EIA REPORT

1. INTRODUCTION

1.1 BACKGROUND OF THE PROJECT

NBCC (India) Limited on behalf of Ministry of Housing and Urban Affairs (MoHUA) has proposed to redevelop General Pool Residential Accommodation (GPRA) Colony at Netaji Nagar, New Delhi. NBCC has obtained Environmental Clearance from Ministry of Environment, Forest and Climate Change vide Lr. No. F.No. 21 – 150/2017-IA-III dated 27.11.2017 for the proposed redevelopment of General Pool Residential Accommodation and copy of the same is enclosed as *Annexure I*.

Environmental clearance has been obtained for execution of work in 4 Phases consisting of Type II to VI quarters of 90 Towers with total dwelling units of 4,882 Nos, 5 Office Block, 1 Hostel Block and other social infrastructure like Netaji Nagar Market, Suvidha Market, Vegetable Market, Local shopping Centre, W.T.I & NDMC Girls Hostel, N.P.CO.ED Primary School & Senior School, Sarvodaya Vidyalaya Sr. Sec. school, Barat Ghar, Grih Kalyan Kendra, Community & Service Apartment, Religious Building, Post Office, Dispensary, Zonal Health Center, Sandhya (Old Age Home) and Maintenance Office. The total built up area and land area of the proposed project is 14, 01,061.58 sq.m and 4, 42,404.80 sq.m respectively.

The work was started, while some writ petitions against felling of trees were filed in the Hon'ble High Court & NGT and they ordered to maintain status quo in redevelopment of all seven GPRA Colonies including Netaji Nagar on 02.07.2018 & 26.07.18. Accordingly, all the work in redevelopment of Netaji Nagar was put on hold. During proceedings, MoHUA has filed an affidavit in the court after revisiting the design thereby reducing the affected trees, Nos of dwelling units and other changes in Social infrastructures. Thereafter, Hon'ble High Court has considered the affidavit of MoHUA for review of Six GPRA colonies including Netaji Nagar and ordered accordingly. The stay for six out of seven GPRA colonies except Nauroji Nagar was vacated on 03.10.2018. The Hon'ble court order is reproduce below and copy of court order is placed as *Annexure IV*.

"MoHUA / NBCC should be permitted to approach appropriate statutory authorities for necessary approvals of the revised proposals, which shall be considered by the said authorities in accordance with law. Ordered accordingly. The respondent No.1/NBCC shall also be at liberty to approach the tree officer (GNCTD), if required as per revised proposal for tree felling permission. Further action/steps shall be taken by respondent No.1/NBCC as per the decision of the statutory authorities"

The redesign has been done based on the following parameters:

- Avoiding cutting of trees
- Wherever possible relocation of trees through transplantation
- Planting large number of trees to increase the green cover

Accordingly, NBCC has reworked their concept plans on the above principles which consists of 5 residential type buildings (Type II, III, IV, V & VI) of 85 Towers with total dwelling units of 4,727 Nos, 5 Office Block, 1 SARTAC Hostel Block and other social infrastructure like Netaji Nagar Market, Suvidha Market (2 nos), Vegetable Market, W.T.I, NDMC Middle School, N.P.CO.ED Senior Secondary School, Sarvodaya Vidyalaya Sr. Sec. school, Barat Ghar, Grih Kalyan Kendra, Post Office, Dispensary, Sandhya (Old Age Home), NBCC Office and Community Building with the revised built up area 12,18,438.08 sq.m.

Due to redesign in the concept plan of the project there will be changes in the project components like population, water requirement, wastewater generation and solid waste generation, etc. For the revised proposal, we submit our application to MoEF&CC, New Delhi seeking amendment in Environmental Clearance under Schedule 8(b) of EIA Notification, 2006.

1.2 IDENTIFICATION OF PROJECT AND PROJECT PROPONENT

1.2.1 Project Proponent

NBCC (India) Limited on behalf of MoHUA has proposed to redevelop General Pool Residential Accommodation (GPRA) Colony at Netaji Nagar of Africa Avenue Marg,

Chanakyapuri Tehsil, New Delhi. NBCC (India) Limited, formerly known as National Buildings Construction Corporation Ltd., is a blue-chip Government of India Navratna Enterprise under the Ministry of Housing and Urban Affairs.

1.2.2 Project

TABLE 1.1 - PROJECT DETAILS

Village	Netaji Nagar
Tehsil / Taluk	Chanakya Puri
District	New Delhi
State	Delhi
Area of the land	4,42,404.80 Sq.m
Built up area	12,18,438.08 Sq.m

1.3 BRIEF DESCRIPTION OF PROJECT

The proposed project is redevelopment of General Pool Residential Accommodation (GPRA) colony at Netaji Nagar of Africa Avenue Marg, Chanakyapuri Tehsil, New Delhi. The project is categorized as Category 'A' in Schedule 8(b) Township and Area Development Projects with built up area more than 1,50,000 sq.m as per EIA Notification 2006 and its subsequent amendments.

1.4 IMPORTANCE AND BENEFITS OF THE PROJECT

The proposed redevelopment project is General Pool residential accommodation (GPRA) with supporting social infrastructure, General Pool Office Accommodation (GPOA) and SARTAC Office & Hostel with advanced facilities under Ministry of Housing and Urban Affairs. The proposed project benefits the surroundings by providing employment opportunities both during construction and operation phase thereby enhancing the socio-economic and standard of living the locality.

1.5 SCOPE OF THE STUDY

The scope of study is limited to assessment of impact associated with proposed construction of area development and Environment Management Plan for safeguarding the core and buffer zone environment of this town with reference to the following components:

- To conduct literature review and to collect data relevant to the study area
- Establishing the baseline environmental aspects in and around the project site
- Identifying various existing pollution loads due to various activities
- Predicting incremental levels of pollutants in the study area due to the proposed redevelopment
- Evaluating the predicted impacts on various environmental attributes in the study area by using scientifically developed and widely accepted environmental impact assessment methodologies
- Identifying critical environmental attributes that are required to be monitored in the post-project scenario.
- To prepare an Environment Management Plan (EMP), outlining the measures for improving the environmental quality in view of future redevelopment for environmentally sustainable development

The area falling within 10 km radius from the project site is defined as the study area.

1.6 APPLICABLE ENVIRONMENTAL REGULATORY FRAMEWORK

The proposed redevelopment project will follow and function under the following Rules, Acts & Regulations that are formulated by the government of India in order to protect the environment and ensure development takes place in a sustainable way. An outline of important environmental legislations and their applicability is given in the Table 1.2.

TABLE 1.2 - APPLICABLE ENVIRONMENTAL LEGISLATIONS

S. No.	Act	Purpose	Objective
1.	The Environment (Protection) Act, 1986 amended in 1991	New, Expansion, Modernization activities	Providing protection and improvement for the environment and preventing

			environmental pollution.
2.	The Water (Prevention and Control of Pollution) Act, 1974 amended in 1988	New, Expansion, Modernization activities	For the prevention and control of water pollution. To ensure discharge of waste water is done as per norms.
3.	The Air (Prevention and Control of Pollution) Act , 1981 amended in 1987	New, Expansion, Modernization activities in industries	To control, reduce air pollution.
4.	EIA Notification 2006 and its amendments.	New, Expansion, Modernization activities in industries	Protection of the Environment and ensuring that all environmental impacts are mitigated appropriately.
5.	The Noise Pollution (Regulation and Control) (Amendment) Rules, 2002	New, Expansion, Modernization activities	To protect workers and public in the surrounding from noise pollution
6.	The Ozone Depleting Substances (Regulation and Control) Rules, 2000	New, Expansion, Modernization activities which include ozone depleting substances	Regulation of production and consumption of ozone depleting substances
7.	Hazardous and other wastes Management, Handling and Trans boundary Movement Rules 2016	New, Expansion, Modernization activities which include Management, Handling and Transboundary Movement of Hazardous waste	Prevention, Control and safe handling of hazardous wastes.
8.	The Municipal Solid Wastes (Management and Handling) Rules, 2016	New, Expansion, Modernization activities which include Management, Handling, treatment and disposal of municipal solid wastes.	Prevention, Control and handling of Municipal Solid wastes.
9.	E-Waste (Management) Rules, 2016.	New, Expansion, Modernization activities which include Management, Handling, treatment and disposal of E-Wastes.	Prevention, Control and handling of E-Wastes.

10.	Construction and Demolition Waste Management Rules, 2016.	New, Expansion, Modernization activities which include handling /disposal of Construction and Demolition Wastes.	Disposal / Handling of Construction and Demolition Waste
11.	Plastic Waste Management Rules, 2016.	New, Expansion, Modernization activities which include Management, Handling, treatment and disposal of Plastic Wastes.	Prevention, Control and handling of Plastic Wastes.

Source: *CPCB and MoEFCC*

1.7 STRUCTURE OF THE EIA REPORT

Environmental Impact Assessment or EIA is one of several tools available for improving the way in which decisions are made in order to promote sustainable development outcomes. According to the International Association for Impact Assessment, Environmental Impact Assessment can be defined as: 'The process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made.

The objectives of an Environmental Impact Assessment are

- ✓ To ensure that environmental considerations are explicitly addressed and incorporated into decision-making processes
- ✓ To anticipate and avoid, minimise the significant adverse biophysical, social and other relevant effects of development proposals
- ✓ To protect the productivity and capacity of natural systems and the ecological processes that maintain their functions and
- ✓ To promote development that is sustainable and optimises resource use and management opportunities.

This report focus on findings, conclusions and recommendations supported by summaries of the data collected and citations for any references used in interpreting those data. The environmental assessment report will be organized according to the

outline given below.

- **Chapter 1** - Introduction
- **Chapter 2** - Project Description
- **Chapter 3** - Description of the Environment
- **Chapter 4** - Anticipated Environmental Impacts and Mitigation Measures
- **Chapter 5** - Analysis of Alternatives (Site and Technology)
- **Chapter 6** - Environmental Monitoring Program
- **Chapter 7** - Additional Studies
- **Chapter 8** - Project Benefits
- **Chapter 9** - Environmental Cost Benefit Analysis
- **Chapter 10** - Environmental Management Plan (EMP)
- **Chapter 11** - Summary & Conclusions (Summary EIA)
- **Chapter 12** - Disclosure of EIA Consultant

2. PROJECT DESCRIPTION

2.1 LOCATION OF THE PROJECT

The proposed project is redevelopment of General Pool Residential Accommodation (GPRA) colony at Netaji Nagar of Africa Avenue Marg, Chanakyapuri Tehsil, New Delhi. The site co-ordinates are 28°34'29.11"N Latitude and 77°11'8.36"E Longitude. The location of the project site and the satellite image of the project site are given in *Figure 2.1* and *2.2* respectively.

2.2 LAND REQUIREMENT AND LAND USE

The proposed project will be developed in an area of 4,42,404.80 sq.m with a total built up area of 12,18,438.08 sq.m. The detailed land use split up and built up area statement of the project site is given *Table 2.1* and *2.2* respectively.

TABLE 2.1 LAND USE SPLIT UP OF THE PROJECT SITE

S.No	Description	EC Obtained		EC Amendment requested	
		Area in sq.m	%	Area in sq.m	%
1	Plot coverage	1,13,875.20	25.74	1,07,525.97	24.30
2	Internal Road & Pavement	66,064	14.93	73212.00	16.55
3	Green Belt Area	1,84,769	41.76	1,81,384	41.00
4	Open Parking Area	7,390	1.67	9972.94	2.25
5	Other Utility Area (including Fire Tender Path)	70,306.60	15.89	70,309.89	15.89
TOTAL LAND AREA		**4,42,404.8**	**100**	**4,42,404.8**	**100**

TABLE 2.2 SUMMARY OF BUILT UP AREA

S.No	Towers	EC Obtained				EC Amendment requested			
		No. of. Floor / Block	No of Towers	No of DU*	Total (sq.m)	No. of. Floor / Block	No of Towers	No of DU*	Total (sq.m)
Residential									
1	Type - 2	G + 9	19	1,482	91585.26	G + 9	18	1414	86456.20
2	Type - 2A					G + 9	1	59	3707.92
3	Type - 3	G + 9	18	1,404	97144.41	G + 9	17	1335	94291.95
4	Type - 3A					G + 9	1	59	4238.56
5	Type - 4 A	G + 10	10	410	49562.7	G + 9	6	233	28076.99
6	Type - 4 B	G + 10	10	420	50182.13	G + 10	13	556	66910.18
7	Type - 5 A	G + 9	4	152	27897.04	G + 10	13	559	101235.85
8	Type - 5 B	G + 10	11	462	84638.25				
10	Type - 6 A	G + 9	2	56	13548	G + 10	16	512	131703.65
11	Type - 6 B	G + 10	16	496	119669				
12	Combined Basement area				433109.54				329075.34
Sub Total (A)			90	**4,882**	**967336.33**		**4,727**		**845696.64**
Office									
1	Block - 1	G + 10	1	-	51375.64	G + 8	1	-	67874.81
2	Block - 2	G + 10	1	-	45613.14	G + 8	1	-	56610.04
3	Block - 3	G + 10	1	-	42048.57	G + 8	1	-	56230.25
4	Block - 4	G + 10	1	-	59720.09			-	-

5	SARTAC Office	G + 5	1	-	3055.81	G + 5	1	-	3135.31
6	SARTAC Hostel	G + 4	1	-	4482.14	G + 8		-	5859.17
7	Combined Basement area				137489.75				140012.75
Sub Total (B)					**343785.12**				**329722.33**
Social Infrastructure									
1	Netaji Nagar Market	G + 2	1	-	5040.41	G + 2	1	-	7228.40
2	Suvidha Market 1	G + 1	4	-	2565.31	G + 1	1	-	476.31
3	Suvidha Market 2					G	1	-	476.31
4	Vegetable Market	G	1	-	351.79	-	-	-	Combined with Netaji Nagar Market
5	Local Shopping Centre	B + G + 3	1	-	12398.95	-	-	-	-
6	W.T.I	G + 3	1	-	1705.85	-	-	-	3266
7	N.P.CO.ED Primary School	G + 3	1	-	1744.536	-	-	-	-
8	NDMC Middle School					-	-	-	1465
9	N.P.CO.ED Senior Secondary School	G + 3	1	-	6823.29	G+3	1	-	5848.42
10	Sarvodayavidyalaya Sr. Sec. School	G + 3	1	-	7809.25	-	-	-	4805
11	Barat Ghar	G + 2	1	-	968.94	G + 1	1	-	762.09
12	Grih Kalyan Kendra	G + 3	1	-	2132.19	G + 1	1	-	1331.94
13	Community& Service Apartments	G + 7	1	-	9531.06	-	-	-	-

14	Religious Building	G + 1	2	-	350	-	-	-	-
15	Post Office	G + 3	1	-	1250.86	-	-	-	1460.00
16	Dispensary	G + 3	1	-	1388.61	G+3	1	-	1302.00
17	Zonal Health Center	G	1	-	196.84	-	-	-	-
18	Sandhya (Old Age Home)	G + 2	1	-	2423.11	-	-	-	1297
19	NDMC Maintenance Office	G	1	-	163.94	-	-	-	
20	CPWD Training Centre	G + 1	1	-	448.35	-	-	-	
21	NBCC Office (Earlier Grih Kalyan Kendra)	G + 1	1	-	1228.00	G + 1	1	-	1228.00
22	Community Building	-	-	-	-	Ground			107.61
23	Gate & Guard Room etc & ESS Building	-	-	-	-				2425.00
24	Combined Basement area				31980.99	-	-	-	9540.03
Sub Total (C)					**89,940.13**				**43019.11**
Grand Total (A + B + C)		**-**	**-**	**4,882**	**14,01,061.58**			**4,727**	**12,18,438.08**

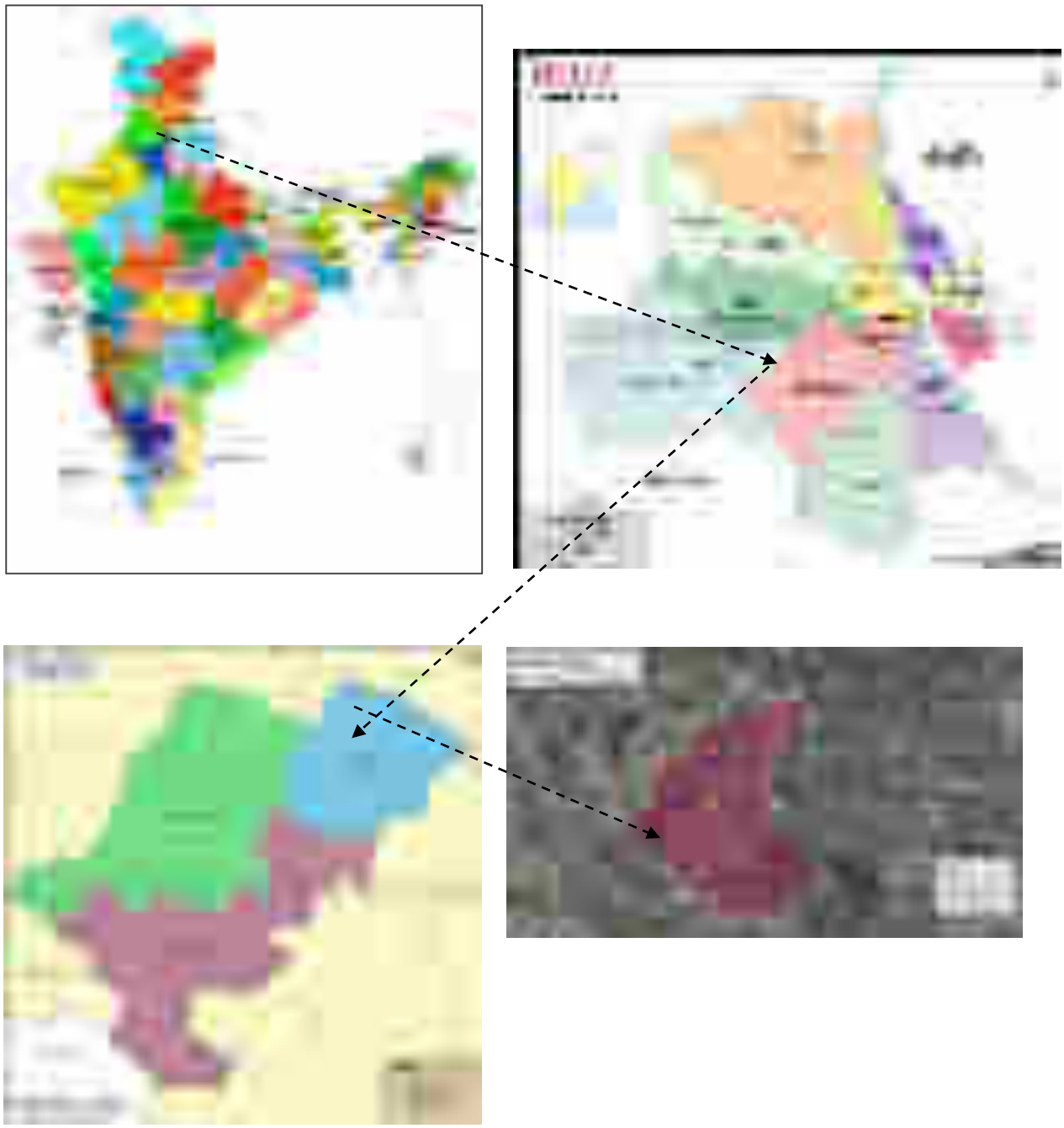


FIGURE 2.1 MAP SHOWING LOCATION OF THE PROJECT SITE

A	28°34'45.62"N 77°11'22.86"E
B	28°34'14.01"N 77°11'22.34"E
C	28°34'14.69"N 77°11'08.45"E
D	28°34'36.36"N 77°10'59.35"E

FIGURE 2.2 SATELLITE IMAGE OF THE PROJECT SITE

TABLE 2.3 SALIENT FEATURES OF THE PROJECT

S.NO	DESCRIPTION	EC OBTAINED	EC AMENDMENT REQUESTED
1.	Total area of Extent	4,42,404.80 sq.m	
2.	Total Built up area	14,01,061.58 sq.m	12,18,438.08 sq.m
3.	Plot Coverage	1,13,875.20 sq.m (25.74%)	1,07,525.97 sq.m (24.30 %)
4.	Achieved FAR	180.97	166.64
5.	Green belt area	1,84,769 sq.m (41.76%)	1,81,384 sq.m (41.00 %)
6.	Parking Two wheelers Four Wheelers	 - 17,928 ECS	 6587 Nos 11,015 ECS
7.	Population	59,621	55, 293
8.	Source of Water Supply	New Delhi Municipal Council (NDMC)	
9.	Total Fresh water Requirement	3,141 KLD	1,874 KLD
10.	Quantity of wastewater generation	4,227 KLD	2, 564 KLD
11.	Treatment system for waste water	4,227 KL Capacity (FAB Technology)	2, 564 KL Capacity (MBR Technology)
12.	Power requirement & Source	48,041 kW and NDMC	37,940 kW and NDMC
13.	Solid waste generation, treatment and management	▪ Municipal Solid waste - 19,863 Kg/day ✓ Bio-degradable - 9,335 Kg/day (OWC) ✓ Non-Biodegradable – 10,528 Kg/day (Authorized Recyclers) ✓ STP sludge - 609 Kg/day (Manure for gardening) ▪ Hazardous waste ✓ DG Filters & filter material - 1.2 TPA (Disposal through TSDF facility) ✓ Used oil - 2.8 TPA	▪ Municipal Solid waste – 18,696 Kg/day ✓ Bio-degradable – 8,787 Kg/day (OWC) ✓ Non-Biodegradable – 9,909 Kg/day (Authorized Recyclers) ✓ STP sludge - 360 Kg/day (Manure for gardening) ▪ Hazardous waste ✓ DG Filters & filter material - 1.2 TPA (Disposal through TSDF facility) ✓ Used oil - 2.8 TPA

		(Disposed to CPCB authorized re-processors)	(Disposed to CPCB authorized re-processors)

2.3 ENVIRONMENTAL SENSITIVITY OF THE PROJECT SITE

The site is categorized as Residential Use by Delhi Development Authority (*Annexure III*). It indicated that the facilities adjacent to the site are residential, educational and vacant lands. Hence proposed development/ land use is consistent with the surroundings. Surrounding Infrastructure map covering 5 km radius given in *Figure 2.3*. Topo map of the project site covering 10 km radius is given in *Figure - 2.4*.andthe drainage map of the project site covering 10 km radius is given in *Figure 2.5*. The Environmental Setting of the project site is given in *Table - 2.4*.

TABLE 2.4 ENVIRONMENTAL SETTING OF THE PROJECT SITE

S.NO.	PARTICULARS	DETAILS
1.	Site Latitude	28°34'29.11"N
2.	Site Longitude	77°11'8.36"E
3.	Present Land use	Residential Use
4.	Nearest railway station	• Safdarjung - 0.40 km (N) • Sarojini Nagar - 0.68 km (NE) • Chankyapuri - 1.9 km (NNW)
5.	Nearest Bus stop	• DTC Sarojini Nagar Depot - 0.07 km (E) • Hyatt Bus Stop - 0.09 km (S) • R K Puram - 0.23 km (SW) • North MotiBagh - 0.5 km (W)
6.	Nearest airport	• Indira Gandhi International Airport - 7.6 km (SW)
7.	Nearest town/ city	Within City Limit
8.	Hills/ valleys	Nil (within 10 km radius)
9.	Topography	Plain
10.	National parks/Wildlife Sanctuaries	• Okhla Bird Sanctuary - 10.81 Km SE • Asola Wildlife Sanctuary - 11.2 km (ESE)

S.NO.	PARTICULARS	DETAILS
11.	Reservoir/Lake/River/Sea	• Deer Park Lake - 2 km (SSE) • Jharera Pond - 4.3 km (WNW) • Yamuna River Canal - 4.8 km (E) • ShamshiTalab Pond - 6.0 (S) • Prasad Nagar Lake - 8.0 km (N) • Yamuna River - 8.2 km (E) • Tihar Lake - 9.7 km (NW) • Nallah - 9.7 km (SSE)
12.	Reserved/ Protected Forests	• Central Ridge Forest - 2.8 km (NNW)
13.	Archaeological Important Places	• Satpula - 5.0 km (SE) • Mehrauli Archaeological Park - 5.2 km (S) • Sultan Garhi's Tomb - 6.0 km (SW) • PuranaQila Fort - 6.1 km (NE)
14.	Seismicity	Seismic Zone IV as per IS 1893 (Part-1): 2002
15.	Defense Installations	Delhi Cantonment - 5.13 km (NW)
16.	Nearest Port	Nil (within 10 km radius)

FIGURE 2.3 SURROUNDING INFRASTRUCTURE MAP OF THE SITE COVERING 5 KM RADIUS

FIGURE 2.4 TOPO MAP OF THE SITE COVERING 10 KM RADIUS

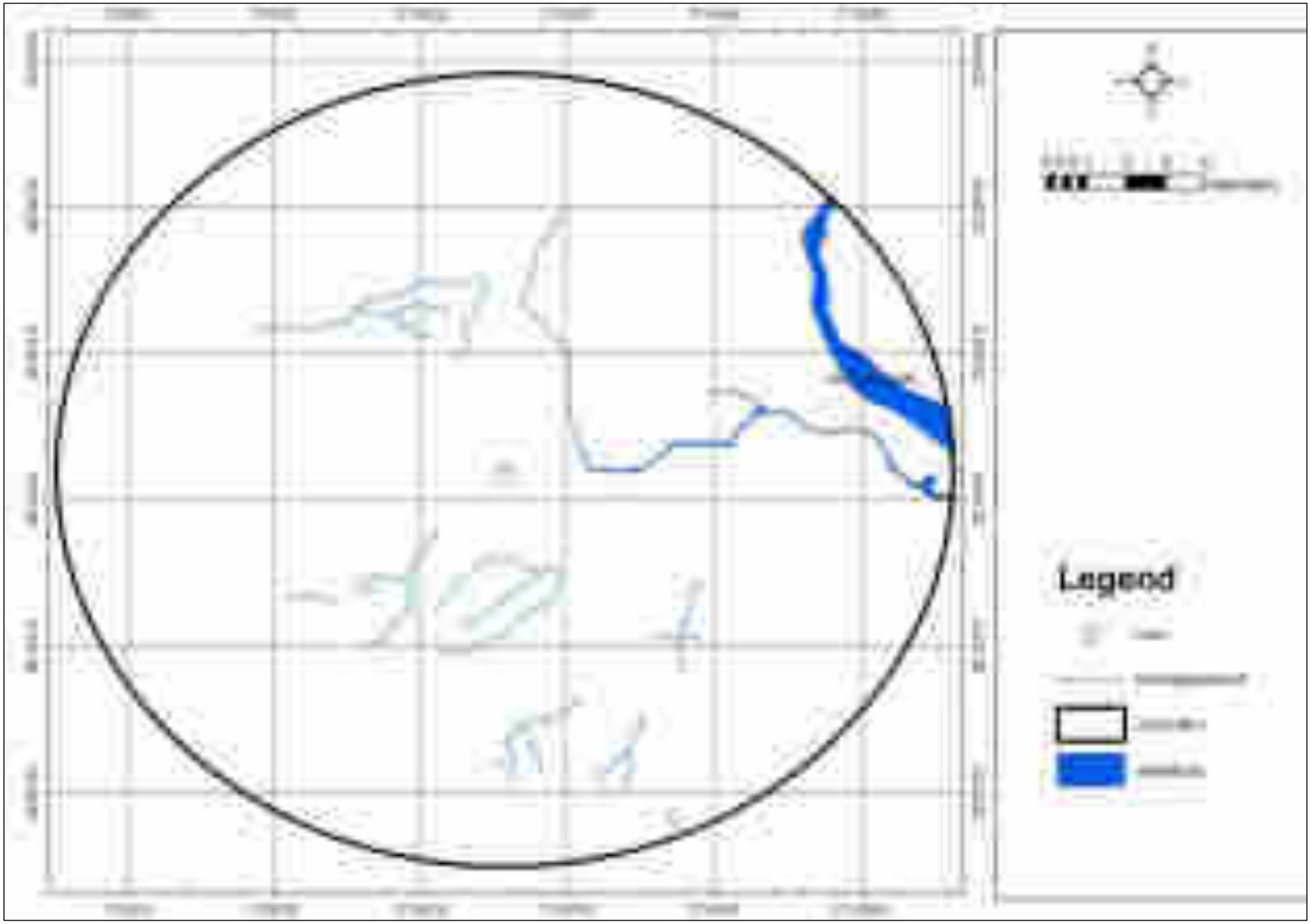


FIGURE 2.5 DRAINAGE MAP SHOWING 10 KM RADIUS OF THE PROJECT SITE

2.4 SITE CONNECTIVITY

The project site is well connected by road, rail and air ways. Safdarjung and Sarojini Nagar Railway station is located at 0.4 km North & 0.6 Km North East from the project site. DTC Sarojini Nagar Depot and Hyatt Bus Stop are located at 0.07 Km East and 0.09 Km South respectively. The map showing the roads and railways are given in *Figure 2.6.*

FIGURE 2.6 LOCAL CONNECTIVITY OF THE PROJECT SITE

2.5 PROJECT COST

The project cost for the proposed Redevelopment of General Pool Residential Accommodation at Netaji Nagar is estimated to be around Rs. 5,466 Crores.

2.6 POPULATION

The total manpower requirement during the construction phase and the expected population during the operational phase of the project are given below in *Table - 2.5* and *Table - 2.6* respectively.

TABLE 2.5 MANPOWER REQUIREMENT DURING CONSTRUCTION PHASE

S.NO	DESCRIPTION	
1.	Approximately 7,500 persons	Inclusive of workmen, Laborers, Supervisors, Engineers, Architects and Managers

TABLE 2.6 EXPECTED POPULATION DETAILS DURING OPERATION PHASE

Description	EC obtained	EC Amendment requested
Type 2	6,669	6,629
Type 3	6,318	6,273
Type 4	5,603	5,326
Type 5	4,145	3,773
Type 6	3,726	3,456
Visitors & MS	1,000	2,546
GPOA (Office blocks 1 to 4)	19,876	18,523
SARTAC (Office & Hostel)	754	631
N.P.CO. ED Middle school	682	375
Sarvodaya Vidyalaya Senior secondary school	781	1,231
WTI	171	837
Sandhya old age home	-	58
Grih Kalyan Kendra	192	910
Barat Ghar	323	521
NDMC Market	1,171	2006
SUVIDHA MARKET - 1	433	119
SUVIDHA MARKET - 2	-	98
Post Office	417	150
Dispensary	733	133
Zonal health center	66	-
NP Sr. Sec. School	-	1,498
Veg Market	117	Combined with Netaji Nagar market
Service apartment & Community	953	-
Local shopping Market	5,083	-
NBCC Maintenance Office (Earlier Grih Kalyan Kendra)	-	126
Community Building	-	74
Rooms	408	-
Total	**59,621**	**55,293**

2.7 WATER REQUIREMENT

Water requirement during Construction Phase will be about 358 KLD which will be met by procuring recycled /treated water from nearby STP for construction purpose.

Total water requirement during operation Phase will be 3,602 KLD. Out of it, 1,874 KLD is fresh water. The fresh water requirement is sourced from New Delhi Municipal Council (NDMC). The current fresh water supply to Netaji Nagar as collected from NDMC is 3821 LPCD (Annexure…….). The requirement of fresh water post development of Netaji Nagar is lesser than the present supply of fresh water.

The per capita water demand has been designed based on the norms provided in "Manual on Norms and Standards for Environmental Clearance of large Construction Projects" developed by Ministry of Environment & Forest, Govt. of India vide order dated - 15.05.2007. As per this manual the water demand per capita will be as under:

Requirement of water per capita : 86 LPCD
Fresh water requirement per capita : 65 LPCD
Flushing (treated) water requirement per capita : 21 LPCD

The details of water requirement calculation are given in Table 2.7 & 2.8.

