

DOCUMENT NO.: EIA/8b/2024/LOHIA/SUPAUL

**ENVIRONMENTAL IMPACT ASSESSMENT REPORT
& ENVIRONMENT MANAGEMENT PLAN OF “630 BEDDED LOHIA MEDICAL COLLEGE
& HOSPITAL” AT SUPAUL, BIHAR**

**Total Plot area: 110883.87Sqm. &
Total built-up area: 165476.93 Sqm.
“Category: B1”**



**TOR –SIA/8(b)/2488/2023 Dated 18/12/2023
Baseline data collection period- Post Monsoon Season
(October 2023 to December 2023)**

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**NABET Accreditation No. QCI/NABET/ENV/ACO/23/2793
valid till September 11, 2024**

Submitted to:

**The Member Secretary,
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List of Abbreviations

AAQM	: Ambient Air Quality Monitoring
AAS	: Atomic Absorption Spectroscopy
ADT	: Average Daily Traffic
AERMOD	: AMS/EPA Regulatory Model
ALARP	: As Low as Reasonably Practicable
APCM	: Air Pollution Control Measures
APHA	: American Public Health Association
AQ	: Air Quality
BOD	: Biological Oxygen Demand
FETP	: Final Effluent Treatment Plant
C&D	: Construction and Demolition
CHWDF&IF	: Common Hazardous Waste Disposal Facility and Incineration Facility
CO	: Carbon Monoxide
COD	: Chemical Oxygen Demand
CPCB	: Central Pollution Control Board
CRO	: Control Room Officer
CSR	: Corporate Social Responsibility
CTO	: Consent to Operate
dB	: Decibels (Sound unit)
DG	: Diesel Generator
DMF	: Dual Media Filter
DMP	: Disaster Management Plan
DPMC	: Disaster Prevention Management Centre
EAC	: Expert Appraisal Committee
EC	: Environmental Clearance
EC	: EIA Coordinator
EIA	: Environmental Impact Assessment
EMC	: Environmental Management Cell
EMP	: Environmental Management Plan
EMS	: Environmental Management Systems
ESC	: Entrepreneur Social Commitment
ETP	: Effluent Treatment Plant
FAA	: Functional Area Associate
FAE	: Functional Area Expert
FCC	: False Color Composite
GoI	: Government of India
GPS	: Global Positioning System
GSI	: Geological Survey of India
GW	: Ground water
HDPE	: High-Density Poly Ethylene
HSD	: High Speed Diesel
HSE	: Health and Safety Environment
IMD	: India Meteorological Department
IRC	: Indian Roads Congress
IS	: Indian Standards
ISO	: International Organization for Standardization
IUCN	: International Union for Conservation of Nature
MoM	: Minutes of Meeting
GLCs	: Ground Level Concentrations
MTPD	: Metric Tons per day
MoEF&CC	: Ministry of Environment, Forest & Climate Change
MoU	: Memorandum of Undertaking

MSDS	: Material Safety Data Sheet
MW	: Mega Watt
NAAQS	: National Ambient Air Quality Monitoring Standards
NABET	: National Accreditation Board of Education & Training
NABL	: National Accreditation Board for Testing and Calibration Laboratories
NFPA	: National Fire Protection Association
NH	: National Highway
NOC	: No Objection Certificate
No.	: Number
NRSA	: National Remote Sensing Agency
NRSC	: National Remote Sensing Centre
NQ	: Noise Quality
MBR	: Membrane bioreactor
OCP	: Operational Control Procedures
OM	: Office Memorandum
OSHAS	: Occupation Health and Safety Assessment Series
PGR	: Plant Grade Regulators
PCM	: Pollution Control Measures
PCU	: Passenger Car Unit
PEL	: Permissible Exposure Level
PFD	: Process Flow Diagram
PM	: Particulate Matter
PPE	: Personal Protective Equipment
ppm	: Parts per Million
Popu	: Population
PUCC	: Pollution under Control Certificates
QCI	: Quality Council of India
QRA	: Quantitative Risk Assessment
GLC	: Ground Level Concentration
RO	: Regional Officer
RO	: Reverse Osmosis
SPL	: Sound Pressure Level
SOI	: Survey of India
SOP	: Standard Operating Procedure
STEL	: Short Time Exposure Limit
STP	: Sewage Treatment Plant
Sqm	: Square meter
SW	: Surface water
SEAC	: State Level Expert Appraisal Committee
SEIAA	: State Environment Impact Assessment Authority
TCL	: Toxic Concentration Low
TF	: Toxicity Factor
TDS	: Total Dissolved Solids
TLV	: Threshold Limit Value
TOC	: Total Organic Carbon
ToR	: Terms of Reference
TREM	: Transport Emergency Card
USEPA	: United States Environmental Protection Agency
VOCs	: Volatile Organic Compounds
ZLD	: Zero Liquid Discharge

UNDERTAKING

Letter NO: BMSIC/KUSHI/2024/28 (II)

Date: 02/02/2024

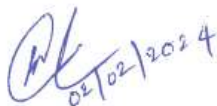
DECLARATION FOR CONSULTANT

To whomsoever it may concern

We hereby declare that the EIA Report has been prepared for **Proposed "630 bedded Lohia Medical College & Hospital" at Debipatti, Supaul Bihar by Bihar Medical Services and Infrastructure Corporation Limited (BMSICL).**

The EIA report has been prepared by the NABET accredited EIA Consultant organisation Rian Enviro Private Limited, 202 & 401, Mangal Market, Sheikhpura, Raja Bazar, Patna, Bihar, India, Pin Code-800 014.

For Bihar Medical Services and Infrastructure Corporation Limited (BMSICL)



Uma Shankar Prasad
DGM (BMSICL)
(Authorized Signatory)

Declaration by Head of the ACO / Authorized person

I, Mr. Muzaffar Ahmad, hereby, confirm that the name of experts mentioned in Chapter 12 have prepared the EIA covered under schedule 8 (b); Category "B" for Proposed Construction of 630 bedded "Lohia Medical College & Hospital" at District- Supaul, Bihar the project proponent and EIA Coordinator (EC) is fully aware of the content. The consultant organization shall be fully accountable for any misleading information. It is also certified that EIA Report has been analyzed good scientific practice. No unethical practices have been carried out and external data / text have not been used without proper acknowledgement, while preparing this EIA report.

Title of EIA Report: **Proposed Construction of 630 bedded "Lohia Medical College & Hospital" at District- Supaul, Bihar**

Name of Accredited Organization: Rian Enviro Private Limited

202 & 402, Mangal Market, Sheikhpura, Raja Bazar, Patna -800014, Bihar

Unique Identification Number: **EIA/8b/2024/LOHIA/SUPAUL**

Name of EIA Co-ordinator: Mr. Muzaffar Ahmad

Date of Check: 13-02-2024.

1 INTRODUCTION

1.1 Preamble

The purpose of EIA study is to assess the beneficial and adverse impacts of the Proposed Construction of 630 bedded “Lohia Medical College & Hospital” on the existing environmental parameters, so that suitable control measures could be taken to reduce impacts. Thus, the EIA report is a summarized presentation of base line information of Air, Water, Soil, Noise, Flora, Fauna, Socio-economic study and the prevailing environmental scenario of the project activity and the likely impacts due to proposed project, so as to decide the suitable mitigation measures for implementation to maintain healthy working environment and contain pollution within permissible limits.

1.2 The Objectives of the EIA study are as follows:

- To describe the proposed project and associated works together with the requirements for proposed development.
- To identify and describe the elements of the community and environment likely to be affected by the proposed development
- To identify and quantify emission sources and determine the significance of impacts on sensitive receptors.
- To identify, predict and evaluate environmental and social impacts during the construction and usage of the project in relation to the sensitive receptors.
- To develop an Environmental Management Plan that identifies the negative impacts and develops mitigation measures so as to minimize pollution, environmental disturbance and nuisance during the construction and operations of the development.
- This report has been prepared as per the EIA Notification, 2006 & its amendments and the guiding document EIA Guidance Manual for Building, Construction, and Township and Area Development project.

1.3 Scope of the Study

The scope of the EIA study considers the impacts arising due to proposed project on physical, biological and socio-economic environment of the surrounding areas in compliance to the approved ToR prescribed by SEIAA, Bihar. The scope of the EIA study includes monitoring of present baseline parameters, quantitative and qualitative impact and risk assessment, identification of site-specific mitigation measures and preparation of environment management plan. Environmental baseline monitoring within the study area was carried out for the period, 1st October 2023 to 31st December, 2023.

1.4 Basis of the EIA Study

The EIA study was carried for the **Proposed Construction of 630 bedded “Lohia Medical College & Hospital” at District- Supaul, Bihar** based on the approved ToR accorded by SEIAA-Bihar on 18/12/2023 vide File No. **SIA/8(b)/2488/2023** dated 18/12/2023 (**Annexure-I**), EIA Notification dated 14th September, 2006 and Environmental Impact Assessment Guidance Manual for Building, Construction, Township and Area Development project prepared by Administrative Staff College of India, February 2010.

1.5 Environmental Clearance Process

The Environmental Clearance process is guided by EIA Notification, 2006 which came in to the effect on 14th September 2006. As per EIA Notification, 2006, and its amendments, all Building construction and Area development projects covering an area of 50 ha and / or built-up area greater than 1,50,000 sqm. are designated as 8 (b) projects and are required to obtain prior environmental clearance from respective State Environmental Impact Assessment Authority (SEIAA). The application for environmental clearance shall comprise submission of Form 1, Form 1A and ToR. Environmental Impact Assessment Report shall be then prepared based on ToR obtained from the authority. Following the appraisal of the project to the satisfaction of the State Expert Appraisal Committee (SEAC), environmental clearance shall be granted.

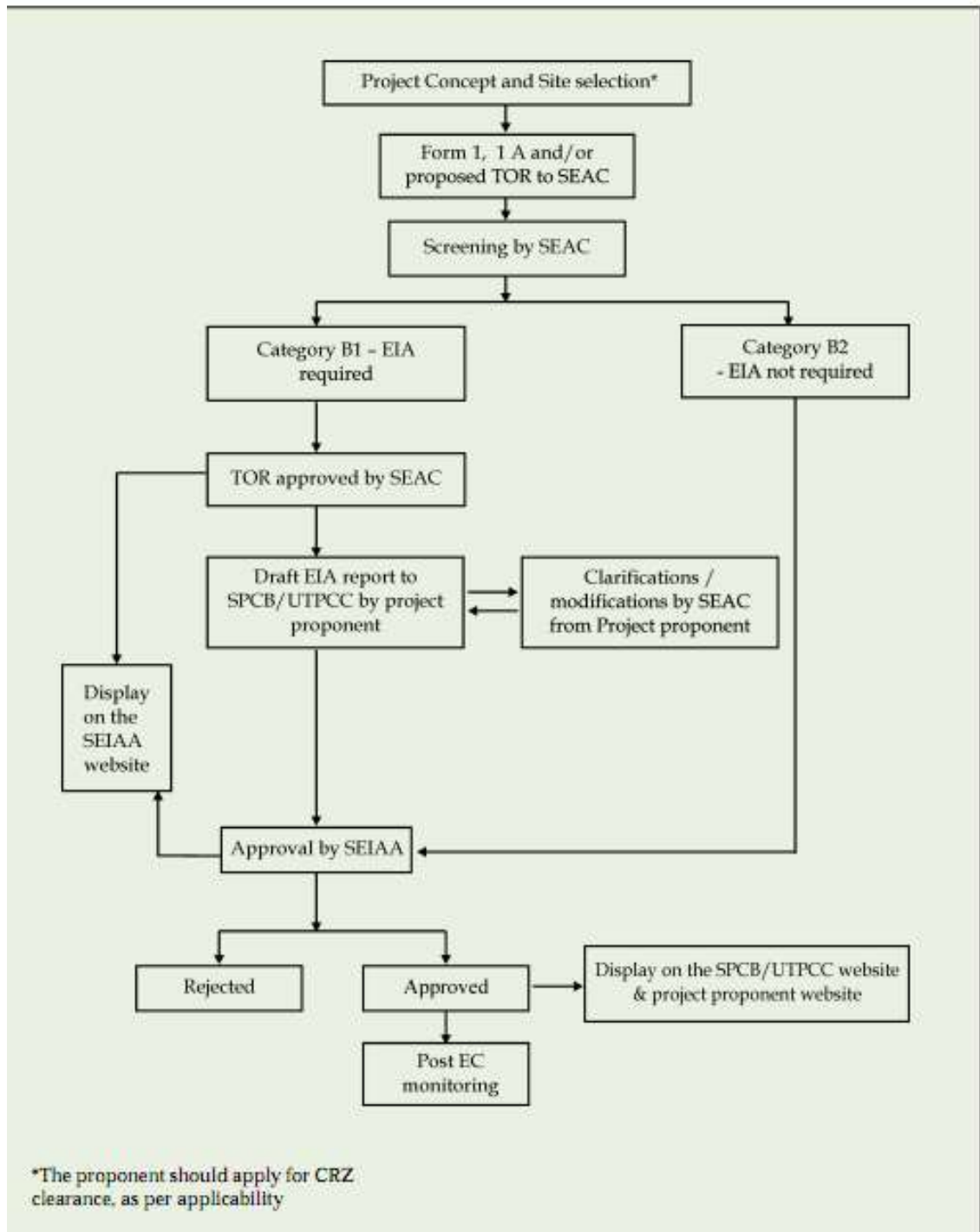
The Categorization of Building/Construction Projects / Area Development projects and Townships are given below:

Table 1-1: Categorization of Building/Construction Projects / Area Development projects and Townships as per EIA Notification 2006 and its amendments

	Project or Activity	Category with threshold limit B Category	Conditions if any
8.	Building /Construction projects/Area Development projects and Townships		
8 (a)	Building and Construction projects	>20000 sq. mtrs and <1,50,000 sq.mtrs. of built-up area#	# (The built-up area for the purpose of this Notification is defined as “the built up or covered area on all the floors put together including basement(s) and other services areas, which are proposed in the building/construction projects”
8 (b)	Townships and Area Development projects.	Covering an area > 50 ha and or built-up area >1,50,000 sq.mtrs ++	++ All projects under item 8(b) shall be appraised as category B1

(Source: EIA Notification 2006 and its amendments)

Since the plot area of the Proposed hospital project is 110883.87 Sqm or 11.088 Ha and Built-up Area 165476.93 Sqm the project falls in “8 (b)” category as per the provisions of the EIA Notification, 2006 and its amendments to obtain environmental clearance from the SEIAA, Bihar. An outline of prior Environmental Clearance process for Category B Projects is given in **Figure 1-1**.



(Source: EIA Guidance manual page no. 4)

Figure 1-1: Prior Environmental Clearance Process for Category B Project

Project Proponent:

Bihar Medical Services and Infrastructure Corporation Limited (BMSICL),
Uma Shankar Prasad,
DGM (BMSICL),
2nd & 3rd Floor, Swasthya Bhawan, Behind IGIMS, Sheikhpura,
adjacent to State Health Society, Bihar, Patna-800014

1.6 Brief description of nature of the project

Bihar Medical Services and Infrastructure Corporation Limited (BMSICL) has proposed Construction of 630 bedded “Lohia Medical College & Hospital” at District- Supaul, Bihar over a land measuring **110883.87 sqm. (11.08 ha.)** and total built up area is **165476.93 sqm.** Proposed project will construct Hospital ward, OPD, Lab, OTs, Labour rooms, Academic blocks of Medical College, Residence for Hospital Staff, Students of Medical College, Nurshing Hostels, Canteen, Kitchen, MLCP, ESS, Mortuary Block, Medical Gas Plant, etc. The proposed project cost is **603 crore** rupees. The salient features of the proposed project is mentioned in **Table 1.2.**

Table 1-2: Salient Feature of the proposed project

Sr. No.	Particulars	
1.	Total Plot area	110883.87 Sqm.
2.	Proposed FAR @ 1.49	165476.93 Sqm.
3.	Hospital Blocks Built-up area	54846.85 Sqm.
4.	College Blocks Built-up area	23529.58 Sqm.
5.	Hostel Blocks Built-up area	39589.96 Sqm
6.	Residential Blocks Built-up area	23643.27 Sqm.
7.	Others (Indoor Sport Complex, Service Block, Multilevel Car Parking, ESS, STP UGT)	23867.27 Sqm.
8.	Total Built-up Area	165476.93 Sqm
9.	Multilevel Car Parking	12881.8 Sqm.
10.	Ground (Open) Parking	2257.2 Sqm
11.	Ground Floor Parking (Resident Block)	4488.61 Sqm
12.	Total Parking Provided	11234.42 Sqm.
13.	Green Belt area Provided @ 27.89	30928.71 Sqm
14.	Proposed Ground Coverage @ 27.90%	30937.03 Sqm
15.	Road Area	24280.99 Sqm
16.	Paved Area	17829.93 Sqm
17.	Rain Water Harvesting Pits (with size)	10 (RWH Pit size= 71.57m ³)
18.	STP Capacity	870 KLD
19.	Maximum Height of the Building (m)	Approx. 24.55 m.
20.	Power Requirement	~3972.86 KW
21.	Power Backup	6 DGs of (3 x 1010 KVA), (2 x 750 KVA) & (1x 625 KVA)
22.	Total water Requirement	~1061 KLD Fresh water –563 KLD Treated water-498 KLD Source: Ground water for fresh water requirement.
23.	Waste water Generated	~725 KLD

EIA EMP Report	Proposed Construction of 630 bedded “Lohia Medical College & Hospital” at District- Supaul, Bihar
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Sr. No.	Particulars		
24.	Solid Waste Generated		~2427 Kg/day
25.	Biodegradable Waste		~1456 Kg/day
26.	Non-Biodegradable Waste		~971 Kg/day
27.	Bio-medical waste		~693 Kg/day
28.	Number of Blocks		Blocks: 4 Hospital, College, Hostel & Residential Blocks
29.	Basement		01
30.	Max. Stories		G+7
31.	Project Cost		603 Cr.
32.	EMP Budget		During Construction Capital Cost: 49 Lakhs Recurring Cost: 16.5 Lakhs
			During Operation Capital Cost: 470 Lakhs Recurring Cost: 48 Lakhs
33.	Connectivity	Supaul Railway Station	Approx. 19 Km towards South-West
		Tharbitia Railway Station	Approx.14.0 Km towards WNW.
		Debipatti Main Road NH- 327 NH- 131	Approx. 0.67 km towards West Approx. 0.48 km. towards South. Approx. 1.15 km towards East.
		Darbhanga Airport	Approx. 86.0 km towards West.

Source: Conceptual Plan

1.7 TERMS OF REFERENCE (ToR)

As per the requirement of EIA Notification 2006 and its amendments, Lohia Medical College & Hospital at District - Supaul, Bihar had submitted the hard copy of online application to SEIAA for approval of Terms of Reference (ToR) on 16/11/2023, and the case was considered in the SEAC meeting held on 23/11/2023. The ToR was approved from SEIAA vide F. No. SIA/8(b)/2488/2023 dated 18/12/2023 for carrying out the Environmental Impact Assessment study is attached as **Annexure-I**. The compliance status to the ToR is mentioned in **Table-1.3** below. The report is based on Baseline data collected in the study area including project site during the period from 1st October 2023 to 31st December 2023 and information from secondary sources.

Table 1-3 : Compliance of Terms of Reference (ToR) Compliance

S. No.	TOR	Work allocation / Responsibility
1	Examine details of land use as per Master Plan and land use around 10 km radius of the project site. Analysis should be made based on latest satellite imagery for land use with raw images. Check on flood plain of any river.	Land use of the project site is open land. The satellite imagery map is mentioned in Chapter 3, Section 3.4 . The land use and land cover classification is mentioned in Figure 3.3 based on Landsat 8 Satellite Imagery dated 04/04/2023.
2	Submit details of environmentally sensitive places, land acquisition status, rehabilitation of communities/villages and present status of such activities	Details are given in Chapter 2, Section 2.3, Table 2.2 (page#13) . There is no rehabilitation of communities/villages.
3	Examine baseline environmental quality along with projected incremental load due to the project.	The baseline environmental quality for Air, water, soil, and noise is mentioned in Chapter 3 and Incremental Load and GLCs for air is mentioned in Chapter 4, Section 4.5, (page#158) .
4	Environmental data to be collected in non-monsoon season in relation to the project development will be (a) land, (b) groundwater, (c) surface water, (d) air, (e) bio-diversity, (f) noise and vibrations, (g) socio economic and health.	The Environmental data was collected in Post monsoon Season (October 2023 to December 2023). Location on toposheet map for baseline monitoring of (a) land, (b) groundwater, (c) surface water, (d) air, (e) noise and vibrations are mentioned in Chapter -3 . Incremental Load and GLCs for air is mentioned in Chapter 4, Section 4.5, (page#158) . Lab Monitoring report is attached as Annexure-XII .
5	Submit a copy of the contour plan with slopes, drainage pattern of the site and surrounding area together with obstruction of the same by the project.	The contour plan with slopes is mentioned is attached in Annexure-XI .
6	Submit the details of the trees to be felled for the project.	There is no tree cutting in the proposed project.
7	Submit the present land use and permission required for any conversion such as forest, agriculture, etc.	Land use of the project site is open land.
8	Submit Roles and responsibility of the developer etc. for compliance of environmental regulations under the provisions of EPA Act.	Head Environment Management Cell of the Lohia Medical College and Hospital will be responsible for the compliance of environmental regulations during

S. No.	TOR	Work allocation / Responsibility
		construction and operational phase of Proposed construction project.
9	Ground water classification as per the Central Ground Water Authority.	Ground water classification details are mentioned in Chapter 3, section 3.5 (page#72).
10	Examine the details of Source of water, water requirement, use of treated waste water and prepare a water balance chart.	Source of water will be ground water. The total water requirement will be 1061 KLD. Fresh water requirement will be 563 KLD and treated water will be 580 KLD will be used in Flushing and landscaping purpose. Details mentioned in Chapter 2, Section 2.4.4, Figure 2.6 & 2.7, Table 2.7 (page#23).
11	Rain water harvesting proposals should be made with due safeguards for ground water Quality. Maximize recycling of water and utilization of rain water. Examine details.	The total 10 Nos. of RWH pits to be constructed with a capacity of 106288.03 cu-m/year recharge potential. Details mentioned in Chapter 2, Section 2.4.5.8, Table 2.9, Figure 2.10 (page#34).
12	Examine soil characteristics and depth of ground water table for rainwater harvesting.	Soil characteristics are mentioned Chapter 3, Section 3.4.2, (page#61). The depth of water level is mentioned Chapter 3, Section 3.5.2, (page#75). Soil Investigation was also completed and the Soil Investigation report is attached as Annexure-VII.
13	Examine details of solid waste generation treatment and its disposal.	It is estimated that maximum solid waste generation would be about~2427 kg/day. Bio-medical waste would be 693 Kg/day.
14	Examine and submit details of use of solar energy and alternative source of energy to reduce the fossil energy consumption. Energy conservation and energy efficiency.	The solar energy usage will be equivalent to 5% i.e. 199 KVA of total power demand i.e. 3972.86 KW. Energy conservation is mentioned in Chapter 2 Section 2.4.5.15, (page#42). Details are given in Chapter 6, Section 6.11 (page#186).
15	DG sets are likely to be used during construction and operational phase of the project. Emissions from DG sets must be taken into consideration while estimating the impacts on air environment. Examine and submit details.	Total 6 Numbers DG sets each of capacity of 3 x 1010 KVA, 2 x 750 KVA & 1 x 625 KVA has been proposed for the power back up. Details are given in Chapter 4, Section 4.5 (page#158). Isopleth for PM ₁₀ , PM _{2.5} , Sox and NOx is

S. No.	TOR	Work allocation / Responsibility
		mentioned in Chapter 4, Figure 4.5 to 4.7 (page#164-166).
16	Examine road/rail connectivity to the project site and impact on the traffic due to the proposed project. Present and future traffic and transport facilities for the region should be analyzed with measures for preventing traffic congestion and providing faster trouble-free system to reach different destinations in the city.	Supaul Railway Station- Approx.19.0 Km towards South- West. Tharbitia Railway Station - Approx.14.0 Km towards WNW Debipatti Main Road- Approx. 0.67 km towards West NH- 327- Approx. 0.48 km. towards South. The traffic survey has been conducted from 07.01.2024 to 09.01.2024 on the Pipra Road, details mentioned in Chapter 3, Section 3.11 (page#143). Details of traffic modelling are mentioned in Chapter 4, Section 4.11.
17	A detailed traffic and transportation study should be made for existing and projected passenger and cargo traffic.	The traffic survey has been conducted from 07.01.2024 to 09.01.2024 on the Pipra Road, details mentioned in Chapter 3, Section 3.10 (page#143).
18	Examine the details of transport of materials for construction which should include source and availability.	Construction material will be transported from local open market.
19	Examine separately the details for construction and operation phases both for Environmental Management Plan and Environmental Monitoring Plan with cost and parameters.	Environmental Management Plan and parameters during construction and operation phase is mentioned in Chapter 6, Table 6.3 (page#194) and Environmental Monitoring Plan is mentioned in Chapter 6, Section 6.14, (page#196). Environment Management cost during construction and operation phase of the project is mentioned in Chapter 10 Table 10.1 to 10.2 (page#215-216).
20	Submit details of a comprehensive Disaster Management Plan including emergency evacuation during natural and man-made disaster.	Disaster Management Plan is mentioned in Chapter 7, Section 7.2, (page#205).
21	Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given.	There is no litigation pending for the proposed project.
22	The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.	Environment Management cost during construction and operation phase of the project is mentioned in Chapter 10 Table 10.1 to 10.2 (page#215-216).

S. No.	TOR	Work allocation / Responsibility
23	Any further clarification on carrying out the above studies including anticipated impacts due to the project and mitigative measure, project proponent can refer to the model ToR available on Ministry website "http://moef.nic.in/Manual/Townships".	Noted.
B	ADDITIONAL SPECIFIC CONDITIONS:	
1.	Conduct close Contour Survey and study the drainage pattern at the site.	Copy of contour map with slopes, drainage pattern of the site is attached as Annexure-XI .

1.8 Validity of Environmental Clearance

As per the provisions of the EIA Notification, 2006 & its amendments, the prior environmental clearance granted is valid for a period of ten years.

1.9 Post Environmental Clearance Monitoring

The project proponent will prominently advertise in the newspapers indicating that the project has been accorded environmental clearance and the details will be displayed on <https://parivesh.nic.in website>.

The Project management will submit half-yearly compliance report in respect of the stipulated prior environmental clearance terms and conditions in hard and soft copies to the regulatory authority on 1st June and 1st December, of each calendar year.

1.10 Transferability of Environmental Clearance

Lohia Medical College & Hospital is proposed for Environment Clearance (EC) in total land area 110883.87 Sqm. & Total built-up area 165476.93 Sqm. at District-Supaul, Bihar, so transferability of Environment Clearance to this project is not applicable.

1.11 GENERIC STRUCTURE OF EIA

The environmental impact assessment has been carried out to assess the impact of the proposed project on various environmental components. The methodologies and findings of the study are detailed in the EIA Report along with other relevant information under the different chapter headings. The EIA report is structured as per the EIA manual prepared by Administrative Staff College of India (ASCI), Hyderabad. The Ministry of Environment and Forest and Climate Change (MoEF&CC) suggested making use of sector specific manuals for preparation of EIA reports vide circular F. No. J-11013/41/2006-IA. II (I) dated 4th December, 2012. Hence, this EIA Report is structured according to ASCI Building and Construction Manual and the chapters of the EIA Report are as follows:

Chapter 1- Introduction

This chapter provides background information about the project and the developers along with the legal environmental requirements of the project. The scope and EIA methodology adopted in preparation of EIA report have also been described in this chapter.

Chapter 2 - Project Description

This chapter contains detailed description of the proposed project, such as the type of the project, need of the project, project location, land availability, utilities and infrastructure facilities such as roads and other requirement.

Chapter 3 - Description of the Environment

This chapter discusses the environmental setting of the project based on primary and secondary data collection. Assessment of the existing environment with regard to its capacity to receive the new development is also given in this chapter.

Chapter 4 - Anticipated Environmental Impacts & Mitigation Measures

Anticipated positive and negative impacts as a result of the construction and operation of the proposed project is covered as a part of this section. The section attempts to forecast the future environmental conditions of the project area that might be expected to occur as a result of the construction and operation of the proposed project.

Chapter 5 - Analysis of Alternatives (Technology and site)

This chapter includes the options, details of the alternatives of materials that are to be used in building construction and energy conservation methods to be adopted.

Chapter 6 - Environmental Monitoring Programmer

This chapter includes details of the monitoring scheme for both during the construction and operational phase and also includes details of the post monitoring scheme. This chapter also gives technical aspects of monitoring for evaluation of the environmental status of the region against the project development and the effectiveness of mitigation measures.

Chapter 7 - Additional Studies

This chapter covers the details of the additional studies required, which are necessary for specific issues applicable to the proposed project for the purpose of better understanding of the environmental impacts of the project. It also highlights any pertinent findings from the study that will aid decision-making.

Chapter 8 - Project Benefits

This chapter covers the benefits accruing to the locality, neighborhood. It also brings out details of benefits by way of improvement in the physical infrastructure, social infrastructure, employment potential and other tangible benefits.

Chapter 9 - Environmental Management Plan

This chapter comprehensively presents the Environment Management Plan (EMP), which includes the administrative and technical setup, summary matrix of EMP, the cost involved to implement the EMP, both during the construction and operational phase.

Chapter 10 - Summary & Conclusion

The overall justification for implementation of the project and explain how the adverse effects have been mitigated.

Chapter-11 Disclosure of Consultants engaged

This chapter includes the name of the consultant engaged with their brief resume and the names of the technical team involved in the report preparation and nature of consultancy rendered.

2 PROJECT DESCRIPTION

2.1 Need for the project

Lohia Medical College & Hospital is proposed construction in total land area 110883.87 Sqm. & Total built-up area 165476.93 Sqm. at District- Supaul, Bihar. Following are the needs of the proposed project

- To make arrangement for imparting / providing education in Medical
- To further the advancement of learning and conducting of research
- To undertake the extension of education of medical and facilities of hospital that are relevant for the rural people of the State;
- To facilitate and ensure qualitative improvement in the teaching and learning processes and methodology in the stream of Medical;

2.2 Infrastructure & It's Details

The project envisages various building structures mentioned in **Table 2.1**.

Table 2-1: Building Details

S. no.	Name of the building blocks	Total area (in sqm.)	Height of building
a	Hospital blocks		
	H1-H1a block	11986.79	G+6
	H2 block	7925	G+6
	H3 block	10205.02	G+6
	H4 block	10205.02	G+6
	H5 block	10205.02	G+6
	Connecting bridge of hospital blocks	4320	G+6
b	College blocks		
1	College block-	23529.58	G+4
c	Hospital blocks		
1	Intern hostel-female	3347.09	G+4
2	Intern hostel-male	4661.31	G+6
3	Boys hostel - 1	5184.93	G+7
4	Boys hostel - 2	5184.93	
5	Girls hostel -1	3908.89	G+5
6	Girls hostel -2	3908.89	
7	Staff nurse's hostel	3148.26	G+5
8	Junior residence hostel	5103.36	G+4
9	Senior residence hostel	5142.3	G+7

S. no.	Name of the building blocks	Total area (in sqm.)	Height of building
d	Resident blocks		
1	Principal residence	413.51	G+1
2	Medical superintendent residence	413.51	G+1
3	Professor residence	6896.5 6896.5	G+7
4	Non-medical staff quarter	7442.72	G+6
5	Karmchari quarter	1580.53	G+3
e	Blocks		
1	Indoor sports complex	3190.47	G+3
2	Service block-1 (hospital)	5335.00	G+4
3	Multi level car parking	12881.80	G+4
4	UGT -1	450	
	UGT -2	360	
5	STP	750	G
6	Electrical sub station-1	300	G
7	Electrical sub station-2	300	G
8	Electrical sub station-3	300	G
	Grand total	165476.93	

(Source: As per conceptual drawing)

2.3 Location Description and Surrounding

2.3.1 Site Surrounding and Connectivity

It is surrounded by areas such as Pipra, Debipatti, Dinapatti within 5 km of the area of the project. Site surroundings and connectivity details of the project are given in **Table-2.2**.

Table 2-2: Site Surroundings and Connectivity Details

S. No.	Description		Distance and Direction
1.	Nearest Railway Station	Supaul Railway Station Tharbitia Railway Station	Approx.19.0 Km towards South-West. Approx.14.0 Km towards WNW.
2.	Nearest Airport	Darbhanga Airport	Approx. 86.0 km towards West.
3.	Nearest Village	Pipra Debipatti Dinapatti	Approx. 1.14 Km towards East. Approx. 0.34 Km towards North. Approx. 0.97 Km towards South-West.
4.	Nearest Highway/Roads	Debipatti Main Road NH- 327 NH- 131	Approx. 0.67 km towards West Approx. 0.48 km. towards South. Approx. 1.15 km towards East.

S. No.	Description		Distance and Direction
5.	Nearest School & College	Middle School, Dinapatti Primary School, Kamalpur B.D.M Boarding School	Approx. 1.26 Km towards South-West. Approx. 1.13 Km towards NE. Approx. 1.05 Km towards East.
6.	Nearest Hospital	Prathmik Swasthya Kendra, Pipra Thumha Hospital	Approx. 1.09 Km towards ESE. Approx. 4.10 Km towards WSW.
7.	Places of worship	Hanuman Temple, Debipatti Shiv Temple	Approx. 0.61 Km towards NNW. Approx. 1.0 Km towards East.
8.	Water Bodies and Ponds	Tilabeh Nadi Koshi River	Approx. 3.30 Km towards West. Approx. 15.50 Km towards WNW.

Source: Google Earth & site visit

Project site location is mentioned in **Figure-2.1**.

Google Map showing project site Coordinates is mentioned in **Figure-2.2**. A Google Map of 500 m buffer radius showing surrounding of the project is mentioned in **Figure-2.3**. The Topographic Map (Survey of India) of 10 km radius showing surrounding of the project site is mentioned in **Figure-2.4**. Site Plan is attached as **Annexure-II**.

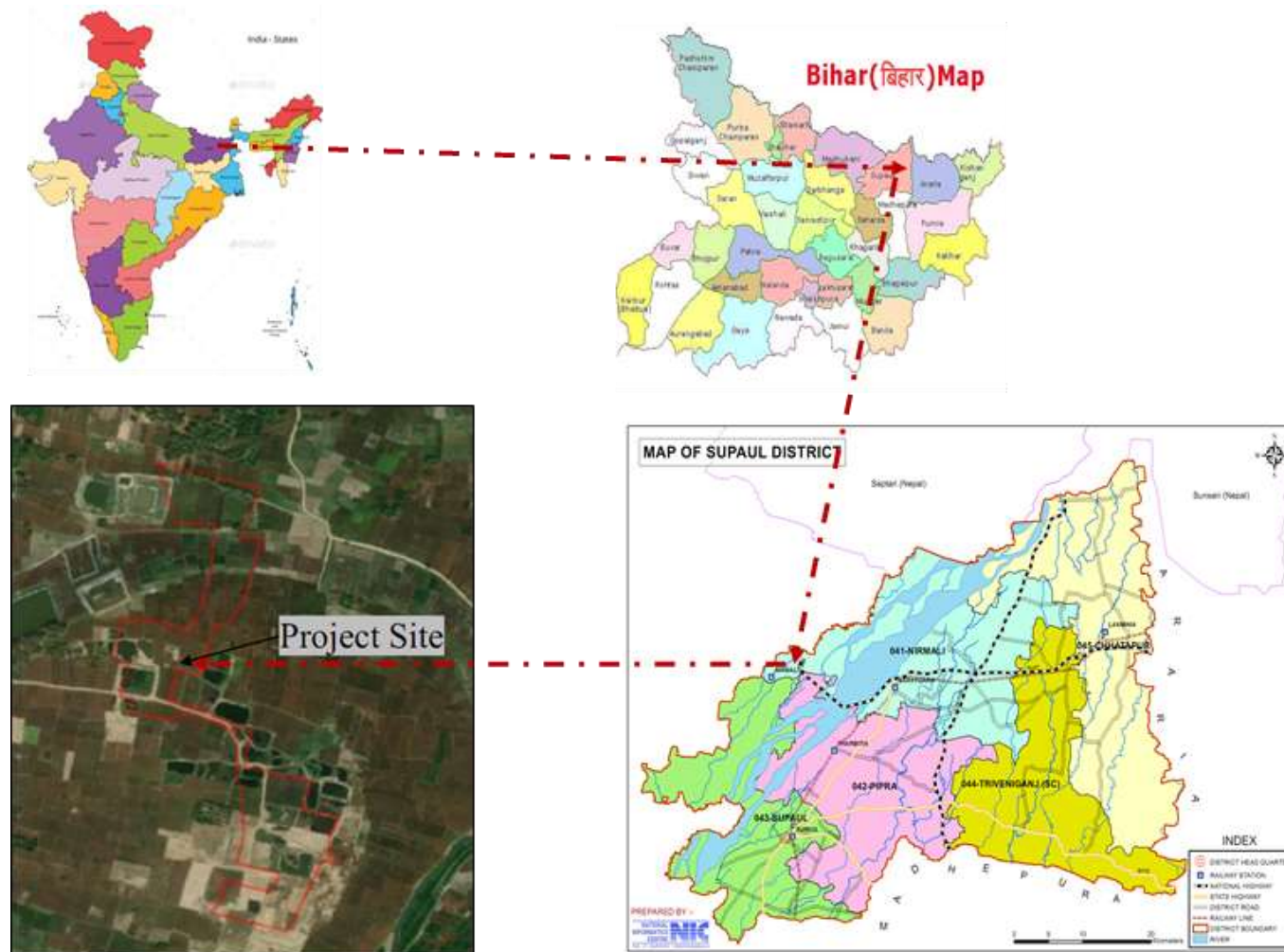


Figure 2-1 : Location Map

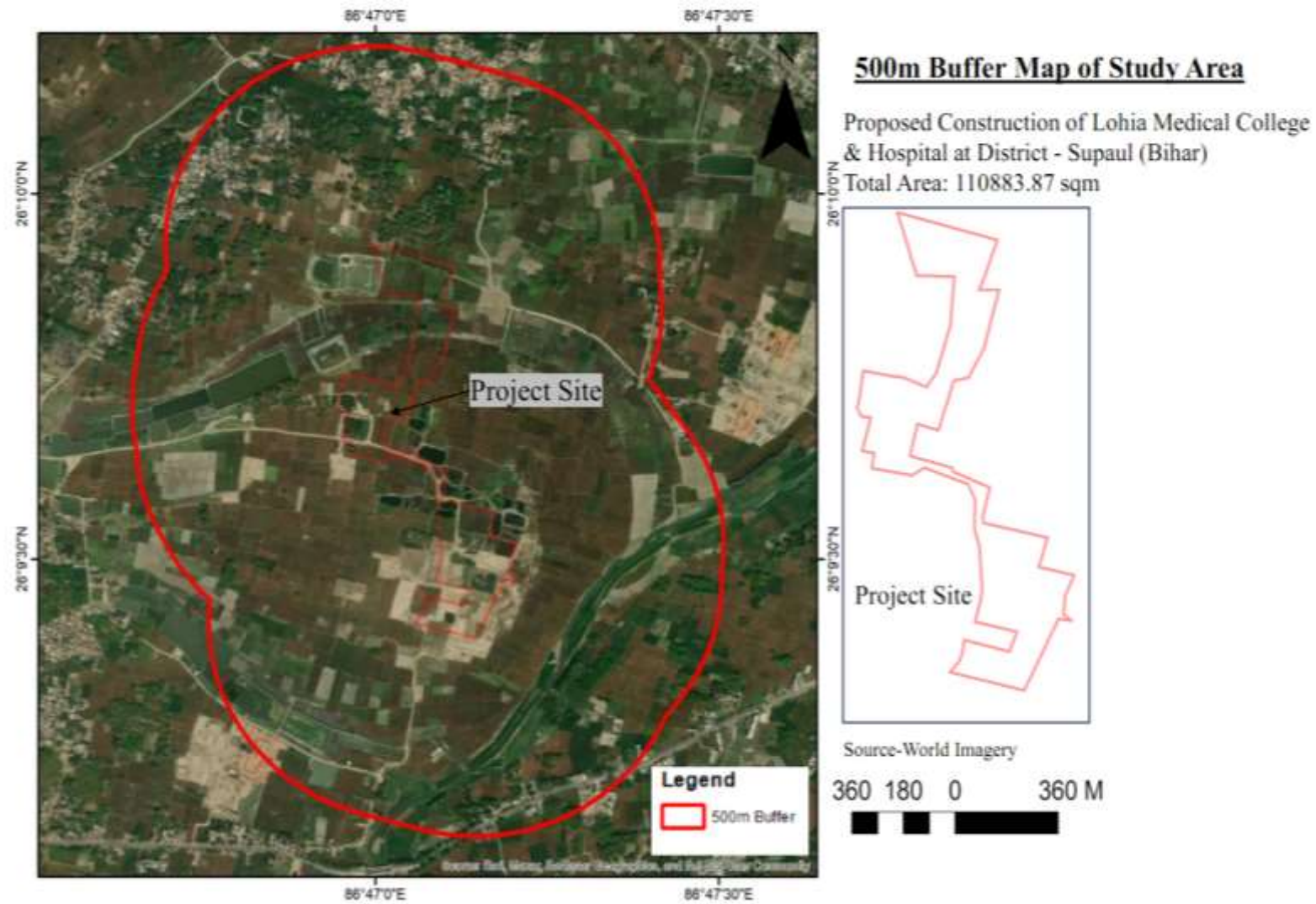


Figure 2-2: 500 m. Google map showing all features

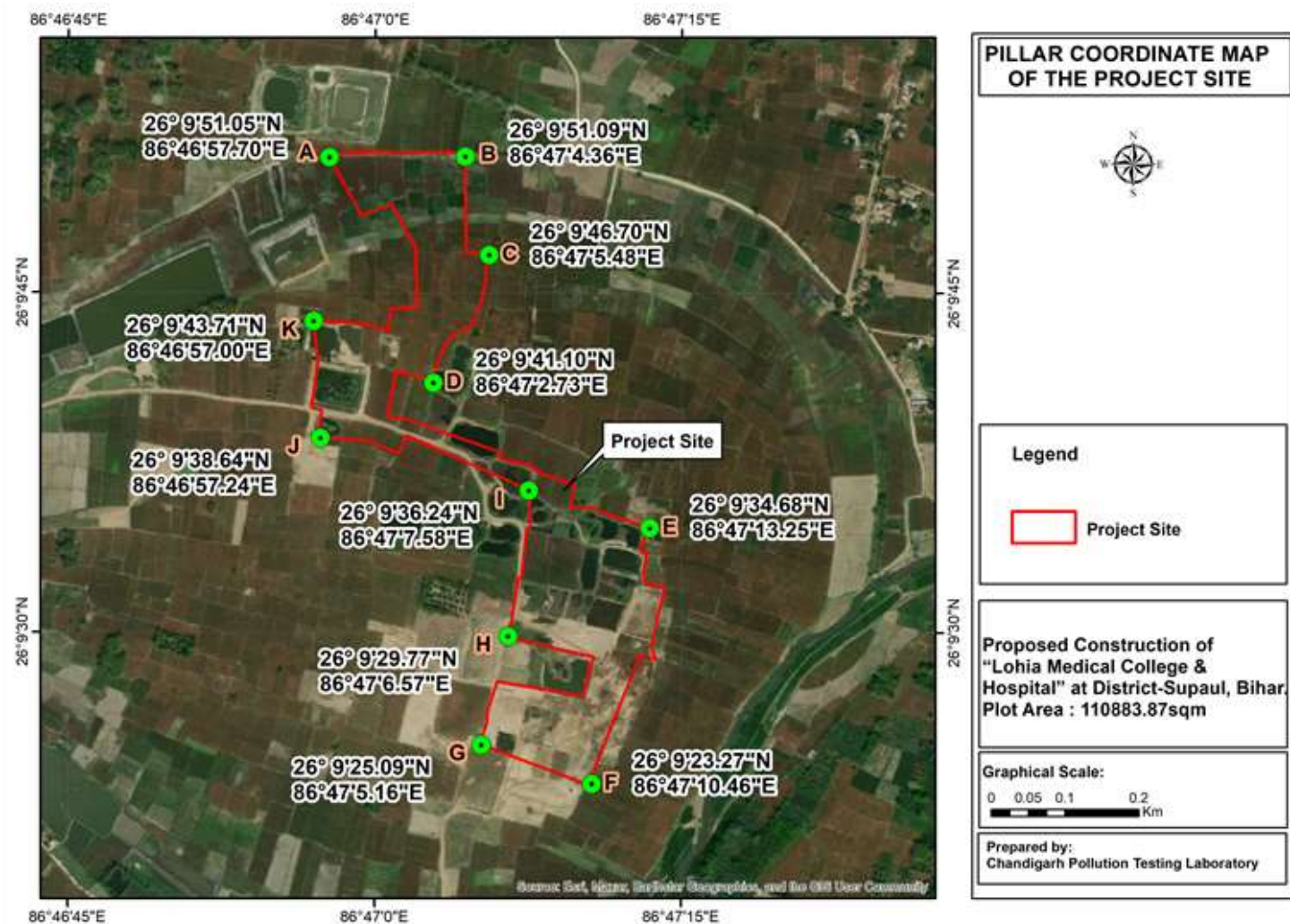


Figure 2-3 : Pillar Coordinate map

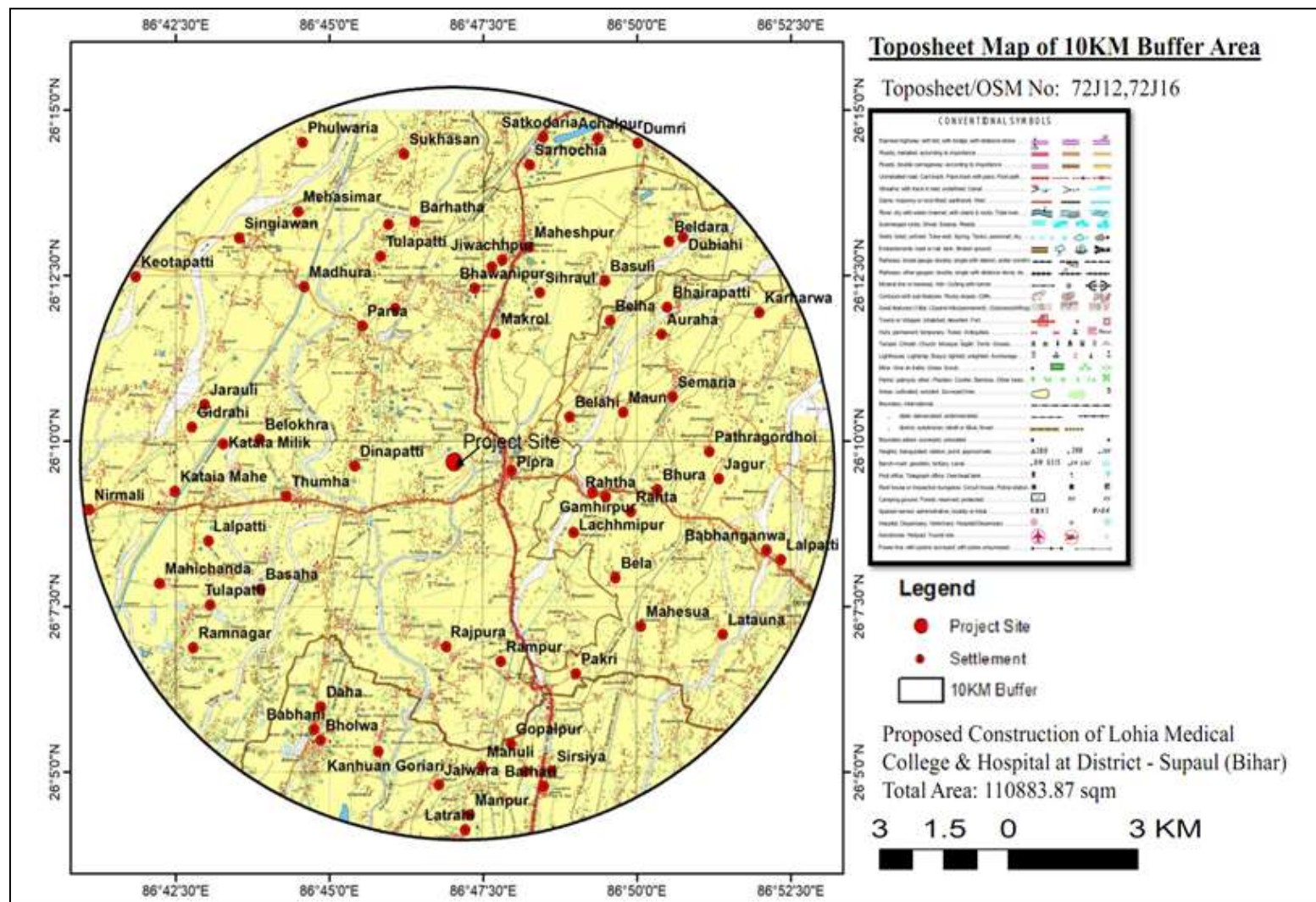


Figure 2-4 : Toposheet Map of 10 km radius



Figure 2-5: Site Photographs

2.4 PROJECT DETAILS AND REQUIREMENTS

The project site is located at Supaul, Bihar. The co-ordinates of the project site are given in Table - 2.3.

Table 2-3: Coordinates of the Project Boundary

Sl. No.	Latitude	Longitude
1.	26°9'51.05"N	86°46'57.70"E
2.	26°9'51.09"N	86°47'04.36"E
3.	26°9'46.70"N	86°47'05.48"E
4.	26°9'41.10"N	86°47'02.73"E
5.	26°9'34.68"N	86°47'13.25"E
6.	26°9'23.27"N	86°47'10.46"E
7.	26°9'25.09"N	86°47'05.16"E
8.	26°9'29.77"N	86°47'06.57"E
9.	26°9'36.24"N	86°47'07.58"E
10.	26°9'38.64"N	86°46'57.24"E
11.	26°9'43.71"N	86°46'57.00"E

2.4.1 LAND USE OF THE PROJECT SITE

The total Plot area of the project is 110883.87 sqm or 11.088 Ha. The total built-up area is **165476.93 Sqm**. The proposed area statement is mentioned in **Table 2.4**, Land use pattern of the project has been mentioned in **Table 2.5**.

Table 2-4: Proposed Area Statement

S. No.	Particulars	Area (Sqm.)
1	Plot Area	110883.87
2	Proposed FAR @ 1.49	165476.93
3	Hospital Blocks	54846.85
4	College Blocks	23529.58
5	Hostel Blocks	39589.96
6	Residential Blocks	23643.27
7	Others (Indoor Sport Complex, Service Block, Multilevel Car Parking, ESS, STP UGT)	23867.27
8	Total Built-up Area	165476.93
9	Multilevel Car Parking	12881.8
10	Ground (Open) Parking	2257.2
11	Ground Floor Parking (Resident Block)	4488.61
12	Total Parking Provided	11234.42
13	Proposed Ground Coverage @ 27.90 %	30937.03
14	Green area @ 27.89%	30928.71
15	Road Area	24280.99

S. No.	Particulars	Area (Sqm.)
16	Paved Area	17829.93
17	Pathway	4650.01

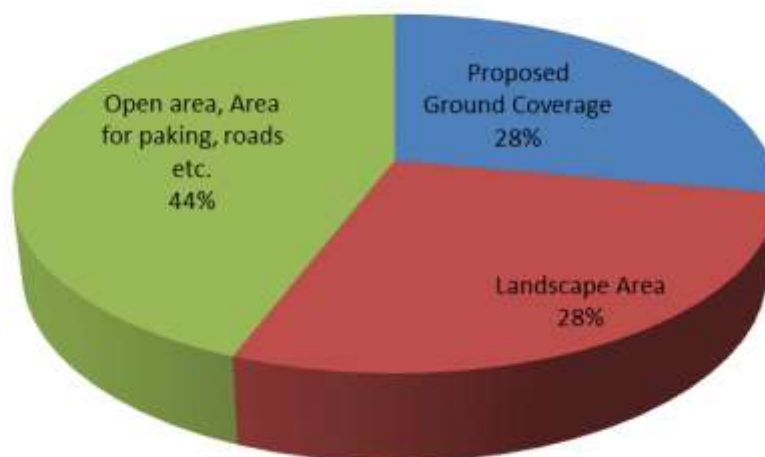
(Source: DPR of the project)

Table 2-5: Land Use Pattern of the project Site

S. No.	Area Statement	Area (m ²)	% of the net Plot Area
1	Proposed Ground Coverage	30937.03	28%
2	Landscape Area	30928.71	28%
3	Open area, area for paking, roads etc.	49018.13	44%
Total		110883.87	100%

(Source: DPR of the project)

Land use Pattern of the Project Site



2.4.2 Occupancy Detail

The population details of the proposed Medical College and Hospital are mentioned in Table-2.6.

Table 2-6: Population Details

Sl. No.	Description	Total Capacity / Bed
1	Hospital Ward (Beds in Hospital Block)	630
2	Attendant (For Patient)	630
3	OPDs Visitors	3250
	Faculty & Staff	800
4	Medical College-Students	1000
5	Visitors @10% of Medical College Student population	100
6	Girls & Boys Hostel	908
6	Resident, Staff quarters for Hospital & College Staff, Workers & Guest House	1074
7	Visitors @10% of Staff quarter population	107
Total		8499

(Source: DPR of the project)

2.4.3 MAN POWER REQUIREMENT

During the construction phase, a large number of professionals and workers will be engaged in various related activities. An approximation of the manpower requirement for the project is around 200-300 workers which include skilled, semiskilled and unskilled. As a responsible corporate, the proponent shall comply with all applicable Acts & rules related to employee's service and their welfare of the Government of India in terms of working hours, basic amenities and welfare facilities such as given below:

- Minimum Wages Act, 1948,
- Contract Labor (Regulation & Abolition) Act, 1970,
- Inter-State Migrant Workmen (Regulation of Employment & Conditions of Services) Act, 1979
- The building and other Construction Workers (Regulation and Employment of Service) Act, 1996,
- The building and other construction workers Welfare Cess Act, 1996
- The child labour (Prohibition & Regulation) Act, 1986.

- All workers and technicians will be provided with clean drinking water, sheds for resting and sanitary facilities as mobile toilets / toilets connected to septic tanks. Camps shall also be organized for health checkup in every six months. No child shall be employed in the process.
- The Man power involved in the construction of roads and Commercial Buildings would be: Skilled Workers- Civil engineers, Structural Engineers Architects, Site Supervisors, MEP Consultants, Plumbers, Electricians, Masons, and un-Skilled Workers – Construction Laborers.

2.4.4 Water Requirement, Supply and Distribution

Water Requirement for the proposed project is discussed below.

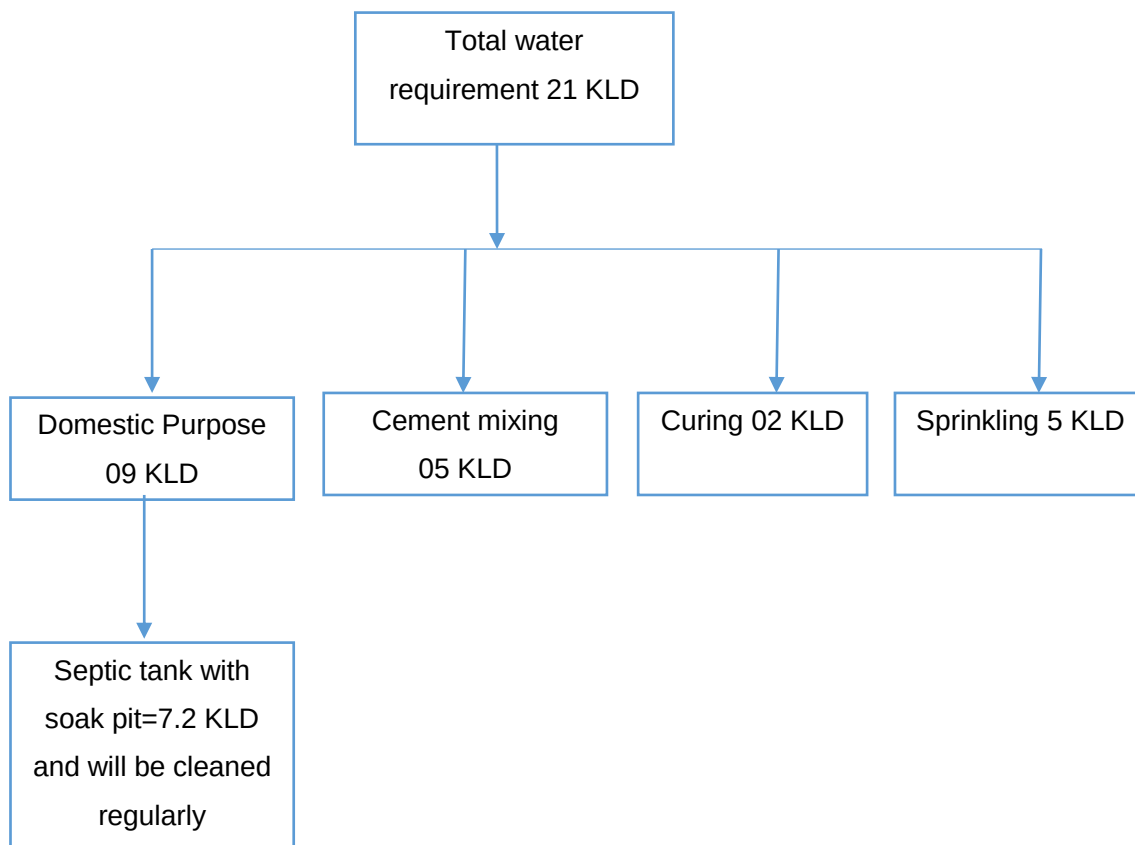
2.4.5.1 Water requirement during Construction phase

Approx. 21 KLD water will be required for domestic as well as for construction purpose. Source of fresh water will be portable water supply. Source of construction water will be treated water & tanker water supply.

