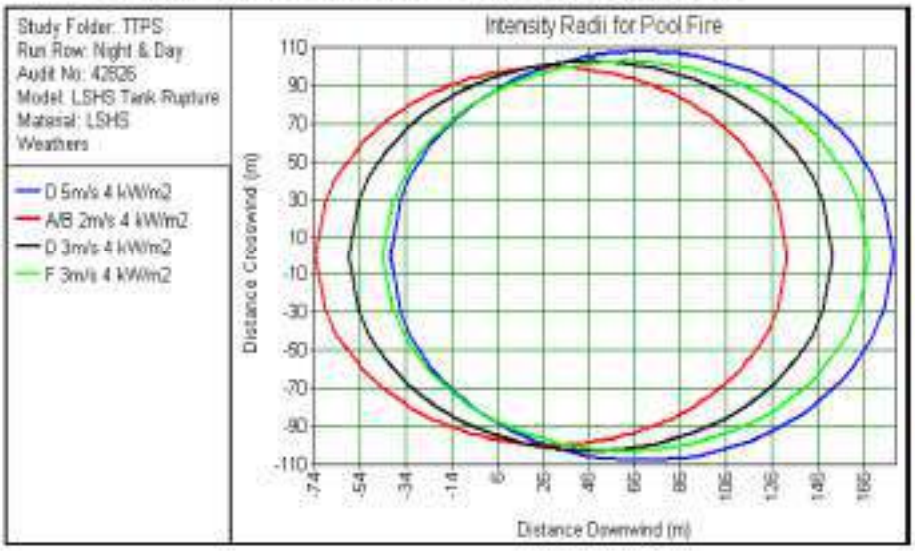
Table VII.9

Distances for IDLH Concentration of 10ppm Occurred due to Chlorine Tonner Valve Failure

Weathers	Distance for IDLH Conc. of 10ppm (m)
D 5m/s	733.64
A/B 2m/s	426.66
D 3m/s	909.51
F3m/s	2893.7

Figure VII.7

4 kW/m^2 Intensity Radii Distances due to LSHS Tank Rupture



Extract From TOR to EC of Environmental Impact Assessment Study For Proposed Conversion Of Catalytic Reforming Unit (CRU) To Isomerisation Unit And Revamp Of Existing Naphtha Hydro Desulphurization Unit (NHDS) project at BPCL- Mumbai Refinery, Maharashtra

Section 1.6.3

Engineers India Limited (EIL), New Delhi, has been appointed by M/s Bharat Petroleum corporation to carry out Quantitative Risk Analysis QRA for entire refinery along with upcoming projects like CDU4 & Isomerization at Mumbai Refinery at Mahul.

While working out the methodology for QRA ,consequent modeling of all the credible scenario has been carried out upon the identification of hazards in the existing plant and new upcoming projects.

QRA study for the entire refinery including CDU4 &ISOM establishes that individual risk of 1 x 10^{-5} per annum remains within refinery boundary and IR of 1 x 10^{-6} per annum marginally crosses refinery boundary at few locations which is well within ALARP region. Societal risk (F-N Curve) for off site is well within ALARP region. On site societal risk is also found to be well with in ALARP region with suitable recommended mitigation measure. Thus both on site and off site societal risk are considered acceptable.

Extract from Executive Summary

EIA STUDY FOR
CONSTRUCTION OF STORAGE TANKS &
ASSOCIATED FACILITIES
AT MUMBAI REFINERY-II, HPCL

Risk Assessment Study

Engineers India Limited (EIL), New Delhi, has been appointed by M/s Hindustan Petroleum Corporation Limited (HPCL) to carry out Risk Analysis for proposed storage tankages and its associated facilities.

The Risk Analysis study has been performed with PHAST 6.7 (Software by DNV) and this report documents the consequence results with hazard contours superimposed on the layouts/ maps to create awareness about the extent of impact.

The Storage tanks are located in the dykes and have been considered based on the required inter-tank separation distances as per OISD. The detailed Risk Assessment report is attached as Annexure-XI.

$~15-16.

* **IN THE HIGH COURT OF DELHI AT NEW DELHI**

\+ LPA 108/2014 & C.M.No.2168/2014 (stay)

EPSILON PROJECTS PVT LTD ..... Appellant

Versus

MINISTRY OF ENVIRONMENT AND FOREST & ORS ..... Respondents

\+ LPA 110/2014& C.M.No.2175/2014 (stay)

MIN MEC CONSULTANCY PVT LTD ..... Appellant

Versus

MINISTRY OF ENVIRONMENT AND FOREST & ORS ..... Respondents

Present:- Ms.Ruchi Kohli, Adv. with Mr.Yash Mishra, Advs. for the appellants.
Mr.Rajeeve Mehra, ASG with Mr.Sachin Datta, Mr.Kartik, Advs. for UOI.

CORAM:
HON'BLE THE CHIEF JUSTICE
HON'BLE MR. JUSTICE RAJIV SAHAI ENDLAW

ORDER

% 03.02.2014

C.M.No.2170/2014 *(exemptions)*in **LPA 108/2014**
C.M.No.2176/2014 *(exemptions)*in **LPA 110/2014**

Exemptions allowed subject to all just exceptions.