TABLE 2.7 WATER REQUIREMENT DURING CONSTRUCTION PHASE

S. No	Description	Total no. of Persons	Water demand per person/ day	Demand per person/day (in LPCD)		Domestic water Demand in LPCD	Flushing Demand in LPCD
				Domestic use	Flushing use		
1.	Workers	7500	45	25	20	1,87,500	1,50,000
2.	Curing	-	-	20	-	20,250	-
TOTAL						2,07,750	1,50,000
GRAND TOTAL (IN KLD)						**357.75 (Say 358)**	

TABLE 2.8a WATER REQUIREMENT DURING OPERATION PHASE - EC OBTAINED

S.No	Phases	Occupancy	Litres per capita per day	Water requirement (KLD)		
				Domestic	Toilet Flushing	Total WR
	Phase 1					
1	Type 2	6669	135	585.21	315.11	900.31
2	Type 3	6318	135	554.41	298.53	852.93
3	Veg Market	117	45	0.74	1.37	2.11
4	Netaji Market	1171	45	7.38	13.7	21.08
5	Primary School	-	45	3.25	1.75	5.00
6	Suvidha Market	120	45	0.76	1.41	2.17
7	Back wash	-	-	24.29	14.55	38.85
8	Sarvodaya Vidyalaya Senior secondary school	781	45	12.3	22.84	35.14
9	Barat Ghar	323	45	2.03	3.77	5.8
10	Post office	417	45	3.15	5.85	9.0
11	Dispensary	733	45	4.61	8.57	13.18
12	Zonal health center	66	45	0.41	0.77	1.18
13	W.T.I	171	45	2.69	4.99	7.68
14	Rooms	100	135	8.77	4.73	13.5
15	Sandhya old age home Kitchen	-	135	3.5	6.5	10.0
16	Rooms	68	-	6.85	4.84	11.68
17	NDMC Maintenance office and bank	-	45	1.22	2.28	3.5
18	NBCC Maintenance and Bank	-	45	1.75	3.25	5.0
19	Religious Building	-	-	1	-	1.0
20	Grih Kalyan Kendra	192	45	3.02	5.62	8.64
21	N.P.CO. ED Senior secondary school	682	45	10.75	19.96	30.71
22	CPWD Training centre	-	45	1.05	1.95	3.0
23	Maintenance Staff	400	45	6.3	11.7	18.00
Sub total (A)		**18,328**		**1,245.44**	**754.04**	**1,999.46**

Phase 2						
	Commercial area					
1	Sartac office & Hostel	754	45	11.87	22.05	33.92
2	Office blocks 1 to 4	19876	45	313.04	581.37	894.41
3	Back wash	-	-	7.36	12.93	20.29
4	Service apartment & Community	953	45	15.01	27.88	42.89
5	Rooms	240	-	28.08	15.12	43.2
6	Maintenance Staff	200	45	3.15	5.85	9.0
Sub total (B)		**22,023**	**-**	**378.51**	**665.20**	**1,043.71**
Phase 3						
1	Type 4 (Main)	3735	135	327.75	176.48	504.23
2	Type 4 (Service)	1868	135	163.87	88.24	252.11
3	Type 6 (Main)	252	135	22.11	11.91	34.02
4	Type 6 (Service)	126	135	11.06	5.95	17.01
5	Suvidha Market (2 Nos.)	106	45	1.85	3.44	5.29
6	Local shopping Market	5083	45	32.02	59.46	91.48
7	Back wash	-	-	11.16	6.88	18.03
8	Maintenance Staff	200	45	3.15	5.85	9.0
Sub total (C)		**11,370**		**572.97**	**356.21**	**931.17**
Phase 4						
1	Type 5 (Main)	2763	135	242.45	130.55	373
2	Type 5 (Service)	1382	135	121.23	65.27	186.5
3	Type 6 (Main)	2232	135	195.86	105.46	301.32
4	Type 6 (Service)	1116	135	97.93	52.73	150.66
5	Suvidha Market	207	45	1.3	2.42	3.72
6	Back wash	-	-	13.17	7.13	20.3
7	Maintenance Staff	200	45	3.15	5.85	9.0
Sub total (D)		**7900**		**675.09**	**369.41**	**1044.5**
Grand Total (A+B+C+D)		**59,621**		**2,872**	**2,145**	**5,016**

Note: Treated water from all phase I, III, IV will be utilized in Phase II as soft water for HVAC, therefore no excess treated water will be disposed outside

TABLE 2.8b WATER REQUIREMENT DURING OPERATION PHASE - EC AMENDMENT REQUESTED

S.No.	Description	Occupancy	Litres per capita per day	Water requirement (KLD)		
				Domestic	Toilet Flushing	Total WR
1. RESIDENTIAL						
1.1	Type II	6628.5	86	430.85	139.19	570.05
1.2	Type III	6273	86	407.74	131.73	539.47
1.3	Type IV	5325.75	86	346.17	111.84	458.01
1.4	Type V	3773.25	86	245.26	79.23	324.49
1.5	Type VI	3456	86	224.64	72.57	297.21
	Subtotal (A)	**25457**		**1654.67**	**534.58**	**2189.25**
1.6	Staff	1273	15	4.77	14.31	19.09
1.7	Visitor	1273	15	4.77	14.31	19.09
1.8	Landscaping (Horticulture etc.)		3	0	544.15	544.15
	Subtotal (B)	**2546**		**9.54**	**28.63**	**38.17**
2. OFFICE						
2.1	GPOA	18523 (18072+452)	30+15	137.23	411.69	548.92
2.2	SARTAC	631 (313+200+118)	30+86+15	7.09	21.28	28.37
	Subtotal (C)	**19154**		**144.32**	**432.97**	**577.29**
3. SOCIAL INFRASTRUCTURE						
3.1	NDMC Market	2006 (201+1805)	30+15	8.27	24.82	33.09
3.2	Suvidha Market-01	119(12+107)	30+15	0.49	1.48	1.97

3.3	Suvidha Market-02	98 (10+88)	30+15	0.41	1.21	1.62
3.4	W.T.I	837 (817+20)	45+15	9.26	27.79	37.05
3.5	NDMC Middle School	375 (366+9)	45+15	4.15	12.46	16.61
3.6	Sarvodaya vidyalaya Sr. Sec. School	1231 (1201+30)	45+15	13.63	40.88	54.51
3.7	Barat Ghar	521 (508+13)	30+15	3.85	11.57	15.42
3.8	Grih Kalyan Kendra	910 (888+22)	30+15	6.74	20.23	26.97
3.9	Post Office	150 (146+4)	45+15	1.66	4.97	6.63
3.10	Dispensary	133 (130+3)	30+15	0.99	2.96	3.95
3.11	Sandhya (Old Age Home)	58 (52+6)	86+15	3.4	1.15	4.55
3.12	NBCC Maintenance Office	126 (123+3)	30+15	0.93	2.80	3.73
3.13	N.P. Sr. Sec. School	1498 (1461+37)	30+15	11.10	33.31	44.41
3.14	Community Building	74 (72+2)	30+15	0.54	1.63	2.17
	Subtotal (D)	**8137**		**65.42**	**187.26**	**252.68**
GRAND TOTAL		**55293**		**1873.95**	**1183.44**	**3057.39**

Total Fresh Water Demand = 1874 KLD
Recycled water consumed in Flushing = 1183 KLD
Recycled water consumed in Horticulture = 544 KLD
Total STP Capacity = 2564 KLD
Treated Water generation @ 90% = 2307 KLD
Excess Treated Water = 580 KLD

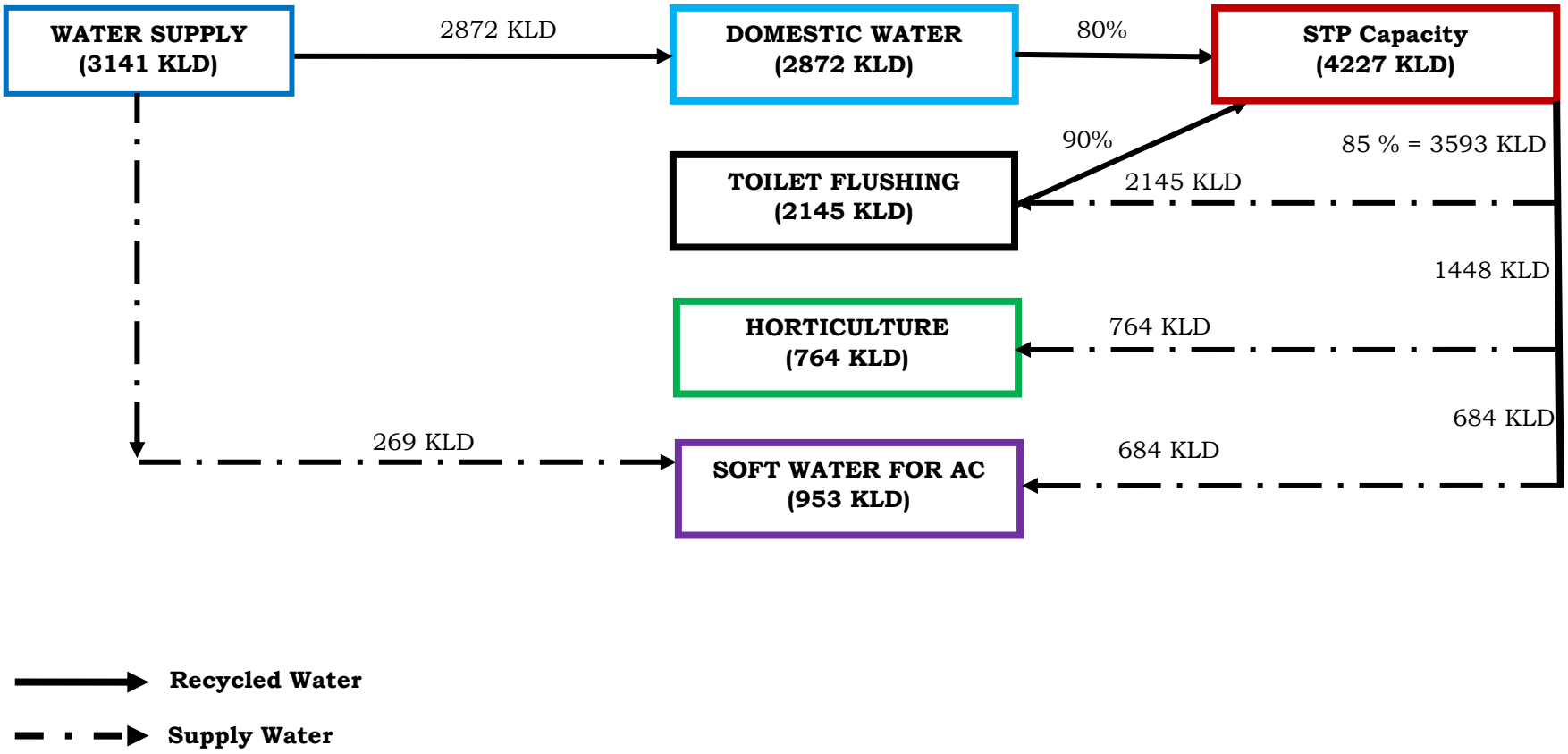
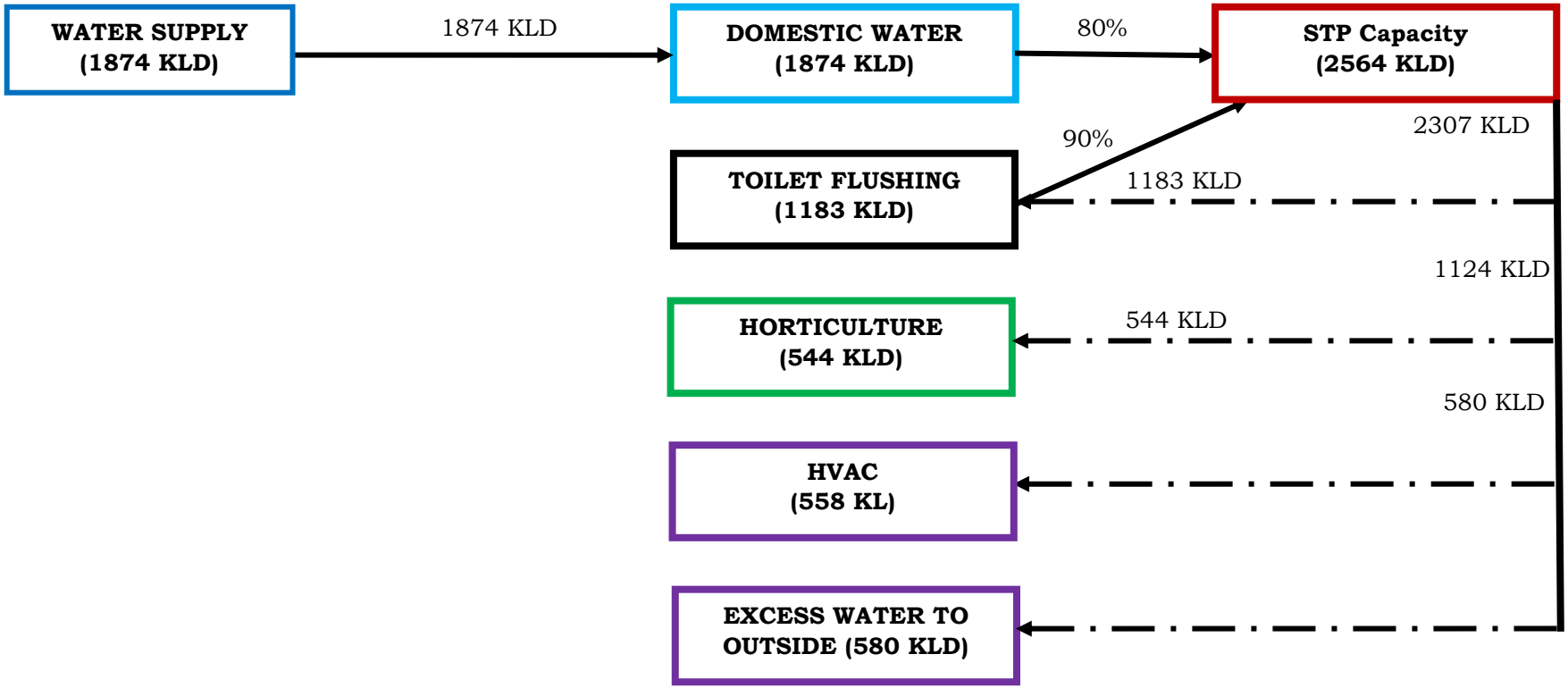


FIGURE 2.7a WATER BALANCE CHART FOR EC OBTAINED



Note :- HVAC water will be required one time & will be re-circulated

FIGURE 2.7b WATER BALANCE CHART FOR EC AMENDMENT REQUESTED

2.8 SEWAGE GENERATION, TREATMENT AND DISPOSAL

2.8.1 During Construction Phase

Quantity of sewage generated during construction phase will be 301 KLD. Thus the sewage will be treated by providing Mobile STP.

2.8.2 During Operation Phase

Quantity of sewage generated during operational phase shall be 2,564 KLD. Thus the sewage will be treated through sewage treatment plant of capacity 2,564 KLD based on MBR technology. The treated sewage will be reused for toilet flushing (1,183 KLD), landscaping (544 KLD), HVAC (558 KL) and excess treated water (580 KLD) will be supplied to NDMC for horticulture and other uses in surrounding area. Totally 8 Nos. of STP having capacity of 2564 KLD will be provided in different pockets. The detail of sewage treatment plant is enclosed as *Annexure XIV*.

2.9 SOLID WASTE GENERATION, COLLECTION, TREATMENT AND ITS DISPOSAL

2.9.1 Municipal Solid Waste

The quantity of municipal Solid waste generated from all the proposed project for the EC obtained and .Amendment requested is given below.

TABLE 2.9(a) SOLID WASTE GENERATION - EC OBTAINED

Description	EC obtained		EC Amendment requested	
	Occupancy	Solid Waste generation	Occupancy	Solid Waste generation
Type 2	6,669	3335	6,629	3314
Type 3	6,318	3159	6,273	3137
Type 4	5,603	2801	5,326	2663
Type 5	4,145	2073	3,773	1887
Type 6	3,726	1863	3,456	1728
Visitors & MS	1,000	200	2,546	509
GPOA (Office blocks 1 to 4)	19,876	3975	18523	4535
SARTAC (Office & Hostel)	754	151	631	141
N.P.CO. ED Middle school	682	136	375	75
Sarvodaya Vidyalaya Senior secondary school	781	156	1,231	246
WTI	171	34	837	167
Sandhya old age home	-	-	58	12
Grih Kalyan Kendra	192	38	910	219
Barat Ghar	323	65	521	142
NDMC Market	1,171	234	2006	478
SUVIDHA MARKET - 1	433	87	119	33
SUVIDHA MARKET - 2	-	-	98	22
Post Office	417	83	150	30
Dispensary	733	147	133	35
Zonal health center	66	13	-	-
NP Sr. Sec. School	-	-	1,498	381
Veg Market	117	23	-	-
Service apartment & Community	953	191	-	-

Local shopping Market	5,083	1017	-	-
NBCC Maintenance Office (Earlier Grih Kalyan Kendra)	-	-	126	25
Community Building	-	-	74	19
Rooms	408	82	-	-
Total	**59,621**	**19,863**	**55,293**	**18,696**

Note: The estimation of solid waste generation for Residential Zone & Other Zones are taken as 0.5 kg/person/day & 0.2 kg/person/day respectively

TABLE 2.10 SOLID WASTE GENERATION & MANAGEMENT

S.No	Description	Quantity (kg/day)		Method of Treatment / Disposal
		EC Obtained	EC Amendment Requested	
1	Bio degradable Waste	9,335	8,787	Organic Waste Converter (OWC)
2	Non Bio degradable Waste	10,528	9,909	Authorized Recyclers
3	STP Sludge	609	360	Used as Manure for landscape area

- The garbage will be collected and stored in garbage collection room and segregated as Biodegradable waste, Non-Biodegradable waste and Recyclable waste using different color coded bins
- Bio degradable waste will be treated by OWC and used as a manure for gardening area
- Recyclable wastes are inert waste which will be disposed through authorized recyclers.
- Dewatered STP sludge will be used as manure for gardening within the facility
- The total excavated earth material will be used for refilling in the low lying area.

2.9.2 Techniques for disposal of generated waste

Organic Waste Converter

The Mechanical Composter involves a biomechanical process which decomposes bacteria and produces odorless pre-organic compost in 15 minutes. The machine occupies small area and provides a cleaner and better environment.

Working Principle

Mechanical Composter converts the organic waste into odorless, pre-compost manure in 15-20 minutes. The organic waste, free from foreign particles is fed into MC. The shredder reduces the organic waste into the optimum particle size for composting. Then it is mixed with moisture absorbing materials and Useful micro-organisms. This mixture is then blended for a homogeneous mixture and is

converted into pre compost manure in 20 minutes. The pre compost manure is then fed into aerated compost blocks or 12 - 15 days.

The compost blocks or piles are specially designed for the pre-compost manure to have proper aeration and suitable environment to mature. The final manure will be rich in nutrients and used for the development of green belt.

Salient Features of Organic Waste Converter (OWC)

- Quick, easy to operate, less space requirement and odor free manure compared to other waste conversion process
- Immediate and hygienic disposal of food waste
- Waste minimization strategy followed by 3R Technique (Reduce, Reuse, Recycle)
- Savings on Purchase of Manure for landscape
- Savings on Waste Disposal Expenses
- Elimination on the usage of chemical fertilizers
- Carbon credit revenue in the future

Optimum Conditions for Composting

During Composting process, optimum conditions shall be maintained to achieve better compost value. The parameters mentioned below shall be maintained accordingly during operation.

TABLE 2.11 OPTIMUM CONDITIONS FOR COMPOSTING

S.No.	Parameters	Values
1.	C/N Ratio	30 : 1
2.	Particle Size	1/8 to 2 inches
3.	Oxygen	15 % - 20 %
4.	Temperature	55 - 65.5 ^{0} C
5.	Moisture	40 % - 60 %
6.	pH	6.5 - 7.5

TABLE 2.12 CHARACTERISTICS OF FINAL COMPOST

S.No	Parameters	Concentrations (% except pH)
1.	Total Nitrogen	1.3
2.	Total Phosphorus	0.2 - 0.5
3.	Total Potassium	0.5

4.	Organic Phosphorus	0.054
5.	pH	8.6
6.	Moisture	45 - 50
7.	Organic matter	30 - 70

2.10 POWER DETAILS

Power will be availed from New Delhi Municipal Council (NDMC). Total Electric load for the proposed project is 37,940 KW. Power back up details is given below for office/flats and common services such as HVAC, STP, staircase lightings & Emergency services lightings etc. The required diesel will be purchased from nearby petrol bunk. 30KL HSD Yard consisting of HSD tanks, pumps, piping etc. shall also be provided as day storage tank. Details of the D.G Set details are shown in Table 2.13.

TABLE 2.13a DG SET DETAILS - EC OBTAINED

S.No	Description	Details			
		Residential	Office		
1	Number of DG set and its Capacity	13 x 500 KVA	15 x 1500 KVA	1 x 750 KVA	1 x 500 KVA
2	Type of Fuel	High Speed Diesel			
3	Material of the Stack	Mild Steel			
4	Diameter of the stack	0.15 m			
5	Height of the stack*	33 m from GL (each)			

TABLE 2.13b DG SET DETAILS - EC AMENDMENT REQUESTED

S.No	Description	Details		
		Residential	Social Infrastructure	Office
1	Number of DG set and its Capacity	2 x 600, 7 x 500, 3 x 400, 1 x 320, 2 x 250 KVA	2 x 500, 1 x 400, 1 x 125, 1 x 100, 1 x 75, 1 X 25 KVA	10 x 2250 kVA and sartac office 1x 600 kVA, 1x500 kVA
2	Type of Fuel	High Speed Diesel		
3	Material of the Stack	Mild Steel		
4	Diameter of the stack	0.15 m		
5	Height of the stack*	36.2 m from GL (each)		

** As per CPCB Norms*

2.11 PARKING DETAILS

The parking space criteria and area requirement provided are summarized in the Table 2.14. Parking details for Commercial and Social infrastructure are designed as per Model Building Bye-Laws, 2016, TCPO (Town and Country Planning Organisation) Norms. The parking details for residential are designed as per GPRA Norms issued vide minutes of meeting F. No. O-17034 dated 08.11.2018.

TABLE 2.14 PARKING AREA DETAILS EC OBTAINED

DESCRIPTION	FAR AREA In sq.m	REQUIRED PARKING in ECS
PARKING REQUIREMENT FOR HOUSING		
Proposed FAR for Housing Excluding EWS	5,34,227.6	-
Parking Requirement for Housing @ 2ECS/100sq.m. of FAR Area	-	10,685
PARKING REQUIREMENT FOR COMMERCIAL		
Proposed FAR for Shopping	12,398.95	-
Parking Requirement for Shopping @ 2ECS/100sq.m. of FAR Area	-	372
PARKING REQUIREMENT FOR SOCIAL INFRASTRUCTURE		
Proposed FAR for Facilities	57,959.16	-
Parking Requirement for Facilities @ 2ECS/100sq.m. of FAR Area	-	1159
PARKING REQUIREMENT FOR OFFICE		
Proposed FAR for Office	2,06,295.38	-
Parking Requirement for Office @ 2ECS/100sq.m. of FAR Area	-	3,713
TOTAL AREA REQUIRED	**-**	**15,929**

TABLE 2.15 BASEMENT PARKING AREA DETAILS EC OBTAINED

PROPOSED PARKING STATEMENT	
DESCRIPTION	**PARKING PROPOSED (IN ECS)**
1st Basement	8,899
2nd Basement	7,810
3rd Basement	1,219
TOTAL PROPOSED PARKING	**17,928**

TABLE 2.15 PARKING AREA DETAILS EC REQUESTED

TABLE 2.15 PARKING AREA CALCULATION DETAILS AS PER NORMS

S.No.	Description	No of parking Spaces
1.	Parking Requirement for Residential Type II Type III Type IV Type V Type VI	 1 ECS/Unit 1 ECS/Unit 2 ECS/Unit 2 ECS/Unit 3 ECS/Unit
2.	Parking Requirement for Offices	1.8 ECS/100sq.m. of FAR Area
3.	Parking Requirement for Social Infrastructure	2 ECS/100sq.m. of FAR Area

TABLE 2.14 PARKING AREA DETAILS

DESCRIPTION	FAR AREA In sq.m	REQUIRED PARKING in ECS
PARKING REQUIREMENT FOR GPRA		
Parking Requirement for as per GPRA Norms	-	7099
PARKING REQUIREMENT FOR GPOA, SARTAC OFFICE & HOSTEL		
Proposed FAR for GPOA, SARTAC OFFICE & HOSTEL	189709.595	-
Parking Requirement @ 1.8ECS/100sq.m. of FAR Area	-	3415
PARKING REQUIREMENT FOR SOCIAL INFRASTRUCTURE		
Proposed FAR for Facilities	17351.311	-
Parking Requirement for Facilities @ 2ECS/100sq.m. of FAR Area	-	353
TOTAL AREA REQUIRED	**-**	**10867**

TABLE 2.15 BASEMENT & SURFACE PARKING AREA DETAILS

PROPOSED PARKING STATEMENT	
DESCRIPTION	**PARKING PROPOSED (IN ECS)**
Basement Parking	10866
GPOA - 3 basements, GPRA - 2 basements,	
TOTAL PROPOSED PARKING ON SURFACE	149
Total Proposed Parking	**11015**

3. DESCRIPTION OF THE ENVIRONMENT

3.1 INTRODUCTION

This chapter illustrates the description of the existing environmental status of the study area with reference to the prominent environmental attributes. The core area of the study covers 10-km radius around the project site.

The existing environmental setting is considered to adjudge the baseline environmental conditions, which are described with respect to climate, atmospheric conditions, water quality, soil quality, vegetation pattern, ecology, socio economic profile, land use and places of archaeological importance.

The baseline monitoring study has been carried out from April to June 2017 and secondary data collected from various Government, Semi- Government and Public sector organizations.

3.2 GEOLOGY AND HYDROGEOLOGY ASPECTS

3.2.1 Geomorphology and Soil Types

Geomorphology

The study area is under Older Alluvial Plain and Delhi ridge. This area has varied surface altitude due to Delhi Ridge. The ridge occupies the western border of the district. Nearly 10 sq. km area falling within the ridge area has an altitude ranging from 225 to 255 m AMSL. Eastern part of the district is under Older Alluvial Plain, with general elevation ranging from 209 to 219 m AMSL.

Soil Types

The study area has clay, silt and fine to medium sand. The soil is mostly calcareous in nature.

3.2.2 Hydrogeology

Water Bearing Formation

Hydrogeological map of the district is presented in Figure 3.1a. The sub-surface configuration of New Delhi district is different at various places. Subsurface disposition of aquifers is shown in Figure 3.1b. The western part adjoining to Delhi ridge is characterized by marginal alluvium where 0 to 30 m thick veneer of alluvium overlies weathered and fractured quartzite rocks (Delhi Ridge). The

alluvium consists of clay, silt and fine to medium sand. A substantial amount of Kankar is also admixed with the clayey-silt below 20m depth. This is the main aquifer material found in these areas. The top soil zone predominantly consists of silty-clay material followed by thin partings of clayey-silt, sandysilt and clay layers alternatively. Sandy-silt strata forms as favorable aquifer zone. In the western part of New Delhi district, covering areas of Rashtrapati Bhavan, Chanakyapuri, Shantipath, South and North Avenue and Connaught Place tube wells are tapping both alluvium as well as hard rock whereas in the eastern part, tube wells generally tap alluvium. The tube wells usually tap kankar zone admixed with clayey-silt and sandy-silt aquifer zone. The yield of the tube wells in the district ranges from 55 to 435 LPM. The depth of bedrock ranges from 5 to 91 m in the district.

Depth of water level

Ground water in the area occurs both under water table as well as under semi-confined conditions. The depth of water level during pre-monsoon in the district varies from 6.44 to 24.05 m bgl and during post monsoon period, it varies from 6.11 to 25.05 m bgl (Figure 3.1c & d). There is a wide variation in water level due to wide range of topographic relief. In the Yamuna flood plain area, depth to water level ranges from 5 to 8 m bgl whereas in the Delhi ridge area, it varies from 10 to 25 m bgl.

Seasonal Water level fluctuation

Seasonal water level fluctuation has been computed from the water level data obtained from the ground water observation wells monitored in the area during pre-monsoon and post-monsoon period. Fluctuation in water level is the outcome of mainly the amount of rainfall received by the area and ground water withdrawal. The seasonal fluctuation in water level between pre and post monsoon shows rise in water level ranging from 0.22 to 1.22 m and fall ranging from 0.15 to 1.80 m.

Long Term Water level trend

The long-term water level trend analysis in the district over the last 10 years period shows i) a fall of 0.04 to 2.58 m during the pre-monsoon period and ii) a fall of 0.03 to 3.11 m during the post-monsoon period.

FIGURE 3.1a HYDROGEOLOGICAL MAP OF NEW DELHI

FIGURE 3.1b HYDROGEOLOGICAL MAP OF NEW DELHI (LEGEND)

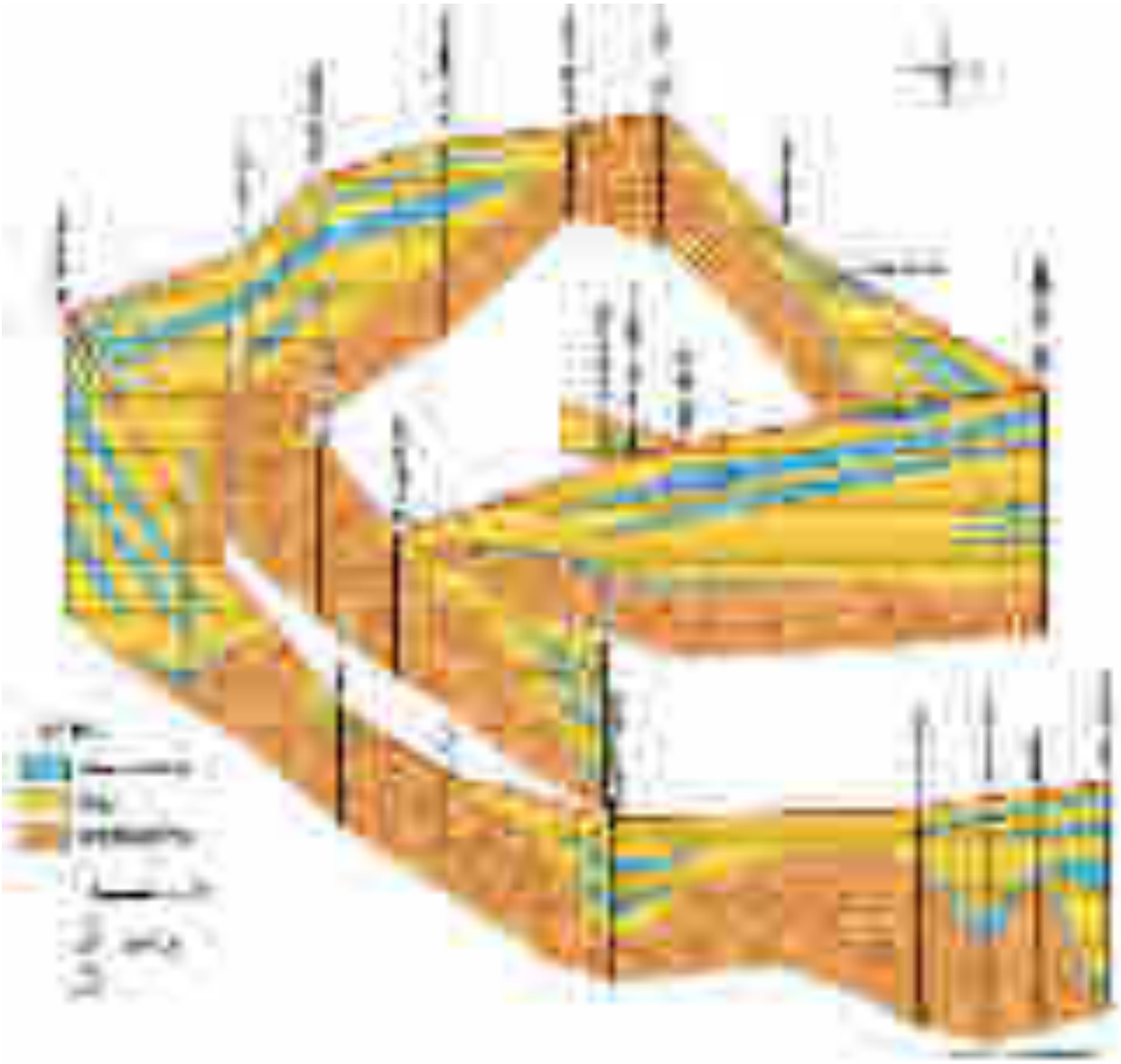


FIGURE 3.1c GEOLOGICAL CROSS SECTION AND AQUIFER GEOMETRY OF NEW DELHI

FIGURE 3.1d DEPTH OF WATER LEVEL MAP DURING PREMONSOON

FIGURE 3.1e DEPTH OF WATER LEVEL MAP DURING POSTMONSOON

3.3 METEOROLOGY

The meteorological data recorded during the study period is very useful for proper interpretation of the baseline information as well as for input to prediction models for air quality dispersion. Historical data on meteorological parameters will also play an important role in identifying general meteorological regime of the region.

On-site monitoring was undertaken for various meteorological variables in order to record the site-specific data. Data was recorded every hour continuously from 1st April 2017 to 30th June 2017. India Meteorological Department has been monitoring surface observations at Delhi. Temperature, relative humidity, rainfall, wind speed and direction are measured twice a day viz., at 08.30 and 17.30 hr. The wind speed and direction data of IMD, Delhi station has been obtained for the past available 10 years. The data for the remaining parameters has also been collected for the last 10 years and processed.

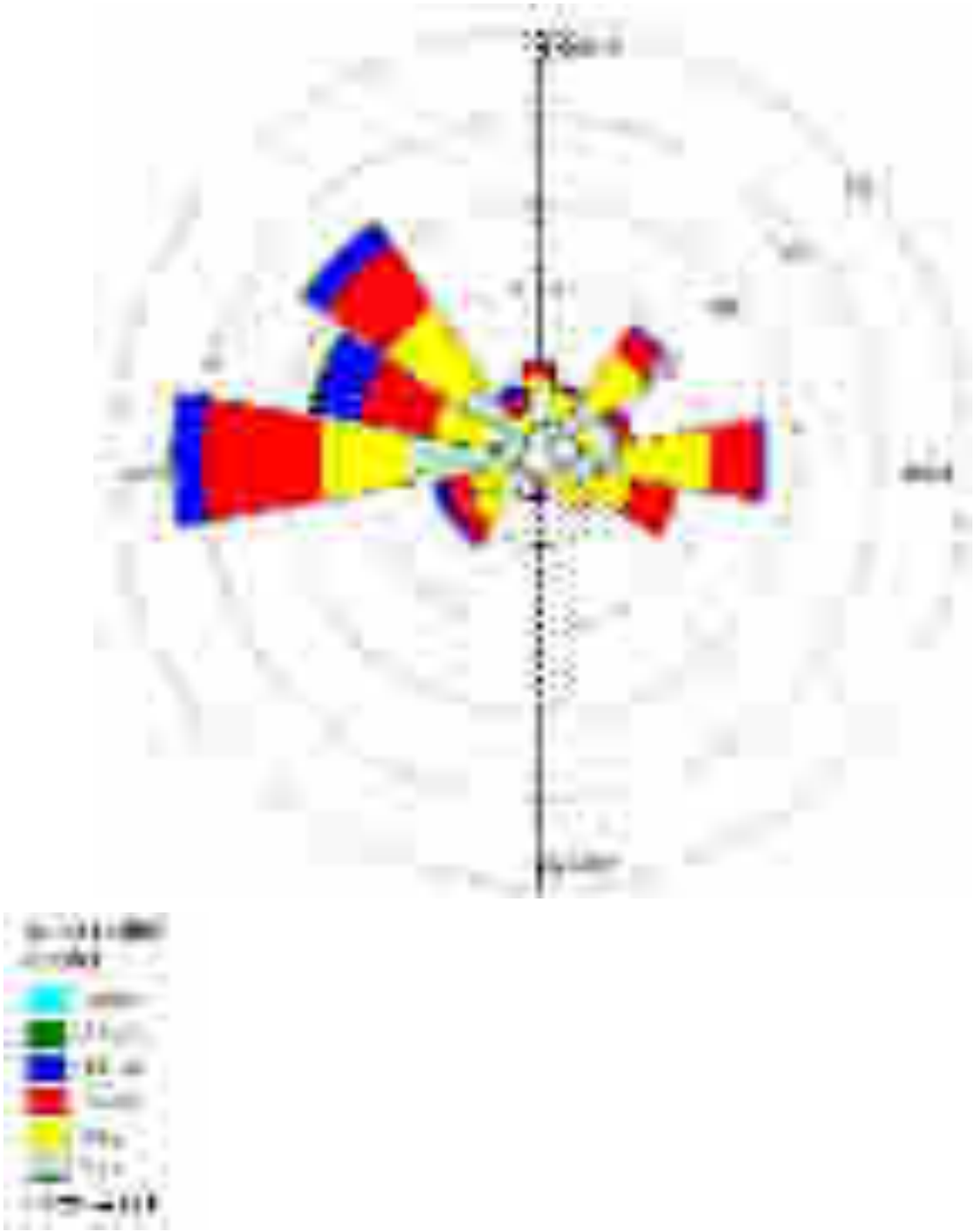
3.3.1 Meteorological Data Recorded at Site

The meteorological parameters were recorded at site on hourly basis during the study period and consists of parameters like wind speed, wind direction and temperature. The total rainfall was recorded daily once at 08.30 hrs. The maximum and minimum values for all the parameters except wind direction are presented in Table 3.1a.