Water requirement for construction activity

The source of construction water will be treated water from nearby areas / STP. Drinking water will be purchased for Domestic purpose. No use of ground water during the construction. The details of water requirement during construction phase are mentioned below:

Cement mixing	05 KLD
Curing	02 KLD
Sprinkling	05 KLD
Domestic purposes	09 KLD
Total	21 KLD



2.4.5.2 Water requirement during Operation phase

Water requirement during the operational phase of the project will be met through Municipal supply. The total water requirement for the project has been estimated to be ~1061 KLD. This includes domestic water requirement, flushing and landscaping. The total fresh water requirement is ~563 KLD which includes Domestic water requirement. The water requirement for Flushing and landscaping will be met through treated water from STP. Details of break-up of water requirement for proposed construction project are given in **Table-2.7** and water balance diagram during monsoon and non monsoon season is mentioned in **Figure-2.6 & Figure 2.7**.

Table 2-7: Details of water requirement (Total)

S.N.	Description	No. of units	Population	Total Population/ Bed	Water Requirement				Total Water Requirement	Total wastewater
					Flushing		Domestic			
					LPCD	in LPD	LPCD	in LPD		
1.0	Hospital Building Side									
1.1	Hospital Ward			630	150.00	94500.00	300.00	189000.00	283500.00	245700.00
	Hospital Attendant with patient (24 hours)			630	20.00	12600.00	25.00	15750.00	28350.00	25200.00
1.2	OPD Visitors			3250	10.00	32500.00	5.00	16250.00	48750.00	45500.00
1.3	Kitchen (500 Meal Per Day)			1950	0.00	0.00	20.00	39000.00	39000.00	31200.00
1.4	Labs, Operation Theaters & Labour Rooms Etc.			-	0.00	0.00	0.00	15000.00	15000.00	12000.00
2.0	Karamchari Residence (G+3)	23	4	92	45.00	4140.00	90.00	8280.00	12420.00	10764.00
3.0	Non Medical Staff Housing (G+6)	72	5	360	45.00	16200.00	90.00	32400.00	48600.00	42120.00
4.0	Nursing Hostel (G+4)			150	45.00	6750.00	90.00	13500.00	20250.00	17550.00
4.1	Animal Shelter					1000.00		1000.00	2000.00	1800.00
4.2	ESS			20	20.00	400.00	25.00	500.00	900.00	800.00
5.0	MLCP			300	10.00	3000.00	5.00	1500.00	4500.00	4200.00
6.0	Organic/Biomedical Waste Plant			15	20.00	300.00	25.00	375.00	675.00	600.00
	Sub Total (I) KLD					171 KLD		333 KLD	504 KLD	437 KLD
7.0	Academic Building									
7.1	Medical College(G+3)			1000	20.00	20000.00	25.00	25000.00	45000.00	40000.00
7.2	Canteen / Kitchen			750	0.00	0.00	20.00	15000.00	15000.00	12000.00
7.3	Labs for Colleges			-	0.00	0.00	0.00	3000.00	3000.00	2400.00
7.4	Faculty & Staff for Academic			800	20.00	16000.00	25.00	2000.00	18000.00	17600.00
7.5	Visitor (10% of Total Population)	-	-	80	10.00	600.00	5.00	300.00	900.00	840.00
8.0	Engineering Service Block									
8.1	Medical Gas plant			10	20.00	200.00	25.00	250.00	450.00	400.00
8.2	Mortuary Block			50	20.00	1000.00	50.00	2500.00	3500.00	3000.00
8.3	Laundry @ 4 kg lenen per day bed			2600	0.00	0.00	20.00	52000.00	52000.00	41600.00

9.0	Residential Building Side									
9.1	Principal Residence	1	10	10	45.00	450.00	90.00	900.00	1350.00	1170.00
9.2	Medical Superintendent	1	10	10	45.00	450.00	90.00	900.00	1350.00	1170.00
9.3	Senior Residency (G+7) 1BHK	49	4	196	45.00	8820.00	90.00	17640.00	26460.00	22932.00
9.4	Professor Residency (G+6) 3BHK	24	6	144	45.00	6480.00	90.00	12960.00	19440.00	16848.00
9.5	Junior Residence (G+4)	64	1	64	45.00	2880.00	90.00	5760.00	8640.00	7488.00
10.0	Guest House and Complex	24	2	48	45.00	2160.00	90.00	4320.00	6480.00	5616.00
10.1	Staff	30		30	20.00	600.00	25.00	2000.00	2600.00	2200.00
10.2	Community			200	10.00	2000.00	5.00	1000.00	3000.00	2800.00
11.0	GYM & Sports Complex			100	20.00	2000.00	25.00	2500.00	4500.00	4000.00
12.0	Hostels									
12.1	Girls Hostel - (G+5)			155	45.0	6975.00	90.00	13950.00	20925.00	18135.00
12.2	Girls Hostel - (G+5)			155	45.0	6975.00	90.00	13950.00	20925.00	18135.00
12.3	Boys Hostel - (G+7)			215	45.0	9675.00	90.00	19350.00	29025.00	25155.00
12.4	Boys Hostel - (G+7)			215	45.0	9675.00	90.00	19350.00	29025.00	25155.00
12.5	Intern Girls Hostel-(G+4)			68	45.0	3060.00	90.00	6120.00	9180.00	7956.00
12.6	Intern Boys Hostel-(G+6)			100	45.0	4500.00	90.00	9000.00	13500.00	11700.00
12.7	Other Use									
12.9	DG Set Cooling	(625*1 KVA,750*2 & 1010 KVA*3) =5155 KVA,1 lt./KVA/ 6 hr.							5155.00	-
12.9	Landscape area	Landscape area use 30928 Sqm. @ 3 Litres/Sqm							92780.00	-
12.1	HVAC Cooling Tower makeup								125000.00	-
	Sub Total (II) KLD					104 KLD		230 KLD	557 KLD	288 KLD
	Total (I+II) KLD					275 KLD		563 KLD	1061 KLD	725 KLD

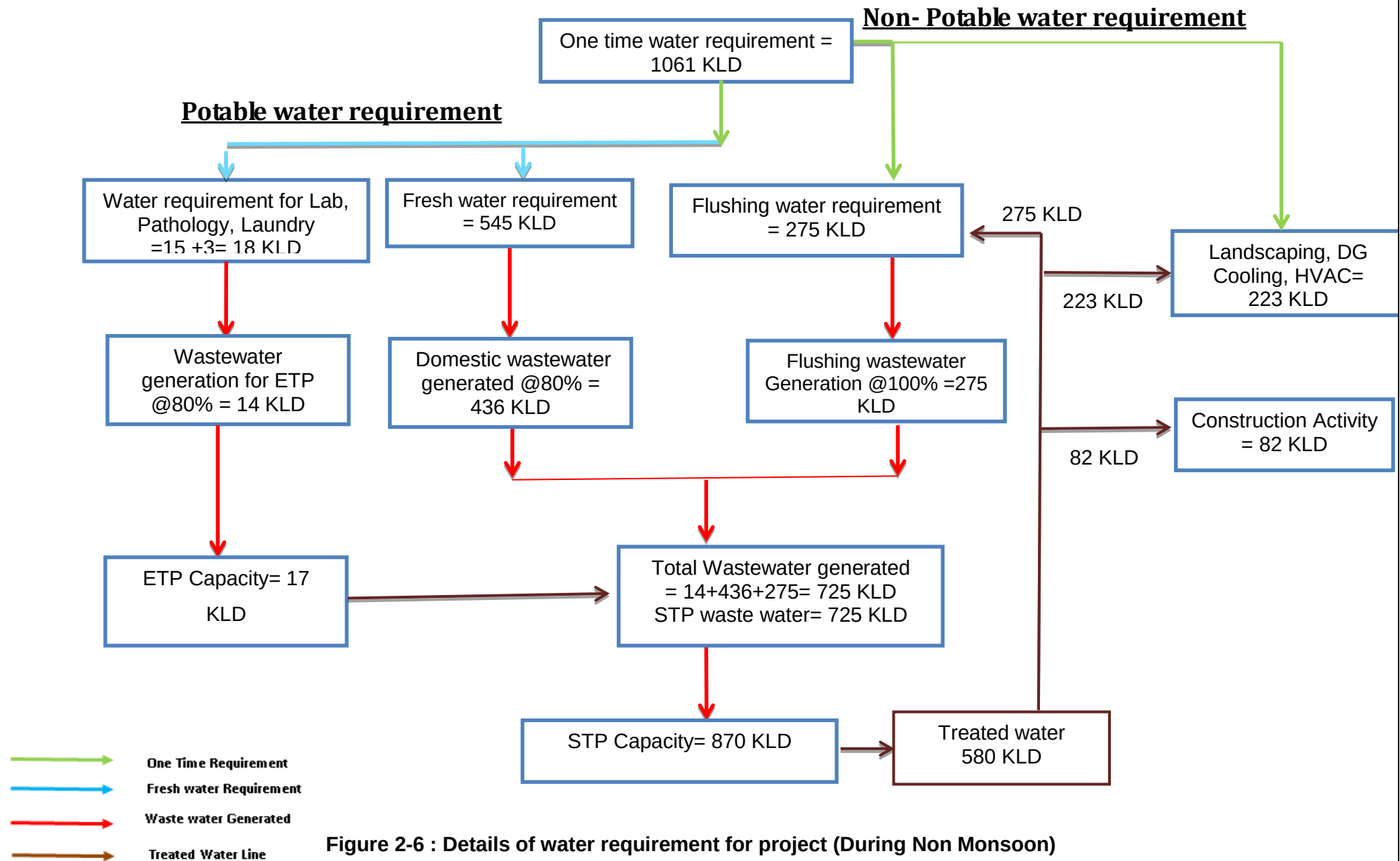


Figure 2-6 : Details of water requirement for project (During Non Monsoon)

Non- Potable water requirement

One time water requirement=
1061 KLD; Daily GW = 13 KLD

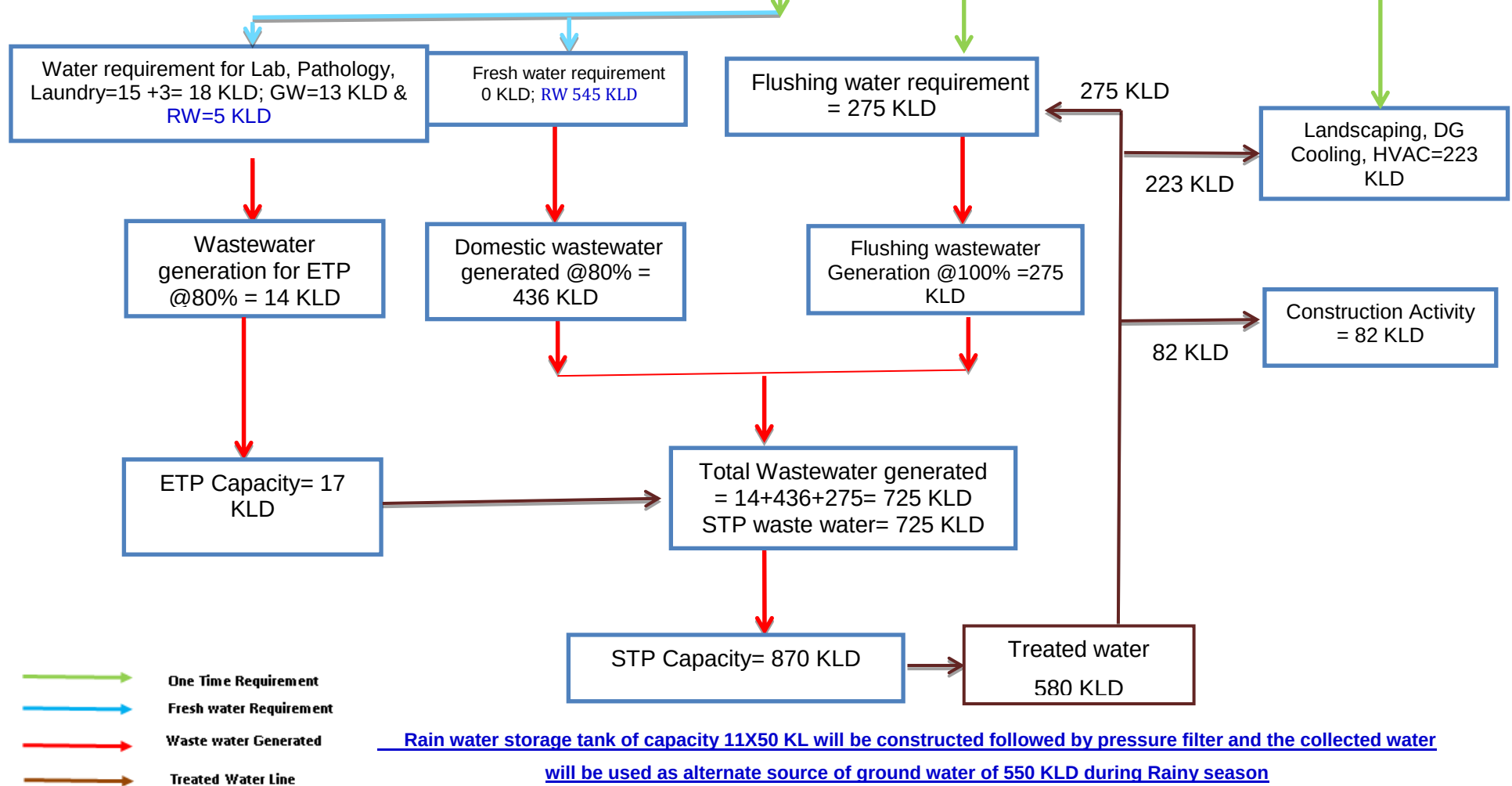
Potable water requirement

Figure 2-7 : Details of water requirement for project (During Monsoon)

2.4.5.3 Wastewater Generation during Operational phase

The total estimated quantity of wastewater to be generated from proposed project is ~725 KLD. Calculation of wastewater generation is shown below in **Table-2.8**.

Table 2-8: Calculation of Wastewater Generation

Details	Water (KLD)
Water requirement for domestic purpose	545
Wastewater to be generated from domestic use (@ 80% of domestic water requirement)	436
Water requirement for Lab, Pathology, Laundry	18
Wastewater to be generated from Swimming pool use (@ 80 % of domestic water requirement)	14
Water requirement for Flushing Purpose	275
Wastewater to be generated from Flushing (@ 100% of flushing requirement)	275
Total Wastewater generated	725
ETP capacity	17
STP capacity 20% higher than total waste water	~870

Water balance diagram is mentioned in **Figure-2.6 & 2.7**.

2.4.5.4 Waste Water Treatment Scheme

The waste water generated will be treated in the Sewage Treatment Plant, and the capacity of Sewage Treatment Plant (STP) will be higher of waste water generated i.e., 870 KLD. The two nos. of STP will be installed each for Medical college and Hospital. The proposed STP (both) will be based on **Membrane Bio reactor (MBR)**. MBR is a process that combines a membrane ultra / micro filtration process and activated sludge process. The MBR process is used in place of the secondary sedimentation tank and sand filter will be used for tertiary treatment in the conventional activated sludge process.

Pre-treatment:

To reduce the chances of membrane damage, wastewater should undergo a high level of debris removal using screens prior to the MBR. Primary treatment is often provided in larger installations. In addition, all MBR systems require 1- to 3-mm-cutoff fine screens immediately before the membranes, depending on the MBR manufacturer. These screens require frequent cleaning. The Brief Description of MBR STP is mentioned below:

Membrane Configuration:

MBR manufacturers employ membranes in two basic configurations: hollow fiber bundles and plate membranes. A number of **bundles** are connected by manifolds into units that can be readily changed for maintenance or replacement.

The other configuration, employ **membranes** in a flatplate configuration, again with manifolds to allow a number of membranes to be connected in readily changed units.

System Operation:

All MBR systems require some degree of pumping to force the water flowing through the membrane. While other membrane systems use a pressurized system to push the water through the membranes, the major systems used in MBRs draw a vacuum through the membranes so that the water outside is at ambient pressure. The advantage of the vacuum is that it is gentle to the membranes; the advantage of the pressure is that throughput can be controlled. All systems also include techniques for continually cleaning the system to maintain membrane life and keep the system operational for as long as possible. All the principal membrane systems used in MBRs use an air scour technique to reduce buildup of material on the membranes. This is done by blowing air around the membranes out of the manifolds.

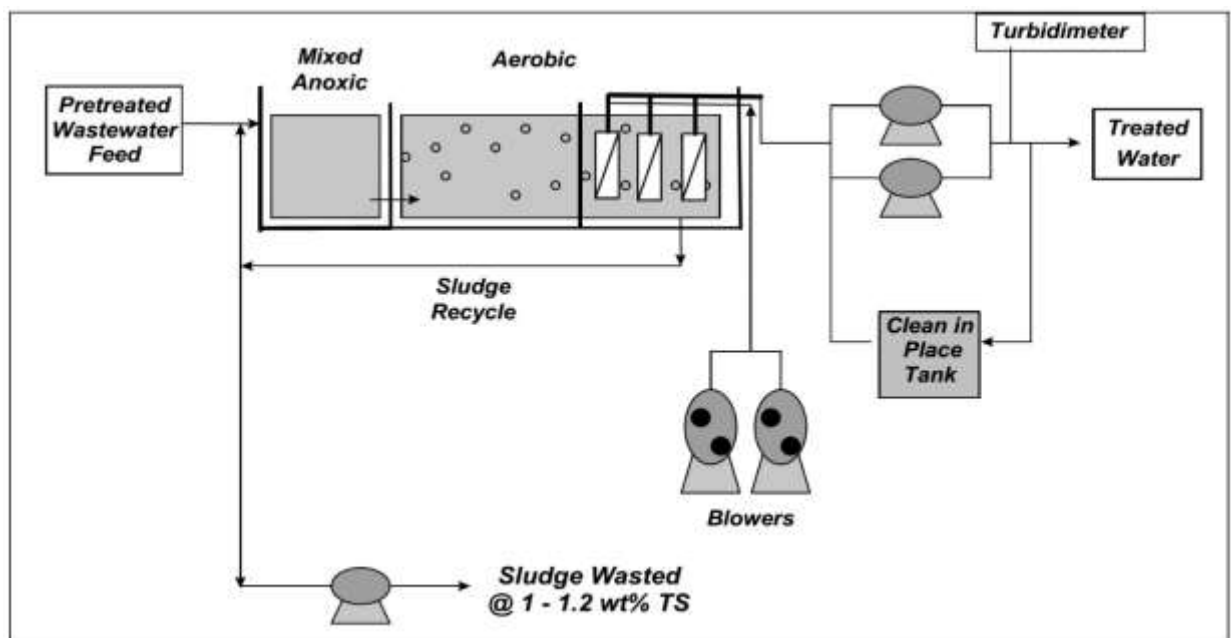


Figure 2-8 : Schematic Diagram of MBR STP

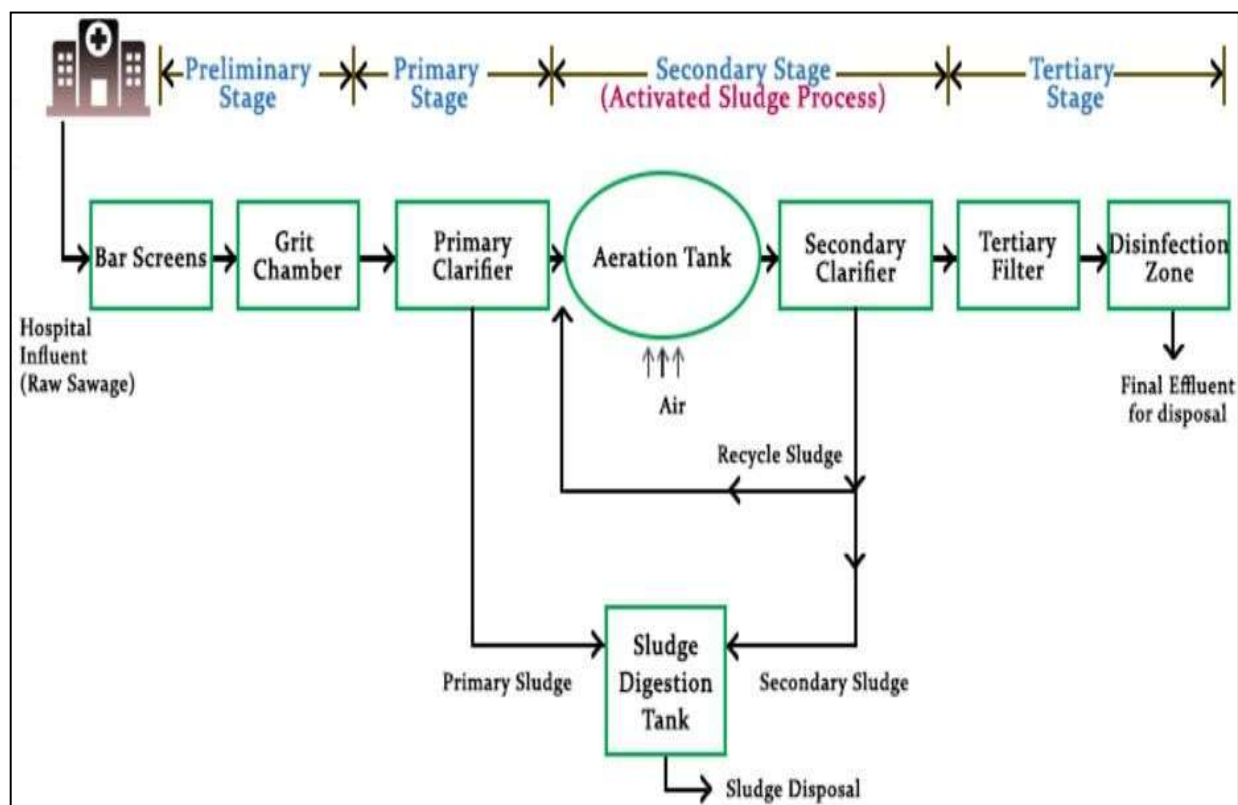


Figure 2-9 : Schematic Diagram of ETP

2.4.5.6 SEWAGE TREATMENT PLANT (STP) & EFFLUENT TREATMENT PLANT

Waste water to be generated from the proposed project would be treated in the in-house Sewage Treatment Plant (STP). It is estimated that about 725 KLD of sewage would be generated. The capacity of proposed Sewage Treatment Plant is about 870 KLD and ETP is 17 KLD. The proposed STP scheme is based on MBR for treatment of waste water.

2.4.5.7 STORM WATER DRAINAGE

The storm water disposal system for the premises shall be self-sufficient to avoid any collection / stagnation and flooding of water. Maximum harvesting will be done within the site. Therefore, it has been decided to provide sufficient at selected locations, which are liable to catch the maximum run-off from the area. Following are few measures for Storm water disposal:

1. Pipe drains is planned adjacent to roads. All building roof water will be brought down through rain water pipes.
2. Proposed storm water system consists of pipe drain, catch basins and seepage pits at regular intervals for rain water harvesting and ground water recharging.

3. The entire site is provided with extensive planned underground drainage system with gravity connections to the Recharge pits. Overflow from last Recharge pit shall be connected to water Drain line.
4. The arrangement provides appropriate protection to the site against flooding.

2.4.5.8 RAINWATER HARVESTING

Rainwater harvesting is the activity of direct collection of rainwater. Collected Rainwater is stored for direct use or for recharging the groundwater. Rain Water Harvesting is the technique through which rain water is captured from the roof and paved surfaces and stored in sub-surface ground water reservoir by adopting artificial recharge techniques.

Advantages:

- ✓ To meet the ever-increasing demand for water.
- ✓ To avoid flooding of roads.
- ✓ To augment the ground water storage and control the decline of water table levels.
- ✓ To reduce ground water pollution.
- ✓ To improve the quality of ground water.
- ✓ To reduce the soil erosion.
- ✓ To supplement domestic water requirement during summer, drought etc.
- ✓ Improves the quality of ground water through dilution when recharged to ground water.
- ✓ In saline areas, rain water provides good quality water and when recharged to ground water, it reduces salinity and also helps in maintaining balance between the fresh-saline water inter-faces.

Rainwater Harvesting Calculation for the project is given in **Table 2.9**.

Table 2-9: Rainwater Harvesting Details

Input Data			Unit	Reference
Catchment Area		Value		
1	Rooftop Area of Building/shed	30937.03	sq-mtr	
2	Green Belt Area	30928.71	sq-mtr	
3	Open & Paved Area	49018.13	sq-mtr	
	Total	110883.87		
Run off Coefficient, c				
	Rooftop Area of Building/shed	0.85		RWH in India, MoEF&CC, e-book 2016
	Green Belt Area	0.15		
	Paved Area	0.75		
	Open Area	0.15		
				CGWB
Rainfall				
	Average Annual Rainfall	1570	mm/year	
	Hourly Peak Rainfall Intensity, I	45	mm/hour	
	Peak Time taken	15	minutes	$Q = A * c * I$

Total Volume of Water to be Captured on Annual Basis				
	Rooftop Area of Building/shed	41285.47	cu-m/year	
	Green Belt Area	7283.71	cu-m/year	
	Paved Area	57718.85	cu-m/year	
Runoff Calculation for the Peak Rainfall, Q				
	Rooftop Area of Building/shed	295.84	cu-mtr/hour	RWH in India, MoEF&CC, e-book 2016
	Green Belt Area	52.19	cu-mtr/hour	
	Paved Area	413.59	cu-mtr/hour	
	Total	761.62	cu-mtr/hour	
Annual Recharge Potential				IMD
	Recharge Potential	106288.03	cu-m/year	
	Rainy Season	June-Sep		
Design of Recharge Structure for Peak Flow				
Calculation for One Pit				
	Diameter of Pit	4.5	mtr	
	Depth of the Pit	4.5	mtr	
	Volume of the Pit	71.57	cu-mtr	
Number of Pits Required to store the peak discharge		10.6		
Rain water harvesting Pits provided		10		

(Source: RWH Guideline by CGWA)

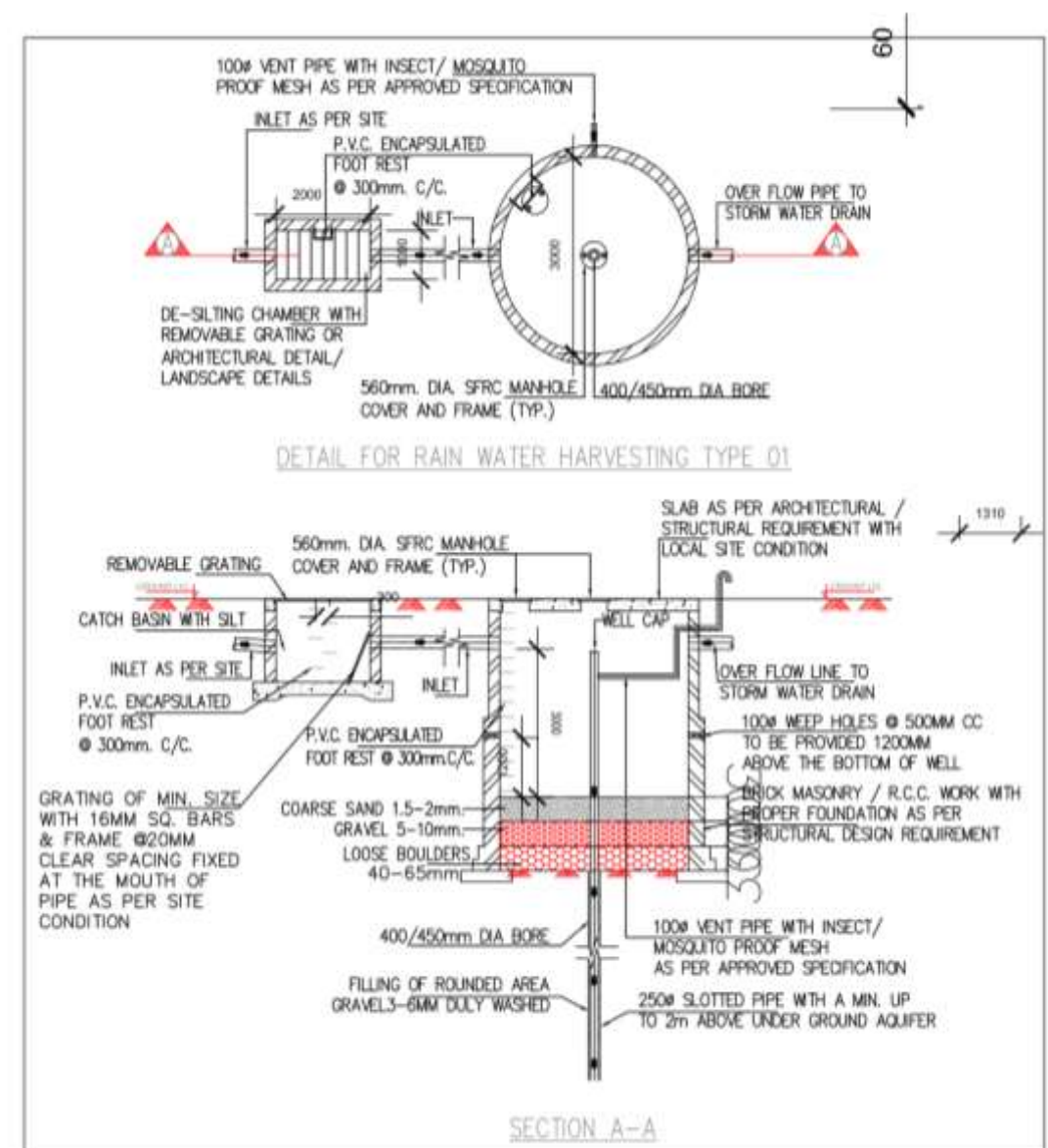


Figure 2-10: Rain water harvesting sectional plan

2.4.5.9 POWER REQUIREMENT

- Power for the proposed project will be supplied by South Bihar State Power Distribution Corporation Limited.
- Maximum power demand for the proposed project is ~3972.86 KW. Approx. 3 x 1010 KVA, 2 x 750 KVA & 1 x 625 KVA DG sets will be used as power backup during power failure.
- The DG sets will be provided with acoustic enclosure, adequate stack heights of D.G. sets will be provided as per the stipulated guidelines of Central Pollution Control Board (CPCB) to facilitate natural dispersion of exhaust gases.

2.4.5.10 ROAD & PARKING DETAILS

- Internal Road – Project has 12m., 9m. & 6m. wide roads inside the premises.
- External Road – 20 meter
- Setbacks- As per Bihar Building Bye Laws
- **Entry/exits provided in the project Premises-**

Parking will be provided in Basement and Ground Floor, attached as **Annexure-VI**.

Internal road networking plan attached.

2.4.5.11 LANDSCAPE DEVELOPMENT

Increasing vegetation in the form of greenbelt is one of the preferred methods to mitigate air pollution. Plants serve as a sink for pollutants, reduce the flow of dust and reduce noise pollution. Calculation of green area for proposed project is given in **Table-2.10**.

Table 2-10: Calculation of Green Area and No of Trees Proposed

Total Plot Area	110883.87 Sqm.
Landscape area provided @ 27.89 %	30928.71 Sqm.
Total No. of Trees will be Planted @ 1 tree per 80 Sqm. of Plot Area	1386 Nos.

2.4.5.12 SOLID WASTE GENERATION AND MANAGEMENT

A systematic approach for solid waste collection and disposal from project activities will be adopted. Solid waste generated from the project is collected properly and managed as per Solid waste Management Rules, 2016.

The domestic solid waste generated from the occupants of the University campus, Residence, Hostel, Visitors, staffs etc.; pertains to the two categories, Bio-degradable and non-biodegradable. These solid wastes are collected separately by putting different types of separate bins at the source of generation. It is estimated that maximum solid waste generation would be about ~2427 kg/day. Detailed Solid waste calculation is mentioned in **Table 2.11**.

Bio-Medical Waste Management will be done as per Bio Medical waste management rules 2016.

Separate colour-coded bins will be provided in the hospital campus for collection of different types of Bio-Medical Waste for the proper treatment.

Bio-Medical Waste: Biomedical waste is waste that is either putrescible or potentially infectious. Biomedical waste is generated from biological and medical sources and activities, such as the diagnosis, prevention, or treatment of diseases. Biomedical waste may be solid or liquid. Examples of infectious waste include discarded blood, sharps, unwanted microbiological cultures and stocks, identifiable body parts, other human or animal tissue, used bandages and dressings, discarded gloves, other medical supplies that may have been in contact with blood and body fluids, and laboratory waste. Biomedical waste is properly collected in the separate container and will be disposed by authorized processor for Biomedical Waste. Bio-medical Waste Treatment Facility (CBMWTF) for disposal of Bio-Medical Waste As per rule.

Table 2-11: Solid and Bio-Medical waste generation details

Sl. No	Description	Total Population	Unit rate Waste Generation	Solid Waste (Kg/day)	Bio-degradable	Non-biodegradable
1	Hospital Bed	630	1	630		
2	Attendant with patient (24 hours)	630	0.45	283.5	170.1	113.4
3	OPD	3250	0.1	325	195	130
4	Hospital & Medical College Staff	1195	0.1	119.5	71.7	47.8
5	Medical college Student	1000	0.1	100	60	40
	Girls & Boys Hostel	908	0.45	408.6	245.16	163.44
6	Boys Hostels, Girls Hostel, Nursing Hostel & Residential Unit	1075	0.45	483.75	290.25	193.5
7	Visitors @10% of Resident & Medical College Student	207	0.15	31.05	18.63	12.42
8	Canteen / Kitchen	2700	0.25	675	405	270
	Total solid Waste			2427	1456	971
	Biomedical Waste Generation (Hospital Bed)	1.0 kg/bed		630 kg/day		
	OPD Medical Waste	10% of total BMW		63 Kg/day		
	Total BMW			693 Kg/day		

Cat.	Type of Bag/ Container used	TYPE OF WASTE	Treatment /Disposal options
Yellow 	non-chlorinated plastic bags Separate collection system leading to effluent treatment system ←	a) Human Anatomical Waste b) Animal Anatomical Waste c) Soiled Waste d) Expired or Discarded Medicines e) Chemical Waste f) Micro, Bio-t and other clinical lab waste g) Chemical Liquid Waste	Incineration or Plasma Pyrolysis or deep burial*
Red 	non-chlorinated plastic bags or containers	Contaminated Waste (Recyclable) tubing, bottles, intravenous tubes and sets, catheters, urine bags, syringes (without needles) and gloves.	Auto/ Micro/Hydro and then sent for recycling. not be sent to landfill
White 	(Translucent) Puncture, Leak, tamper proof containers	Waste sharps including Metals	Auto or Dry Heat Sterilization followed by shredding or mutilation or encapsulation
Blue 	Cardboard boxes with blue colored marking	Glassware	Disinfection or auto/ Micro/hydro and then sent for recycling.

Figure 2-11: Bio Medical waste Management Details

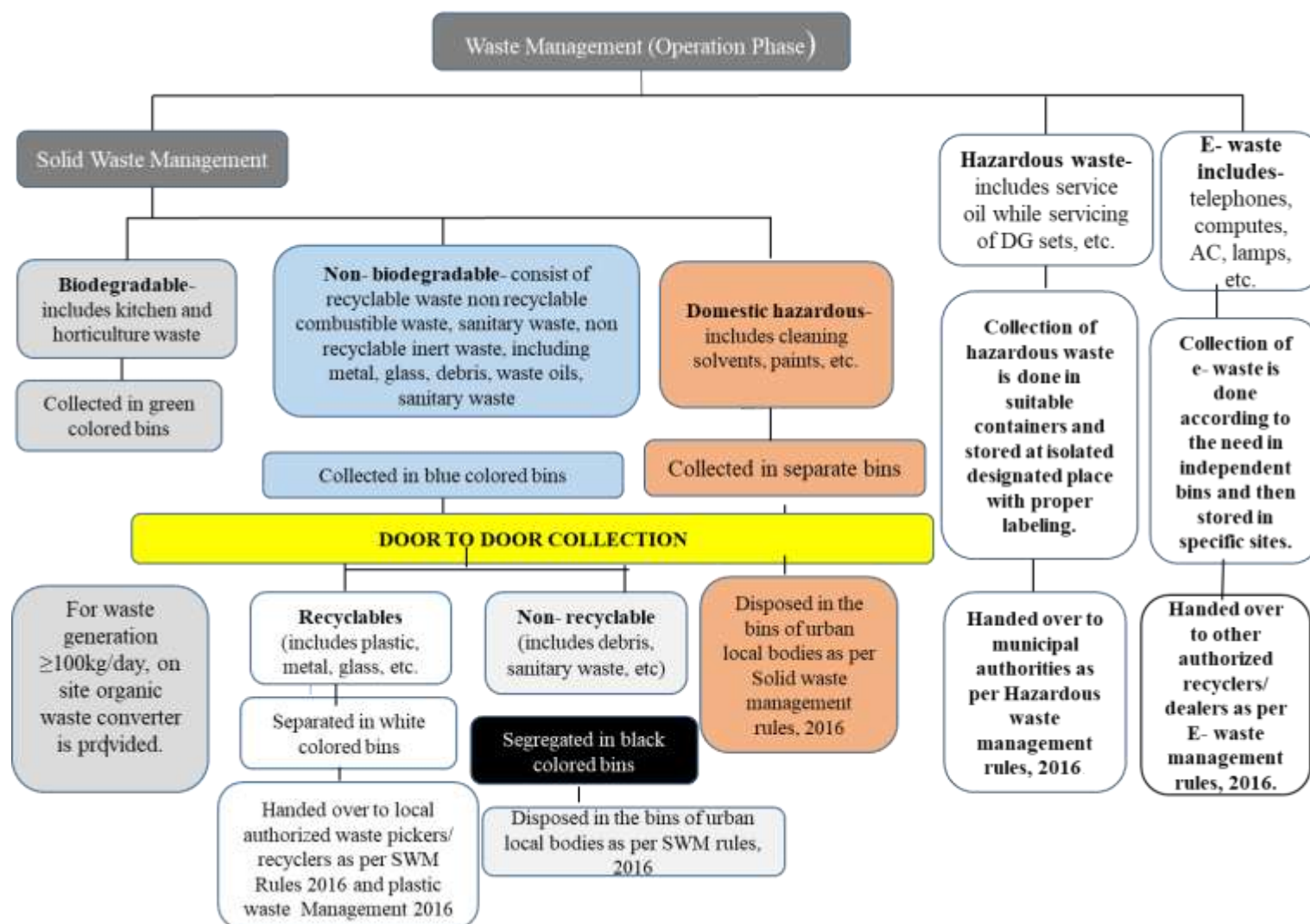


Figure 2-12: Solid waste Management Details

Table 2-12: Classification of Solid wastes and other wastes

S. No.	Types of Solid waste and other waste	Description
1.	Food waste (garbage)*	Wastes from the kitchen including preparation, cooking and serving of food.
2.	Rubbish*	Combustible (Primary organic): Paper, cardboard, cartons, wood, boxes, plastics, rags, cloths, beddings, leather, rubber, grass, leaves. Non-combustibles (Primary Inorganic): Metals, tin cans, metals foils, dirt, stones, bricks, ceramics, crockery, glass bottles, other metal refuses.
3.	Street Waste*	Street sweeping, dirt, leaves, catch basin dirt, animal dropping, contents of litter receptacles dead animals.
4.	Horticultural waste*	Tree trimming, leaves, waste from parks and gardens etc.
5.	General domestic waste from office and administration	Paper, General Domestic waste etc.
6.	STP Sludge	Sludge generation after treatment of sewage in STP.

***Source: Manual on Municipal Solid Waste Management, published by Central Public Health and Environmental Engineering Organization (CPHEEO), Ministry of Urban Development, Government of India.**

2.4.5.13 Organic waste converter

An Organic waste converter is a machine used for the treatment and recycling of solid and liquid refuse material. A converter is a self-contained system capable of performing the following functions: pasteurization of organic waste; sterilization of pathogenic or biohazard waste; grinding and pulverization of refuse into unrecognizable output; trash compaction; dehydration.

The total quantity of solid waste generation will be 2427 Kg/day out of which Bio degradable waste will be 1496 Kg/day. An organic waste converter of 3x500 Kg/day is required to be installed.

Principle:

The organic waste converter works on the principle of aerobic microbial decomposition of solid waste into compost. This is a bio-mechanical process which produces homogeneous odour free output in 2-3 days. The compost which is generated can be utilized for horticulture development and soil conditioning. It prevents production of methane gas.

Benefits of Organic Waste Converter:

1. Large quantity of solid waste is converted to fertilizer in a very short period
2. This fertilizer can be sold as compost to farmers, or used for gardening
3. Machine requires less space and the efficiency is high
4. Manpower and maintenance is very less
5. This is one of the latest techniques of managing solid waste.

Bio Medical waste from Hospital:

Total Bio Medical waste generation will be ~693 Kg/day. Bio Medical waste will be sent to Common Bio Medical Treatment Facility.

Hazardous Waste:

As regard to hazardous wastes, this project is generating following categories of hazardous waste.

Used Oil (Category 5.1, as per Schedule-1 of the Rules) - from DG sets

Oil contaminated Wastes (Category 5.2, Schedule-1) - from cleaning of DG sets, maintenance operations, etc.

Hazardous waste such as tube lights, thermometers, paint cans etc. shall be handed over separately to the garbage collectors for disposal.

The Hazardous waste generated will be managed as per the Hazardous waste (Management and Trans-Boundary Movement) Rules, 2016. Hazardous wastes will be stored in secured places with adequate secondary containment and labeling as per the requirements of Hazardous Waste (Management, Handling and Trans-Boundary Movement) Rules, 2008.

Appropriate records of hazardous wastes generation and disposal (in Form-3, Form-4, Form-9, Form-13 etc.) shall be maintained as per the requirements of Hazardous Waste (Management, Handling and Trans-Boundary Movement) Rules, 2008.

The used oil and oil-contaminated wastes shall be disposed of through authorized recyclers / re-refiners. Any other hazardous wastes, generated on-site, shall be sold only to authorized contractors.

Permanent electricity connection from State Electricity Board has been obtained for smoother functioning of the project. DG sets are placed as power backup and are being used only during power failure.

Operational hours of DG Sets are very less as the supply of power is good in this region. Therefore, quantum of hazardous waste generation to be less.

E-Wastes:

E-waste "is a popular, informal name for electronic products nearing the end of their "useful life". E-wastes are considered dangerous, as certain components of some electronic products contain materials that are hazardous, depending on their condition and density. The hazardous waste content of these materials pose a threat to human health and environment. Discarded computers, televisions, stereos, copiers, fax machines, electric lamps, cell phones, audio equipment and batteries if improperly disposed can leach lead and other substances into soil and groundwater. Many of these products can be reused, refurbished, or recycled in an environmentally sound manner so that they are less harmful to the ecosystem. Reducing e-waste requires that we reduce, reuse, recycle and recover. The goal is nothing less than zero land fill. Network of scrap dealers will be motivated to procure from door to door for the smaller quantities.

The E-waste generated is managed as per the E-waste management and handling rules 2016. The detailed Solid Waste Generation Management Plan is provided in **Figure-2.10**.

Plastic wastes will be managed by Plastic waste management rules, 2016.

2.4.5.14 Construction Material

List of building materials are being used at site:

1. Coarse sand
2. Fine sand
3. Stone aggregate
4. Cement
5. Steel,
6. Bricks
7. Sand Stone
8. Granite/Marble
9. Blocks
10. Glass

List of Machinery being used during Construction is as follows:

1. Dumper: Shall be used for mud and material handling
2. Concrete mixer with hopper: for RCC work
3. JCB: Shall be used for digging and earth work
4. Concrete Batching Plant: Will be used for concrete mixing
5. Road roller: For compacting the earth

2.4.5.15 ENERGY CONSERVATION MEASURES:

The details of solar energy usage equivalent to 18% of the demand load are given below:

Table 2-13: Energy Conservation details

LED Based Lighting								
Sl. No.	Description	Consumption with conventional light (watt/sqm.)	Consumption with LED light (watt/sqm.)	FAR (sqm.)	Total Consumption with conventional light (watt)	Total Consumption with LED light (watt)	Saving (Watts)	Saving (kVA)
1.	LED Light	1	0.4	165476.93	165476.93	66,190.77	99,286.16	99.29
Usage of energy efficient Lift (VVVF gearless lifts)								
Sl. No.	Description	Consumption with conventional lift (KW)	Consumption with VVVF gearless lifts (KW)	No. of lifts	Total Consumption with conventional lift (KW)	Total Consumption with VVVF gearless lifts (KW)	Saving (KW)	Saving (kVA)
1.	Lifts	21	10	18	210	180	30	33
S. No.	Net Energy saved (weighted Average Calculation)							
1.	Solar Based lighting will be done in the common areas, Signages, entry gates and boundary walls etc. @ 5%							199 KVA
2.	LED Based lighting will be done in the dwelling units							99.29 KVA
3.	Usage of energy efficient Lift (VVVF non gear lifts)							33 KVA
	Total Energy saved							331 KVA (8.33%)
	Total Energy consumption							3972.86 KVA
	Energy saving in Residence Envelope Transmittance Value (RETV)							10 %
	Total Energy saving							18 %

2.4.5.16 Fire Fighting System:**Salient Features of Engineering Systems****Objective**

The complex is categorized under 'Ordinary Hazard' as per National Code of India 2016. The main objective of firefighting system shall be to protect loss to Life and Property duly complying or exceeding statutory provisions. Essential Life Safety aspects relating to fire compartmentation and emergency escapes/ egress route planning shall be dealt by Architect. However, scope of this report shall be to highlight the proposed firefighting measures including installation of sprinkler for the entire facility, external/ internal hydrants, hand held fire extinguishers, inert gas fire suppression system for electrical rooms. The entire system shall be monitored from the Fire pump room / Fire Control Room.

Basis of Design

- National Building Code of India - 2016
- Relevant Bureau of Indian Standards (BIS) Codes
- Motors, cabling, wiring and accessories as per BIS codes / IE Rules / IS codes
- Recommended practices of Equipment manufacture.
- Recommendations of CFO, BIHAR

Design Philosophy

In the event of fire, the occupant initial firefighting arrangements sprinkler system in the area shall get activated in case of fire.

Occupants on floors would evacuate the complex as announced on the P.A. System. Firefighting system sprinklers shall be activated in case of fire. Hose reel and landing valve on each floor will provided.

System Description

- A centralized Fire Pump Room having centrifugal pumps to maintain minimum pressure of 3.5 kg/cm² at the highest point.
- Separate risers for Hydrant system and Sprinkler system and for water curtain.
- System is designed that at no sprinkler / hydrant points water pressure is more than 3.5 Kg/cm² bar in static condition. Orifice plate will be used at each Valve to control the pressure.
- For External Protection of the buildings, Ring Main dia. 150 mm with Hydrants at 45m intervals is provided.

A) Pumps & Equipment's shall be as per requirement of NBC-2016 as detailed.

S. No.	Description	
1	Electrically driven Hydrant Pump	- 2280 LPM - One No
2	Electrically driven Sprinkler Pump	- Electrical Driven – 2280 LPM
3	Diesel engine driven pump (Stand by)	- 2 Nos 2280 LPM
4	Jockey pump	a. Hydrant – 180 LPM b. Sprinkler – 180 LPM
5	Water Curtain Pump	- 1 Nos 900 LPM

Fire Hydrant System

Internal Hydrants / Fire Hose Cabinets

All Buildings shall be provided with fire hydrant riser. Fire hose cabinet to have internal landing valve isolation valve, orifice plate, swinging hose reels with valve and shutoff nozzle, fire man's axe, 2 No 63 mm dia. RRL hose, one standard nozzle, fire extinguishers Co₂ 1 x 4.5 kg and ABC 1 x 6 kg. Fire hose cabinet shall have framed glass door 1200 x 2000 mm.

Yard Hydrants / Cabinets

Yard hydrants shall be located at maximum 45-meter intervals. One Butter fly valve, one hydrant valve, two No RRL 63 mm dia hose pipe and one nozzle shall be placed in a closed cabinet with glass shutters in the cabinets. Yard Hydrants will be located between (2-15 mtrs.) away from the building.

FIRE DEPARTMENT CONNECTION

Fire Brigade Connections would be provided for feeding the wet risers and the sprinklers system directly by the fire brigade for each building. These would be provided at locations easily accessible by the Fire Tender. 4-way fire brigade connection and draw off connection for the underground fire war tanks to be provided.

SPRINKLER SYSTEM

Sprinklers shall be installed in all buildings as per National Building Code 2016.

Range of Sprinklers: -

- (i) 12 sqm area for pendant sprinklers for all floors except basements, 9 sqm area for upright sprinklers in basements.
- (ii) Extended wall mounted sprinkler.
- (iii) Public areas shall have pendant/extended wall mounted type sprinklers.

- (iv) Upright Sprinklers will be installed above fall ceiling in case the gap between fall ceiling and slab exceeds 799 mm.

The sprinkler pump shall be automatic operation and will start in case of a drop of pressure in the system. Installation control valves along with hydraulic alarm will be provided in pump house. The operation theaters shall have normal sprinklers.

Flow switches shall be provided on each floor and connected to the fire control panel through intelligent fire alarm system in the fire control room, to announce the location of affected floor. Valves on flow switches shall have butterfly valves chain and lock to indicate the position of valve. Installation valves shall be provided as per NBC / Local Fire Authority.

Passive Fire Protection Measures:

FIRE RATED SMOKE CHECK DOORS: These shall be provided in accordance with N.B.C. Part IV, 2016 wherever required to stop ingress of fire/smoke to other areas. Viz. all stairwells and lift lobbies etc.

All horizontal and vertical openings in the service shafts, cable ducts etc. shall be effectively sealed with non-combustible materials to stop spread of fire/smoke.

Ventilation: Adequate ventilation shall be provided complying with NBC 2016, using ducted system.

FIRE ALARM SYSTEM:

The entire complex shall be provided with intelligent addressable fire alarm system, public address system and manual call points.

Electrical Sub-Station, Electrical Panels & Wiring:

The electrical distribution system would conform to NBC Part-4 as applicable all wires / cables used inside the building shall be fire resisting type. Separate circuits for firefighting pumps, lifts, staircases and corridor lighting & blowers for pressurizing system, smoke extraction system, water supply pumps, lifts exit signs, corridor and street lighting shall be provided so, that fire in one circuit will not affect the others.

No other Utility Lines would be laid in the Electrical Cable ducts.

Fire Control Room & Intercommunication System:

A Fire Control Room would be provided to conform to NBC Part 4, having communication system to all floors. This would be located on the ground floor.

PORTABLE FIRE EXTINGUISHERS

Portable fire extinguishers Carbon dioxide 4.5 kg and ABC 6 kg capacity shall be provided as first aid fire extinguishing appliances. These extinguishers shall be suitably distributed in the entire public as well as service areas. The appliances shall be so distributed over the entire floor area so that a person has to travel not more than 15 m to reach the nearest appliance. These shall be hung on wall in a group at suitable places. The number of extinguishers shall be as per IS: 2190. 5 kg Inert Gas fire extinguishers, ceiling mounted, operated through thermostats will be installed in each electrical room.

3 DESCRIPTION OF THE ENVIRONMENT

3.1 Introduction

This chapter describes the existing baseline condition of the project site and its immediate surroundings. This includes the physical environment comprising air, water and land components, biological environment and socio-economic environment. Attributes of the physical environment like air, water, soil quality and noise level in the project site and surrounding area were assessed through monitoring and analysis of samples collected from the sampling locations.

Details of topography, geology, hydrology, prevailing natural hazards like floods, earthquake etc. have been collected from different available literatures and information from various government departments. Primary surveys were carried out to understand and record the biological environment prevailing in the area and the same was verified against published information and literatures. The socio-economic environment has been analysed through the data obtained from Census 2011 report.

3.2 Environmental Baseline Data Collection

Baseline data for the proposed project was collected during winter season (October 2023 to December 2023) to assess the present scenario of the area, the baseline data has been collected by NABL Accredited Laboratory i.e. Enviro-Tech Services (ETS), South Side of G. T. Road, Ghaziabad, Uttar Pradesh, India.

Primary Data

An area, covering a 10 km radial distance from the project site is considered as study area for the purpose of baseline studies. The environmental monitoring for the study area, for the proposed project, was undertaken for the winter season. Initially, a reconnaissance survey of the study area was carried out and then field monitoring for measuring ambient air quality, water quality, and soil quality and noise levels was carried out from October 2023 to December 2023. In addition, certain aspects like land area, socio-economic status, climatological conditions, etc., have been analyzed based on secondary information available from sources like district census reports, district gazetteers, Indian Meteorological Department, etc. The baseline status of various environmental components is described in the succeeding sections.

Table 3-1: Primary Data Collection

Sl. No.	Description
1.	Meteorology Meteorological parameters on hourly basis at project site. Parameters: Temperature, Relative humidity, Wind Speed & Wind Direction.
2.	Air Ambient air quality monitoring (24 hourly), twice a week. Parameters: PM10, PM2.5, SO2, NO2 & CO. No. of Locations: 08 locations in core and buffer zone.
3.	Noise Noise level monitoring (day & night time), once in a season. No of locations: 08 locations in core and buffer zone.
4.	Water Ground water sampling, once in a season. No of Locations: 08 locations in core and buffer zone. Tested for physical and chemical parameters. Surface water sampling, once in a season. No of Locations: 02 locations in core and buffer zone. Tested for physical and chemical parameters.
5.	Soil Soil sampling, once in a season. No. of Locations: 08 locations in core and buffer zone.
6.	Biological Environment. Biodiversity survey, once in a season. Location: Core and buffer zone.
7.	Socio-economic Environment Socio-economic survey, once in a season. Location: Core and buffer zone.

3.2.1 Source of Primary Data

The Primary data has been collected by Rian Enviro Private Limited located at 202 and 402 Mangal Market, Raja Bazar, Sheikhpura, Patna-800014 and Enviro-Tech Services. NABL & MOEF&CC accredited Lab. Correspondence & Lab: Plot No1/32, South Side G.T. Road Industrial Area Ghaziabad (UP)-201001. Head Office: - G-232, M.G. Road Industrial Area, Hapur - Ghaziabad (UP)-20101.

3.2.2 Instrument used for Environmental Baseline Data Collection

The following instruments were used at the site for environmental baseline data collection work.

1. Respirable Dust Sampler with attachment for gaseous Pollutants.
2. Fine Particulate Matter (FPM) Sampler
3. Weather Monitoring Station
4. Global Positioning System (GPS)
5. Digital D.O. Meter.
6. Sound Level Meter Model

Apart from collecting samples of air, water, noise and soil from representative sampling points given in proceeding sections, the data on land use, vegetation and agricultural crops were also collected by the field team through interaction with a large number of local inhabitants of the study area and different Government departments / agencies. This has provided an excellent opportunity to the members of the field team for obtaining clear scenario of the existing environment of the study area.

3.3 Secondary Data

The secondary data collected from different Department has been mentioned in **Table 3.2**

Table 3-2: Source of Secondary Data

Sl. No.	Description	Source
1	Land Use & Topography	Survey of India (SOI) Maps Landsat 7 8 (Imagery 7 spectral data) Google Maps GIS Revenue Record
2	Hydrology	District Hand book
3	Geology	District Hand book
4	Meteorology	Indian Metrological Department (IMD)
5	Ecology	IUCN
6	Socio Economic	Census of India 2011, Administrative Atlas

3.3.1 Location & surrounding features

The terrain is almost flat, no hills in the surroundings. The site is located at Mauza- Debipatti, Halka- Dinapatti, Block- Pipra, District- Supaul, Bihar. The total land is 11.088 Ha. (110883.87 Sqm) under Government of Bihar. The project site is adjacent to Debipatti Main Road, NH- 327 and NH- 131 which is approx. 1.15 km towards East.

The nearest railway station is Supaul Railway Station (approx. 19.0 km towards South West) and Tharbitia Railway Station is Approx.- 14.0 Km towards WNW from the project site. The

nearest airport Darbhanga Airport is at distance of approximately 86.0 km in West direction from the project site (Distance in Aerial).

3.3.2 Geology

The district in general possesses alluvial soil. The soils are of poorly drained type. The entire Ganga plain covering the northern part of the district is mostly underlain by considerably thick fluvial sediments of variable thickness, belonging to Quaternary age bordered by Siwalik group of rocks (Eocene period) in the north. The southern boundary of this vast plain is with plateau comprising formations belonging to Proterozoic period. Isolated patches of formations of Gondwana system are seen at places. The Siwalik succession constituting the southern slopes of Himalayan foothills provide a vital link of the reconstruction of geological history of Ganga basin. In the vicinity of foothill, the Quaternary sequence lies uncomfortably over the Siwalik formations. It slopes southerly and is texturally dominated by pebble, cobble and boulders in sandy/silty matrix along with inter-bedded sand, silt and clay of variable thickness. Such gravel pebble zone commonly known as Bhabar belt and falls outside the project area.

The grain size considerably reduces in down slope direction. The bulk of Ganga alluvium present in the project area consists of thick pile of unconsolidated sediment comprising multi-cyclic sequence of finer clastic, gradually fining upwards. The exact thickness of alluvial sediments is still unknown, but may be few hundred meters. The recent studies of Oil and Natural Gas Commission, both geophysical and exploratory drilling has indicated the thickness of Quaternary alluvial sediments around 300 to 400 m, underlain by Siwalik sediments.