LPA No.108/2014 & C.M.No.2169/2014 *(delay in filing)*
LPA No.110/2014

Issue notice. Learned counsel for the respondents No.1&2 accepts notice. Notice be also issued to remaining respondents No.2 to 5.

List this matter on 14th March, 2014. In the facts obtaining, we are of the considered view that till the filing of the reply, on reasons of parity and comity of courts and uniformity in dealing with identical cases, the appellant shall also be allowed to prepare and present Environment Impact Assessment (EIA) report to the Central and State Government Environmental Appraisal Committees till 14th March, 2014

Dasti under signature of the Court Master.

Sd/-
CHIEF JUSTICE

Sd/-
RAJIV SAHAI ENDLAW, J

FEBRUARY 03, 2014
'anb'

ANNEXURE : XX

$~3 to 5

* **IN THE HIGH COURT OF DELHI AT NEW DELHI**

\+ LPA 23/2014 & CM No. 667/2014
RANI GUPTA ..... Appellant
versus
MINISTRY OF ENVIRONMENT AND FOREST & ORS ..... Respondents

\+ LPA 108/2014 & CM Nos. 2168/2014, 2169/2014
EPSILON PROJECTS PVT LTD ..... Appellant
versus
MINISTRY OF ENVIRONMENT AND FOREST & ORS ..... Respondents

\+ LPA 110/2014 & CM No. 2175/2014
MIN MEC CONSULTANCY PVT LTD ..... Appellant
versus
MINISTRY OF ENVIRONMENT AND FOREST & ORS ..... Respondents

Through: Ms Ruchi Kohli, Mr Yash Mishra, Ms Vidushi Chokhani and Ms Ankita Singh, Advocates for appellants
Mr Sandeep Prabhakar and Mr Vikas Mehta, Advocates for respondent Nos. 3 to 5

ORDER

% **14.03.2014**

The Hon'ble Division Bench could not assemble today.

Renotify on 13.05.2014.

By Order

(Court Master)

MARCH 14, 2014 / SU

THE SEAL OF THE HIGH COURT OF DELHI

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Government
Section 79 of Indian Evidence Act.

$~2 to 4.

* **IN THE HIGH COURT OF DELHI AT NEW DELHI**

\~ LPA 23/2014 & C.M.No.667/2014
RANI GUPTA ..... Appellant
Versus
MINISTRY OF ENVIRONMENT AND FOREST & ORS ..... Respondents

\+ LPA 108/2014 & C.Ms.No.2168/2014, 2169/2014.
EPSILON PROJECTS PVT LTD ..... Appellant
Versus
MINISTRY OF ENVIRONMENT AND FOREST & ORS ..... Respondents

\+ LPA 110/2014 & C.M.No.2175/2014.
MIN MEC CONSULTANCY PVT LTD ..... Appellant
Versus
MINISTRY OF ENVIRONMENT AND FOREST & ORS ..... Respondents

Present:- Ms.Vidushi Chokhani, Adv. with Ms.Nidhi Jaswal, Adv. for the appellants.
Mr.Rajeeve Mehra, ASG with Mr.Sachin Datta, Mr.Vikram Aditya Narayan, Ms.Shruti Aggarwal, Advs. for UOI/MOEF.
Mr.Sandeep Prabhakar, Mr. Amit Kumar, Mr.Vikas Mehta, Advs. for R-2 to 5.

CORAM:
HON'BLE THE CHIEF JUSTICE
HON'BLE MR. JUSTICE RAJIV SAHAI ENDLAW

ORDER

% **13.05.2014**

Re-notify for 14.08.2014. Interim order to continue.

CHIEF JUSTICE

MAY 13, 2014/*'anb'*

RAJIV SAHAI ENDLAW, J

THE SEAL OF THE HIGH COURT OF DELHI NEW DELHI

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Government
Section 79 of Indian Evidence Act,

ANNEXURE : XX Contd..

S-1 to 3

(Common Orders)

* **IN THE HIGH COURT OF DELHI AT NEW DELHI**

\+ LPA 23/2014 & CM No.667/2014 *(stay)*

RANI GUPTA ..... Appellant

versus

MINISTRY OF ENVIRONMENT AND FOREST & ORS
..... Respondents

\+ LPA 108/2014 & CM Nos.2168/2014 *(stay)* & 2169/2014 *(delay)*

EPSILON PROJECTS PVT LTD ..... Appellant

versus

MINISTRY OF ENVIRONMENT AND FOREST & ORS
..... Respondents

\+ LPA 110/2014 & CM No.2175/2014 *(stay)*

MIN MEC CONSULTANCY PVT LTD ..... Appellant

versus

MINISTRY OF ENVIRONMENT AND FOREST & ORS
..... Respondents

Present:- Mr. Yash Mishra with Ms. Vidushi Chokhani, Adv. for the appellants.
Mr. Akshay Makhija, CGSC with Mr. Vikas Bhadauria & Ms. Mahima Bahl, Adv. for R-1 & 2 in LPA No.23/2014.
Mr. Sandeep Prabhakar with Mr. Vikas Mehta, Adv. for R-3 to 5.
Mr. Kirtiman Singh, CGSC with Mr. Waize Ali Noor, Adv. for respondent/UOI in LPA No.110/2014.