TABLE 3.1a SITE SPECIFIC METEROLOGICAL DATA FROM APRIL - JUNE 2017

Month	Temperature (°C)		Relative Humidity (%)
	Maximum	Minimum	
April	38	23	31
May	40	26	38
June	37	27	54

Source: *IMD, New Delhi*



Source: *ABC Techno Labs India Private Limited*

FIGURE 3.2 - SITE SPECIFIC WIND ROSE DIAGRAM FOR APRIL 2017 TO JUNE 2017

TABLE 3.1b WIND FREQUENCY DISTRIBUTION

S. No	Directions / Wind Classes (Knots)	1-4	4-7	7-11	11-17	17-21	>=22	Total
1	348.75 - 11.25	51	13	10	3	0	0	77
2	11.25 - 33.75	35	19	3	3	0	0	60
3	33.75 - 56.25	56	44	22	4	0	0	126
4	56.25 - 78.75	32	27	13	2	0	0	74
5	78.75 - 101.25	63	68	39	5	0	0	175
6	101.25 - 123.75	41	32	36	0	0	0	109
7	123.75 - 146.25	20	28	3	0	0	0	51
8	146.25 - 168.75	13	10	0	0	0	0	23
9	168.75 - 191.25	4	13	9	4	0	0	30
10	191.25 - 213.75	12	2	2	0	0	0	16
11	213.75 - 236.25	37	25	15	5	0	0	82
12	236.25 - 258.75	25	30	19	8	1	2	85
13	258.75 - 281.25	100	68	90	22	0	2	282
14	281.25 - 303.75	40	44	58	34	3	2	181
15	303.75 - 326.25	71	71	58	19	2	0	221
16	326.25 - 348.75	20	15	14	10	0	0	59
Sub-Total		620	509	391	119	6	6	1651
Calms								553
Missing/Incomplete								0
Total								**2184**

Source: *ABC Techno Labs India Private Limited*

3.3.2 Secondary Data from IMD

The nearby India Meteorological Department station that is generating meteorological data is 3.84 km from the project site i.e. IMD, Delhi. Hence, secondary information on meteorological conditions has been collected from IMD station at New Delhi.

TABLE 3.2a RAINFALL DATA FOR A PERIOD OF 5 YEARS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2012	13.8	1.5	6.3	12.8	2.5	133	105.7	348.9	44.8	7.0	1.1	2.6
2013	33.2	102.1	10.9	10.5	0.3	99.8	342.2	301.0	104.4	69.1	0.5	5.7
2014	11.5	48.8	35.8	9.9	52.9	43.6	108.6	138.9	84.9	1.4	0.0	12.3
2015	25.7	2.2	103.0	32.6	4.7	67.2	242.1	181.7	22.3	0.1	1.2	0.0
2016	0.0	1.3	29.8	0.0	18.3	27.8	291.5	145.7	71.1	1.5	0.0	0.0

Source: *IMD, New Delhi*

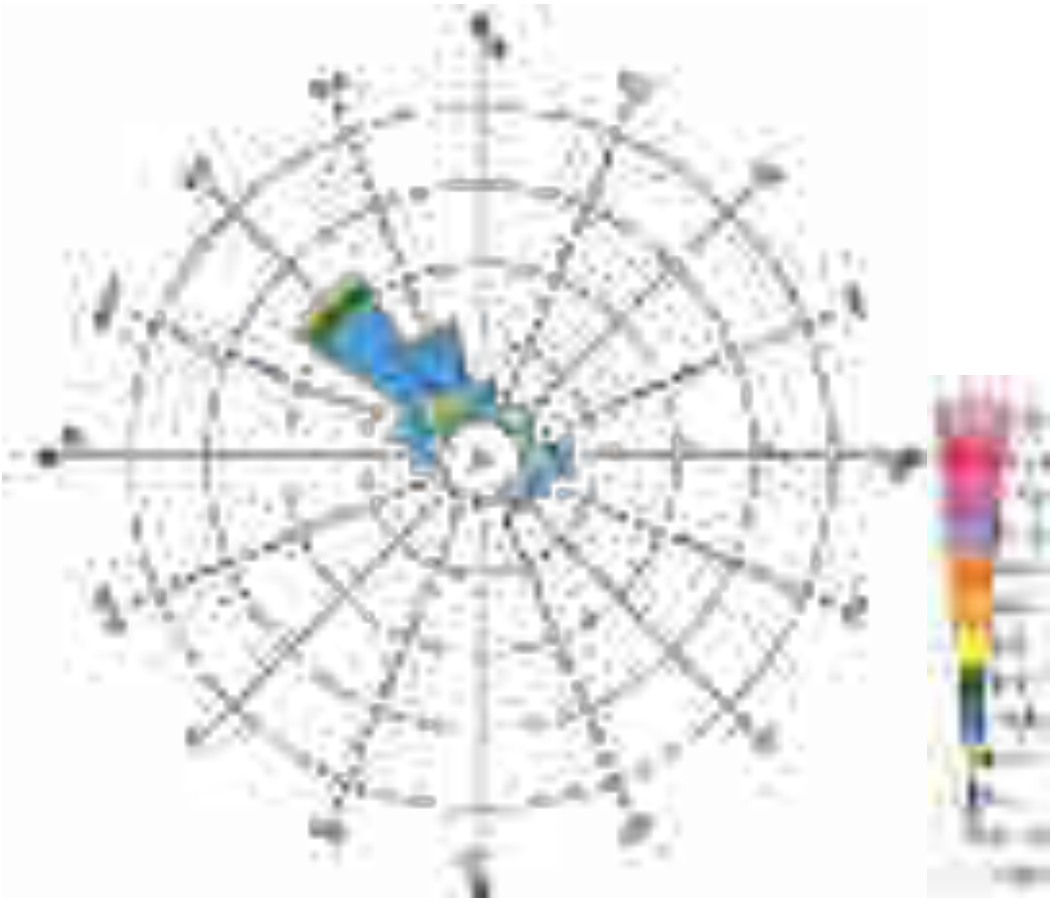


FIGURE 3.3 ANNUAL WIND ROSE DIAGRAM - IMD DELHI (1971 - 2000)

Source: *IMD*

TABLE 3.2 b WIND FREQUENCY DISTRIBUTION

Source: *IMD*

TABLE 3.2c CLIMATOLOGICAL DATA STATION FOR THE YEAR 2016 IMD, DELHI

Month	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)
	Max	Min	Max	Min	Mean
January	21	9	98	49	0.0
February	26	11	94	32	1.3
March	31	17	88	29	29.8
April	38	23	56	13	0.0
May	40	26	64	22	18.3
June	39	28	79	33	27.8
July	34	27	91	60	291.5
August	34	26	90	55	145.7
September	35	26	84	43	71.1
October	34	20	85	34	1.5
November	29	13	89	25	0.0
December	24	9	97	39	0.0

3.3.3 Observation of secondary data

3.3.3.1 Rainfall

The average annual rainfall of the district is 712 millimetres. About 81% of the annual rainfall is received during the monsoon months of July, August and September. The rest of the rainfall is received as winter rain and as thunderstorm rain in the pre and post monsoon months. The variation of rainfall from year to year is large. On an average rain of 2.5 mm or more falls on 27 days in a year, of which, 19 days are during the monsoon months. Two to three days in June are rainy. In other months, except in November and in first half of December when it is practically rainless, rain falls on a day or two only in each month.

3.3.3.2 Climate

The climate of district is mainly influenced by its inland position and prevalence of air of the continental type during major part of the year. Extreme dryness with intensely hot summer and cold winter are characteristics of the climate. The cold season starts towards the latter half of November when both day and night temperatures drop rapidly with the advance of the season. January is the coldest month with the mean daily maximum temperature at 21.3°C and the mean daily minimum temperature at 7.3°C. May and June are the hottest months. In May and June, maximum temperature may sometimes reach 46 °C or 47°C.

3.4 AIR QUALITY

3.4.1 Methodology Adopted for Air Quality Survey

3.4.1.1 Selection of Sampling Locations

The baseline status of the ambient air quality has been assessed through a scientifically designed ambient air quality monitoring network. The design of monitoring network in the air quality surveillance program has been based on the following considerations:

Meteorological conditions on synoptic basis;

- Topography of the study area;
- Representatives of regional background air quality for obtaining baseline status;
- Representatives of likely impact areas.

Ambient Air Quality Monitoring (AAQM) stations were set up at six locations with due consideration to the above mentioned points. Table 3.3 gives the details of environmental setting around each monitoring station. The location of the selected stations with reference to the plant boundary is given in the same table and shown in Figure 3.4.

TABLE 3.3 DETAILS OF AMBIENT AIR QUALITY MONITORING LOCATIONS

S.No	Place	Geographical Location	Direction w.r.t the project site	Distance from the project site	Environmental Settings
1.	Project Site	28°34'29.11" N 77°11'08.36" E	-	-	Empty Land
2.	R. K Puram	28°33'50.70" N 77°10'38.60" E	SW	1.1	Residential
3.	Safdarjung Enclave	28°33'50.09" N 77°11'30.09" E	NE	0.75	Residential
4.	Near Sarojini Market	28°34'31.06" N 77°12'00.81" E	E	1.07	Residential
5.	Chanakyapuri	28°35'28.41" N 77°11'25.39" E	N	1.33	Residential
6.	Arjun Vihar	28°35'28.41" N 77°09'18.97" E	NW	3.18	Residential

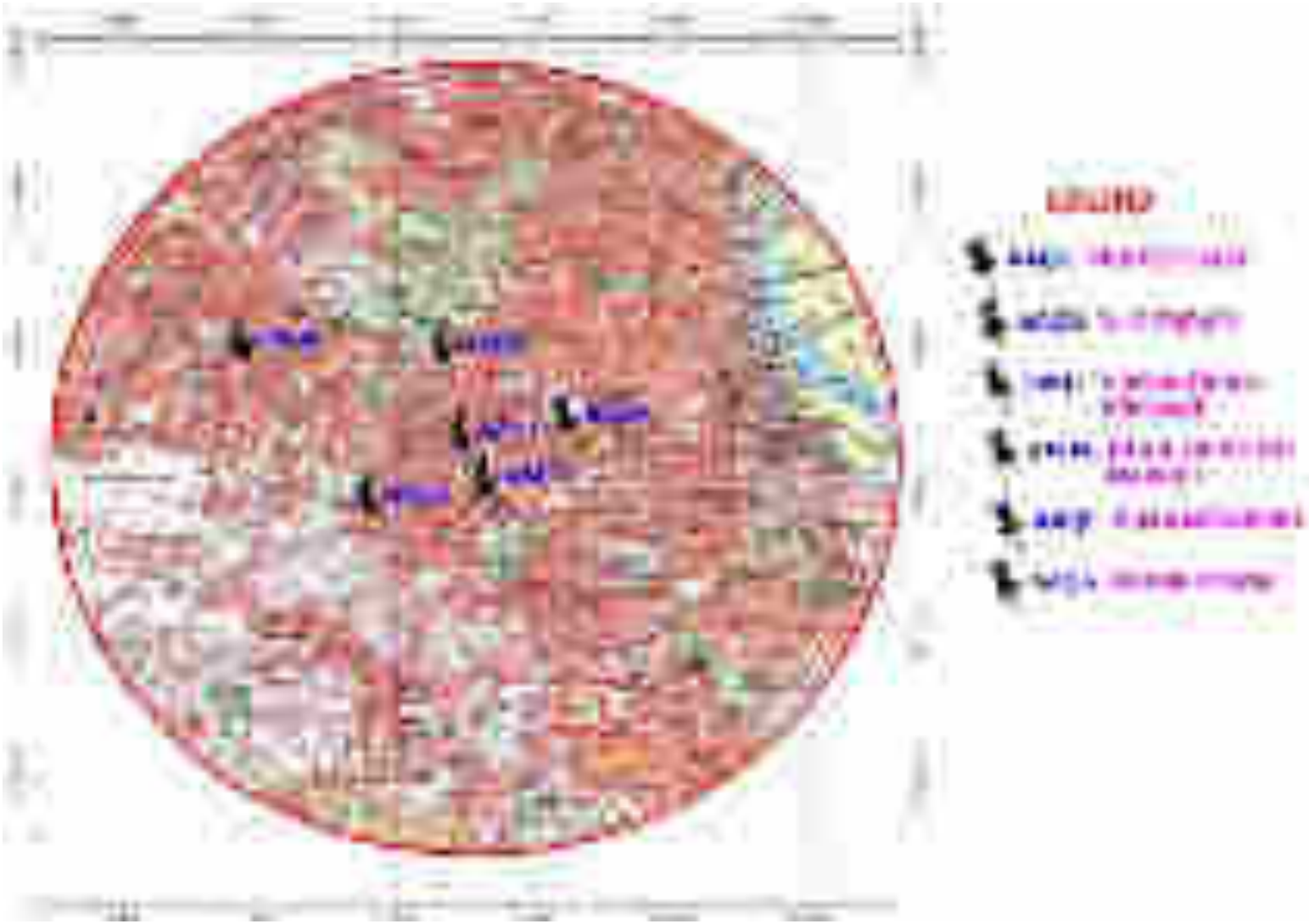


FIGURE 3.4 AMBIENT AIR QUALITY SAMPLING LOCATION

3.4.1.2 Frequency and Parameters for Sampling

Ambient air quality monitoring was carried out at each location. Respirable particulate matter (PM_{10} and $PM_{2.5}$), Sulphur dioxide (SO_2), Oxides of Nitrogen (Nox), Carbon Monoxide and Lead associated with project. All parameters are sampled twenty-four hour continuously twice a week for three months. This is to allow a comparison with the present revised standards mentioned in the latest Gazette Notification of the Central Pollution Control Board (CPCB) (November 18, 2009).

3.4.1.3 Method of Analysis

The air samples were analyzed as per standard methods specified by Central Pollution Control Board (CPCB), IS: 5184 and American Public Health Association (APHA).

3.4.2 Instruments used for Sampling

Respirable Dust Samplers APM-460 BL of Envirotech were used for monitoring Particulate matter (PM_{10}), other pollutants like SO_2, NOx, and Gas Analyzer for Carbon Monoxide and Lead. Fine Particulate Samplers APM 550 of Envirotech was used for monitoring $PM_{2.5}$.

3.4.3 Sampling and Analytical Techniques

The techniques for sampling and analysis of parameters are presented in the Table 3.4.

TABLE 3.4 TECHNIQUES USED FOR AMBIENT AIR QUALITY MONITORING

S. No	Parameters	Technique
1.	Particulate Matter (PM_{10}), $\mu g/m^3$	Gravimetric (High- Volume with Cyclone) IS: 5182(Part 23)2006 (RA 2012)
2.	Particulate Matter ($PM_{2.5}$), $\mu g/m^3$	Gravimetric (Fine particulate Sampler)
3.	Oxides of Sulphur (SO_2), $\mu g/m^3$	EPA Modified West & Gaeke method IS: 5182(Part 2)2001 (RA 2012)
4.	Oxides of Nitrogen (NO_x), $\mu g/m^3$	Arsenite Modified Jacob & Hochheiser IS: 5182(Part 6)-2006 (RA 2012)
5.	Carbon Monoxide, mg/m^3	Gas Analyser (NDIR)

3.4.4 Presentation of Primary Data

The summary of these results for each location is presented in Table 3.5. These are compared with the standards prescribed by Central Pollution Control Board (CPCB).

TABLE 3.5 SUMMARY OF AMBIENT AIR QUALITY RESULTS

Code	Location	$PM_{2.5}$, µg/m³				$PM_{,10}$ µg/m³				SO_2 , µg/m³				NO_X, µg/m³				CO, mg/m³			
		Min	Max	Avg	98 Per	Min	Max	Avg	98 Per	Min	Max	Avg	98 Per	Min	Max	Avg	98 Per	Min	Max	Avg	98 Per
AAQ1	Project Site	53	88	68.5	85.1	155	256	198	252.6	24	43	33.2	41.8	24	43	35.1	41.6	0.45	0.81	0.63	0.78
AAQ2	R.K Puram	55	93	75.5	91.6	152	237	192	233.1	35	67	50.6	65.4	28	46	36.7	44.7	0.47	0.94	0.71	0.91
AAQ3	Safdarjung Enclave	42	76	56.6	72.4	125	218	171	214.2	27	51	39.6	49.2	18	29.3	23.5	28.1	0.28	0.67	0.45	0.64
AAQ4	Near Sarojini Nagar Market	66	107	83.8	104.6	200	292	241	287.5	43	66	54.1	64.3	23.9	48.2	35.7	46.9	0.44	1.07	0.75	0.96
AAQ5	Chanagyapuri	52	97	73.6	95.4	169	290	232	283.2	32	58	44.1	56.4	20.6	33.6	26.5	31.7	0.51	0.88	0.66	0.81
AAQ6	Arjun Vihar	55	96	74.1	94.7	140	266	192	260.5	28.2	47.1	39.1	45.8	26.6	37.8	31.1	36.5	0.41	0.86	0.62	0.84
CPCB / MoEF Standards																					
Industrial /Residential / Rural and Other Area		60				100				80				80				2			

3.4.4.1 Observations of Primary Data

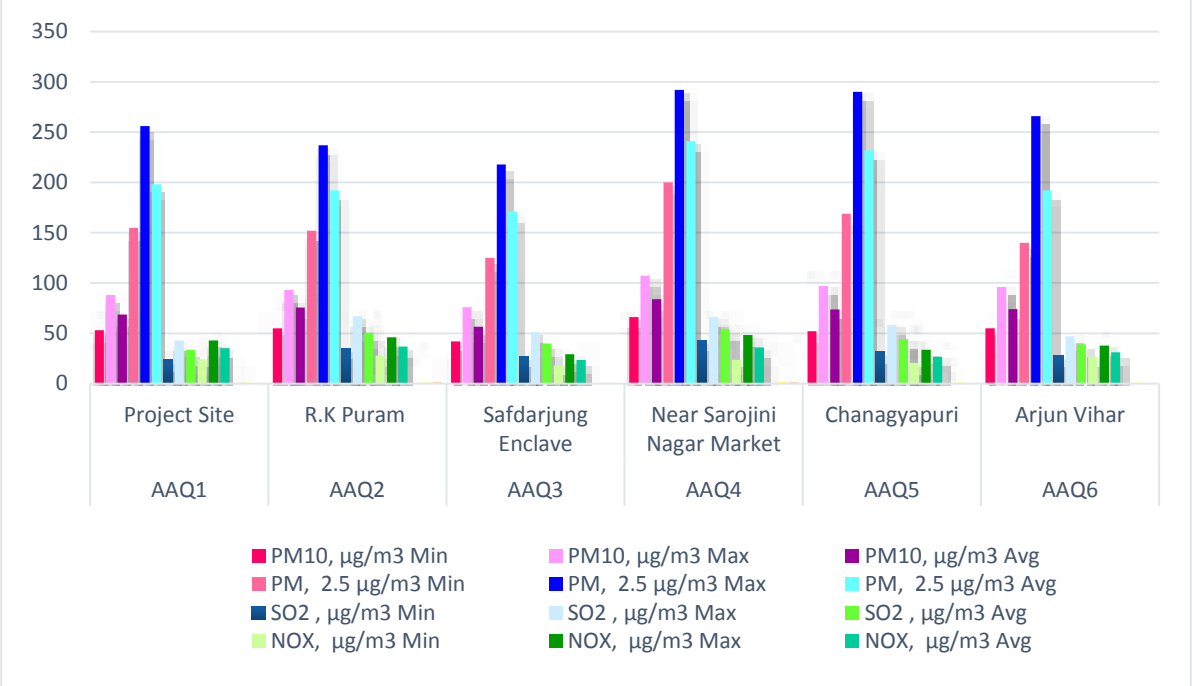
$PM_{2.5}$: The maximum and minimum concentrations for $PM_{2.5}$ were recorded as 107 µg/m³ and 42 µg/m³ respectively. The maximum concentration was recorded Near Sarojini Nagar Market (AAQ4) and the minimum concentration was recorded at Safdarjung Enclave (AAQ3). The average concentrations were ranged between 56.6 and 83.8 µg/m³.

PM_{10}: The maximum and minimum concentrations for PM_{10} were recorded as 292 µg/m³ and 125 µg/m³ respectively. The maximum concentration was recorded Near Sarojini Nagar Market (AAQ4) and the minimum concentration was recorded at Safdarjung Enclave (AAQ3). The average concentrations were ranged between 171 and 241 µg/m³.

SO_2: The maximum and minimum concentrations for SO_2 were recorded as 67 µg/m³ and 24 µg/m³ respectively. The maximum concentration was recorded at R.K. Puram (AAQ2) and the minimum concentration was recorded at Project site (AAQ1). The average concentrations were ranged between 33.2 and 54.1 µg/m³.

NO_2: The maximum and minimum concentrations for NO_2 were recorded as 48.2 µg/m³ and 18 µg/m³. Maximum concentration was recorded Near Sarojini Nagar Market (AAQ4) and the minimum concentration was recorded at Safdarjung Enclave (AAQ3). The average concentrations were ranged between 23.5 and 36.7 µg/m³.

CO: The maximum and minimum concentrations for CO were recorded as 1.07 µg/m³ and 0.28 µg/m³. Maximum concentration was recorded Near Sarojini Nagar Market (AAQ4) and the minimum concentration was recorded at Safdarjung Enclave (AAQ3). The average concentrations were ranged between 0.45 and 0.75 µg/m³.



3.5 WATER QUALITY

Selected water quality parameters of ground water resources and surface water resources within 10-km radius of the study area has been studied for assessing the water environment and to evaluate anticipated impact of the project. The purpose of this study is to: Assess the water quality characteristics for critical parameters;

- Evaluate the impacts on agricultural productivity, habitat conditions, recreational resources and aesthetics in the vicinity; and
- Predict impact on water quality by this project and related activities.

The information required has been collected through primary surveys and secondary sources.

3.5.1 Methodology

Reconnaissance survey was undertaken and monitoring locations were finalized based on:

- Drainage pattern;
- Location of residential areas representing different activities/likely impact areas; and

- Likely areas, which can represent baseline conditions.

Six (6) ground water sources and One (1) surface water sources covering 10km radial distance were examined for physico-chemical, heavy metals and bacteriological parameters in order to assess the effect of industrial and other activities on ground water. The samples were analyzed as per the procedures specified in '*Standard Methods for the Examination of Water and Wastewater*' published by American Public Health Association (APHA).

Samples for chemical analysis were collected in polyethylene carboys. Samples collected for metal content were acidified with 1 ml HNO_3. Samples for bacteriological analysis were collected in sterilized glass bottles. Selected physico chemical and bacteriological parameters have been analyzed for projecting the existing water quality status in the study area. Parameters like pH and temperature were analyzed at the time of sample collection.

3.5.2 Water Sampling Locations

Six (6) ground water samples and one (1) surface water samples were collected. These samples were taken as grab samples and were analyzed for various parameters to compare with the standards for drinking water as per IS:10500 for ground water sources. The water sampling locations in the study area are identified and given in Table 3.6 and shown in Figure 3.5.

TABLE 3.6 DETAILS OF WATER SAMPLING LOCATIONS

Code	Location	Geographical Location	Direction w.r.t site	Distance w.r.t site
Ground water				
GW 1	Project Site	28°34'17.69"N 77°11'08.58"E	-	-
GW 2	R.K. Puram	28°33'54.12"N 77°10'34.48"E	SW	1.10
GW 3	Safdarjung Enclave	28°33'46.67"N 77°11'28.70"E	SSE	0.85
GW 4	Near Sarojini Nagar Market	28°34'27.44"N 77°12'00.54"E	W	1.03
GW 5	Chanakyapuri	28°35'19.07"N 77°11'22.50"E	N	1.02
GW 6	Arjun Vihar	28°35'25.36"N 77° 9'9.37"E	NW	3.34
Surface water				
SW 1	Yamuna River	28°35'31.09"N 77°16'12.88"E	ENE	8.03

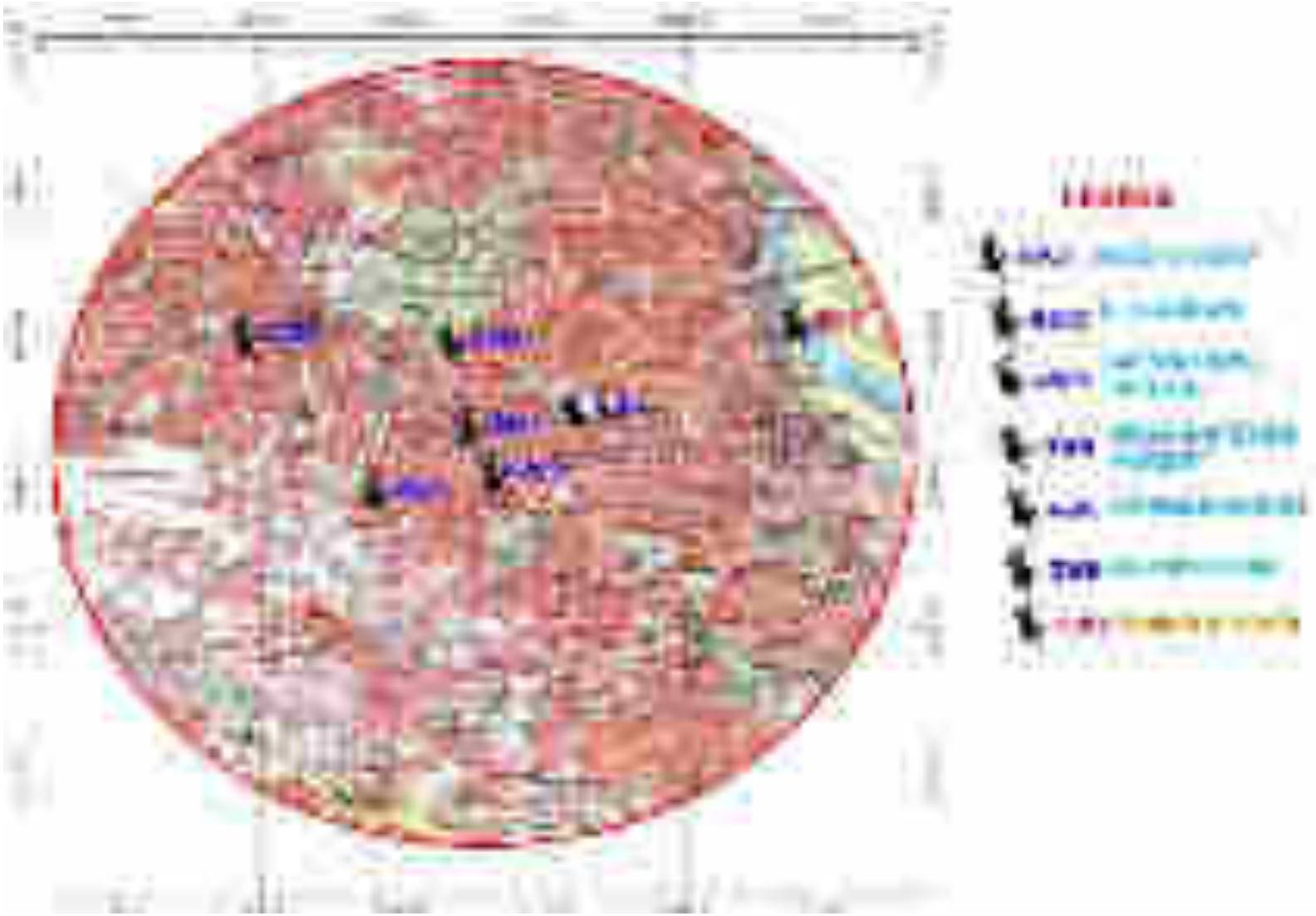


FIGURE 3.5 WATER SAMPLING LOCATION

3.5.3 Presentation of Results

The results of the ground and surface water quality monitored during the study period are given in Table 3.7a & Table 3.7b respectively.

TABLE 3.7 a DETAILS OF GROUND WATER RESULTS

S. No	Parameters	Unit	Test Method	Limit as per IS 10500 : 2012	GW1	GW2	GW3	GW4	GW5	GW6
1	Colour		APHA 22nd Edition	5	Nil	1	3	1	Nil	1
2	Odour	-	APHA 22nd Edition	Unobjectionable	No Odour Observed	No Odour Observed	No Odour Observed	No Odour Observed	No Odour Observed	No Odour Observed
3	pH at 25°C	-	IS : 3025 Part 11- 1983 (Reaff: 2002)	6.5-8.5	7.87	6.93	7.40	7.47	7.54	7.68
4	Electrical Conductivity	µS/cm	IS : 3025 Part 14- 1984 (Reaff: 2002)	Not Specified	1194	2560	3980	6310	3120	2820
5	Turbidity	NTU	IS : 3025 Part 10-1984 (Reaff: 2002)	1	0.8	0.5	1.3	0.6	1.1	1
6	Total Dissolved Solids	mg/l	IS : 3025 Part 16-1984 (Reaff: 2003)	500	702	1438	2266	3501	1660	1895
7	Total Hardness as CaCO3	mg/l	IS : 3025 Part 21-1983 (Reaff: 1998)	200	460	810	458	956	657	770
8	Total Alkalinity as CaCO3	mg/l	IS : 3025 Part 23- 1986(Reaff:2003)	200	266	370	540	220	480	200
9	Chloride as Cl	mg/l	IS : 3025 Part 32-1988 (Reaff: 2003)	250	163	496	813	1715	403	694
10	Sulphate as SO_4	mg/l	APHA 22nd EDI-4500- SO_4^{2-} E	200	124	133	233	271	242	160
11	Fluoride as F	mg/l	APHA 22nd EDI-4500-F B&D	1.0	0.67	1.33	1.48	0.54	1.67	0.94
12	Nitrate as NO_3	mg/l	APHA 22nd EDI-4500- NO_3^- B	45	5.97	71	1.7	84	91	17
13	Ammonia as N	mg/l	APHA 22nd EDI-4500- NH_3 B&C	0.5	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)
14	Sodium as Na	mg/l	IS : 3025 Part 45-1993 (Reaff:2003)	Not Specified	720	210	710	920	270	260
15	Potassium as K	mg/l	IS : 3025 Part 45-1993 (Reaff:2003)	Not Specified	28	5.2	8.2	52	64	2.8
16	Calcium as Ca	mg/l	IS : 3025 Part 40-1991 (Reaff:2003)	75	160	192	80	208	174	208
17	Magnesium as Mg	mg/l	APHA 22nd EDITION	30	44	80	63	106	54	60
18	Iron as Fe	mg/l	IS : 3025 Part 53-2003	1	0.16	BDL(<0.05)	0.12	0.21	0.12	0.21
19	Manganese as Mn	mg/l	APHA 22nd EDN -3500-Mn D	0.1	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)
20	Phenolic compounds as Phenol	mg/l	APHA 22nd EDN 5530 B,C,D	0.001	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)
21	Copper as Cu	mg/l	IS:3025 Part 42 (Reaff:2003)	0.05	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)
22	Mercury as Hg	mg/l	APHA 22nd EDN -3112B	0.001	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)

23	Cadmium as Cd	mg/l	APHA 22nd EDN -3113 B	0.003	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)
24	Selenium as Se	mg/l	APHA 22nd EDN -3113B	0.01	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
25	Total Arsenic as As	mg/l	APHA 22nd EDN -3113 B	0.01	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
26	Cyanide as CN	mg/l	APHA 22nd EDN -4500-CN E	0.05	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)
27	Lead as Pd	mg/l	APHA 22nd EDN -3113 B	0.01	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.05)	BDL(<0.01)	BDL(<0.01)
28	Zinc as Zn	mg/l	APHA 22nd EDN -3111 B	5	0.22	0.23	0.37	0.18	0.17	0.25
29	Total Chromium as Cr	mg/l	APHA 22nd EDN -3113 B	0.05	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)
30	Nickel	mg/l	APHA 22nd EDN -3113 B	0.02	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)
31	Aluminium as Al	mg/l	APHA 22nd EDN -3500-Al-B 2012	0.03	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)

TABLE 3.7 b DETAILS OF SURFACE WATER RESULTS

S.No	Parameters	Unit	Test method	SW1
1	Colour	Hazen	APHA 22ND EDITION	8
2	Odour	-	APHA 22ND EDITION	No Odour Observed
3	Turbidity	NTU	IS : 3025 Part 10-1984 (Reaff: 2002)	5.6
4	pH at 25°C	-	IS : 3025 Part 11- 1983 (Reaff: 2002)	7.96
5	Electrical Conductivity,	µS/cm	IS : 3025 Part 14- 1984 (Reaff: 2002)	2140
6	Total Dissolved Solids	mg/l	IS : 3025 Part 16-1984 (Reaff: 2003)	1281
7	Total Hardness as $CaCO_3$	mg/l	IS : 3025 Part 21-1983 (Reaff: 1998)	420
8	Total Alkalinity as $CaCO_3$	mg/l	IS : 3025 Part 23-1986(Reaff:2003)	480
9	Chloride as Cl	mg/l	IS : 3025 Part 32-1988 (Reaff: 2003)	377
10	Sulphate as SO_4	mg/l	APHA 22ND EDITION -4500-SO_4^{2-} E	168
11	Fluoride as F	mg/l	APHA 22ND EDITION -4500-F B&D	1.71
12	Nitrate as NO_3	mg/l	APHA 22ND EDITION -4500-NO_3^- B	3
13	Ammonia as NH_3	mg/l	APHA 22ND EDITION -4500-NH_3 B&C	1.05
14	Phosphate as PO_4	mg/l	IS : 3025 Part 31-1988 (Reaff:2002)	1.36
15	Sodium as Na	mg/l	IS : 3025 Part 45-1993 (Reaff:2003)	302
16	Potassium as K	mg/l	IS : 3025 Part 45-1993 (Reaff:2003)	12.8
17	Calcium as Ca	mg/l	IS : 3025 Part 40-1991 (Reaff:2003)	98
18	Magnesium as Mg	mg/l	APHA 22ND EDITION	42
19	Iron as Fe	mg/l	IS : 3025 Part 53-2003	0.78
20	Manganese as Mn	mg/l	APHA 22nd EDN -3500-Mn D	BDL(<0.02)
21	Phenolic compounds as Phenol	mg/l	APHA 22nd EDN 5530 B,C,D	BDL(<0.001)
22	Copper as Cu	mg/l	IS:3025 Part 42 (Reaff:2003)	BDL(<0.03)
23	Mercury as Hg	mg/l	APHA 22nd EDN -3112B	BDL(<0.001)
24	Cadmium as Cd	mg/l	APHA 22nd EDN -3113 B	BDL(<0.001)

25	Selenium as Se	mg/l	APHA 22nd EDN -3113B	BDL(<0.01)
26	Total Arsenic as As	mg/l	APHA 22nd EDN -3113 B	BDL(<0.01)
27	Cyanide as CN	mg/l	APHA 22nd EDN -4500-CN E	BDL(<0.05)
28	Lead as Pd	mg/l	APHA 22nd EDN -3113 B	0.07
29	Zinc as Zn	mg/l	APHA 22nd EDN -3111 B	0.58
30	Total Chromium as Cr	mg/l	APHA 22nd EDN -3113 B	BDL(<0.03)
31	Nickel	mg/l	APHA 22nd EDN -3113 B	BDL(<0.02)
32	Aluminium as Al	mg/l	APHA 22nd EDN -3500-Al-B 2012	BDL(<0.03)
33	Total Suspended Solids	mg/l	IS : 3025 Part 17-1984 (Reaff: 2002)	16
34	Anionic Surfactants as MBAS	mg/l	APHA 22ND EDITION	BDL(<0.025)
35	Dissolved Oxygen as O_2	mg/l	IS:3025:Part-38:1989 (Reaff:2003)	5.2
36	Chemical Oxygen Demand	mg/l	IS:3025:Part-58:2006	38
37	Bio-Chemical Oxygen Demandat 27°C for 3 days	mg/l	IS:3025:Part-44:1993 (Reaff:2003)	6.4
38	Total Coliforms	MPN/ 100ml	IS 1622 (1981) (Reaff – 2014)	>1600
39	E coli	MPN/ 100ml	IS 1622 (1981)(Reaff – 2014)	>1600

3.5.3.1 Water Quality

Ground water

The analysis results indicate that the pH ranges in between 6.93 to 7.87, which is well within the specified standard of 6.5 to 8.5. The maximum pH of 7.87 was observed at Project Site (GW1) and the minimum pH of 6.93 was observed at R.K. Puram (GW2). Total hardness was observed to be ranging from 458 to 956 mg/l. The maximum hardness (956 mg/l) was recorded Near Sarojini Nagar (GW4) and the minimum (320 mg/l) was recorded at Safdarjung Enclave (GW3).