The Geological Survey of India have identified 5 broad geological domain with different geological character over north Bihar plain viz. (1) Kosi – Mahananda belt (2) Kosi –Gandak interfluvial belt (3) Gandak – Ghaghra doab (4) Ganga meander and (5) South Ganga Plain. The study area forms a part of Kosi – Mahananda belt. The older Quaternary units are exposed along narrow belt in the vicinity of Himalayan belt exhibiting distinct angular unconformity with underlying Neogene sediments. These sediments are limited to the extreme north– western corner of North Bihar. Local stratigraphic sequence /geological successions of Supaul district.

The entire district is covered under Quaternary sediments of Pleistocene to late Holocene age and as per the nature of sediments and depositional age the sediments are classified in four Formations named as per their type area, these are Hazipur formation of pleistocene

age, followed by Purnea , Kosi and Diara Formation. The Diara formation is the youngest, present day deposits. Hazipur formation is exposed in the north western parts of the district for limited areal extent constitutes older alluvium deposits.

3.3.3 Geomorphology & Soils

The district forms a part of the Kosi megafan. The river is known for its notorious shifting and channel abandonment approximately in every 25 years. The district Supaul is subjected to frequent flooding related to either shifting of the river Kosi or bank overtopping / breaching by floodwater.

Sweeping of the river in the megafan has created the alluvial landscape with abandoned channels and the flood plains. The abandoned channels exhibit sand bodies of huge dimension, often exposed or buried under thin veneers (~1.0 m) of mud. They also characterize the depressions in the megafan surface, which are prone to water-logging. Often the channels are occupied by mis-fit channels of smaller dimension (Fig 7). During lean period, these channels get water from the aquifers. These smaller channels rework and redistribute the flood plain sediments, and hence contribute in the evolution of the flood plain architecture.

land surface in the district slopes southward with 30-35 cm/km at the northern half, while it is 45-55 cm/km at the southern half with an average value of ~ 40 cm/km. The reach segment of the Kosi River within the district Supaul is wide (6 to 8 km) and highly braided in nature.

Geo-morphologically the district is represented by two distinct geomorphic surfaces i.e., Purnea surface represented by older flood plain and Diara surfaces represented by younger alluvial plain and present day deposits. Besides, paleo-channels, active flood plain, channel bar deposits, point bar sedimentation, meander scars, oxbow lakes etc. constitute other geomorphic landforms. The geomorphic features typical of river shifting, migration and flood plain area are predominant in the district. However, the geomorphic landforms in the district to a large extent are influenced by the mighty Kosi River hydrology and basin movements/neo tectonic activities which are discussed subsequently.

Source: Ground Water Information Booklet, Supaul District, Bihar State

3.3.4 Seismology

Proposed project site comes under India's seismic zone V, indicating its vulnerability to major earthquakes. Supaul also falls in the risk zone for floods and cyclones.

3.4 Land Environment

3.4.1 Land use Landcover Analysis

Landcover data highlights the area covered by forests, wetlands, impervious surfaces, agriculture, and other land and water types. Water types include wetlands or open water. Landuse shows how people use the landscape for development, conservation or for other purposes. Therefore it highlights the current scenario as well as predict the impact.

1. Objectives: Main objectives are:

- To prepare the land use land cover map of study area based on recent satellite imageries.
- To assess the impact of proposed project on existing land use and land cover
- To suggest mitigations measures

2. Hardware: The equipment used during the present investigation includes ground truth hand held GARMIN 12 GPS receiver for ground truth collection, besides the visual observation and analysis.

3. Software: The following software were applied to extract indicators and maps:

- **ERDAS Imagine:** The Erdas imagine version 2016 is used to process Landsat-8 satellite data and to extract the required indicators through spatial & spectral analysis.
- **ArcGIS:** The ArcGIS version 10.3 has been used to prepare the final Maps for indicators through the outcomes of ERDAS software.

4. Methodology: The methodology applied for the study involved obtaining satellite images from open source, and then using a range of software to process the images and also by GPS coordinates (ground truthing) for drawing observations. The detailed methodology is explained as below.

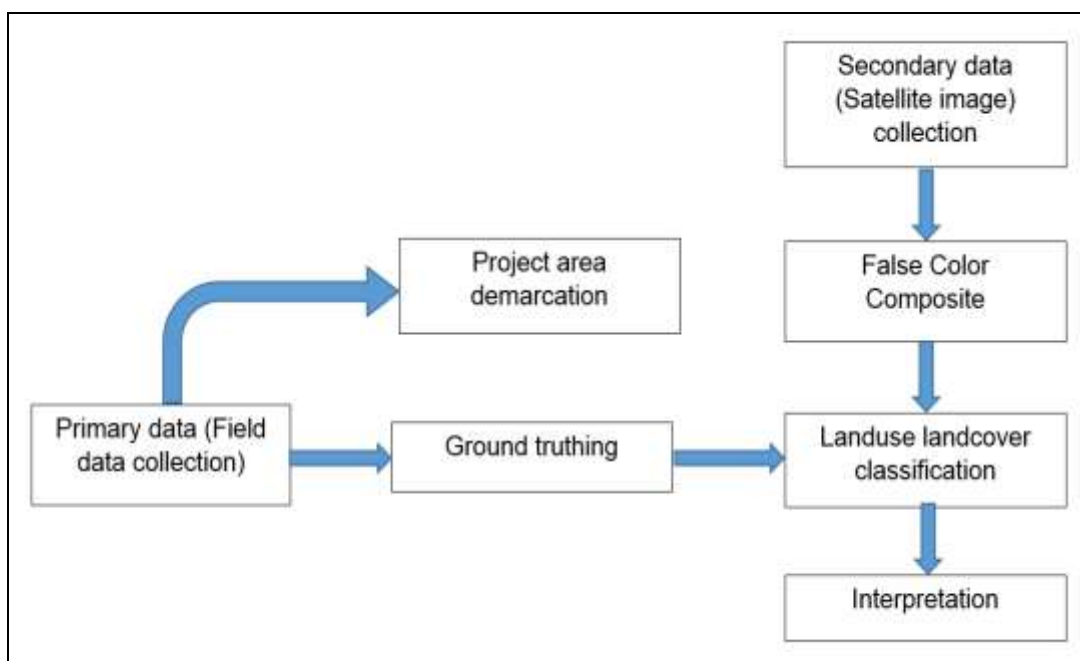


Figure 3-1 : Flow Chart Methodology of LULC classification

- **Primary Data:** The coordinates along land features of project area is collected with the help of GPS device for ground truthing. This data is primary data. On the basis of this data, land use land cover analysis is appropriate.
- **Secondary Data:** Satellite image (secondary data) is required to show the current land features of the project area and buffered area (10 km). Landsat 7 and 8 Satellite image is used, which is collected from open source of USGS earth explorer.

The path, row, date, resolution of satellite data used were as follows.

Path	140
Row	42
Date of pass	04 April 2023
Resolution (panchromatic)	15 Meter

- **Landsat 8 Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS)** images consist of nine spectral bands with a spatial resolution of 30 meters for Bands 1 to 7 and 9. The ultra-blue Band 1 is useful for coastal and aerosol studies. Band 9 is useful for cirrus cloud detection.
- **False Color Composite (FCC):** False color (or false colour) refers to a group of color rendering methods used to display images in color which were recorded in the visible or non-visible parts of the electromagnetic spectrum. A false-color image is an image that depicts an object in colors that differ from those a photograph (a true-color

image) would show. False-color image sacrifices natural color rendition in order to ease the detection of features. The FCC for 10 km buffer zone of the project area is shown in **Figure 3-2.**

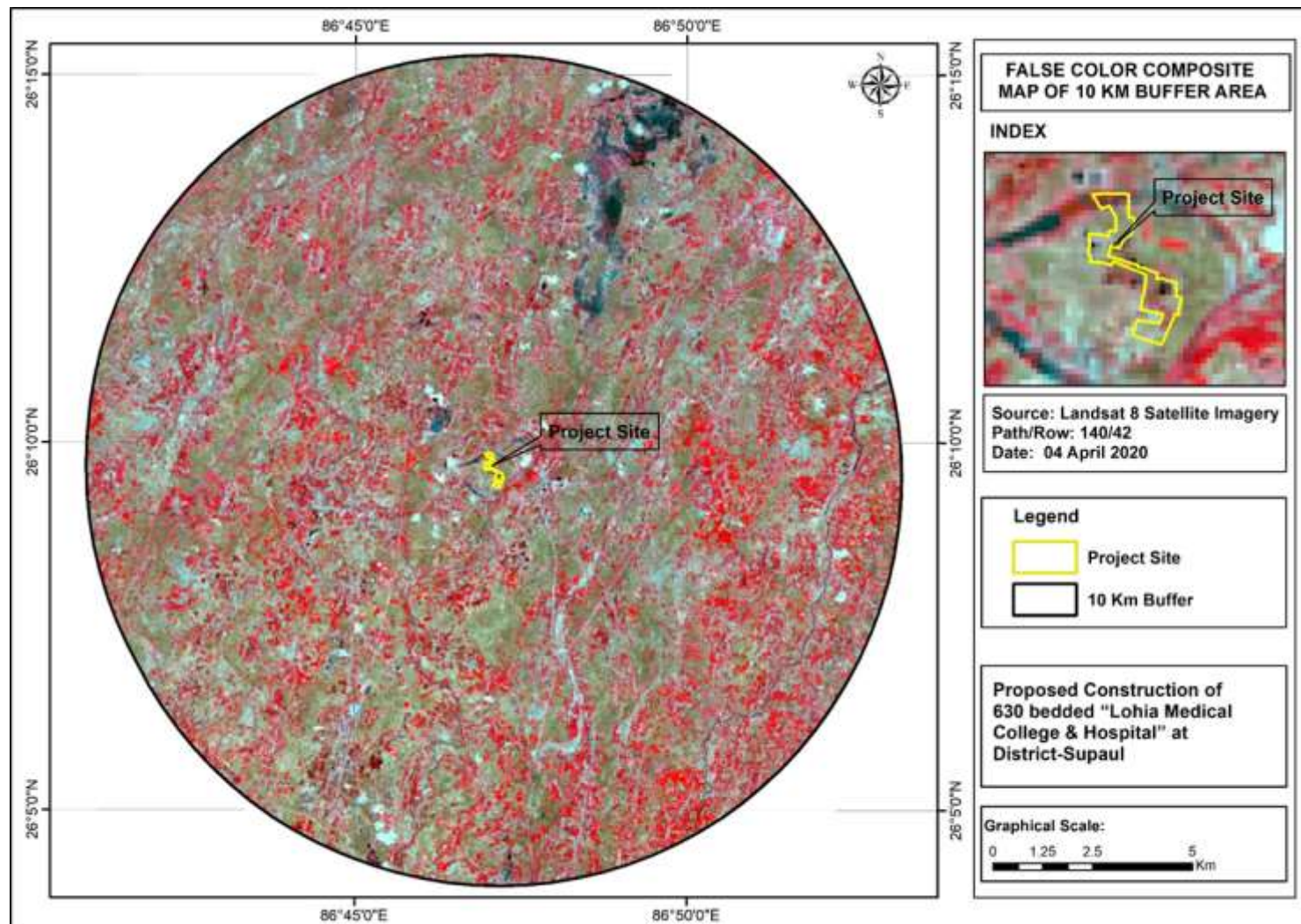


Figure 3-2: Shows the False colour Composite Map of the study area

- **Landuse landcover classification & Interpretation:** The classification approach is applied on the basis of various characteristics like colour, texture, shape, association etc. The Landuse landcover map for 10 km buffer zone of the project area is shown in figure 3-2.

The unsupervised classification approach was obtained for the Landuse and Landcover classification by using ERDAS Imagine software. In this approach, the pixels of the project area are clustered in several classes on the basis of spatial & spectral variation in pixel value which are following:

- I. **Built-up land:** 4.27 per cent of the total project area is covered by built-up land. This area is identified by grey color and square/rectangular shape in the satellite image. Built-up land can be described as an area of intensive use with much of the land covered by structures. Areas included in this category are cities, towns, villages, strip developments along with highways, transportation, power and communications facilities, and other areas such as those occupied by mills, shopping centers, industrial and commercial complexes, and institutions that may, in some instances, be isolated from built-up areas.
- II. **Agricultural land:** 29.47 per cent of the total project area is covered under agricultural land. Agricultural land may be defined as the land that is used primarily for the production of food and fiber. In the satellite imageries, cropland is identified by light pinkish to dark pinkish color or red, fine texture and rectangular/square shape.
- III. **Agricultural fallow land:** It is the type of cropland which is not seeded for a season so as to allow the fields become fertile again. The practice of allowing fields to remain fallow dates back to ancient times when farmers realized that using soil over and over again depletes its of its nutrients. Agricultural fallow land covers 60.93 per cent of the total project area.
- IV. **Open Land:** Open land is any degraded land or a land which is currently underutilized but can be brought under vegetative cover with reasonable efforts. This type of land covers 2.75 per cent of the total project area. This area is identified by off-white color and rough texture in the satellite image.
- V. **River/Water Bodies:** All natural and man-made ponds, reservoirs, river come under this class. A river is a natural flowing watercourse, usually freshwater, flowing towards an ocean, sea, lake or another river. In some cases a river flows into the ground and becomes dry at the end of its course without reaching another body of water. This

feature is identified by dark blue to black color, fine texture in the satellite image and cover only 0.71 percent of the total project area.

VI. Vegetation: This type of land covers 1.87 per cent of the total project area.

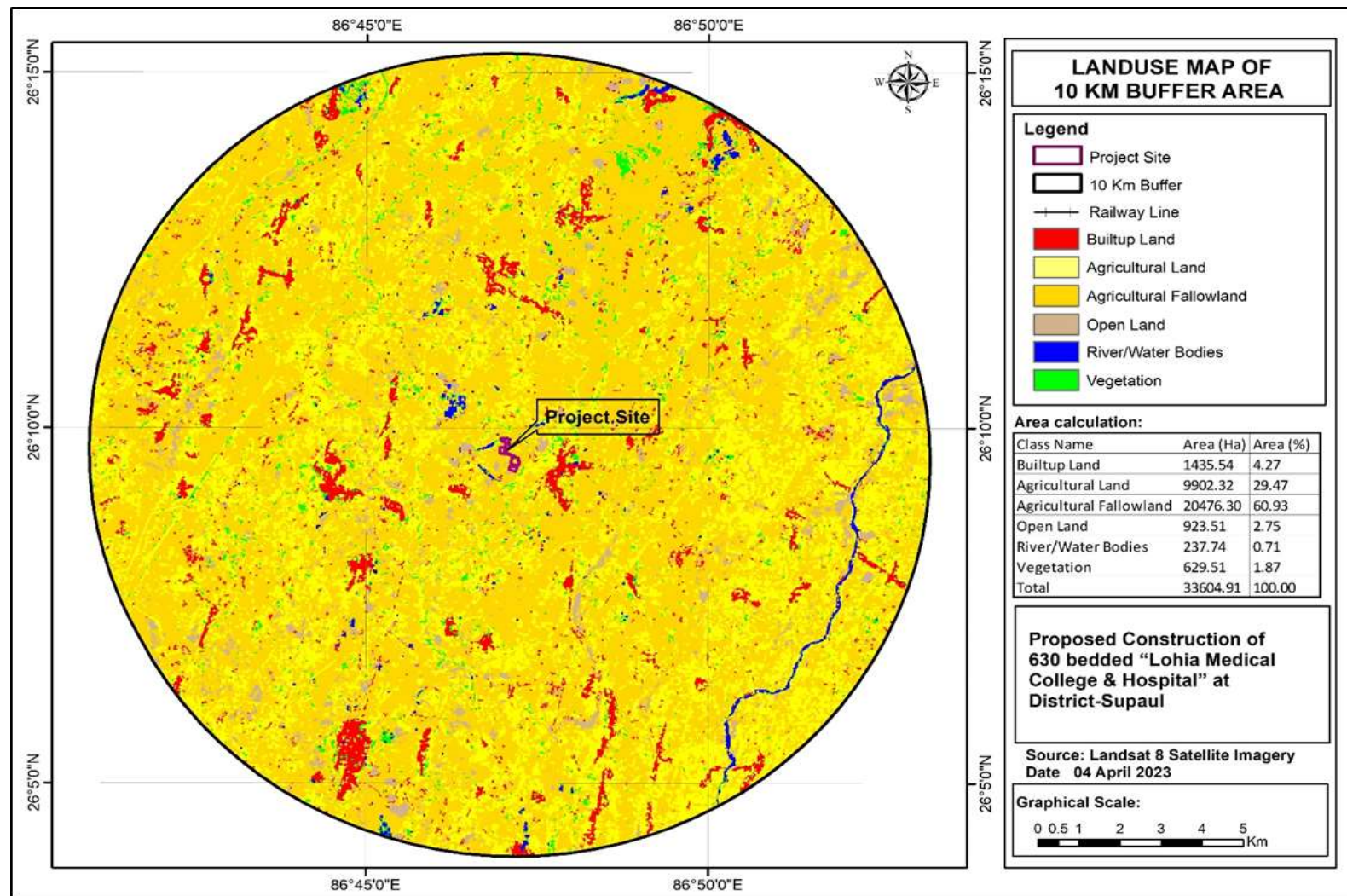


Figure 3-3: Land use land cover classification

On the basis of the landuse landcover classification, the areas of different land features are as follows:

Table 3-3: Land use Landcover classification of the study area

Class Name	Area (Ha)	Area (%)
Built-up Land	1435.54	4.27
Agricultural Land	9902.32	29.47
Agricultural Fallowland	20476.30	60.93
Open Land	923.51	2.75
River/Water Bodies	237.74	0.71
Vegetation	629.51	1.87
Total	33604.91	100.00

Impact Analysis:

This Construction project will have some anticipated impacts which are as follows

1. Creation of employment, quality shelter and improved infrastructure.
2. The surrounding land use pattern will be changed.
3. Road network will be developed.
4. Impact on the public utilities arising out of the utilities for the project activities.
5. Impact on the natural drainage system and soil erosion.
6. Impact of construction activity on the fertility status of soil in the study area

Mitigation measurement:

Mitigation measures are means to prevent, reduce or control adverse environmental effects of a project, and include restitution for any damage to the environment caused by those effects through replacement, restoration, compensation or any other means. The mitigation measures are as follows:

1. Selection of suitable local plant species for greenbelt development in and around the sites.
2. Top soil conservation plan and its re-utilization depending on its quality
3. Recycling of recyclable non-biodegradable garbage and only non-recyclable portion shall be handed over to local authority to reduce the load on dumping grounds.

3.4.2 SOIL TYPE

The district in general possesses alluvial soil. The soils are of poorly drained type. The areas close to the Kosi channels possess soil types of sandy loam, loamy sand and sand character, whereas, the areas away from the river channels consist of silty sand to sandy silt in nature. The soils in general are fine textured away from the river course and rivulets and coarse textured along their courses. Nature of the soil is the function to support the growth of agricultural and horticultural crops. Soil is the mainstay of agriculture and horticulture, forming as it does the medium in which growth and ultimately the yield of food producing crops occurs.

3.4.3 SOIL QUALITY

To understand the soil characteristics, 08 locations in the study area were selected for soil sampling. For selection of soil sampling locations, the following criterion was considered:

- Soil from agricultural land, Park and open land, where there is possibility of contamination

Table 3-4 : Soil Monitoring Location

Sample ID	Monitoring Location	Distance & direction from project site	Coordinates
SQ1	Project Site	--	26° 9'34.69"N 86°47'8.46"E
SQ2	Near Khedan Baba Sthan Debipatti (Under 500 meter)	0.42 Km in ENE	26° 9'40.13"N 86°47'26.72"E
SQ3	Near Pipra	1.3 Km in East	26° 9'27.24"N 86°47'57.74"E
SQ4	Near Golden Public School, Amaha	2.5 Km in WNW	26° 8'50.19"N 86°47'31.71"E
SQ5	Atlakha Belahi	2.7 Km in NE	26°10'12.69"N 86°48'40.33"E
SQ6	Near Debipatti	1.0 Km in NW	26°10'1.67"N 86°46'42.99"E
SQ7	Near Dinapatti	1.1 Km in NE	26° 9'32.55"N 86°46'28.09"E
SQ8	Near Bishunpur	1.6 Km West	26° 8'52.26"N 86°46'34.63"E

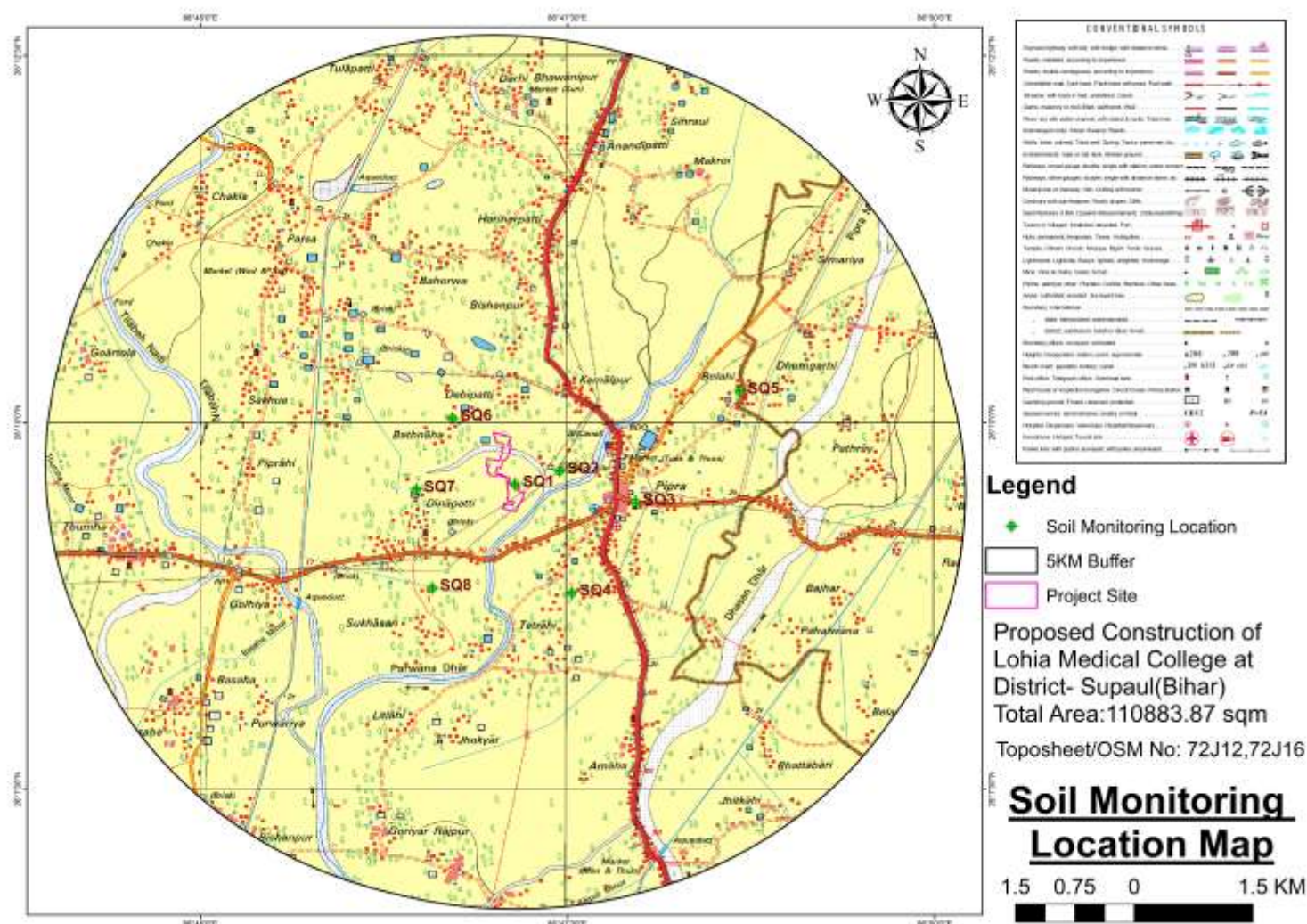


Figure 3-4 : Soil Monitoring Location Map



Figure 3-5 : Soil Sampling Photographs

The details of soil sampling locations & result are given in **Table 3-5** & **Table 3-6** respectively. The soil sampling locations are shown in **Figure 3-12**. Composite sampling of soil up to root depth (10 - 15 cm) was carried out at each location.

Analysis results of physical and chemical parameters of soil samples are given in **Table 3-5**. Chemical classification of soil quality as per Indian Council Agriculture Research (ICAR) is given in **Table 3-6**.

Table 3-5 : Results of soil sample analyses report

S. No.	Test Parameters	Unit	SQ-1 (Project Site)	SQ-2 (Near Khedan Baba Sthan Debipatti (Under 500 meter))	SQ-3 (Near Pipra)	SQ4 (Near Golden Public School, Amaha)	SQ5 (Atlakha Belahi)	SQ6 (Near Debipatti)	SQ7 (Near Dinapatti)	SQ8 (Near Bishunpur)	Test Method
1.	Texture	...	Sandy Clay Loam	Sandy Clay Loam	Sandy Clay Loam	Sandy Clay Loam	Sandy Clay Loam	Sandy Clay Loam	Sandy Clay Loam	Sandy Clay Loam	IS:2720 (Pt-4)
2.	Sand	%	52.5	50.4	58.6	60.7	51.3	63.9	48.2	63.5	IS:2720 (Pt-4)
3.	Silt	%	33.2	32.1	28.4	24.0	27.1	24.0	34.7	26.0	IS:2720 (Pt-4)
4.	Clay	%	14.3	17.5	13.0	15.3	20.6	12.1	17.1	10.5	IS:2720 (Pt-4)
5.	pH (1:2 Suspension)	..	7.79	7.48	7.80	7.37	7.57	7.76	7.67	7.62	IS:2720 (Pt-26)
6.	Cation Exchange Capacity (CEC)	meq/100g	24.48	26.52	21.42	24.48	26.01	26.52	23.46	26.52	IS:2720 (Pt-24)
7.	Electrical Conductivity (1:2)	µmho/cm	331.5	357.0	362.1	321.3	352.9	323.3	342.7	335.6	IS:14767
8.	Water Holding Capacity (WHC)	%	36.7	36.2	21.4	31.0	29.6	22.4	29.6	31.6	IS 2720 (Part-2)
9.	Sodium (Na)	mg/kg	115.3	126.9	82.1	125.5	134.6	138.7	131.6	162.2	APHA-3125B
10.	Calcium (Ca)	mg/kg	1146.0	1071.0	1191.9	1240.7	1084.8	1056.2	1053.2	986.9	IS 2720 (Part-23)
11.	Magnesium (Mg)	mg/kg	462.1	522.2	332.5	328.7	472.6	420.2	432.5	447.8	ETS/STP/ SOIL-08

S. No.	Test Parameters	Unit	SQ-1 (Project Site)	SQ-2 (Near Khedan Baba Sthan Debipatti (Under 500 meter))	SQ-3 (Near Pipra)	SQ4 (Near Golden Public School, Amaha)	SQ5 (Atlakha Belahi)	SQ6 (Near Debipatti)	SQ7 (Near Dinapatti)	SQ8 (Near Bishunpur)	Test Method
12.	Bulk Density	g/cm ³	1.48	1.37	1.38	1.28	1.56	1.45	1.51	1.86	IS 2386 (Part-4)
13.	Total Nitrogen (N)	mg/kg	176.4	166.1	180.3	194.5	186.4	151.3	168.5	169.7	APHA, Pt 4500:(N)
14.	Phosphorus (PO ₄)	mg/kg	44.2	59.1	52.4	53.4	47.4	44.4	57.1	60.6	ETS/STP/ SOIL-19
15.	Potassium (K)	mg/kg	285.1	251.6	229.0	335.2	226.2	195.3	192.2	201.9	APHA-3125B
16.	Organic Matter	%	2.86	3.06	2.86	2.45	2.75	2.75	2.75	2.24	IS: 2720 (P-22)
17.	Organic Carbon	%	1.84	1.53	1.43	1.63	2.14	1.63	1.94	1.94	BS 1377 - 3)
18.	Sulphate as (SO ₄)	mg/kg	2.35	2.04	2.65	1.28	1.68	2.55	2.55	2.45	IS:3025(P-24)
19.	Porosity	%	29.6	27.9	20.3	23.4	19.2	31.6	20.4	16.3	IS 13030
20.	Manganese, (Mn)	mg/kg	3.77	3.88	3.26	4.59	3.88	3.37	3.67	3.16	ETS/STP/ SOIL-18
21.	Nickel, (Ni)	mg/kg	1.63	1.53	1.00	1.53	0.97	1.63	0.90	1.02	ETS/STP/ SOIL-18
22.	Zinc, (Zn)	mg/kg	1.12	1.12	1.02	1.33	1.53	1.84	1.63	1.43	ETS/STP/ SOIL-18
23.	Lead, (Pb)	mg/kg	2.35	1.63	1.88	1.73	1.22	2.55	1.73	1.84	ETS/STP/ SOIL-18

Table 3-6: Chemical Classification of Soil Quality

Sr. No.	Soil Analysis Parameters	Classification
1	Ph	4.5 Extremely acidic 4.51- 5.50 Very strongly acidic 5.51-6.00 moderately acidic 6.01-6.50 slightly acidic 6.51-7.30 Neutral 7.31-7.80 slightly alkaline 7.81-8.50 moderately alkaline 8.51-9.0 strongly alkaline 9.01 very strongly alkaline
2	Salinity Electrical Conductivity (mmhos / cm) (1ppm = 640 mmho/cm)	Up to 1.00 Average 1.01-2.00 harmful to germination 2.01-3.00 harmful to crops (Sensitive to salts)
3	Organic Carbon (%)	Up to 0.2: very less 0.21-0.4: less 0.41-0.5 medium, 0.51-0.8: on an average sufficient 0.81-1.00: sufficient >1.0 more than sufficient
4	Nitrogen (Kg/ha)	Up to 50 very less 51-100 less 101-150 good 151-300 Better >300 sufficient
5	Phosphorus (Kg/ha)	Up to 15 very less 16-30 less 31-50 medium 51-65 on an average sufficient 66-80 sufficient >80 more than sufficient

Sr. No.	Soil Analysis Parameters	Classification
6	Potash (Kg/ha)	0 -120 very less 120-180 less 181-240 medium 241-300 average 301-360 better >360 more than sufficient

3.4.4 Interpretation of Soil Quality Results

3.4.5 Analysis of result of soil data

Physical characters

The physical characters include Bulk density, grain size distribution (textural analysis), Porosity, Infiltration, Water holding capacity.

Grain size distribution: Texture indicates relative proportion of various sizes of primary soil particles such as sand, silt and clay present in the soil. Based on their quantities present in the soil sample and using the textural classification diagram. The textural classes of eight soil samples are sandy clay loam, i.e. coarse to fine texture. Bulk density values confirm the textural class.

Bulk Density: In case of bulk density total soil space (space occupied by solid and pore spaces combined) are taken in to consideration. Thus, Bulk Density is defined as the mass (weight) of a unit volume of a dry soil. This volume would, off course include both solids and pores. Soil texture, soil structure and organic matter content are the factors influencing the bulk density of a soil. Bulk Density, besides being an interesting and significant physical characteristic, is very important as a basis for certain computations. The Bulk density of the eight soil sample under consideration ranges between 1.28 to 1.86 g/cm³ and confirms the texture of the soil samples of the area under study.

Water Holding Capacity (WHC): Water holding capacity of soil is the maximum amount of moisture, a dry soil is capable of holding, under given standard condition. If the moisture content is increased further percolation result WHC is of great value to practical agriculture, since it provides a simple means to determine moisture content. WHC required for good crop growth is 35 to 70%. The WHC of the eight soil samples ranges between 21.4 to 36.7 % indicating somewhat frequent water application for growing crops.

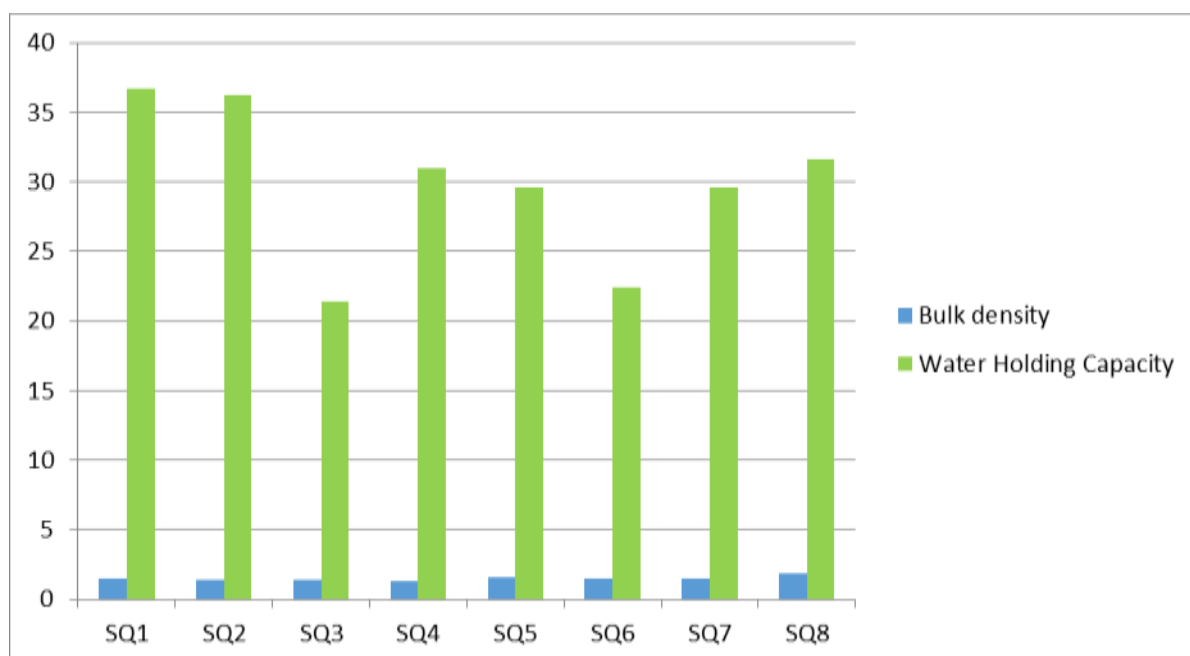


Figure 3-6 : Physical characters

Chemical Characters

The parameters considered for chemical analysis are: Soil reaction (pH), Electrical conductivity (EC), Cation Exchange Capacity (CEC), Sodium Adsorption Ratio, (SAR), ESP, Macro nutrients like Available Nitrogen, Total Organic carbon, organic matter, available phosphorus, available potassium Micro nutrients like Zinc, manganese, copper. Heavy metals like Lead (Pb), Nickel (Ni), Cadmium (Cd), Chromium (Cr), arsenic (As) and PAH.

Soil reaction (pH): The nutritional importance of pH is illustrated, thus hydrogen ion concentration has influence not only on, solubility of nutrients, but also upon facility with which these nutrients are absorbed by plants, even already in soil solution for e.g. Fe, Mn and Zn become less available as pH rises from 4.5 to 7 to 8. At pH 6.5 to 7.0 utilization of nitrate and ammonia nitrogen becomes more available. In case of phosphorus, it becomes less available to plant as pH increases above 8.5, due to its fixation in exchange complex of soil. For the eight-soil sample under consideration the pH range between 7.37 to 7.80 indicating soils are slightly alkaline and are almost normal for crop growth.

Electrical conductivity (EC): The salt content of the soils are estimated by EC measurements, and is useful to designate soils as normal or sodic (saline). Electrical conductivity is expressed as $\mu\text{mhos/cm}$ at 25°C, $\mu\text{mhos/cm}$, mmhos/cm or $\mu\text{S/cm}$. The EC of eight soil samples are between 321.3 to 362.1 $\mu\text{mhos/cm}$ and are below the limits to be called as saline and hence the soils are normal for crop growth.

Organic Carbon / Organic matter (%): Although accounting for only a small part of the total soil mass in mineral soils, organic matter influences physical, chemical, and biological activities in the soil. Organic matter in the soil is plant residue which serves as a reserve for many essential nutrients, especially nitrogen. Determination of organic matter helps to estimate the nitrogen which will be released by bacterial activity for the next season depending on the conditions, soil aeration, pH, type of organic material, and other factors. The eight soil samples under consideration contain 1.43% to 1.94% organic carbon calculated from organic carbon estimation. As per crop requirements different soils samples are more than sufficient in organic matter content.

Available Nitrogen (N): Nitrogen is a part of all living cells and is a necessary part of all proteins, enzymes and metabolic processes involved in the synthesis and transfer of energy. Nitrogen is a part of chlorophyll, the green pigment of the plant that is responsible for photosynthesis. Helps plants with rapid growth, increasing seed and fruit production and improving the quality of leaf and forage crops. The available nitrogen in the eight samples in question, as per analysis, ranges between 151.3 to 194.5 mg/kg showing better available nitrogen content in different samples, for crop growth.

Available Phosphorus (P): Like nitrogen, phosphorus (P) is an essential part of the process of photosynthesis involved in the formation of all oils, sugars, starches, etc. Helps with the transformation of solar energy into chemical energy; proper plant maturation; withstanding stress. Effects rapid growth, Encourages blooming and root growth. The phosphorus content of soil of eight samples ranges between 44.2 to 60.6 mg/kg and falls under on an average sufficient category for crop growth.

Available Potassium (K): Potassium is absorbed by plants in larger amounts than any other mineral element except nitrogen and in some cases calcium helps in the building of protein, photosynthesis, fruit quality and reduction of diseases. The Potassium content of eight soil samples ranges between 192.2 to 335.2 mg/kg and is better for crop growth.

Available Sodium (Na): Sodium is not a plant nutrient but it does play a role in soil health. High level of sodium indicates salinity problems or sodicity problems such as poor soil structure. Excess sodium can also reduce the uptake of other by plants. For healthy and productive soil, it should aim for a sodium concentration of less 1.0 meq/100g. High sodium levels can be remediated by watering more frequently and applying gypsum. The available sodium in the eight samples in question, as per analysis, ranges between 82.1

to 162.2 mg/kg showing available sodium content in different samples are suitable for crop growth.

Available Calcium (Ca): Calcium up taken as Ca^{2+} is essential element for the growth of the plants and fruit development, and it is important in the resistance of the plants to diseases due to with base in the protection of the cell wall. Calcium plays important biochemical functions and supports many metabolic processes, in addition to activating several enzymatic systems, thus contributing to the proper development of plants. Calcium plays fundamental role in the stability of the membrane and cell integrity. Among all organs, the leaves contain the highest concentration. The available calcium in the eight samples in question, as per analysis, ranges between 986.9 to 1240.7 mg/kg showing more available calcium & sufficient for crop growth content in different samples.

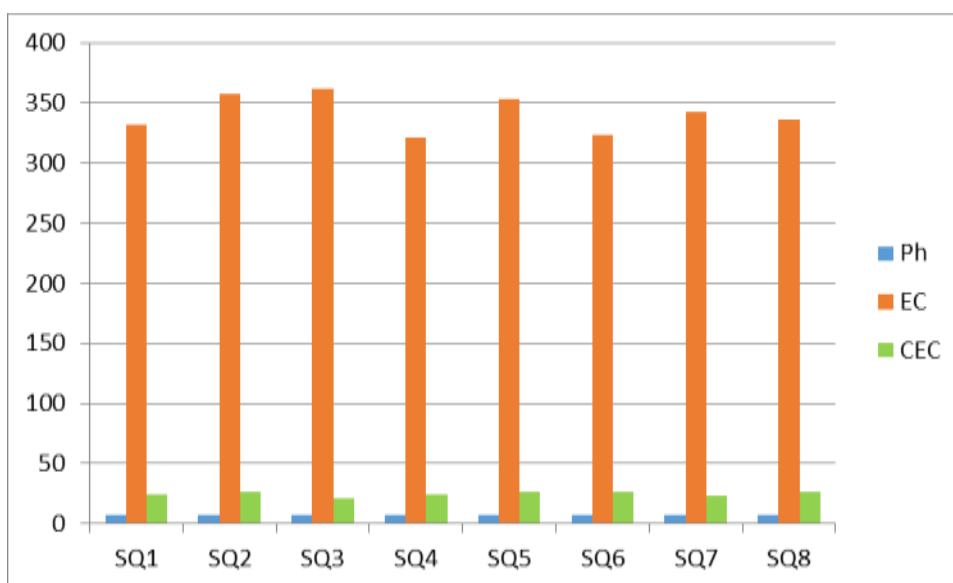


Figure 3-7 : Chemical Characters

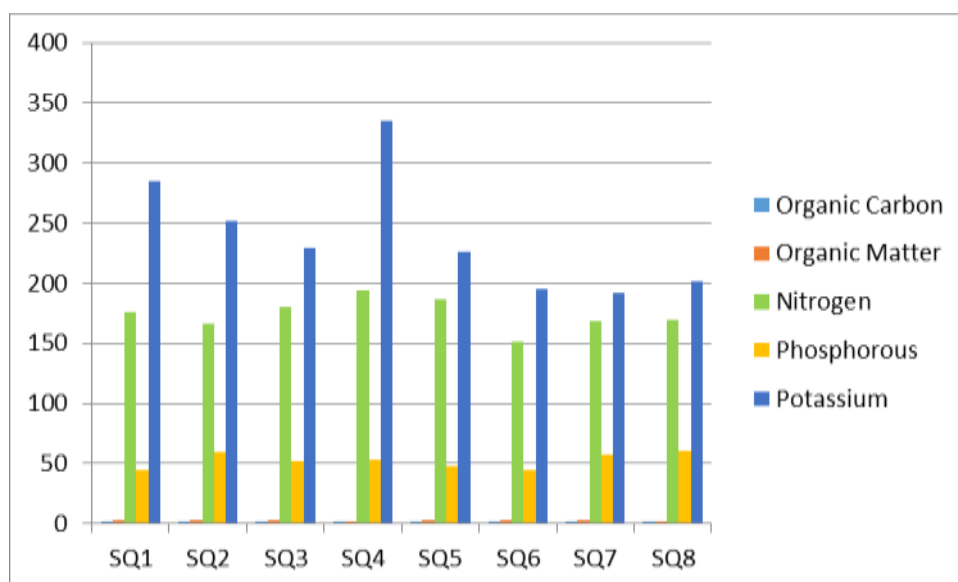


Figure 3-8 : Chemical Characters

Comments: Through the interpretation of field data, physical and chemical data it can be concluded that:

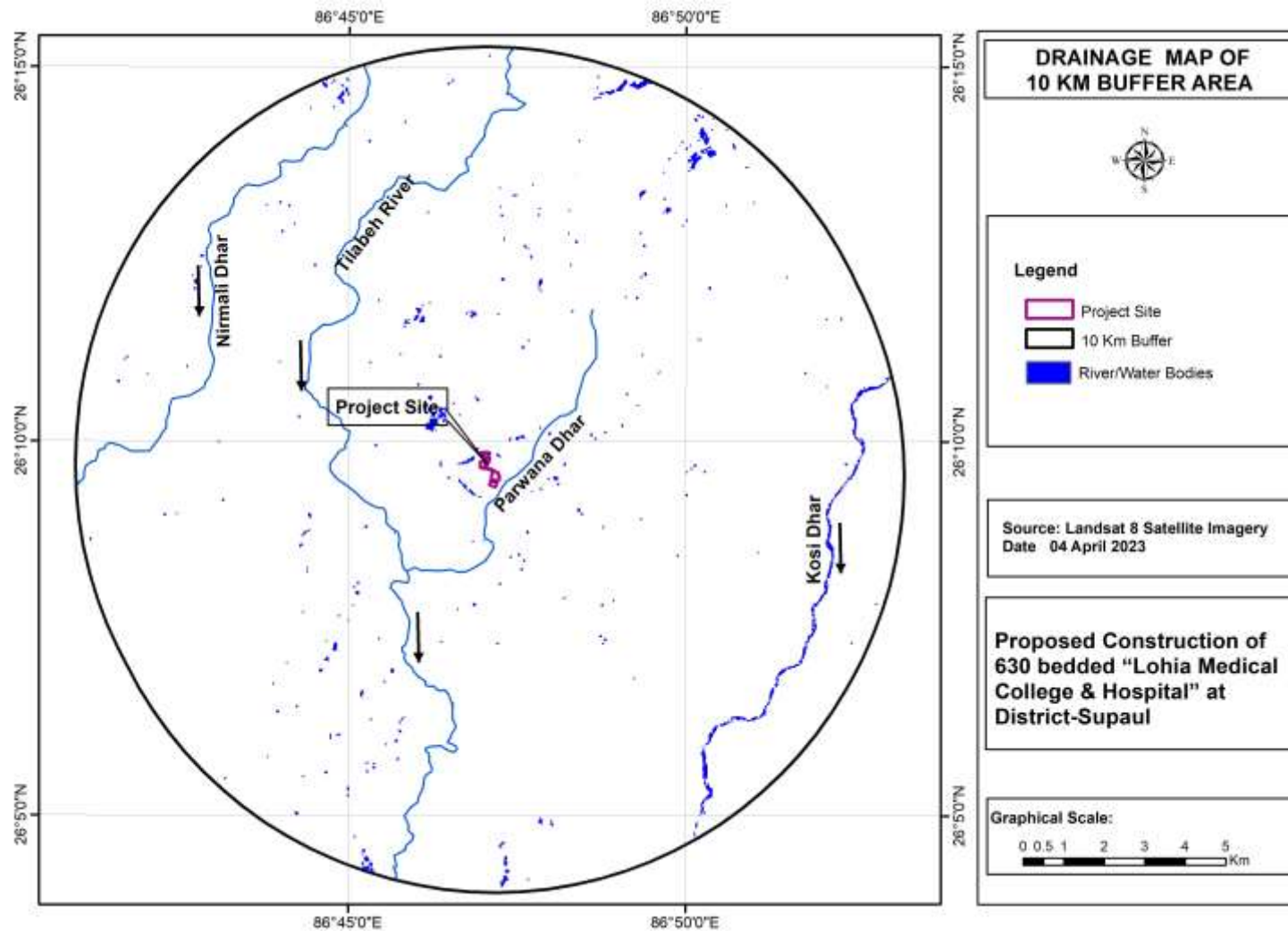
As per the physical data soils are coarse to fine texture, imperatively moderate water holding capacity, and moderate to slow permeability. As per physical characteristics soils are rated as moderately good for agriculture.

As per chemical characters of soil like pH are slightly alkaline and normal for crop growth.

3.5 WATER ENVIRONMENT

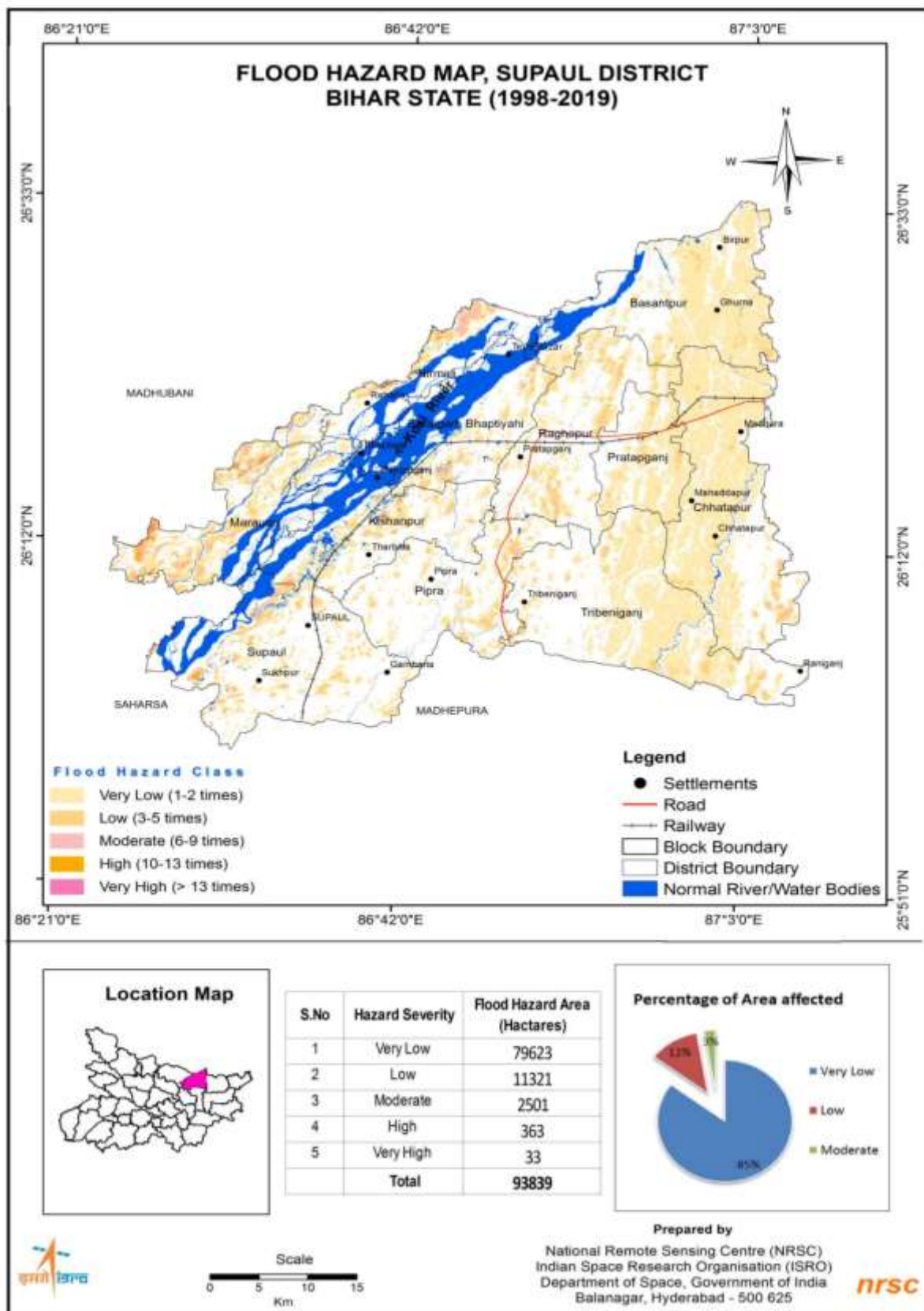
3.5.1 Drainage Pattern of the Study area

The district forms a part of the Kosi basin. The North Bihar Plains are mainly characterized by fan (megafan) and interfan areas. In the west of the Supaul district lies the Gandak Megafan, whereas in the east lies the Kosi megafan. The entire area of the Supaul district forms a part of the Kosi megafan. The Kosi river originates from upper and middle Himalayan ranges with large catchments in Tibet and Nepal, carries huge sediment load and on its merge with the flat lands the debouching of sediments tend to create a huge cone or fan shaped alluvial deposits of considerable areal extent popularly known as Kosi Mega fan. This are also termed as inland delta. The active Kosi River flows in the extreme western parts of the district. The drainage map of the study are in mentioned in **Figure 3.9**. The map of Contour Survey and the drainage pattern at the site is enclosed as **Annexure-XI**.



Source: Landsat & Satellite Imagery dated 04th April 2023

Figure 3-9: Drainage Pattern of the Study Area



Source: National Remote Sensing Centre (NRSC)

Figure 3-10 : Flood Hazardous map of the area

3.5.2 Baseline Information on Water Quality: Water quality monitoring were carried out at 8 (Eight) locations for ground water and 2 (Four) locations for surface water.

Frequency of sampling was once for one season, during Post Monsoon season 2023 for 2 SW sampling locations and 8 GW sampling locations. The locations of water quality monitoring stations are mentioned in the **Table No 3.7 & 3.8** for surface water and ground water respectively and locations are shown in **Figure 3.19 & Figure 3.23**.

Depth to water level during Pre monsoon

Pre monsoon depth to water level map of the dug well zone reveals average water level of 3.01 mbgl and post monsoon average water level at 2.12 mbgl. The water level is comparatively shallower in the northern and in north western part of the district. Whereas, the premonsoon water level as measured from the piezometers and the tube wells of PHED show average water level at 3.00 mbgl and post monsoon average water level at 1.59 mbgl. Therefore, the dug wells zone and the drinking water tube wells/pz zones in Supaul district represent similar ground water regime in terms of depth to water level. During the pre-monsoon time majority of the area is under water level within 3-5 mbgl. Comparatively deeper water level in Pipra, Raghopur, Tribeniganj, Chhatapur etc. may be reflection of more development through irrigation tube wells in the area.

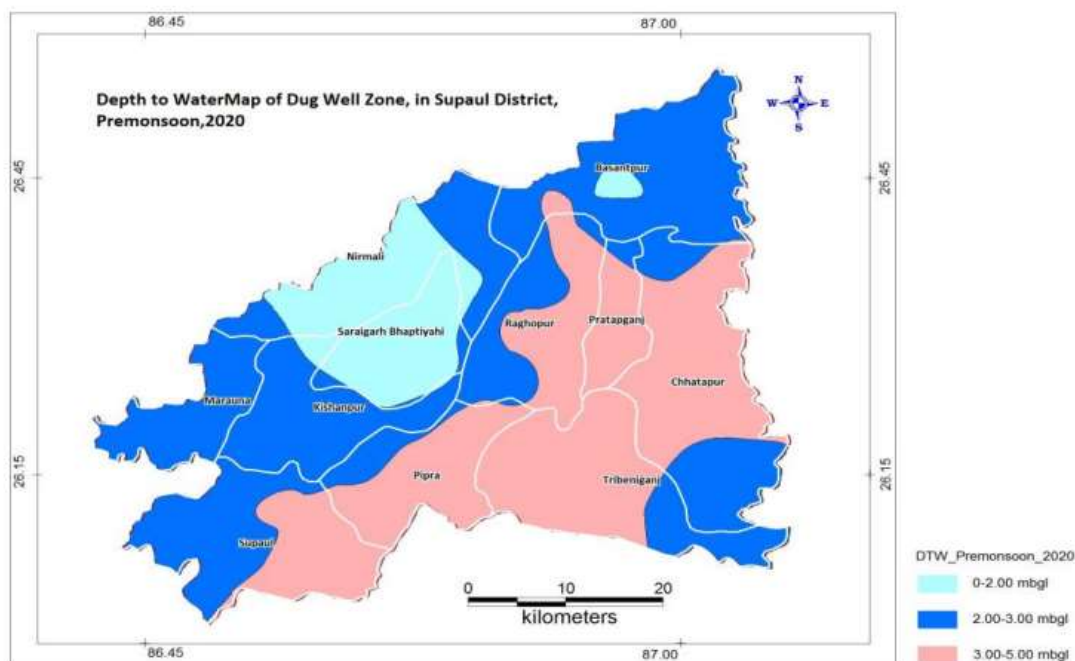


Figure 3-11: Depth of water level map (Pre-monsoon 2020), Supaul District

Depth to water level during Post monsoon

The post monsoon water level in major parts of the district is shallower and lies within 0-2 mbgl. Ground water level fluctuation, of the aquifer system (both dug well and pz/ Tw zones) reflects more or less uniform and moderate fluctuation of 0-1 m and 1-2 m in the major parts of the area. However, fluctuation of more than 2 m has been reported in small isolated area.