CORAM:
HON'BLE THE CHIEF JUSTICE
HON'BLE MR. JUSTICE RAJIV SAHAI ENDLAW

ORDER
% 14.08.2014

An adjournment slip is moved by the learned counsel for the appellant.

Renotify on 13.11.2014.

CHIEF JUSTICE

RAJIV SAHAI ENDLAW, J

AUGUST 14, 2014
kks

ANNEXURE : XX Contd..

$-2 to 4

* IN THE HIGH COURT OF DELHI AT NEW DELHI

\+ LPA 23/2014 & CM No.667/2014 *(stay)*

RANI GUPTA ..... Appellant

Through: Mr. Ruchi Kohli with Mr. Yash Mishra & Mr. Shashwat Tripathi, Adv.

versus

MINISTRY OF ENVIRONMENT AND FOREST & ORS ..... Respondents

Through: Mr. Sanjay Jain, ASG with Mr. Akshay Makhija, CGSC & Mr. Akash Nagar, Adv. for UOI.
Mr. Sandeep Prabhakar with Mr. Vikas Mehta, Adv. for R-3 to 5.

\+ LPA 108/2014 & CM Nos.2168/2014 *(stay)* & 2169/2014 *(delay)*

EPSILON PROJECTS PVT LTD ..... Appellant

Through: Nemo.

versus

MINISTRY OF ENVIRONMENT AND FOREST & ORS ..... Respondents

Through: Mr. Sanjay Jain, ASG with Mr. Amit Mahajan, CGSC & Mr. Akash Nagar, Adv. for UOI.
Mr. Sandeep Prabhakar with Mr. Vikas Mehta, Adv. for R-3 to 5.

\+ LPA 110/2014 & CM No.2175/2014 *(stay)*

MIN MEC CONSULTANCY PVT LTD ..... Appellant

Through: Nemo.

versus

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Examiner Judicial Department High Court of Delhi Authorised under Section 76 Indian Evidence Act.

MINISTRY OF ENVIRONMENT AND FOREST & ORS ..... Respondents

Through: Mr. Sanjay Jain, ASG with Mr. Kirtiman Singh, CGSC & Mr. Akash Nagar, Adv. for UOI.
Mr. Sandeep Prabhakar with Mr. Vikas Mehta, Adv. for R-3 to 5.

CORAM:
HON'BLE THE CHIEF JUSTICE
HON'BLE MR. JUSTICE RAJIV SAHAI ENDLAW

ORDER

% **13.11.2014**

It is represented by the learned counsel for both the parties that transfer writ petitions are moved before the Supreme Court of India for the transfer of several cases pending before different High Courts in which an identical issue is raised.

Hence, we deem it appropriate to adjourn the hearing.

Re-notify on 06.02.2015.

Interim orders to continue.

sd/-
CHIEF JUSTICE

sd/-
RAJIV SAHAI ENDLAW, J

NOVEMBER 13, 2014
kks

Certified to be True Copy
Examiner Judicial Department High Court of Delhi Authorised under Section 76 Indian Evidence Act.

ANNEXURE : XX Contd..

§-6 to 8

IN THE HIGH COURT OF DELHI AT NEW DELHI

\+ LPA 231/2014 & CM No.667/2014 *(stay)*

RANI GUPTA ..... Appellant

versus

MINISTRY OF ENVIRONMENT AND FOREST & ORS
..... Respondents

\+ LPA 108/2014 & CM Nos.2168/2014 *(stay)* & 2169/2014 *(delay)*

EPSILON PROJECTS PVT LTD ..... Appellant

versus

MINISTRY OF ENVIRONMENT AND FOREST & ORS
..... Respondents

\+ LPA 110/2014 & CM No.2175/2014 *(stay)*

MIN MEC CONSULTANCY PVT LTD ..... Appellant

versus

MINISTRY OF ENVIRONMENT AND FOREST & ORS
..... Respondents

Present:- Ms. Ruchi Kohli with Mr. Yash Mishra and Mr. Shashwat Tripathi, Advs. for appellant.
Mr. Sandeep Prabhakar with Mr. **Amit** Kumar and Mr. Vikas Mehta, Advs. for R-3 to 5.
Mr. **Amit** Mahajan, CGSC with Mr. Shashi Shekhar, Adv. for UOI in LPA **No.108/2014.**

CORAM:
HON'BLE THE CHIEF JUSTICE
HON'BLE MR. JUSTICE RAJIV SAHAI ENDLAW

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ORDER
06.02.2015

%

It is represented that on **16.01.2015** notice has been ordered in the Transfer Petitions by the Supreme Court.

Re-notify on **25.05.2015**.

Interim orders to continue.