Chlorides ranges between 163 and 1715 mg/l. Fluorides are ranging in between 0.67 to 1.67 mg/l. Nitrates were found to be in the range of from 1.7 mg/l to 91 mg/l. Bacteriological studies reveal that coliform bacteria is not present in the

samples. The heavy metal content is below detectable limits. The Total Dissolved Solids (TDS) concentrations were found to be ranging in between 702 to 3501 mg/l.

Surface water

The analysis results indicate that the pH is 8, which is well within the specified standard of 6.5 to 8.5. Total hardness was observed to be 420 mg/l.
Chlorides at this location is 377 mg/l. Fluorides is 1.71 mg/l. Nitrates were observed to be 3 mg/l. Bacteriological studies reveal that coliform bacteria are not present in the samples. The heavy metal content is below detectable limits. The Total Dissolved Solids (TDS) concentrations were found to be 1281 mg/l.

3.6 SOIL CHARACTERISTICS

It is essential to determine the potential of soil in the area and identify the current impacts of urbanization on soil quality and also predict impacts, which may arise due to the proposed project. Accordingly, a study of assessment of the baseline soil quality has been carried out.

3.6.1 Data Generation

For studying soil profile of the region, sampling locations were selected to assess the existing soil conditions in and around the project area representing various land use conditions. The physical, chemical and heavy metal concentrations were determined. The samples were collected by ramming a core-cutter into the soil upto a depth of 90 cm.

The present study of the soil profile establishes the baseline characteristics and this will help in future in identifying the incremental concentrations if any, due to the proposed redevelopment. The sampling locations have been identified with the following objectives:

- To determine the baseline soil characteristics of the study area;
- To determine the impact of redevelopment on soil characteristics; and
- To determine the impact on soils more importantly from agricultural productivity point of view.

Six locations within 10km radius of the site boundary were selected for soil sampling. At each location, soil samples were collected from three different depths viz. 30 cm, 60 cm and 90 cm below the surface and are homogenized. This is in line

with IS: 2720 and Methods of Soil Analysis, Part-1, 2nd edition, 1986 of (American Society for Agronomy and Soil Science Society of America). The homogenized samples were analyzed for physical and chemical characteristics. The soil samples were collected during 1stApril 2017 - 30th June 2017.

The samples have been analyzed as per the established scientific methods for physico-chemical parameters. The heavy metals have been analyzed by using Atomic Absorption Spectrophotometer and Inductive Coupled Plasma Analyzer. The details of the sampling locations are given in Table 3.8 and are shown in Figure 3.6.

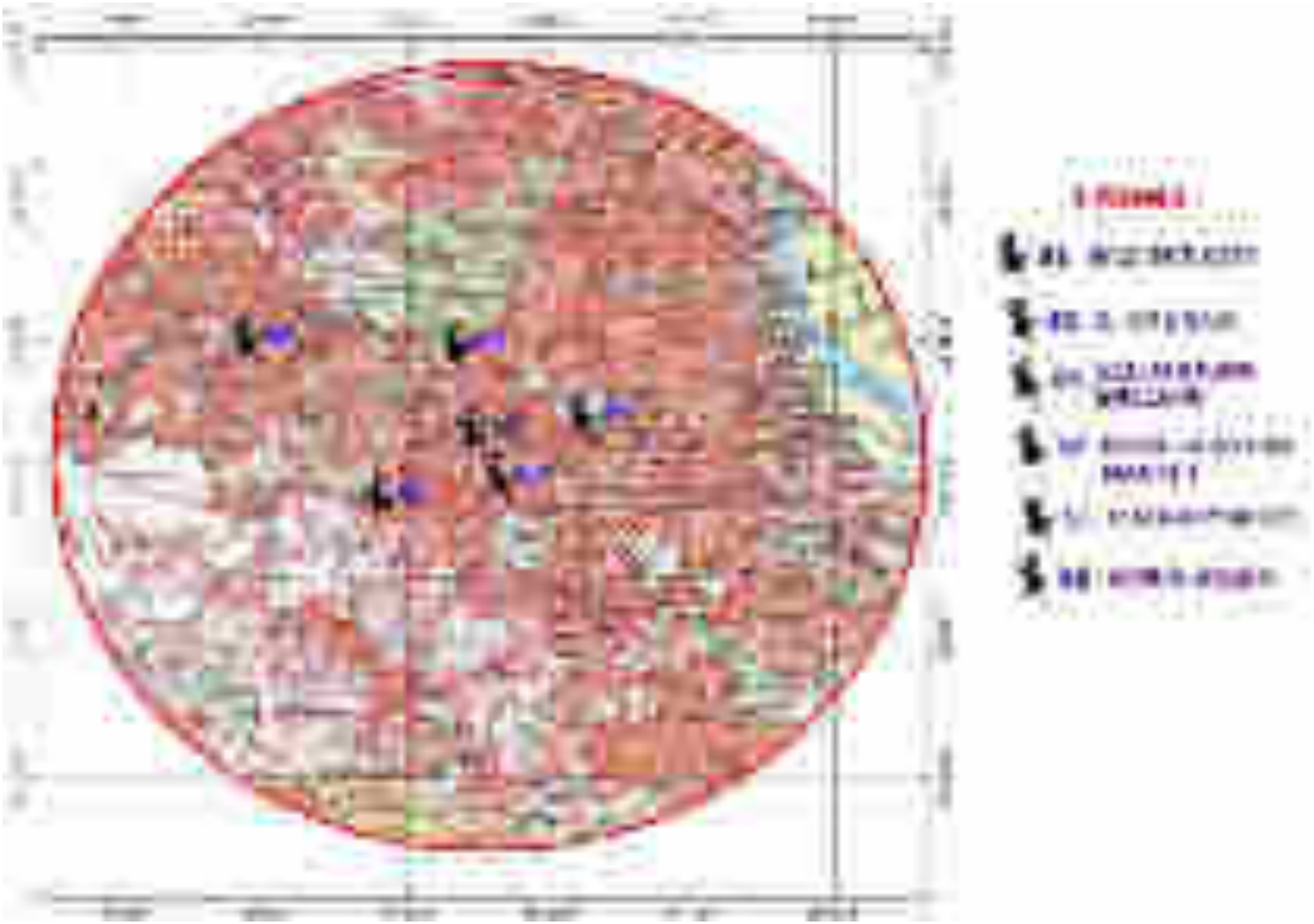


FIGURE 3.6 SOIL SAMPLING LOCATIONS

TABLE 3.8 DETAILS OF SOIL SAMPLING LOCATIONS

Code No	Location	Latitude and Longitude	Direction w.r.t site	Distance w.r.t site
S1	Project Site	28°34'29.11" N 77°11'08.36" E	-	-
S2	R.K. Puram	28°33'50.70" N 77°11'38.60" E	ENE	0.45
S3	Safdarjung Enclave	28°33'50.09" N 77°11'30.09" E	SSE	0.76
S4	Near Sarojini Nagar Market	28°34'31.06" N 77°12'00.81" E	ENE	1.06
S5	Chanakyapuri	28°35'33.23" N 77°11'25.39" E	N	1.47
S6	Arjun Vihar	28°35'28.41" N 77°09'18.97" E	NW	3.24

3.6.2 Baseline Soil Status

The soil quality at all the locations during the study period is tabulated in Table 3.9.

TABLE 3.9 SOIL ANALYSIS RESULTS

S. NO.	PARAMETERS	UNIT	RESULTS						TEST PROCEDURE
			S1	S2	S3	S4	S5	S6	
1	Moisture, %	%	4.77	5.96	3.85	6.11	5.24	3.88	IS 2720:Part 2
2	pH (1:5 Soil Suspension)	-	6.96	7.15	8.11	7.24	7.55	6.97	IS -2720(Part 26) 1987(RA 2011)
3	Electrical conductivity	mS/cm	0.115	0.247	0.096	0.136	0.242	0.077	IS -14767:2000 (RA 2010)
4	Bulk Density	g/cc	1.44	1.36	1.51	1.42	1.54	1.37	FAO Chapter 3, ABCTL/SOIL/SOP 1
5	Available Nitrogen,	kg/ha	325	415	296	354	371	335	IS -14684:1999, Reaff:2008
6	Available Phosphorous,	kg/ha	45.8	51.6	36.7	54.7	66.2	32.8	FAO Chapter 3, ABCTL/SOIL/SOP 2
7	Available Potassium,	kg/ha	412	375	425	384	326	374	FAO Chapter 3, ABCTL/SOIL/SOP 7
8	Chloride as Cl	mg/kg	97	113	174	136	95	171	EPA 9023
9	Exchangeable Sodium as Na,	m.eq/ 100g	0.77	1.12	0.47	0.54	1.17	0.48	FAO Chapter 3, ABCTL/SOIL/SOP 6
10	Cation Exchange Capacity,	Meq/ 100g	13.6	14.7	16.8	12.7	15.5	12.5	EPA 9081
11	Sodium Absorption Ratio (SAR),	-	0.68	0.96	0.82	0.74	0.54	0.69	IS 11624:1986 By Calculation
12	Lead as Pb	mg/Kg	BDL(<5)	BDL(<5)	BDL(<5)	BDL(<5)	BDL(<5)	BDL(<5)	EPA 3050 B
13	Chromium as Cr	mg/Kg	BDL(<5)	BDL(<5)	BDL(<5)	BDL(<5)	BDL(<5)	BDL(<5)	EPA 3050 B

14	Cadmium as Cd	mg/Kg	BDL(<5)	BDL(<5)	BDL(<5)	BDL(<5)	BDL(<5)	BDL(<5)	EPA 3050 B
15	Zinc as Zn	mg/Kg	31.8	17	14.8	19.2	25.7	23.6	EPA 3050 B
16	Copper as Cu	mg/Kg	7.11	6.39	5.84	5.04	8.11	7.25	EPA 3050 B
17	Nickel as Ni	mg/Kg	BDL(<5)	BDL(<5)	BDL(<5)	BDL(<5)	BDL(<5)	BDL(<5)	EPA 3050 B
18	Manganese as Mn	mg/Kg	8.8	10.7	13.4	11.4	15.2	13.6	EPA 3050 B
19	Iron as Fe	mg/Kg	114	96	187	144	135	118	EPA 3050 B
20	Organic Carbon	%	1.36	1.74	1.05	0.96	1.58	1.87	Walkey and Black Method
21	Texture Classification	-	Loam	Sandy Clay Loam	Sandy Clay Loam	Loam	Sandy Clay Loam	Loam	Robinson Pipette Method
	Sand	%	45	55.6	57.1	50	50.4	42	
	Clay	%	22.8	22.8	26.4	19.7	27.1	25.4	
	Silt	%	32.2	21.6	16.5	30.3	22.5	32.6	

It has been observed that the texture of soil is mostly 'Loam' and 'Sandy Clay Loam' in the study area. It has been observed that the pH of the soil quality ranged from 6.96 - 8.11, indicating that the soil is 'Strongly alkaline' in nature. The bulk density of soil ranges in between 1.36 to 1.54. The Electrical Conductivity of the soil was observed to be in the range of 0.077 - 0.247 mS/cm, with the maximum (0.247) observed in the R, K. Puram (S2) and with the minimum (0.077) observed in the Arjun Vihar (S6). Nitrogen percentage ranged between 296 - 412 kg/ha. Maximum of 412 mg/kg of nitrogen was observed in Project Site (S1) and minimum of 296 kg/ha was observed at the Safdarjung Enclave (S3). Phosphorus in the soil range between 32.8 - 66.2 kg/ha. Maximum of 66.2 kg/ha was observed in Chanakyapuri (S5) and minimum of 32.8 kg/ha was observed at Arjun Vihar (S6). Potassium in the soil range in between 326 - 425 kg/ha. Maximum was observed at Safdarjung Enclave (S3) and minimum was observed at the Chanakyapuri (S5).

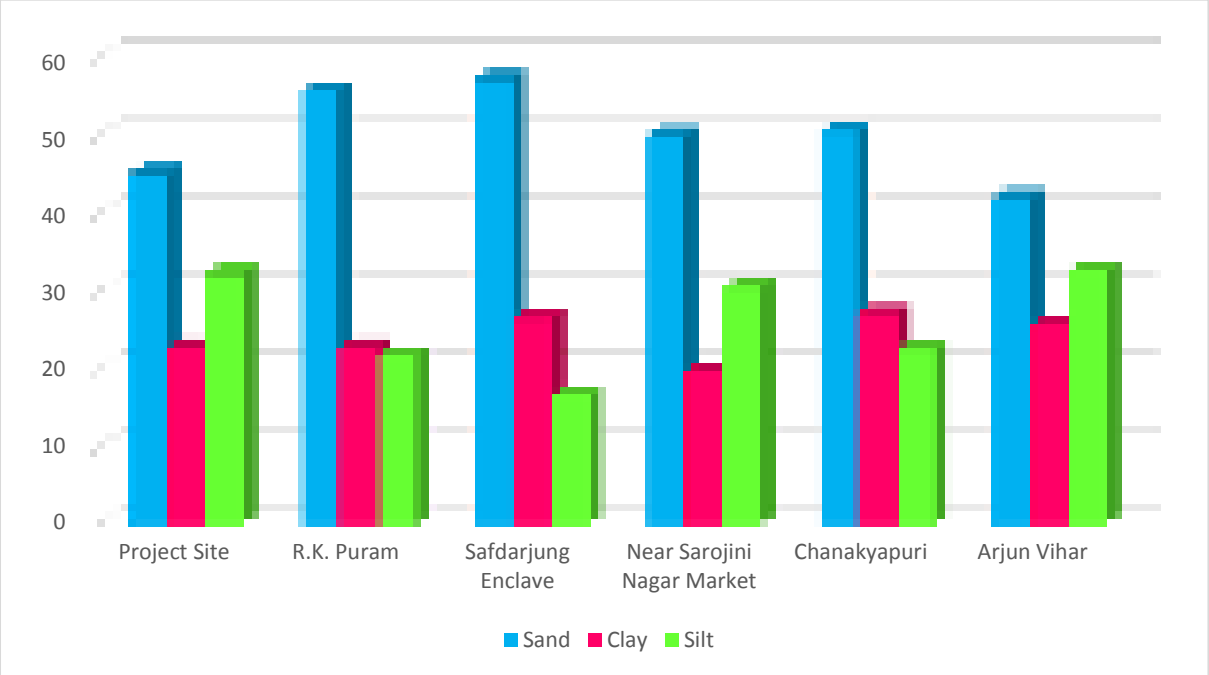


Figure 3.7 Texture Classifications of Soils

3.7 NOISE LEVEL SURVEY

The main objective of noise monitoring in the study area is to assess the baseline noise and assess the impact of the total noise expected to be generated by proposed redevelopment project. Noise levels were measured using a sound level meter. The sound level meter measures the equivalent continuous noise level (Leq) by switching on the corresponding function mode.

3.7.1 Identification of Sampling Locations

A preliminary reconnaissance survey has been undertaken to identify the major noise generating sources in the area. Noise at different noise generating sources has been identified based on the residential, industrial and commercial activities in the area. The noise monitoring locations are given in Table 3.10 and depicted in Figure 3.8.

TABLE 3.10 DETAILS OF NOISE SAMPLING LOCATIONS

Code No	Location	Latitude and Longitude	Direction w.r.t site	Distance w.r.t site
N1	Project Site	28°34'29.11"N 77°11'08.36"E	-	-
N2	R.K.Puram	28°33'50.70"N 77°10'38.60"E	SW	1.05
N3	Safdarjung Enclave	28°33'50.09"N 77°11'30.09"E	SE	0.75
N4	Near Sarojini Nagar Market	28°34'31.06"N 77°12'00.81"E	ENE	1.07
N5	Chanakyapuri	28°35'33.23"N 77°11'25.39"E	N	1.49
N6	Arjun Vihar	28°35'28.41"N 77° 9'18.97"E	NW	3.22

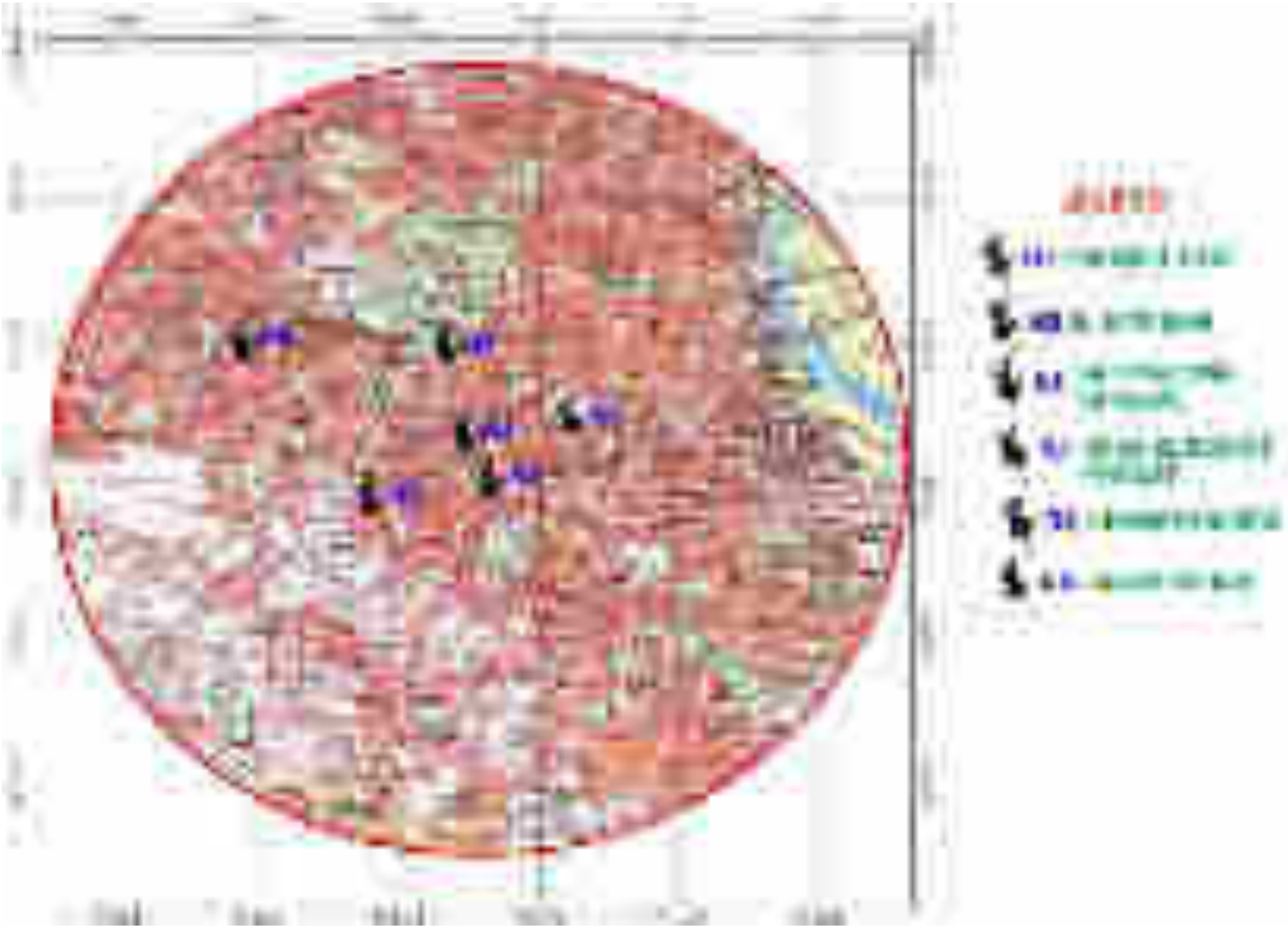


FIGURE 3.8 NOISE SAMPLING LOCATIONS

3.7.2 Methodology of Data Generation

Noise, in general, is sound which is composed of many frequency components of various types of loudness distributed over the audible frequency range. Various noise scales have been introduced to describe, in a single number, the response of an average human to a complex sound made up of various frequencies at different loudness levels. The most common and universally accepted scale is the 'A' weighted Scale which is measured as dB (A). This is more suitable for audible range of 20 to 20,000 Hz. The scale has been designed to weigh various components of noise according to the response of a human ear.

Sound Pressure Level (SPL) measurements were measured at all locations. The readings were taken for every hour for 24 hours. The day noise levels have been monitored during 6 am to 10 pm and night levels during 10 pm to 6 am at all the locations covered in 10-km radius of the study area. The noise levels were measured once during the study period. These readings were later tabulated and the frequency distribution table was prepared. Finally, hourly and 24 hourly values for various noise parameters viz. L day and L night were calculated.

For noise levels measured over a given period of time, it is possible to describe important features of noise using statistical quantities. This is calculated using the percent of the time certain noise levels exceed the time interval. The notations for the statistical quantities of noise levels are described below:

- L10 is the noise level exceeded 10 per cent of the time
- L50 is the noise level exceeded 50 per cent of the time and
- L90 is the noise level exceeded 90 per cent of the time

3.7.3 Equivalent Sound Pressure Level (Leq)

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

This is calculated from the following equation:

$$Leq = L50 + (L10 - L90)2/60$$

3.7.4 Parameters Measured During Monitoring

For noise levels measured over a given period of time interval, it is possible to describe important features of noise using statistical quantities. This is calculated using the percent of the time, certain noise levels are exceeded during the time interval. The notation for the statistical quantities of noise levels id described below:

- Leq day: Equivalent noise levels between 6.00 hours to 22.00 hours.
- Leq night Equivalent noise levels between 22.00 hours to 6.00 hours.

TABLE 3.11 NOISE LEVELS IN THE STUDY AREA

Code No	Location	Lday dB(A)	Lnight dB(A)	Leq dB(A)
N1	Project Site	56.8	49.5	55.4
N2	R.K.Puram	59.3	53.6	58
N3	Safdarjung Enclave	57.1	53.1	56.1
N4	Near Sarojini Nagar Market	58.2	52.7	57
N5	Chanakyapuri	56.9	50.2	55.5
N6	Arjun Vihar	58.8	53.96	57.6

TABLE 3.12 AMBIENT NOISE STANDARDS

Category of Area / Zone	Limits in dB (A) Leq	
	Day Time	Night Time
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Silence Zone	50	40

Source: CPCB

Note: *Daytime shall mean from 6.00 a.m. to 10.00 p.m.*

Night time shall mean from 10.00 p.m. to 6.00 a.m

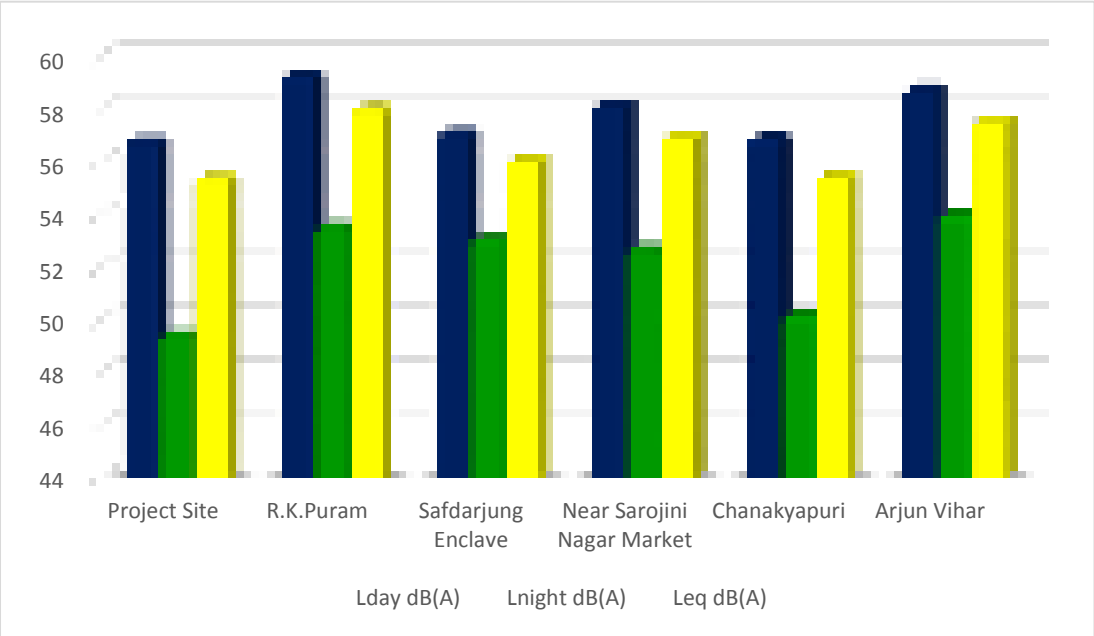


Figure 3.9 Results of Noise Levels

3.8 ECOLOGICAL SURVEY

The biological survey has been done to establish the baseline ecological conditions of the study area to assess the potential ecological impacts of the redevelopment project on ecology, to develop adequate and feasible mitigation measures to keep ecological impacts within acceptable limits and to prepare comprehensive management plan. The area did not record the presence of any critically threatened species. The records of Botanical Survey of India and Forest Department also did not indicate presence of any high endemic or vulnerable species in this area.

3.8.1 Methodology

To achieve the above objectives a detailed study of the area was undertaken with the existing site as its centre. The different methods adopted were as follows:

- Generation of primary data by undertaking systematic ecological studies in the study area;
- Primary data collection for flora through random sampling method for trees, shrubs and herbs from the selected locations to know the vegetation cover qualitatively.
- To spot the fauna in the study area and also to identify the fauna by secondary indicators such as pugmarks, scats, fecal pallets, calls and other signs.

- For ecological information, the secondary sources such as local officials, villagers and other stakeholders were interviewed.
- Sourcing secondary data with respect to the study area from published literature.

3.8.2 Flora in the study area

Detailed observation studies were conducted on flora in the study area (Core and Buffer Zone) covering surrounding areas of 10 km radius is presented below.

TABLE 3.13 LIST OF FLORA SPECIES OBSERVED IN THE STUDY AREA

SL.NO	SCIENTIFIC NAMES	COMMON NAME
1	*Acacia nilotica*	Babool
2	*A. modesta*	Pbulahi
3	*A. catechu*	Katha
4	*Butea monosperma*	Dhak (Palas)
5	*Delonix regina*	Gulmohar
6	*Azadirachta indica*	Neem
7	*Ficus religiosa*	Peepal
8	*Bougainvelliea*	Paper flower
9	*Cassia fistula*	Golden Shower
10	*Quercussp*	Oak
11	*Dalbergia sissoo*	Rosewood
12	*Nyctanthes arbor-tristis*	Queen of the night
13	*Ehretia laevis*	Chamror
14	*Neolamarckia cadamba*	Kadam
15	*Acacia auriculiformis*	Ear-pod Wattle
16	*Polyalthia longifolia*	Ashoka
17	*Polyalthia pendula*	Ashoka
18	*Terminalia arjuna*	Arjun
19	*Plumeria obtusa*	White Frangipani
20	*Madhuca longifolia*	Indian Butter Tree
21	*Tectona grandis*	Teak
22	*Pterospermum acerifolium*	Maple-leaved Bayur tree
23	*Prosopis Juliflora*	Algaroba
24	*Albizia lebbeck*	Siris tree
25	*Melia azederach*	Chinaberry tree
26	*Prosopis cineraria*	Khejri Tree
27	*Toona ciliata*	Indian mahogany
28	*Bombax ceiba*	Silk Cotton Tree

29	*Acacia leucocephala*	White Bark Acacia
30	*Kigelia africana*	Common Sausage Tree
31	*Butea monosperma*	Flame of the Forest
32	*Callistemon viminalis*	Weeping Bottle brush
33	*Bauhinia variegata*	Orchid Tree
34	*Bauhinia purpurea*	Butterfly tree
35	*Hardwickia binate*	Anjan
36	*Ailanthus excelsa*	Indian Tree of Heaven
37	*Jacaranda mimosifolia*	Blue Jacaranda

3.8.2.1 Forest Vegetation of the Buffer Zone

The Central Ridge (also called New Delhi) consists of around 864 Hectares of forested area, from south of Sadar Bazaar to Dhaula Kuan, but some bits of the Central Ridge have been nibbled away.

The Ridge of Delhi represents a tropical dry thorn forest characterized by the presence of scattered trees and thorny shrubs. The native plants exhibit xerophytic adaptations such as stunted growth, thorny appendages, wax coated, succulent and tomentose leaves. Where the soil profile is good, accompanied by an adequate soil moisture regime and sufficient humus content, broad-leaved tree species like Dhak (*Butea monosperma*), Kaniar (*Bauhinia purpurea*), Pilu (*Salvadora persica*), etc. also thrive well.

Some other tree species found in the Ridge area worth mentioning are *Dichrostachys cinerea, Morus alba, Acacia tortilis, Alstonia scholaris, Balanites roxburghii, Acacia auriculiformis, Erythrina variegata, Euphorbia neriifolia, Jacaranda mimosifolia, Maytenus senegalensis, Delonix regia, Fernando aadenophyllun, Capparis decidua, Ficus virens, Pongamia pinnata, Syzygium cumini, Coccinia grandis, Opuntia elatior, Lactuca dissecta, Albizia lebbeck* etc.

Some of the shrubs found in the Ridge forest are *Adhatoda vasica, Capparis Sepiaria, Abrus precatorius, Asparagus racemosus, Datura netel, Ipomea carnea, Lantana camara, Oxystelama esculentum, Plumbago zeylanica, Solanum xanthocarpum, Tabernaemontana divaricata, Withania somnifera* etc.

3.8.3 Fauna in the study area

We observed some reptiles such as lizard in the study area and also observed frog, mouse, squirrel, rat, cat, and dog in Delhi, wildlife is extremely less due to plain

terrain without any forest cover. Different types of birds are observed in the study area. Some of the prominent birds such as House Crow, Sparrows are common in the inhabited locality.

TABLE 3.14 LIST OF FAUNA OBSERVED IN THE STUDY AREA

SL.NO	COMMON NAME	ZOOLOGICAL NAME	WPA* Schedule
I	**Mammals**		
1	Squirrel	*Funambulas*	Schedule IV
2	Bat	*Pteropus*	Schedule IV
3	Rat	*Rattus rattus*	Schedule V
4	Dog	*Canis lupus familiaris*	-
II	**Amphibians**		
5	Common tree frog	*Polypedates maculates*	Schedule IV
6	Common Indian Toad	*Bufo melanostictus*	Schedule IV
III	**Avifauna**		
7	Kingfisher	*Alcedo atthis*	Schedule IV
8	Owlet, spotted	*Athene brama*	Schedule IV
9	Crow, Pheasant	*Cetropus sinensis*	Schedule IV
10	Koel	*Eudynamys scolopaceus*	Schedule IV
11	Jacobin Cuckoo	*Clamator jacobinus*	Schedule IV
12	Kite	*Elanus caervleus*	Schedule IV
13	Eagle	*Spilornis cheela*	Schedule IV
14	Dove, Spotted	*Streptopelia chinensis*	Schedule IV
15	Dove, Little brown	*Streptopelia senegalensis*	Schedule IV
16	Myna	*Sturnus pagodarum*	Schedule IV
17	Pigeon, Common green	*Treron phoenicopteras*	Schedule IV
18	House sparrow	*Passer domesticus*	Schedule IV
IV	**Reptiles**		
19	Common Garden Lizard	*Calotes versicolor*	Schedule IV
20	House lizard	*Hemidactylus sp*	-

** Wildlife Protection Act*

3.9 LANDUSE STUDIES

3.9.1 Objectives

The objectives of land use studies are:

- To determine the present land use pattern;
- To analyse the impacts on land use due to the proposed project in the study area; and

- To give recommendations for optimizing the future land use pattern and associated impacts.