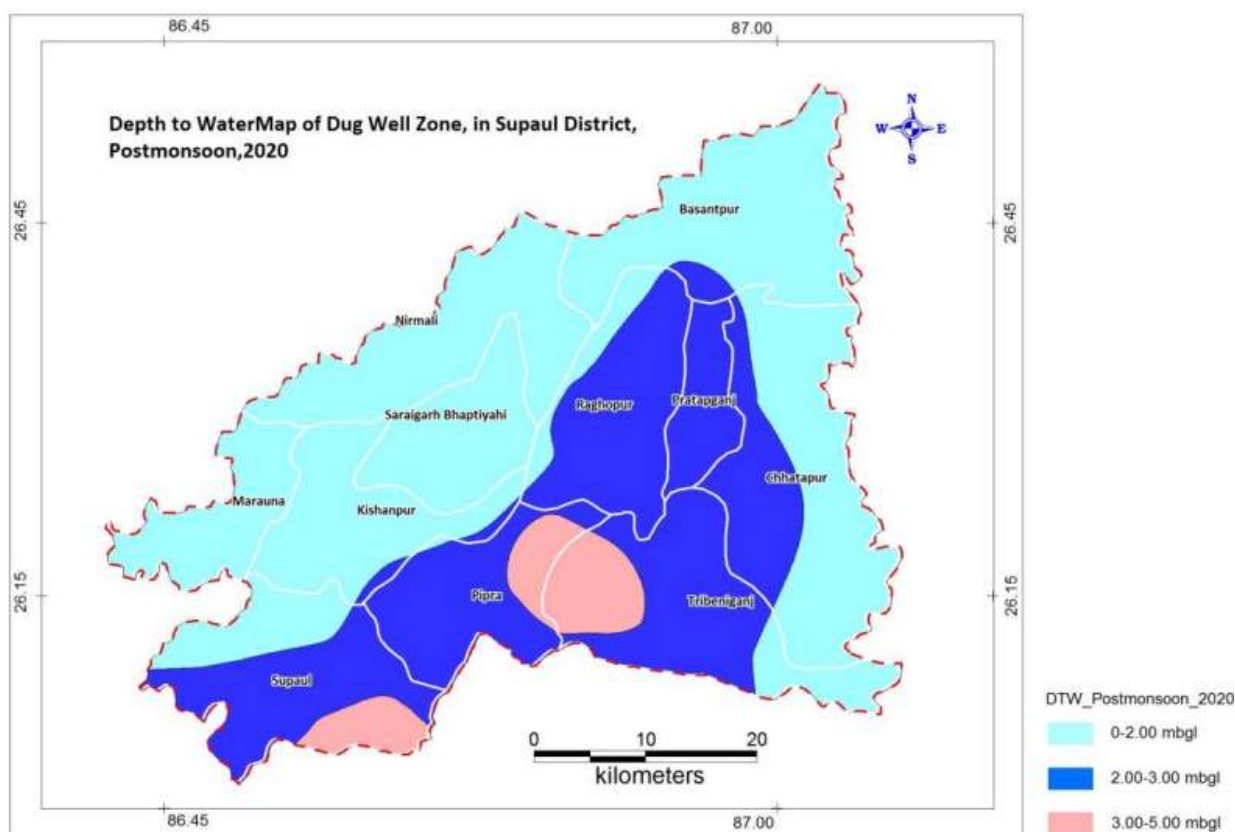


Figure 3-12: Depth of water level map (Post-monsoon 2010), Supaul District

Table 3-7: Surface water sampling locations

Station No	Location	Distance & Direction from project site	Co-ordinate
SW1	Tilabeh Nadi Near Thumha	3.30 Km in West	26°09'21.88"N 86°44'51.24"E
SW2	Koshi River Near Babhangama	8.40 Km in East	26°08'40.37"N 86°52'06.05"E

Table 3-8: Ground Water Sampling Stations

Station No	Location	Distance & Direction from project site	Co-ordinate
GW1	Near Khedan Baba Sthan Debipatti (Under 500	0.42 Km in ENE	26°09'40.13"N

Station No	Location	Distance & Direction from project site	Co-ordinate
	meter)		86°47'26.72"E
GW2	St. Stephens College of Nursing Pipra.	1.3 Km in East	26° 9'27.24"N 86°47'57.74"E
GW3	Near Golden Public School, Amaha	2.5 Km in WNW	26° 8'50.19"N 86°47'31.71"E
GW4	SDH School Pipra	1.35 Km in East	26° 9'54.78"N 86°47'54.15"E
GW5	Ramjanaki temple Thakurbari	0.60 Km in NW	26°10'4.25"N 86°46'48.67"E
GW6	Brahmasthan Debipatti	0.75 Km in WSW	26° 9'32.08"N 86°46'30.52"E
GW7	Hanuman Mandir Dinapatti	0.70 Km SW	26° 9'2.89"N 86°46'59.68"E
GW8	Dinapatti Panchayat	1.40 Km WSW	26° 9'12.71"N 86°46'22.84"E

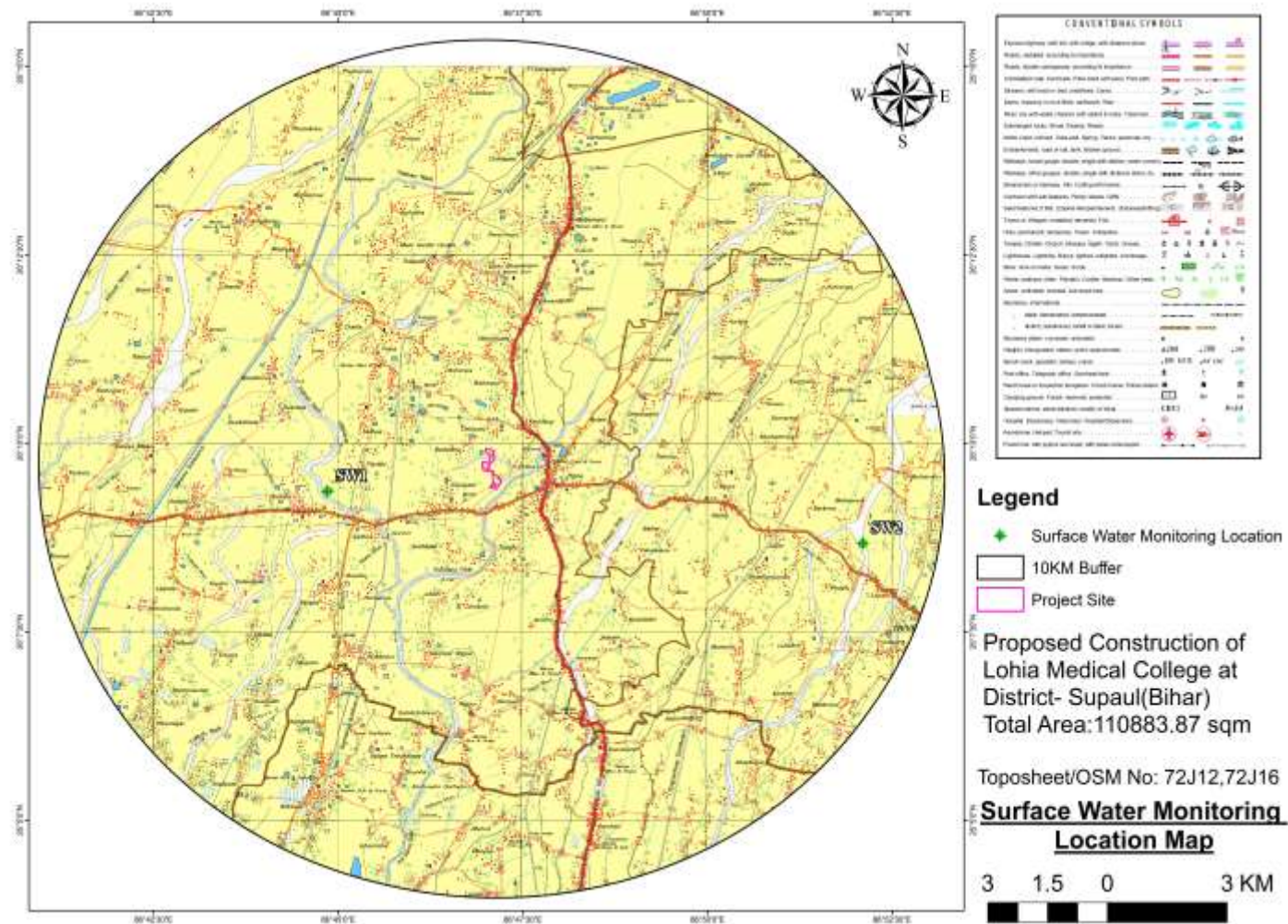


Figure 3-13: Surface water sampling locations on Topomap



Figure 3-14 : Surface Water sampling photographs

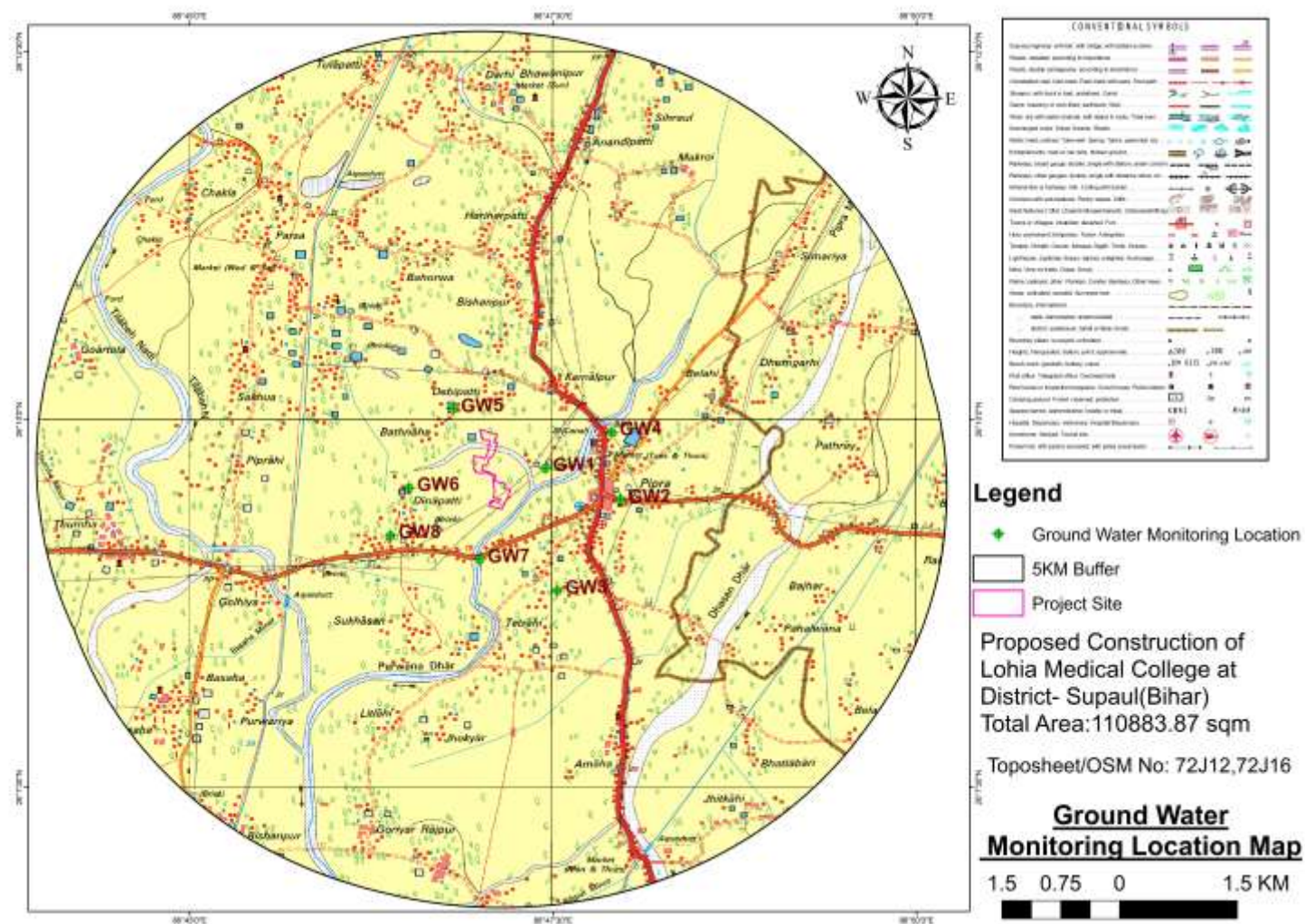


Figure 3-15: Ground water sampling location on Google map



Figure 3-16: Ground Water sampling photographs

Methodology: Water samples were collected manually from selected 8 (eight) sampling points as mentioned in previous paragraphs. Polytetrafluoroethylene (PTFE) sample bottles were used for sample collection. These bottles were washed and sterilized properly in an autoclave before used for water sample collection.

The analysis of water samples is carried out at NABL Accredited Chemical Testing Laboratory of ETS. Analysis procedures adopted as per the Standard Operating Procedure (SOP) for WATER prepared based on BIS specification confirming to Central Pollution Control Board Guidelines.

Table 3-9: Surface water quality monitoring result

S. No.	Test Parameters	Unit	Tilabeh Nadi Near Thumha (SW1)	Koshi River Near Babhangama (SW2)	Test Method
1	Colour	Hazen	<5.0	<5.0	IS:3025 (Pt-4)
2	Odour	---	Agreeable	Agreeable	IS:3025 (Pt-5)
3	pH	---	7.10	7.79	IS:3025 (Pt-11)
4	Turbidity	NTU	13.0	11.33	IS:3025 (Pt-10)
5	Total Dissolve Solid (TDS)	mg/L	418.9	374.8	IS:3025 (Pt-16)
6	Total Alkalinity (CaCO ₃)	mg/L	126.3	172.3	IS:3025 (Pt-23)
7	Total Hardness (CaCO ₃)	mg/L	162.7	135.7	IS:3025 (Pt-21)
8	Chloride (Cl)	mg/L	88.5	62.3	IS:3025 (Pt-32)
9	Calcium (Ca)	mg/L	58.2	21.8	IS:3025 (Pt-40)
10	Mineral Oil	mg/L	<0.01	<0.01	IS:3025 (Pt-39)
11	Sulphate (SO ₄)	mg/L	52.6	36.67	IS:3025 (Pt-24)
12	Nitrate (NO ₃)	mg/L	3.12	2.39	IS:3025 (Pt-34)
13	Fluoride (F)	mg/L	0.37	0.31	IS:3025 (Pt-60)
14	Iron (Fe)	mg/L	0.26	0.15	IS:3025 (Pt-53)
15	Aluminium (Al)	mg/L	<0.01	<0.01	APHA-3500 (B)
16	Selenium (Se)	mg/L	<0.01	<0.01	APHA-3113 (B)
17	Cyanide (Cn)	mg/L	<0.02	<0.02	APHA-4500 (C)
18	Copper (Cu)	mg/L	<0.05	<0.05	APHA-3111(B)
19	Magnesium (Mg)	mg/L	26.8	12.15	IS:3025 (Pt-45)

S. No.	Test Parameters	Unit	Tilabeh Nadi Near Thumha (SW1)	Koshi River Near Babhangama (SW2)	Test Method
20	Manganese (Mn)	mg/L	<0.1	<0.1	APHA-3111(B)
21	Zinc (Zn)	mg/L	0.55	0.56	APHA-3111 (B)
22	Cadmium (Cd)	mg/L	<0.001	<0.001	APHA-3111 (B)
23	Lead (Pb)	mg/L	<0.01	<0.01	APHA-3111 (B)
24	Boron	Mg/L	<0.05	<0.05	IS:3026(Pt-57)
25	Mercury (Hg)	mg/L	<0.001	<0.001	APHA-3112 (B)
26	Molybdenum(mo)	mg/L	<0.05	<0.05	IS:3025(Pt-2)
27	Nickel (Ni)	mg/L	<0.01	<0.01	APHA-3111 (B)
28	Arsenic (As)	mg/L	<0.01	<0.01	APHA-3500 (B)
29	Chromium (Cr+6)	mg/L	<0.01	<0.01	APHA-3500 Cr-B
30	Conductivity (25 °C)	µs/Cm	632.0	553.1	APHA-2510
31	Chemical Oxygen Demand (COD)	mg/L	22.5	21.7	APHA-5220 (B)
32	Biological Oxygen Demand (BOD at 27°C for 3 day)	mg/L	3.9	3.6	APHA-4500 (D)
33	Dissolve Oxygen (DO)	mg/L	4.8	7.4	APHA-5210
34	E. Coli	MPN/100ml	190	460	IS:1622-1981
35	Total Coliform	MPN/100ml	410	830	IS:1622-1981

3.5.2 Observation on Surface water Quality

The baseline quality of water based on the results of the surface water quality monitoring within the study area, it is observed that,

- pH was observed in the range of 7.10 – 7.79 with minimum at Tilabeh Nadi Near Thumha (SW1) and maximum at Koshi River Near Babhangama (SW2).
- TDS was observed in the range of 374.8 -418.9 mg/L with minimum at Koshi River Near Babhangama (SW2) and maximum at Tilabeh Nadi Near Thumha (SW1).
- COD was in the range of 21.7-22.5 mg/L with minimum at Koshi River Near Babhangama (SW2) and maximum at Tilabeh Nadi Near Thumha (SW1).
- BOD was in the range of 3.6- 3.9 mg/L with minimum at Koshi River Near Babhangama (SW2) and maximum at Tilabeh Nadi Near Thumha (SW1).
- DO was in the range of 4.8-7.4 mg/L with minimum at Tilabeh Nadi Near Thumha (SW1) and maximum at (SW2) Koshi River Near Babhangama.

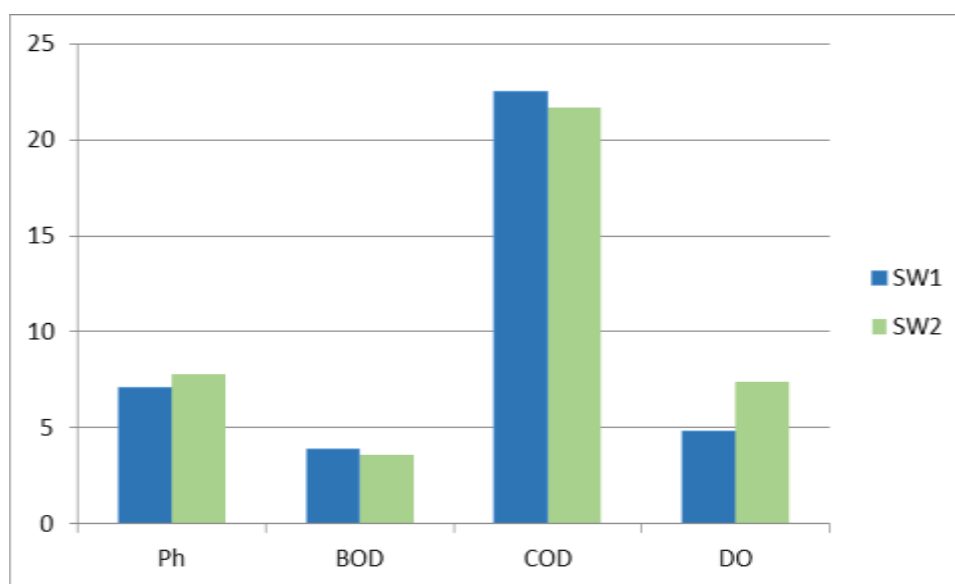


Figure 3-17: SW Quality in Study Area Parameters – pH Value, BOD (in mg/l), COD (in mg/l) and DO (in mg/l)

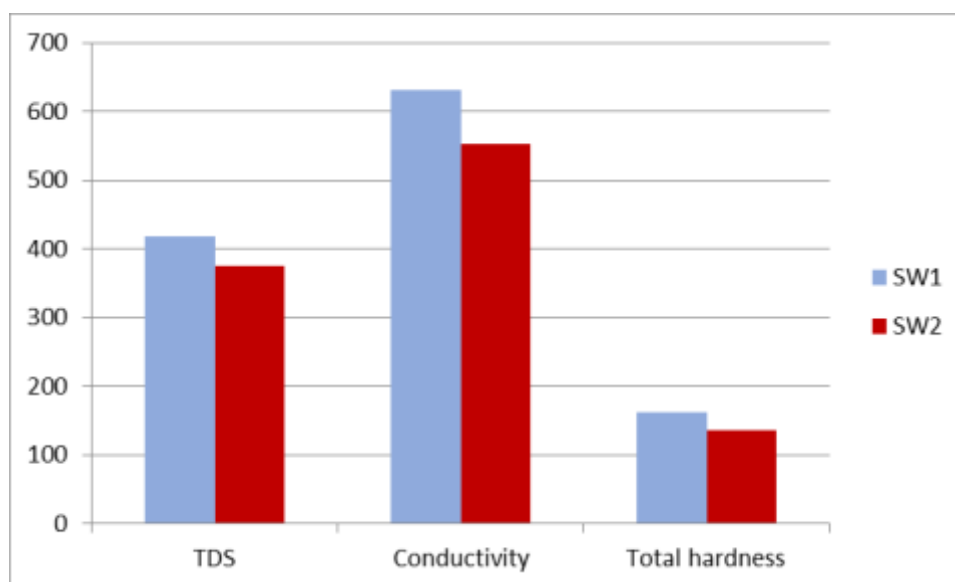


Figure 3-18: SW Quality in Study Area Parameters – TDS (in mg/L), Conductivity (in $\mu\text{S/cm}$) and TH (in mg/L)

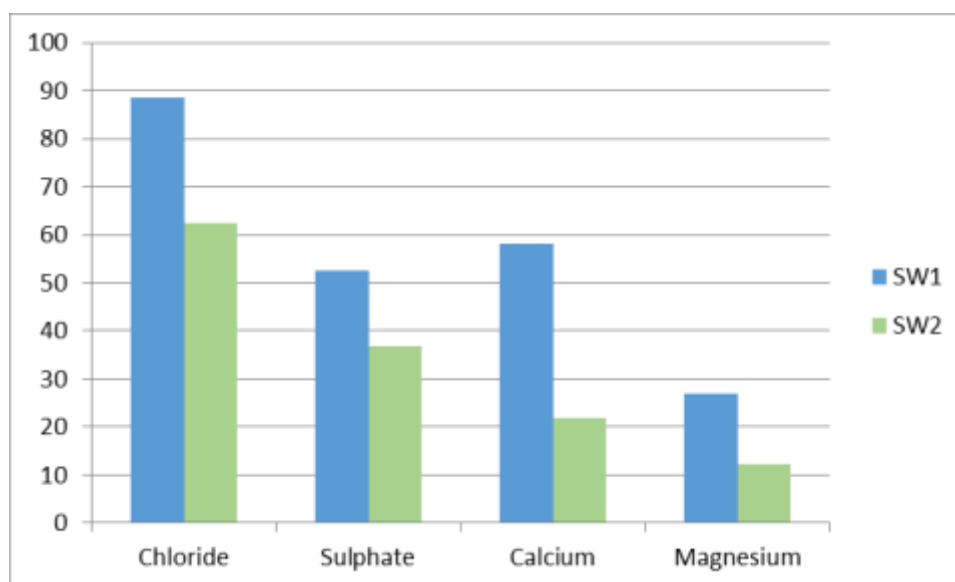


Figure 3-19: SW Quality in Study Area Chloride (in mg/l), Sulfate (in mg/L), Calcium (in mg/l) and Magnesium (in mg/l)

Table 3-10: Ground Water quality monitoring result

S. No.	Test Parameters	Unit	Near Khedan Baba Sthan Debipatti (in 500 m.) (GW1)	St. Stephens College of Nursing Pipra (GW2)	Near Golden Public School, Amaha (GW3)	SDH School Pipra (GW4)	Ramjan aki temple Thakur bari (GW5)	Brahmasthan Debipatti (GW6)	Hanuman Mandir Dinapatti (GW7)	Dinapatti Panchayat (GW8)	Specification/Limit (As per IS:10500: 2012)		Test Method
											Desirable	Permissible	
1.	Colour	Hazen	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5	15	IS:3025 (Pt-4)
2.	Odour	---	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	IS:3025 (Pt-5)
3.	pH	---	8.00	7.34	7.89	7.76	7.76	7.80	7.67	7.76	6.5 - 8.5	No Relaxation	IS:3025 (Pt-11)
4.	Taste	---	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	IS:3025 (Pt-8)
5.	Turbidity	NTU	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1	5	IS:3025 (Pt-10)
6.	Total Dissolve Solid (TDS)	mg/L	418.2	482.5	263.3	293.4	387.6	519.6	470.6	397.8	500	2000	IS:3025 (Pt-16)
7.	Total Alkalinity (CaCO ₃)	mg/L	129.5	168.7	101.0	116.7	117.9	144.8	122.4	121.4	200	600	IS:3025 (Pt-23)
8.	Total Hardness (CaCO ₃)	mg/L	150.2	135.0	114.3	139.5	167.1	189.5	171.4	162.0	200	600	IS:3025 (Pt-21)
9.	Chloride (Cl)	mg/L	81.6	96.9	67.8	53.6	95.9	88.7	82.6	93.8	250	1000	IS:3025 (Pt-32)
10.	Calcium (Ca)	mg/L	62.2	59.2	38.3	28.1	52.0	64.3	43.4	61.2	75	200	IS:3025 (Pt-40)
11.	Mineral Oil	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.5	No Relaxation	IS:3025 (Pt-39)
12.	Sulphate (SO ₄)	mg/L	35.90	38.15	21.31	13.25	35.29	58.75	42.43	47.53	200	400	IS:3025 (Pt-24)

S. No.	Test Parameters	Unit	Near Khedan Baba Sthan Debipatti (in 500 m.) (GW1)	St. Stephens College of Nursing Pipra (GW2)	Near Golden Public School, Amaha (GW3)	SDH School Pipra (GW4)	Ramjan aki temple Thakur bari (GW5)	Brahmasthan Debipatti (GW6)	Hanuman Mandir Dinapatti (GW7)	Dinapatti Panchayat (GW8)	Specification/Limit (As per IS:10500: 2012)		Test Method
											Desirable	Permissible	
13.	Nitrate (NO ₃)	mg/L	0.69	0.75	0.79	1.76	0.80	1.45	0.74	2.14	45	No Relaxation	IS:3025 (Pt-34)
14.	Fluoride (F)	mg/L	0.33	0.21	0.29	0.26	0.26	0.26	0.26	0.26	1	1.5	IS:3025 (Pt-60)
15.	Iron (Fe)	mg/L	0.21	0.10	0.21	0.18	0.10	0.18	0.17	0.17	0.3	No Relaxation	IS:3025 (Pt-53)
16.	Aluminium (Al)	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.03	0.2	APHA-3500 (B)
17.	Selenium (Se)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	No Relaxation	APHA-3113 (B)
18.	Cyanide (Cn)	mg/L	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	0.05	No Relaxation	APHA-4500 (C)
19.	Copper (Cu)	mg/L	0.06	0.07	0.02	0.09	0.08	0.08	0.08	0.08	0.05	1.5	APHA-3111(B)
20.	Magnesium (Mg)	mg/L	18.97	20.71	12.73	13.66	14.48	22.84	24.99	17.03	30	100	IS:3025 (Pt-45)
21.	Manganese (Mn)	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.3	APHA-3111(B)
22.	Zinc (Zn)	mg/L	0.79	0.85	0.73	0.74	0.80	0.72	0.73	0.73	5	15	APHA-3111 (B)
23.	Cadmium (Cd)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	No Relaxation	APHA-3111 (B)
24.	Lead (Pb)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	No Relaxation	APHA-3111 (B)
25.	Mercury (Hg)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	No Relaxation	APHA-3112 (B)

S. No.	Test Parameters	Unit	Near Khedan Baba Sthan Debipatti (in 500 m.) (GW1)	St. Stephens College of Nursing Pipra (GW2)	Near Golden Public School, Amaha (GW3)	SDH School Pipra (GW4)	Ramjan aki temple Thakur bari (GW5)	Brahmasthan Debipatti (GW6)	Hanuman Mandir Dinapatti (GW7)	Dinapatti Panchayat (GW8)	Specification/Limit (As per IS:10500: 2012)		Test Method
											Desirable	Permissible	
26.	Nickel (Ni)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	No Relaxation	APHA-3111 (B)
27.	Arsenic (As)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.05	APHA-3500 (B)
28.	Chromium (Cr+6)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.05	No Relaxation	APHA-3500 Cr-B
29.	Phenolic Compound (C ₆ H ₅ OH)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.002	APHA-5530
30.	Conductivity (25 °C)	mhos /cm	653.8	685.9	352.5	416.8	574.3	778.3	690.7	553.9	Not Specified	Not Specified	APHA-2510
31.	E. Coli	Coli/ 100 ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Shall Not be Detectable	Not Specified	IS:1622-1981
32.	Total Coliform	MPN/ 100ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Shall Not be Detectable	Not Specified	IS:1622-1981
33.	Temperature	°C	18.67	18.67	17.65	16.63	18.69	17.65	18.87	18.67	Not Specified	Not Specified	IS 3025 (Pt-9)
34.	Sodium (Na)	mg/L	55.10	48.04	13.25	28.15	36.52	49.47	52.53	37.74	Not Specified	Not Specified	APHA-3500 (Na)
35.	Fecal Coliform	MPN /100ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Shall Not be Detectable	Not Specified	APHA-9221

Observations: The results obtained are depicted in the following graphs **Figure No. 3.24, 3.25 and 3.26** for Surface Water Quality. Results obtained are also given in the **Table No. 3.9 to Table No. 3.10**. As per the test results given hereunder, drinking water quality is found to be potable i.e. within the permissible limit of the standard prescribed.

3.5.3 Interpretation of Ground Water Quality

- All the samples were colourless meeting desirable norms (<5 Hazen).
- All the samples meet the desirable standards (pH ranges from 7.34 to 8.00).
- TDS in samples ranges from 263.3 mg/L to 519.6 mg/L. All the samples meet the permissible limit of 2000 mg/L.
- Total Hardness in the water ranges from 114.3 mg/L to 189.5 mg/L. All the samples meet the permissible limit of 600 mg/L.
- Calcium content in the water ranges from 28.1 mg/L to 64.3 mg/L all the samples meet the permissible limit of 200 mg/L.
- Magnesium content in the water ranges from 12.73 mg/L to 24.99 mg/L. All the samples meet the permissible limit of 100 mg/L.
- Sulphate content in the water ranges from 13.25 mg/L to 58.75 mg/L. The permissible limit of Sulphate is 400 mg/L for drinking water.
- Total alkalinity in the water samples ranges from 101.0 mg/L to 168.7 mg/L. All the samples are within the permissible limit of drinking water (600 mg/L).
- Chloride ranges from 53.6 mg/L to 96.9 mg/L. Which are below permissible limits (1000 mg/L).

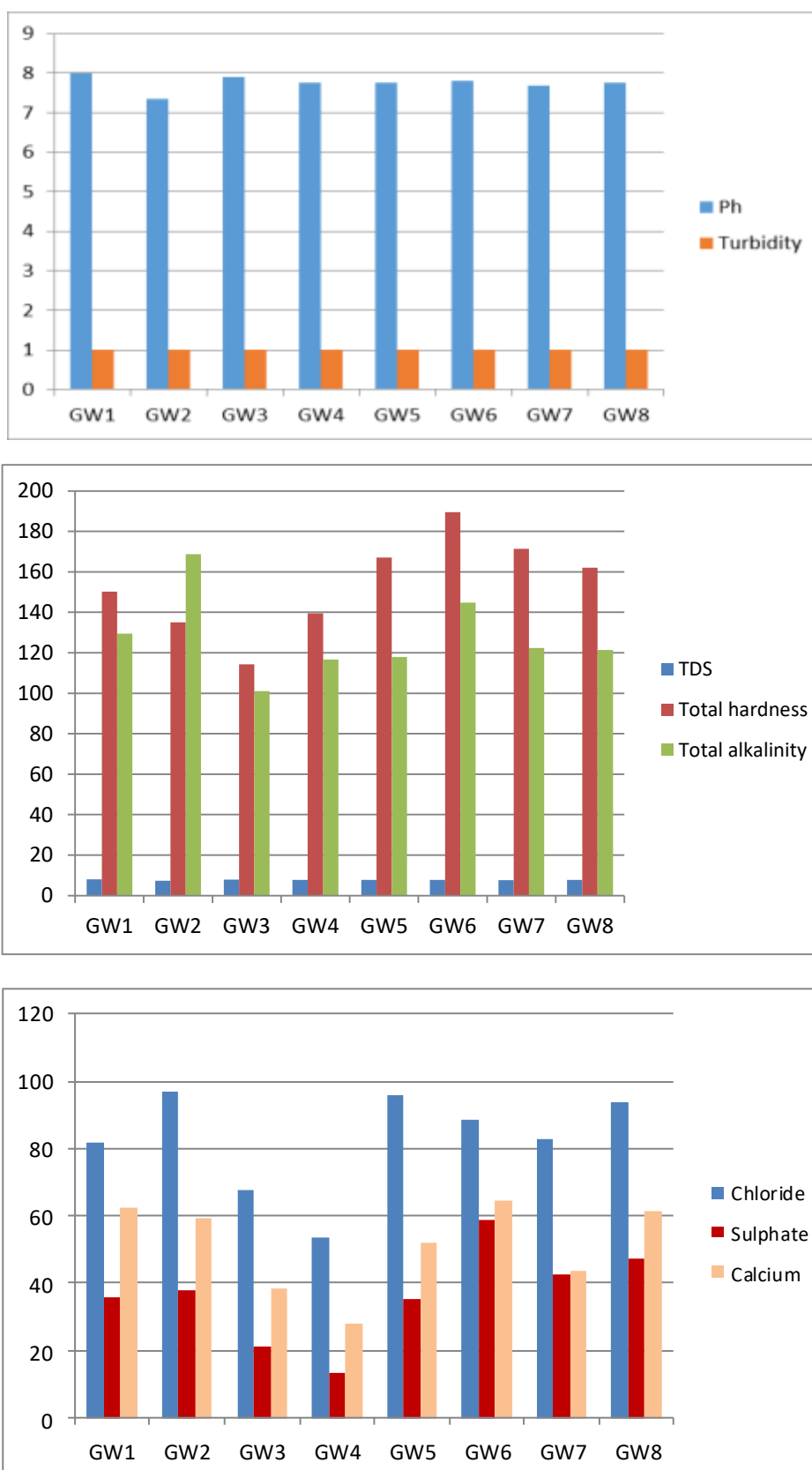


Figure 3-20: GW Quality in Study Area

3.6 AIR ENVIRONMENT

The knowledge of ambient air quality plays an important role in assessing the environmental scenario of the study area. The baseline studies on air environment includes identification of specific air pollutants expected to have significant impact and assessing their existing levels in ambient air within the study area. The baseline status of air environment can be assessed through air quality surveillance program with scientifically designed ambient air quality monitoring network.

3.6.1 Climatology and Meteorology

The study of micrometeorological conditions of the region is an essential requirement for proper interpretation of the existing air quality status and for the prediction of impacts on air environment through mathematical models. Pollutants emitted into the atmosphere undergo transportation, dispersion, transformation and finally removal from the atmosphere. Pollutants are transported through the action of mean wind velocity whereas dispersion results from the turbulent characteristics of the atmosphere and helps in diffusing the pollutants in all directions. Since most of the pollutants are injected into the atmosphere near the surface of the earth, the physics of the atmospheric boundary layer controls the transport and dispersion of pollutants.

The data is used for measuring the capacity for dispersion and diffusion of pollutants during the construction and operation stages of the project. This data also plays a vital role in locating the construction plants to avoid or reduce the pollution concentrations on the settlements during the construction stage of the project. The meteorological data is also useful for the modelling of the air pollutant levels during the operation of the project. Since the meteorological data show wide variations with time, meaningful interpretation can only be drawn from the long term and reliable data.

The project zone has a tropical wet and dry climate with four distinct seasons;

- Winter – December to February
- Summer – March to June
- Monsoon – July to September
- Post-Monsoon – October to November

The area has warm and humid climate with high temperature and medium to high rainfall.

The temperatures are lowest during December-January with an average minimum of 8°C to 10° C and maximum of 24° C to 25° C. The temperatures in the hottest months of April to June are minima 23°C to 25°C and maxima 35°C to 38°C. The normal annual rainfall for the district stands at 1404 mm. Most of the rainfall (80% to 90%) is received during July to

September. The late September-October rains (locally known as ‘Hathia’) are very crucial to agriculture in the region and their timing and distribution make all the difference between plenty and scarcity. In order to study the meteorology of the project area, site specific climatic data were collected from IMD.

3.6.2 Temperature & Rainfall

Under the Köppen–Geiger climate classification Supaul features a humid subtropical climate (Cwa). Temperatures typically range between 16 °C (61 °F) and 30 °C (87 °F) through the year, but rarely can drop to 6 °C (43 °F) or can rise to as high as 43 °C (109 °F). The average annual precipitation amounts to about 1511 mm (59.5 inches) and receives 140 rainy days on the 1 mm (0.04 inches) threshold annually. The table below details historical monthly averages for climate variables.

Table 3-11 : Historical monthly averages for climate variables

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high °C (°F)	29.0 (84.2)	33.0 (91.4)	39.0 (102.2)	44.0 (111.2)	44.0 (111.2)	44.0 (111.2)	41.0 (105.8)	40.0 (104.0)	38.0 (100.4)	36.0 (96.8)	36.0 (96.8)	30.0 (86.0)	44.0 (111.2)
Average high °C (°F)	24.42 (75.96)	27.19 (80.94)	33.57 (92.43)	37.28 (99.1)	38.09 (100.56)	37.1 (98.78)	33.7 (92.66)	34.55 (94.19)	33.04 (91.47)	31.99 (89.58)	30.48 (86.86)	26.05 (78.89)	32.29 (90.12)
Daily mean °C (°F)	20.98 (69.76)	23.68 (74.62)	30.05 (86.09)	33.8 (92.84)	34.61 (94.3)	34.32 (93.78)	31.76 (89.17)	32.51 (90.52)	31.0 (87.8)	29.2 (84.56)	27.46 (81.43)	22.89 (73.2)	29.35 (84.83)
Average low °C (°F)	15.43(5 9.77)	17.38(6 3.28)	22.3(7 2.14)	25.9 (78.62)	26.75(8 0.15)	28.04(8 2.47)	27.63(8 1.73)	28.09(8 2.56)	26.8(8 0.24)	24.01(7 5.22)	21.49(7 0.68)	17.41(6 3.34)	23.44(7 4.19)
Record low °C (°F)	12.0 (53.6)	13.0 (55.4)	15.0 (59.0)	22.0 (71.6)	22.0 (71.6)	23.0 (73.4)	22.0 (71.6)	26.0 (78.8)	17.0 (62.6)	18.0 (64.4)	18.0 (64.4)	11.0 (51.8)	11.0 (51.8)
Average precipi tation mm (inches)	2.5 (0.1)	8.8 (0.35)	2.3 (0.09)	13.28(0 .52)	26.59 (1.05)	86.2 (3.39)	179.46 (7.07)	83.89 (3.3)	102.55 (4.04)	7.72 (0.3)	0.12 (0.0)	0.61 (0.02)	42.84 (1.69)
Average precipitation days (≥ 1.0 mm)	0.64	1.0	0.64	2.73	4.55	6.27	7.0	6.36	5.36	1.45	0.09	0.27	3.03
Average relative humidity (%)	52.66	51.53	33.15	37.82	50.84	60.8	72.51	69.97	72.99	64.13	49.26	45.1	55.06
Mean monthly sunshine hours	8.48	8.44	10.88	12.69	13.27	12.59	11.57	11.7	9.7	11.07	9.72	8.6	10.73

Source: Wikipedia

3.6.3 Humidity

The nature and characteristics of the pollutants will vary with change of the humidity in the atmosphere. Fog provides possibility for suspended particles to coalesce and also enhances chemical reaction of the gaseous pollutants.

On annual basis, it can be noted that high humidity occurs in the month of December, January, July, August and September and low humidity occurs in the month of March to May.

The details of the average monthly relative humidity (RH) recorded, is presented below:

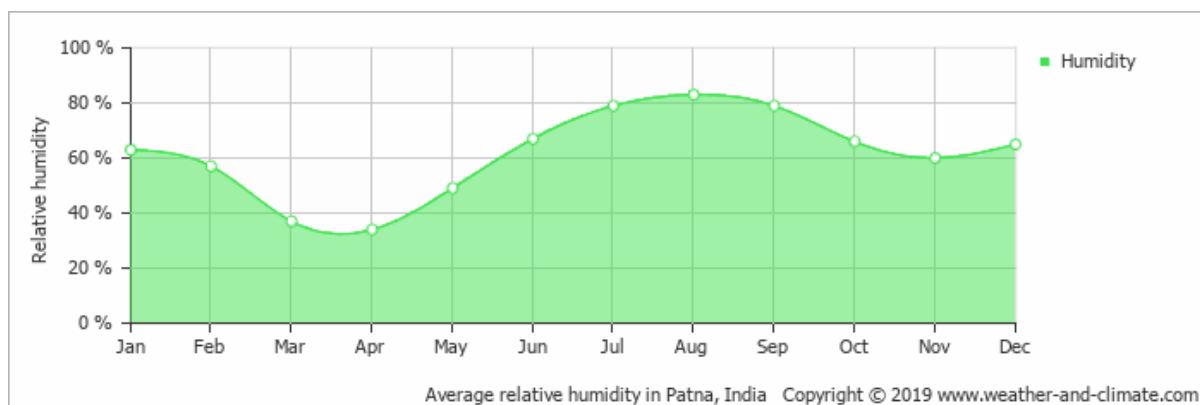


Figure 3-21 : Mean monthly relative humidity over the year in (Bihar), India

#Source : weather-and-climate.com

- On average, August is the most humid.
- On average, April is the least humid month.
- The average annual percentage of humidity is: 62.0%

3.6.4 Wind speed and direction

Wind speed and wind directions have a significant role in the dispersion of atmospheric pollutants and therefore, in the air quality of the area. Ground level concentrations for the pollutants are inversely proportional to the wind speed in the down wind direction, while in the upwind direction no effect will be observed and in cross wind directions partial effect due to the emission sources is observed.

The prominent seasonal wind direction is from West towards East contributing more than approximately 9.42% of the total Wind speed is 2.63 m/s. The wind rose is shown in **Figure 3.6-2**.

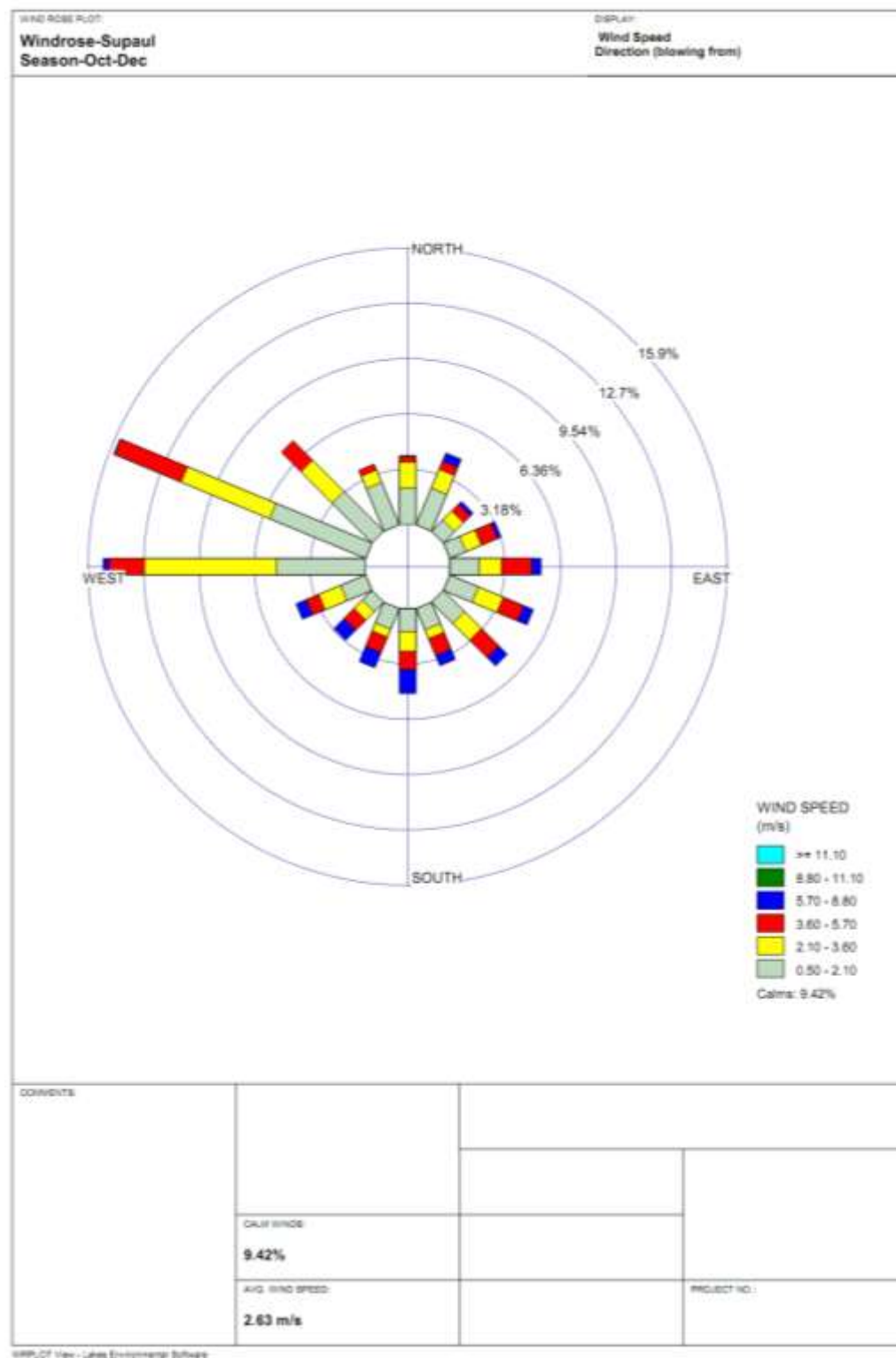


Figure 3-22: Wind Rose during study period (October – December 2023)

3.6.5 Micro Meteorological Data for the Site

Site specific climatic condition refers to weather conditions comprising of temperature, relative humidity, wind speed, rainfall, cloud cover etc. This determines the baseline conditions and

probable impacts on environmental parameters with respect to the Project. The site-specific climatic conditions are given below in **Table 3.12**.

Table 3-12: Summary of Micro Meteorological Conditions at the Site

Particulars	Min	Max	Mean
Temp, C	8.8	36.5	25.6
RH %	39	69	52
Wind Speed, m/s	0.5	8.8	2.63
Solar radiation, w/m2	5200	5500	5350

Source weather monitoring station

3.6.6 Ambient air quality monitoring stations

The following criteria were taken into account in the design of ambient air quality monitoring network and fixing of monitoring stations;

- Meteorology of the study area
- Topography / terrain of the study area
- Population density distribution within the region
- Residential and sensitive areas
- Proximity of industries
- Representation of regional background

3.6.7 Ambient air sampling period

The ambient air quality survey was conducted during winter season from **October 2023 to December 2023**.

3.6.8 Ambient air quality monitoring (AAQM)

To understand the existing baseline status of ambient air quality, 08 AAQM stations were selected based on the guidelines of network sitting criteria. The locations of AAQM stations are presented in **Figure 3-30** and sampling photographs are also shown in **Figure 3-31**. Details of these stations are given in **Table 3-13**.

3.6.9 Selection of Ambient Air Sampling Locations

The ambient air quality monitoring locations were established in the study area. For selection of ambient air quality monitoring locations, the following factors were considered:

- ✓ Meteorological conditions in the area;

- ✓ Topography of the study area;
- ✓ Representativeness of the habitation for establishing baseline status;
- ✓ Likely impact areas.

Table 3-13 : Details of Ambient Air Quality Monitoring stations

Sample ID	Monitoring Location	Distance & Direction from project site	Coordinates
AAQ1	Project Site	--	26° 9'34.69"N 86°47'8.46"E
AAQ2	Near Khedan Baba Sthan Debipatti (Under 500 meter)	0.42 Km in ENE	26° 9'40.13"N 86°47'26.72"E
AAQ3	Pipra	1.3 Km in East	26° 9'27.24"N 86°47'57.74"E
AAQ4	Near Golden Public School, Amaha	2.5 Km in WNW	26° 8'50.19"N 86°47'31.71"E
AAQ5	Atlakha Belahi	2.7 Km in NE	26°10'12.69"N 86°48'40.33"E
AAQ6	Debipatti	1.0 Km in NW	26°10'1.67"N 86°46'42.99"E
AAQ7	Dinapatti	1.1 Km in NE	26° 9'32.55"N 86°46'28.09"E
AAQ8	Bishunpur	1.6 Km West	26° 8'52.26"N 86°46'34.63"E

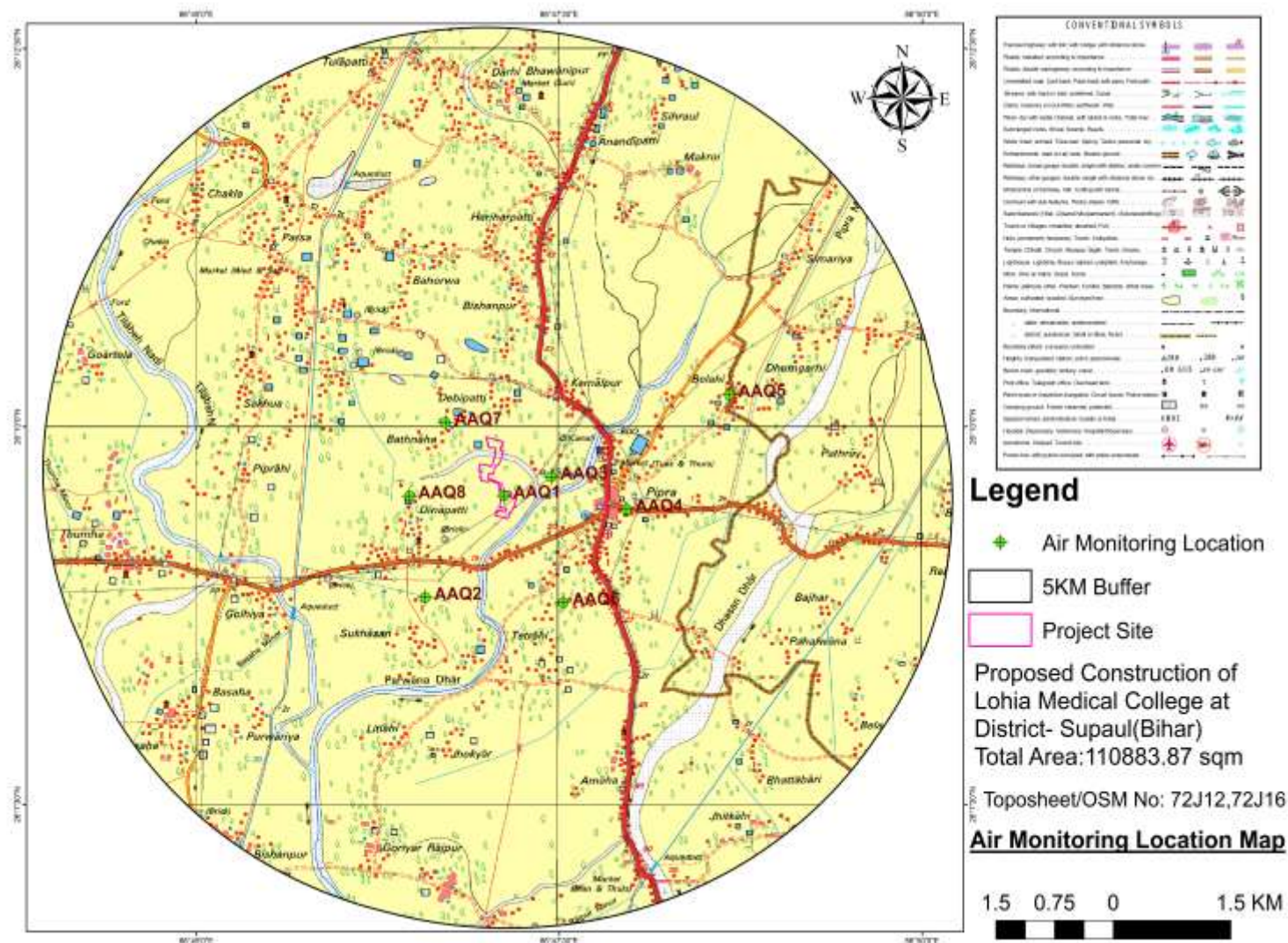


Figure 3-23: Air monitoring location on Topomap



Figure 3-24: Air Monitoring Location Photographs

Table 3-14: Report of collected ambient air monitoring samples

Parameter		AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8	NAAQS
		Project Site	Near Khedan Baba Sthan Debipatti (Under 500 meter)	Pipra	Near Golden Public School, Amaha	Atlakha Belahi	Debipatti	Dinapatti	Bishunpur	
PM ₁₀ (µg/m ³)	Min.	115.5	114.0	117.7	108.3	104.7	127.1	117.0	110.0	100
	Max.	252.7	292.0	256.1	260.7	303.3	276.5	281.6	318.4	
	Mean	191.1	225.3	204.8	211.4	222.3	221.2	223.5	230.4	
	98 %*	249.1	291.9	253.7	256.9	294.6	274.0	277.5	309.3	
PM _{2.5} (µg/m ³)	Min.	68.5	66.1	63.1	78.3	74.2	71.9	82.8	73.1	60
	Max.	126.8	192.9	185.3	188.1	142.3	200.1	198.5	149.4	
	Mean	104.4	146.2	105.7	150.3	114.8	115.3	155.2	119.0	
	98 %*	125.6	191.0	159.0	186.1	140.2	171.7	196.9	147.2	
SO ₂ (µg/m ³)	Min.	10.5	11.5	11.0	9.3	8.2	14.0	9.4	12.6	80
	Max.	19.3	17.2	19.3	15.7	16.4	19.2	18.4	20.3	
	Mean	15.9	14.0	13.8	11.6	12.2	17.0	12.2	17.1	
	98 %*	18.9	16.4	18.6	14.7	16.0	19.1	16.2	20.1	
NO _x (µg/m ³)	Min.	20.7	23.0	21.7	21.6	24.7	25.8	23.1	28.4	80
	Max.	36.1	30.0	32.1	34.0	36.3	34.0	35.9	40.0	
	Mean	30.9	26.8	26.0	29.2	33.2	30.1	32.4	33.6	
	98 %*	35.9	29.9	31.5	33.8	36.2	33.8	35.6	39.4	
(CO) (mg/m ³)	Min.	1.33	2.33	1.58	1.92	1.92	1.58	2.22	1.72	1 Hrs.=04
	Max.	7.20	7.04	6.74	5.14	6.34	7.22	6.90	7.48	
	Mean	3.77	4.28	3.15	3.19	3.47	4.63	4.51	4.58	
	98 %*	6.54	6.71	5.61	5.02	6.18	7.00	6.88	7.22	

The summary of results of ambient air quality monitoring of PM_{2.5}, PM₁₀, SO₂, NO₂, CO are presented in **Table 3-14**. Detailed monitoring results are given in **Annexure- XII**. The graphical representation of ambient air quality in the study area is given in **Figure 3.32 to Figure 3.36**. On the basis of tabulated data in **Table 3-14**, the following observations can be made:

3.6.9.1 Particulate Matter (PM₁₀)

The maximum and minimum concentrations for PM₁₀ were recorded as 318.4 µg/m³ and 104.7 µg/m³, respectively. The maximum concentration of PM₁₀ was recorded at the (AQ8) Bishunpur and minimum concentration was observed at (AQ5) Atlakha Belahi. The mean concentrations range between 191.1 µg/m³ to 230.4 µg/m³. 98th percentile values for PM₁₀ during study period range between 249.1 µg/m³ to 309.3 µg/m³.

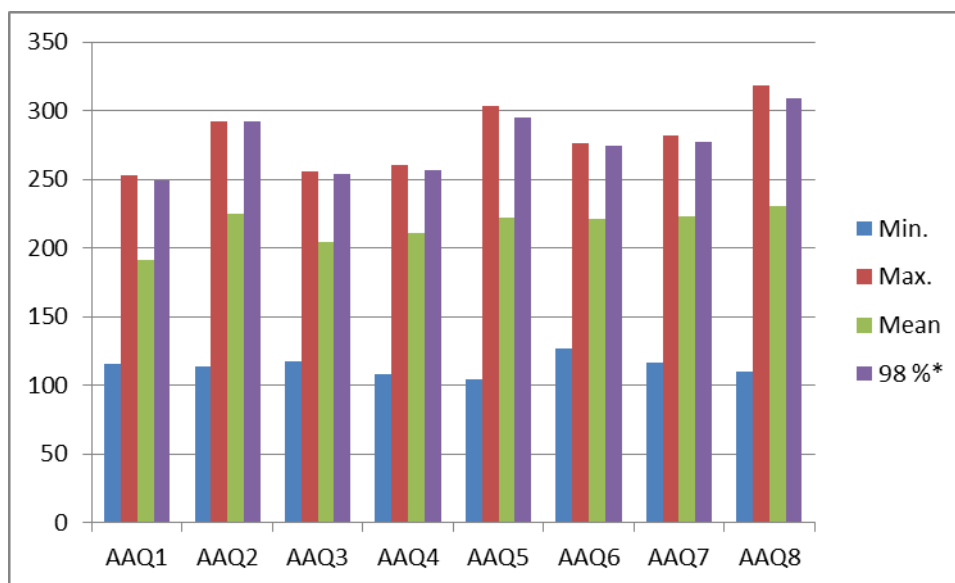


Figure 3-25: PM₁₀ Values of the Study Area

3.6.9.2 Fine Particulate Matter (PM_{2.5})

The maximum and minimum concentrations for PM_{2.5} were recorded as 200.1 µg/m³ and 63.1 µg/m³, respectively. The maximum concentration was recorded at (AQ6) Debipatti and the minimum concentration was recorded at (AQ3) Pipra. The mean concentrations range between 104.4 µg/m³ to 155.2 µg/m³. 98th percentile values for PM_{2.5} during study period range between 125.6 µg/m³ to 196.9 µg/m³.

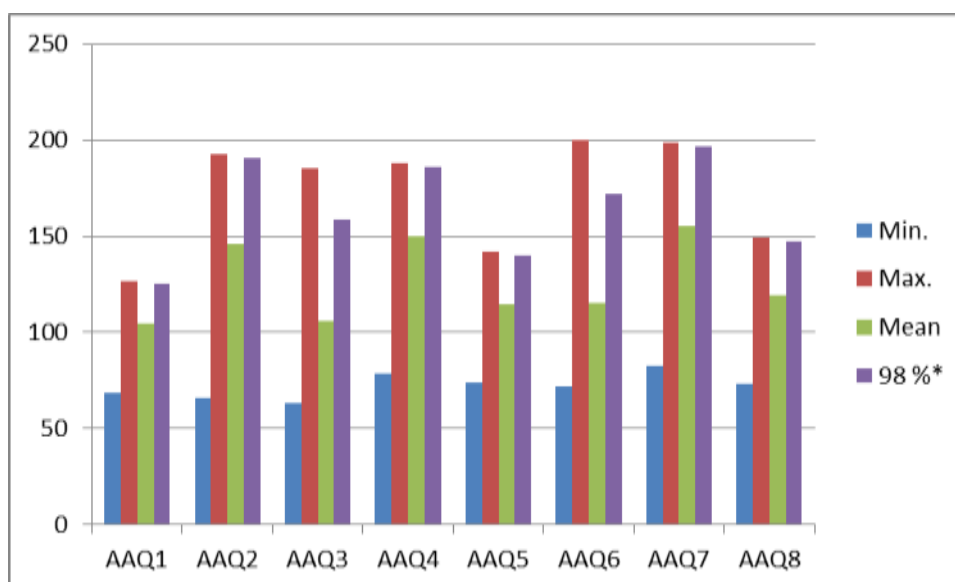


Figure 3-26: PM2.5 Values during the Study Area

3.6.9.3 Sulphur Dioxide (SO₂)

The maximum and minimum SO₂ concentrations were recorded as 20.3 $\mu\text{g}/\text{m}^3$ and 8.2 $\mu\text{g}/\text{m}^3$. The maximum concentration was recorded at (AQ8) Bishunpur and the minimum concentration was recorded at (AQ5) New Atlakha Belahi. The mean values were observed from 11.6 $\mu\text{g}/\text{m}^3$ to 17.1 $\mu\text{g}/\text{m}^3$. 98th percentile values for SO₂ during study period range between 14.7 to 20.1 $\mu\text{g}/\text{m}^3$.