CHIEF JUSTICE

RAJIV SAHAI ENDLAW, J

FEBRUARY 06,2015
Kks

DIGITALLY SIGNED DATA
Certified to be True Copy

ANNEXURE : XX Contd..

S-3 to 5

* **IN THE HIGH COURT OF DELHI AT NEW DELHI**

\+ LPA 23/2014 & CM No.667/2014

RANI GUPTA ..... Appellant
Through: Mr. Yash Mishra with Mrs. Ruchi Kohli & Mr. Shashwat Tripathi, Advs.

Versus

MINISTRY OF ENVIRONMENT AND FOREST & ORS
..... Respondents
Through: Mr. Akshay Makhija, Adv. for UOI.
Mr. Sandeep Prabhakar with Mr. Amit Kumar & Mr. Vikas Mehta, Advs. for R-3 to 5.

\+ LPA 108/2014 & CM Nos.2168/2014 & 2169/2014

EPSILON PROJECTS PVT LTD ..... Appellant
Through: Mr. Yash Mishra with Mrs. Ruchi Kohli & Mr. Shashwat Tripathi, Advs.

Versus

MINISTRY OF ENVIRONMENT AND FOREST & ORS
..... Respondents
Through: Mr. Amit Mahajan, CGSC for UOI.
Mr. Sandeep Prabhakar with Mr. Amit Kumar & Mr. Vikas Mehta, Advs. for R-3 to 5.

\+ LPA 110/2014 & CM No.2175/2014

MIN MEC CONSULTANCY PVT LTD ..... Appellant
Through: Mr. Yash Mishra with Mrs. Ruchi Kohli & Mr. Shashwat Tripathi, Advs.

Versus

MINISTRY OF ENVIRONMENT AND FOREST & ORS
..... Respondents
Through: Mr. Kirtiman Singh, CGSC with Ms. Prerna Shah Deo, Adv. for UOI.
Mr. Sandeep Prabhakar with Mr. Amit Kumar & Mr. Vikas Mehta, Advs. for R-3 to 5.

CORAM:
HON'BLE THE CHIEF JUSTICE
HON'BLE MR. JUSTICE RAJIV SAHAI ENDLAW

ORDER

% **25.05.2015**

It is brought to our notice that the Transfer Petition before the Supreme Court of India stands posted to 11.08.2015.

Hence, call on 04.09.2015.

CHIEF JUSTICE

RAJIV SAHAI ENDLAW, J

MAY 25, 2015
kks

ANNEXURE : XX Contd..

$~1 to 3 (Common Orders)

* **IN THE HIGH COURT OF DELHI AT NEW DELHI**

\+ LPA 23/2014 & CM No.667/2014

RANI GUPTA ..... Appellant

versus

MINISTRY OF ENVIRONMENT AND FOREST & ORS ..... Respondent

\+ LPA 108/2014 & CM Nos.1268-69/2014

EPSILON PROJECTS PVT LTD ..... Appellant

versus

MINISTRY OF ENVIRONMENT AND FOREST & ORS ..... Respondent

\+ LPA 110/2014 & CM No.2175/2014

MIN MEC CONSULTANCY PVT LTD ..... Appellant

versus

MINISTRY OF ENVIRONMENT AND FOREST & ORS ..... Respondent

Presence: Mr.Yash Mishra along with Mr.Shashwat Tripathi and Ms.Srishty Kaul, Advs. for appellant.
Mr.Sandeep Prabhakar along with Mr.Amit Kumar and Mr.Vikas Chopra, Advs. for r-3 to 5.
Mr.Kirtiman Singh along with Mr.Waize Ali Noor, Mr.Gyajesh Bhardwaj and Ms.Prerna Shaj Deo, Advs. and Mr.Akshay Makhija & Mr.Amit Mahajan, Advs. for UOI.

CORAM:
HON'BLE THE CHIEF JUSTICE
HON'BLE MR. JUSTICE JAYANT NATH

ORDER
04.09.2015

%

Renotify on 01.12.2015.

CHIEF JUSTICE

JAYANT NATH, J

SEPTEMBER 04, 2015/pmc

ANNEXURE : XX Contd..

$~7 to 10 (Common Orders)

* **IN THE HIGH COURT OF DELHI AT NEW DELHI**

\+ LPA 23/2014 & CM No.667/2014

RANI GUPTA ..... Appellant

versus

MINISTRY OF ENVIRONMENT AND FOREST & ORS ..... Respondent

\+ LPA 108/2014 & CM Nos.2168-69/2014

EPSILON PROJECTS PVT LTD ..... Appellant

versus

MINISTRY OF ENVIRONMENT AND FOREST & ORS ..... Respondent

\+ LPA 110/2014 & CM No.2175/2014

MIN MEC CONSULTANCY PVT LTD ..... Appellant

versus

MINISTRY OF ENVIRONMENT AND FOREST & ORS ..... Respondent

\+ LPA 552/2015 & CM No.16077/2015

HARI OM SHARAN DWIVEDI ..... Appellant

versus

NATIONAL ACCREDITATION BOARD FOR EDUCATION AND TRAINING & ORS ..... Respondent

Counsel for the appellant: Mr.Yash Mishra along with Mr.Shashwat Tripathi and Ms.Srishty Kaul, Advs.;
Counsel for the respondent: Mr.Sandeep Prabhakar along with Mr.Amit Kuma and Mr.Vikas Mehta, Advs.; Mr.Vikas Chopra; Mr.Akshay Makhija, Mr.Jasmeet Singh, Mr.Kirtiman Singh and Mr.Amit Mahajan, CGSCs.