3.9.2 Land use Pattern Based on Remote Sensing Data

Remote sensing satellite imageries were collected and interpreted for the 10 km radius study area for analyzing the Land use pattern of the study area. Based on the satellite data, Land use/ Land cover maps have been prepared.

3.9.2.1 Land use/Land cover classification system

The present Land use / Land cover maps were prepared based on the classification system of National standards. For explanation for each of the Land use category, the details as given in Table 3.15 were considered.

3.9.2.2 Data Requirements

IRS P6 LISSIV satellite data was acquired on 13th December 2016 and was used for the mapping and interpretation. Besides, other collateral data as available in the form of maps, charts, census records, other reports and especially topographical survey of India maps are used. In addition to this, ground truth survey was also conducted to verify and confirm the ground features.

3.9.2.3 METHODOLOGY

The overall methodology adopted and followed to achieve the objectives of the present study involves the following steps:

- Collection of source data of Survey of India (SOI) topo sheets. These are the main inputs for the preparation of essential layers.
- Satellite data of IRS P6 LISSIV sensor is geometrically corrected and enhanced using principal component method and Nearest Neighborhood resampling technique.
- Preparation of basic themes like layout map, transport & settlement map and contour map from the source data. Then updating of layout map, transport map and drainage map from the satellite image by visual interpretation.
- Essential maps (related to natural resources) like Land use / Land cover map are prepared by visual interpretation of the satellite imagery. Visual interpretation is carried out based on the image characteristics like tone,

size, shape, pattern, texture, location, association, background etc. in conjunction with existing maps/ literature.

- Preliminary quality check and necessary corrections are carried out for all the maps prepared.
- All the maps prepared are converted into soft copy by digitization of contours and drainages. In that process editing, labeling, mosaicing, quality checking, data integration etc are done, finally Land use areas are measured in Square Kilometers.

3.9.2.4 MAP FOR THE LAND USE LAND COVER IN THE STUDY AREA

Land use map Figure 3.10 showing the classifications of the land with different colours. While classifying many remote sensing techniques like supervisory-unsupervisory classification methodologies applied and also sampling techniques are used for better results.

Classification were done in ERDAS & ArcGIS software's and found some doubtful locations, verified those areas during ground truth validations.

Land uses classes are interpreted from the satellite image and same is been cross checked with ground, in order to meet the accurate feature classes verified highways, settlements around 10 km buffer from the project site, water bodies, plantation and scrub land and found that there is no much change.

The land use map within 10 km radius based on IRS P6 LISSIV are shown in Figure 3.11.

TABLE 3.15 LAND USE / LAND COVER STATISTICS OF BUFFER ZONE

LULC Statistics			
Sl No	**LULC_Classification**	**Area (Ha)**	**Area (%)**
1	Water Bodies	1956.20	6%
2	Settlement	17880.20	57%
3	Rail Network	1795.92	6%
4	Road Network	2198.84	7%
5	Open land	1183.68	4%
6	Scrub	1090.34	3%
7	Plantation	1391.22	4%
8	Airport area	2512.11	8%
9	Forest	1430.65	5%
		31439.17	**100%**

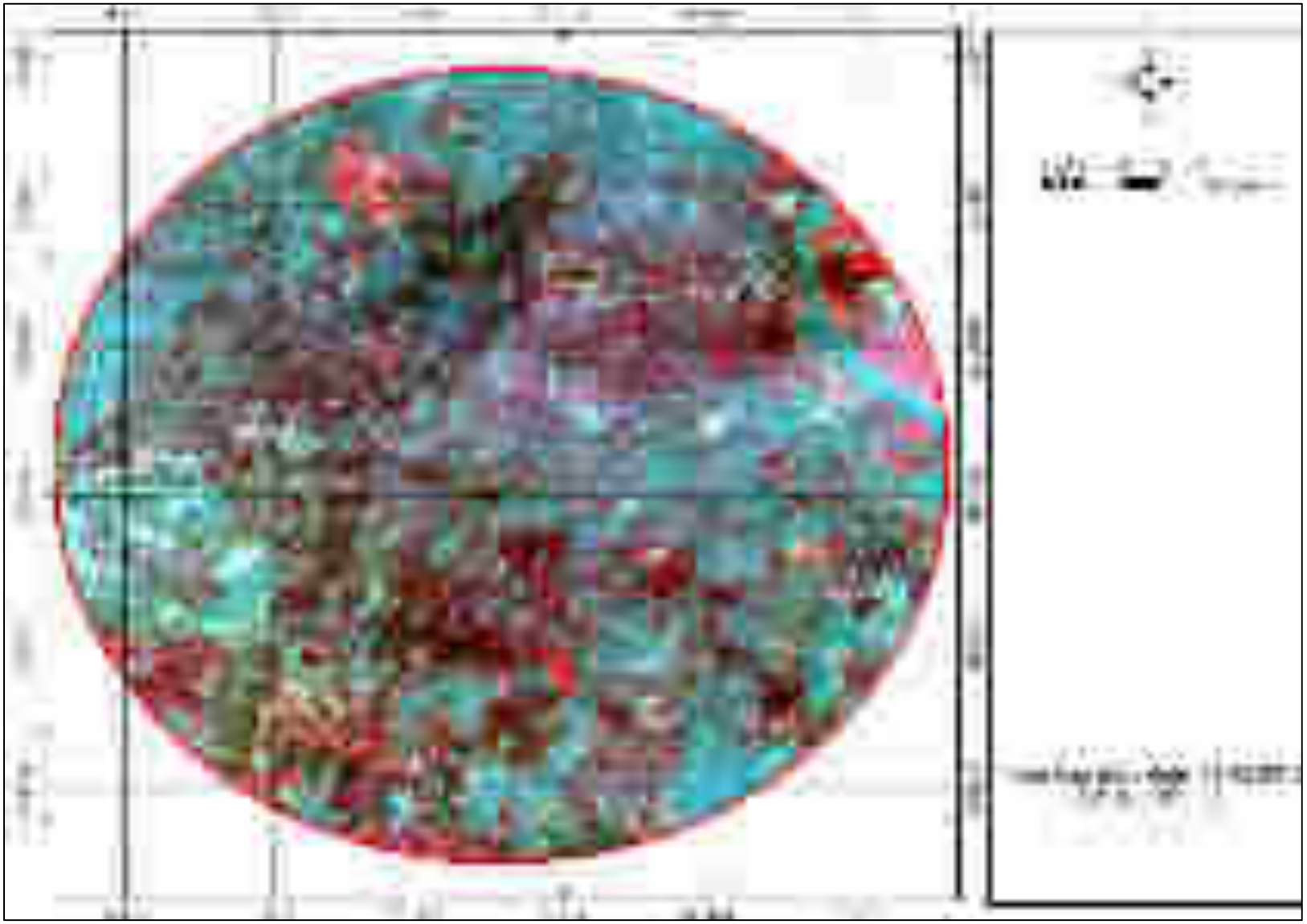


FIGURE 3.10 RAW SATELLITE IMAGERY (10 KM RADIUS)

FIGURE 3.11 LAND USE MAP 10 KM RADIUS OF THE PROJECT SITE

Source: Extracted from Satellite Imagery

3.10 DEMOGRAPHY AND SOCIO-ECONOMICS

Socio- Economic status in the study area is assessed from the census data of 2011 and as per the methodology detailed below.

3.10.1 Methodology

The methodology adopted in assessment of socio-economic condition is as given below;

- Assessment of socio-Economic conditions of the Population.
- Analysis of the identified social attributes like population distribution, availability of public utilities etc., through Census of India 2011.
- Primary household survey to assess the present status of population of the study area.

3.10.2 Source of Information

As per the scope of this study, the information on socio-economic aspects has been gathered and compiled from several secondary sources. These include Taluk Office, Collectorate, Agriculture Department, Irrigation Department, Central Ground Water Board, Directorate of Census Operation, New Delhi etc. The demographic data has mainly been compiled from the CD of Census of India Census 2011. The socio-economic details are briefly described in following sections.

3.10.3 Settlement Pattern

The proposed project site is located in New Delhi. The study area is decided as an area within 10 km radius from the proposed area. The following are the villages around the site.

As per 2011 census, the study area had population of 4806736 persons. The distribution of population in the study area of 10 km radius is shown in Table 3.16.

TABLE 3.16 LIST OF VILLAGE AND POPULATION

S.No	Village Name	Population
1	Connaught Place	28,228
2	Chanakya Puri	61,382
3	Parliament Street	52,394
4	Vivek Vihar	2,47,906
5	Patel Nagar	12,62,158

6	Hauz Khas	12,31,293
7	Karol Bagh	1,36,599
8	Defence Colony	6,37,775
9	Kalkaji	8,62,861
10	Delhi Cantonment	2,86,140

Source: Primary Census Abstract: Districts & Sub Districts- NCT of Delhi

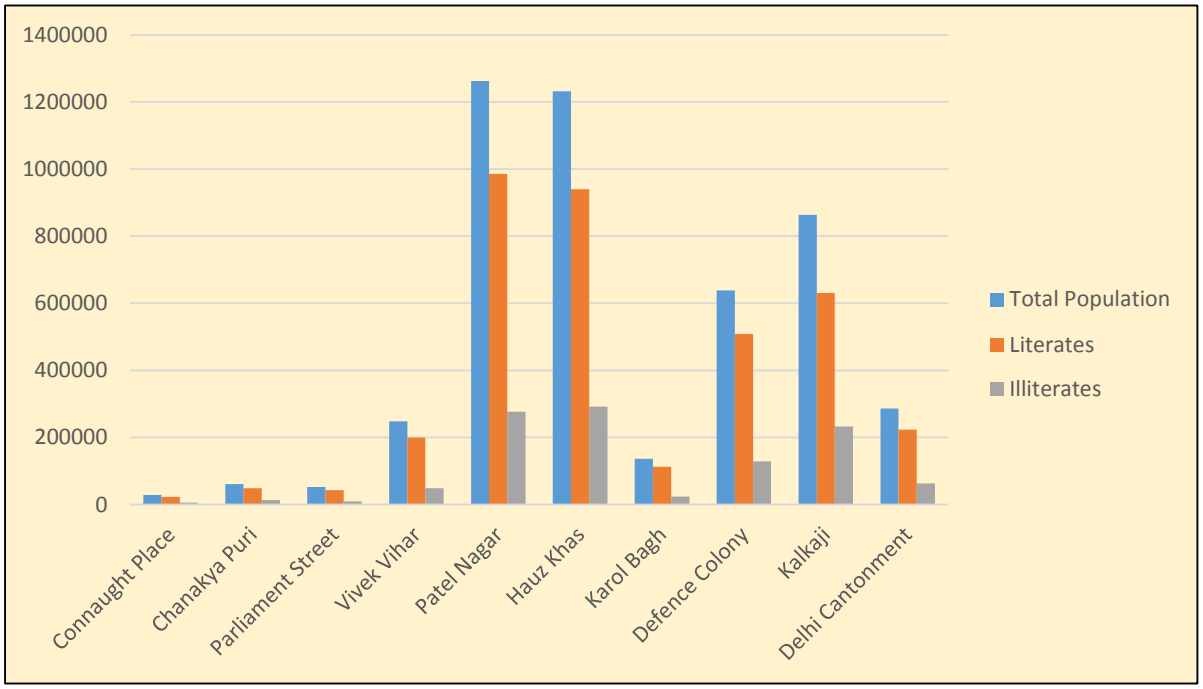
The males and females constitute to about 53.65 % and 46.35% in 10km radius of the study area.

3.10.4 Average Household Size

The study area has a family size of 5 persons as per 2011 census. The decrease of family size could be attributed to a high degree of urbanization with migration of people with higher literacy levels who generally opt for smaller family size with family welfare measures and also due to the prevalence of single member families.

3.10.5 Education and literacy profile

Literacy is an important indicator to assess the Human Development Index of the area. Overall literacy rate for the ten places is presented in Figure 3.12.



Source: Primary Census Abstract: Districts & Sub Districts - NCT of Delhi, 2011

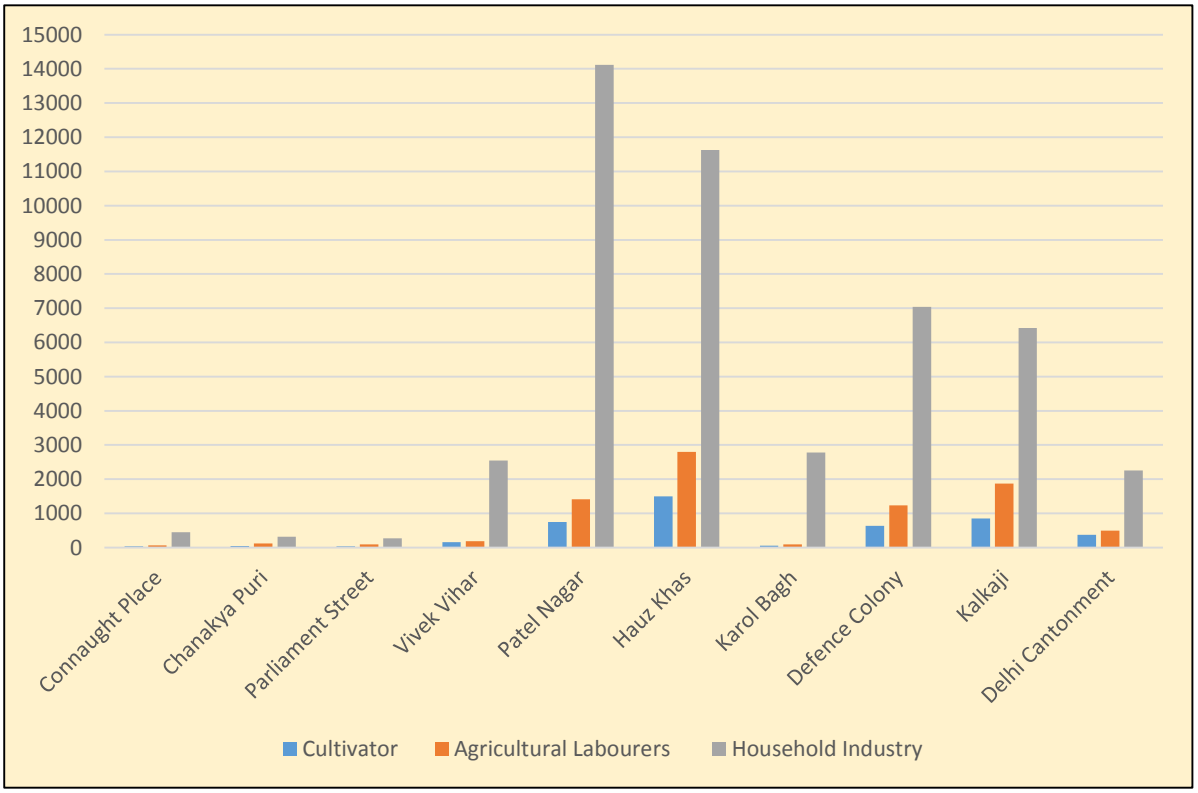
FIGURE 3.12 LITERACY RATE IN THE TEN VILLAGES

3.10.6 Economic structure

Economic aspects of the study area include the economical structure of the people of the surrounding area. The geographical location, natural resources, business and employment, industries and manpower play vital role in the economic development of any region. It can be predicted that economic structure of the study area will be improved with time, due to the proposed redevelopment of General Pool residential accommodation, which will provide employment opportunities. The population can be divided into two groups in terms of employment.

- ✓ Workers and
- ✓ Non-workers

Workers are further categorized into Main workers and Marginal workers. Main worker is a person who has worked last year for six months or more. Marginal worker is a person who has worked last year for less than six months. Non-worker is a worker who did not work at all during the reference period of one year. The Details of workers engaged in different activities are given **Figure 3.13.**The detailed socio economic status of study area is given in **Table 3.17**



Source: Primary Census Abstract: Districts & Sub Districts- NCT of Delhi, 2011

FIGURE 3.13 WORKFORCE PARTICIPATION IN TEN VILLAGE

TABLE 3.17 SOCIO ECONOMIC STATUS OF THE STUDY AREA

Sl. No	Village	No. of HH	Population			SC Population			Sex Ratio
			Total	Male	Female	Total	Male	Female	
1.	Connaught Place	6814	28228	15208	13020	5534	2928	2606	856.1283535
2.	Chanakya Puri	15074	61382	34005	27377	15095	8281	6814	805.0874871
3.	Parliament Street	11320	52394	28729	23665	12616	6676	5940	823.7321174
4.	Vivek Vihar	50134	247906	130769	117137	48421	25309	23112	895.7551102
5.	Patel Nagar	267062	1262158	670390	591768	157422	83498	73924	882.7219976
6.	Hauz Khas	254502	1231293	658380	572913	219813	115084	104729	870.1859109
7.	Karol Bagh	30496	136599	71544	65055	59352	30206	29146	909.3005703
8.	Defence Colony	137677	637775	339725	298050	68480	35958	32522	877.32725
9.	Kalkaji	181954	862861	469323	393538	134633	72157	62476	838.5227232
10.	Delhi Cantonment	63974	286140	160494	125646	53894	29216	24678	782.8703877

* There is no ST Population

Sl. No	Village	Literates	Illiterates	Total Workers			Cultivators		Agricultural Laborers		Workers in HH industries		Non Workers		
				Total	Male	Female	Male	Female	Male	Female	Male	Female	Total	Male	Female
1	Connaught Place	22969	5259	12714	9003	3053	17	18	47	14	300	148	15514	5783	9731
2	Chanakya Puri	48178	13204	25830	19690	4540	35	11	78	40	195	120	35552	13297	22255
3	Parliament Street	43032	9362	20997	16223	3962	27	13	73	23	220	47	31397	11922	19475
4	Vivek Vihar	199028	48878	85214	68887	13455	114	48	148	42	2182	359	162692	59826	102866
5	Patel Nagar	985305	276853	430177	347024	63527	539	208	1165	250	11856	2261	831981	309458	522523
6	Hauz Khas	939355	291938	413366	330625	59961	1187	311	2243	558	9664	1961	817927	311527	506400
7	Karol Bagh	112691	23908	51608	40441	8915	37	22	74	19	2403	379	84991	29723	55268
8	Defence Colony	508758	129017	232196	175385	42566	494	142	999	237	5987	1049	405579	154482	251097
9	Kalkaji	630289	232572	278831	229525	31024	731	119	1559	312	5246	1174	584030	225827	358203
10	Delhi Cantonment	223321	62819	110721	86393	14872	286	89	401	92	1697	560	175419	67398	108021

Source: Primary Census Abstract: Districts & Sub Districts - NCT of Delhi, 2011

4. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.1 IDENTIFICATION OF IMPACTS

This chapter deals with identification and appraisal of various environmental and social impacts due to the proposed redevelopment of multi-storied residential, Office complex based on the prevailing baseline setting and inventory of pollution sources described in the previous chapters.

Generally, the environmental impacts can be categorized as either primary or secondary. Primary impacts are those, which are attributed directly due to the proposed project and the secondary impacts are those, which are indirectly induced and typically include the associated investments and changed patterns of social and economic developments.

The proposed redevelopment project is likely to create impact on the environment in two distinct phases:

- During the construction phase, which may be regarded as temporary or short term
- During the operational phase which will have long-term effects.

The construction and operational phases of the proposed redevelopment project comprises of various activities, each of which will have some impact on one or more environmental parameters. Various impacts during the construction and operational phase of the project have been studied to estimate the impact on the environment and are discussed briefly in the subsequent sections.

4.2 IMPACTS DURING CONSTRUCTION PHASE

4.2.1 Impact on Topography and Land Use

The proposal is for redevelopment of General Pool residential accommodation colony at Netaji Nagar. There will not be any change in the land use, land cover or topography as the site is categorized as Mixed Residential use as per the Development control rules of Delhi Development Authority (DDA). Hence, it will not alter the topography of

the site. This development will further improve the environment. Thus no negative impacts are identified with respect to topography.

The project site is fairly flat land and there is no wetland. The proposed redevelopment project activity may slightly affect the natural drainage system due to the creation of built-up area and roads. To overcome this problem, the proposed activity includes the rain water harvesting system and storm water drainage with a proper design to recharge ground water aquifers using recharge pits.

4.2.2 Impact on Soil

The proposed redevelopment project site is presently not used for cultivation. The topsoil removed from the site will be stored in dumps during construction period and in the post construction phase, the topsoil will be spread on the un-built area of the plot and tree plantations and green belt development will be taken up. As the topsoil removed from the site will be re-used for growth of plants, no impact will result due to removal of topsoil from the site.

The dripping of oil from construction vehicles might cause soil contamination. In order to prevent soil contamination likely to result from the oil spill dripping from vehicles, drip pans will be placed at the parking places of vehicles and the dripped oil will be collected. The collected dripped oil will be stored and subsequently sent to the authorized recycling agencies.

4.2.3 Impact on Air Quality

During construction phase, suspended particulate matter will be the main pollutant, which will be generated during the site development activities such as leveling of land, cutting and filling activities, transportation of construction material to the project site from various sources, operation of DG sets etc.

Also, due to the increased vehicular movements, increase in NOx and CO concentrations may result at the project site. However, the increase in pollution levels in the ambient air, will be negligible and also it is a temporary phenomenon. As most of the construction equipment will be mobile, the emissions are likely to be fugitive and not concentrated at a single place or source. As the impacts will be localized in

nature, the areas outside the proposed project boundary are not likely to face any significant adverse impact with respect to ambient air quality.

No major vegetative cover exists in the immediate vicinity of the project. Hence no impacts on terrestrial flora and fauna are envisaged due to construction activities.

Fugitive Emission

Major emissions during construction phase are likely from activities like demolition of existing buildings and Vehicular movements, excavation and leveling activity.

Mitigation Measures

- Sprinkling of water in the construction area and unpaved roads.
- Proper maintenance of vehicles shall be done.
- Restrict dust-generating activities, such as blasting or top soil removal, to calm wind conditions.
- Cover heavy vehicles moving offsite.
- Covering of materials and provision of barricading all around the construction area.

4.2.4 Impact on Water Quality

During construction phase, water will be required only for construction of structures, sprinkling on roads for dust suppression, domestic and non-domestic uses of the construction workers.

Impact on water quality during construction phase will be due to non-point discharges of sewage generated at the project site by the construction workforce. However, due to relatively smaller area that will be taken-up for construction the impact of water discharges at the site will be negligible.

At the construction site, adequate number of toilets with hygienic environment will be provided. If such facilities are not provided, this may lead to environmental pollution at the project site. Hence no contamination of groundwater will occur. The sewage generated by construction workers shall be treated by providing suitable STP.

4.2.5 Impact due to Solid Waste Generation

During construction period, considerable quantities of earth and boulders will be excavated from the foundations of various proposed structures. The excavated earth and boulders will be used for leveling the low-lying terrain. The topsoil excavated from the project site will be used for covering the area leveled with excavated material from foundation trenches, on which tree plantations and green belt development within the project premises will be undertaken.

During construction phase, total solid waste in terms of food packet wrappers will be generated. This may cause for environmental degradation at the project site as well as its immediate surroundings, if adequate measures are not taken.

In order to avoid any solid waste disposal problems, an effective solid waste management system by means of collection of wastes in dust bins and transporting the same to the authorized dumping grounds / processors by the contractors will be provided. Strict adherence to the established solid waste collection & disposal system will ensure clean environment during construction period.

Demolition waste

Demolition of the existing buildings /structures in proposed project site increases the availability of solid waste like bricks, steel, aggregates, etc.

Demolition will start after covering the entire building block and the surrounding area with geotextile cloth / tarpaulin fabric and barricading to protect from dust and for safety purpose. Provision of water sprinkler to reduce dust and pollution will be made. 40% and 75% of the bricks and steel respectively after demolition will be sold and remaining debris / Malba will be sent to the government specified C&D plant for recycling and reuse in the project.

4.2.6 Impact on Noise Levels

The major sources of noise during the construction phase will be due to operation of construction equipment such as rock drills, pneumatic tools, concrete mixers, cranes, generators, pumps, compressors, vibrators, etc. The operation of this equipment will generate noise ranging between 70-85 dB (A). Due to moderate levels of construction

activities, the anticipated noise generation during construction phase will be mostly confined to the facility itself and not anticipated to have significant adverse impacts on the surrounding ambient noise levels. In order to have less impact on noise levels in the area, the major works will be carried out during daytime as far as possible.

Some construction equipment may generate more noise levels and might affect the personnel operating these equipment. In order to safeguard the construction workers working at the noise generation sources, these personnel will be provided with proper personal protective equipment such as earplugs, earmuffs, etc. Hence, no significant impact is envisaged due to the operation of the noise generating equipment at the project site, if suitable mitigation measures are adopted.

4.3 IMPACTS DURING OPERATION PHASE

The proposed project involves redevelopment of Residential accommodation, GPOA, SAARTAC Office by constructing residential and other buildings. This does not involve any manufacturing or chemical processes, hence does not result in any severe environmental pollution such as air and water pollution. However, the following activities related to the redevelopment project are anticipated to have varying degree of impacts on the environment, hence considered for impact assessment.

- ✓ Topography
- ✓ Land use
- ✓ Soil
- ✓ Air quality
- ✓ Water quality
- ✓ Storm water drainage
- ✓ Solid waste
- ✓ Noise levels
- ✓ Terrestrial and aquatic ecology

4.3.1 Impact on Topography

During the operational phase of the project, no impact on topography of the project site will be experienced, as all the land leveling and construction activities will be

completed during the construction phase of the project itself. However, the green belt and avenue plantation will be grown with which the aesthetics will improve further.

4.3.2 Impact on Land use

There is no impact on the land use during the operational phase, as the proposed redevelopment project does not alter the land use pattern as per Development control rules of Delhi Development Authority (DDA). Due to the development of the project there will be a significant improvement in the aesthetics of the site.

4.3.3 Impact on Soil

All the impacts related with soils are restricted to the construction phase only; hence there will not be any impact on soils of the proposed project site during the operational phase. The top soil removed during construction stage will be spread on landscaped areas and plantation will be developed. The matured plantation will help in reduction of possible soil erosion.

The probable sources causing degradation of soil in the project site are due to generation of solid wastes and wastewater from the proposed redevelopment project. As appropriate solid waste management systems will be followed, no soil pollution is anticipated in the project area. Further, the proposed greenbelt, green cover and avenue plantation measures will enrich the soil binding characteristics and preserve topsoil from erosion.

4.3.4 Impact on Air Quality

The major source of air pollution is the emission of dust from vehicles and stacks of DG sets. In the proposed project DG sets with adequate stack height will be provided and very insignificant vehicles are envisaged. Even though to check the impact of DG sets on Ambient Air, an Air Quality modeling was carried out and its details are given in *Annexure – VII*.

4.3.4.1 Fugitive Emissions

The additional development of the existing project will be excellently landscaped with proper terracing and benching and will be provided with pucca roads. As the entire

project site will be covered with good landscaping and tree/grass cover, generation of fugitive dust within the premises will be minimal. Even the dust, outside the project site will be minimal due to the proposed compound walls, which will function as barriers and tree plantations along the boundary. Further, all fugitive emissions are likely to be controlled to a great extent, through proper maintenance of tree plantations and the green belt development undertaken within the project area.

4.3.4.2 Gaseous Emissions

The sources of gaseous pollutants within the project site are kitchens, DG sets and vehicular movement within the premises. The emissions of Sulphur Dioxide (SO2) and Oxides of Nitrogen (NOx) will be due to operation of DG sets, in case of the failure of the power grid.

In order to control emissions of particulates during operation of the DG sets, adequate control equipment will be installed and adequate stack height will be provided as per (Emission Regulation Part-IV COINDS/26/1986-87) CPCB norms.

Minimum Stack Height Requirement, $H=h+0.2\sqrt{p}$

Where

H = Height of the Stack

h = height of the building in which the DG is installed

P = the size of DG set in KVA

Adequate stack height of 33 m from GL will be provided above ground level for each DG set for wide dispersion of gaseous emissions.

4.3.4.3 Impact due to Vehicular Traffic

Control of Vehicular Emission - It will be ensured that all such vehicles are maintained on a regular basis and meet PCU norms. This will be applicable to all vehicles coming to the premises. Development of Green belt with specific species will help in reducing the SPM levels. Informatory sign shall be provided to encourage vehicle owners to maintain their vehicle and follow the emission standards fixed by Government Authorities.

4.3.5 Impact on Water Quality

The total Fresh water requirement for the proposed redevelopment project will be about 1874 KLD against the present supply of 3821KLD and same will be met from New Delhi Municipal Council.

During the operational phase of the project, no manufacturing or process of any industrial product is involved. The wastewater generated is only from the sanitation facilities. The entire sewage generated will be treated in Sewage Treatment Plant of 2564 KLD and the treated water will be reused for flushing, HVAC and watering the landscaped areas, garden.

4.3.6 Impact due to Solid Waste Generation

During operational phase of the project, considerable quantities of solid wastes such as kitchen wastes, used paper plates and cups, polythene sheets and wastepaper will be generated. If the solid wastes are not disposed off efficiently, these may cause for environmental degradation. In order to avoid problems associated with solid waste disposal problems, an effective solid waste management system will be followed. The solid waste generated are segregated into Biodegradable (8,787 Kg/day) will be composted in Organic waste convertor, Non-Biodegradable (9,909 Kg/day) including recyclable waste will be handed over to the Authorized recyclers and the sludge from STP (378 Kg/day) will be used as manure for green development.

Hence, the generation of solid wastes in the proposed redevelopment project will not create adverse impacts.

4.3.7 Noise Environment

Noise pollution is caused due to the various activities which involves the vehicular movement, D.G sets etc.

Proper and suitable acoustic barrier will also be provided around areas generating high noise. DG sets will also be housed in acoustically treated room so that the ambient noise level at 1m from the periphery of the service block will be less than 55 dB (A) (day time). Plantation and landscaping will be designed to ensure that there is

adequate green belt near the service block so that further noise attenuation is achieved. Effective preventive maintenance and vibration measurement of all rotating equipment will help in the noise reduction.

4.4 MITIGATION MEASURES

4.4.1 Environment Management during Construction

The construction phase involves site preparation, transportation of construction materials and equipment and construction of the infrastructure. During this phase, it is imminent that workers/labourers will be staying on site till the completion of construction. However, this is not a long-term impact as this is a temporary phase.

From the above activity, it is envisaged that there will be marginal impact on the environment. To minimize these impacts, the proponent will undertake all preventive and remedial measures, which are outlined hereunder.

4.4.1.1 Land Environment

The following mitigation measures shall be adopted:

- ✓ As soon as construction is over, the surplus earth shall be utilized to fill up the low lying areas, the rubbish will be cleared and all un-built surfaces be reinstated;
- ✓ The top soil from the excavated areas shall be preserved in separate stacks for re-use during the plantation;
- ✓ There shall be minimum/optimum concreting of the top surfaces so that sufficient scope for maximum groundwater recharge due to rainfall with appropriate rain water harvesting measures;

4.4.1.2 Water Environment

During construction period, the water quality is likely to be affected due to the construction work and loosening of topsoil. This is likely to increase the suspended solids in the run-off during heavy precipitation. In order to reduce the impact on water quality, temporary sedimentation tanks shall be constructed for the settlement of the suspended matter.

Sanitation

The construction site shall be provided with sufficient and suitable toilet facilities for workers to meet the proper standards of hygiene. These facilities shall be maintained to ensure minimum environmental impact.

4.4.1.3 Air Environment

During construction period, there is likelihood of generation of dust and NOx emissions. This can be attributed to leveling activity and vehicular movement. The transport vehicles using petrol or diesel should be properly maintained to minimize smoke in the exhaust. Water sprinkling is suggested to address this issue.

Since there is likelihood of fugitive dust from the construction activity, material handling and from the truck movement in the premises. It is proposed for tree plantation program along the boundaries of the project site during the period of construction itself.

Additional recommendations include the following:

- ✓ Sprinkling of water shall be done at frequent intervals by preferably using truck-mounted sprinklers;
- ✓ Construction equipment shall be maintained and serviced regularly such that the gaseous emissions from these equipment are maintained within the design specifications; and
- ✓ Construction activities shall be restricted to daytime only as much as possible to minimize disturbance during nighttime.
- ✓ All demolition and construction waste shall be stored securely and removed within a stipulated period.
- ✓ Proper movement of vehicles within the project site.

4.4.1.4 Noise Environment

Generation of noise during construction phase is due to operation of heavy equipment and increased frequency of vehicular traffic in the area. Vibration levels will also increase due to these activities. However, these impacts will be short term and

intermittent in nature. The noise effect on the nearest inhabitants during the construction activity will be negligible, as the noise levels will be dissipated within the project site itself. Nevertheless, the following mitigation measures shall be adopted:

- ✓ Provision for insulating caps and aids at the exit of noise source on the machinery;
- ✓ The use of damping materials such as thin rubber/lead sheet for wrapping the work places like compressors, generator sheets;
- ✓ Shock absorbing techniques should be adopted to reduce impact;
- ✓ Inlet and outlet mufflers should be provided, which are easy to design;
- ✓ Earmuffs should be provided to the workers and it should be enforced to be used by the workers;
- ✓ Noise prone activities shall be restricted to the extent possible during night time, particularly during the period between 10 pm to 6 am in order to have minimum environmental impact on the workers as well as on the neighborhood;
- ✓ No worker shall be allowed to expose to more than 90 dB (A) in an 8-hour shift and under no circumstance the noise level from any equipment shall be greater than 115 dB(A).

4.4.1.5 Ecological Aspects

During construction period, there could be some clearing of vegetation in order to prepare the site for construction. However, this will be mitigated by proper landscaping and extensive plantation within the project area. A comprehensive greenbelt program will improve the ecological condition of the region.

4.4.1.6 Storage of Hazardous Material

The hazardous materials used during the construction may include diesel, welding gas and paints. These materials shall be stored and handled as per the guidelines specified under Hazardous Wastes (Storage, Handling and Transportation) Management Rules of Environment Protection Act. Some of the precautions of storage include the following:

- ✓ Dyked enclosures shall be provided so as to contain complete contents of the largest tank; and

- ✓ Diesel and other fuels shall be stored in separate dyke enclosures.