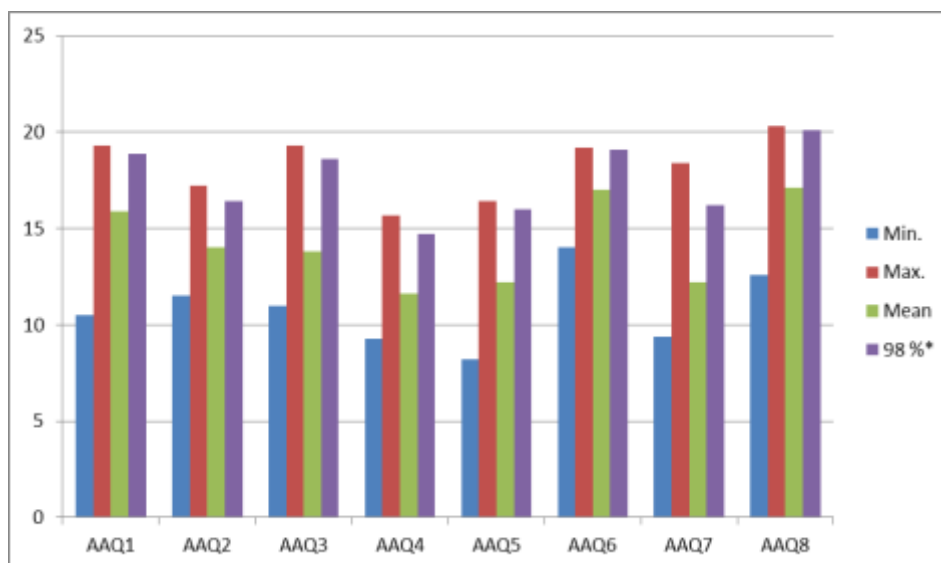


Figure 3-27: SO2 Values during the Study Area

3.6.9.4 Nitrogen Oxide (NO₂)

The maximum and minimum NO₂ concentrations were recorded as 40.0 $\mu\text{g}/\text{m}^3$ and 20.7 $\mu\text{g}/\text{m}^3$. The maximum concentration was recorded at (AQ8) Bishunpur and the minimum

concentration was recorded at (AQ1) Project Site. The mean values for NO₂ were observed in the range between 26.0 to 33.6 µg/m³. 98th percentile values for NO₂ during study period range between 29.9 to 39.4 µg/m³.

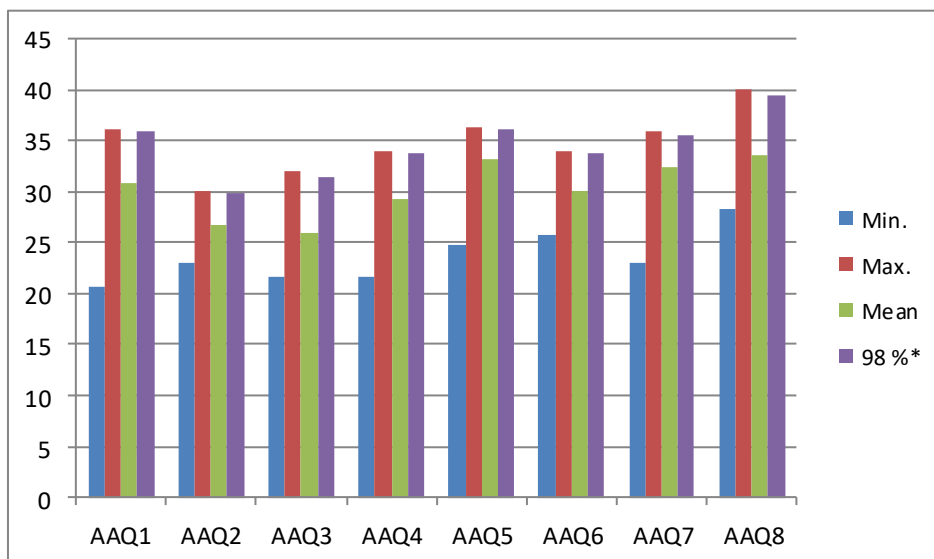


Figure 3-28: NOx Values during the Study Area

3.6.9.5 Carbon Monoxide (CO)

The maximum and minimum CO concentrations were recorded as 7.48 mg/m³ and 1.33 mg/m³. The maximum concentration was recorded at (AQ8) Bishunpur and the minimum concentration was recorded at (AQ1) Project Site. The mean values for CO were observed in the range between 3.15 to 4.63 mg/m³. 98th percentile values for CO during study period range between 5.02 to 7.22 mg/m³.

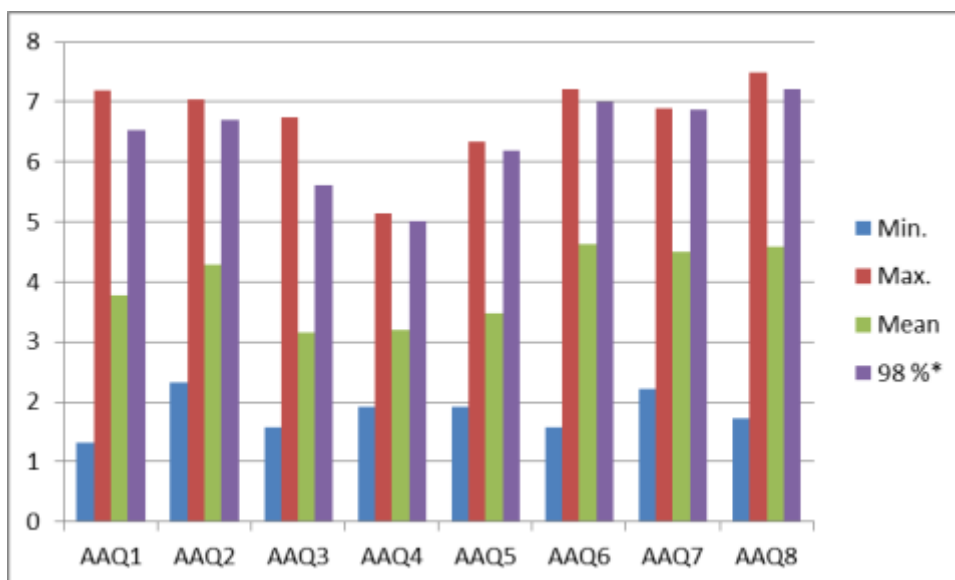


Figure 3-29: CO Value during the study area

3.7 Noise Environment

The physical description of sound concerns its loudness as a function of frequency. Noise, in general, is sound that is composed of many frequency components of various levels 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 in the audible range of 20 to 20,000 Hz. The scale has been designed to weigh various components of noise according to the response of the human ear. The impact of noise sources in surrounding community depends upon;

- Characteristics of noise sources (instantaneous, intermittent or continuous in nature). It can be observed that steady noise is not as annoying as one which is continuously varying in loudness.
- The time of day at which noise occurs, for example high noise levels at night in residential area are not acceptable because of sleep disturbance.
- The location of the noise source w.r.t. noise sensitive area, which determines the loudness and period of exposure.

3.7.1 Ambient noise monitoring locations

A preliminary reconnaissance survey was undertaken to identify the major noise generating sources in the area. Noise generating sources were identified with respect to the activities, viz., traffic noise, ambient noise due to residential population and Industrial Noise. The noise survey involved the determination of noise levels in decibels at **08** locations. The noise monitoring locations are indicated in **Table No 3-15**.

Table 3-15: Ambient Noise Quality Monitoring stations

Sample ID	Monitoring Location	Distance & Direction from project site	Coordinates	Site justification
NQ1	Project Site	--	26° 9'34.69"N 86°47'8.46"E	Residential Area
NQ2	Near Khedan Baba Sthan Debipatti (Under 500 meter)	0.42 Km in ENE	26° 9'40.13"N 86°47'26.72"E	Residential Area
NQ3	St. Stephens College	1.3 Km in East	26° 9'27.24"N	Silence Zone

Sample ID	Monitoring Location	Distance & Direction from project site	Coordinates	Site justification
	of Nursing Pipra.		86°47'57.74"E	
NQ4	Near Golden Public School, Amaha	2.5 Km in WNW	26° 8'50.19"N 86°47'31.71"E	Silence Zone
NQ5	SDH School Pipra	1.35 Km in East	26° 9'54.78"N 86°47'54.15"E	Silence Zone
NQ6	Ramjanaki temple Thakurbari	0.60 Km in NW	26°10'4.25"N 86°46'48.67"E	Residential Area
NQ7	Brahmasthan Debipatti	0.75 Km in WSW	26° 9'32.08"N 86°46'30.52"E	Residential Area
NQ8	Hanuman Mandir Dinapatti	0.70 Km SW	26° 9'2.89"N 86°46'59.68"E	Residential Area

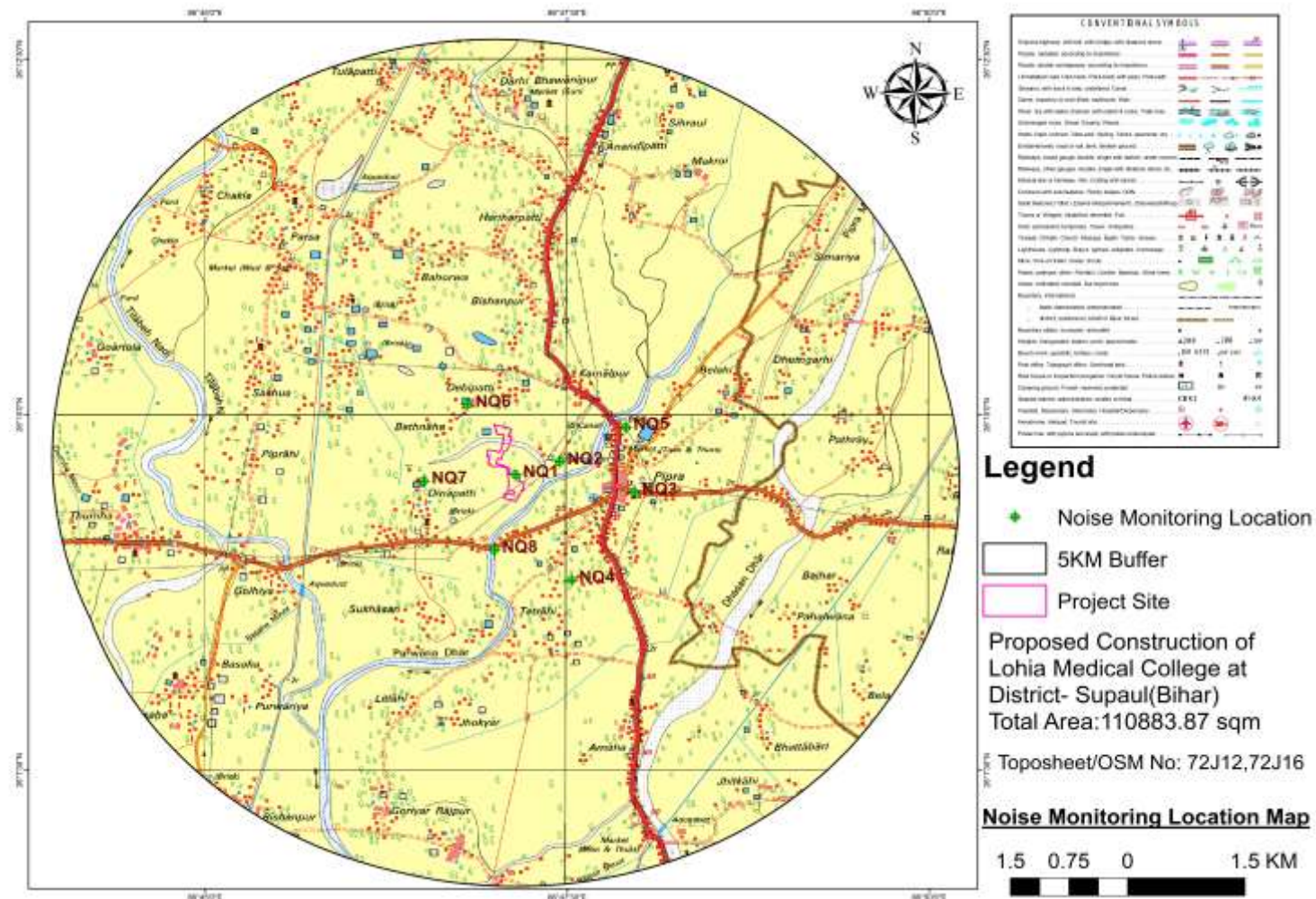


Figure 3-30 : Noise monitoring location on Topomap



Figure 3-318: Noise monitoring location photographs

3.8 Methodology of data generation

3.8.1 Method of Monitoring

The noise monitoring was carried out at eight locations during day and at night time in the study area covering all the areas i.e. industrial, commercial, and residential and silence zones as mentioned in Noise (Pollution and Control) Rules, 2000.

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

3.8.2 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:

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

Noise level was recorded at every hour for 10 minutes continuously for 24 hours at 'A' response. Then the data was tabulated to get frequency table with different intervals. The ambient noise levels measure for the study is given in **Table 3-16**.

Table 3-16 : Noise monitoring data

S. No.	Test Parameters	Unit	Result	Ambient Noise Standards / Specification (CPCB / Factories Act)
NQ 1 Project Site				
1	Noise Level Day Time	Leq : dB (A)	52.6	55
2	Noise Level Night Time	Leq : dB (A)	40.1	45
NQ2 Near Khedan Baba Sthan Debipatti (Under 500 meter)				
1	Noise Level Day Time	Leq : dB (A)	50.3	55
2	Noise Level Night Time	Leq : dB (A)	38.8	45
NQ3 St. Stephens College of Nursing Pipra				
1	Noise Level Day Time	Leq : dB (A)	46.3	50
2	Noise Level Night Time	Leq : dB (A)	37.1	40
NQ4 Near Golden Public School, Amaha				
1	Noise Level Day Time	Leq : dB (A)	48.5	50
2	Noise Level Night Time	Leq : dB (A)	36.2	40
NQ5 SDH School Pipra				
1	Noise Level Day Time	Leq : dB (A)	45.8	50
2	Noise Level Night Time	Leq: dB (A)	37.3	40
NQ6 Ramjanaki temple Thakurbari				
1	Noise Level Day Time	Leq : dB (A)	51.6	55
2	Noise Level Night Time	Leq : dB (A)	39.4	45
NQ7 Brahmasthan Debipatti				
1	Noise Level Day Time	Leq : dB (A)	49.3	55
2	Noise Level Night Time	Leq : dB (A)	37.5	45
NQ8 Hanuman Mandir Dinapatti				
1	Noise Level Day Time	Leq : dB (A)	50.1	55
2	Noise Level Night Time	Leq : dB (A)	35.4	45

Observations

- The maximum and minimum concentrations for Noise were recorded as 52.6 dB (A) and 45.8 dB (A) respectively in day. The maximum concentration was recorded at Project Site and the minimum concentration was recorded at SDH School Pipra.

- The maximum and minimum concentrations for Noise were recorded as 40.1 dB (A) and 35.4 dB (A) respectively in Night. The maximum concentration was recorded at Project Site and the minimum concentration was recorded at Hanuman Mandir Dinapatti.

3.9 Ecology & Biodiversity:

Introduction

Biological study is essential to understand the impact of industrialization and urbanization on existing flora and fauna of the study area. Forests are repository of the bio-diversity, gene pool resources, sequester carbon dioxide and provide lot of other environmental services. They play a very vital role in sustaining the life of people and are crucial for the food and water security. The hydrological functions of forests include interception of rainfall and regulating the stem flows, binding soil to prevent soil erosion and conserving the soil moisture.

Studies on various aspects of ecosystem play an important role in identifying sensitive issues for under taking appropriate action to mitigate the impact, if required.

A baseline survey was conducted to study floral and faunal diversity of the terrestrial and aquatic environment of the study area within in 10 Km radius of the plant site.

Methodology

The primary survey of study area was conducted particularly with reference to habitat types, listing of species and assessment of the existing baseline ecological (terrestrial and aquatic ecosystem) conditions. All data were collected through manual optical observation using actual count, patch sampling, line transect, point count and specimen collection methods accompanied with the help a pair of 8*42 binoculars.

For the collection of primary data from the aquatic and terrestrial habitats near the project site, a total of 06 sampling sites were selected for each. For the identification of sampled species, Handbooks, field guides, field observation and other technologies like Google Lense have been used. For identification of birds, animals and insects; calls, trails, feathers, scat and marks were being recorded and matched with the field guides, eBird and iNaturalist.

The Study area was divided into two virtual zones as Core zone (being the project site itself) and Buffer zone (being a 10 km virtual radius around the project) and all the samples and observation were taken from there only.

The primary survey of study area was conducted particularly with reference to habitat types, listing of species and assessment of the existing baseline ecological (terrestrial and aquatic ecosystem) conditions.

Study Area

Core Zone: The core zone was devoid of any plant or tree naturally growing over there. The agro-biodiversity of the study area is unique and there is no reserve or protected forest. The

The fauna visiting the core zone includes Squirrels (*Funambulus pulmarum*), crows (*Corvus splendens*), Mynas (*Acridotheres tristis*) etc.

Similarly, Dogs (*Canis lupus familiaris*), Cows (*Bos taurus*), Mynas (*Acridotheres tristis*) and Rats (*Mus booduga*) were found to be most frequently seen faunal species.

As the core zone was mostly empty construction land and only very few organisms were seen, the sampling site was selected from the immediately outside the Core zone and Buffer zone collectively so that an overall unbiased data can be recorded and shown in the study.

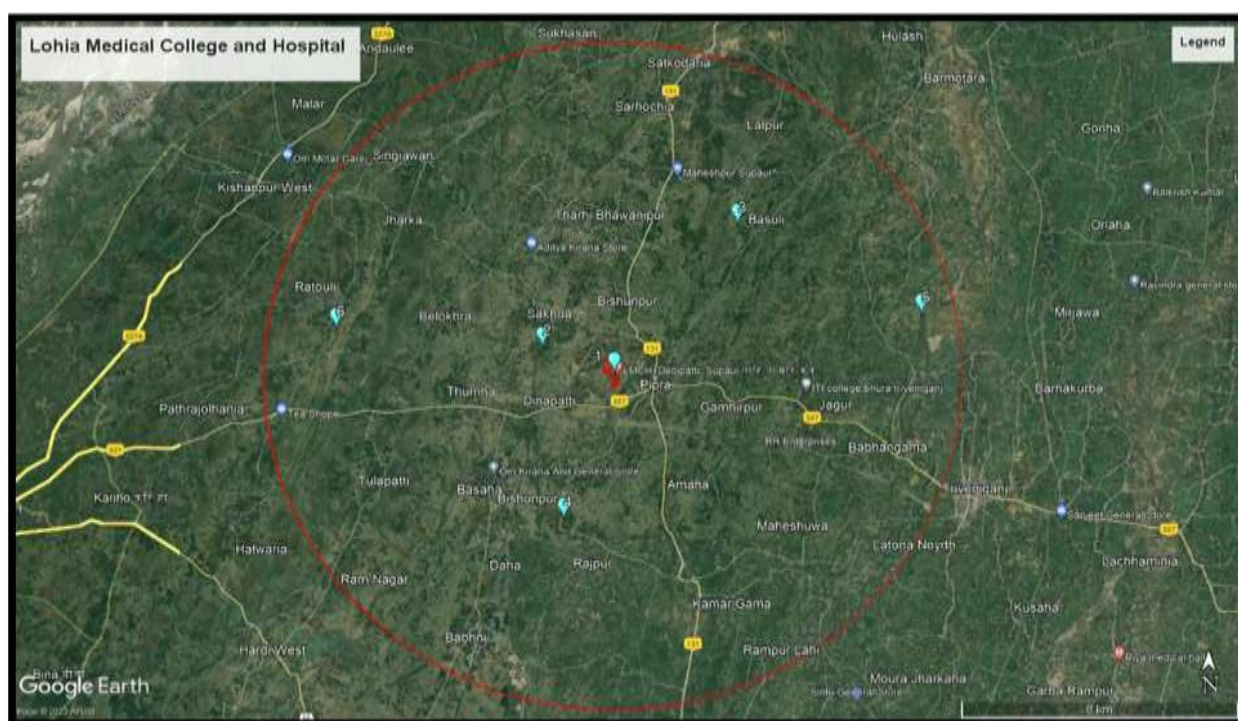


Figure 3-32: Google Image of the study area and sampled sites

A total of 06 sites were sampled for aquatic and terrestrial habitat assessment as shown in the image above. The locations are as given below in the table:

Table 3-17: Sampling locations for biological study

S. No.	Sample site	Latitude	Longitude
1	S1 (terrestrial)	26° 9'36.27"N	86°47'8.54"E
2	S2 (terrestrial)	26°10'1.48"N	26°10'1.48"N
3	S3 (terrestrial)	26°12'2.17"N	86°49'17.65"E
4	S4 (terrestrial)	26° 7'14.15"N	86°46'15.98"E
5	S5 (aquatic)	26°10'33.60"N	86°52'29.25"E
6	S6 (aquatic)	26°10'19.68"N	86°42'18.24"E

Table 3-18: Flora & Fauna from the selected sample sites (Outside & near project site)

S. No.	Species	S1	S2	S3	S4	S5	S6	category
Flora								
1.	<i>Aloe vera</i>	-	-	+	+	-	+	Succulent
2.	<i>Azadirachta indica</i>	-	+	-	+	+	-	Tree
3.	<i>Ficus religiosa</i>	+	+	+	+	+	+	Tree
4.	<i>Ficus racemosa</i>	-	+	-	-	+	-	Tree
5.	<i>Mangifera indica</i>	+	+	+	-	-	-	Tree
6.	<i>Moringa oleifera</i>	+	-	-	+	+	+	Tree
7.	<i>Prosopis cineraria</i>	+	+	-	+	-	+	Tree
8.	<i>Catharanthus roseus</i>	+	+	+	+	+	+	Shrub
9.	<i>Clitoria ternatea</i>	-	+	+	+	-	-	Shrub
10.	<i>Lantana camara</i>	+	+	-	+	+	+	Shrub
11.	<i>Oscimum sanctum</i>	+	+	+	-	-	-	
12.	<i>Parthenium hysterophorus</i>	+	+	-	-	+	+	Grass
13.	<i>Cynodon dactylon</i>	+	+	-	+	-	+	Grass
14.	<i>Marsilea minuta</i>	-	+	-	-	+	+	Aquatic plant
15.	<i>Canna indica</i>	+	+	-	-	+	+	Semi-aquatic plant
16.	<i>Cenchrus purpureus</i>	+	+	-	+	-	-	Aquatic grass
17.	<i>Saccharum spontaneum</i>	+	+	+	-	+	-	Aquatic grass
18.	<i>Ludwigia parviflora</i>	-	+	+	-	+	+	Emergent plant
19.	<i>Cyperus rotundus</i>	-	-	-	-	+	+	Submerged plant
Fauna								
20.	<i>Eutrophis multifasciata</i>	+	-	+	-	-	+	Reptile

21.	<i>Calotes versicolor</i>	+	+	+	-	+	+	Reptile
22.	<i>Canis lupus familiaris</i>	+	+	+	+	+	+	Mammal
23.	<i>Bos taurus</i>	+	+	-	+	+	-	Mammal
24.	<i>Funambulus palmarum</i>	+	+	-	+	-	-	Mammal
25.	<i>Rana hexadactyla</i>	+	-	+	-	-	+	Amphibian
26.	<i>Dutta stomaticus</i>	-	+	-	-	+	-	Amphibian
27.	<i>Haplobatrachus crassus</i>	+	-	-	-	+	-	Amphibian
28.	<i>Corvus splendens</i>	+	+	+	-	-	+	Birds
29.	<i>Acredothores tristis</i>	+	+	+	+	-	-	Birds
30.	<i>Acredothores ginginianus</i>	-	+	+	-	+	+	Birds
31.	<i>Bubulcus ibis</i>	-	-	+	-	+	+	Birds
32.	<i>Passer domesticus</i>	+	+	-	+	-	-	Birds
33.	<i>Pycnonotus cafer</i>	+	+	+	-	+	-	Birds

Source: Primary data from field observations

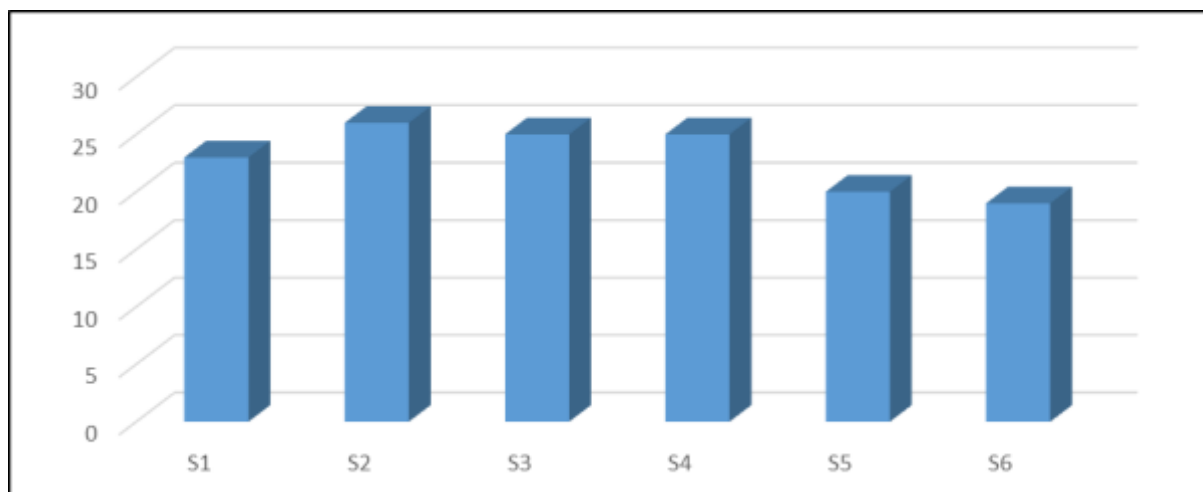


Figure 3-33: Site wise Flora & Fauna details from inside and near the Project site

The plants recorded in the study area were divided in two different categories i.e., Terrestrial and Aquatic plants. Similarly, the animals were divided in two categories based on flying and non- flying as Avifauna and Faunal species. Based on the categories a site wise qualitative comparison is shown in the figure below.

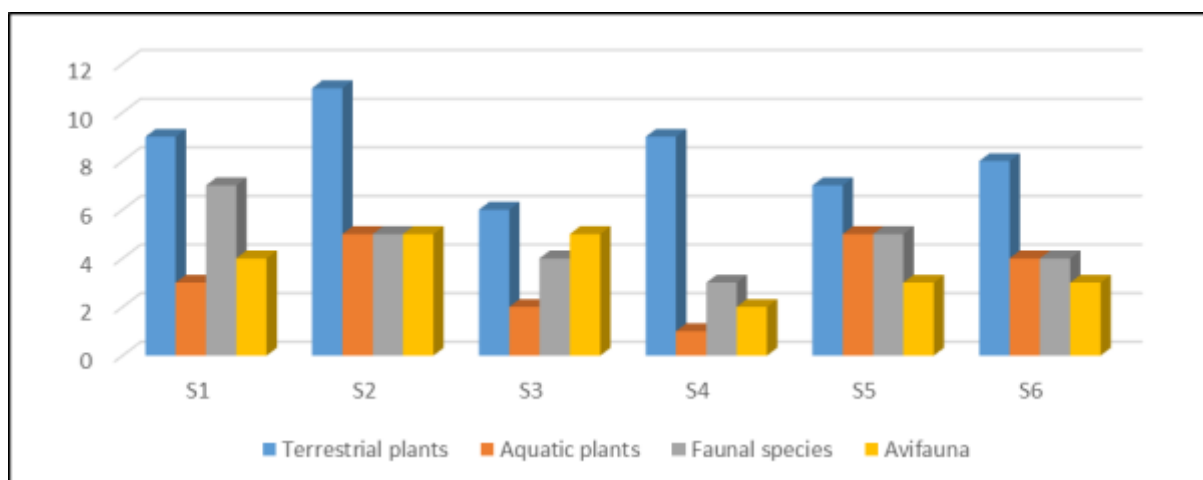


Figure 3-34: Site wise qualitative variation of Flora and Fauna

Floral biodiversity

The Primary and secondary data shows that the study area harbors many species of trees, shrubs, herbs, vines and climbers that are supported with the suitable soil quality and climatic conditions of the area. River Kosi being situated near the project site gives the study area a comparatively rich biodiversity than the neighboring localities. All the plant species were identified using handbooks, field guides, Google Lense and virtual herbariums of the **Botanical Survey of India (BSI)**.

Table 3-19: List of Flora in the study area

Sr. No.	Local Name	Scientific Name	Family
Tree			
1	Amaltas	<i>Cassia fistula</i>	Fabaceae
2	Arjun	<i>Terminalia arjuna</i>	Combretaceae
3	Aam	<i>Mangifera indica</i>	Anacardiaceae
4	Amla	<i>Phyllanthus emblica</i>	Euphorbiaceae
5	Babool	<i>Acacia nilotica</i>	Mimosaceae
6	Bel	<i>Aegle marmelos</i>	Rutaceae
7	Bargad	<i>Ficus bengalensis</i>	Moraceae
8	Ber	<i>Ziziphus mauritiana</i>	Rhamnaceae
9	Dhamani	<i>Grewia tiliaefolia</i>	Tiliaceae
10	Gamhaar	<i>Gmelenia arborea</i>	Verbenaceae
11	Imli	<i>Tamarindus indica</i>	Fabaceae
12	Jungle Jalebi	<i>Pithecellobium dulce</i>	Mimosaceae
13	Jamun	<i>Syzygium cumini</i>	Myrtaceae
14	Karanj	<i>Pongamia pinnata</i>	Fabaceae
15	Kathal	<i>Artocarpus heterophyllus</i>	Moraceae
16	Mahua	<i>Madhuca indica</i>	Sapotaceae
17	Neem	<i>Azadirachta indica</i>	Meliaceae
18	Pangar	<i>Erythrina variegeta</i>	Fabaceae

19	Peepal	<i>Ficus religiosa</i>	Fabaceae
20	Sal	<i>Shorea robusta</i>	Dipterocarpaceae
21	Siris	<i>Albizzia lebbek</i>	Mimosaceae
22	Saripha	<i>Anona squamosa</i>	Annonaceae
23	Semal	<i>Bombax ceiba</i>	Bombacaceae
24	Sisham	<i>Dalbergia sisso</i>	Fabaceae
25	Sal	<i>Shorea robusta</i>	Dipterocarpaceae
Shrub			
1	Arusha	<i>Adhatoda zeylanica</i>	Acantaceae
2	Arka	<i>Calotropis gigantea</i>	Asclepiadaceae
3	Behaya	<i>Ipomoea carnea</i>	Convolvulaceae
4	Banber	<i>Ziziphus oenoplia</i>	Rhamnaceae
5	Jamal Gota	<i>Jatropha curcas</i>	Euphorbiaceae
6	Nirgundi	<i>Vitex negundo</i>	Verbenaceae
	Putus	<i>Lantana camara</i>	Verbenaceae
Herb/Grasses			
1	Amrul	<i>Oxalis corniculata</i>	Oxalidaceae
2	Anantamul	<i>Hemidesmus indicus</i>	Periplocaceae
3	Bans	<i>Bambusa bambos</i>	Poaceae
4	Chirchita	<i>Achyranthus aspera</i>	Amaranthaceae
5	Charota	<i>Cassia tora</i>	Fabaceae
6	Dub	<i>Cynodon dactylon</i>	Poaceae
7	Dudhi	<i>Euphorbia hirta</i>	Euphorbiaceae
8	Jangji pudina	<i>Ageratum coenozoides</i>	Asteraceae
9	Kala bhangra	<i>Croton bonplandianus</i>	Euphorbiaceae
10	Khal-muriya	<i>Tridax procumbens</i>	Asteraceae
11	Lajwanti	<i>Mimosa pudica</i>	Mimosaceae
12	Motha	<i>Cyperus rotundus</i>	Cyperaceae
13	Punarnava	<i>Boerhavia diffusa</i>	Nyctaginaceae
14	Satyanasi	<i>Argemone mexicana</i>	Papaveraceae
15	Uloo	<i>Imperata cylindrica</i>	Poaceae
16	Visnukrantha	<i>Evolvulus alsnoides</i>	Convolvulaceae
Climbers & Twines			
1	Bougainvella	<i>Bougainvella glabra</i>	Nyctaginaceae
2	Blue Pea flower	<i>Clitoria parula</i>	Fabaceae
3	Ivu Guard	<i>Ciccinia grandis</i>	Cucurbitaceae
Aquatic Plants			
1.	Chaupattiya	<i>Marsilia minuta</i>	Marsiliaceae
2.	Indian Shot	<i>Canna indica</i>	Cannaceae
3.	Elephant rass	<i>Cenchrus purpureus</i>	Poaceae
4.	Kush	<i>Saccharum spontaneum</i>	Poaceae
5.	Water Primetose	<i>Ludwigia parviflora</i>	Onagraceae
6.	Nut grass	<i>Cyperus rotundus</i>	Cyperaceae

Fauna

The buffer area is principally dominated by Indian Street Dog, Domestic Cow, House Rat, Garden Lizard and Common Indian Toads etc. Being located near the river koshi, the area is habitat to many aquatic species of Mammals, Rodent, Reptiles, Amphibian, Avifauna, Insects and Fishes. The common birds inhabiting in the study area are Asian Koel (*Eudynamys scolopaceus*), Jungle Babbler (*Turdoides striatus*), Common Crow (*Corvus splendens*) along with some water birds like Cattle egret (*Egretta garzetta*), Black Drongo (*Dicrurus macrocercus*) and White- throated Kingfisher (*Halcyon smyrnensis*). The recorded faunal species are given below.

Table 3-20: List of Flora in the study area

Sr. No.	Local Name	Scientific Name	Schedule	IUCN Status
Mammals				
1	Cow	<i>Bao Taurus</i>	---	---
2	Common langur	<i>Semnopithecus entellus</i>	II	LC
3	Domestic Water Buffalo	<i>Bubalus bubalis</i>	---	---
4	Goats	<i>Capra hircus</i>	---	LC
5	Indian Fox	<i>Vulpes bengalensis</i>	II	LC
6	Indian hare	<i>Lepus nigricollis</i>	IV	LC
7	Jackal	<i>Canis aureus</i>	II	LC
8	Jungle cat	<i>Felis chaus</i>	II	LC
9	Mongoose	<i>Herpestes edwardsi</i>	II	LC
10	Mouse	<i>Rattus rattus</i>	V	LC
11	Squirrel	<i>Funambulus pennanti</i>	IV	LC
Rodent				
1	House Rat	<i>Rattus rattus</i>	V	LC
2	Indian Field Mouse	<i>Mus booduga</i>	V	LC
3	Indian Mole Rat	<i>Bandicota bengalensis</i>	V	LC
Reptiles				
1	Binocellata Cobra	<i>Naja naja</i>	II	LC
2	Banded Krait	<i>Bungarus fasciatus</i>	II	LC
3	Common boa	<i>Boa constricta</i>	II	LC
4	Common garden lizard	<i>Calotes versicolor</i>	IV	LC
5	Indian Chameleon	<i>Chamaeleo zeylanicus</i>	II	LC
6	Indian Rat snake	<i>Ptyas mucosus</i>	II	LC
7	Monitor lizard	<i>Varanus bengalensis</i>	II	LC

8	Russell's Viper	<i>Daboia russelii</i>	II	LC
Amphibians				
1	Hyla	<i>Hyla hyla</i>	IV	LC
2	Indian toad	<i>Bufo melanostictus</i>	IV	LC
3	Indian Bullfrog	<i>Rana tigrina</i>	IV	LC
4	Paddy field Frog	<i>Rana limnocharis</i>	IV	LC
5	Skipping frog	<i>Rana cyanophyclics</i>	IV	LC
6	Tree frog	<i>Racophorus lencamystale</i>	IV	LC
Avifauna				
1	Asian Koel	<i>Eudynamys scolopacea</i>	IV	LC
2	Asian Openbill	<i>Anastomus oscitans</i>	IV	LC
3	Black Stork	<i>Ciconia nigra</i>	IV	LC
4	Bronze-winged Jacana	<i>Metopidius indicus</i>	IV	LC
5	Black Drongo	<i>Dierurus macrocercus</i>	IV	LC
6	Black headed Oriole	<i>Oriolus xanthornus</i>	IV	LC
7	Barbet	<i>Psilopogon zeylanicus</i>	IV	LC
8	Beater	<i>Merops orientalis</i>	IV	LC
9	Blue Rock Pigeon	<i>Columba livia</i>	III	LC
10	Crow Pheasant	<i>Centropus sinensis</i>	IV	LC
11	Common Kite	<i>Milvus migrans</i>	IV	LC
12	Common Iora	<i>Aegithina tiphia</i>	IV	LC
13	Common Crow	<i>Corvus splendens</i>	V	LC
14	Cattle Egret	<i>Bubulcus ibis</i>	IV	LC
15	Common Shelduck	<i>Tadorna tadorna</i>	IV	LC
16	Common Quail	<i>Coturnix coturnix</i>	IV	LC
17	Common Pochard	<i>Aythya ferina</i>	IV	LC
18	Doves	<i>Streptopelia spp.</i>	IV	LC
19	Eurasian Wigeon	<i>Anas penelope</i>	IV	LC
20	House crow	<i>Corvus splendens</i>	V	LC
21	House Sparrow	<i>Passer domesticus</i>	IV	LC
22	Indian Myna	<i>Acridotheres tristis</i>	IV	LC
23	Indian Spot-billed Duck	<i>Anas poecilorhyncha</i>	IV	LC
24	Jungle Babbler	<i>Turdoides striatus</i>	IV	LC
25	Jungle crow	<i>Corvus macrorhynchos</i>	V	LC
26	Little Cormorant	<i>Microcarbo niger</i>	IV	LC
27	Little Grebe	<i>Tachybaptus ruficollis</i>	IV	LC
28	Lesser Whistling- Duck	<i>Dendrocygna javanica</i>	IV	LC
29	Little Egret	<i>Egretta garzetta</i>	IV	LC
30	Mallard	<i>Anas platyrhynchos</i>	IV	LC

31	Painted Stork	<i>Mycteria leucocephala</i>	IV	NT
32	Pheasant-tailed Jacana	<i>Hydrophasianus chirurgus</i>	IV	LC
33	Pond Heron	<i>Ardeola grayii</i>	IV	LC
34	Red Junglefowl	<i>Gallus gallus</i>	IV	LC
35	Red Vented Bulbul	<i>Pycnonotus cafer</i>	IV	LC
36	Red-crested Pochard	<i>Netta rufina</i>	IV	LC
37	Ruddy Shelduck	<i>Tadorna ferruginea</i>	IV	LC
38	Spotted Owlet	<i>Athene brama</i>	IV	LC
39	Tufted Duck	<i>Aythya fuligula</i>	IV	LC
40	Tailor Bird	<i>Orthotomus sutorius</i>	IV	LC
41	Tree Pie	<i>Dendrocitta vagabunda</i>	IV	LC
42	White breasted kingfisher	<i>Halcyon smyrnensis</i>	IV	LC
43	Woolly-necked Stork	<i>Ciconia episcopus</i>	IV	VU

Insects

Sr. No.	Local Name	Scientific Name	Family	IUCN Status
1	Caper white	<i>Belenois aurota</i>	Pieridae	---
2	Centipede	---	---	---
3	Crab spiders	---	Thomidae	---
4	Common Crow			
5	Common Wanderer	<i>Pareronia valeria</i>	Pieridae	---
6	Common Social Wasp	<i>Ropalidia marginata</i>	Vespidae	---
7	Coral tailed Cloud wing	<i>Tholymis tillarga</i>	Libellulidae	---
8	Ditch Jewel	<i>Brachythemis contaminata</i>	Libellulidae	---
9	Fire ants (red ants)	<i>Selonopsis invicta</i>	Formicidae	---
10	Handmaiden moth	<i>Amata cyssea</i>	Arctiinae	---
11	Indian Drywood Termites	<i>Cryptotermes dudleyi</i>	Termitoidea	---
12	Indian Hive Bee	<i>Apis indica</i>	Apidae	---
13	Peacock Pansy	<i>Junonia almana</i>	Nymphalidae	LC
14	Lady Bug	<i>Coccinella septempunctata</i>	Coccinellidae	---
15	Tawny Coaster	<i>Acraea terpsicore</i>	Nymphalidae	---

Source- Field Observations and Secondary Data**IUCN Code: LC- Least Concerned: VU- Vulnerable**

Table 3-21: List of Fish found in the Kosi River

Sr. No.	Family	Species	Common Name
1.	Bagridae	<i>Mystus vittatus</i> (Bloch)	Dwarf Catfish
2.		<i>Aorichthys seenghala</i> (Sykes)	Seenghala
3.		<i>M. cavasius</i> (Ham-Buch)	Striped Catfish
4.	Belonidae	<i>Xenentodon cancella</i>	Needle Fish
5.	Cyprinidae	<i>Catla catla</i> (Hamilton-Buchanan)	Catla
6.		<i>Labeo rohita</i> (Hamilton-Buchanan)	Rohu
7.		<i>Cirrhinus mrigala</i> (Hamilton-Buchanan)	Mrigala
8.		<i>Cirrhinus Reba</i> (Hamilton)	Reva Fish
9.		<i>Puntius sophore</i> (Hamilton-Buchanan)	Jat Putiya
10.		<i>Puntius conchoni</i> (Hamilton-Buchanan)	Putiya
11.		<i>Puntius phutunio</i> (Hamilton-Buchanan)	Phutani Puti
12.		<i>Puntius terio</i> (Hamilton-Buchanan)	Teri Punti
13.		<i>Puntius sarana sarana</i> (Hamilton-Buchanan)	Oliver barb
14.		<i>Amblypharyngodon mola</i> (Hamilton-Buchanan)	Carplet
15.		<i>Parluciosoma daniconius</i> (Hamilton-Buchanan)	Rasbora
16.		<i>Esomus danricus</i> (Hamilton-Buchanan)	Flying barb
17.	Clupidae	<i>Gudusia chapra</i> (Hamilton-Buchanan)	Indian Shad/ Chapila
18.	Schilbeidae	<i>Pseudeutropius atherinoides</i> (Bleeker)	Potasi
19.	Siluridae	<i>Wallago attu</i> (Schneider)	Padhan
20.		<i>Ompok bimaculatus</i> (Bloch)	Butter Catfish
21.	Mastacembelidae	<i>Mastacembelus armatus</i>	Spiny Eel

Results

There is no **National Park, Wildlife Sanctuary and Critically Polluted area** or **Protected Forests** in 10 km radius from the project site. There are no Critically Polluted areas inside the study area.

Core Zone

The core zone of the study area is occupied with existing industry/ buildup area, green belt area and lawns. Other than few Birds and insects no larger animal were recorded from the core zone.

Buffer Zone

The Buffer zone has a considerably rich biodiversity which is already reported above by the help of field and secondary surveys. Total 43 species of flora were reported from the study area. Trees were dominant life form and reported with maximum 30 species, followed by 24

species of Shrub, Herbs and Climbers collectively, 13 Grasses and 06 Aquatic plants. All species are arranged in alphabetical order. Species names are followed by vernacular names/local names and families are given in the table below.

Similarly, a total of 108 species of fauna were recorded where Birds are found to be the most dominant life form with 43 species followed by 15 species of Insects, 21 Fishes, 11 Mammals, 8 Reptilians, 3 Rodents and 6 Amphibians.

3.10 Socio Economic:

Socio-economic status of the population is an indicator of development of the region. Any developmental project of any magnitude will extrapolate economic bearing of the population in the study area. The section delineates the overall appraisal of the socially relevant attributes.

The data on socio-economic aspects in the study area has been carried out through the analysis of the available secondary data.

3.10.1 Methodology

The following Procedure is being applied for carrying out Socio- Economic Status of the Study area as a part of EIA for a project. The activity has been performed by SE –FAE.

A reconnaissance survey (a preliminary survey) was conducted. Collection and Review of Secondary Data from the authentic sources, Literature and Other Relevant Documents, Documents such as District Census Hand Book, District Gazetteer, District Statistics, maps and information on existing livelihood projects, government employment schemes and services in which people in the concerned districts / blocks are largely involved, would also be collected from government and non-government sources and reviewed. Such pertinent data will mainly relate to develop understanding about the socio-economic conditions of the concerned area and availability of infrastructure facilities, and service delivery system.

The List of Secondary Data Collection from the Field

- District Gazetteer
- District Census Handbook
- District Statistical Map
- Revenue Map for each revenue village.
- Books and other documents related to the area of impact
- Secondary data or available recent primary data from local NGOs.
- Human Development Report of the district

3.10.2 Primary data Collection

To ensure that people's concerns are incorporated in the project design and to promote public understanding about the project and its implications public consultation and information dissemination is treated as a two way process where the information is passed on to public and their feedback is sought to understand their issues. The consultative process is continued throughout the project period – design preparation, implementation and post implementation periods. The preparatory stage consultation helps to explore alternative design options, to avoid very adverse social impacts and to reduce the magnitude of the impacts of the project, while consultations during implementation stage helps to facilitate a smooth resettlement of the PAFs thereby enabling speedy implementation of the project.

Salient observation of the survey

- House pattern: Study area was mainly urban dominant. Near about 60% houses were in pukka form.
- Employment: Main occupation in the study area was service, business, small shops, hotels, Restaurants, small scale industries and its allied activities like pan tapari, tea stalls etc. Other income generation source in the area was labour work in the construction site.
- Fuel: Mainly people were using LPG.
- Language: Official language as well as mother tongue of the people in the study area is hindi and magahi.
- Sanitation: In the study area sanitation facilities were adequate. Lack of awareness about sanitation was found root cause behind the problem. 90% households were using the toilets facilities and 10% household was found that they are going for open defecation in the study area.
- Water Supply: Main source of drinking water in the study area were Tap water. Tap water at household level is also found in the rural houses of the study area.
- Education facility: All type of schools; viz. Primary, Middle and High are available in the study area.
- Transportation facility: Most of the areas were connected with concrete road. For transportation purpose auto, Government & Private buses are available. Private vehicles like bicycles & motor cycles were also found to be used by the people to large extent
- Communication facility: In the study area, mobile phones, television, radio, newspapers, post offices were mainly used for communication purpose
- Medical facility: Most of the areas had the medical facilities in the form of sub- centers, primary health centre. General Hospitals Private clinics and medical shops also existed in the study area
- Electricity: Electricity facility for all domestic & commercial purpose is available.
- Market facility: Market facilities were available.

3.10.3 Secondary data Collection

Study of the socio-economic set up in the study area based on the Secondary data:

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

- Evaluation of the parameters defining the socio-economic conditions of the population.
- Analysis of the identification of social attributes like population distribution, sex ratio, occupational structure, available public utilities, etc., through literatures like district census hand book.
- Public opinion for the future development in the study area.

Sociological aspects include human settlements, demographic and socio-economic aspects and infrastructural facilities available in the study area. The economic aspects include agriculture, industry and occupational structure of workers.

The studies carried out are descriptive and exploratory in nature and are done by FAE, Socio-Economic.

Table 3-22: Methodologies & Secondary data

S. No.	Collection of data	With effect from
Secondary Sources		
I	Census of India, 2011	Latest Update available from 2012
Primary Sources		Method / Technique
Field observations		Market area survey
Extensive site-specific survey		Non-Probability Random Sampling
Survey period		Target sample of people interviewed of near road side, through Open interview Manner and the order of Sub-round/ per monitoring season
Type		Residence Shopkeeper etc.

3.10.4 Demographic structure of the study area

3.10.4.1 Population in Core Zone

Socio-economic status of the population is an indicator of development of the region. Any developmental project of any magnitude will have a bearing on the living condition and the economic bearing of the population in particular and the region as a whole. The section delineates the overall appraisal of the socially relevant attributes. The data on socio-economic aspects in the study area has been carried out through the analysis of the secondary data available for the study area.

3.10.4.2 Population in Buffer Zone

The study area was defined as an area within 10 km radius around the proposed project site. Total 54 villages are coming within 10 km radius of the study area. The study area is falling under two districts name as Supaul and Madhepura. Total numbers of villages in study area are 54 out of which 51 villages falls in Supaul district & remaining 3 villages comes under the Madhepura district of state Bihar.

Supaul district of Bihar has a total population of 2,229,076 as per the Census 2011. Out of which 1,155,283 are males while 1,073,793 are females. In 2011 there were a total 443,073 families residing in Supaul district. The Average Sex Ratio of Supaul district is 929. The total area of Supaul district is 2,425 km². Thus the density of Supaul district is 919 people per square kilometer. As per the initial provisional data of Census 2011, around 36 sq. km. area is under urban region while 2,389 sq. km. is under rural region.

Madhepura district of Bihar has a total population of 2,001,762 as per the Census 2011. Out of which 1,047,559 are males while 954,203 are females. With regards to Sex Ratio in Madhepura, it stood at 911 per 1000 male compared to 2001 census figure of 915. The average national sex ratio in India is 940 as per latest reports of Census 2011 Directorate. In 2011 census, child sex ratio is 930 girls per 1000 boys compared to figure of 927 girls per 1000 boys of 2001 census data. Settlement map is mentioned in **Figure 3-35**.

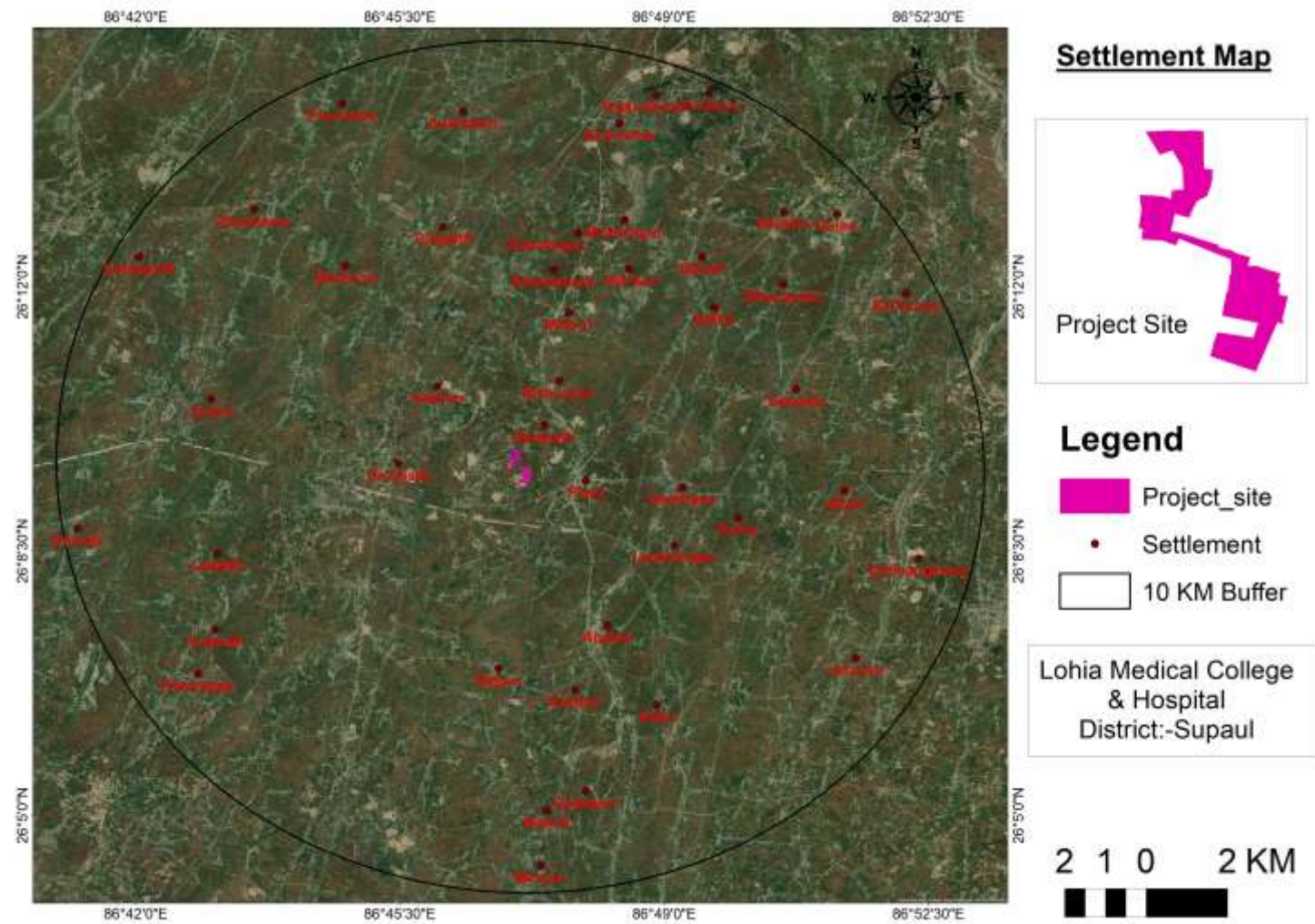


Figure 3-35: Settlement map of the Study Area

Table 3-23: List of villages present in the study area

Sl. No.	Village Name	Distance
0-03Km		
1.	Sakhua	1.72
2.	Bishunpur	1.82
3.	Debipatti	1.50
4.	Dinapatti	1.20
5.	Pipra	1.10
6.	Atlakha Belahi	1.90
7.	Amaha	2.75
03-07Km		
8.	Lachhmipur	5.73
9.	Kataia Mahe	4.78
10.	Kataia Milik	4.45
11.	Thumha	5.25
12.	Basaha	5.75
13.	Belokhra	6.84
14.	Jarauli	4.43
15.	Madhura	6.47
16.	Parsa	5.00
17.	Tulapatti	5.90
18.	Bahorwa	5.90
19.	Tharhi Bhawanipur	4.78
20.	Jiwachhpur	4.45
21.	Maheshpur	4.55
22.	Makroi	6.77
23.	Basuli	5.84
24.	Belha	3.43
25.	Atlakha Belahi	6.28
26.	Maun	5.00
27.	Gamhirpur	5.78
28.	Rahta	3.73
29.	Jagur	4.78
30.	Bela	4.45
31.	Amaha	7.00

Sl. No.	Village Name	Distance
32.	Pakri	6.77
33.	Rajpur	5.84
07 - 10 km		
34.	Gidrahi	9.50
35.	Keotapatti	9.36
36.	Bairio	9.02
37.	Jharka	9.46
38.	Mahi Sardar Chakla	7.66
39.	Sarhochia	9.04
40.	Satkodaria	7.37
41.	Maheshpur	8.10
42.	Lalpur	9.92
43.	Bhaiaram Sardar Chakla	7.89
44.	Beldara	7.28
45.	Bhairapatti	9.31
46.	Auraha	9.79
47.	Karharwa	7.06
48.	Lalpatti	8.87
49.	Thalha Garhia	9.54
50.	Kanhuan Goriari	7.52
51.	Jalwara	9.74
52.	Babhani Bholwa	8.08
53.	Tulapatti	9.06
54.	Mahichanda	8.80

Table 3-24: Demographic details of the study area

Sr. No	District	Village	No. of household	Total population	Total population Males	Total population Females	Sex Ratio Male %	Sex Ratio Female %	Scheduled Castes	Scheduled Tribes	Literate population	Literate population Males	Literate population Females
0 TO 03 KM													
1.	Supaul	Sakhua	1380	7071	3601	3470	702	572	466	0	3372	2040	1332
2.	Supaul	Bishunpur	1119	5438	2765	2673	507	494	683	1	2539	1566	973
3.	Supaul	Debipatti	562	2548	1313	1235	264	244	357	0	1122	696	426
4.	Supaul	Dinapatti	1305	6779	3507	3272	696	660	1353	2	2399	1577	822
5.	Supaul	Pipra	1732	8469	4451	4018	828	735	1848	38	4538	2785	1753
6.	Supaul	Atlakha Belahi	489	2630	1391	1239	244	214	22	1	1252	805	447
7.	Supaul	Amaha	2701	13921	7160	6761	1437	1365	3001	3	6430	4101	2329
03 TO 07 KM													
8.	Supaul	Lachhmipur	269	1708	884	824	187	184	365	0	776	529	247
9.	Supaul	Kataia Mahe	1857	9969	5095	4874	872	849	802	0	4776	3033	1743
10.	Supaul	Kataia Milik	142	774	393	381	75	81	0	0	305	190	115
11.	Supaul	Thumha	1427	6817	3481	3336	628	648	914	3	3288	2068	1220
12.	Supaul	Basaha	1692	8438	4393	4045	789	795	806	0	3653	2461	1192
13.	Supaul	Belokhra	801	3939	2063	1876	394	297	693	3	1526	1022	504
14.	Supaul	Jarauli	591	2737	1455	1282	244	209	77	0	1235	823	412
15.	Supaul	Madhura	495	2630	1336	1294	305	306	273	0	1298	777	521
16.	Supaul	Parsa	1126	5217	2719	2498	606	536	1255	1	2277	1418	859
17.	Supaul	Tulapatti	1096	5506	2868	2638	548	490	781	1	2323	1527	796
18.	Supaul	Bahorwa	637	2763	1420	1343	223	239	152	0	1145	766	379
19.	Supaul	Tharhi Bhawanipur	1659	8564	4396	4168	913	936	1408	0	3456	2201	1255
20.	Supaul	Jiwachhpur	590	3104	1583	1521	273	289	1080	1	1387	868	519
21.	Supaul	Maheshpur	1293	6764	3536	3228	669	643	1043	12	3441	2239	1202
22.	Supaul	Makroi	1067	5068	2658	2410	515	442	707	4	2535	1589	946
23.	Supaul	Basuli	645	3137	1625	1512	228	231	360	4	1392	894	498

Sr. No	District	Village	No. of household	Total population	Total population Males	Total population Females	Sex Ratio Male %	Sex Ratio Female %	Scheduled Castes	Scheduled Tribes	Literate population	Literate population Males	Literate population Females
24.	Supaul	Belha	166	914	459	455	83	82	0	0	592	342	250
25.	Supaul	Atlakha Belahi	489	2630	1391	1239	244	214	22	1	1252	805	447
26.	Supaul	Maun	200	1037	526	511	97	101	79	0	541	342	199
27.	Supaul	Gamhirpur	634	3748	1933	1815	423	377	127	0	1756	1111	645
28.	Supaul	Rahta	111	680	345	335	76	92	0	0	361	219	142
29.	Supaul	Jagur	847	3975	2041	1934	359	374	254	0	2052	1257	795
30.	Supaul	Bela	688	2779	1474	1305	216	214	323	1	1258	855	403
31.	Supaul	Amaha	2701	13921	7160	6761	1437	1365	3001	3	6430	4101	2329
32.	Supaul	Pakri	377	2077	1070	1007	201	197	209	0	944	624	320
33.	Supaul	Rajpur	817	4095	2108	1987	366	328	1114	1	1990	1239	751
07-10 KM													
34.	Supaul	Gidrahi	387	2072	1077	995	358	184	279	0	931	615	316
35.	Supaul	Keotapatti	393	1954	985	969	350	174	0	0	1143	679	464
36.	Supaul	Bairio	381	1736	918	818	334	175	105	0	745	502	243
37.	Supaul	Jharka	635	3312	1756	1556	509	283	188	0	1375	971	404
38.	Supaul	Mahi Sardar Chakla	172	926	481	445	165	82	49	0	348	222	126
39.	Supaul	Sarhochia	276	1360	688	672	263	139	6	0	658	412	246
40.	Supaul	Satkodaria	422	2443	1240	1203	493	263	19	0	1133	722	411
41.	Supaul	Maheshpur	1293	6764	3536	3228	1312	669	1043	12	3441	2239	1202
42.	Supaul	Lalpur	857	4180	2191	1989	793	421	610	1	1812	1134	678
43.	Supaul	Bhaiaram Sardar Chakla	210	1015	514	501	210	107	660	1	452	273	179
44.	Supaul	Beldara	418	1987	1047	940	357	174	415	0	918	590	328
45.	Supaul	Bhairapatti	421	1912	979	933	357	172	84	0	1046	693	353
46.	Supaul	Auraha	480	2689	1345	1344	566	255	857	0	1097	735	362
47.	Supaul	Karharwa	494	2778	1466	1312	548	292	229	0	1229	750	479

Sr. No	District	Village	No. of household	Total population	Total population Males	Total population Females	Sex Ratio Male %	Sex Ratio Female %	Scheduled Castes	Scheduled Tribes	Literate population	Literate population Males	Literate population Females
48.	Supaul	Lalpatti	308	1504	781	723	229	123	48	0	893	577	316
49.	Supaul	Thalha Garhia	4416	22723	11921	10802	4252	2227	4242	107	11756	7195	4561
50.	Madhepura	Kanhuan Goriari	771	3912	2027	1885	693	357	970	0	1715	1100	615
51.	Madhepura	Jalwara	361	1771	935	836	296	162	418	0	791	507	284
52.	Madhepura	Babhani Bholwa	2830	14720	7587	7133	2700	1380	2462	6	6702	4110	2592
53.	Supaul	Tulapatti	1096	5506	2868	2638	1038	548	781	1	2323	1527	796
54.	Supaul	Mahichanda	302	1648	850	798	268	122	257	0	747	503	244
Total			48628	246759	127792	118967	23958	22585	37297	208	114896	72926	41970

The Total Population of study area is 246759 individuals and 48628 numbers of households. A comparative assessment has been made for the respective demographic aspects, based on the year 2011 data, which has been discussed in the following sections.