CORAM:
HON'BLE THE CHIEF JUSTICE
HON'BLE MR. JUSTICE JAYANT NATH

ORDER
01.12.2015

% On joint request, call on 23.02.2016.

CHIEF JUSTICE

JAYANT NATH, J

DECEMBER 01, 2015/pmc

ANNEXURE : XX Contd..

$~A-13 to A-16

* **IN THE HIGH COURT OF DELHI AT NEW DELHI**

\+ LPA 23/2014 & CM 667/2014

RANI GUPTA ..... Appellant
Through Mr.Yash Mishra, Mr.Shashwat Tripathi and Ms.Srishty Kaul, Advs.

versus

MINISTRY OF ENVIRONMENT & FOREST & ORS...Respondent
Through Mr.Akshay Makhija, Adv. for UOI
Mr.Sandeep Prabhakar, Mr.Amit Kumar, Mr.Umang Mittal and Mr.Vikas Chopra, Advs. for R-3 to R-5

\+ LPA 108/2014 & CM Nos.2168/2014 & 2169/2014

EPSILON PROJECTS PVT LTD ..... Appellant
Through Mr.Yash Mishra, Mr.Shashwat Tripathi and Ms.Srishty Kaul, Advs.

versus

MINISTRY OF ENVIRONMENT & FOREST & ORS. ...Respondent
Through Mr.Amit Mahajan, CGSC for UOI
Mr.Sandeep Prabhakar, Mr.Amit Kumar, Mr.Umang Mittal and Mr.Vikas Chopra, Advs. for R-3 to R-5

\+ LPA 110/2014 & CM No.2175/2014

MIN MEC CONSULTANCY PVT LTD ..... Appellant
Through Mr.Yash Mishra, Mr.Shashwat Tripathi and Ms.Srishty Kaul, Advs.

versus

MINISTRY OF ENVIRONMENT & FOREST & ORS. ...Respondent
Through Mr.Kirtiman Singh, CGSC for UOI
Mr.Sandeep Prabhakar, Mr.Amit Kumar, Mr.Umang Mittal and Mr.Vikas Chopra, Advs. for R-3 to R-5

\+ LPA 552/2015 & CM No.16077/2015

HARI OM SHARAN DWIVEDI ..... Appellant
Through Mr.Yash Mishra, Mr.Shashwat Tripathi and Ms.Srishty Kaul, Advs.

versus

NATIONAL ACCREDITATION BOARD FOR EDUCATION AND TRAINING & ORS ..... Respondent
Through Mr.Umang Mittal and Mr.Vikas Chopra, Advs. for R-1 & R-2
Mr.Jasmeet Singh, CGSC for UOI

CORAM:
HON'BLE THE CHIEF JUSTICE
HON'BLE MR. JUSTICE JAYANT NATH

O R D E R

% 23.02.2016

It is brought to our notice that the Transfer Petition(s) (Civil) Nos.1682-1722/2014 are still pending before the Hon'ble Supreme Court of India.

List on 11th July, 2016.

CHIEF JUSTICE

JAYANT NATH, J

FEBRUARY 23, 2016
n

ANNEXURE : XX Contd..

$~20 to 23

* **IN THE HIGH COURT OF DELHI AT NEW DELHI**

\+ LPA 23/2014
RANI GUPTA ..... Appellant
Through Ms.Srishty Kaul and Mr. Yash Mishra, Advs.

versus

MINISTRY OF ENVIRONMENT AND FOREST & ORS
..... Respondents
Through Mr.Umang Mittal and Mr.Vikas Chopra, Advs. For R-1 and R-2. Mr.Akshay Makhija CGSC, Mr.Vikas Bhadauria and Mr.Sanjngeeta Moktan, Advs. For UOI.

\+ LPA 108/2014
EPSILON PROJECTS PVT LTD ..... Appellant
Through Ms.Srishty Kaul and Mr. Yash Mishra, Advs.

versus

MINISTRY OF ENVIRONMENT AND FOREST & ORS
..... Respondent
Through Mr.Amit Mahajan, CGSC with Mr.NItya Sharma, Adv. for UOI. Mr.Umang Mittal and Mr.Vikas Chopra, Advs. For R-1 and R-2. Mr.Sandeep Prabhakar with Mr. Vikas Mehta, Advs. For R- 3 to 5.