4.4.1.7 Site Security

Adequate security arrangement should be made to ensure that the local inhabitants and the stray cattle are not exposed to the potential hazards of construction activities.

4.4.1.8 Migrant Laborers

Safe and secure camping area should be provided for the migrant laborers during the construction period. Adequate arrangements should be made for water supply, sanitation and cooking fuels. The construction site should be provided with sufficient and suitable toilet facilities for workers to allow proper standards of hygiene. These facilities will be connected to a septic tank followed by soak pits or suitable capacity of moveable STP and maintained to ensure minimum environmental impact.

4.4.1.9 Facilities to be provided by the Labour Contractor

The contractor has to provide following facilities to construction work force:

First Aid: At work place, first aid facilities should be maintained at a readily accessible place where necessary appliances including sterilized cotton wool etc. shall be available. Ambulance facilities should be kept readily available at workplace to take injured person to the nearest hospital.

Potable Water: Sufficient supply of water fit for drinking should be provided at suitable places.

Sanitary Facility: Within the precinct of very work place, latrines and urinals should be provided at accessible place. These should be cleaned at least twice during working hours and kept in a good sanitary condition. The contractor should conform to sanitary requirement of local medical and health authorities at all times.

Security: The proponent will provide necessary security to work force.

Facilities for Women: Facilities as per Factory Rules of the State government shall be provided to the women work force. Separate toilets for women shall be provided and

marked in local language with conspicuous letters for women only. A poster showing the figure of a man and woman shall also be exhibited at the entrance to toilets.

4.4.2 Environment Management Plan during Operational Phase

The EMP in the design stage endeavors to mitigate the problems related to health, safety and environment at the initial stage itself. The proposed facilities will be designed taking into account all applicable standards/norms both for regulatory and safety purpose.

The design of Netaji Nagar will be made by laying special emphasis on the measures to minimize sewage generation and emission control at source. The specific control measures related to gaseous emissions, liquid sewage discharges, noise generation, solid waste disposal etc are described below:

4.4.2.1 Land Environment

Some of the anticipated impacts on the land environment due to the project are:

Change in Runoff and Drainage pattern: With the development of the project, pervious vegetative area will be replaced by impervious and paved surfaces leading to lesser infiltration and thereby increased runoff. This can lead to more localized flooding.

Potential Loss of Green spaces: Demolition of huge buildings would reduce the natural greenery of the area. About 3906 trees are existing in the site and due to the proposed redevelopment 1,600 (+/-5%) no of trees may be affected which will be translocated within the site and 2306 (+/-5%) nos. will be retained in the site. Besides this, 224 trees have already been felled. However, the large landscaping planned and suggested in the Master plan for the project, would compensate for this loss.

Mitigation Measures

A land of 21.45 Hectares for compensatory plantation against the felling of trees near Garhi Mandu Village has been allotted by Delhi Development Authority to NBCC (India) Limited. The compensatory plantation in the ratio of 1:10 is to be done by Dy Conservator of forest (North) in the land allotted by DDA. Against this, 16056 nos of plants of saplings of measure species have been completed on 14.45Ha. Balance compensatory plantation if required shall be done by Dy Conservator of forest (North) in

the remaining 7Ha. Moreover, efforts will be made to translocate all the remaining affected trees within the site.

4.4.2.2 Air Pollution Management

A site-specific baseline air quality monitoring program was conducted for the existing project site and the results are briefed in Chapter 3. Existing baseline condition reveals that concentration of CO, NOx, SO_2 are below the prescribed limits by NAAQS. However, concentrations of PM_{10} and $PM_{2.5}$ exceed the limits by NAAQS of 100µg/m3 and 60µg/m3 respectively. High levels of concentration as evaluated from baseline monitoring are due to prevailing smog in the city which has been formed by construction activities. The major impacts on ambient air could be vehicular emissions from increase in traffic volume and emission from power backup/ DG sets.

Mitigation Measures

Power Backup

The DG sets shall be provided for power back up in case of any power failure. Following precautionary measures shall be taken care of:

- DG sets shall be located downwind of the residential areas;
- Stack heights for DG sets shall be maintained as per CPCB/ MoEFCC norms;

Vehicular Emissions

- Vegetative barriers in the form of green belt shall be provided around the redevelopment area which will minimize the building up of pollution level by acting as pollution sinks.
- Only CNG using public vehicles shall be allowed to ply on the site

4.4.2.3 Water and Wastewater Management

❖ **Controlled Water Use**

The fresh water requirement of the total project will be about 1,913 KLD and this would be sourced from NDMC. Wastage of water will be totally controlled and only the minimum quantum of water will be used.

❖ **Monitoring of Water Consumption**

Periodic water audits shall be conducted to explore the possibilities for minimization of water consumption.

❖ **Water Conservation**

In order to reduce the water consumption in the redevelopment project suitable measures will be taken. For watering the plants and landscaped areas, adequately treated sewage shall be used, thus conserving water.

❖ **Wastewater Treatment and Reuse**

The quantity of wastewater generation depends upon the quantity of water used for various purposes. The quantum of wastewater generation from the project will be about 2702 KLD.

Wastewater generated from the domestic activities of the proposed project site will be treated in Sewage Treatment Plant of 2702 KLD to manage the additional sewage and treated water will be utilized for the flushing and landscaping purposes.

Mitigation Measures

- Water meters conforming to ISO standards shall be installed at the inlet point of water uptake and the discharge point to monitor the daily water consumption and identify leakages if any. Project Proponent shall be responsible for carrying out systematic leak tests all year round;
- Appropriate flow restrictors shall be installed for economizing on water consumption.
- Efficient Water saving devices/ fixtures shall be installed in kitchens and toilets to reduce the water consumption per flush.
- The sewage generated shall be treated through STP and the treated sewage shall be reused for flushing, Greenbelt development, HVAC and Excess water shall be supplied to NDMC for use in horticulture etc. in surrounding area.

4.4.2.4 Groundwater Recharge with Rain Water Harvesting

There will be generation of surface run-off from the premises during monsoon season. The run-off will be of two types i.e. run-off from the pervious area of the site and run-off from the built-up area of the complex.

- **Run-off from the Built-up Areas**

The run-off from the impervious surfaces and built up areas of the project site will be routed through a carefully designed storm water drainage network discharging into rainwater harvesting structures provided along the boundary of the project site. Surplus storm water after percolation into ground will be collected through the storm water drain and will be connected with rain harvesting pit to replenish the ground water.

- **Run-off from Other Area**

The run-off from other area will be routed directly to the rainwater harvesting structures, proposed to be constructed at suitable locations as per the contours.

4.4.2.5 Rainwater Harvesting Structures

For augmenting the ground water resources in the project site, appropriate numbers of rainwater harvesting structures will be constructed along the boundary of the blocks. These structures will facilitate percolation of water into the ground and thus augmenting the groundwater sources. This will result in increase in groundwater tables. Only the surplus water after possible percolation into the ground will be discharged into the municipal storm water drains outside the project site.

Water harvesting connotes collection and storage of rainwater and also other activities aimed at harvesting surface water and ground water, prevention of losses through evaporation.

Recharge pits will be of RCC pre-cast ring soak pit type, having adequate depth and diameter. For percolation of water into the ground the pre-cast RCC structure will have adequate number of outlets.

4.4.2.6 Noise Level Management

The incremental noise levels in the proposed project will be high due to the increased traffic movement within the city and further incremental due to the usage of DG set. However, the greenbelt to be provided will further attenuate the noise levels.

Recommendations

- ✓ Noise levels would be reduced by the use of absorbing material on roof walls and floors;
- ✓ The project area would be thickly vegetated with species of rich canopy
- ✓ DG sets shall be provided with acoustic enclosures

4.4.2.7 Solid waste Management

The project will generate approximately 19,863 kg/day of MSW per day during peak season. The potential impacts associated with disposal of solid waste include the following:

- Inadequate collection and treatment of municipal solid waste can lead to unhygienic conditions leading to spread of diseases and other vectors
- Improper transportation of municipal solid waste may lead to generation of odour;
- The accumulation of waste along streets can clog drains and cause localized flooding;

Mitigation Measures

- An integrated solid waste management will be put in place for collection, transport, treatment and disposal of solid waste generated from the activities;
- An Organic waste converter has been planned for processing of Biodegradable waste and the e-waste generated shall be sold to authorised recyclers in accordance with e-waste Management Handling Rules, 2016.
- The recyclable waste like glass, metal, plastics, paper etc shall be collected separately and sold to authorized recyclers/ vendors.

4.4.2.8 Traffic & Transport

The potential impacts on traffic and transport for proposed project include the following:

- Increase in traffic volume due to proposed developments and likelihood of congestion on the existing and proposed road network;
- Random parking of vehicles and unplanned loading/ unloading areas can lead to confusion.

Mitigation Measures

It has been decided by the Ministry of Housing and Urban Affairs (MoHUA), Government of India that in the seven redevelopment of GPRA Colonies including Netaji Nagar, infrastructure for traffic decongestion will be developed simultaneously and possession of buildings will be given only after additional infrastructure for smooth traffic is provided. Accordingly, the affidavit has been submitted by MoHUA in the Hon,ble High Court of Delhi.

Planning of pedestrian facilities

Pedestrian facilities shall be planned for movement of pedestrians on all major corridors and junctions. The pedestrian facilities which shall be provided for the safe movement of pedestrians are

- Footpaths along the road
- Zebra markings
- Grade-separated pedestrian facilities viz. subways and pedestrian over bridge for across movement of pedestrian.
- Pedestrian Guard Rails, Road safety Signage and overhead signs shall be placed on a structurally sound gantry or cantilever structure made of circular pipes or steel sections

4.4.2.9 Social Economy and Livelihood

During operational phase, certain impacts might emerge which will affect the local population positively. The anticipated impacts have been given below:

- With the onset of new project activities, employment opportunities might increase among the local population. The unskilled local population of the adjoining areas will find job opportunities as drivers, security guards, cleaners, housekeeping etc. which will improve their economic condition.
- With the execution of the project, there will be more transport facilities plying to the area thus, benefitting the population living in the area in the long run.
- Development of infrastructure will also take place with the coming of the project in the area. The project will involve activities like road upgrading and better power supply in the area. This will enhance the existing structure and also encourage further development in the surroundings.

4.4.2.10 Impact Analysis on Neighboring Reserve Forest

The Central Ridge Reserve Forest is located at a distance of 2.5 km from the proposed project site. Hence, there will not be any hindrance to the reserve forest due to the proposed redevelopment activity. The management of Reserve Forest includes

- Improving the environment and reducing the ill-effects of pollution by preserving existing vegetation and through plantations of suitable local species as per the site conditions.
- Increasing the green cover of the area.
- Gradually suppressing the monoculture plantations of exotic species by raising mixed plantations of local species.
- Protecting the forests from encroachment.
- Creating favorable conditions for protection and development of wildlife.
- Enhancing aesthetic beauty of the forest, providing shade along the length of strips passing through the city and to create recreational centers.
- Fencing of the areas that are in the vicinity of the industries, workshops, housing estates, slum, etc. Live hedges in combination with barbed wire fence can be very effective. It increases the stability of the main fence. They also act as soil binders.
- A species chosen for live hedge should be fast growing with long and stout spines or horns, thick and bushy in form.

4.5 GREENBELT DEVELOPMENT

Implementation of garden and greenbelt development is of paramount importance in development of the proposed redevelopment project. In addition to augmenting the existing vegetation, it will also prevent soil erosion, make the ecosystem more complex and functionally more stable, make the climate more conductive and restore water balance.

The greenbelt helps to capture the fugitive emissions and to attenuate the noise generated in the premises apart from improving the aesthetics of the site. Plantation program should be undertaken in all available areas. This would include plantation in the premises, along the internal and external roads and in between buildings. The plant species selected for greenbelt shall include the native species. These saplings should be planted in rows. About 41 % (1,81,384 Sq.m) of the project site shall be brought under greenbelt/green cover program.

The plantation at the proposed redevelopment project shall take into consideration of the existing social forestry in the region. The proposed plantation shall cover the following design aspects:

- There shall be a greenbelt all around the project site
- All along the internal and external roads, plantation shall be taken up
- Shrubs and trees shall be planted in encircling rows around the project site
- Planting of trees in each row shall be in staggered orientation (Triangular form)
- Since the trunks of the tall trees are generally devoid of foliage, it will be useful to have shrubs in front of the trees so as to give coverage to this portion
- Standard pit size will be 1 m x 1 m x 1 m
- The pits shall be filled using good soil from nearby agricultural fields (3 parts) and farmyard manure (1 part).

4.5.1 Plant Species for Greenbelt

Based on climate and soil characteristics of the study area, some species are recommended for plantation. In order to have a ground cover, some fast growing

species, which do not require watering, have been recommended for mass plantation. The green belt in the project site for both existing and proposed includes tree plantation Ashoka, Neem, Palm, Pine, Bamboo, etc.

All plants shall be of the size specified in the Plant Schedule at the time of delivery to the site and shall be obtained from an approved source. Trees shall have a minimum caliper (measured at 500 mm above ground level) of 15mm or more as specified. Shrubs and ground covers shall be twin or multi stemmed.

All plants shall be well-balanced and well formed, sound, vigorous, healthy and free from disease, sunscald, abrasion, harmful insects or insect eggs and with a healthy, unbroken root system filling their containers but not root-bound. Unless otherwise specified only nursery-grown plants will be used. All plants shall be container grown. Samples from all plant material shall be made available for approval by the Engineer. All planting shall be certified free of pests, viruses etc.

As per guidelines of CPCB, the three main criteria for selection of plants may be as follows,

- Trees, shrubs will have dense foliage with a large surface area, because leaves absorb pollutants.
- Evergreen trees are found to be more effective.
- The species chosen must be resistant to pollutants, particularly in the early stages of their growth.
- The species chosen may be native species and drought tolerant.

5. ANALYSIS OF ALTERNATIVES (SITE & TECHNOLOGY)

5.1 INTRODUCTION

This chapter presents a comparative analysis of various alternatives to be considered to avoid or minimize impacts that would be inevitable. The consideration of alternatives to a proposal is a requirement of the EIA report.

5.2 SELECTION OF SITE

The existing site will be redeveloped for General Pool Residential Accommodation, GPOA, SARTAC Office & Hostel and other Social Infrastructre. The selection of site for the proposed project is determined by the following factors.

- Location
- Proximity to sources of supply of raw materials
- Proximity to water source
- Proximity to Treated Sewage discharge
- Proximity to power source
- Availability of land for the development of greenbelt
- Availability of labour source in the proximity
- Connectivity
- Acceptability of site from Environmental aspects like availability of areas for solid waste disposal.

A. Location

The proposed project is redevelopment of General Pool Residential Accommodation (GPRA) Colony at Netaji Nagar, Africa Avenue Marg, Chanakyapuri Tehsil, New Delhi District. The site co-ordinates are 28°34'29.11"N Latitude and 77°11'8.36"E Longitude.

B. Proximity to sources of supply of raw materials

All Construction raw materials will be transported by road and purchased from local sources.

C. Proximity to water source

The total fresh water requirements during Operation Phase will be 1,874 KLD, which will be sourced through New Delhi Municipal Council (NDMC) and there will be no drawl of ground water during the operation phase of the project.

D. Proximity to Treated Sewage Discharge

The sewage generated during operation phase will be 2,564 KLD which will be treated through proposed sewage treatment plant of 2,564 KLD based on MBR Technology. The treated sewage will be utilized for toilet flushing (1,183 KLD), Green belt development (544 KLD), HVAC (558 KLD) and the excess (580 KLD) will be supplied to NDMC for horticulture in surrounding area.

E. Proximity to Power source

Power will be availed from New Delhi Municipal Council (NDMC). Total Electric load for the proposed redevelopment project is 37,940 KW and power back up with DG set of 2 x 600, 7 x 500, 3 x 400, 1 x 320, 2 x 250 KVA for residential and 1x 600 kVA, 1x500 kVA for sartac office, 10 x 2250 kVA for office and 2 x 500, 1 x 400, 1 x 125, 1 x 100, 1 x 75, 1 X 25 KVA for social infrastructure purpose will be utilized.

F. Availability of land for the development of greenbelt

The land allotted for development of greenbelt is 1, 81,386 sq.m (41% of total land area).

G. Availability of labour source in the proximity

Labors will be deployed by contractor from locally as well as outside.

H. Connectivity

The project site is well connected by road, rail and air ways. Safdarjung and Sarojini Nagar Railway station are located at 0.4 km North & 0.6 Km North East respectively from the project site. DTC Sarojini Nagar Depot and Hyatt Bus Stop are located at 0.07 Km East and 0.09 Km South respectively.

I. Acceptability of site from Environmental aspects like availability of areas for solid waste disposal.

The estimated quantity of Municipal solid waste generated during operation phase will be 18,696 kg/day. Bio degradable waste will be treated through proposed Organic Waste Converter. Non Bio degradable waste and inert waste will be disposed to Authorized Recyclers.

6. ENVIRONMENTAL MONITORING PROGRAM

An Environmental Monitoring Plan provides feedback about the difference between actual environmental scenario and the impacts of the project on the environment and helps to judge the adequacy of the mitigation measures provided in protecting the environment. The purpose of environmental monitoring is to evaluate the effectiveness of implementation of Environmental Management Plan (EMP) by periodically monitoring the important environmental parameters within the impact area, so that any adverse effects are detected and timely action can be taken.

6.1 OBJECTIVIES

- To ensure implementation of mitigation measures during project implementation;
- To provide feedback to the decision makers about the effectiveness of their actions;
- To determine the project's actual environmental impacts so that modifications can be made to mitigate the impacts;
- To identify the need for enforcement action before irreversible environmental damage occurs;
- To provide scientific information about the response of an ecosystem to a given set of human activities and mitigation measures;

6.2 SUGGESTED ENVIRONMENTAL MANAGEMENT PLAN

As per the guidelines of MoEF&CC, environmental monitoring shall be required during construction and operational phases. The schedule for monitoring ambient air quality, ambient noise quality, ground water quality, and waste water quality both during the construction and operation phases of the project is given in Table 6.1

TABLE 6.1 ENVIRONMENTAL MONITORING PLAN

S. No	Particulars	Monitoring Frequency	Duration of Sampling	Important Monitoring Parameters
1.	**Ambient Air Quality Monitoring**			
a)	Project site	Once in 3 Months	24 hr continuously	PM_{10}, $PM_{2.5}$, SO_2, NOx, and CO
2.	**Stack Monitoring**			
a)	DG Set - Stack	Once in 3 Months	30 - 60 min	SO_2, NOx, PM, CO, Temperature, Flow rate & Velocity of the gas
3.	**Ambient Noise Level**			
a)	Near DG set	Once in 3 Months	8 hr continuous with 1 hr interval	Noise level in dB(A)
4.	**Ground / Drinking Water Quality Monitoring**			
a)	Ground Water at project site	Once in 6 Months	Grab Sampling	Major parameters etc as per Parameters specified under IS:10500, 2012
5.	**Sewage Quality Monitoring**			
a)	STP Inlet	Once in a Month	Grab Sampling	Physical (major), Chemical & Biological Parameters specified under IS:2490:1982
b)	STP Outlet			
6.	**Soil Quality**			
a)	At the green belt area	Once in 6 months	Samples to be collected from three different depths viz., 30cm, 60cm, and 100cm below the surface.	Parameter for soil quality: pH, texture, electrical conductivity, organic matter, nitrogen, phosphate, sodium, calcium, potassium and Magnesium.

Source: *ABC Techno Labs India Pvt. Ltd.*

7. ADDITIONAL STUDIES

7.1 DISASTER MANANGEMENT PLAN

7.1.1 INTRODUCTION

Disaster means a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or manmade causes, or by accident or negligence which results in substantial loss of life or human suffering or damage to and destruction of property, or damage to or degradation of environment and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area.

Disaster Management Plan (DMP) gives a broad idea of Emergency preparedness in case of an accident. Thus an appropriate DMP shall be prepared in consultation with the project proponent, architect, service consultant and maintenance staff. DMP envisages the need for providing appropriate action so as to minimize damage and loss of life/property and for restoration of normalcy within the minimum time. Adequate manpower, training and infrastructure shall achieve this. An appropriate fire protection system is also developed to meet any emergency.

The emergencies are classified as demolition and construction hazard, natural hazard and Man-made hazard. Disaster risk reduction begins throughout our local communities. For greatest impact, these steps must be grounded in local knowledge and communicated broadly.

7.1.2 OBJECTIVES OF PLAN

This plan is developed to make best possible use of resources to:

- Rescue the victims and treat them suitably.
- Safeguard others (evacuating them to safer places).
- Contain the incident and control it with minimum damage.
- Identify the persons affected.
- Preserve relevant records and equipment needed as evidence in case of an inquiry.
- Rehabilitate the affected areas.

The following important elements in the disaster management plan (DMP) are suggested to effectively achieve the objectives of emergency planning:

- Reliable and early detection of an emergency and careful planning.
- The command, co-ordination, and response organization structure along with efficient trained personnel.
- The availability of resources for handling emergencies.
- Appropriate emergency response actions.
- Effective notification and communication facilities.
- Regular review and updating of the DMP
- Proper training of the concerned personnel.

In order to handle disaster/emergency situations, an organizational chart entrusting responsibility to various plant personnel has been prepared along with their specific roles during an emergency. The possible composition of the management team is given in Figure 7.1.

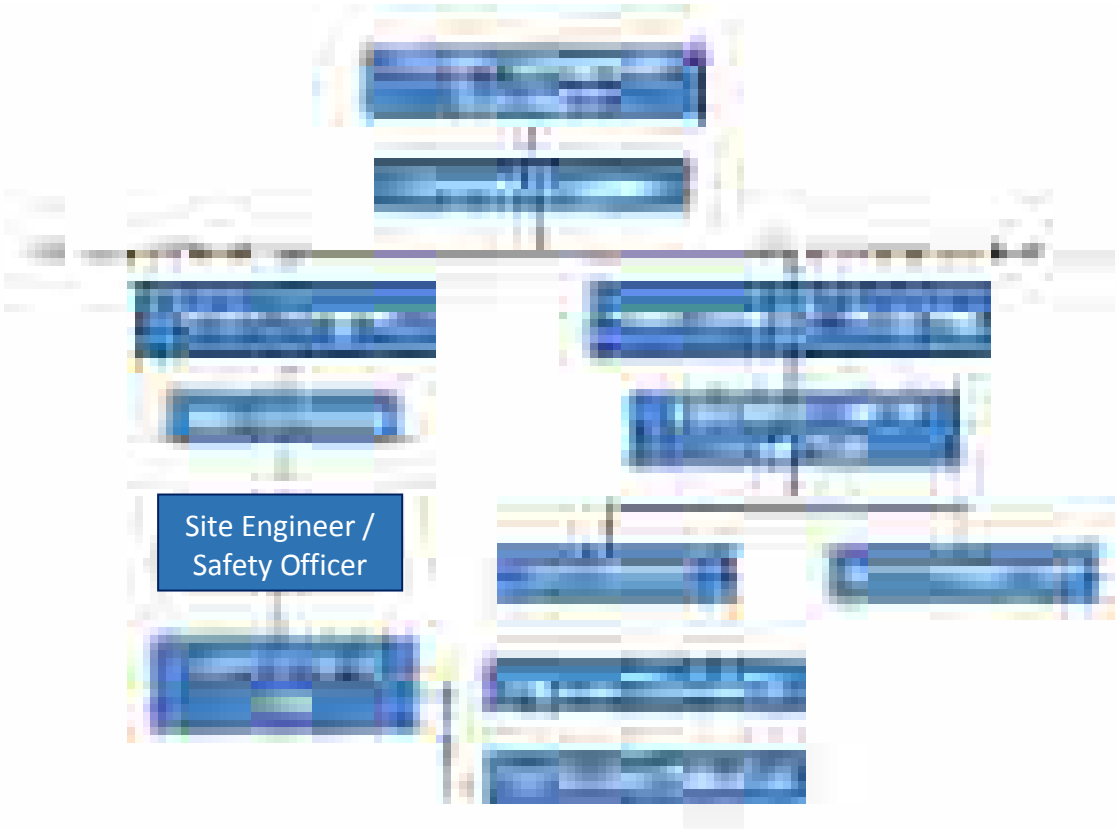


FIGURE 7.1. DISASTER MANAGEMENT TEAM

7.1.3 ROLES AND RESPONSIBILITIES OF MANAGEMENT TEAM

7.1.3.1 Construction Hazard:

During the construction time good construction practice and safety requirement should be enforced by the contractor at site. The construction manager can be the co-ordinator for the emergency management. Depending on the severity of the injury/ disaster, outside medical help can be obtained. Before commencement of the work the hospital facilities should be identified and the address and phone numbers to be made available to the contractor as well as the construction manager. Proper measures should be taken to ensure safety at heights. Fencing/railing should be provided at construction openings to prevent physical injuries and fall of construction workers.

Natural Hazard:

During natural hazard the emergency plan to be implemented with the help and guidance from the District Collector, who is the co-ordinator for such activity. Disaster Management Team (DMT) will also be responsible for disaster mitigation and disaster recovery. The primary mass disaster potential for the area is fire and water damage. Fire has an immediate response that can be delivered by the occupants or nearby Fire service Department. In terms of water damage this can occur via storm damage to roofs and/or flooding. In these instances access to tarpaulins and sand bags are critical. Coordination of these efforts is through the DMT.

Manmade/ Operational Hazard:

During the phase project proponent and maintenance staff becomes the co-ordinator for the emergency activity and the emergency cell will be acting in accordance with the disaster management plan (DMP).

Insurance: Key to the management of any disaster is having adequate insurance in place to:

- Reduce the loss in terms of assets if a disaster happens; and

- Reduce lost income in the event that the facility becomes unavailable or partly unavailable.

7.1.4 LEVELS OF DISASTERS

Based on severity of the disaster, degree of material and physical losses and assistance requirements different levels of disasters are being identified. The activation of the plan will be dependent on the declared level of disaster.

Level 0 (L_0) - This is a level during peace and normal times; time will be utilized for monitoring, prevention and preparatory activities. Capacity building of key departments, mock rescue, rehearsals, testing evacuation plans is rehearsed during this level. Similarly, response and recovery mechanisms are reviewed at state, district, level.

Level I (L_I) - At this level, district machinery can manage the disaster; state and central governments will monitor the progress and remain alert to activate other mechanisms if needed.
General inundation, crop losses, livestock losses, minor property losses and disrupted normal life due to disaster/incident.

Level II (L_{II}) - At this level, active participation of state departments, mobilizing resources at the state level and close monitoring in coordination with district machinery is warranted. Mobilizing rescue and recovery teams consisting of paramilitary forces may be required at this level. In addition to losses identified in LI, human and livestock losses and substantial property losses such as damaged homes, damaged infrastructure and isolation of an area due to the severity of the disaster are part of Level II.

Level III (L_{III}) - This is critical and highest level. State and district machinery would need active assistance from the union government. Mobilizing rescue and recovery teams consisting of paramilitary forces may be required at this level. Early warning mechanisms both at state and central government play significant role in identifying situations that may be declared as Level III disasters. Similar levels of losses are identified in LI and LII at higher proportions.

Activation of the plan would vary depending on the level of disasters and intensity as identified; however, at all levels, certain activities especially preparedness,

prevention and capacity building are round the year functions. Based on the information received from competent agencies like IMD, district administration and the degree of intensity, the State Executive Committee (SEC) in consultation with Revenue (Disaster Management) Department will identify the level of disaster and notify the impacted districts.

7.1.5 HAZARD VULNERABILITY RISK ANALYSIS

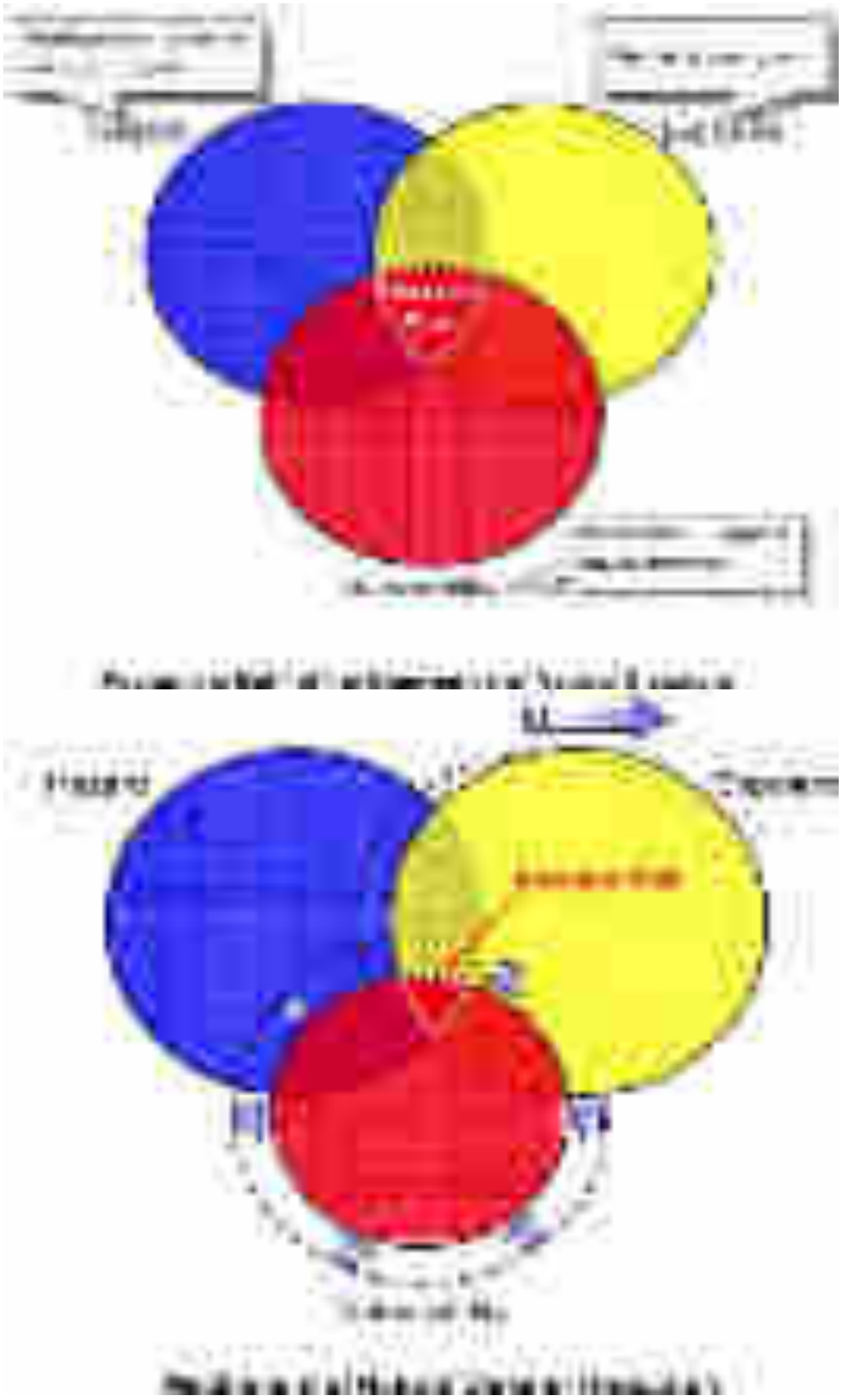
7.1.5.1 Basic Terminology

1. **Hazard** - Hazard is an event or occurrence that has the potential for causing injury to life or damage to property or the environment. The magnitude of the phenomenon, the probability of its occurrence and the extent and severity of the impact can vary. In many cases, these effects can be anticipated and estimated.

2. **Vulnerability** - Vulnerability is the degree to which a population, individual or organization is unable to anticipate, cope with, resist and recover from the impacts of disasters. Vulnerability is a function of susceptibility (the factors that allow a hazard to cause a disaster) and resilience (the ability to withstand the damage caused by emergencies and disasters and then to recover)

3. **Risk** - "Risk" is defined as the expectation value of losses (deaths, injuries, property, etc.) that would be caused by a hazard. Disaster risk can be seen as a function of the hazard, exposure and vulnerability as follows;
   Disaster Risk = function (Hazard, Exposure, Vulnerability)

To reduce disaster risk, it is important to reduce the level of vulnerability and to keep exposure as far away from hazards as possible by relocating populations and property. Growing exposure and delays in reducing vulnerabilities result in an increased number of natural disasters and greater levels of loss.



Source: *Asian Disaster Reduction Centre*

7.1.6 TYPES OF HAZARD

7.1.6.1 Natural Hazard

- **Earthquake**

An earthquake is a sudden shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface and followed by a series of vibrations. Earthquakes can cause buildings and bridges to collapse, telephone and power lines to fall, and result in fires, explosions and landslides.

Seismicity in Delhi

Delhi is located in zone IV which has fairly high seismicity where the general occurrence of earthquakes is of 5 - 6 magnitude, a few of magnitude 6 - 7 and occasionally of 7 - 8 magnitude. Delhi thus lies among the high-risk areas.

Geological Survey of India (GSI) reports mention that the bedrock depth is 60 m in the Patel Road area, 15 m in Connaught Place Central Park, 40 - 50 m near Rajghat and 150 m and beyond in the Yamuna river bed. Similarly, the depth is reported to be 80 - 100 m in the Aurobindo marg-Hauz Khas area

Recent Earthquakes in Delhi

Date	Latitude °N	Longitude °E	Magnitude
June 6,1992	28.65	76.69	2.8
February 16, 1993	28.63	76.35	2.6
March 27, 1993	28.63	77.20	3.6
SEPTEMBER 6,1993	28.64	77.14	2.5
December 3, 1993	28.60	77.40	3.5
July 28, 1994	28.51	77.25	2.8
October 15, 1994	28.59	79.92	2.8
November 16,1994	28.50	76.95	2.9
March 18, 1994	28.62	77.25	2.7
March 28, 1994	28.60	77.10	1.6
April 4, 2004	28.60	77.20	1.5
April 5, 2004	28.70	77.30	1.9
April 21, 2004	28.60	77.30	1.5
June 06, 2004	28.60	77.00	2.0
October 08,2004	-	-	5.6
December 26,2004	-	-	9.3

March 5, 2012	-	-	5
November 12, 2013			3.3

Figure 7.2 Seismic Zoning of India

Earthquake Resistant Construction

Promotion of Earthquake resistant construction mainly includes construction safety, quality control and proper inspection. Previously there were no specific guidelines on earthquake resistant constructions and seismic strengthening. Due to the very fact, most of the buildings till 1990s were built without any safety

measures. But in the present scenario, there are building byelaws and guidelines to construct earthquake resistant structures.