The total population of study area is 246759 the percentages of male & female population are 53% & 47% respectively. Breakup of the population for male and female is given in following **Table: 3.25**.

Table 3-25: Break-up of the population for male and female

Particulars	Number
No of households	48628
Total population	246759
Male population	127792
Female population	118967
Average family size	5

(Source: As per Census Data 2011)

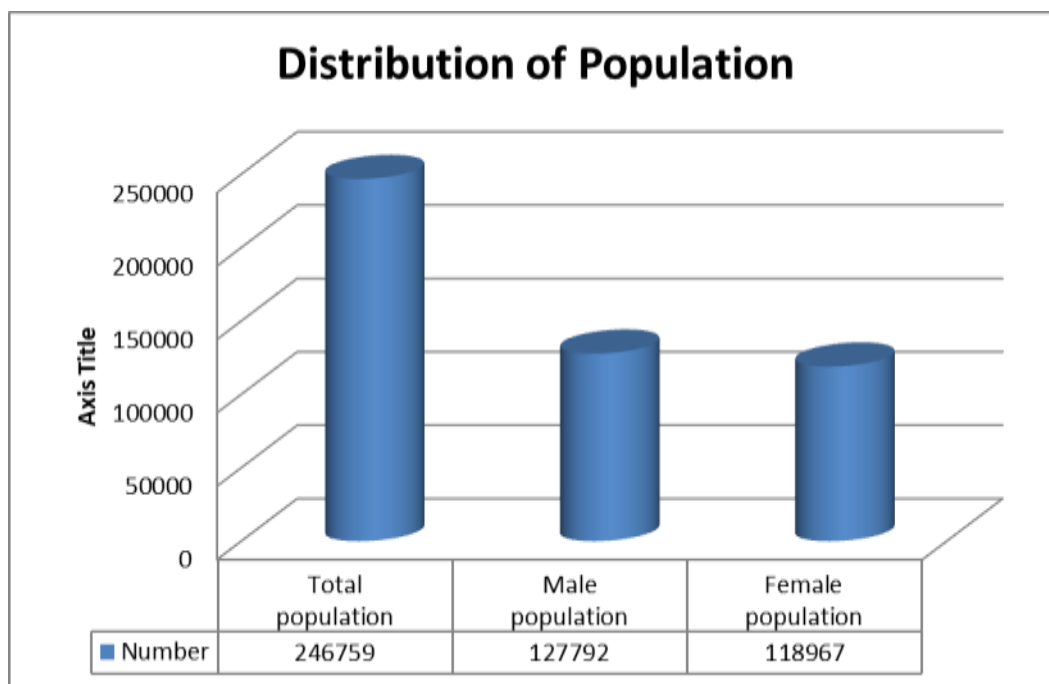


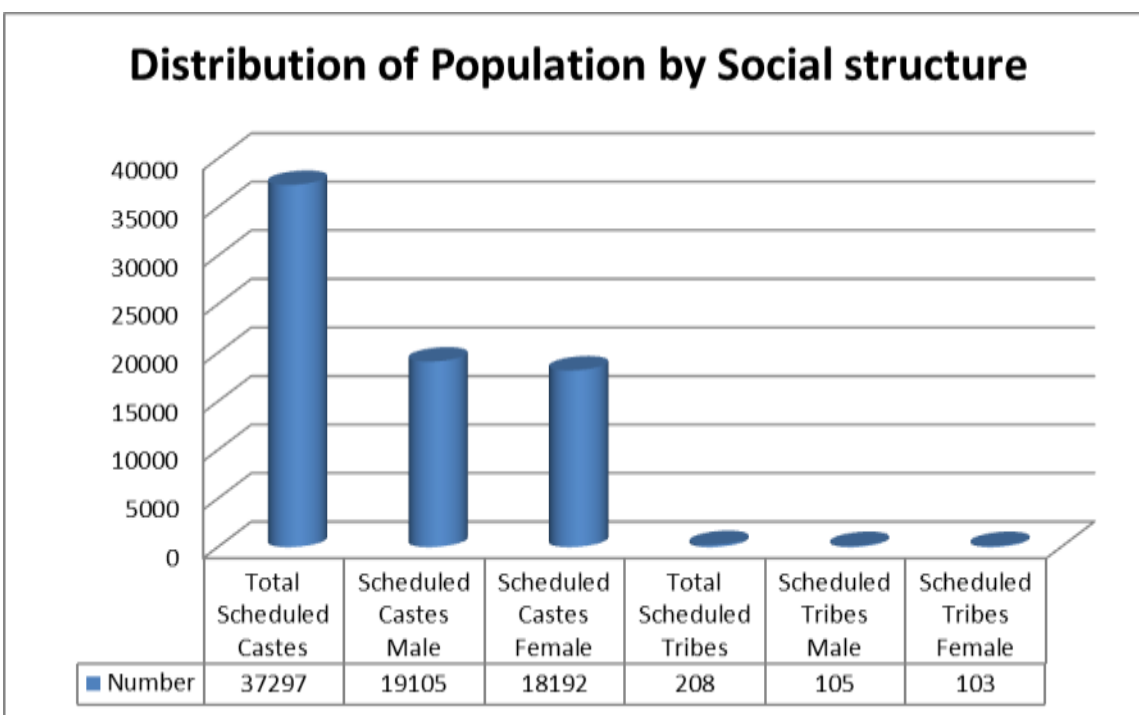
Figure 3-36 : Distribution of Population in Study area

3.10.4.3 Social Infrastructure:

In 2011, about 15% of the total population belonged to Scheduled Castes (SC). The distribution of population in the study area by social structure is presented in **Table 3-26**:

Table 3-26: Distribution of Population by Social structure in Study Area

Particulars	Number
Total Scheduled Castes	37297
Scheduled Castes Male	19105
Scheduled Castes Female	18192
Total Scheduled Tribes	208
Scheduled Tribes Male	105
Scheduled Tribes Female	103

(Source: As per Census Data 2011)**Literacy levels**

The literacy rate in study area is 47% of the total population in 2011. The male literacy rate was 57% (of total male population), whereas corresponding figures for the female literacy rate was 35% (of total female population) in 2011. The details are presented in Table 3-24 and represented in the form of a bar chart as given in Figure 3-41.

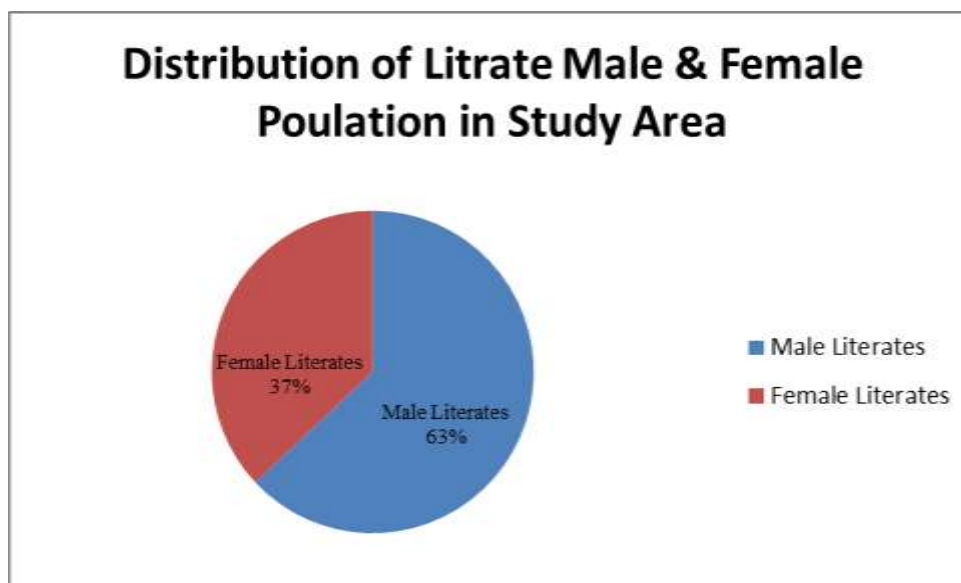


Figure 3-37 : Distribution of Literate Male & Female Population in Study Area

Table 3-27: Distribution of Literates in Study Area

Particulars	Number
Total Literates	114896
Male Literates	72926
Female Literates	41970
Total illiterates	131863
Male	54866
Female	76997

(Source: As per Census Data 2011)

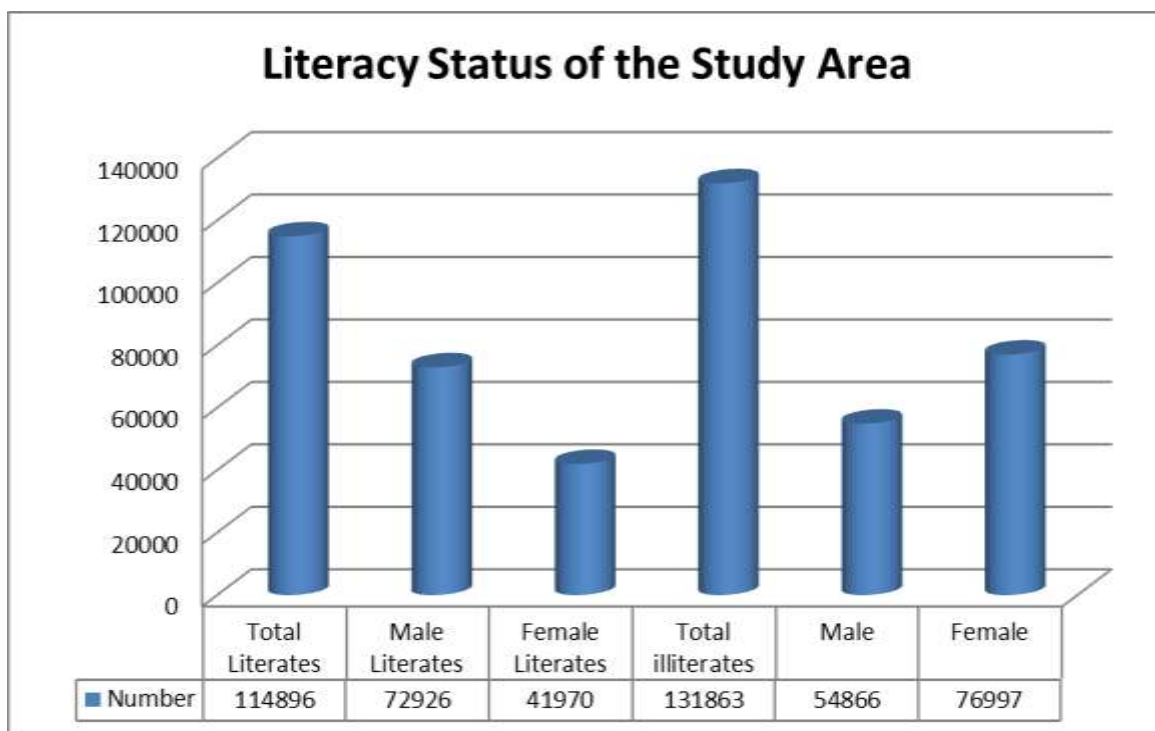


Figure 3-38 : Literacy Status of the Study Area

3.10.6 Occupation Pattern of the study area

The occupational structure of the population in the study area has been studied with reference to the total workers and non-workers. Further total workers grouped into two categories main workers and marginal workers. Main workers have been grouped into four categories namely: Cultivators, agricultural laborers, household workers and other workers.

3.10.7 Total workers:

Work is defined as participation in any economically productive activity with or without compensation, wage. Such participation may be physical and/ or mental in nature. Work involves not only actual work but also include supervision and direction of work. It even includes part time help or unpaid work on farm, family enterprise or its economic activity. All persons engaged in 'work' as defined above are workers.

The number of total workers in the study area is 104663 which are 42% of total population. Out of which 61% is male and only 39% is female. Total workers further divided into main workers and marginal workers.

3.10.7.1 Main workers:

Those workers who had worked for the major part of the reference period (i.e., 6 months or more) are term main workers. Total number of main workers in the study area is 46819 which are 45% of total workers and 19% of total population.

3.10.7.2 Marginal Workers

The marginal workers are those workers, who are engaged in some work for a period of less than six months, during the reference year prior to the census survey. Total number of marginal workers in study area is 57844 which are approx. 55% of the total workers.

3.10.7.3 Cultivator

A person is classified as cultivator if he or she is engaged in cultivation of land own or from government or held from private persons or institutions for payment in money, kind or share. Cultivation work includes effective supervision or direction in cultivation. A person who has given out her/his land to another person or institution(s) for cultivation for money, kind or share of crop and who does not even supervise or direct cultivation process is not treated as cultivator. Similarly, a person working on another person's land for wages in cash or kind or combination of both is not treated as cultivator.

Total cultivators in study area are 15386 which are 15% of Total workers. The distribution of cultivators is male percentage is 78% and female percentage is 22%.

3.10.7.4 Agricultural Labourers

A Persons working on the land of others for wages or share in the yield have been treated as agricultural labourers. The total Agriculture workers of this category are about 24465 which are 10% of the total population in study area. The distribution of agricultural labours within study area male percentage is 69% and female is 31%.

3.10.7.5 Household Worker

Household industry relates to production, processing, servicing, repairing or making and selling but not includes professions such as a pleader, Doctor, Musician, Dancer, Waterman, Astrologer,

Dhobi, Barber, even if such professions, trade or services are run at home by members of the household. The total Household workers of this category are about 6245 (6% of total workers) in which 75% are male and 25% are female.

3.10.7.6 Non-Workers:

The total number of non-workers population is 142096 which are 58% of the total population. Out of which 45% is male and 55% is female.

Table 3-28: Occupational Pattern of the study area

S. No.	Particulars	Number of workers in the study area		
		Total	Male	Female
1.	Total Workers	104663	63736	40927
2.	Main Workers	46819	34122	12697
3.	Marginal Worker	57844	29614	28230
4.	Non-workers	142096	64056	78040
5.	Cultivators	15386	11954	3432
6.	Agricultural Labour	24465	16967	7498
7.	Others Workers	6245	4714	1531

(Source: As per Census Data 2011)

Occupational Pattern of the study area

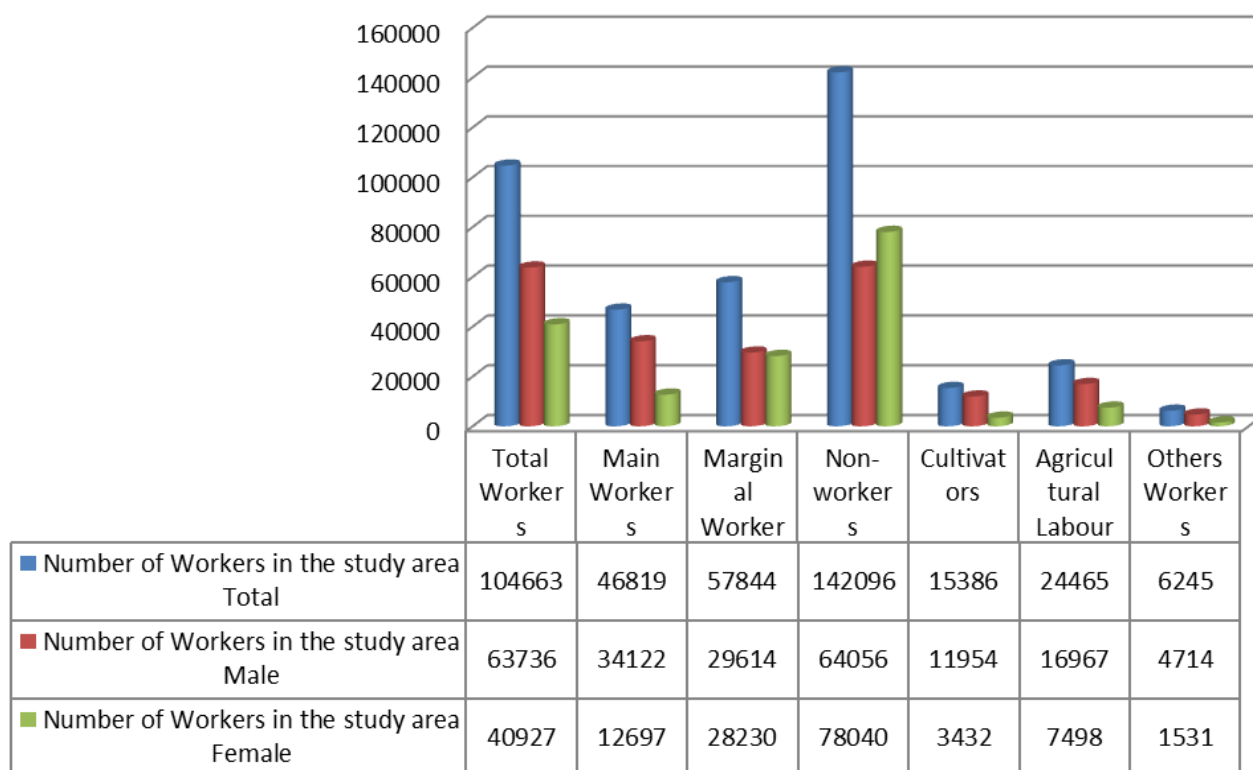


Table 3-29: Social setup of the study area

1	Total no. of villages in the study area	54			
2	Total Population of the Study Area	246759			
	Male	127792	52		
	Female	118967	48		
	Sex Ratio (No. of females per 1000 males)	931			
3	0-6 Year Population in Study Area	46543	19	of total population	
	Male	23958	51		
	Female	22585	49		
	Sex Ratio (No. of females per 1000 males)	943			
4	Total number of Households	48628			

	Average Household size in the Study Area as a whole	5			
5	Total Population of Schedule Caste Community in the Study Area	37297	15	of total population	
	Male	19105	51		
	Female	18192	49		
6	Total Population of Schedule Tribe Community in the Study Area	208	0.1	of total population	
	Male	105	50		
	Female	103	50		
7	Total Literates in the Study Area	114896	47	of total population	
	Male	72926	63		
	Female	41970	37		
8	Total illiterates in the Study Area	131863	53	of total population	
	Male	54866	42		
	Female	76997	58		
9	Total Worker Population	104663	42	of total population	
	Male	63736	61		
	Female	40927	39		
10	Main Worker Population	46819	19	of total population	
	Male	34122	73		
	Female	12697	27		
11	Marginal Workers	57844			
	Male	29614	51		
	Female	28230	49		
12	Cultivators	15386	15	of total Workers	
	Male	11954	78		
	Female	3432	22		
13	Agricultural Labour	24465	10	of total population	
	Male	16967	69		
	Female	7498	31		
14	Others Workers	6245			
	Male	4714	75		

	Female	1531	25		
15	Non- Workers	142096	58	of total population	
	Male	64056	45		
	Female	78040	55		

Table 3-30: Basic Infrastructure status in the villages of the study area

S. N	Village Name	CD Block Name	Gram Panchayat Name	Total House holds	Total Population of Village	Govt. Primary School (Numbers)	Govt. Middle School (Numbers)	Govt. Secondary School (Numbers)	Govt. Senior Secondary School (Numbers)	Primary/ Sub Health Centre (Numbers)	Veterinary Hospital (Numbers)	Nutritional Centres/ Anganwadi Centre (Status)
1.	Sakhua	Pipra	Dinapatti	1500	7600	4	3	3	2	2	1	4
2.	Bishunpur	Pipra	Basaha	1300	6550	4	3	2	1	1	1	3
3.	Debipatti	Pipra	Dinapatti	650	3100	3	2	1	0	0	0	2
4.	Dinapatti	Pipra	Dinapatti	1400	7000	4	3	3	2	1	1	3
5.	Pipra	Pipra	Pipra	1900	9400	5	4	3	1	2	1	4
6.	Atlakha Belahi	Tribeniganj	Simaria	550	3100	3	2	2	0	1	0	2
7.	Amaha	Pipra	Amaha	3000	15500	6	4	3	2	2	2	5
8.	Lachhmipur	Tribeniganj	Maheshuwa	300	1750	2	1	0	0	1	0	1
9.	Kataia Mahe	Pipra	Kataia Mahe	2000	10500	5	4	3	2	2	1	4
10.	Kataia Milik	Pipra	Kataia Mahe	150	900	1	1	0	0	0	0	1
11.	Thumha	Pipra	Thumha	1600	8100	4	4	2	1	2	1	4
12.	Basaha	Pipra	Basaha	1800	9100	4	3	2	1	2	1	4
13.	Belokhra	Pipra	Thumha	850	4100	3	3	1	1	1	0	3
14.	Jarauli	Pipra	Ratouli	650	3200	3	2	1	0	1	0	2
15.	Madhura	Kishanpur	Meha Simar	550	2600	2	1	0	0	1	0	2
16.	Parsa	Supaul	Pipra Khurd	1200	6100	4	3	2	1	2	1	3

S. N	Village Name	CD Block Name	Gram Panchayat Name	Total House holds	Total Population of Village	Govt. Primary School (Numbers)	Govt. Middle School (Numbers)	Govt. Secondary School (Numbers)	Govt. Senior Secondary School (Numbers)	Primary/ Sub Health Centre (Numbers)	Veterinary Hospital (Numbers)	Nutritional Centres Anganwadi Centre (Status)
17.	Tulapatti	Pipra	Tulapatti	1200	6050	4	3	1	1	2	1	3
18.	Bahorwa	Kishanpur	Tuuaoahee	700	3400	3	2	0	0	1	0	2
19.	Tharhi Bhawanipur	Pipra	Tharhi Bhawanipur	1750	8650	5	4	3	2	2	1	4
20.	Jiwachhpur	Pipra	Mahesh Pur	650	3200	3	2	0	0	1	0	3
21.	Maheshpur	Pipra	Mahesh Pur	1400	7100	4	3	2	2	2	1	3
22.	Makroi	Pipra	Pipra	1200	6150	4	3	2	1	1	1	3
23.	Basuli	Pipra	Dubiahi	700	3500	3	2	0	0	1	0	2
24.	Belha	Tribeniganj	Karharwa	180	1000	2	1	0	0	0	0	1
25.	Atlakha Belahi	Tribeniganj	Simaria	500	3200	3	2	1	0	1	0	2

Source: Primary data

3.10.8 Salient observation of the survey

The social set up in the study area was studied using a combination of methods, including Focus Groups Discussion (FGD) tools and techniques, direct visits, community observations, and informal and formal questionnaire-based surveys. Direct observation-based methods were implemented to help identifying current socio economic environmental scenario and potential impacts of upcoming project's activities as to be experienced by the local people in the study area. The range in collected data reflected various socioeconomic variables and direct-indirect impacts between working and non-working individuals of communities. Major findings based on the survey are as follows:

- Mostly semi constructed type of households owned by the local residents was observed in the nearby villages during the study.
- Agriculture is the predominant occupation but the local inhabitants from the villages like **Pipra, Amaha, Kataia Mahe, Basaha, Thumha etc** people works in the metro cities mostly as skilled labours as mason, plumbing and other unorganized sectors. Migration in the villages was found to be quite rampant.
- The economic status and the demand pattern have changed paving way for economic diversification and up liftment in the villages of the study area. Remittances from the out-migration family members have added to the income of the families.
- People are engaged in crop production, vegetable farming and agriculture allied activities. Livestock farming is also practiced in the villages of the study area.
- Mechanisation in agriculture and advent of allied agricultural interventions were also observed in villages during the study.
- Water availability and accessibility to suffice since the intervention of various drinking water and irrigation schemes was seen satisfactory, hence reported by the group of farmers.
- Power line and electricity meter connections for electricity supply.
- Status of rural sanitation is in progress since the Swachh Bharat Mission is on ground but still the sanitary conditions and health status of public infrastructures such as Anganwadi Centers, Primary and Middle Schools either poorly managed or not functional. The Anganwadi Centre located in the villages were mostly found to be running in the rented premises. The sanitation facilities at the schools, PHCs and Anganwadi centers were found too satisfactory. The Anganwadi center Sevika demanded for the provisions of water purifiers at the AWCs.
- Health related assistance such as referral services in case of emergencies was not found satisfactory but some village has no Primary Health Center (PHC) and villagers go to Block hospital to avail medical facilities.

3.10.9 Awareness and opinion of the respondents

- Public opinion is the aggregate of individual attitudes or beliefs. It is very important to take opinion of the people about the project. The awareness will not only promote community participation but also enable them to understand the importance of the project and encourage them to express their view
- Local people expect that project proponent should take care of people's livelihood during construction and operational phase.

- Most of the people in the core area and in some villages of the were aware about the project.
- People were asked for to follow better health and safety measures during construction phase.

3.10.10 Impact Assessment & Conclusion

The project activity together with inflow of capital, in-migration and employment of local inhabitants will show positive impact on the overall social and economic condition of the people of the area. The project will provide a direct job opportunity to the local persons as both technical and non-technical workers. Literacy may further increase because of better income and awareness amongst the people. The project will provide direct employment opportunity to local people. Indirect employment will be generated in trade and other ancillary services. Employment in these sectors is both permanent and temporary or contractual and involvement of unskilled labour. A major part of this labour force is mainly from nearby villages that are expected to engage themselves both in agriculture and project activities. This will enhance their income and lead to overall economic growth of the area. The following socio-economic changes may take place due to project activities:

- The project will be a positive employment and income effect, both direct as well as indirect.
- Expected Improvement of infrastructure & transportation.
- The project will have positive impact on consumption behavior by way of raising average consumption and income through multiplier effect.
- The project will bring about changes in the pattern of demand from food to non-food items as sufficient income is being generated.
- People located in the project area and in close vicinity, will enjoy positive changes in life style and better quality of life.

3.11 Traffic Study:

The three days traffic survey has been conducted from 07.01.2024 to 09.01.2024 on the Pipra Road from 06:00 AM to 10:00 PM. Average values have been used for traffic estimation. Manual of Standard & Specification for Two Laning of State Highways (IRC: SP:73-2007) has been used for traffic calculations and projections. A minimum 5% annual increase in the traffic is taken for the projection. Highest traffic volume however has been observed during working hours and returning hours i.e. 9:00-11:00 AM and 05:00-07:00 PM respectively. It is envisaged that the construction will be done in one year.



Figure 3-39 : Locations of traffic survey

Table 3-31: Traffic on Pipra Road (Point 1)

Classification of Traffic	Adopted PCU Value	Existing Traffic on Pipra Road as on Jan 24		Operational Phase on Pipra Road as on Jan-25		
		ADT	PCU	ADT	Traffic due to Project	PCU
Cars	1	560	560	588	400	988
Three-Wheeler	1	176	176	185	200	385
Two-wheeler	0.5	1500	750	1575	800	1187.5
Buses	3	24	72	26	10	108
LCV	1.5	860	1290	903	50	1429.5
Trucks	3	34	102	36	0	108
Tractor-Trailer	4.5	128	576	135	5	630
Cycle	0.5	1462	731	1536	500	1018

Rickshaw (Cycle+Battery)	2	110	220	116	50	332
Total Vehicles			4477			6186
V/C			0.25			0.34
Capacity as per (IRC :SP:73-2007) for 2 lane Highway				18000		

Level of Service (LoS)

The design service volume of two-lane highway in PCUs per day in plain area with paved shoulders (c=18000 pcu) has been adopted.

The following guidelines of IRC have been followed:

Table 3-32: Guidelines of IRC for Judging LOS Vs Performance

V/C	LOS	Performance
0.0-0.2	A	Excellent
0.2-0.4	B	Very Good
0.4-0.6	C	Good/Average
0.6-0.8	D	Below Average
0.8-1.0	E	Poor
1.0-1.2	F	Very Poor

Table 3-33: Design Service Volume in PCUs per day

Nature of Terrain	Design Service Volume in PCUs per day	
	without paved shoulder	with minimum 1.5 m paved shoulder
Plain	15,000	18,000
Rolling	11,000	13,000
Mountainous and Steep	7,000	9,000

(IRC: SP: 73-2007)

LoS in Existing Scenario 0.25 (B-Very Good)

LoS after Construction of the Project = 0.34 (B-Very Good)

4 ENVIRONMENTAL IMPACT IDENTIFICATION AND ASSESSMENT

4.1 INTRODUCTION

This section identifies and predicts the potential impacts on different environmental components due to the construction and operation of the proposed project. The proposed project would create impacts on the environment in two distinct phases:

- During the construction phase which may be recorded as temporary or short – term
- The other during the operation stage which would have long – term effects

Environmental impact can be defined as "any alteration of environmental conditions or creation of a new set of environmental conditions, adverse or beneficial, caused or induced by the action or set of actions under consideration". Environmental impact is classified into primary and secondary impacts. Primary impacts are those, which are attributed directly by the project while secondary impacts are those which are induced by primary impacts and include the associated investments and changed patterns of the social and economic activities by the action.

It details all the potential impacts on biophysical and socio-economic components of the local environment due to the proposed activities and sub-activities.

Prediction of impacts is the most important component in the Environmental Impact Assessment studies. Several qualitative and quantitative techniques and methodologies are used to conduct analysis of the potential impacts likely to accrue as a result of the proposed development activities on physical, ecological and socio-economic environments. Such predictions are superimposed over the baseline (pre-project) status of the environmental quality to derive at the ultimate (post-project) scenario of environmental conditions. The prediction of impacts helps to minimize the adverse impacts and maximize the beneficial impacts on environmental quality during pre and post project execution.

The negative impacts of the project will be mitigated / prevented / controlled. Most of them would be transitory in nature. Details of the control and preventive measures are described in detail in the subsequent section. There would not be any effect on the flora and fauna of the area also there would not be any effect on the surface drainage.

This section identifies and assesses the potential changes in the environment and the mitigation measures during both construction and operation stage. The environmental parameters most commonly affected by project operations are:

- Land Environment
- Water Environment
- Air Environment
- Noise Environment
- Biological Environment
- Socio-economic Environment
- Solid Waste

The impacts studied have been classified as under;

- a) **Positive and negative impacts** – an action will result in significant environmental impacts all of which are either beneficial or adverse (undesirable).
- b) **Primary and secondary impacts** – **primary impacts** covers those which are direct fallout of the proposed project and that generally occur at the same time or place as the action (and are generally obvious and quantifiable). **Secondary impacts** are indirect or induced changes (as a result of chain of consequences) due to the project/action. Secondary impacts span the potential effects of additional changes that are likely to occur later in time or at a different place as a result of implementation of a particular action. **Cumulative impacts** result from the incremental impact of the proposed action on a common resource when added to other past, present, and reasonable foreseeable future action.
- c) **Scope of the impacts**
- i) **Temporal** – This analyze the impact on basis of its bearing on time scale depending on persistence or duration of the impacts. The impact may be **immediate** (immediate consequence of the action which may or may not persist over time), **term** (takes place continuously over a period of time till action continues), or **chronic** (get manifested at a later stage due to accumulated effect over time).
 - ii) **Spatial** – The impact can effect **immediate work area** (within the complex of the proposed project), **in the vicinity** – outside boundary, and far and **wide area** around the project site.
 - iii) **Frequency** – Whether the impact is **continuous** (always there during project operation), **sporadic** (the impact is irregular due to some activity or situation which is random or infrequent), or **accidental** (it may be due to some uncontrolled happening resulting into accident).
- d) **Control / mitigation possibilities** – these include various options for minimizing damage to the environment, which include, **avoidance** (no action – mitigation by *not carrying out* proposed project / action), **minimization** (mitigation by *scaling-down the magnitude* of the project, *reorienting the layout* of the project, or *employing pollution prevention or cleaner production technology and procedures* that reduces factors generating the undesirable environmental impact), **restoration** (mitigation by *restoration of the environments* affected by the action), **reduction** (mitigation by *taking control, prevention, or maintenance steps* during the course of the action), **compensation** (mitigation through the *creation of environments* similar to those affected by the action).
- e) **Controversial status** – impending public controversy (disagreement among the public groups or concerned/affected individuals about the purpose, need, or location of the action) or historical proneness to arouse public controversy is an important aspect needing specific attention.
- f) **Sensitivity** – the actions encroaching sensitive environmental resources need specific consideration. Sensitive natural resources may be certain natural environments (such as, major wetland complexes – inland or coastal, floodplains of major rivers, wildlife reserves / habitats, large tracts of prime agricultural land, or regions with extensive and important cultural, or unique resources) or "sensitive receptors" in the affected area.

4.2 LAND ENVIRONMENT

4.2.1 Anticipated Impact

The major land use of present project is construction of building which includes hospital blocks, Academic blocks of, resident block etc. The project will be developed on the total plot area of 110883.87 sqm. or 11.088 Ha. Total green area is 30928.71 Sqm.

Impacts caused due to activity could be as follows:

DURING CONSTRUCTION PHASE:

Anticipated Impacts

- Air pollution due to demolition
- C& D waste
- Storage of construction material / chemicals
- Accidental spillage of Diesel used in DG which may lead to soil contamination.
- Solid Waste generation during construction phase by workers dwelling on site.
- Compaction of soil by earth moving equipment
- Erosion and modification of surface
- Over Exploitation of agricultural soils due to future development in a zone sensitive to erosion
- Irreversible salination and acidification of mangrove swamp soil

Mitigation Measures:

- Fugitive dust emission control
- The mitigation of soil erosion will be done by removing the vegetative cover only from the specific site on which construction is to take place without disturbing the vegetation in the adjacent area. Land clearing activities will be minimum and use of crushed stone rather than asphalt or concrete
- Water will be sprinkled to control dust emissions due to excavation, leveling and vehicle movement
- Movement and parking of heavy machinery and other vehicles will be restricted to identified routes and areas to limit soil compaction
- Movement and parking of heavy machinery and other vehicles will be restricted to identified routes; thereby limiting the possibility of compaction;
- Temporary grass cover has been provided on excavated, piled up soil.
- No excavation will be carried out during monsoon
- Installation of underground drainage structures helps to reduce sediment loads.

Significance of Impact

The overall impact is assessed to be major, however with the implementation of mitigation measures the impact can be contained with minor residual impacts.

During Operation Phase:**Anticipated Impacts**

- The solid waste generation during operation of the proposed project
- Accidental spillage of diesel used for DG sets leads to soil contamination
- Bio medical waste
- Waste water discharge

Mitigation Measures

- Waste minimization recovery and reuse
- Segregation at source for all solid waste streams
- Recycling of recyclable non-biodegradable garbage and only non-recyclable portion shall be handed over to local authority to reduce the load on dumping grounds
- Treatment of biodegradable garbage by Organic waste converter and its uses as manure
- Use of dried STP sludge as manure
- Hazardous waste shall be handed over to authorized common hazardous waste disposal site for further treatment and disposal.
- This being a construction project apart from impacts on the site, no adverse impact on the land environment and soil in the surrounding area is anticipated.

During the operation phase, carefully designed landscaped areas and plantation will be maintained. No significant impact is expected on the soil in and around the site, due to the following management measures:

- All solid and other wastes from the building will be properly collected, stored and disposed. An integrated solid waste management plan will be developed.
- Wastewater will be treated, disinfected and reused for various horticulture / green belt and other activities like flushing, etc.
- Storm water will be used to recharge the aquifer after filtration of silt, sand.
- The entire site area will be well paved and thus there will be no leaching of any substances in case of spills.
- Use of "floating" foundations and height restrictions in earthquake zones and increased foundation height, wall strength, and roof support in areas to reduce the hazards

4.3 WATER ENVIRONMENT

4.3.1 During Construction Phase

(i) Impacts

During Construction Phase, the impact on water environment is in two ways:

- Use of water for construction activity
- Release of waste water

Construction activities for the proposed project can have non-significant impact on the water environment. Potential impacts on the ground water quality have been discussed as under:

- Wastewater generation from Construction:** The wastewater generation during construction phase will be from domestic consumption in camp office and labour camp. Mainly containing high suspended solids, in case these activities are undertaken during rainy season.
- Wastewater generation from Site workshop:** The repair and maintenance of construction equipments / transport vehicles, DG Sets, and washing of vehicles on-site may also generate wastewater containing oil and grease (though only in minimal quantities as normally these activities are not undertaken on-site).
- Toilets and Washing area:** Domestic wastewater will be generated from the temporary toilets, washing areas, drinking water points, etc. constructed for the construction workers and other staff on-site.

4.3.2 Mitigation Measures

Substantial quantities of water would be used in the construction activities and to meet the domestic requirement of the construction personnel. Stagnant pools of water may promote breeding of mosquitoes and generally create in sanitary conditions. When it comes to water quality, wastewater from construction activities would typically contain suspended impurities. However, a suitable drainage network would be made to ensure proper drainage of wastewater from the construction sites, so that such water do not form stagnant pools or aggravate soil erosion.

Under good construction practices, construction wastewater shall be collected in construction pits and reused in construction activities e.g. wastewater from stone cutting, cleaning, curing, etc. Thus, no significant impacts are expected on water quality in the project area due to generation of this wastewater.

The impact of the surface runoff (from the stockpiles, construction areas, etc.) is not expected to be significant except during the rainy season. To mitigate any impacts, garland would be constructed around the stockpiles of materials and wastes (till they are used/ moved off-site). It would be ensured that construction materials and wastes stockpiles are moved on a periodic basis to prevent any stockpiles.

4.3.3 During Operation Phase

(i) Impacts

During this phase, two basic activities related to impacts on water environment are:

(ii) Procurement of water

During operation phase, water would be drawn from ground water supply. The water consumption during Operation Phase for different purposes is given in **Table-4-1**. Water Balance diagram is mentioned in **Figure 4.1**. Water Balance diagram is mentioned in Chapter 2.

Figure 4-1 : Water Requirement for Proposed Project

S.N.	Description	Total Area in Sqm./Building	Population @1 Person / Sqm./Bed	Total Population/ Bed	Water Requirement				Total Water Requirement	Total wastewater
					Flushing		Domestic			
					LPCD	in LPD	LPCD	in LPD		
1.0	Hospital Building Side									
1.1	Hospital Ward			630	150.00	94500.00	300.00	189000.00	283500.00	245700.00
	Hospital Attendant with patient (24 hours)			630	20.00	12600.00	25.00	15750.00	28350.00	25200.00
1.2	OPD Visitors			3250	10.00	32500.00	5.00	16250.00	48750.00	45500.00
1.3	Kitchen (1500 Meal Per Day)			1950	0.00	0.00	20.00	39000.00	39000.00	31200.00
1.4	Labs, Operation Theaters & Labour Rooms Etc.			-	0.00	0.00	0.00	15000.00	15000.00	12000.00
2.0	Karamchari Residence (G+3)	23	4	92	45.00	4140.00	90.00	8280.00	12420.00	10764.00
3.0	Non Medical Staff Housing (G+6)	72	5	360	45.00	16200.00	90.00	32400.00	48600.00	42120.00
4.0	Nursing Hostel (G+4)			150	45.00	6750.00	90.00	13500.00	20250.00	17550.00
4.1	Animal Shelter					1000.00		1000.00	2000.00	1800.00
4.2	ESS			20	20.00	400.00	25.00	500.00	900.00	800.00
5.0	MLCP			300	10.00	3000.00	5.00	1500.00	4500.00	4200.00
6.0	Organic/Biomedical Waste Plant			15	20.00	300.00	25.00	375.00	675.00	600.00
	Sub Total (I) KLD					171 KLD		333 KLD	504 KLD	437 KLD
7.0	Academic Building									
7.1	Medical College(G+3)			1000	20.00	20000.00	25.00	25000.00	45000.00	40000.00
7.2	Canteen / Kitchen			750	0.00	0.00	20.00	15000.00	15000.00	12000.00
7.3	Labs for Colleges			-	0.00	0.00	0.00	3000.00	3000.00	2400.00

7.4	Faculty & Staff for Academic			800	20.00	16000.00	25.00	2000.00	18000.00	17600.00
7.5	Visitor (10% of Total Population)	-	-	80	10.00	600.00	5.00	300.00	900.00	840.00
8.0	Engineering Service Block									
8.1	Medical Gas plant			10	20.00	200.00	25.00	250.00	450.00	400.00
8.2	Mortuary Block			50	20.00	1000.00	50.00	2500.00	3500.00	3000.00
8.3	Laundry @ 4 kg lenen per day bed			2600	0.00	0.00	20.00	52000.00	52000.00	41600.00
9.0	Residential Building Side									
9.1	Principal Residence	1	10	10	45.00	450.00	90.00	900.00	1350.00	1170.00
9.2	Medical Supritendent	1	10	10	45.00	450.00	90.00	900.00	1350.00	1170.00
9.3	Senior Residency (G+7) 1BHK	49	4	196	45.00	8820.00	90.00	17640.00	26460.00	22932.00
9.4	Professor Residency (G+6) 3BHK	24	6	144	45.00	6480.00	90.00	12960.00	19440.00	16848.00
9.5	Junior Residency (G+4)	64	1	64	45.00	2880.00	90.00	5760.00	8640.00	7488.00
10.0	Guest House and Complex	24	2	48	45.00	2160.00	90.00	4320.00	6480.00	5616.00
10.1	Staff	30		30	20.00	600.00	25.00	2000.00	2600.00	2200.00
10.2	Community			200	10.00	2000.00	5.00	1000.00	3000.00	2800.00
11.0	GYM & Sports Complex			100	20.00	2000.00	25.00	2500.00	4500.00	4000.00
12.0	Hostels									
12.1	Girls Hostel - (G+5)			155	45.0	6975.00	90.00	13950.00	20925.00	18135.00
12.2	Girls Hostel - (G+5)			155	45.0	6975.00	90.00	13950.00	20925.00	18135.00
12.3	Boys Hostel - (G+7)			215	45.0	9675.00	90.00	19350.00	29025.00	25155.00
12.4	Boys Hostel - (G+7)			215	45.0	9675.00	90.00	19350.00	29025.00	25155.00

12.5	Intern Girls Hostel- (G+4)			68	45.0	3060.00	90.00	6120.00	9180.00	7956.00
12.6	Intern Boys Hostel- (G+6)			100	45.0	4500.00	90.00	9000.00	13500.00	11700.00
12.7	Other Use									
12.9	DG Set Cooling	(625*1, KVA, 750*2. & 1010 KVA*3) =5155 KVA ,1 lt./KVA/ 6 hr.							5155.00	-
12.9	Landscape area	Landscape area use 30928 Sqm. @ 3 Litres/Sqm							92780.00	-
12.1	HVAC Cooling Tower makeup								125000.00	-
	Sub Total (II) KLD					104 KLD		230 KLD	557 KLD	288 KLD
	Total (I+II) KLD					275 KLD		563 KLD	1061 KLD	725 KLD

ii) Release of wastewater

During the operational phase, ~725 KLD waste water will be generated which will be treated in the STP. While developing the water system for the project, utmost care would be taken to maximize the recycle/ reuse of sewage and minimize wastewater quantity. Sewage would be generated which would be treated in the STP and treated water would be reused for horticultural, DG Cooling, HVAC Cooling and for flushing purposes.

4.3.4 Mitigation Measures

Rain Water Harvesting (RWH) system would be developed which would help in augmenting ground water.

1) Rain Water Harvesting

Rainwater harvesting is the activity of direct collection of rain water. Rain water collected can be stored for direct use or can be re-charged into the ground water. The main aim of Rain Water Harvesting is to minimize flow of rain water through drain / nallah to the river without any use. Rain Water Harvesting aims for optimum utilization of rain water. For rain water conservation point of view, it is essential to use rainwater for recharging the ground water.

Rain water harvesting details and storm water drain calculation is mentioned in **Table 4-3**.

Figure 4-2 : Rainwater Harvesting Proposal

Input Data			Unit	Reference
Catchment Area		Value		
1	Rooftop Area of Building/shed	30937.03	sq-mtr	
2	Green Belt Area	30928.71	sq-mtr	
3	Open & Paved Area	49018.13	sq-mtr	
	Total	110883.87		
Run off Coefficient, c				
	Rooftop Area of Building/shed	0.85		RWH in India, MoEF&CC, e-book 2016
	Green Belt Area	0.15		
	Paved Area	0.75		
	Open Area	0.15		
Rainfall				
	Average Annual Rainfall	1570	mm/year	CGWA Supaul
	Hourly Peak Rainfall Intensity, I	45	mm/hour	
	Peak Time taken	15	minutes	
Total Volume of Water to be Captured on Annual Basis				
	Rooftop Area of Building/shed	41285.47	cu-m/year	Q = A* c* I
	Green Belt Area	7283.71	cu-m/year	
	Paved Area	57718.85	cu-m/year	
Runoff Calculation for the Peak Rainfall, Q				
	Rooftop Area of Building/shed	295.84	cu-mtr/hour	RWH in India, MoEF&CC, e-book 2016
	Green Belt Area	52.19	cu-mtr/hour	
	Paved Area	413.59	cu-mtr/hour	

	Total	761.62	cu-mtr/hour	
Annual Recharge Potential				
	Recharge Potential	106288.03	cu-m/year	
	Rainy Season	June- Sep.		IMD
Design of Recharge Structure for Peak Flow				
Calculation for One Pit				
	Diameter of Pit	4.5	mtr	
	Depth of the Pit	4.5	mtr	
	Volume of the Pit	71.57	cu-mtr	
Number of Pits Required to store the peak discharge		10.6		

Number of RWH Pits Proposed = ~10

Rain Water Harvesting Potential of the Project Area

The proposed Rain Water Harvesting Pit details are as mentioned.

- 1) Further, it is proposed that the treated water recycling and reusing techniques would be adopted.
- 2) It has been proposed that treated water recycling and reuse techniques would be adopted; hence this will further reduce dependency on ground water.

Wastewater Treatment:

Waste water would be generated as sewage from the proposed project site. A large number of pollutants occur in waste water, which includes suspended and dissolved solids consisting of inorganic and organic matter, nutrients, oil and grease and pathogenic micro-organisms. Considerable impact from wastewater would occur if it were not properly treated before disposal or reuse. Hence, proper arrangement of disposal of wastewater would be made and the generated sewage would be treated in the STP. Details of STP and ETP are provided in Chapter -2.

4.4 AIR ENVIRONMENT

4.4.1 During Construction Phase

(i) Impacts

The Construction phase would have the following types of impacts on the air environment:

- Fugitive Dust Emission
- Gaseous Emission

Sources of Fugitive Dust Emission, is due to movement of vehicle and land preparation activities, loading and un-loading of construction materials. The building material carrying vehicles as well as the construction machinery generate emissions and pollute the environment. Dusts include brick and silica dusts, and from earthmoving and other vehicle movements within the site. Construction machineries pose a special threat to air quality. Source of Gaseous emission during construction phase would be DG sets.

4.4.2 Mitigation Measures

Dust Suppression

The most cost-effective dust suppressant applied to mitigate airborne dust is water, because of its efficiency as well as ready availability. Water can be applied using handheld sprays and automatic sprinkler systems depending on the location. Thus, Fugitive dust will be controlled by sprinkling of water at the site. Wheel wash point will be provided at entry and exit point of the construction zone. Apart from this adequate stack height of DG sets will also be maintained as per the CPCB norms. During the installation of DG Sets the conditions specified in the Environment Protection Act, 1986 third amendment rules 2002, vide GSR 489 (E), dated 9th July, 2002 at serial No. 96 shall be complied.

The vehicles carrying building materials as well as the construction machinery generate emissions and pollute the environment. Dusts include brick and silica dusts, and from earthmoving and other vehicle movements within the site. The vehicle transporting the loose material like sand, bricks, soil will be covered while transporting. Development of Greenbelt also work as Barrier for the dust pollution.

Emission Control for Construction Equipment

Construction equipment and heavy transport vehicles shall meet emission standards like Bharat Stage-IV and above requirements for vehicles. The operation and maintenance of all vehicles, equipment deployed on site by different contractors would be regulated and effectively monitored. The Pollution under Control (PUC) certification will be ensured for proper O&M of vehicles.

Improved Maintenance

Recognizing that significant emission reductions can be achieved through regular equipment and vehicle maintenance; all site contractors must take necessary steps for proper maintenance of vehicle and equipment. A monetary incentive / disincentive provision encourages contractors to comply with regular maintenance requirements. The fuel used in the equipment and vehicles must be of good quality with low "Sulphur" percentage by following the norms prevailing in project area.

The other measures to reduce the air pollution on site are:

- Sprinkling of water and fine spray from nozzles to suppress the dust.
- On-Road-Inspection should be done for black smoke generating machinery.
- Promotion of use of cleaner fuel would be done.
- All DG sets would comply with emission norms notified by CPCB.
- Use of covering sheet to prevent dust dispersion at buildings and infrastructure site which are being constructed.
- Use of tarpaulin sheets should be done for trucks to prevent dust dispersion
- Paving is a more permanent solution to dust control, suitable for longer duration projects.
- Reducing the speed of a vehicle to 20 kmph can reduce emissions by a large extent
- Speed limits would be commonly used to ensure speed reduction.

4.4.3 During Operation Phase

The land use of the site is designed to have open areas covered with either soft or hard landscape and paved areas (roads and pedestrian walkways). This will mitigate dust emissions in any meteorological conditions.

Impacts

During the operational phase, the Diesel Generator sets to be operated for back-up power supply are the major source of air pollution. The D.G. Set emission consist of following pollutants

1. Hydrocarbon+ NO_x
2. Carbon Monoxide (CO)
3. Particulate Matter (PM)
4. Smoke

4.4.4 Mitigation Measures

If unchecked the emissions from D.G sets will increase the concentration of above mentioned pollutants in the atmosphere. To mitigate the polluting effects of D.G. sets following mitigation measures will be taken,

- A. Use of High speed Diesel as a fuel to run D.G. sets
- B. Provision of stack with height as prescribed by Central Pollution Control Board
- C. Emission test of D.G. stacks every 6 months to check the concentration of pollutants.

The point source of gaseous pollutants would be, emissions from the DG sets, this is controlled by maintaining proper stack height. Hence, there would not be any significant increase in the concentration of PM₁₀, PM_{2.5}, SO₂, NO₂ & CO.

4.5 AIR QUALITY MODELING:

Objective

Atmospheric modelling is used by air quality managers to make decisions on effective and efficient ways to implement the National Ambient Air Quality Standards (NAAQS) and improve air quality. Air quality modelling is done to estimate the relationship between sources of pollution and their effects on ambient air quality, predict the impacts from potential emission sources, and simulate ambient pollution concentrations under different policy scenarios. They are critical for determining the relative contributions from different sources, monitoring compliance of air quality regulations, and making policy decisions.

The Air Quality Model

In order to estimate the ground level concentrations due to the emissions from the proposed project, EPA approved American Meteorological Society/Environmental Protection Agency Regulatory Model - AERMOD View 10.0.1 dispersion Model has been used. AERMOD View dispersion Model provides option to model emissions from a wide range of sources that are present at a typical industrial source complex. The model considers the sources and receptors in undulated terrain as well as plain terrain and the combination of both. The basis of the model is the steady state Gaussian Plume Equation, with modifications to model simple point source emissions from stacks that experience the effect of aerodynamic down wash due to nearby buildings, isolated vents, multiple vents, storage piles etc. AERMOD

View dispersion model with the following options has been used to predict the cumulative ground level concentrations due to the proposed emissions. Area being rural, the rural dispersion parameters are considered as below:

- Predictions have been carried out to estimate concentration values over radial distance of 10 km around the sources.
- Cartesian receptor network has been considered.
- Emission rates from the sources were considered as constant during the entire period.
- The ground level concentrations computed were as in basis without any consideration of decay coefficient.
- Calm winds recorded during the study period were also taken into consideration.
- 24-hour mean meteorological data, extracted from the meteorological data collected during the study period as per guidelines of IMD/CPCB has been used to compute the mean ground level concentrations to study the impact of proposed activity.
- Stability class was evaluated based on wind direction fluctuation.
- The mathematical equations used for the dispersion modelling assumes that the earth surface acts as a perfect reflector of plume and physico-chemical processes such as dry and wet deposition and chemical transformation of pollutants are negligible.
- Washout by rain is not considered.
- Source of emission is continuous and at steady state.

Sources of Pollution/Emission

Point Source:

1. DG Set of 1 x 625 KVA
2. DG Set of 2 x 750 KVA
3. DG Set of 3 x 1010 KVA

Emission Calculation

An emissions factor is a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant. The general equation for emissions estimation is:

$$E = A \times EF \times (1 - ER/100)$$

Where;

E = emissions in (gm/sec);

A = activity rate (Tonnes/Hr);

EF = emission factor (Kg/Tonnes), and

ER = Overall emission reduction efficiency, %

Emission rate of pollutants from operation of DG sets are computed based on research paper of Emission Inventory of Air Pollutants from Diesel Generator Used at Selected Locations in Jaipur City, India by *Suthar Gaurav et al.* International Journal of Technical

Innovation in Modern Engineering & Science (IJTIMES) Volume 4, Issue 12, December-2018. As per the emission factors published in the above documents, the emission rate has been computed and is provided below.

Height of the Building: 24.5m

Height of Stacks: $h+0.2 \sqrt{\text{KVA}}$

For 1x625 KVA = $24.5 + 0.2 \sqrt{625} = 29.5 \text{ m}$ say 30m

For 2x750 KVA = $24.5 + 0.2 \sqrt{750} = 30 \text{ m}$

For 2x1010 KVA = $24.5 + 0.2 \sqrt{1010} = 30.8 \text{ m}$ say 31m

Table 4-1: Calculation of Emission factor

DG Sets	Working hours/day	Stack Parameters (Per DG)				
		Stack Height, m	Stack Dia., m	Exit Velocity, m/s	Flue Gas Temp, K	Flue Gas Flow Rate, m3/sec
625 KVA	2	30	0.15	16	720	0.2827
750 KVA	2	30	0.15	16	720	0.2827
1010 KVA	2	31	0.20	18	720	0.5655

Table 4-2: Calculation of Incremental Load and GLCs

DG Sets	Avg. Fuel Consumption, L/Hrs per DG	Emission Rate per DG Set			
		PM10, g/sec	NOx, g/sec	SO2, g/sec	CO, g/sec
625 KVA x 1	95	0.044	0.717	0.321	0.255
750 KVA x 2	100	0.0536	0.860	0.385	0.289
1010 KVA x 3	150	0.072	1.158	0.518	0.354

Quantitative estimation of impacts on air environment

An attempt has been made to predict the incremental rise of various ground level concentrations (GLCs) above the baseline status in respect of air pollution due to DG sets operations. The mathematical model used for predictions in the study is USEPA approved AERMOD View 10.0.1 software which is designed for point source for the prediction of impacts due to DG set operations. For estimation of the GLC in worst case scenario, the DG Sets operations are assumed to be carried out on the flat terrain. The predicted GLC computed using AERMOD View developed by Lakes Environment model is plotted on isopleths and are shown in Figure given below.