\+ LPA 110/2014
MIN MEC CONSULTANCY PVT LTD ..... Appellant
Through Ms.Srishty Kaul and Mr. Yash Mishra, Advs.

versus

MINISTRY OF ENVIRONMENT AND FOREST & ORS
..... Respondent
Through Mr.Umang Mittal and Mr.Vikas Chopra, Advs. For R-1 and R-2. Mr.Sandeep Prabhakar with Mr. Vikas Mehta, Advs. For R- 3 to 5. Mr.Kirtiman Singh, CGSC

\+ LPA 552/2015
HARI OM SHARAN DWIVEDI ..... Appellant
Through Ms.Srishty Kaul and Mr. Yash Mishra, Advs.

versus

NATIONAL ACCREDITATION BOARD FOR EDUCATION AND TRAINING & ORS ..... Respondents
Through Mr.Umang Mittal and Mr.Vikas Chopra, Advs. For R-1 and R-2. Mr.Jasmeet Singh, CGSC for UOI. Mr.Kirtiman Singh, CGSC

CORAM:
HON'BLE THE CHIEF JUSTICE
HON'BLE MS. JUSTICE SANGITA DHINGRA SEHGAL

% **O R D E R**
11.07.2016

It is stated that the Transfer Petition(s) (Civil) Nos. 1682-1722/2014 before Supreme Court are still pending.

Re-notify on 26.09.2016.

CHIEF JUSTICE

SANGITA DHINGRA SEHGAL, J

JULY 11, 2016/*mr*

ANNEXURE : XX Contd..

$~29

* **IN THE HIGH COURT OF DELHI AT NEW DELHI**

\+ W.P.(C) 3665/2016

MRS. RANI GUPTA & ANR ..... Petitioners

Through Mr. Yash Mishra with Ms.Ruchi Kohli, Ms.Srishty Kohli and Ms.Nidhi Jaswal, Advocates.

versus

MINISTRY OF ENVIRONMENT FOREST AND CLIMATE CHANGE & ANR ..... Respondents

Through Mr.Sanjay Jain, ASG and Mr.Rajesh Gogna, CGSC with Mr.Tushar Sannu, Mr.Sumit Misra, Ms.Shreya Sinha and Mr.Shreshth Jain, Advocates.

CORAM:
HON'BLE MR. JUSTICE MANMOHAN

ORDER

% 03.05.2016

C.M.No.15700/2016

Exemption allowed, subject to all just exceptions.

Application stands disposed of.

W.P.(C) No.3665/2016 & C.M.No.15699/2016

Present writ petition has been filed challenging Notification dated 3rd March, 2016 whereby an amendment has been made to the Environmental Impact Assessment Notification, 2006 stating that the Environmental Consultant Organisations which are accredited for a particular sector and category of project for that project with the Quality Council of India (QCI) or National Accreditation Board for Education and Training (NABET) or any other agency which may be notified by the Ministry of Environment Forest and Climate Change shall be allowed to prepare the Environmental Impact Assessment (EIA) report and Environmental Management Plan (EMP) of a project in that sector and to appear before the State or Central Expert Appraisal Committee.

Learned counsel for the petitioners states that the NABET had issued a scheme for accreditation of EIA Consultants organisations in January, 2010 and the respondent No.1 issued Office Memorandums dated 2nd December, 2009 and 18th March, 2010 stating that no final EIA or EMP prepared by non-accredited consultant would be entertained after 1st July, 2010.

He further states that petitioner No.1 submitted an application for accreditation in January, 2010. However, the same was rejected vide minutes of meeting dated 10th January, 2011 and petitioner No.1 challenged the said decision by virtue of a writ petition being W.P.(C) 7034/2012. However, the said writ petition was dismissed. The petitioner then preferred LPAs being LPA Nos.23/2014 and 110/2014, wherein the petitioners were allowed to prepare and present the Environmental Impact Assessment report to the Central and State Government Expert Appraisal Committee.

Learned counsel for the petitioners submits that the impugned notification dated 3rd March, 2016 is not only contrary to the aforesaid Division Order but also violative of Section 23 of the Environment Protection Act, 1986.

Issue notice.

Mr.Rajesh Gogna, CGSC accepts notice on behalf of the respondents. He prays for and is permitted to file a counter-affidavit within a period of four weeks. Rejoinder-affidavit, if any, be filed before the next date of hearing.

ANNEXURE : XX Contd..

List on 12th August, 2016.

In the meantime, till the Division Bench varies, vacates or modifies the interim orders dated 17th January, 2014 and 3rd February, 2014 passed in LPA Nos.23 of 2014 and 110 of 2014, the petitioners are allowed to prepare and present Environmental Impact Assessment report to the Central and State Government Expert Appraisal Committee.

Order *dasti*.

MANMOHAN, J

MAY 03, 2016
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* **IN THE HIGH COURT OF DELHI AT NEW DELHI**

\+ **W.P.(C) 3665/2016**

MRS. RANI GUPTA & ANR ..... Petitioners

Through: Mr Yash Mishra and Ms Srishty Kaul, Advocates.

versus

MINISTRY OF ENVIRONMENT FOREST AND CLIMATE CHANGE & ANR ..... Respondents

Through: Mr Rajesh Gogna, Advocate for R-1.