As per the National Disaster Management Authority of India, the Geographical areas which fall under seismic zones II, III, IV and V are vulnerable to potential impact of earthquakes, landslides, rock falls or mudflows. Proposed project site come in the Seismic Zone IV (High), the risk involves due to earth quake is high. Therefore all the structures in this zone shall be built in accordance with Earthquake-resistance.

I) For the Safety of Walls

- The mortar used in foundations and walls
- Size and placement of door, window openings in walls
- Length of the wall between the transverse walls
- Provision of horizontal seismic bands

  a. Plinth level

  b. Door and window lintel level

II) Provision of vertical steel bars

- In every corner / junction of walls
- The door and window jamb

III) For the safety of roofs or floors

- Rooftops / storey precast or precast

1V) General guidance for masonry

- Too much window openings make a wall weaker. The use of smaller size (less than 18 inches / 45 cm) in width between the two further increases the damageability.
- Richer mortar of cement and sand of 1:4 (cement 1 part with 4 parts of sand) causes the strongest earthquake shaking masonry against compared with 1:06 mortar by a factor of 2.5 to 3.0. Also 1:06 mortar is stronger than lime cinder

- Use of clay mud mortar produces the weaker masonry. The strength in dry condition reduces to less than 50 percent when the walls get wet during rains. Therefore, the use of a good plastering is essential to protect such masonry during the rainy months.

- The most important requirement of seismic safety is the provision of seismic bands on all floors in all external and inner walls. These bands sustain the integrity of the entire building as a unit under earthquake shaking and also increases the stability of walls.

A great disaster may occur if

A. An earthquake of sufficiently large magnitude,
B. Occurrence of the earthquake close enough to a population Centre, and
C. The population Centre having buildings which are not earthquake resistant.

7.1.6.2 Flood Hazard

An overflow of a large amount of water beyond its normal limits, especially over what is normally dry land.

Floods in Delhi

The flow of Yamuna within Delhi is by and large influenced by discharge from Tajewala Headwork 240 kms upstream. In the event of heavy rain in the catchment area excess water is released from Tajewala. Depending upon the river flow level downstream, it takes about 48 hours for Yamuna level in Delhi to rise. The rise in water level also causes backflow effect on the city's drains. The city also experiences floods due to its network of 18 major drains having catchment areas extending beyond the city's limits.

1978: (September) River Yamuna experienced a devastating flood. Widespread breaches occurred in rural embankments, submerging 43 sq km of agricultural land under 2 meters of water, causing total loss of the kharif crop. In addition to this, Colony of North Delhi, namely, Model town, Mukherjee Nagar, Nirankari Colony etc. suffered heavy flood inundation, causing extensive damage to property.

1988: (September) River Yamuna experienced floods of very high magnitude, flooding many villages and localities like Mukherjee Nagar, Geeta Colony, Shastry Park, Yamuna Bazzar and Red Fort area, affecting approximately 8,000 families.

1995: (September) The Yamuna experienced high magnitude floods following heavy runs in the upper catchment area and resultant release of water from Tajewala water works. Slow release of water from Okhla barrage due to lack of coordination between cross state agencies further accentuated the problem. Fortunately, the flood did not coincide with heavy rains in Delhi, and could be contained within the embankments. Nonetheless, it badly affected the villages and unplanned settlements situated within the river-bed, rendering approximately 15,000 families homeless.

List of Affected Area

As per the Flood Control Order-2014 following areas of Delhi are vulnerable to drainage congestion (Urban Flooding)

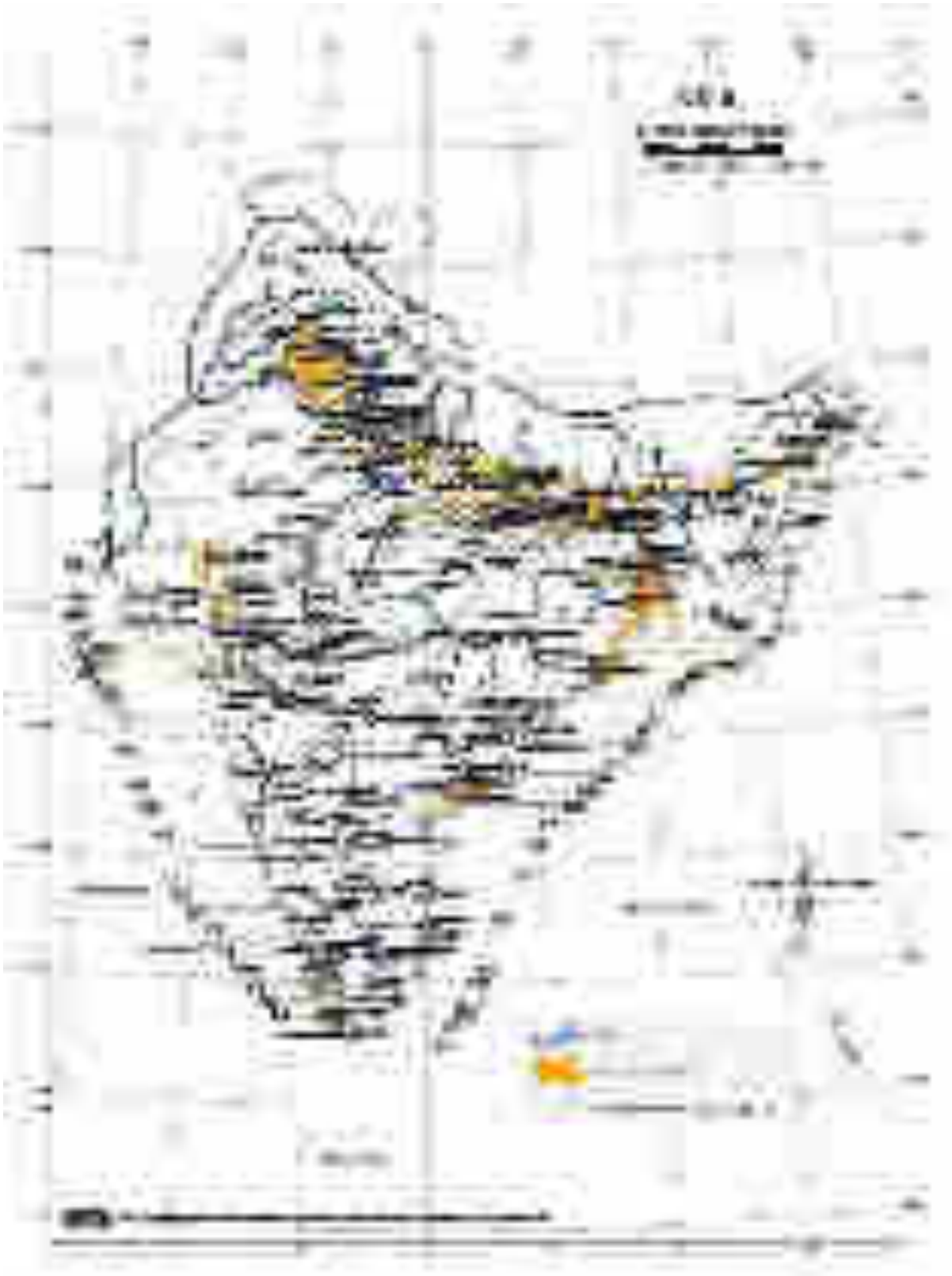


Figure 7.3 Flood Vulnerability Zones of India

Figure 7.4 Flood Vulnerability Zones of Delhi

Prevention & Mitigation Measures

- Increasing the elevation of the proposed building
- Flood proofing of the building such as flood walls and all air ventilation and openings shall be above the expected water level
- A natural depression suitably improved and regulated, if necessary or by diversion of a part of the peak flow to another river or basin, where such diversion would not cause appreciable damage.
- Channel and drainage by "V" channel, to reduce water retention within the channel and increase the water flow.
- Creating a spider drainage system with main drainage lines along the peripheral of the boundary is recommended to keep the buildings and assets

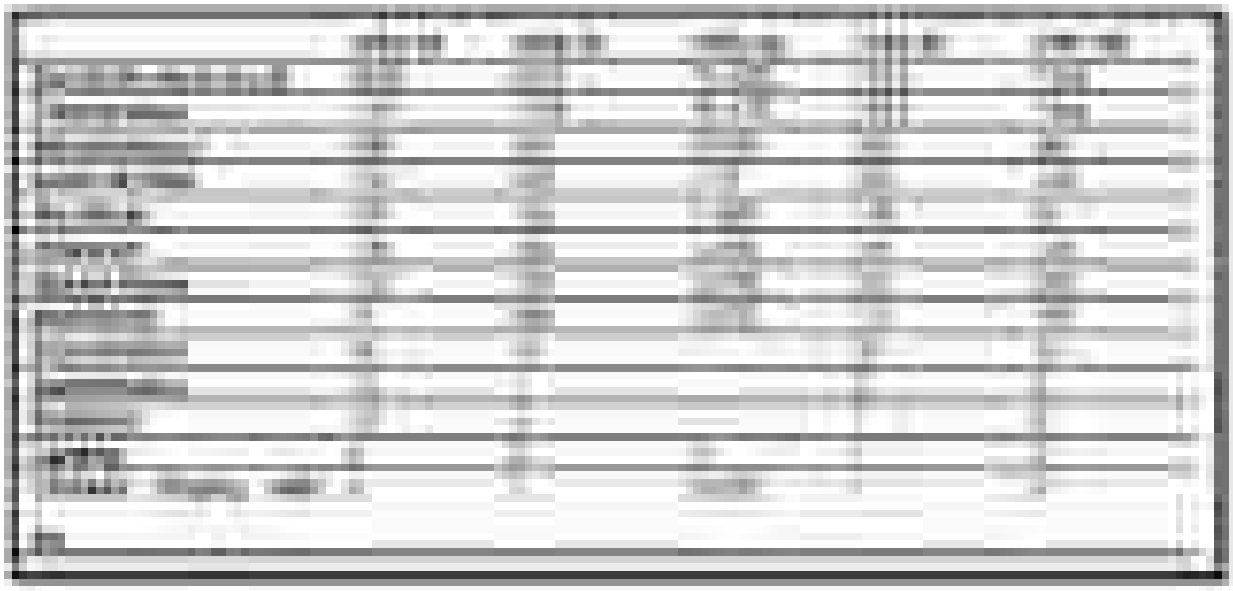
away from storm water lines. Thereby the normal to heavy rainfall would be collected through storm water drain and to be connected to rain water harvesting system to replenish the underground water.

7.2 Man Made Hazard

7.2.1 Fire Hazard

Fire hazards, for the purpose of this study, include fires due to LPG as well as short circuit of electrical systems.

Major Causes of Fire



Source: Delhi Fire Service Department, 2001

Vulnerable locations

- Storage areas of flammable / explosive material in the vicinity of populated areas
- Using improper practices of storage of cooking fuel such as LPG, kerosene etc.
- Multi-storied buildings, especially in cities, with inadequate fire safety measures
- Narrow lanes, congested, overcrowded buildings, old buildings with poor internal wiring.

Fire Safety Provision

Fire protection is one of the most essential services to be provided. The principal objective of the rescue and firefighting services is to save lives. For this reason, the provision for means of quick dealing with an accident or incident occurring at, or in the immediate vicinity of, any building, assumes primary importance because it is within this area that there is the greatest opportunity of saving lives. This must assume at all times the possibility of, and need for, extinguishing a fire which may occur either immediately following an accident or incident, or at any time during rescue operations. In the design component of the project, adequate measure is being taken as per the provisions of the National Building Code, 2016. The firefighting system will comprise the following,

A. Fire hydrant system

- Number of Exit, location and their width should conform to the requirements of NBC 2016
- Adequate fire water storage tank capacity to be provided.
- Hose reel assembly should be provided covering each floor
- Automatic / Manual fire call points as per NBC -2016 Norms shall be provided
- Alternative and independent power system should be provided to fire pumps.
- Emergency Lighting system

B. Fire hydrant system

- Select appropriate extinguisher for type of fire.
- Pull pin from squeeze handle.
- Test extinguisher by squeezing handles briefly.
- Approach fire aiming nozzle at base of fire.
- Squeeze handles and operate extinguisher in a sweeping motion.

C. Public Address System

As per appendix D.5 of part IV of NBC, every high rise building should have a public address system with 2 way communication to conduct evacuation in a

systematic manner & to communicate any messages to occupants on every floor from the control room.

D. Escape Route

As per section 8.2.5 of part IV of NBC, the escape route should be marked with a sign board on the corridor & passage to guide evacuation. Normally, the escape route sign board must be written in luminous paint for easy identification. This is to guide every occupant of the building who is bound to panic in the event of accident.

E. Portable fire extinguishers

Section: As per section 7.10.4 part IV of N.B.C.

First Aid Firefighting appliances are provided & installed in accordance with latest IS: 2190-1992 in the existing blocks. In the proposed blocks shall also be provided as per code.

F. Water fire extinguishers

- Two extinguishers per compartment/floor of building will be provided.
- As per requirement laid down in National Building Code of India, adequate capacity of the underground tank and overhead tanks will be provided.

G. MOEPA (Manually Operated Electric Fire Alarm)

Manually operated electric fire alarm (MOEPA) shall be provided near escape point in all building including machine rooms as per clause 9.3.9 of UBBL (Unified Building Bye Laws) - 2016 and the same shall conform to IS: 2189/1999.

H. Sprinkler System

Section: As per section 7.10.7 of part IV of NBC.

- The Automatic sprinkler system shall be installed in all the office building, having basements as per clause 9.3.9 of UBBL - 2016 in accordance with BIS: 15105/2002
- Sprinkler system is a must for basement parking & other risk areas where large quantities of combustible materials are stored.
- Each sprinkler should cover 6.96 m2 area

- The capacity of water tank shall be calculated on the basis of sprinklers.
- Sprinklers may connect to main water tank & pump.
- Detectors shall be installed as per IS 2189/ 1988.

I. CO2 Type

- For area where electrical fire is expected

J. Hose Reels

- Hose reels are used on fires involving wood, paper and textiles only, they are not to be used on live electrical appliances or flammable liquids.
- A hose reel containing 30m length of 20mm bore terminating into a shut nozzle of 5mm outlet connected directly to riser shall be provided as per clause 9.3.9 of UBBL-2016 in all building. This shall conform to IS: 884/1998.
- To release the hose reel, turn the valve on this will charge the hose and release the nozzle (if fitted with a nozzle release lock).
- The hose can then be pulled out to the fire, the nozzle operates like a garden hose in most cases by twisting the nozzle, and the nozzle can be adjusted to give a spray pattern or a straight jet.

K. Alternate Power Supply

As per appendix D-1.5 of part IV of N.B.C. a stand by generator shall be installed to supply power for staircase lighting, corridor lighting, fire pump, pressurization fan & blowers, in the event of disconnection of failure of main supply.

L. Fire Control Room

As proposed on the building plans a fire control room in each high rise building shall be established at entrance floor in accordance with the provisions contained in clause 9.3.10 of UBBL-2016. Trained personal shall be appointed round the clock to look after the fire protection arrangements in the building.

Emergency Response for Fire

A. Basic Actions

- Immediate action is the most important factor in the emergency control because the first few seconds count.
- Take immediate steps to stop Gas leakage / fire and raise alarm simultaneously.
- Stop all operations
- Electrical system except the lighting and firefighting system should be isolated. If the feed to the fire cannot be cut off, the fire must be controlled not extinguished.
- Start water spray systems in the areas involved in or exposed to fire risks.
- In case of leakage of gas without fire and inability to stop the flow, take all precautions to avoid source of ignition.
- Block all roads in the adjacent area and enlist police support for the purpose, if warranted.

B. Action in the Event of Fire

- Basic actions as detailed above.
- Extinguishing fires: A small fire at a point of leakage should be extinguished by enveloping with a water spray or a suitable smothering agent such as CO2 or DCP. Fog nozzles should be used.
- Firefighting personnel working in or close to un-ignited vapour clouds or close to fire, must be protected continuously by water sprays. Fire fighters should advance towards the fire downwind if possible.

7.2.2 Demolition Construction Hazard

The Demolition and construction work will be outsourced to private contractors. The Operational Phase Risk and hazard analysis and Management is described below.

7.3 Risk and Vulnerability Assessment

Risk Analysis

Risk has been defined by the United Nations as a measure of the expected losses due to a hazard event of a particular magnitude occurring in a given area over a specific time period. The level of risk depends upon the nature of the hazard, the vulnerability of the elements which it affects and the economic value of those elements. As communities grow larger, more established and more complex, experience has shown that the level of risk which they face increases. Risk Analysis means the identification of undesired events that lead to the materialization of a hazard, the analysis of the mechanisms by which these undesired events could occur and, usually, the estimation of the extent, magnitude, and likelihood of any harmful effects.

Vulnerability Analysis

The vulnerability of a particular element of society is defined as the degree of loss which it would suffer as a result of a specific hazard event. The nature of vulnerability and its assessment vary according to whether the element involved represents people and social structures, physical structures, or economic assets and activities. The vulnerability of an area is determined by the capacity of its social, physical and economic structures to withstand and respond to hazard events. The concept of vulnerability implies a measure of risk combined with the level of social and economic ability to cope with the resulting event in order to resist major disruption or loss. In this part, on the basis of nature of hazards, socio-economic parameters and institutional arrangements and community preparedness Strength, Weakness, Opportunity, Threats (SWOT) risk and vulnerability assessment has been conducted.

Vulnerability Matrix of Delhi											
District	**N**	**NW**	**C**	**W**	**SW**	**ND**	**S**	**SE**	**NE**	**SH**	**E**
Earthquake											
Flood											
Fire											
Building Collapse											
INDEX											

Districts	
N: North, NW: North West, C: Central, W: West, SW: South West, ND: New Delhi, S: South, SE: South East, NE: North East, SH: Shahdara, E: East	
Vulnerability:	
	High
	Moderate
	Low
	Nil

Table 7.1 Prevention & Mitigation Measures

Key Aspect	Mitigation Measures
Prevention or mitigation for disaster risk reduction	❖ Hazards, Risk, and Vulnerability Assessment ❖ Human resource development ❖ Launching demonstration projects ❖ Safety education in educational institutions ❖ Documenting lessons from previous disasters and ensuring their wide dissemination ❖ Preparing DM plans, regular updating, and mock drills ❖ Strengthening early warning systems ❖ Mainstreaming of disaster risk assessment, mapping and management into development plans and programs ❖ Revision of building codes and standards for rehabilitation reconstruction practices both for urban and rural areas ❖ Retrofitting techniques ❖ Rapid visual surveys for safety evaluation of buildings ❖ Training and skill development for masons and other artisans ❖ Promoting community-based DM taking into account specific needs, regional diversities and multi-hazard

	vulnerabilities ❖ Preparedness and response plans at all levels ❖ Community-based DRR and DM plan
Effective preparedness and response	❖ Emergency response capabilities – EOCs, infrastructure, equipment upgrades and adoption of best available technologies ❖ Strengthening of the Fire and Emergency Service through revamping, institutional reforms, and modernization ❖ Comprehensive revamping of Fire and Emergency Services with institutional reforms and modernization ❖ Adoption and adaptation of emerging global good practices ❖ Rigorous training and HRD of first responders ❖ Early warnings, maps/ satellite data/ effective dissemination of information ❖ Table-top exercises, simulations, and mock drills to improve operational readiness of the plans ❖ Rescue equipment at all levels ❖ Systems to provide basic services in emergencies ❖ Housing and Temporary shelters ❖ Medical care for casualties, health care and sanitation ❖ Power and fuel supply management ❖ Transportation systems and network
Recovery and Build Back Better	❖ Post-Disaster Needs Assessment systems and expertise ❖ Credible damage assessment mechanisms and expertise ❖ Studies on past disasters and recovery to draw useful lessons

Source: National Institute of Disaster Management (NIDM)

7.3.1 The Key Elements of Emergency Preparedness:

Once the likelihood of a disaster is suspected, action has to be initiated to prevent a failure. The project in-charge, responsible for preventive action will identify sources of repair equipments, materials, labour and expertise for use during emergency. The multiple floors of a high rise building create the cumulative effect of requiring great numbers of persons to travel great vertical distances on stairs in order to evacuate the building.

The Building in-charge will notify the occupants for the following information:

- Early Warnings (Through an alarm or Voice communication system)
- Exit routes (Adequate means of egress).
- Safety areas (Assembly points)
- Nearest infrastructure facilities (Medical aid / Fire aid)
- Occupant Familiarity with the plan through and Practice (Signages / Evacuation plan)

7.3.2 EMERGENCY COMMUNICATION SYSTEM

An efficient communication system is absolutely essential for the success of any disaster management plan. Different types of alarms to differentiate types of emergencies should be provided. In case of failure of alarm, placards/boards of various colors should be used to indicate the situations. If everything fails, a messenger should be used for sending the information and the various placards mentioned would also be used. This has to be worked out in consultation with local authorities involving police and fire department, hospital department considering the following points.

- ✓ Identify the relevant officials to be involved for the first, second and third level of information
- ✓ Preparation of the telephone directory of these officials and making available to all concerned
- ✓ Allotment of toll free number to a central communication center
- ✓ Provide wireless communication tools to safety and security and communication officers
- ✓ Empowering central communication center with latest communication equipment and tools

7.3.3 EMERGENCY PLANNING COMMITTEE

To ensure coordinated action, an Emergency Planning Committee will be constituted. An Emergency evacuation plan based on local needs and facilities available will be prepared. The broad content of plan will include following:

- ✓ Demarcation of the areas to be evacuated with priorities.
- ✓ Safe area and shelters.
- ✓ Security of property left behind in the evacuated areas.
- ✓ Functions and responsibilities of various members.
- ✓ Setting up of joint control action.

An elaborate safety arrangement is designed for the proposed project as per the requirement of National Building Code Part-IV.

Assembly areas for all type of buildings are allocated in their respective landscape area which is sufficient for the emergency period.

7.3.4 Evacuation Path

The road straight to the entrance gate is quite wide and no hazardous installation besides the road. This road can be taken as the evacuation path.

The occupants of the fire floor and floors above and below should immediately use the exit stairs to descend to a floor level that is least a few floors below the Fire Floor. It is never appropriate to use the elevator during building emergency. Buildings shall have written evacuation procedure for all emergencies.

7.3.5 Infrastructure

Following infrastructure & systems should be provided to meet emergencies.

a) First aid boxes
b) Gas masks
c) Telephone line with STD facility
d) Emergency lighting system
f) Stretchers
g) Transport facility
h) Fire-fighting machinery

7.3.6 Emergency Services

This includes fire-fighting system, first aid center, hospital etc. Alternate sources of power supply for operating fire-pumps, communication with local bodies, fire-brigade etc. should also be clearly identified. Adequate number of external and internal telephone connections should be installed.

7.4 Record Keeping and Reporting

Records will be maintained for regulatory, monitoring and operational issues. Log book of Equipment inspection and calibration records, Vehicle maintenance and inspection records, incident records, Maintenance of Corporate Social Responsibilities towards the society even after the completion of construction of the project work and during the Operation/maintenance phase.

TABLE 7.2 FACILITES NEAR TO THE BUILDING IN CASE OF NATURAL DISASTER

S. NO	Description	Distance	Direction	Contact No
1.	Charak Palika Government Hospital	1.0 km	NW	+91 11 2611 7879
2.	Apollo Hospital	1.4 km	ESE	099990 11202
3.	Safdarjung Hospital	1.4 km	E	011 2616 5060
4.	AIIMS Hospital	1.9 km	E	011 2658 8500
5.	Sadhu Vaswani Mission Medical Centre	1.37 km	WNW	+91 11 2411 4316
6.	Primus Super Specialty Hospital	1.56 km	NNW	+91 11 6620 6630
7.	Nehru Homoeopathic Medical College and Hospital	3.8 km	E	+91 11 2433 4225
8.	Max Super Speciality Hospital	5.2 km	SSE	+91 11 2651 5050
9.	Police Control Room	-	-	100
10.	Ambulance	-	-	101
11	Delhi Fire Station	0.3 km	S	+91 11 2617 3583
12.	Safdarjung Fire station	2.5 km	NE	+91 11 2461 1111
13.	Fire Station Naraina	7.6 km	NW	91 11 2579 8798
14.	Hari Nagar Fire Station	8.73 km	NW	+91 11 2514 1433
15.	Coastal security helpline	-	-	1093

8. PROJECT BENEFITS

8.1 INTRODUCTION

The project will have huge socio-economic impact benefits in the region as a whole. The project will generate employment opportunities to the local people thereby upgrading the prosperity of the region. Thus the project will enhance the economic status of the neighboring community both during construction and operational phase. The project thus provides advance facilities for Government Offices (GPOA) and General Pool residential accommodation (GPRA).

8.2 CONSTRUCTION PHASE

8.2.1 Employment

The major benefit due to the proposed project will be in the sphere of generating temporary employment for substantial number of workers. Construction workers will be deployed locally benefiting them to a great extent.

8.2.2 Community Services

The proposed project will employee local people to the extent possible reducing the need for creation of additional infrastructure.

8.2.3 Transportation

The Construction phase will involve movement of material of great magnitude. The material to be transported includes earthwork, concrete, steel and other materials. Transportation of construction materials to the project site will result in increased traffic in the area, which will certainly put additional load on the existing road infrastructure. This will be temporary phase and same will be regulated by implementing suitable traffic control measures.

8.3 OPERATION PHASE

8.3.1 Socio-Economic and Community Development

The socio-economic conditions of the population in the region represent the standard and quality of life. The important indicators, which decide the quality of life and require to be improved for better living conditions are literacy levels, occupational

structure, industrial development, infrastructure facilities, transportation and communication facilities etc.

A full time Community development team is employed to supervise the development activities. The social welfare activities planned include:

- Health
- Women empowerment
- Socio religious activity
- Infrastructure development and
- Income generation (employment)

8.4 CORPORATE SOCIAL RESPONSIBILITY

The proposed project is redevelopment of General Pool Residential Accommodation, GPOA, SARTAC Office & Hostel and other Social Infrastructre. NBCC (India) Limited is a blue-chip Government of India Navratna Enterprise under the Ministry of Housing and Urban Affairs and Corporate Social Responsibility as applicable shall be implemented.

9. ENVIRONMENTAL COST BENEFIT ANALYSIS

Not applicable as this chapter is needed if recommended at the scoping stage.

10. ENVIRONMENTAL MANAGEMENT PLAN

10.1 GENERAL

An Environmental Management Plan (EMP) is a site specific plan developed to ensure that the project is implemented in an environmentally sustainable manner where all contractors and subcontractors, including consultants understand the potential environmental risks arising from the proposed project and take appropriate actions to properly manage that risk. EMP also ensures that the project implementation is carried out in accordance with the design and the mitigation measures as recommended in the Environment Impact Assessment study, to reduce the adverse impacts during the project's life cycle. The plan outlines existing and potential problems that may adversely impact the environment and recommends corrective measures where required. Also, the plan outlines roles and responsibility of the key personnel and contractors who are charged with the responsibility to manage the proposed project site and its surroundings.

The EMP is generally:

- Prepared in accordance with the approved ToR given by MoEF&CC and in compliance with the rules and requirements of Central Pollution Control Board (CPCB)
- To ensure that the proposed facilities are operated in accordance with the design
- A process that confirms proper operation through supervision and monitoring
- A system that addresses public complaints during construction and operation of the facility and take appropriate corrective action plans to overcome those unwanted situation
- A plan that ensures remedial measures are implemented immediately

The key benefits of EMP are that it provides the organization with means of managing and improving its environmental performance thereby allowing it to contribute to better environmental quality. The other benefits include cost control and improved relations with the stakeholders. EMP includes four major elements.

10.2 ELEMENTS OF EMP

Commitment & Policy: The proposed project management will strive to provide and implement the Environmental Management Plan that incorporates all issues related to environmental and social components and will comply with the suggestions given by MoEF&CC.

Planning:This includes identification of environmental impacts and setting environmental objectives. The various potential impacts are discussed under Chapter 4.

Implementation: This comprises of resources available to the developers, accountability of contractors, training of operational staff associated with environmental control facilities and documentation of measures to be taken.

10.3 PLAN FOR ENVIRONMENTAL MANAGEMENT

Based on project description, Environmental Baseline Data and Environmental Impacts, the Environmental Management Plans are suggested of the following:

- Institutional set up for EMP Implementation
- Construction Safety and Occupational Health Management
- Rain Water Harvesting
- Solid waste Management
- Green Belt Development & Management
- Energy Management

10.3.1 ENVIRONMENTAL MANAGEMENT CELL (EMC)

- Environment Management Cell (EMC) will look after the environment related matters during the construction and operation phase of the project. EMC will perform the following assignments.
- Periodic monitoring of emissions and report any abnormalities for immediate corrective measures.
- Periodic monitoring of ambient air quality, ground and surface water quality.
- Periodic noise monitoring of the building zone and surrounding area.
- Regular monitoring of storm water drains.

- Green belt plantation, maintenance, development of other forms of greenery.
- Regular monitoring of solid wastes quantity and ascertaining avenues for utilization of solid wastes.
- Development / maintenance of schemes for water conservation.

The Environmental Management Cell (EMC) will take the overall responsibility for coordination of the actions required for environmental management and mitigation, and for monitoring the progress of the proposed management plans and actions to be taken.

The organizational set up of the Environmental Management Cell is shown in Figure 10.1.

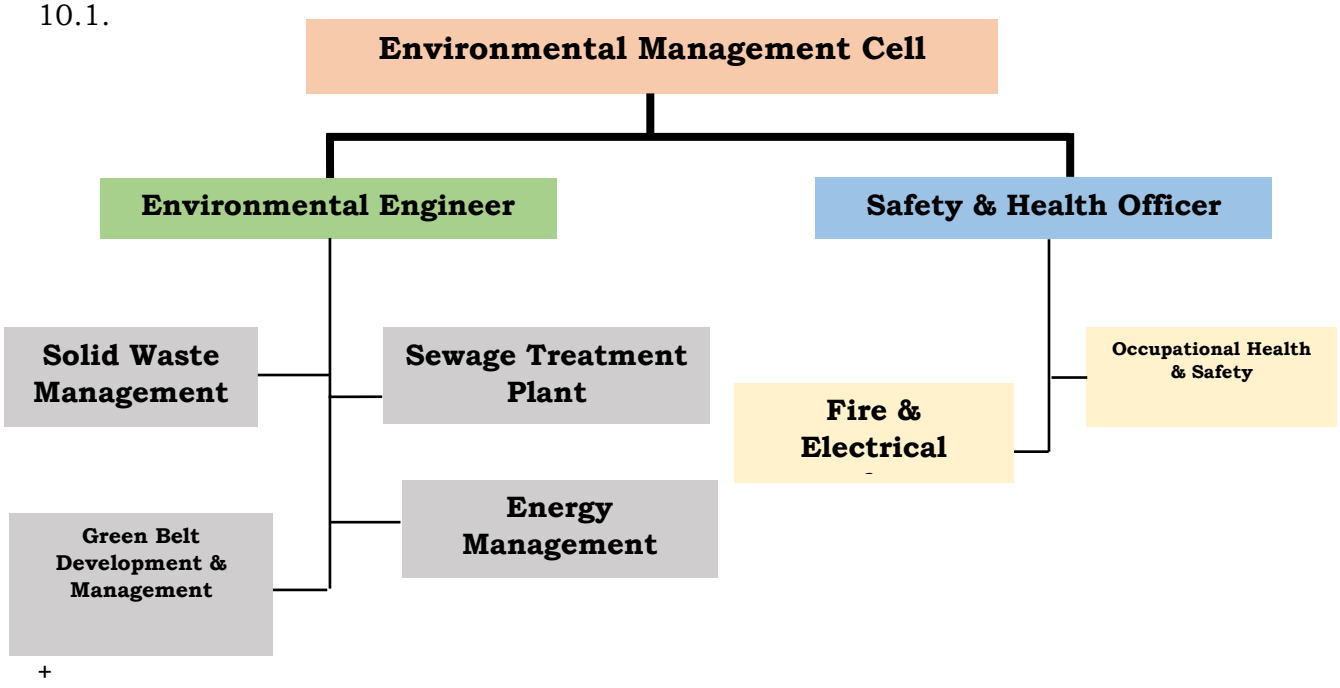


FIGURE 10.1 ENVIRONMENTAL MANAGEMENT CELL

Source:*ABC Techno Labs India Pvt. Ltd.*

10.4 ENERGY CONSERVATION &MANAGEMENT

Construction of the buildings will require additional power and energy requirement. To minimize the energy consumption, buildings will be designed and constructed according to Energy Conservation Building Code 2017 andalso to reduce heat gain, use of ASHRAE 90.1 which sets minimum energy standards for buildings.

The following methods could be implemented to the proposed buildings.

- Use of CFL/LED light fittings or star rated light fittings in common areas
- Usage of Solar water heating systems.
- Usage of energy efficient equipment and appliances.
- Use of glazed windows with proper sealing to minimize infiltration.
- Use of copper wound transformer.
- Use of occupancy sensors and dimmers for lights in the parking areas.
- Use of gearless, machine room less elevators with variable frequency drive motors for energy
- Use of Variable frequency drives motors in pumps.