Meteorological Data

The meteorological data recorded for three months i.e. Oct-Dec 2023 (**Post-Monsoon**) on hourly basis for wind speed, wind direction, relative humidity, precipitation and temperature and the same is processed to extract the 24-hour mean meteorological data as per the guidelines of IMD and MoEF for application of AERMOD Version 10.0.1 model. Stability

classes computed for the mean hours is based on the guidelines issued by CPCB on modelling. Mixing heights representative of the region have been taken from the available published literature.

Stability Classification

Wind direction fluctuation method (CPCB PROBES/70/1997-1998) is adopted for hourly stability as determined by wind direction fluctuation method as suggested by Slade (1965).

$$\sigma_{\theta} = Wdr/6$$

Wdr: the overall wind direction fluctuation or width of the wind direction in degrees, over the averaging period.

σ_{θ} : the standard deviation of wind direction fluctuation.

The stability classes is as detailed below:

Table 4-3: Slades Stability Classification based Wind direction fluctuation

Stability Class	σ_{θ} (degree)
A (Extremely Unstable)	>22.5
B (Moderately Unstable)	22.4-17.5
C (Slightly Unstable)	17.4-12.5
D (Neutral)	12.4-7.5
E (Slightly Stable)	7.4-3.5
F (Stable)	<3.5

The AERMOD advanced model, no longer uses the Pasquill stability classes to categorized atmospheric turbulence. Instead, it uses the surface roughness length and the Monin-Obukhov length which were adopted from the purchased data.

Dispersion Parameters

The area is classified as urban when more than 50% of land inside a circle of 3 km radius around the source can be considered built up with medium residential units. The sites is located near the road, the area is considered rural and dispersion coefficient for rural are used in the modelling.

Table 4-4: Brigg's Dispersion Parameters σ_y (m) and σ_z (m) ($100\text{m} < x < 10000\text{m}$)

S. No.	Stability Class	σ_y (m)	σ_z (m)
For Rural Conditions			
1	A	$0.22x(1+0.0001x)^{-0.5}$	$0.2x$
2	B	$0.16x(1+0.0001x)^{-0.5}$	$0.12x$
3	C	$0.11x(1+0.0001x)^{-0.5}$	$0.08x(1+0.0002x)^{-0.5}$
4	D	$0.08x(1+0.0001x)^{-0.5}$	$0.06x(1+0.0015x)^{-0.5}$
5	E	$0.06x(1+0.0001x)^{-0.5}$	$0.03x(1+0.0003x)^{-1}$
6	F	$0.04x(1+0.0001x)^{-0.5}$	$0.016x(1+0.0003x)^{-1}$
For Urban Conditions			
1	A-B	$0.32x(1+0.0004x)^{-0.5}$	$0.24x(1+0.001x)^{-0.5}$
2	C	$0.22x(1+0.0004x)^{-0.5}$	$0.20x$
3	D	$0.16x(1+0.0004x)^{-0.5}$	$0.14x(1+0.0003x)^{-0.5}$
4	E-F	$0.11x(1+0.0004x)^{-0.5}$	$0.08x(1+0.0015x)$

Mixing Height

As site specific mixing height were not available, mixing height based on CPCB publication, "Spatial Distribution of Hourly Mixing Depth over Indian Region", PROBES/88/2002-03 has been considered for model to establish the worst-case scenario.

Table 4-5: Meteorological Data Supaul: (Oct-Dec)

Particulars	Min	Max	Mean
Temp, C	8.8	36.5	25.6
RH %	39	69	52
Wind Speed, m/s	0.5	8.8	2.63
Solar radiation, w/m ²	5200	5500	5350

Wind Direction: West

Rainfall: No of rainy days: 12, Rainfall: 38, Annual Rainfall: 1404 mm

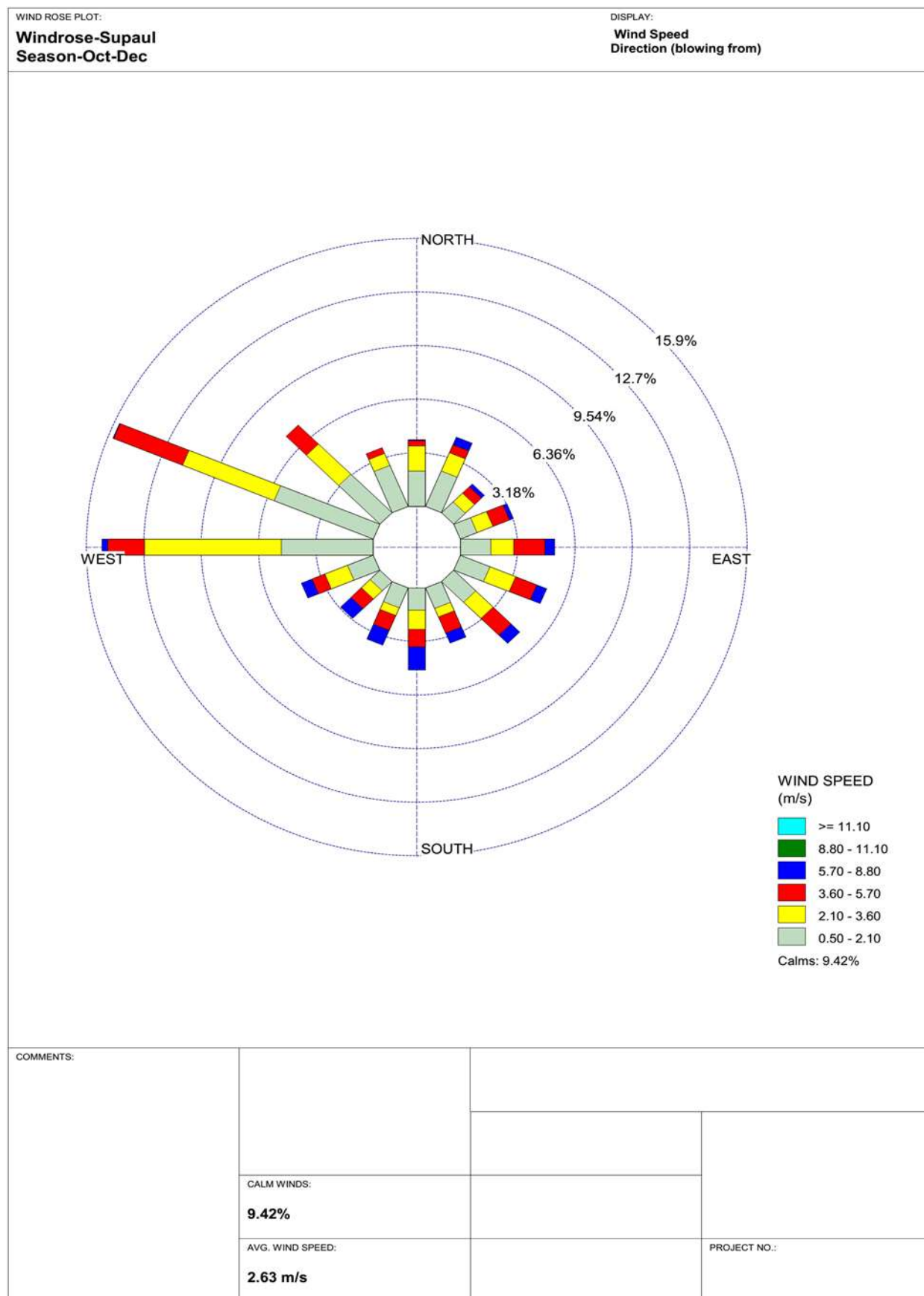


Figure 4-3: Windrose Diagram

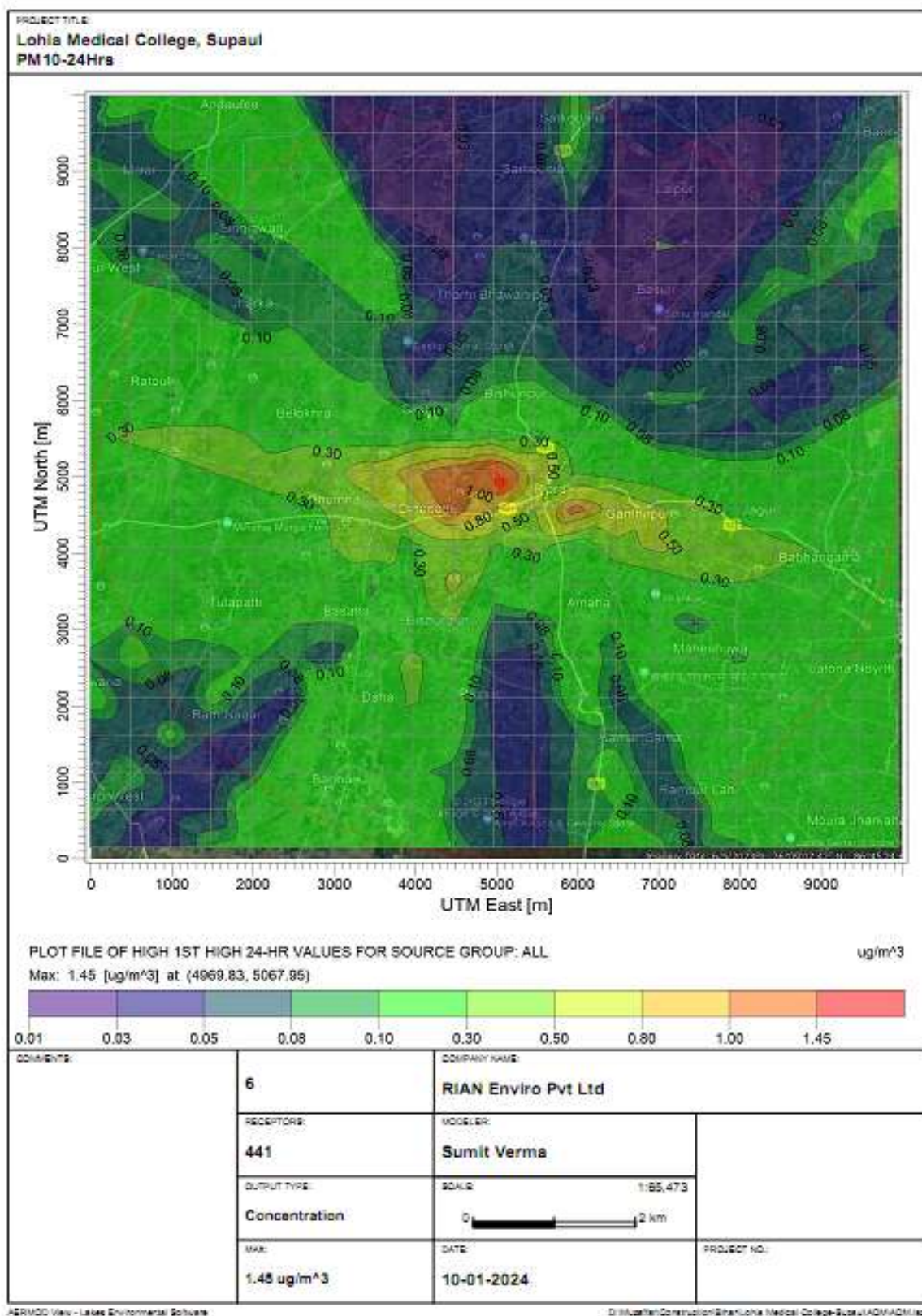
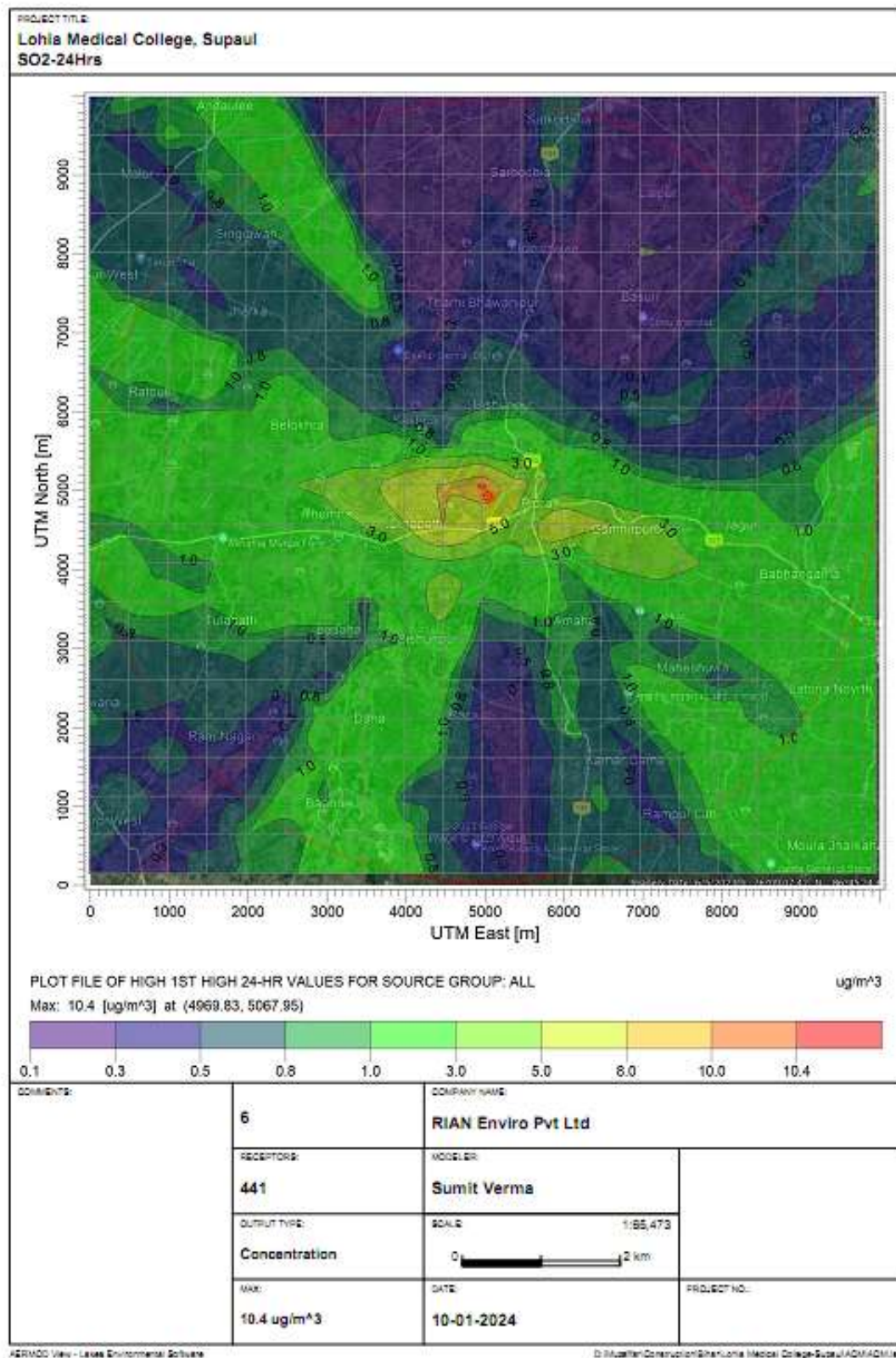


Figure 4-4: Isopleth PM10

Figure 4-5: Isopleth SO₂

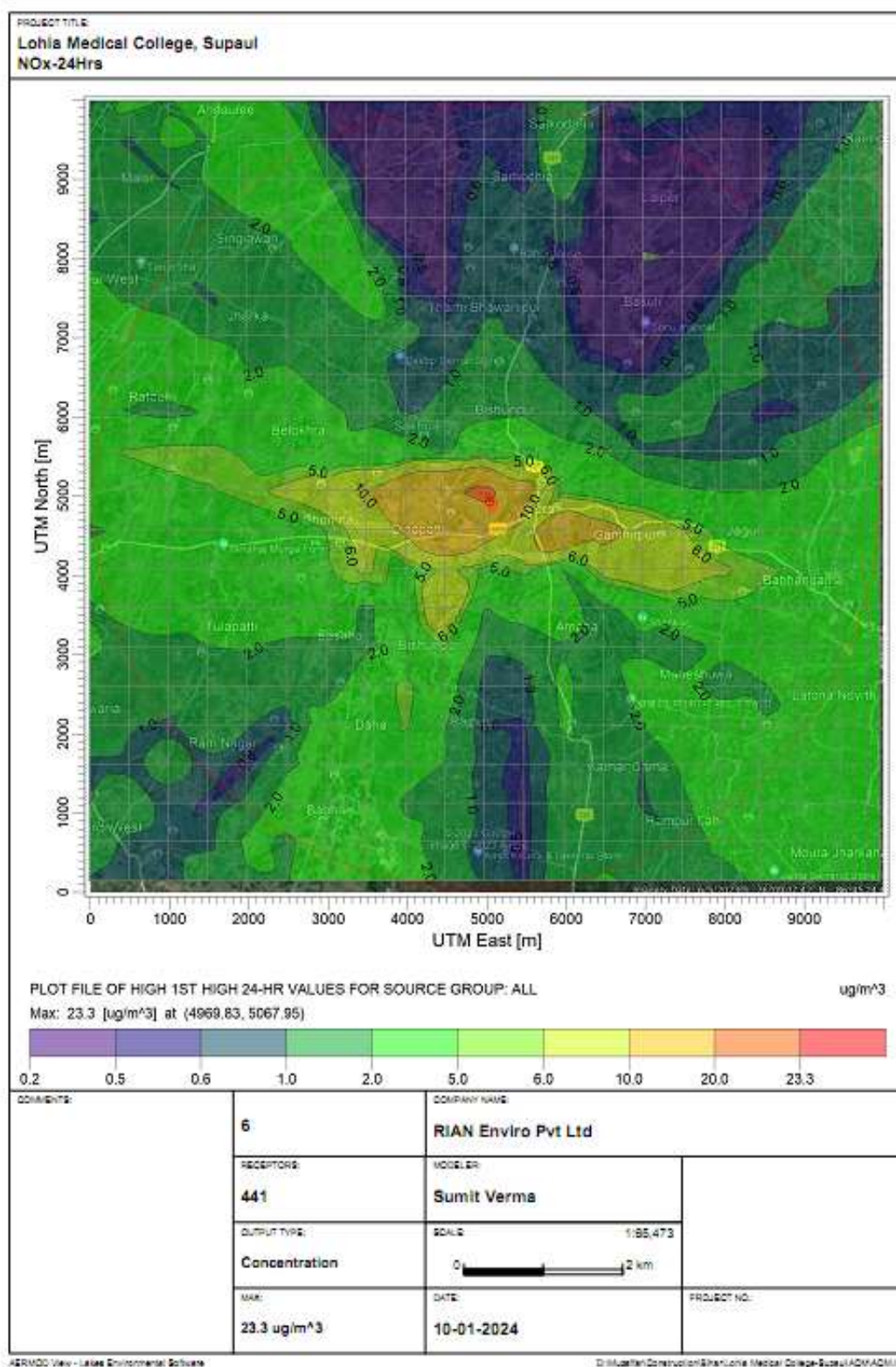


Figure 4-6: Isopleth NO2

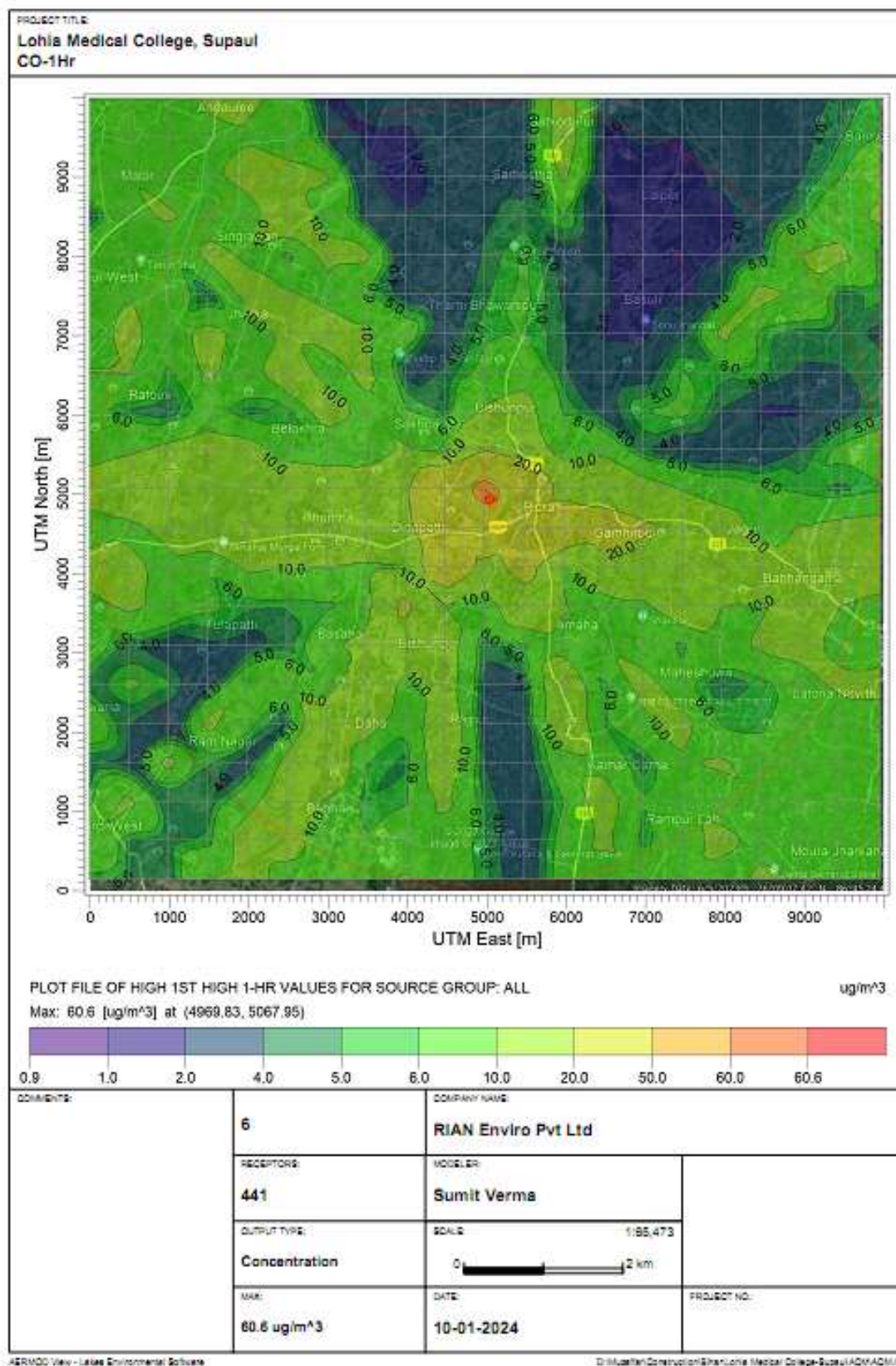


Figure 4-7: Isopleth CO

Table 4-6: Calculation of Incremental Load and GLCs

S. No.	Pollutant	Unit	Baseline Concentration	Predicted Max GLC	Cumulative GLC	NAAQS Limit
1	PM ₁₀ (24 Hr)	µg/m ³	318.4	1.45	319.85	100
2	SO ₂ (24 Hr)	µg/m ³	20.3	10.4	30.7	80
3	NO ₂ (24 Hr)	µg/m ³	40.0	23.3	63.3	80
4	CO (1 Hr)	µg/m ³	7.78	60.6	68.38	4000

4.6 NOISE ENVIRONMENT

4.6.1 During Construction Phase

(i) Impacts

During the construction phase of the site, the main source of noise pollution would be Construction equipment, transportation activities, operation of DG sets and impact of noise due to work at night.

4.6.2 Mitigation Measures

Restriction Time of Construction:

The heavy construction and transport activities will be restricted to daytime operation when the background noise levels are high so that impacts like sleep disturbance during the night time are avoided.

Provision of Noise Barrier (in accordance with National Building Code 2016)

All around the construction activity area on the site periphery, Temporary barrier of GI sheet with adequate height will be installed which shall restrict the noise impact by about 10 dB(A).

Proper Maintenance of Construction Equipment / Vehicles

Proper operation and maintenance of heavy equipment as well as transport vehicles shall also ensure lower noise emissions.

Occupational & Passive Protection:

Ear plugs, ear muffs, etc. provided to workers handling high noise equipment or stone cutting operations shall protect them from high noise exposure.

4.6.3 During Operation Phase

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

- Diesel generator operations
- Increase in transport within the site from nearby roads.

4.6.4 Mitigation Measures during Operation Phase

During operational phase of the project, the major source of noise would be 6 DG sets of 3x1010 KVA, 2x750 KVA & 1 x 625 and traffic activity in and around the project site.

Even among these sources, the most important noise source shall be the DG sets. The impact of the traffic activity on the noise and vibrations will not be significant as the number of vehicle movement due to the project is negligible in comparison to the existing vehicular movement on the road. Silent type DGs will be installed during operation phase to avoid the maximum noise emission.

The measures to reduce the Noise pollution on site are:

- Provision of Enclosures for DG Sets
- Provision of adequate structural foundation to minimize vibration
- Setting up the barriers
- Control of noise from road traffic
- Green Belt Development

4.7 BIOLOGICAL ENVIRONMENT

4.7.1 Impact

Direct Impact

The proposed Construction of **630 bedded "Lohia Medical College & Hospital" at District- Supaul, Bihar** during construction and operation phase will have insignificant negative impact on biological environment. The aesthetic biodiversity of area will be enriched by the proposed project as it will involve Landscaping and greenbelt development.

Indirect Impact:

The major indirect impact include following.

- a) Construction activity is likely to affect the movement of the animal and birds.
- b) Increase in noise may affect the feeding, breeding and movement of animals.
- c) Likely settling of dust to be generated by movement of vehicles and construction activities on leaves may results in to stunted growth of vegetation and may also affect the capacity of production.

Cumulative Impact:

- a) Indirect and cumulative impacts are associated with various construction activities such as clearing of vegetation for establishment of various project units, movement of vehicles, construction equipments & machineries etc., interferences due to influx of labours etc.
- b) The losses of land for various project units will also not adversely affect the fauna as similar habitat is present throughout the project immediate influenced area. Therefore, impact due to loss of habitat for birds, reptiles and mammals of the project area is not expected.
- c) Impacts on surrounding fauna due to movement of vehicles, machinery, equipment and work force may slightly interfere in animal movements. As most of the domestic animals Cows, Buffaloes, Goats, Sheep's and Donkeys are guided &

controlled by the owners/caretakers and hence any causality in terms of killing or accident are not expected.

Recommendation

- Construction activities will be restricted to day hours only.
- Ward and watch for the animal movement in and around the project area during construction phase will be provided.
- All the vehicles delivering materials to the site shall be covered to avoid spillage of material.
- Approach road used by vehicles shall be kept clean and clear of dust.
- All earth work shall be protected to minimize dust generation.
- All crusher used in construction shall confirm to relative dust emission devices.
- Before the start of work with help of forest department a snake catcher is appointed and other preparation will also be done so that the conservation of existing fauna will be done.
- Cutting, uprooting, coppicing of trees or small trees present in and around the project site for cooking, burning or heating purposes by the laborers will be prohibited and suitable alternative fuel arrangement shall be made.
- Proper disposal of construction material shall be done and disposal of the same at vegetated shall be avoided.
- Along the major construction work the peripheral Greens belt should be developed, so that; it will grow to become a full-fledged Green cover by the time the construction is over.

4.8 SOCIO-ECONOMIC

4.8.1 Impacts

Development of this project will increase the socio-economic condition of the area. Possibility of direct and indirect employment opportunity will increase due to development of the project and associated activities. Local people in the vicinity of the project may also be involved during construction stage of the project. During operation phase people may be involved as per their qualification and skill related to the activities. Thus, there would be positive impact on the socio-economic condition of the project. It is expected that the area would witness remarkable improvement in basic social infrastructure like road, school-colleges, community building etc. in the surrounding area due to the proposed project.

4.8.2 Mitigation Measures

As the impacts are insignificant, no specific mitigation measures are envisaged for demography and socio-economic environment. During the construction phase, temporary hutments will be constructed at the earmarked space for the labour force. The labour colony will be provided drinking water and sanitation facilities. Temporary toilets as per PHED norms will be constructed for the work force during construction period. Suitable septic tanks of appropriate capacities will be constructed for treatment of sewage before disposal.

Health and safety of the workers will be ensured during construction by making effective provisions for the basic facilities of sanitation, drinking water, safety of equipment or machinery etc. The following recommendations will be followed:

- Safety procedures, norms and guidelines (as applicable) as outlined in the document Part -7, Constructional practices and safety, 2016, National Building Code of India, Bureau of Indian Standards will be complied with.
- Clean drinking will be provided to all the workers.
- Adequate number of decentralized latrines and urinals will be provided to construction workers.
- All parts of dangerous machinery will be guarded.
- Hoists and lifts, lifting machines, chains, ropes and other lifting tackles will be kept in good condition and protected by barricades.
- Protective equipment like helmets etc. will be provided to the workers.
- Fire extinguishers and buckets of sands will be provided in the fire-prone areas and elsewhere as measures to prevent fires.

4.9 SOLID WASTE

4.9.1 SOLID WASTE GENERATION AND MANAGEMENT

4.9.1.1 During Construction Phase:

Impacts: The average quantity of waste generated during construction phase at the project site would be inert waste, mainly comprising of clay, sand, gravel, brick, concrete, concrete block, asphalt, pipes, conduits, steel waste etc.

Construction waste: The solid waste anticipated to be generated during the construction phase like metal cutting. Debris, plastic material and wooden log etc., which will be approx. 3% of total quantity, will be collected and stored in a separate covered area so as to prevent damage to property and personnel working at the project site. Further, most of the construction debris will be used for filling activities and the rest will be disposed off through authorized recyclers. All demolished materials will be disposed or reused as per the prevailing rules.

The excavated top soil will be used for the development of green belt and leveling of the plot within the project site.

The waste generated during the construction activities will be limited to project site only and during construction phase only. These will be reused for backfilling and road development after manual segregation. This waste will be utilized for construction of roads. Major types of construction wastes expected from the proposed Project are as follows: -

▪ Clean Fills:

Clean fill is uncontaminated soil, rock, sand, gravel, concrete, asphaltic concrete, cinder blocks brick, minimal amounts of wood and metal and inert (non-reactive) solids for fill, reclamation or other beneficial use. Minimal means the smallest amount possible.

4.9.2 During Operational Phase

The domestic solid waste generated from the occupants of the College, Residence, Hostel, Visitors, Patients, and Staff; pertains to the two categories, Bio-degradable and non-biodegradable. These solid wastes are collected separately by putting different types of

separate bins at the source of generation. It is estimated that maximum solid waste generation would be about **~2427 kg/day** and biomedical waste would be generated **693 kg/day**. The type of solid waste generation considered is given in **Table-4-5**.

Bio-Medical Waste Management will be done as per Bio Medical waste management rules 2016.

Table 4-1: Type of Solid Waste Generation during operational Phase

S. No.	Types of Solid waste and other waste	Description
1.	Food Waste (garbage)*	Wastes from the kitchen including preparation, cooking and serving of food.
2.	Rubbish*	Combustible (Primary Organic): Paper, cardboard, cartons, wood, boxes, plastics, rags, cloths, beddings, leather, rubber, grass, leaves. Non-combustibles (Primary Inorganic): Metals, tin cans, metals foils, dirt, stones, bricks, ceramics, crockery, glass bottles, other metal refuses.
3.	Street Waste*	Street sweeping, dirt, leaves, catch basin dirt, animal dropping, contents of litter receptacles dead animals.
4.	Horticultural waste*	Tree trimming, leaves, waste from parks and gardens etc.
5.	General domestic waste from office and administration	Paper, General Domestic Waste etc.
6.	STP Sludge	Sludge generation after treatment of sewage in STP.

***Source: Manual on Municipal Solid Waste Management, published by Central Public Health and Environmental Engineering Organization (CPHEEO), Ministry of Urban Development, Government of India.**

- The proposed project is expected to generate certain types of wastes which would include both non-hazardous and some hazardous wastes. The non-hazardous wastes generated at the project would be municipal solid waste including paper & cardboard wastes, food wastes, plastic wastes etc. STP sludge and other solid waste would also generate.

Separate color-coded bins will be provided in the hospital campus for collection of different types of Bio-Medical Waste generated from the animals for the proper treatment.

Bio-Medical Waste: Biomedical waste is the waste that is either putrescible or potentially infectious. Biomedical waste is generated from biological and medical sources and activities, such as the diagnosis, prevention, or treatment of diseases. Biomedical waste may be solid or liquid. Examples of infectious waste include discarded blood, sharps, unwanted microbiological cultures and stocks, identifiable body parts, other human or animal tissue, used bandages and dressings, discarded gloves, other medical supplies that will be in contact with blood and body

fluids, and laboratory waste. Biomedical waste will be properly collected in the separate container and will be disposed by authorized processor for Biomedical Waste. Bio-medical Waste Treatment Facility (CBMWTF) for disposal of Bio-Medical Waste as per rule.

Cat.	Type of Bag/ Container used	TYPE OF WASTE	Treatment /Disposal options
Yellow 	non-chlorinated plastic bags Separate collection system leading to effluent treatment system →	a) Human Anatomical Waste b) Animal Anatomical Waste c) Soiled Waste d) Expired or Discarded Medicines e) Chemical Waste f) Micro, Bio-t and other clinical lab waste g) Chemical Liquid Waste	Incineration or Plasma Pyrolysis or deep burial*
Red 	non-chlorinated plastic bags or containers	Contaminated Waste (Recyclable) tubing, bottles, intravenous tubes and sets, catheters, urine bags, syringes (without needles) and gloves.	Auto/ Micro/Hydro and then sent for recycling. not be sent to landfill
White 	(Translucent) Puncture, Leak, tamper proof containers	Waste sharps including Metals	Auto or Dry Heat Sterilization followed by shredding or mutilation or encapsulation
Blue 	Cardboard boxes with blue colored marking	Glassware	Disinfection or auto/ Micro/hydro and then sent for recycling.

The E-waste generated is managed as per the E-waste management and handling rules 2016. Solid waste generated from the project is collected properly and managed as per Solid waste Management Rules, 2016.

Hazardous waste – Hazardous waste will include used/spent oils and lubricants ~1 Lit/day of aggregate quantity (as described above). The used oils will be stored in metallic drums inside a lined and covered room and will be, ultimately, sold to the authorized recyclers.

4.10 RISK AND HAZARD

4.10.1 Impacts:

Impacts of risk and hazard are higher during construction phase. Impacts associated with the construction & operational phase of the project are as follows:

1. Handling, storage, use or spillage of hazardous materials
2. Explosions, spillages, fires etc. from storage, handling use or production.
3. Fall from height
4. Ignition Control

4.10.2 Mitigation Measures:

To reduce the occurrence of risk & hazard at the construction site following are mitigation measures suggested:

Good House Keeping

Proper storage and handling of hazardous materials like diesel, oil, paint, gas cylinder for welding and cutting

- Use of proper scaffolds, safety belt, with double hook, safety net etc.
- Proper gradient cutting/slope cutting where there is space constraint.
- Control of electrical ignition
- Providing proper training and education to staff
- Providing resident training and education.

4.11 TRAFFIC MODELLING

Estimation of Emission due to Traffic

AP-42 for the Paved Roads is referred to calculate the emission factor due to traffic activities. "Emission Factor development for Indian Vehicles" prepared by ARAI Pune has also been used to calculate the emission rate. The following assumptions have been made to estimate the emission rate:

1. All two wheelers on the road have been assumed to be motorcycle of 4S (>200cc).
2. All three wheelers on the road have been assumed of Diesel vehicles.
3. All four wheelers on the road have been assumed of Diesel Cars (1600-2400 cc).
4. All LCV wheelers on the road have been assumed of Diesel vehicles (>3000cc).
5. All tractors are considered as equivalent to the LCV (>3000CC).
6. All buses are considered of HCV Bus Diesel (>6000 cc).
7. All trucks are considered of HCV Trucks Diesel (>6000cc).

5 ANALYSIS OF ALTERNATIVES (TECHONOLGY AND SITE)

5.1 Introduction

Planned urban development is encouraged by successive Five-Year Plans and State Governments that have promulgated Urban Town Planning Acts to provide for proper land use zoning for, hospital areas, control on slums and urban sprawl, design and development of civic amenities (such as sewerage and waste disposal) and development of Master Plans for important urban areas in their respective States. This requires the systematic comparison of the feasible alternatives for technology and operational alternatives. Alternatives are compared in terms of their potential environmental impacts, capital and recurring costs, suitability under local conditions etc.

For examining the alternatives for carrying out a project, the following aspects should be kept into consideration:

- (i) Type of the alternatives
- (ii) Environment impacts associated with each alternative
- (iii) Rationale for selecting the preferred alternative

5.2 Alternative Technology

The proposed project has buildings developed in such a manner which makes them a beautiful place to live in. The atmosphere is made keeping in mind, to have lush greenery all around. The garden does not bear greenery alone, but it also has a landscaped approach to it. Nothing can provide you more peace of mind after a long and hectic day at work than the feel of a landscaped garden or terrace. This is the reason why creating a serene atmosphere is on the top priorities of all. The project proponent has adopted state- of-the-Art Technology considering the requirement of the project and environmental aspects related to the construction and operation of the project.

5.3 Alternative Site

The land of the proposed project is private land, the land has been donated by Villagers of Debipatti considering the need of the project at that area, hence no alternative site is required for the project. The reasons favorable for setting up this project:

There will be easy access to the people being near to the national highway to avail the facility.

Owing to the various above advantages, the site was selected for the development of facilities / activities.

6 ENVIRONMENTAL MANAGEMENT PLAN

The environmental management plan (EMP) is meant to ensure that the adverse residual environmental impact, if any, due to the regular operations of the project, are completely checked or, otherwise, minimized. Further, the EMP also warrant compliance with all the statutory requirements applicable to the project, from time-to-time right from the conception.

The EMP addresses the following areas;

- The treatment and discharge of unavoidable pollutants into the atmosphere
- The monitoring of the state of physical environment, internal as well as external to the proposed project
- The house-keeping practices
- The emergency/disaster management

6.1 Pollution Generation

The pollution likely to be caused as a result in regular activities associated with complex fugitive / gaseous emissions, wastewater discharges and solid waste refuse generation. This is hospital project, so noise pollution will be minimal.

Suitable management and control systems have been planned and measures have been proposed to eliminate or mitigate the adverse impacts of various possible forms of pollution.

6.1.1 Air Pollution

Air pollution sources during & post construction will be as follows:

6.1.1.1 Construction phase

Significant aspects include on-site construction material handling and transportation. Following measures are recommended;

- Water will be regularly sprinkled on the loose construction material – surface saturation will prevent the material from getting air-borne.
- Provision shall be made for sprinkling of water on the unpaved tracks for movement of vehicles and speed of vehicle will be restricted to ~20 km/hour.
- All machinery/equipment will conform to applicable emission and noise standards and will be periodically maintained to ensure the compliance with the standards.

6.1.1.2 Operation phase

During the operation phase the potential air pollution would be due to cooking activities in Vehicles movement and emission from DG sets. LPG/HSD will be used as fuel. Appropriate combustion of any of these do not produce emissions (at the point of use) which have polluting potential (beyond the permissible emission discharge norms) the atmosphere.

As per the applicable norms, the DG sets will be housed in acoustic chambers. The combustion emission outlets will be provided with mufflers along with minimum stack heights as per prescribed norms.

Any pollution due to generation/distribution of electrical power is beyond the scope of present discussion.

Vehicular emissions are non-point sources. By assuring that the vehicles comply with the applicable emission discharge norms, the effect on account of these will be minimised.

6.1.2 Wastewater generation

The proposed Lohia Medical College & Hospital will need water basically to fulfill Domestic water requirements, Flushing water and Landscaping water requirement. The total waste water generation will be 725 KLD. It is proposed to separate grey water and black water for the proposed infrastructure. The wastewater will be treated in two nos. of STP of total; capacity 870 KLD & ETP of capacity 17 KLD.

Disposal of treated wastewater

Mode of treated wastewater disposal will be as under;

- Reuse of treated grey water for sanitation/flushing of toilet facilities and housekeeping
- Reuse of treated black water for irrigation (watering of green area within the complex)

Separate water lines and a separate storage tank (of adequate capacity) will be provided for distribution of treated wastewater to various points of use.

For use in sanitation, a separate overhead storage tank (of adequate capacity) will be provided for each building, from where the water will be supplied to respective toilets.

6.1.3 Solid Wastes

The domestic solid waste will be generated Academic Building, Hostel and staff quarters, Kitchen, Laundry etc.; pertains to the two categories, Bio-degradable and non-biodegradable. These solid wastes will be collected separately by putting three types of separate bins at source of generation. For the biodegradable waste green bins will be provided, for the recyclable waste blue bins and for the non-recyclable waste dark grey bins will be provided. It is estimated that maximum solid waste generation would be about ~2427 kg/day & Biomedical Waste would be about ~693 Kg/day.

Management includes;

- Collection and handling – through service bins (colour-coded for various components of the waste)
- Segregation at source into recyclable, bio-degradable and non-recyclable rejects
- Recyclable component – sold to the authorized recycler
- Bio-degradable component – stabilization through on-site mechanical composter and to be used/disposed as manure
- Non-recyclable component – disposal through MC, Supaul (NOC to be obtained). The MC shall be paid requisite fee, as applicable from time to time.
- STP sludges – to be stabilized and used as soil conditioner

6.1.4 Noise Pollution

There will be minimal increase in noise due to vehicular traffic. Also, DG sets may result in generation of some noise.

To attenuate the noise due to transportation, appropriate use of green belt plantation. As per the applicable norms, the DG sets will be housed in acoustic chambers. The combustion emission outlets will be provided with mufflers.

6.1.5 Hazardous waste

Hazardous waste will include waste/used oil (*Category 5.1 of Schedule – I*) as per the Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2016.

The waste will be stored in a covered lined room (isolated and marked) before being disposed through authorized recyclers. Every precaution will be ensured to avoid spillage/leakage of the waste oil from storage and handling.

6.2 Environmental Monitoring

The environmental monitoring is meant to establish the state and quality of environment, the adequacy of pollution control measures, and the performance of environmental management system in place. It helps in establishing trends in the quality of the environment (its various components), and changes in the same with respect to the baseline reference quality. It may further help in setting overall performance benchmarks. The monitoring data and results will be communicated to the appropriate authorities.

6.2.1 Air Quality Monitoring

To check the adverse impact, if any, on the local atmosphere, ambient air quality will have to be monitored at regular intervals during construction phase as well as operation phase.

- Monitoring parameters – PM_{2.5}, PM₁₀, SO₂, NO_x, CO
- Monitoring frequency – Quarterly (during construction phase) Half-yearly (during operation phase)
- Monitoring location – at a critical point at/around the site within 50 m

6.3 Water Quality Monitoring

The water quality monitoring will include monitoring of wastewater for treatment and disposal and the quality of ground water. Besides this, the water being used for domestic consumption is also required to be monitored regularly.

6.3.1 Wastewater Monitoring

The wastewater and its treatment plant will need to be monitored on day to day basis. This will help in managing the performance and working of the unit. Appropriate parameters will be fixed, along with the frequency of their measurement, to serve as performance (quality and efficiency), early warning (of impending problem), and diagnostic (cause of problem, if any) indicators.

Parameter	Stage	Frequency
pH	Inlet to STP	Every 3-4 hours
BOD	- Inlet to the STP - Outlet to the STP	~Once a month
COD	- Inlet to the STP - Treated wastewater	~Once a week
Total phosphates	Treated wastewater	Quarterly
TKN	Treated wastewater	Quarterly
MLSS/MLVSS	Aeration tank	~Once a month
SVI	Aeration tank	Daily
TSS	Treated wastewater	~Once a month

6.4 Green Belt Development

A scientifically designed green belt along the inner periphery of the premises, plantation along the road sides and pathways, plantation around the waste treatment and management facilities, etc., is proposed. Extensive horticulture development and landscaping within the plant will also be taken up.

While selecting the plantation, due importance will be given to plant height, leaf spread and characteristics, availability of local species, pollutants assimilation capacity, meteorological conditions, maturity age, commercial value, etc.

For the purpose of pollution attenuation, the green belt in three tiers is recommended, detailed as under;

- a) **First Tier** – Shrubs species having good levels of air pollution tolerance limits which is referred to as Tolerance zone
 - **Broken or interrupted** – The branching pattern and canopy formation is not uniform (e.g., palm varieties). In between the shrubs species at regular intervals is suggested.
 - **Drooping canopy** – The branches and leaves droop downwards (e.g. Polyalthia long folia). In between the shrubs species at regular intervals is suggested.
- b) **Second Tier** – Trees having fast growth potential with conical canopy called dispersion zone
 - **Rotund type** – The shape of the crown is more or less rounded; branches and leaves are closely arranged (e.g. Ficus species).
 - **Flat topped canopy** – The branches of the crown uniformly given flat topped crown and the spread of the crown are wide to cover a wide area (e.g. Cassia fistula).

c) **Third Tier** – Trees having hairy leaves with thick and round canopy called as absorption zone

- **Cylindrical Type** – The branches and leaves form a close network and given the longitudinal spread (e.g. *Delbergia species*)
- **Chimney Type** – The branches give the appearance of long chimney (e.g. *Polyalthia longifolia*).
- **Conical Type** – The growth of main stem and horizontal branches appear in the form of a cone (e.g. Casuarinas).

A comprehensive 'Green Belt Development Program' would be implemented in a phase wise manner under the proposed project development.

Features of proposed green belt development program -

- A thick barrier of trees would be created along the entire periphery of the plot.
- Trees would be planted in the project's premises along the internal roads and open plot.
- Indigenous, fast growing, evergreen and semi evergreen tree species would be planted.
- As per the recommendations by Central Pollution Control Board (CPCB) and Ministry of Environment & Forests (MoEFCC), the green belt development plan has been designed.

For shelter belt and mass plantation, trees with 50 to 90 Sq. Ft. canopies with distance of 9 feet between two trees and 8 feet between two adjacent rows would be planted.

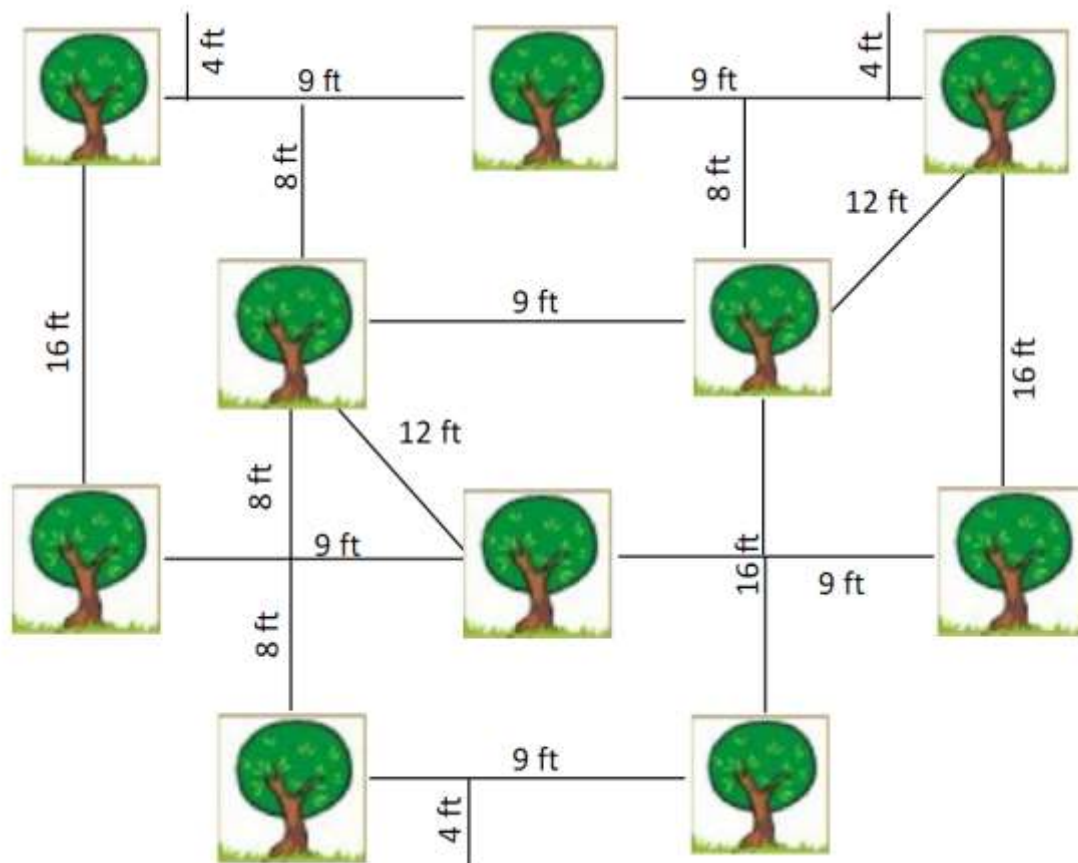
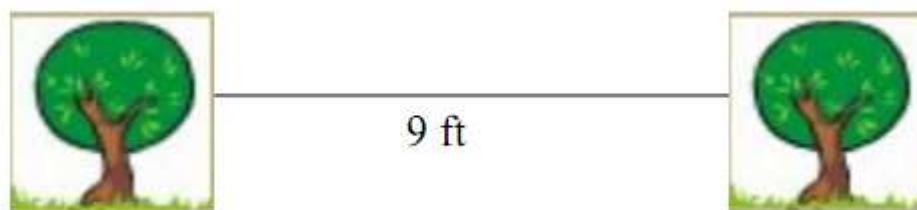


Figure 6-1 : Tree plantation scheme

Moreover, plantation along the internal roads would be done in single row on either side of the road. Here the distance between adjacent trees is considered as 9 feet with 8 feet width and area covered by a single tree is taken as 50 to 90 Sq. Ft.



Total GB area is 30928.71 sq.m. with total proposed no. of trees will be 1386 at the site. Based on the above facts and figures, the green belt development plan has been designed.

6.5 Soil management

Measures to protect soil quality and prevent erosions are as under;

Best practices

- To do excavation and grading work preferably during dry seasons

- b) To prevent free flow/run-off of curing water to be applied
- c) Sprinkling of water on loose debris of soil
- d) Disturbed areas shall be seeded, mulched, or landscaped immediately after final grade is achieved
- 1. Top soil, wherever removed, shall be stock piled and preserved. It shall be reapplied for final landscaping.
- 2. Sediment traps shall be provided around the construction areas to prevent carry-over of loose soil
- 3. Minimal disturbance to the vegetation during construction activity
- 4. To attenuate adverse effects on environment during construction, green belt shall be suitably developed, which may eventually be maintained to serve landscaping requirement afterwards

6.6 Storm Water Management

Ground water recharge is the technique of percolation of rain water at surface or in sub-surface aquifer, before it is lost as surface run-off. The augmented resource can be harvested in the time of need. Artificial recharge to ground water is a process by which the ground water reservoir is augmented at a rate exceeding that under natural conditions of replenishment.

6.6.1 Need

- a) To overcome the inadequacy of surface water / ground water to meet our demands.
- b) To arrest overuse, and, hence, decline in ground water levels.
- c) To enhance availability of water at specific place and time, and utilize rain water for sustainable development.
- d) To increase infiltration of the rain water in sub-soil which has decreased drastically in urban areas due to hard paving of open area.
- e) To improve ground water quality by dilution.

6.6.2 Advantages

- The cost of recharge to sub-surface reservoir is lower than that for surface reservoirs
- The aquifer serves as distribution system also
- No land is wasted for storage purpose and no population displacement is involved
- Ground water is not directly exposed to evaporation and pollution
- Storing water under ground is more environment friendly
- It increases the productivity of aquifer
- It reduces flood hazards
- Effects rise in ground water levels
- Mitigates effects of draught
- Reduces soil erosion

6.6.3 Design aspects

The important aspects to be looked into for designing a rainwater harvesting system to augment ground water resources are;

- a) Hydro-geology of the area including nature and extent of aquifer, soil cover, topography, depth to water level, and qualitative characteristics of ground water.
- b) The availability of source water basically assessed in terms of non-committed surplus monsoon runoff.
- c) Area contributing runoff like area available, land use pattern, industrial, residential, green belt, paved areas, roof top area, etc.
- d) Hydro-meteorological characteristics like rainfall duration, general pattern, and intensity of rainfall.

6.6.4 The System

The storm water from roof-top will require following arrangement;

- a) Storm water drainage and collection system
- b) Desilting (pre-clarification)/filtration chamber
- c) Water recharge system – trench with recharge wells

Whole of the complex area will be provided by a network of storm water drains. The drains will link water recharge system.

The drains will provide inlet to a pre-clarification/desilting chamber through a grating (screen) which will clarify the storm water and allow it to flow into respective trench of each recharge wells.

6.6.5 Salient features of the adopted recharge system

- a) In areas where large quantities of surface run-off are available, the use of trench/pits is made to store water in a filter media, and subsequently recharge to ground water through specially constructed recharge wells.
- b) Based in the lithology of the area, well assembly is designed with slotted pipes against the shallow and deeper aquifers.
- c) A lateral trench, of suitable size depending upon the availability of water, is constructed with the recharge well in the centre.
- d) The trench is backfilled with boulders, gravels, and coarse sand to act as a filter media for recharge wells.

6.6.6 Maintenance

Following basic procedures are recommended for maintenance to assure effectiveness and long life of recharge structures;

- a) All desilting chambers will be cleaned at least once a year (preferably before monsoon).
- b) The trench filter top layers (up to sand) will be cleaned at least once in 2 years).
- c) Whole of the trench packing will be required to be cleaned at least once in 3 years.

- d) The recharge well rehabilitation will be undertaken at least once in 5 years or as required (in case the recharge rate of a well goes down significantly. This will be done through *jetting and simultaneous pumping* – the method combines high pressure water jetting with pumping (usually using an airlift system). Essentially the jetting process loosens the fine material and the pumping action draws it through the screen and directly to the surface.

6.7 Traffic management

Well-designed traffic management is planned with following features;

- a) Approach road is the main connecting road i.e. NH-327 & NH-131
- b) All interior roads have adequate width conforming to NBC guidelines and local byelaws.
- c) Adequate provision of parking exceeding the provisions of NBC guidelines and local byelaws.
- d) Well defined entry and exit routes to avoid conflict free movement
- e) Segregated movement path for pedestrians
- f) Routes/paths for vehicle movement routes and parking to be clearly identified and marked.

6.8 Occupational Health and Safety (during construction)

The Management of the project is committed for the health and safety of workers as under;

- The management declares its intention and commitment with all relevant statutory requirements in regard to environment, health and safety of workers.
- The management has assigned responsibilities at different levels as:

Project Manager : For all the workers/employees.

Supervisor : For casual and daily/unskilled workers.

The management will ensure the occupational health and safety, at the site during construction, by adopting following practices;

- a) Every responsible effort shall be made to provide and maintain safe and healthy working conditions, environment, and system of work for all employees.
- b) It shall also be endeavor of the project proponent to ensure that surrounding environment is not adversely affected by the work activity.
- c) The working environment would be healthy and co-operative.
- d) The prevention of accidents or accident hazards leading to personal injury or damage of equipment/property is recognized as essential as an integral part of efficient operations.
- e) Every employee shall follow safety rules/regulations, operating procedures/safe work method design to protect people and equipment from risk of injury of damage to property.
- f) The project shall endeavor to adequately train all employees suitably equip them to perform their duties in a safe and effective way.

- g) Every employee shall discharge his personal responsibility, and shall co-operate and actively participate in maintaining and improving safety standards.
- h) A primary health care centre has been provided within the campus. Besides, there is a multi-speciality private hospital (on panel of the institute) just opposite to the institute entrance.
- i) A doctor shall be appointed for health checkup of workers at regular intervals and related records shall be maintained. A doctor and a hospital will be empaneled for attending off site health problems of the workers.
- j) First Aid kits will be kept ready and available to the workers, in case of emergencies, company will provide fastest possible medical aid. Staff will be adequately trained for this.
- k) Adequate supply of clean drinking water, neat and clean toilets and washing facilities will be provided at the site.
- l) Proper ventilation, wherever required, shall be provided in the work areas.
- m) Proper safety and protections, steps and guards shall be provided at all required places.
- n) Suitable safety instructions will be displayed in writing (including that in vernacular language) for all critical areas and working conditions.
- o) A vehicle/ambulance will be specifically positioned at the site for emergency evacuation of workers in case of any health problem/accident.

6.9 Disaster and Emergency Response Management

Disaster, in this context, means a sudden, accidental event that causes many deaths and injuries. Most disasters also result in significant property damage. Common natural causes of disasters include earthquakes, floods, Tsunamis.

Major hazards can be generally associated with the potential of fire, flood, or earthquake or human activities of terrorism and disruption. Hazard control system is meant to ensure the avoidance of the hazards, or in case of any mis-happening with minimum possible impact on facility occupants, surrounding residents and surrounding environment.

Most of the situations are likely to be in the category of *Level 1 Emergency* (a local incident with a likely impact only to immediate surroundings of local site, where the impact radius may not be more than 15 m, such as, local fire, etc.) or *Level 3 Emergency* (an incident with likely impact area extending beyond the boundary limits of the project area, such as, floods, earthquakes, etc.).

On site emergency management will meet the exigency created due to all Level 1 emergencies. Level 3 emergencies need off-site management plan.

Disaster, in this situation, may include incidences of flood, earthquake, fire, or disruptive incidents of human extremism. While the incidences of natural disaster are remote, these may result in significant loss of life and property. There is no fire sensitive establishment within or vicinity of the complex. Adequate, fire-fighting arrangement at micro level will be provided by the promoter.

The construction specifications adopted significantly incorporate fire-retarding properties. Adequate, fire-fighting arrangement at micro level will be provided by the promoter. In case

of mishap, suitable provisions for emergency evacuation will be incorporated.