CORAM:
HON'BLE MR. JUSTICE SANJEEV SACHDEVA

ORDER

% **12.08.2016**

W.P.(C) 3665/2016 & CM No.15699/2016(stay)

The counter-affidavits have not been filed. The respondents shall file their counter-affidavits within a period of four weeks. Rejoinders thereto, if any, be filed within four weeks thereafter.

Renotify on 14th March, 2017.

SANJEEV SACHDEVA, J

AUGUST 12, 2016
'sn'

ANNEXURE : XX Contd..

रजिस्ट्री सं० डी० एल०-33004/99 REGD. NO. D. L.-33004/99

भारत का राजपत्र
The Gazette of India

असाधारण
EXTRAORDINARY
भाग II—खण्ड 3—उप-खण्ड (ii)
PART II—Section 3—Sub-section (ii)
प्राधिकार से प्रकाशित
PUBLISHED BY AUTHORITY

सं. 947] नई दिल्ली, मंगलवार, मई 22, 2012/ज्येष्ठ 1, 1934
No. 947] NEW DELHI, TUESDAY, MAY 22, 2012/JYAISTHA 1, 1934

पर्यावरण और वन मंत्रालय

अधिसूचना

नई दिल्ली, 22 मई, 2012

का.आ. 1150(अ).—केन्द्रीय सरकार, पर्यावरण (संरक्षण) नियम, 1986 के नियम 10 के साथ पठित पर्यावरण (संरक्षण) अधिनियम, 1986 (1986 का 29) की धारा 12 की उप-धारा (1) के खंड (ख) और धारा 13 द्वारा प्रदत्त शक्तियों का प्रयोग करते हुए, भारत सरकार के पर्यावरण और वन मंत्रालय की अधिसूचना संख्यांक का.आ. 1174(अ), तारीख 18 जुलाई, 2007 में निम्नलिखित और संशोधन करती है, अर्थात् :—

2. उक्त अधिसूचना से उपाबद्ध सारणी में,—

(क) क्रम संख्यांक 17 में उससे संबंधित प्रविष्टियों के स्थान पर निम्नलिखित प्रविष्टियां रखी जाएंगी, अर्थात् :—

(1)	(2)	(3)	(4)
"17	मैसर्स ईदमा लैबोरेट्रीज लिमिटेड, 391, इन्डस्ट्रियल एरिया फेज-1, पंचकुला-160019 (हरियाणा)	(1) डॉ. पी. के. अग्रवाल (2) श्री निरंजन देव बहल (3) श्री प्रेम कुमार	22-5-2012 से 21-5-2017";

(ख) क्रम संख्यांक 96 और उससे संबंधित प्रविष्टियों के पश्चात् निम्नलिखित क्रम संख्या और प्रविष्टियां अंतस्थापित की जाएंगी अर्थात् :—

(1)	(2)	(3)	(4)
"97	मैसर्स मिन मैक आर. एण्ड डी. लैबोरेटरी, ए-121, पर्यावरण कॉम्प्लेक्स, इग्नू रोड, नई दिल्ली-110030	(1) श्री बी. डी. शर्मा (2) डॉ. मरिश शर्मा (3) डॉ. रतन कुमार	22-5-2012 से 21-5-2017
98	मैसर्स भगवती इन्वायरो केयर प्रा. लि., 28, 29 एण्ड 30, परमेश्वर एस्टेट-2, फेज-1, एमको बैंक के सामने, जीआईडीसी एस्टेट, वात्वा, अहमदाबाद-382445 (गुजरात)	(1) श्री शैलेश पटेल (2) श्री महेश ओझा (3) श्री राजेश चौहान	22-5-2012 से 21-5-2017";

[फा. सं. क्यू-15018/7/2003-सीपीडब्ल्यू]

अजय त्यागी संयुक्त सचिव

टिप्पण.—मूल अधिसूचना भारत के राजपत्र, असाधारण में संख्यांक का.आ. 1174 (अ), तारीख 18 जुलाई, 2007 द्वारा प्रकाशित की गई थी और पश्चात्वर्ती संशोधन अधिसूचना सं. का.आ. 1539(अ), तारीख 13 सितंबर, 2007, का.आ. 1811(अ), तारीख 24 अक्तूबर, 2007, का.आ. 55(अ), तारीख 9 जनवरी, 2008, का.आ. 428(अ), तारीख 4 मार्च, 2008, का.आ. 865(अ), तारीख 11 अप्रैल, 2008, का.आ. 1894(अ), तारीख 31 जुलाई, 2008, का.आ. 2728(अ), तारीख 25 नवंबर, 2008, का.आ. 1356(अ), तारीख 27 मई, 2009, का.आ. 1802(अ), तारीख 22, जुलाई, 2009, का.आ. 2399(अ), तारीख 18 सितंबर, 2009 का.आ. 3122(अ), तारीख 7 दिसंबर, 2009, का.आ. 3123(अ), तारीख 7 दिसंबर, 2009 और का.आ. 142(अ), तारीख 21 जनवरी, 2010 का.आ. 619(अ), तारीख 19 मार्च, 2010, का.आ. 1662 (अ), तारीख 13 जुलाई, 2010, का.आ. 2390(अ), तारीख 30 सितंबर, 2010, का.आ. 2904(अ), तारीख 8 दिसंबर, 2010, का.आ. 181(अ), तारीख 28 जनवरी, 2011, का.आ. 692(अ), तारीख 5 अप्रैल, 2011, का.आ. 1537(अ), तारीख 6 जुलाई, 2011, का.आ. 1754(अ), तारीख 28 जुलाई, 2011, का.आ. 2609(अ), तारीख 22 नवंबर, 2011, का.आ. 264(अ), तारीख 13 फरवरी, 2012 द्वारा उसमें पश्चात्वर्ती संशोधन किए गए ।