TABLE 10.1 ENERGY SAVINGS CALCULATION

ENERGY SAVING IN EXTERNAL LIGHTING						
(A)	Electrical load Calculations by using HPSV lamps (100% of Total Fixtures 477)					
Type of load Diversity						
S. No.	Point description	Total qty. (in Nos.)	Load for each (in watts)	Total load (in watts)	Diversity	Working load (in KW)
1	Sodium Street Lights	477	70	33,390	1	33.39
Total						33.39
Total Consumed per hour						33.39
Operating Time Assumed In a day						10hour
Energy Consumed Per day						333.90
Energy Consumed Per Annum					A	1,21,874KW
(B)	Electrical load Calculations by using 20% Solar Lighting LED (20% of Total Fixtures 477)					
Electrical load Calculations by using LED lamps (80% of Total Fixtures 477)						
Type of load Diversity						
S. No.	Point description	Total qty. (in Nos.)	Load for each (in watts)	Total load (in watts)	Diversity	Working load (in KW)

1	Solar Street Lights	95	40	3800Watts	1	3.80
2	LED Street Lights	382	60	22920Watts	1	22.92
Total						26.72

(C)			
(i)	*Total Energy Consumed per hour by Solar Street Lights*		*3.80KW*
	Operating Time Assumed In a day		*10hour*
	Energy Consumed Per day		*38 KW*
	Energy Consumed Per Annum	*B*	*13,870KW*
(ii)	*Total Energy Consumed per hour by LED Street Lights*		*22.92KW*
	Operating Time Assumed In a day		*10hour*
	Energy Consumed Per day		*229.2 KW*
	Energy Consumed Per Annum	*C*	*83,658KW*
(D)	*Total Energy Consumed per Annum by Solar light & LED Street Lights*	*D*	*97,528 KW*
	Energy Save Per Annum	*A-D*	*24,346 KW*
	Percentage Energy Save Per Annum		*19.97 %*
	Hence by following above steps we can save around 24,346 units/Annum.		
	Hence by following above steps we can save around 66.7 units/day		

Source: *NBCC (India) Limited*

TABLE 10.2CALCULATION ON SIZING OF SOLAR WATER HEATING SYSTEMS

Type	No of towers	Total Units	Total population	Total water requirement @86 LPCD per person	Domestic requirement @ 65 LPCD	Total hot water 20 % of domestic per tower	Solar water requirement 20% of hot water requirement per tower	Say
YPE II A	18	1414	6363	547218	413595	4595.5	919.1	1000 X 18 Nos
Type II B	1	59	265.5	22833	17257.5	3451.5	690.3	700 X 1Nos
TYPE III A	17	1335	6007.5	516645	390487.5	4593.97	918.79	1000 X 17 Nos.
Type III B	1	59	265.5	22833	17257.5	3451.5	690.3	800 X 1 Nos.
TYPE IVA	6	233	1048.5	90171	68152.5	2271.75	454.35	500 X 6 Nos.
TYPE IVB	13	556	2502	215172	162630	2502	500.4	600 X 13Nos.
TYPE V	13	559	2515.5	216333	163507.5	2515.5	503.1	600 X 13 Nos.
TYPE VI	16	512	2304	198144	149760	1872	374.4	400 X 16 Nos.
SARATEC Hostel								400 X 1 Nos.
Total solar units								85 Nos.

10.5 DEVELOPMENT OF GREENBELT

10.5.1 OBJECTIVIES

The main objective of the greenbelt is to provide a barrier between the plant and the surrounding areas. The greenbelt helps to capture the fugitive emissions and to attenuate the noise generated in the plant apart from improving the aesthetics of the plant site. Plantation program shall be undertaken in all available areas. This should include plantation in the project site premises, along the internal and external roads, along the administrative buildings and other open areas. The tree species selected for greenbelt include the native species. These trees will be planted in several rows with a tree density of 400 trees/ha.

10.5.2 DESIGN OF GREEN DEVELOPMENT

To provide a dense tree cover and to provide good sound and dust barriers, the tree species are to be planted in open areas of the redevelopment project. As per guidelines of CPCB, the three main criteria for selection of plants may be as follows,

- Trees, shrubs will have dense foliage with a large surface area, because leaves absorb pollutants.
- Evergreen trees are found to be more effective.
- The species chosen must be resistant to pollutants, particularly in the early stages of their growth.
- The species chosen may be native species and drought tolerant.

TABLE 10.3 DETAILS OF GREENBELT DEVELOPMENT

1.	Greenbelt Area	**1,84,769Sq.m**
2.	Existing No. of. Trees	**3,906**
3.	No. of Trees to be felled	**1,600 (+/- 5%)**
4.	No. of Trees to be retained	**2306 (+/- 5%)**

TABLE 10.4 LIST OF EXISTING TREES IN THE PROJECT SITE

S. No	Name	No of trees	S. No	Name	No of trees
1	*Alstonia*	154	33	*Kasia Semia*	1
2	*Amaltas*	275	34	*Kathal*	11

3	*Amla*	8	35	*Keekar*	17
4	*Arjun*	16	36	*Lasoda*	5
5	*Ashoka*	479	37	*Lemon*	53
6	*Babul*	2	38	*Mahuwa*	1
7	*Bael*	95	39	*Mango*	313
8	*Bakain*	178	40	*Marod Fali*	27
9	*Banyan*	38	41	*Mehandi*	11
10	*Ber*	15	42	*Molesary*	36
11	*Bogan Balia*	2	43	*Morphankhi*	3
12	*Bottle Brush*	34	44	*Neem*	294
13	*Bottle Palm*	2	45	*Palm*	16
14	*Chameli*	5	46	*Papri*	116
15	*Champa*	85	47	*Patranja*	31
16	*Chandni*	4	48	*Pilkhan*	153
17	*Christmas Tree*	7	49	*Pipal*	131
18	*Dry Tree*	21	50	*Rajni Pilas*	1
19	*Eucalyptus*	29	51	*Rehta*	2
20	*Ficus*	91	52	*Rubber Plant*	15
21	*Guava*	72	53	*Sagwan*	3
22	*Gullar*	93	54	*Sahjan*	143
23	*Gulmohar*	19	55	*Sahtoot*	287
24	*Harshringar*	45	56	*Satranji*	2
25	*Imli*	7	57	*Semal*	74
26	*Jamun*	137	58	*Sheesam*	11
27	*Jungle Jalebi*	27	59	*Silver Oak*	12
28	*Kachnaar*	27	60	*Sirus*	19
29	*Kadam*	2	61	*Sirus Safed*	3
30	*Kadipatta*	57	62	*Sonjanam*	2
31	*Kaner*	77	63	*Ullu*	9
32	*Karonda*	1			
Total					**3906**

FIGURE 10.2 GREENBELT DEVELOPMENT PLAN

Source: *NBCC (India) Ltd*

10.6 RAIN WATER HARVESTING SYSTEM AND STORM WATER MANAGEMENT

Rain water harvesting trenches will be constructed all around the compound wall to collect rain water. Excess storm water will be allowed to drain into the external storm drain. The depth of the trench will be 1.2 m and the width will be 0.9 m. The trench will be filled with rounded pebble 25 to 40 mm size. The sectional detail of the proposed rain water recharge pit. The existing rainwater harvesting structures are given in Figure 3.3. The latest modular type rain water harvesting system shall be implemented.

The path ways around the harvesting lines will be graded to facilitate drainage into trenches proposed around the compound. Recharge wells/pits are envisaged along the path of the storm water drains for rain water recharging & surplus water from the recharge wells/pits shall be diverted to the storm water drainage network.

The collected storm water will be allowed to percolate to the sub-soil by suitably designed percolation pits. The pits will be designed based on the soils percolation capability. The subsoil water table is high in these areas and however harvesting pits with bores will be provided.

Percolation pits of suitable numbers will be provided for recharge of ground water potential. A total of **62** rain water harvesting pits will be constructed. The quantity of run-off water potential for the proposed construction project is given below. The rainwater harvesting arrangement helps in replenishing the underground water column and soil lithography is given in Table 10.5.

TABLE 10.5 SOIL LITHOGRAPHY

Sl. No.	Depth Below G.L.(m)	Soil Classification
1.	0.0 - 1.0	Filled up (Building Material)
2.	1.0 - 2.50	Coarse grained soil (Silty Sand)
3.	2.50 - 2.80	Silty sand - sandy gravel
4.	2.80 - 4.50	Sandy silt of low plasticity
5.	4.50 - 6.00	Silty sand
6.	6.00 - 12.00	Fine coarse grained silty sand
7.	12.00 - 27.00	Rocky Strata

Source: *Soil Test Report*

Rain Water harvesting will be done through the trench which is provided with the pebble bed of 1500 mm width & 1000 mm depth all around the building which will

be filled with rounded pebble of size 25 to 40 mm. The path ways will be graded to drain into rain water drain channels proposed in main drive ways/ roads, so that rain water from the terrace flow over this pavement and spread into the pebble bed.

Storm water Management plan to abate the flooding of the surrounding areas considering the catchment area as per the guidelines laid down in storm water design manual is given in table below.

TABLE 10.6 RAINFALL RUN OFF CALCULATION

Maximum storm runoff using Lloyd Davis Formula					
S. No	**Description**	**Runoff Co-efficient (C_r)**	**Critical Rainfall Intensity (Hourly Maximum Rainfall in Centimeters) (i)**	**Catchment area in Hectares (A)**	**Peak Storm Runoff (m^3/hr) (Q_p)**
1	Roof Area	0.85	5	9.4105925	3999.50
2	Paved Area	0.75	5	7.3212	2745.45
3	Unpaved Area	0.15	5	18.1384	1360.38
Total				**34.8701**	**8105.33**

Source: *ABC Techno Labs India Pvt. Ltd*

The collected storm water will be allowed to percolate to the sub-soil by suitably designed percolation pits. The pits will be designed based on the soil percolation capability. The subsoil water table is high in these areas and however harvesting pits with bores will be provided. The rain water harvesting layout is enclosed as Annexure III.

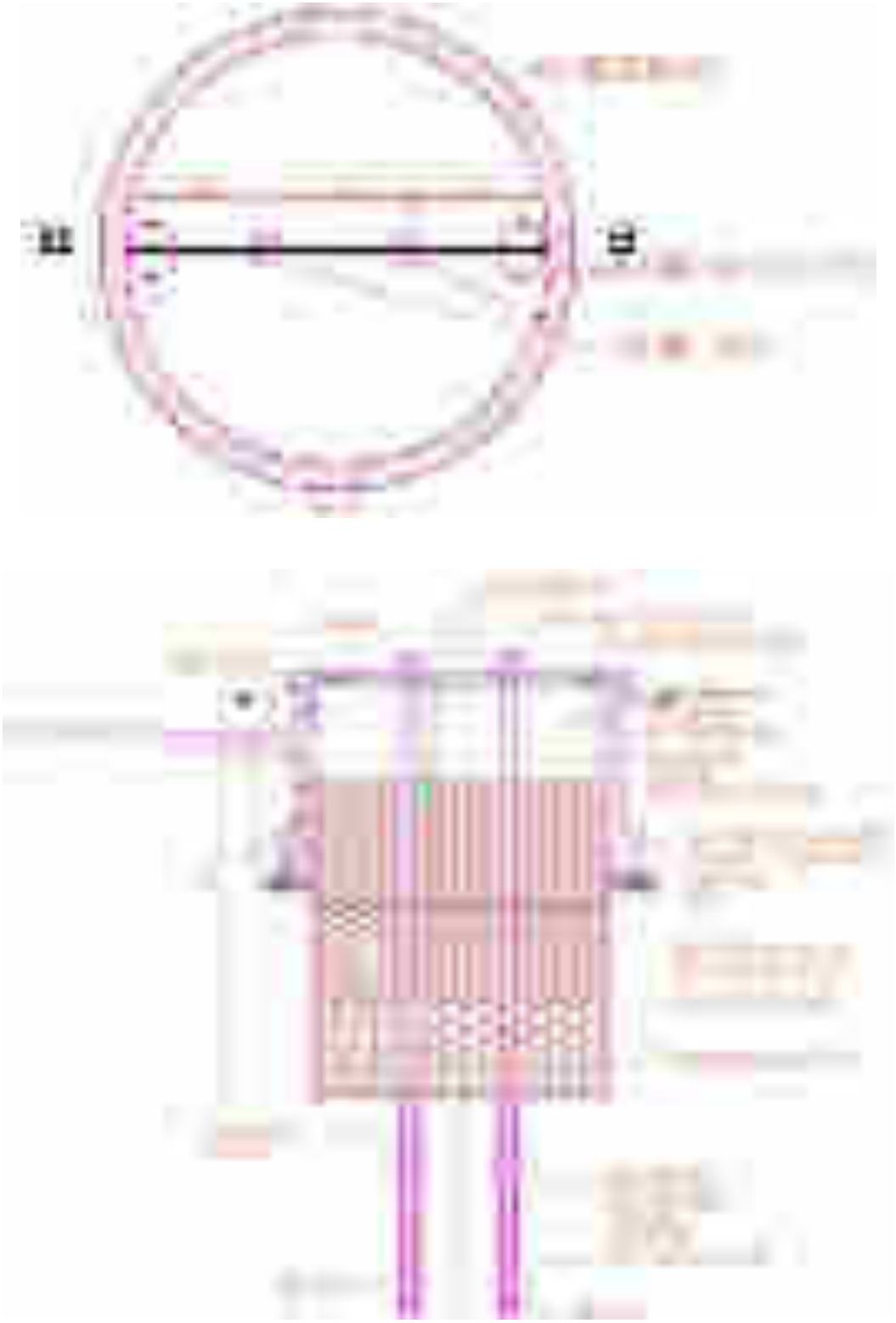


FIGURE 10.3RAIN WATER HARVESTING PIT AND TRENCH DETAILS

Source: *NBCC (India) Ltd*

10.7 EXPENDITURE ON ENVIRONMENTAL MANAGEMENT

The implementation of the pollution control and environmental monitoring and management programme is the basis of mitigation of impacts. The environmental expenditures show commitment of the management on environmental front. The details of the expenditure on environmental measures are given in Table 10.7 & 10.8

TABLE 10.7 ENVIRONMENTAL MANAGEMENT PLAN –BUDGET (CONSTRUCTION)

S.No	Description	Capital Cost (Rupees in Lakhs)	Recurring cost (Rupees in Lakhs)
1	Toilets & sanitation facilities	3.0	1.0
2	Water Sprinkler for dust Control	4.5	1.5
3	Construction Waste management	3.5	1.2
4	Occupational Health and Safety	7.0	2.5
Total		**18.0**	**6.2**

TABLE 10.8 ENVIRONMENTAL MANAGEMENT PLAN – BUDGET (OPERATION)

S.No	EMP Component	Capital Cost (Rupees in Lakhs)	Operational Cost Lakhs / Annum
1.	Water Conservation Measures & Sewage Water Treatment Plant	1,350.0	85.0
2.	Energy Conservation Measures (Solar equipments)	80.0	6.5
3.	Solid waste management	115.0	15.0
4.	Green Belt Development	23.0	2.5
5.	Monitoring of Environmental components	-	9.0
6.	Environmental Management Cell	-	7.0
Total		**1,568.0**	**125.0**

Source: *ABC Techno Labs India Pvt. Ltd*

11. SUMMARY & CONCLUSION

11.1 INTRODUCTION

This chapter presents the justification for implementation of the project, Summary of anticipated impacts and mitigation measures and conclusions.

11.2 JUSTIFICATION FOR IMPLEMENTATION OF THE PROJECT

The proposed redevelopment project will have marginal adverse impacts on the local environment. However, with the implementation of the proposed pollution control and environment management measures, the minor impacts anticipated due to construction and operation of the proposed plan will be mitigated.

The proposed redevelopment project will provide business opportunities for the local people, they will also be benefited in the areas such as education, health care, infrastructure facilities and women empowerment. Thus, in view of considerable benefits from the project without any major adverse environmental impact, the proposed project is most advantageous to the region as well as to the nation.

11.3 SUMMARY OF ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

The summary of anticipated adverse environmental impacts due to the proposed project and mitigation measures is given in Table 11.1.

TABLE 11.1 ANTICIPATED ADVERSE ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES (CONSTRUCTION & OPERATION)

Discipline	Potential Negative Impacts	Probable Source	Mitigation Measures	Remarks
CONSTRUCTIONAL IMPACT				
Air Quality	Increase in ambient dust (PM) and NO_X levels	Vehicular movements, excavation and leveling activity	• Sprinkling of water in the construction area and unpaved roads. Proper maintenance of vehicles shall be done. Restrict dust-generating activities, such as blasting or top soil removal, to calm wind conditions. Cover heavy vehicles moving offsite. Restrict vehicle speed on construction roads and ensure vehicles use only dedicated construction roads and access points. • Visually monitor particulate emissions from diesel vehicles and carryout regular maintenance of equipment.	Construction vehicles will be maintained properly for reducing air pollution levels from vehicle exhausts.
Noise Quality	Increase in ambient noise level	Construction equipment and vehicle movement	• Develop and implement a construction noise management plan. • Limit hours of construction where practical. Where blasting occurs, pit shapes and blast campaigns will be designed such that the blast faces are oriented away from noise sensitive receivers.	Equipment shall be kept in good condition to keep the noise level within 90-dB(A). Workers shall be provided with necessary protective equipment

			• The workers operating high noise machinery or operating near it will be provided with ear plugs. The high noise generating stationary machinery will be located at central portion of the site Construction contracts should specify that the construction equipment should meet the noise and air emission levels as per EPA Rules, 1986. • Identification of alternate access roads to the site to facilitate one-way movement of traffic or reduction of traffic density on any particular road • Improvement of road surface to standards adequate to withstand movement of heavy construction vehicles. • Installing appropriate signage and deploying flagmen during peak traffic period to regulate the movement of traffic	e.g.earplugs, earmuffs
Water Quality	Increase in suspended solids due to soil run-off during heavy precipitation Increase of water	Loose soil at construction site	• During monsoon season run-off from construction site shall be routed to a temporary sedimentation tank for settlement of suspended solids.	---

	Pollutants	Discharge of wastewater from construction	• All wastewater discharges from construction site will be received in septic tanks with adequate capacity. • Oil handling and storage area will be surfaced and provided with catch pit to intercept any accidental spillages	
Ecology	Clearing of Vegetation	Soil enabling activities	Landscaping and extensive plantation shall be done.	Open spaces reserved will be green turfed and appropriate type of plantations will be done.
Socio-economics	Land oustees	Land Acquisition	The project site is already in possession of the project promoters and free from encumbrances, hence land acquisition and resultant rehabilitation and resettlement issues are not involved.	---
Excavated Material	Loss of excavated top soil	Excavation	The topsoil shall be properly stored and used for levelling in the low-lying area. The construction debris shall be used to level the low lying area	---
Traffic	Creation of Traffic	Material carrying vehicles	Improvement and widening of the existing access roads. Establishment of additional connecting roads to the project site to provide multiple accesses points.	---
OPERATIONAL IMPACT				

Discipline	Potential Negative Impacts	Probable Source	Mitigation Measures	Remarks
Air Quality	Increase in dust (PM) and gaseous pollutants in ambient air	Vehicular traffic, Stack emissions from DG sets	• Usage of low sulphur fuel in DG sets. • Adequate stack height is provided for the generators for dispersion of pollutants. • Motorable roads in the building shall be paved to reduce dust emission. • Restricting the speed of the vehicles inside the campus. • Internal roads will be maintained properly for free movement of vehicles. • Ensure operational procedures are adequately implemented and regularly reviewed so as to identify opportunities for continual improvement. • Green belt will be developed which acts as pollutants absorber. • Roadside tree plantation to be restored and maintained.	Emissions from DG sets and AAQ levels shall be maintain below regulatory standards
Noise	Increase in noise levels	DG sets operation, Vehicle movement, pump house	• Acoustic enclosure is provided for D.G. sets. • Ear muffs / plugs will be provided to the personnel in the close vicinity of noise sources. • Restricting the speed of the vehicles inside the campus. noise levels • Pumps / equipments shall be designed to conform to noise levels prescribed by regulatory agencies	Green belt will also be developed all along the boundary wall for attenuating the noise

			• Green belt will be developed which acts as noise absorber.	
Water Resources	Depletion of ground / surface water source	Water usages in different locations	• Rain water harvesting structures will be constructed to recharge the ground water. • Rainwater from the roof top will be taken to Recharge Trench constructed near all the buildings. • Selection & use of native species of vegetation to reduce landscape water requirement. • Minimizing the paved surfaces to minimize the storm water runoff volume thereby increases the aquifer recharge. • An effective storm water management plan will be implemented. • Storm water drains will be constructed to collect the excess runoff within the compound. • Water efficient fixtures and devices can be used.	Conducting water audit to increase the water conservation measures
Water Quality	Deterioration of quality of receiving water body, if any	Sewage discharge from various sources	Sewage from the proposed buildings will be conveyed to the proposed Sewage Treatment Plant. The treated sewage from STP will be reused for green belt development, toilet flushing and HVAC. There will be no excess treated sewage will be disposed outside.	The treated sewage will be regularly monitored for its confirmation to the regulatory standards.

Traffic	Increase of vehicle count in existing road	Additional vehicle movement	Improvement of infrastructure, use of modern emission standard vehicles for transportation, provision of the proper parking yard and evaluate impact of traffic density and vehicular emissions	Proper roads will reduce the dust emissions to a great extent.
Solid waste	Impact on human health	Domestic usage	a) Proper segregation and collection of wastes will be practiced. b) The non-biodegradable solid wastes are sold to vendors and while transporting the waste the vehicles are covered properly to avoid spillages c) Biodegradable waste will be collected, segregated and treated by Organic Waste Converter.	-
Demography and Socioeconomics	Strain on existing amenities like water sources and sanitation and infrastructure facilities	Influx of people of proposed project	All ultra-modern work environments shall be provided inside the project site.	The proposed project would generate employment both directly and indirectly which will enhance overall socioeconomic development and quality of life of people.
Terrestrial Ecology	Impact on plant Species	Vehicular movement and emissions from stack	• It is proposed to develop lawns and green cover. • Part of the treated wastewater from domestic uses can be used for greenbelt development	As emissions will be within limits, no active damage to vegetation is expected.
Fire and Safety	Accidents /disasters related to fire and safety	Domestic firing	• Prepare DMP and implement DMP.	

			• A well-laid firefighting system and fire extinguishers will be installed as per fire safety norms • Regular fire safety training and mock drills will also be conducted.	

***Source**: ABC Techno Labs India Pvt. Ltd*

11.4 CONCLUSION

The proposed redevelopment project will have certain level of marginal impacts on the local environment. However, development of this project has certain beneficial impact/effects in terms of providing the positive impact both during Construction and operation phase of the project.

Thus, it can be concluded that with the judicious and proper implementation of the pollution control and mitigation measures, the proposed project will be beneficial to the society and will contribute to the economic development of the region in particular and country in general.

12. DISCLOSURE OF CONSULTANT

12.1 BACKGROUND OF THE PROJECT

ABC Techno Labs India Private Limited is an ISO 9001, ISO 14001 & OHSAS 18001 Certified Company & leading Environmental Engineering & Consultancy Company. ABC is the first firm to be accredited by NABET (National Accreditation Board for Education and Training), Quality Council of India, as an EIA Consultant. ABC is equipped with in-house, spacious laboratory, accredited by NABL (National Accreditation Board for Testing & Calibration Laboratories), Department of Science & Technology, Government of India. Copy of the NABET accreditation is given in the last page.

Since establishment our focus is on sustainable development of Industry and Environment based on sound engineering practices, innovation, quality, R&D and most important is satisfying customers need. The company has successfully completed more than 100's projects of variety of industries, in the field of pollution control. We are also dealing in the projects of waste minimization and cleaner production technology. Our team of technocrats and scientists are well experienced to deal with the Designing, Manufacturing, Fabrication, Installation and Commissioning of Effluent/Wastewater Treatment Plants, Sewage Treatment Plants, Combined Treatment Plants.

We are having a well experienced team of Scientists & Engineers who are looking after our well-equipped analytical laboratory with a facility including analysis of physical, chemical and biological parameters as per the requirements of the State Pollution Control Board and our clients.

12.2 QUALITY POLICY

- Providing high quality consultancy services
- Time bound completion of projects and submission of reports
- Employing competent engineers and scientists
- Implementing the best available technology
- Maintaining a good quality products and public relation practice
- Continually improving the effectiveness of Quality Management System

12.3 MANAGEMENT AND BOARD OF DIRECTORS

1.	Mr. G. Murugesh	Chairman & Managing Director
2.	Mrs. G.V. Nagavalli	Director
3.	Ms. G.M. Priyanka	Director
4.	Ms. D. Vaishnavi	Director
5.	Mr. V. Ganapathy	Director
6.	Dr. R.K. Jayaseelan	Director - Technical

12.4 SERVICES OFFERED

A. ENVIRONMENTAL SERVICES

- Environmental Impact Assessment (EIA)
- Environmental Management Plan (EMP)
- Social Impact Assessment (SIA)
- Environmental Baseline data collection for Air, Meteorology, Noise, Water, Soil, Ecology, Socio-Economic and Demography etc;
- Environmental Monitoring
- Socio Economic Studies
- Resettlement & Rehabilitation Plan
- Ecological & Human Health Risk Assessment Studies
- Ecological Impact Assessment
- Environmental Management Framework
- Solid Waste Management
- Hazardous Waste Management
- Internship & Training

B. MULTILAB DIVISION

- Chemical Testing
- Environmental Testing
- Microbiological Testing
- Food Testing

- Metallurgical Testing
- Mechanical Test
- Chemical Testing

C. TURNKEY PROJECTS

- Water Treatment Plants
- Sewage Treatment Plant
- Recycling & Water Conservation Systems
- Zero Discharge System
- Operation & Maintenance of Water & Waste Water Plants
- Water & Waste Water Treatment Chemicals
- Pilot Plant studies
- Feasibility studies & preparation of budgetary estimates

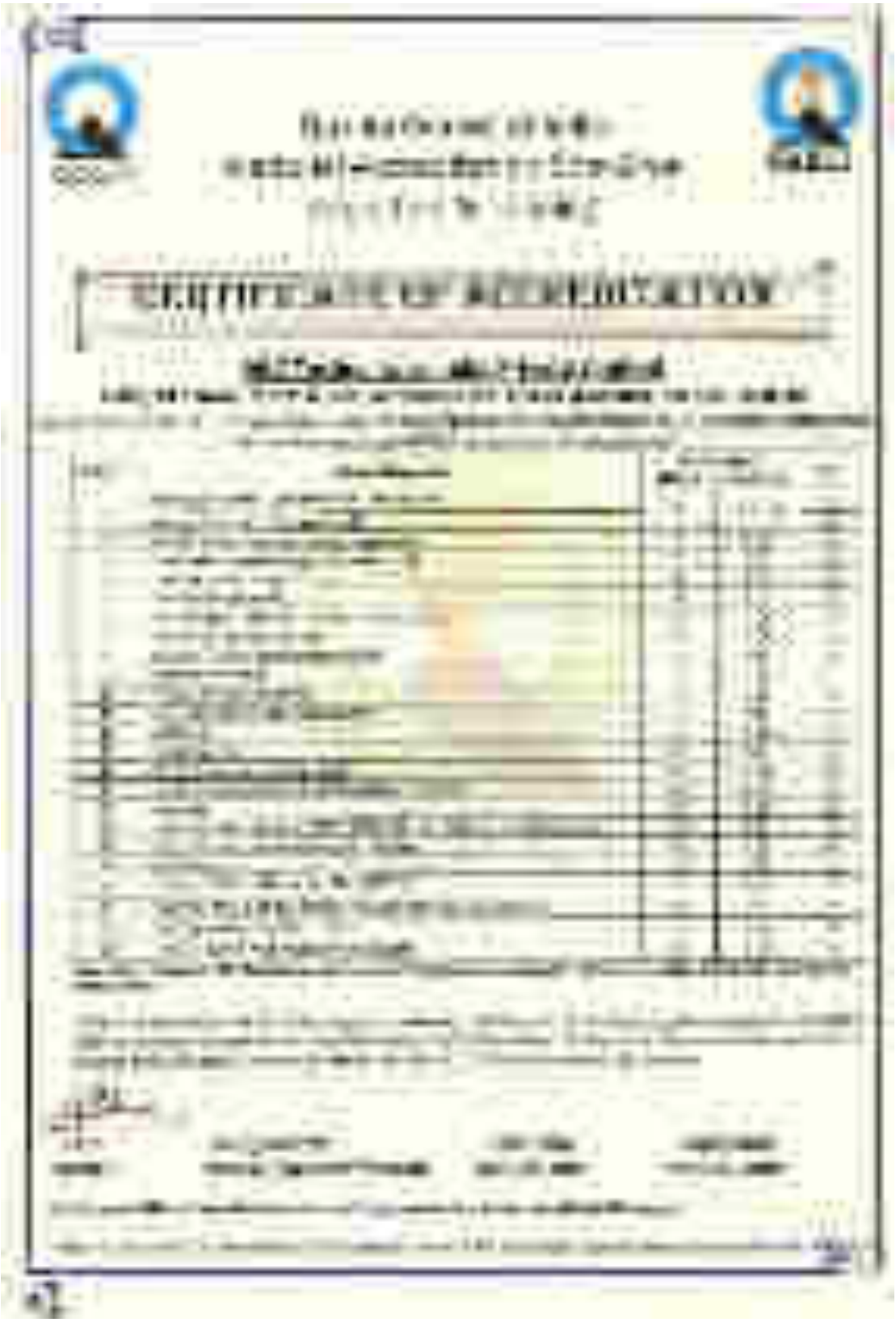
12.5 SECTORS WE SERVE

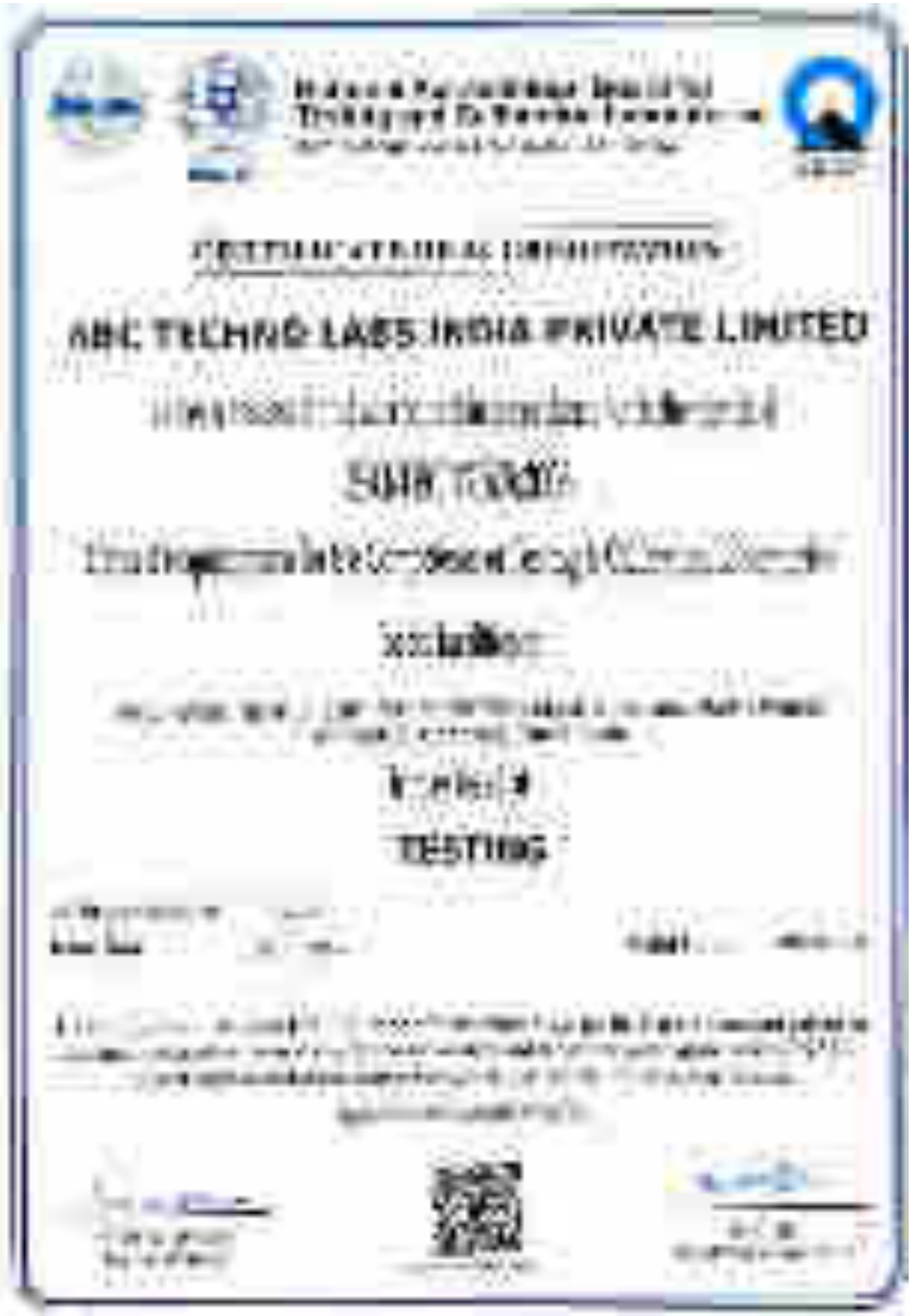
- Mining of Minerals including Opencast/Underground mining
- Thermal Power Plants
- Mineral Beneficiation including Pelletisation
- Metallurgical Industries (Ferrous & Non Ferrous)
- Chlor-alkali Industry
- Textile- cotton & Man-made fibre
- Coke Oven Plants/ Waste Heat Recovery
- Synthetic Organic Chemical Industries
- Sugar, Distilleries and Cogeneration
- Integrated Paint Industries
- Common Municipal Solid waste Management facility
- Industrial Estates/ Parks/Complexes/Special Economic Zones
- Common Effluent Treatment Plants
- Building & Construction Projects,
- Townships & Area Development Projects

12.6 STUDY TEAM

The multidisciplinary team included expertise in Environmental Impact Assessment, Air pollution & Control measures, Noise Control measures, Ecology and bio-diversity, Land use, Geology, Environmental Chemistry and Socio-Economic planner.

NAME	ROLE
Dr. R.K. Jayaseelan	EIA coordinator & Functional Area Expert - Water Pollution, Monitoring, Prevention & Control, Hydrology, Groundwater and Water conservation
Dr. Muthiah Mariappan	FAE – Air Pollution, Prevention & Control
Mr. Sushil U. Meshram	FAE – Socio-Economic
Mr. J. Srinivasa Rao	FAE – Land use
Mrs. Vijayalakshmi	FAE – Noise & Vibration, Meteorology,Air Quality Modeling & Prediction
Mr. Abhik Saha	FAE – Ecology & Biodiversity
Mr. Sameer V Deshpande	FAE – Soil Conservation
Mr. Senthil Kumar M	FAE – Risk Assessment and Hazards Management
Mr. R. Rajendran	SHW (Team Member)
Ms. P. Indu	Project Engineer / FAA - Meteorology, Air Quality Modeling & Prediction - Report Analysis and Documentation
Ms. Yaazhmozhi K	Junior Project Engineer
Mr. Cibichakravarthy P	Junior Project Engineer
Mr. Robson Chinnadurai	Team Member - Environmental Monitoring
Mr. Venkateshwaralu	Team Member - Environmental Monitoring





ABC TECHNO LABS INDIA PRIVATE LIMITED

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