MINISTRY OF ENVIRONMENT AND FORESTS

NOTIFICATION

New Delhi, the 22nd May, 2012

S.O. 1150(E).—In exercise of the powers conferred by clause (b) of sub-section (1) of Section 12 and Section 13 of the Environment (Protection) Act, 1986 (29 of 1986) read with rule 10 of the Environment (Protection) Rules, 1986, the Central Government hereby makes the following amendments the further to amend notification of Government of India in the Ministry of Environment and Forests, number S.O. 1174(E), dated the 18th July, 2007, namely :—

2. In the Table appended to the said notification,—

(a) In serial number 17, for the entries relating thereto, the following entries shall be substituted, namely :—

(1)	(2)	(3)	(4)
"17	M/s. Idma Laboratories Ltd., 391, Industrial Area, Phase-1, Panchkula-160019 (Haryana)	(1) Dr. P. K. Aggarwal (2) Mr. Niranjan Dev Bahl (3) Mr. Prem Kumar	22-5-2012 to 21-5-2017";

(b) after serial number 96, and the entries relating thereto, the following serial numbers and entries shall be inserted, namely :—

(1)	(2)	(3)	(4)
"97	M/s. Min Mec R&D Laboratory, A-121, Paryavaran Complex, IGNOU Road, New Delhi-110030	(1) Shri B. D. Sharma (2) Dr. Marisha Sharma (3) Dr. Ratan Kumar	22-5-2012 to 21-5-2017
98	M/s. Bhagwati Enviro Care Pvt. Ltd., 28, 29 and 30, Parmeshwar Estate-II, Phase-I, Opp. AMCO Bank, GIDC Estate Vatva, Ahmedabab-382445 (Gujarat)	(1) Mr. Shailesh Patel (2) Mr. Mahesh Oza (3) Mr. Rajesh Chauhan	22-5-2012 to 21-5-2017";

[F. No. Q.-15018/7/2003/-CPW]

AJAY TYAGI, Joint Secy.

Note.—The principal notification was published in the Gazette of India, Extraordinary *vide* number S. O. 1174(E), dated the 18th July, 2007, and subsequently amended *vide* notification numbers S.O. 1539(E), dated the 13th September, 2007, S.O. 1811(E), dated the 24th October, 2007, S.O. 55(E), dated 9th January, 2008, S.O. 428(E), dated the 4th March, 2008, S.O. 865(E), dated the 11th April, 2008, S.O. 1894(E), dated the 31st July, 2008, S.O. 2728(E),dated the 25th November, 2008, S.O. 1356(E), dated the 27th May, 2009, S.O. 1802(E), dated the 22nd July, 2009 and S.O. 2399(E), dated the 18th September, 2009 and S.O. 3122(E), dated the 7th December, 2009 and S.O. 3123(E), dated the 7th December, 2009, S.O. 142(E)), dated the 21st January, 2010, S.O. 619(E), 19th March, 2010, S.O. 1662(E), dated the 13th July, 2010, S.O. 2390(E), dated the 30th September, 2010, S.O. 2904(E), dated the 8th December, 2010 and S.O. 181(E), dated the 28th January, 2011, S.O. 692(E), dated the 5th April, 2011, S.O. 1537(E), dated the 6th July, 2011, S.O. 1754(E), dated the 28th July, 2011 S.O. 2609(E), dated the 22nd November, 2011. S.O. 264(E),dated the 13th February, 2012.

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ANNEXURE : XXI

NABL

National Accreditation Board for Testing and Calibration Laboratories

(An Autonomous Body under Department of Science & Technology, Govt. of India)

CERTIFICATE OF ACCREDITATION

MIN MEC R & D LABORATORY

has been assessed and accredited in accordance with the standard

ISO/IEC 17025:2005

"General Requirements for the Competence of Testing & Calibration Laboratories"

for its facilities at

A-121, Paryavaran Complex, IGNOU Road, New Delhi

in the discipline of

CHEMICAL TESTING

(To see the scope of accreditation of this laboratory, you may also visit NABL website www.nabl-india.org)

Certificate Number T-1157

Issue Date 08/10/2015

Valid Until 07/10/2017

This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the additional requirements of NABL.

Signed for and on behalf of NABL

N. Venkateswaran	Anil Relia	Prof. S. K. Joshi
Program Manager	Director	Chairman