Regarding earthquakes, the promoters have got the structures of the complex designed to include earthquake resistant features. These will be appropriately incorporated while erection of the complex.

To contain the retrospective effects, only government authorities and agencies, at local and state level got to be adequately prepared in its mechanism to contain or minimize the losses arising thereof.

6.10 Management, Staffing and Capacity Development

The efficiency of a system depends not only on the infrastructure but also on the level of commitment from the facility management and the kind of manpower and resources provided for its optimal working.

6.10.1 Staffing

The complex shall be creating an environmental committee, headed by a co-ordinator. The team may include selected persons from among the occupants of the complex, on voluntary basis. Adequately qualified and trained team will facilitate the performance on the environmental front. Operators will be engaged to operate the waste management and treatment facilities on day-to-day basis.

6.10.2 Training

Suitable training programs will be arranged for the manpower, which is directly responsible for the environmental performance, in their respective field/area of responsibility. The training aspects will include start-up, shut-down, day-to-day trouble shooting, operational control and management, monitoring requirements and techniques, analytical techniques, etc., of the pollution control systems, and more importantly, on emergency response management including first aid. Information will also be imparted on regulatory requirement applicable.

6.10.3 Budgetary allocation

The commitment has to be in terms of allocation of adequate financial resources, the constraints in which may result in failure of the overall environmental performance as laid down in the environmental management plan. The promoters of the complex have committed to satisfy the budgetary requirements needed to achieve the desired performance levels, without any kind of compromise.

6.11 Energy conservation and sundry green measures

- Use of solar energy for outdoor common lighting
- Use of double-glazed windows (vertical fenestrations) with wooden frames and proper sealings to allow U-factor of $<3.4 \text{ W/m}^2\text{°C}$, and SHGC of 0.55
- Use of e-glass/thermal treated roofing to reduce heat load

- Use of venturi effect for nature ventilation – the wind channeling effect, which is dependent on building shape and arrangement, is an efficient way to drive wind into buildings and through open areas, and to concentrate flows in certain areas to speed up the wind. The venturi effect has been created by reducing the width of a section of the buildings.
- Special emphasis over selection of building materials/techniques (for east and west facing walls) and fenestrations to reduce solar gain
- Use of low energy material and methods of construction (to reduce embodied energy content) – minimize use of synthetic material, preferred use of locally available material
- Careful integration of windows and light-shelves to ensure effective day-light distribution
- Reduction in heat gains by use of use of sun-shadings, roof finished with china mosaic, higher surface finish, selecting light/pale colour finish of the building envelope
- Orientation of the building and fenestrations – minimum openings on east and west walls, sun spaces along southern walls
- Building design to increase compactness factor by keeping low surface to volume ratio
- Increasing buffer zones to protect the building masses from direct exposure to solar radiations
- Extensive use of LED based lighting
- Putting fire pumps on terrace (to reduce power rating)
- Use of high efficiency motors and transformers
- Use of servo-stabilised HT transformers to cut-down losses
- Use of VFDs for all variable load motors above 7.5 HP to operate them at desired efficiency
- Top soil excavated during construction to be adequately preserved and relaid in the green belts
- ~28% greenbelt area proposed to maintain high ambient air quality and as curtain to noise pollution from surroundings
- Well-designed storm water management system to augment ground water resource
- Providing interruptible flushing cisterns – flushing can be stopped by the user at will
- Providing flow regulated faucets
- Providing aerators in faucets

Table 6-1: Summary of energy conservation

LED Based Lighting								
Sl. No.	Description	Consumption with conventional light (watt/sqm.)	Consumption with LED light (watt/sqm.)	FAR (sqm.)	Total Consumption with conventional light (watt)	Total Consumption with LED light (watt)	Saving (Watts)	Saving (kVA)
1.	LED Light	1	0.4	165476.93	165476.93	66,190.77	99,286.16	99.29
Usage of energy efficient Lift (VVVF gearless lifts)								
Sl. No.	Description	Consumption with conventional lift (KW)	Consumption with VVVF gearless lifts (KW)	No. of lifts	Total Consumption with conventional lift (KW)	Total Consumption with VVVF gearless lifts (KW)	Saving (KW)	Saving (kVA)
1.	Lifts	21	10	18	210	180	30	33
S. No.	Net Energy saved (weighted Average Calculation)							
2.	Solar Based lighting will be done in the common areas, Signages, entry gates and boundary walls etc. @ 5%							199 KVA
2.	LED Based lighting will be done in the dwelling units							99.29 KVA
3.	Usage of energy efficient Lift (VVVF non gear lifts)							33 KVA
	Total Energy saved							331 KVA (8.33%)
	Total Energy consumption							3972.86 KVA
	Energy saving in Residence Envelope Transmittance Value (RETV)							10 %
	Total Energy saving							18 %

6.12 Safety aspects

General

- As per NBC specifications
- Emergency collection point and entry/exit routes
- Emergency electrical switching control
- Security deputed at important and strategic locations
- 24 x 7 CCTV surveillance of the complex
- Complex to be fully access controlled
- Strict entry and exit procedures
- Communication system – intercoms, PAS, cellular phones, sirens
- Training and information
- Safety drills to be conducted at least once a year
- Important emergency contact numbers to be prominently displayed at appropriate locations
- Medical room with trained para-medical staff and first-aid arrangements to be provided

Fire

- Dead underground water storage of 100 m³
- Automated fire-sensor/smoke-detector actuated fire-alarm
- Providing "panic bar" (to manually trigger alarm) at appropriate locations
- Wet riser system, fire hydrants, fire panel hooter, portable fire extinguishers to be adequately provided
- Fire water storages at terrace of each building – ~20 m³
- Fire pumps at terrace – 450 lpm @3 kg/cm²
- Well defined fire exit routes

Electrical

- Safety earthing system – buried MS conductor earthing grid
- Connected to earth grids of various buildings
- Earthing grid connected to buried earthing electrodes (40 mm Φ & 3 m long GI rods)
- Main earth conductor – cross-sectional area of copper earthing conductor to be not smaller than half of that of largest current carrying conductor subject to upper limit of 65 mm²
- Lightning protection system – as per IS:2309 – roof conductors, air terminals, and down-comers for all tall structures

6.12.1 Disaster and Emergency Response Management

An emergency is defined as a situation or an impending situation caused by the forces of nature, an accident, an intentional act or otherwise that constitutes a danger of major proportions to life or property.

Disaster, in this context, means a sudden, accidental event that causes many deaths and injuries. Most disasters also result in significant property damage. Common natural causes of disasters include earthquakes, floods, hurricanes and typhoons, and tornadoes. Tsunamis (popularly, but incorrectly, known as tidal waves), volcanic eruptions, wildfires, and landslides and avalanches rank among the other natural forces that sometimes create disasters.

Major hazards can be generally associated with the potential of fire, flood, or earthquake or human activities of terrorism and disruption. Hazard control system is meant to ensure the avoidance of the hazards, or in case of any mis-happening with minimum possible impact on facility occupants, surrounding residents and surrounding environment.

Most of the situations are likely to be in the category of *Level 1 Emergency* (a local incident with a likely impact only to immediate surroundings of local site, where the impact radius may not be more than 15 m, such as, local fire, etc.) or *Level 3 Emergency* (an incident with likely impact area extending beyond the boundary limits of the project area, such as, floods, earthquakes, etc.).

On site emergency management will meet the exigency created due to all Level 1 emergencies. Level 3 emergencies need off-site management plan.

Disaster, in this situation, may include incidences of;

1. **Flood** – No long flow surface water body (having high command/watershed area) within 5 km carrying regular or seasonal water.
2. **Earthquake** – The area is located in Zone-V (Very High damage risk zone) seismic classification. Supaul Lies in the Zone V, as per Building Department directive the building in the Lohia Medical College has been design for seismic loads as per provision in zone V.
3. **Fire** – The construction and material specifications adopted by the promoters lay specific emphasis fire-retarding and fire safety properties. Adequate, firefighting arrangement at micro level has been planned by the promoter. In case of any mishap, suitable provisions for emergency evacuation has been incorporated. There is no fire sensitive establishment within or vicinity of the complex.
4. **Disruptive incidents of human extremism** – The complex, during inhabitation, has been planned to have controlled entry of authorized/identified persons. Appropriate safety and guard system will be adopted in consultation with the local police (including CCTV).

To contain the retrospective effects, only government authorities and agencies, at local and state level got to be adequately prepared in its mechanism to contain or minimize the losses arising thereof.

6.13 Fire Protection System

The fire protection system for the building blocks is to be designed as per the provisions of National Building Code - 2016 and the directions of local fire service authority

The maximum height of the building would be 24.55 m. Hence, as per National Building Code-2016 it falls under category (C) institutional Buildings. As per this classification, the following provisions will be made available as required in the building which, it is expected, would provide a reasonable degree of protection from fire hazards and at the same time satisfy the local fire authority, if any:

- Wet risers with hose reels at each floor.
- Yard hydrants on the periphery of the building.
- Manual call alarm system on each floor.
- Automatic fire detection & alarm system.
- Public Address and Communication System.
- Good Housekeeping & Maintenance and training of staff.

Hydrant System

Hydrant system will be provided at each floor and also on the periphery of the building (Yard hydrants). The water supply to hydrants would be by means of wet riser piping system connected to the static storage in the underground reservoir through a set of automatic pumps installed in the pump room. The system is also fitted with inlet connection (fire brigade breaching inlet) at ground level for charging with water by pumping from the fire service appliances and an air release valve at roof level to release trapped air. The Fire Hose Cabinets would be placed at conspicuous locations preferably near staircase and lift lobby, ensuring that no part on the floor is more than 30 m away from it.

Automatic Sprinkler System

The entire building except electric substation and plant room is to be provided with automatic sprinkler system. The system will be designed as per IS: 15105 – design and Installation of fixed automatic sprinkler Fire Extinguishing system/NFPA 13 - standard for the Installation of Sprinkler System. Sprinkler system shall incorporate an alarm system also. The Sprinkler Annunciation Panel located in the fire control room will indicate the operation of the sprinklers on the particular floor with an audio-visual alarm.

Portable Fire Extinguishers

ISI marked portable fire extinguishers of specified type and capacities shall be provided at all levels including electric substations, meter rooms and lift machine rooms as per the provisions of IS: 2190 - 1979.

Table 6-2: Register of Applicable Regulatory Requirements

	Legal provision	Applicable requirements	Compliance status
1.	Water (Prevention & Control of Pollution) Act, 1974	- Obtaining "Consent to establish" - Obtaining "Consent to operate"	"Consent to operate" obtained after completion project planning "Consent to establish" for the proposed project planning to be applied for after obtaining the Environmental Clearance
2.	Air (Prevention & Control of Pollution) Act, 1981	- Obtaining "Consent to establish" - Obtaining "Consent to operate"	"Consent to operate" obtained after completion project planning "Consent to establish" for the proposed project planning to be applied for after obtaining the Environmental Clearance
3.	Water (Prevention & Control of Pollution) Cess Act, 1977	Providing water consumption returns periodically and paying applicable water cess	NOC from CGWA will be obtained and cess will be paid as per the demand
4.	Environment (Protection) Act, 1986		
	The Solid Wastes Management Rules, 2016	The solid waste to be collected and disposed through solid waste facility of the local municipal authority	- Segregated collection of the MSW "NOC" from local municipal authority obtained for the disposal
	Noise Pollution (Regulation and Control) Rules, 2000	The ambient air quality in respect of applicable noise standards for silence zones to be maintained.	All construction and operation activities to be managed/regulated in a way so as not to exceed the noise levels beyond the prescribed standards.

	Legal provision	Applicable requirements	Compliance status
	Environmental Impact Assessment Notification-2006	Projects having built-up area more than 150000 m ² need “Environmental clearance” from State Environmental Impact Assessment Authority/Ministry of Environment & Forests	Currently under progress

Construction phase**Table 6-3: Environment Management Plan (Summary)**

	Issue	Management / Mitigative measures
1.	Safety during construction	All manpower will be provided with personal protective equipment. Working hours and working conditions, as per ILO norms, will be strictly adhered to. Adequate preventive measures to be implemented. Workers to be properly trained in on-site emergency response management.
2.	Construction water usage	Fresh groundwater shall not be used for meeting construction water requirement. Instead, treated wastewater (arranged from various sources) shall only be used for the purpose.
3.	Equipment and machinery	All equipment and machinery will conform to the relevant BIS norms, various other statutory provisions (in terms of performance, emissions, noise, etc.). A record of PUC will be maintained for all plant and machinery.
4.	Construction material	The material to be procured from existing approved sources conforming to the applicable environmental provisions and should have valid consents/permissions/ authorizations.
5.	Construction operations	Construction material will be regularly sprinkled with water to keep the exposed surface wet and preventing it from getting air borne.
6.	Material transportation and handling	The vehicles should conform to Motor Vehicles Act, 1988. The covered transportation will be preferred. Due care to be taken during unloading.
7.	Parking and machinery bays	The area for parking of construction vehicles, fuel/lubricant storage area, equipment and machinery area, will be lined. All operations will be carried out in a way to prevent the contamination of ground from spillage of fuels/lubricants. Arrangement will be provided to arrest the run-off from the area and send it to septic tank.
8.	Environmental conditions	Periodic monitoring of air, water, noise, and soil quality, through an approved monitoring agency will be periodically undertaken to ensure safe environmental conditions.
9.	Labour camp	The camp will provide necessary facilities in functional and hygienic manner. The sanitation and sewage system are designed, built, and operated, such that no health hazards occur and no pollution to air, ground water, etc., takes place. No labour is allowed to stay at site as per contract agreement. However toilets would be provided for labour use during day time and operated so that there is no health hazard.

Operation phase

	Issue	Management/Mitigative measures
1.	Wastewater treatment and disposal	Elaborate wastewater treatment facility will be developed to ensure, to the maximum capacity, the reuse of treated wastewater (the treated wastewater reuse potential is >63-84% of wastewater generation). The excess treated wastewater will be disposed through public sewer.
2.	Solid waste management	Solid wastes will be appropriately segregated (at source) into recyclable, and non-compostable components. The recyclable fraction will be sold directly to recyclers. Disposal of remaining waste through MC, Supaul.
3.	Equipment and machinery	All equipment and machinery will conform to the relevant BIS norms, various other statutory provisions (in terms of performance, emissions, noise, etc.)
4.	Ground water usage	To minimize the additional stress to meet the project's water requirement, appropriate ground water recharge using rain water harvesting will be implemented. Compliance with the requirements of Central Ground Water Authority is to be ensured.
5.	Drainage	Adequate storm water management will be developed.
6.	Green belt development	Approx. 28% area of total plot will be used for horticulture and green area (as dedicated parks and along pavements) will be provided within the complex.
7.	Accidents	Adequate preventive measures to be implemented for fire, electrical hazards, earthquakes, etc.
8.	Environmental conditions	Regular monitoring of air, water, noise, and soil quality, through an approved monitoring agency will be periodically undertaken.
9.	Energy conservation	Efforts will be incorporated, through expert planning, to minimize the electrical power consumption of the complex with due care to use of natural lighting, solar power, etc.
10.	Management and staffing	Dedicated environmental, health and safety department with qualified and trained team to be provided, supported by adequate budgetary allocations and training to all the staff.

6.14 Environmental Monitoring Plan

It is proposed to monitor essential parameters for ambient air quality, ambient noise quality, ground water quality, and waste water quality both during the construction and operation phases of the project. However, the monitoring schedule for the compliance report is given in Table 6.4.

Table 6-4: Environmental Monitoring Schedule for Compliance

S. No	Particulars	Monitoring Frequency	Duration of Sampling	Important Parameters
1	Ambient Air Quality Monitoring			
	Project site	Once in 6 Months	24 hr continuously except CO (8 hourly)	PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂ & CO
3	Ambient Noise Level			
	Near DG set	Once in 6 Months	8 hr continuous with 1 hr interval	Noise level in dB(A)
4	Ground/Drinking Water Quality Monitoring			
	Ground Water – at project site	Once in 6 Months	Grab Sampling	Parameters specified under IS:10500, 2012
5	Soil Quality			
	At the green belt area	Twice in a year	Samples will 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.

6.15 Management Commitment for EMP

- The project management undertake to owe entire responsibility for upkeep and management of the apartment complex continually forever.
- The project management shall create environment management cell with active participation from the occupants which will be responsible for implementation of the EMP.
- The project management commits required funds of INR ~470 lakhs, for meeting capital cost requirement to ensure effective implementation of the EMP during construction phase including creation of wastes treatment/management facilities.
- An emergency fund reserve of INR ~50,00,000.00 will be allocated to meet any exigency/ crisis.
- A consultant will be retained on continual basis for advising on various environmental issues and aspects.

- Though, the occupants will be responsible for bearing the cost of operation and management of waste treatment/management facilities, the project management will be pro-active in ensuring compliance with all statutory requirements.
- The project management commits adequate funds for meeting operational cost of the environmental management plan.
- Any adverse environmental quality found during monitoring will be suitably addressed.
- The project manager will be entrusted with overall responsibility of environment management of the site. Also, a consultant will be retained on continual basis for advising on various environmental issues and aspects.
- The day-to-day implementation and management of the EMP may be outsourced to specialized agencies in the related area
- The beautification and greening of surroundings (as legally permitted) will be taken up

7 ADDITIONAL STUDIES RISK AND DISASTER MANAGEMENT PLAN

7.1 Introduction

“Risk” is defined as the combination of the expected frequency and consequence of accidents that is caused by a hazard. A risk assessment (RA) is a systematic approach of identifying objects, events or processes that may cause harm or hazard to people, environment and asset or property. After identification of hazards, the severity of the risk is evaluated, and measures are suggested to effectively eliminate or control the hazards. This process of control usually involves monitoring, re-evaluation, and compliance with decisions. RA are crucial as they form an integral part of an occupational health and safety management plan. RA play a vital role in the following aspects:

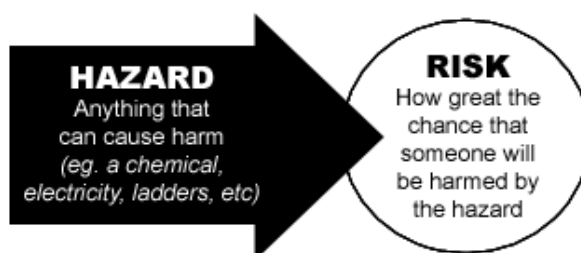
- Create awareness of hazards and risk.
- Identify who may be at risk
- Determine whether a control program is required for a particular hazard.
- Determine if existing control measures are adequate or if more should be done.
- Prevent injuries or illnesses, especially when done at the design or planning stage.
- Prioritize hazards and control measures.
- Meet legal requirements where applicable.

In the present context, the scope of RA study includes the following:

- Identification of hazards arising in the proposed projects
- Identification of potential risk scenarios that may arise from the identified hazards.
- Recommendation of feasible preventive and risk mitigation measures as well as provide inputs for drawing up of Emergency Response Plan (ERP) for the project.
- Hazard Identification includes investigation of all events or processes which could result in possible adverse impacts on people, environment & equipment. On identification of potential incidents of hazards, its risk potential is assessed.

A **hazard** is something that can cause harm, e.g. electricity, chemicals, working up a ladder, noise, a keyboard, a bully at work, stress, etc.

A **risk** is the chance, high or low, that any **hazard** will actually cause somebody harm.



Risk assessment is essential for prevention of accidents and there is a need to be aware about the risk of an accident and steps can be taken to prevent the same before its happening.

7.1.1 Rules and Regulations on Safety Involving Risks and Hazards

The responsibility of the Lohia Medical College and Hospital management is to comply with the provisions of various statutory rules and regulations on safety, health and environment. For this construction project, some rules would be implicated to ensure the safety of the environment, which are as follows:

- The Manufacture, Storage and Import of Hazardous chemical Rules, 1989, and subsequent amendment.
- EIA Notification, 2006 and subsequent amendment.
- Bio-Medical Waste Management Rules, 2016 and subsequent amendment.
- Hazardous and other wastes (Management and Tans boundary movement) Rules, 2016.
- Solid Waste Management Rules, 2016.
- Plastic Waste Management Rules, 2016.
- Construction and Demolition waste management rules, 2016.
- E – Waste (Management) management Rules, 2016 and amendments.
- The Public liability Insurance Act and Rules, 1991 and 1993.
- Petroleum Act 1934 and Petroleum Rules 2002.
- Explosive act 1884/1984 and Explosive Amendment rules 2019, subsequent amendment.
- The Electricity Act 2003.

7.1.2 Hazard assessment and evaluation

A preliminary hazard analysis has been carried out for both construction and operation phase, to identify the major hazards associated with the activities of the project. This is followed by some suggested mitigation measure, to nullify the adverse impact, up to the highest extent possible.

7.1.1 Hazard during Construction phase

7.1.1.1 Occupational hazard

The major risk probability is associated with the construction activity for this project. The construction activity would be comprising of demolishing of the existing structure, operation of heavy-duty construction equipment like crane, pay loader etc. These kinds of activities are always hazard prone, if not done with proper working plan. The workers would also be exposed to several kind of hazardous scenario like working in height, working in confined

spaces etc. The hazard prone activity during the construction phase has been identified, and the mitigation measures are tabulated below:

Hazard associated activities	Control/mitigation measure
Manual Handling: - Strains and sprains due to incorrect lifting - too heavy loads -twisting - bending - repetitive movement - body vibration.	• Exercise/warm up-get help when needed • Control loads • Rest breaks/no exhaustion • No rapid movement/twisting/bending/repetitive movement
Falls, Slips and trips: Due to poor housekeeping or slippery surfaces, uneven surfaces poor access to work areas climbing on and off plant - unloading materials into excavations wind - falling objects.	• Proper Housekeeping • Tidy workplace. • Installation of guardrails, handholds. • Use of harnesses. • No slippery floors • Clear/safe access to work areas
Fire: Flammable liquids/Gases like LPG, Diesel storage area and combustible building materials - poor housekeeping - grinding sparks - open flames, absence of Fire hydrant network.	• Combustible / flammable materials properly stored/used • Good housekeeping • Fire extinguishers made available & Fire hydrant Network with reserve Fire water. • Emergency Plan in case of Fire or collapse of structure.
Improper and un use of Personal Protective Equipment (PPE): Lack of adequate footwear - head protection – hearing / eye protection - respiratory protection - gloves -goggles.	• Proper Head/face protection • Safety footwear • PPE for ear and eye • Respiratory protection masks provided • Periodic training • Maintenance of PPE at regular interval.
Use of Defective or wrong Hand Tools.	• Right tool for the job and used properly – • good condition of the equipment and maintenance of the same. • Eye /face protection • Controlling flying debris in the site.
Electricity: • Electrocution during overhead/ Underground services. • Damaged or poorly insulated. • Temporary repairs • No testing and tagging • Circuits overloaded • Non-use of protective Devices	• Wires should be in good condition and earthed • No temporary repairs. • No exposed wires-good insulation • No overloading • Use of protective devices-testing and tagging-no Overhead/underground services.
Scaffolding: • Poor foundation. • Lack of ladder access insufficient Planking.	• All scaffolds correctly braced and stabilized. • 3:1 height to base ratio should be maintained.

• Lack of guardrails and toe boards. • Insufficient ties or other means. • All scaffolds incorrectly braced or Stabilized to prevent overturning.	• firm foundation, plumb and level ladder access • provided and used. • proper platform should be installed (3 planks/675 mm). • planks should be well maintained and secured • guardrails and toe boards should be in height of 900 mm to 1100 mm, within 200 mm of working face.
Ladders: • Excess Carrying loads. • Not secured against dislodgement. • Defective ladders within sufficient length. • wrong positions and incorrect placement of ladders (angles, in access ways, vehicle movements).	• Secured against movement or footed. • ladders should be in good condition and regularly inspected. • Placed in such a manner that the ladder would be extend 1 m above platform and 4:1 angle. • The ladder should be placed out of access ways, vehicle movements. • The ladder should only be used for climbing.
Excavations: • Trench collapse. • Material falling in undetected Underground services. • Hazardous atmosphere struck by traffic and mobile plant.	• Soil stability test. • No water accumulation. • Hardhats / PPE should be used. • atmospheric testing • Traffic controls in the excavation site. • Emergency Plan in case of accident.
Gas Cutting and Welding: • Fire could be caught from welding flash. • Burns to the nearby person. • Electrocutation in wet conditions. • Flashback in oxygen set due to leak. • leaking in acetylene cylinders. • Lying of cylinders in floors. • Poor storage of gas cylinders.	• Welding flash and burns controlled with PPE and shields. • fumes controlled with ventilation and PPE (in good condition and properly positioned). • Gas cylinders be kept upright & secured position (properly tied). • Combustible materials to be kept at secured place to avoid fire. • Fire Extinguishers to be kept in fire prone area with training to people for its use.
Falling Materials: Fall during carrying/Lifting materials- dislodged tools and materials from overhead work areas.	• Materials to be kept in secured position and kept away from edge and toe boards. • Mandatory use of hard hats.
Cranes & Lifts: • No Display board of carrying capacity • Incorrectly slung.	• Periodic testing by competent authority. • Correctly slung/secured loads. • Lifting equipment in good conditions.

• Defective lifting equipment. • Unsecured loads. • Craning in close proximity to building people and plant. • No caution board for swing areas of cranes.	• Use of proper hand signal. • Installation of display board of the necessary information.
Visitors Presence at the Site: • Falls. • Struck by Dropped Materials. • Loading Accidents. • Insufficient hoarding or fencing. • No pedestrian access roads past site. • Mechanical plant movement on and off site.	• Sufficient hoarding to aware people of the construction activity. • Fencing and barricades around the site. • Safe pedestrian access past site. • Traffic management for loading and delivery.

Storage and Handling of waste materials

During the construction phase of the project there would be hazardous waste in terms of lube oil, paints, lubricating material, oil-soaked cloth etc. Though it has been anticipated that the amount of hazardous waste storage would be low in quantity, hence it would not be regarded as the potential hazard scenario. But on the other hand, it was evaluated that all the hazardous waste material is flammable in nature, and by any chance it came in contact with the fire the hazardous waste material could triggered the domino effect in the site, which could result in a huge fire disaster. To mitigate such type of hazard, the mitigation measure is suggested below:

- Separate storage places for the hazardous waste material, and far from any kind of ignitable source.
- The area of the storage places would be determined according to the quantity and type of hazardous waste materials.
- The hazardous waste material would be disposed off within 90 days from the generation time, through CPCB approved recyclers.

Fire Hazard

During the construction phase fire hazard would be one of the main concerned factors, as a part of risk assessment procedure. There would be several sources, which could act as a potential causing agent of fire. The probable sources of fire hazard are discussed below:

- Electrical faults - Sites will have a combination of fixed electrical wiring from mains sources and electricity generated from fixed and/or mobile power generators. All electrical installations must be tested, inspected and commissioned before becoming available for use and at suitable intervals.
 - Hot working - hot works are defined as all "processes involving the generation of heat by a naked flame, electrical arc, sparks etc. Cutting operations use open flame gas cutting equipment or disc cutting. Such type of activity should be done in a specific place within the site and far from any ignitable sources.

- Smoking - smoking is usually prohibited on site or designated smoking areas are provided away from the main work site and the site offices.
- Temporary lighting - Sometimes the illumination of work areas is from temporary lighting installed. The hazards from such lighting come from placing light units too close to combustible items. Lighting units should be secured in position away from combustible material to prevent them being dislodged. Light units should be inspected periodically, and broken units should be removed immediately.
- Lightning - lightning protection systems shall be provided where appropriate and should be tested annually with certificates provided to confirm a satisfactory test.
- Combustible building components - the control of combustible materials is fundamental to site safety and materials should not exceed the quantities required for a day's work; storage of combustible items should be limited and a gap of 6-10m should be left between any fuel packages. Care should be taken not to leave any readily ignitable substances near to fuel packages.
- **Control measure to mitigate fire hazard**
- Sufficient number of suitable emergency routes and exits that must be kept clear and free from obstruction and, where necessary, provided with emergency lighting so that it may be used at any time.
- Exit routes must be indicated by suitable signs.
- Where necessary suitable and sufficient fire-fighting equipment and fire detection and alarm systems must be installed.
- Workers must be instructed in the correct use of fire-fighting equipment

7.1.2 Hazard during Operation phase

During the operation phase of the project, there would be patient in the building, along with the medical staffs. So, any kind of hazardous situation would result in huge loss of lives and property. So, based on the risk assessment and hazard identification, some of the key hazard situation, along with their mitigation has been discussed below:

Storage and Handling of Hazardous Materials

During the operation phase some hazardous material would be stored at site. It has been anticipated that approx. 500 KL of liquid oxygen and 200 KL of diesel would be stored in the operation phase. To avoid any kind of accidents due to storage or handling of such materials, separate temporary storage places are proposed to be made within the project area. The area of the storage places would be determined according to the quantity and type of hazardous waste material like hazardous construction and demolition wastes, used batteries, used bulb and tube lights, PVC waste materials, used oil etc. The hazardous waste material would be disposed off within 90 days from the generation time, through CPCB approved recyclers.

Storage of gas cylinders will be done as per the Gas cylinder Rules, 2016 would be followed. The hazardous materials used would include laboratory reagents, chemicals for wastewater treatment plant etc. All these chemicals will be stored in proper containers on paved and designated storage space. No storage on open ground would be practiced. MSDS for chemicals shall be displayed in the storage area.

7.1.3 Guidelines for Storage of Petroleum Products

The Petroleum Rules, 2002 specify some criteria for storage of petroleum and petroleum-based products.

- License would be required depending on the quantity of the product and handling of the products envisaged within the project premises.
- However, no license is required for storage, handling and transport of any such products (petroleum class B) if the total quantity in possession does not exceed 2500 litres in non-bulk or 1000 litres in receptacle or tank.

Safety Codes for Building and Firefighting system

The firefighting system would also adhere to the chapter 4 of the National Building Code. Other than this Indian standard code and local regulation for fire protection would also take in consideration for the firefighting system of the building. The firefighting network would be followed by Emergency Response mock drill which is proposed as an essential part of risk control measures.

Arrangements of Fire Fighting

There would be adequate provisions of firefighting arrangements and equipment in the building as follows:

- High pressure fire water connections.
- Fire water inlet and outlet connections would be provided to water storage tanks.
- External main fire ring, with 150 mm diameter and hydrants at least of 45 m³/s spacing would be provided. The external fire ring will be separated from the sprinkler main system.
- All flow switches, test valves, drainpipes would be provided as per local fire protection guidelines on the sprinkler system.
- All pump installations and arrangements would be made in accordance with IRI guidelines.
- Bypass arrangements would be provided with NRV and gate valve and bulk flow meter on the discharge header of each pump to check the efficiency of pump.
- Storage tanks would be provided in the basement for the supply of water for the firefighting facility.
- Fire extinguishers would be placed in all designated places of the building and the material of the fire extinguisher substance should be in accordance with Ozone depleting substances (Regulation and Control) Rules, 2000.

7.1.4 Onsite Emergency plan

The on-site emergency plan would be prepared to mitigate any kind of risk or hazard, during construction and operation phase of the project. The plan would be circulated to all concerned person at site as all the teams should be aware about their roles and responsibilities during any kind of hazard. The onsite emergency plan would be according to the risk assessment and the mitigation measure suggested during construction and operation phase. The objective of the plan is to take immediate actions to meet any emergency situation for speedy and efficient rescue and relief operation. The main stages, which should be followed in on site emergency plan is given below

- Immediate isolation of the affected area for speedy rescue operation.
- Rescue and provide first aid to the casualties and safeguard the rest.
- Minimize damage to life and property
- Secure and safe rehabilitation of the affected area.
- Provide authoritative news information to the media, if needed.
- Contain and bring the situation under control.

The primary goal of an effective on-site emergency plan is to control and contain the situation. To cover eventuality in the plan and the successful handling of the emergency, will depend on appropriate action and decision being taken on the spot.

It has been proposed to plan and construct the building to maintain all safety norms. However, it is not possible always to eliminate all eventualities to mitigate the risk. Rather the plan should isolate all risk involved activities in the construction and operation phase, and state precautionary measure while performing such activities.

7.2 Disaster Management Plan

Introduction

Disasters are the situation which has the ability to expose the vulnerabilities of systems, structures, processes and people causing large scale damages. Disasters may be due to internal factors like fire, exposure to hazardous material and external factors like as earthquakes, mass casualty events or epidemics or pandemics.

Disaster management encompasses disasters due to:

1. Fire
2. Earthquake
3. Biological disaster
4. Urban flooding
5. Chemical disaster
6. Power outage

For man-made disaster like fire, requirements of National Building Code of India will be considered, and necessary precaution would be undertaken.

For natural disaster management, there are the Natural Disaster Management Authority (NDMA) at the Centre, Government of India and the State Disaster Management Authority (SDMA) at the State level. For natural disasters, guidelines need to be followed as given in the Vulnerability Atlas of India (Earthquake, Windstorm, and Flood Hazard Maps and Damage Risk Housing) formulated by the Building Materials and Technology Promotion

Council (BMTPC), Ministry of Housing & Urban Poverty Alleviation (MHUPA), Government of India.

In case of natural disasters such as earthquakes, Earthquake Zoning Maps have been considered and earthquake resistant building structures have been considered as applicable to the place where the project is located. Emergency planning is a vital part of the overall loss control program and is essential for the project. This is important for effective supervision of an accident/incident to curtail losses to people and property, both in and around the facility.

The format and contents of the Emergency Response Plan (ERP) / On-Site Disaster Management Plan (DMP) has been developed taking into consideration the regulatory guidelines, other applicable documents and accepted good industrial practices formulated as a result of lessons learned in actual emergencies requiring extensive emergency response. Hospitals can be prepared for disasters by increasing their resilience; by strengthening both structural, inter connection and operational aspects of the hospital, to achieve a reasonable degree of safety. Hospitals campus will be fully functional immediately after disasters.

7.2.2 Objective of the Disaster Management Plan

The main moto of plan is to get prepared for any probable emergency situations and to minimize the damage to the property, environment and human life in these situations. The plan is useful to tackle emergencies such as fire, explosion, major accidents at the project site and natural calamities. This plan needs to be periodically reviewed and modified. It should also be reformed based on the observations of emergency mock drills and experience of handling actual emergencies. The objective of the Disaster Management Plan is to make use of the combined resources of the project and the outside services to achieve the following:

- Speed up the rescue and medical treatment of casualties;
- Safeguard other people;
- Minimize damage to property and the environment;
- Initially contain and ultimately bring the incident under control;
- Identify any dead;
- Provide for the needs of the relatives;
- Provide authoritative information to the news media;
- Secure the safe rehabilitation of affected area;
- Preserve relevant records and equipment for the subsequent inquiry into the cause and circumstances of the Emergency.

In effect, the DMP is to heighten operational efficiency to rescue rehabilitation and help to restore normalcy. Disaster Management Plan has been prepared considering the following: -

- Emergency Preparedness Plan
- Emergency Response Team
- Emergency Communication
- Emergency Responsibilities
- Emergency Facilities and
- Emergency Actions.

7.2.3 Provision of Essential Services

The following provisions are proposed for the project which is expected to be helpful to minimize hazards in the event of disasters.

7.2.4 Emergency Response Plan during Disaster

The overall goal of an Emergency Response Plan (ERP) is to make use of the collective resources at the site and outside services to achieve the following:

- To localize the emergency and if possible, eliminate it;

- To minimize the effects of the accident on people and property;
- Effect the rescue and medical treatment of casualties;
- Safeguard other people;
- Evacuate people to safe areas;
- Informing and collaborating with statutory authorities;
- Initially contain and ultimately bring the incident under control;
- Investigating and taking steps to prevent reoccurrence

The ERP is, therefore, related to identification of sources from which hazards can arise and the maximum credible loss scenario that can take place in the concerned area. The plan takes into account the maximum credible loss scenario - actions that can successfully mitigate the effects of losses/emergency need to be well planned so that they would require less effort and resources to control and terminate emergencies.

7.2.5 On-site and off-site Emergency Response Plan (ERP)

On-Site and Off-Site Emergency Response Plans have been formulated and key points of the same are as follows:

- First Aid at site, Safety Officer and a Doctor must be available to give First Aid at the site and proper record for the same must be maintained at the site;
- Availability of Ambulance at the site for emergency moving of the patients from site to the hospital;
- Phone numbers of Fire Brigade Office and Police Station must be displayed at the Site Administrative Building and at the Emergency Control Room (Centre);
- Alarm must be automatically activated in case of any hazard;
- All the workers and people residing inside the campus must be aware of the Assembly Point and must reach there in case of any evacuation to be made from the site;
- The Site Office shall serve as the Emergency Control Room (Centre) in case of emergency during the construction phase;

7.2.6 On Site ERP

The main objective of the plan is to take immediate actions to meet any emergency situation for speedy and efficient rescue and relief operations. The main steps in an On- Site emergency plan is described below:

- Cordon and isolate the affected area for smooth rescue operation;
- Rescue and treat casualties and safeguard the rest;
- Minimize damage to life, property and surroundings;
- Contain and ultimately bring the situation under control;
- Secure and safe rehabilitation of the affected area;
- Identify any casualty and provide for the needs of the relatives;
- Provide necessary information to statutory agencies;
- Provide authoritative information to the news media;
- Ward off unsocial elements and prying onlookers;
- Counter rumor mongering and panic by relevant accurate information;

The parameters considered are given as follows:

- To constitute Disaster Management Committee under a senior officer not below the rank of the Project Manager or General Manager;

- To identify potential hazards areas in the layout map of the Project;
- To use models to predict hazards impact in the surrounding areas in form of pool-fire or gas leakage;
- To predict degree of burns and distance of the risk zone by using model;
- To evacuate the area within the risk zone;
- To localize the emergency and if possible, eliminate it;
- To minimize the effects of accidents on people and property;
- To take remedial measures in the quickest possible time to contain the incident and control it with minimum damage;
- To mobilize the internal resource and utilize them in the most effective way;
- To get help from the local community and government official to supplement internal manpower and resources;
- To minimize the damage in other sections;
- To keep the required emergency equipment in stock at right places and ensure that they are in working condition;
- To keep the concerned personnel fully trained in the use of emergency equipment;
- To give immediate warning to the surrounding localities in case of emergency situation arising;
- To mobilize transport and medical treatment of the injured;
- To educate the public in the surrounding villages regarding hazards;
- To arrange treatment of casualties;
- To safeguard the people;
- To identify the casualties and communicate to persons known to them;
- To render necessary help to the concerned;
- To rehabilitate the area affected;
- To provide information to media and government agencies;

On Site Disaster Emergency team

It is proposed to form a dedicated committee or team who would deal with management activities for disasters and emergency response, named as Hospital Disaster Management Committee (HDMC). This committee would undertake preparation of site and activity specific Hospital Disaster Management Plan (HDMP). Members of this committee would be trained to institute and implement the Hospital Incident Response System (HIRS) for both on-site and offsite emergency situations and Disasters. Chief Incident Controller (CIC) and Work Incident Controller (WIC) would be the core members of this committee who would be assisted by a support team.

8 PROJECT BENEFITS

8.1 General

Lohia Medical College & Hospital is proposed construction of Hospital and Medical College in total land area 110883.87 Sqm. & Total built-up area 165476.93 Sqm. at District- Supaul, Bihar.

8.1.1 Financial Benefits

The major advantage of the proposed project is to provide better health facility to the large number of patients from Bihar State suffering from Heart Diseases, Neurological problems, Cancer, Renal Dialysis, Ophthalmic problems etc. go to Lohia Medical College and Hospital. Getting treatment at Lohia Medical College and Hospital puts heavy economic burden on them apart from the difficulty of traveling to a distant location and puts excessive loads on those institutions.

Looking into the problem, State Government, in consultation with experts from various parts of country, decided to setup an institute of Lohia Medical College and Hospital standard so that the patients from Bihar, Sikkim, Nepal, and Bhutan etc. may get best Medicare at the lowest possible expense.

8.1.2 Benefits to the Community

This project will provide medical experts, professionals etc.

- Awareness and Research in this sector will promote
- Improving methods for diagnosing health conditions
- Developing better treating and preventing illnesses methods
- Teaching students at educational institutions
- In addition to this the upcoming project will also provide employment.

9 ENVIRONMENTAL COST BENEFIT ANALYSIS

It is not recommended at the Scoping stage (ToR).

10 ENVIRONMENTAL MANAGEMENT PLAN

10.1 Environmental Management Plan (EMP)

Environmental Management Plan or programme (EMP) that seeks to achieve a required end state and describes how activities that have or could have an adverse impact on the environment, will be mitigated, controlled, and monitored.

The EMP will address the environmental impacts during the design, construction and operational phases of a project. Due regard must be given to environmental protection during the entire project. In order to achieve this number of environmental specifications/recommendations are made. These are aimed at ensuring that the contractor maintains adequate control over the project in order to:

- Minimize the extent of impact during construction.
- Ensure appropriate restoration of areas affected by construction.
- Prevent long term environmental degradation.

10.2 Impact Mitigation Measures During Construction Phase

The impacts during the construction phase on the environment would be basically of temporary in nature and are expected to reduce gradually on completion of construction activities.

10.2.1 Air Quality Management

During construction phase, a certain amount of dust shall be generated due to the transportation of men, machinery and materials, land clearing and leveling of land, use of construction and earthmoving machinery, construction of foundations, buildings and other requisite infrastructure etc. may cause fugitive dust problem and also some gaseous emissions like SO_x, NO_x, CO and hydrocarbons in small periodic scale are also anticipated. The impacts shall be fully temporary and basically for short term in nature and shall marginally deteriorate the ambient air quality locally, primarily dust nuisance. However, the following measures that are contemplated during construction phase shall reduce such short term dust problems.

Construction materials shall be transported to the site in covered trucks, where necessary.

- Land clearing for construction site will be kept at the absolute minimum practicable.
- Layout designed to minimize the removal of soil and vegetation

- Topsoil removed will be preserved for later reinstatement purposes by piling it within and along the boundary of the site.
- Dust suppression systems (water spray) shall be put into service as per requirement at the construction site.
- Earth moving equipment, typically bulldozer with grader blade and ripper shall be used for excavation work.

10.2.2 Noise Level Management

Noise shall be generated mainly due to operation of machinery/ equipment used for construction and transportation of materials to the site. The general noise levels due to construction activities may sometimes go up to 90 dB(A) or even beyond at the work sites during day time. The workers in general are likely to be exposed to an equivalent noise level of 80-90 dB(A) in an 8-hour shift for which all statutory precautions as per law shall be implemented. The measures described below shall be able to mitigate the noise levels generated at site:

- Provision of silencers to modulate the noise generated by machines
- Provision of protective devices like ear muff/ plugs to the workers who will be working in the noise prone areas.

10.2.3 Water Resource Management

During the construction phase of the proposed plant, the total water requirement is estimated to 21 m³ per day depending on the construction fronts. This requirement of water will be met from treated water supply. The following measures shall be adopted for water resource management:

- Continuous attempt shall be made to optimize/ reduce the use of water
- Continuous attempt shall be made to avoid wastage and leakage of water

10.2.4 Water Quality Management

During the construction phase, the waste water shall be mainly generated from domestic activities. The strength of total skilled, semiskilled and unskilled labour required for construction is estimated at 500 (peak) and 200 (average). A proper drainage system shall be constructed at site on a temporary basis at an early stage. The salient features of water quality management shall comprise of the following:

- Raw water quality shall be checked on regular basis for essential parameters
- All sanitary waste from the site shall be disposed into the septic tanks followed by soak pits

- All the debris resulting from the site shall be isolated from the waste water and disposed of separately generally through dedicated handling agency.
- An oil trap shall be provided in the drainage line to prevent contamination by accidental spillage of oil / grease
- Wash down area for cleaning of vehicles wheels shall be provided and wheel wash waste shall be drained properly. Here also a settling pit and baffled oil water separator is being contemplated

10.2.5 Soil Quality Management

Construction related activities could have an adverse impact on the soil resulting from clearing, excavation, topsoil removal, soil disposal, road construction and refuse / waste disposal. The following measures shall be adopted to prevent/ reduce soil contamination.

- Litter, fuel, oil drums, used grease cartridges shall be collected and removed properly as per recommendation of competent authority.
- Dustbins / litter bins shall be placed at strategic locations
- Lubrication waste oil shall be collected separately in drums and shall be disposed of as per the stipulations of Consent order and HW authorization from SPCB

Land Use Pattern and Ecology Management

Disturbance during construction phase shall be confined to the land acquired for the proposed complex only. To keep the disturbance at a minimum, the following measures are recommended:

- Land clearing for construction site will be kept at the absolute minimum practicable
- Master Plan Layout will be designed to minimize removal of top soil and vegetation
- Whatever topsoil needs to be removed will be stored for later reinstatement purposes by piling it at some suitable location(s) within the site itself.

10.2.6 Traffic Movement

Traffic to and from would become more intensive and heavier than at present in normal conditions. Road, it is capable of taking this extra load easily. The roads leading to the site off Station Road will experience additional traffic loads.

With proposed widening of those roads the additional traffic is expected to be managed satisfactorily. However, the following measures are proposed for traffic control during construction phase:

Proper planning vehicle movements

- Advise traffic police of activities
- Road crossings to be used shall be well marked
- Water Spray down to dirty roads if the same is too dusty

10.2.7 Socio-economy

In addition to the operation phase staff of around 800 persons, mostly local skilled and unskilled labourers shall be engaged in construction activities:

- Adequate dialogue with the local bodies / local population
- Protection of traditional water structure.
- Provision of health and entertainment services
- Provide temporary employment generation opportunities to local people,
- Especially in unskilled categories

10.3 Impact Mitigation Measures during Operation Phase

The impacts during the operation phase on the environment would be basically negligible. Environment protection measures / precautions shall be adopted to minimize the impacts due to operation of complex and this includes all environmental and socio- economic mitigation measures as proposed and discussed below :

- Solid Waste Management
- Water Pollution Control Measure
- Air & Noise Pollution Control Measure
- Plantation (Green Belt Development)
- Building Architectural Design and Energy Conservation Measures
- Socio – Economic Measures and Corporate Environmental Policy
- Occupational safety and health
- Emergency Preparedness (Disaster management Plan)
- Audit

Details of Environmental monitoring during operational phase is given in Chapter -6 of this report. The EMP Budget is mentioned in **Table 10-1 & Table 10-2.**

Table 10-1: Cost of E.M.P. during Construction Phase

Sr. No.	Component	Particulars	Capital Investment (Lakhs)	Recurring Expenditure per Annum (Lakhs)
1.	Air	Anti-smog Construction of Gun, wind breaking wall	15	3.0
2.	Water	STP etc.	10	3.0
3.	Solid and C&D Waste and its Management	Stockyard and its management	15	5
4.	Environment	Environment Monitoring as	04	2.5

Sr. No.	Component	Particulars	Capital Investment (Lakhs)	Recurring Expenditure per Annum (Lakhs)
	Monitoring & Management	per monitoring plan		
5.	Green Belt	Development and maintenance of green belt	05	03
Total (Rs.)			49	16.5

Table 10-2: Cost of E.M.P. during Operation Phase

Sr. No.	Component	Particulars	Capital Investment (Lakhs)	Recurring Expenditure per Annum (Lakhs)
1.	Air	Stack emission control	5	3
2.	Water	ETP comprising of pre-primary, primary, secondary & tertiary treatment, STP, etc.	200	10
3.	Rain Water Harvesting	Installation of RWH System & Annual Cleaning of RWH tank	50	5
4.	Solid/Biomedical Waste Area and its Management	Purchase of Containers for Storage of Waste & Installation of OWC	25 25	5 5
5.	Environment Monitoring & Management	Environment Monitoring as per monitoring plan	--	5
6.	Green Belt	Development and maintenance of green belt	15	5
7.	Energy Saving Measures	LED, Solar Panels, EV charging points etc.	150	10
Total (Rs.)			470	48

11 SUMMARY & CONCLUSION

11.1 INTRODUCTION

The purpose of EIA study is to assess the beneficial and adverse impacts of the proposed Hospital project on the existing environmental parameters, so that suitable control measures could be taken to reduce impacts. Thus, the EIA report is a summarized presentation of base line information of Air, Water, Soil, Noise, Flora, Fauna, Socio-economic study and the prevailing environmental scenario of the project activity.

The Construction sector in India is the second largest economic activity after agriculture and provides employment to about 33 million people. Construction investment accounts for around 52.4% of the Gross Fixed Capital Formation in India.

Lohia Medical College & Hospital is proposed construction in total land area 110883.87 Sqm. & Total built-up area 165476.93 Sqm. at District- Supaul, Bihar. The Project will be developed as per Supaul Master Plan 2031.

11.2 SUMMARY OF THE PROJECT

Table 11-1: Summary of the project

Sr. No.	Particulars	
1.	Total Plot area	110883.87 Sqm.
2.	Proposed FAR @ 1.49	165476.93 Sqm.
3.	Hospital Blocks Built-up area	54846.85 Sqm.
4.	College Blocks Built-up area	23529.58 Sqm.
5.	Hostel Blocks Built-up area	39589.96 Sqm
6.	Residential Blocks Built-up area	23643.27 Sqm.
7.	Others (Indoor Sport Complex, Service Block, Multilevel Car Parking, ESS, STP UGT)	23867.27 Sqm.
8.	Total Built-up Area	165476.93 Sqm
9.	Multilevel Car Parking	12881.8 Sqm.
10.	Ground (Open) Parking	2257.2 Sqm
11.	Ground Floor Parking (Resident Block)	4488.61 Sqm
12.	Total Parking Provided	11234.42 Sqm.
13.	Green Belt area Provided @ 27.89	30928.71 Sqm
14.	Proposed Ground Coverage @ 27.90%	30937.03 Sqm
15.	Road Area	24280.99 Sqm
16.	Paved Area	17829.93 Sqm

Sr. No.	Particulars		
17.	Rain Water Harvesting Pits (with size)		10 (RWH Pit size= 71.57m ³)
18.	STP Capacity		870 KLD
19.	Maximum Height of the Building (m)		Approx. 24.55 m.
20.	Power Requirement		~3972.86 KW
21.	Power Backup		6 DGs of (3 x 1010 KVA), (2 x 750 KVA) & (1x 625 KVA)
22.	Total water Requirement		~1061 KLD Fresh water –563 KLD Treated water-498 KLD Source: Ground water for fresh water requirement.
23.	Waste water Generated		~725 KLD
24.	Solid Waste Generated		~2427 Kg/day
25.	Biodegradable Waste		~1456 Kg/day
26.	Non-Biodegradable Waste		~971 Kg/day
27.	Bio-medical waste		~693 Kg/day
28.	Number of Blocks		Blocks: 4 Hospital, College, Hostel & Residential Blocks
29.	Basement		01
30.	Max. Stories		G+7
31.	Project Cost		603 Crores
32.	EMP Budget		During Construction Capital Cost: 49 Lakhs Recurring Cost: 16.5 Lakhs
			During Operation Capital Cost: 470 Lakhs Recurring Cost: 48 Lakhs
33.	Connectivity	Supaul Railway Station	Approx. 19 Km towards South-West
		Tharbitia Railway Station	Approx.14.0 Km towards WNW.
		Debipatti Main Road	Approx. 0.67 km towards West
		NH- 327	Approx. 0.48 km. towards South.
		NH- 131	Approx. 1.15 km towards East.
		Darbhanga Airport	Approx. 86.0 km towards West.

11.3 NEED OF THE PROJECT

Lohia Medical College & Hospital is proposed construction in total land area 110883.87 Sqm. & Total built-up area 165476.93 Sqm. at District- Supaul, Bihar.

- To further the advancement of learning and conducting of research.
- To undertake the extension of education of such sciences and technologies that are relevant for the livelihood of rural people of the state.

- To facilitate and ensure qualitative improvement in the teaching and learning processes and methodology
- To facilitate the need for an organized process of lifelong learning.
- To disseminate knowledge and findings emerging in the university, its colleges and institutions
- To establish Hospital for treatment / research role of the university

11.4 EIA STUDY

The Environmental Clearance process is guided by EIA Notification, 2006 which came in to effect on 14th September 2006. As per EIA Notification, 2006, and its amendments, all Building construction and Area development projects covering an area of 50 ha and/ or built-up area greater than 1,50,000 sqm are designated as 8 (b) projects and are required to obtain prior environmental clearance from respective State Environmental Impact Assessment Authority (SEIAA).

Since the plot area of the proposed project is 110883.87 sqm or 11.08 Ha and Built-up Area 165476.93 sqm. The project falls in “8 (b)” category as per the provisions of the EIA Notification, 2006 and its amendments to obtain environmental clearance from the SEIAA, Bihar.

11.5 PROJECT PROFILE

Site and Surrounding

The proposed project site is located at District- Supaul, Bihar. The nearest railway station is Supaul Railway Station at a distance of approximately 19.0 km in South West direction. The Nearest airport is Darbhanga Airport which is located at an approximate distance of 86 km in the West direction from the proposed project site.

Land

Lohia Medical College & Hospital is proposed construction in total land area 110883.87 Sqm. & Total built-up area 165476.93 Sqm. at District- Supaul, Bihar.

Water

Water requirement will be met through ground water. The water requirement for the project has been estimated to be **1061 KLD** and the fresh water requirement will be 563 KLD for which Ground water NOC to be obtained. This includes domestic, flushing and landscaping. Out of this, domestic requirement will be met through daily fresh water from the municipal supply whereas for flushing and landscaping through treated water from STP/ETP will be used.

Table 11-2: Baseline Environmental Status

Attribute	Baseline status
Ambient Air Quality	The ambient air quality study for the 8 AAQ monitoring stations shows that the maximum and minimum concentrations for PM₁₀ were recorded as 318.4 µg/m³ and 104.7 µg/m³, respectively. The maximum concentration of PM₁₀ was recorded at the (AQ8) Bishunpur and minimum concentration was observed at (AQ5) Atlakha Belahi. The mean concentrations range between 191.1 µg/m³ to 230.4 µg/m³. 98th percentile values for PM₁₀ during study period range between 249.1 µg/m³ to 309.3 µg/m³. The maximum and minimum concentrations for PM_{2.5} were recorded as 200.1 µg/m³ and 63.1 µg/m³, respectively. The maximum concentration was recorded at (AQ6) Debipatti and the minimum concentration was recorded at (AQ3) Pipra. The mean concentrations range between 104.4 µg/m³ to 155.2 µg/m³. 98th percentile values for PM_{2.5} during study period range between 125.6 µg/m³ to 196.9 µg/m³. Similarly, maximum and minimum SO₂ concentrations were recorded as 20.3 µg/m³ and 8.2 µg/m³. The maximum concentration was recorded at (AQ8) Bishunpur and the minimum concentration was recorded at (AQ5) New Atlakha Belahi. The mean values were observed from 11.6 µg/m³ to 17.1 µg/m³. 98th percentile values for SO₂ during study period range between 14.7 to 20.1 µg/m³. The maximum and minimum NO₂ concentrations were recorded as 40.0 µg/m³ and 20.7 µg/m³. The maximum concentration was recorded at (AQ8) Bishunpur and the minimum concentration was recorded at (AQ1) Project Site. The mean values for NO₂ were observed in the range between 26.0 to 33.6 µg/m³. 98th percentile values for NO₂ during study period range between 29.9 to 39.4 µg/m³. The maximum and minimum CO concentrations were recorded as 7.48 mg/m³ and 1.33 mg/m³. The maximum concentration was recorded at (AQ8) Bishunpur and the minimum concentration was

Attribute	Baseline status
	recorded at (AQ1) Project Site. The mean values for CO were observed in the range between 3.15 to 4.63 mg/m ³ . 98th percentile values for CO during study period range between 5.02 to 7.22 mg/m ³ .
Noise Levels	□ The maximum and minimum concentrations for Noise were recorded as 52.6 dB (A) and 45.8 dB (A) respectively in day. The maximum concentration was recorded at Project Site and the minimum concentration was recorded at SDH School Pipra. □ The maximum and minimum concentrations for Noise were recorded as 40.1 dB (A) and 35.4 dB (A) respectively in Night. The maximum concentration was recorded at Project Site and the minimum concentration was recorded at Hanuman Mandir Dinapatti.
Water Quality	The examination of the physicochemical analysis of the ground water shows that the quality of ground water is generally good with respect to the limits laid down in Bureau of India Standards (IS: 10500:2012) for drinking water. Based on the above result it is concluded that the ground water samples are fit for drinking purpose.
Soil Quality	The Soil quality study for the 8 AAQ monitoring stations shows that The result show that the pH varies between is 7.37 to 7.80. Most crops grow best if the soil pH is in between 6.0-7.5. The bulk density present in the soil sample is between 1.28 to 1.86 g/cm ³ . Electrical Conductivity in the soil sample is between 321.3 to 362.1 µmhos /cm. The content of organic matter is 1.43% to 1.94%.
Ecology and Bio-diversity	There are no Ecologically Sensitive Areas present in the study area.

SOCIO-ECONOMIC ENVIRONMENT

Impacts

Development of this project will increase the socio-economic condition of the area. Possibility of direct and indirect employment opportunity would increase due to development of the project and associated business activities. Local people in the vicinity of the project

may also be involved during construction stage of the project. During operation phase people may be involved as per their qualification and skill related to the activities. Thus, there would be positive impact on the socio-economic condition of the project. It is expected that the area would witness remarkable improvement in basic social infrastructure like road, school-colleges, community building etc. in the surrounding area due to the proposed project.

Mitigation Measures

As the impacts are insignificant, no specific mitigation measures are envisaged for demography and socio-economic environment. During the construction phase, temporary hutments will be constructed at the earmarked space for the labour force. The labour colony shall be provided drinking water and sanitation facilities. Temporary toilets as per PHED norms will be constructed for the work force during construction period. Suitable septic tanks and soak pits of appropriate capacities will be constructed for treatment of sewage before disposal.

Health and safety of the workers will be ensured during construction by making effective provisions for the basic facilities of sanitation, drinking water, safety of equipment or machinery etc. The following recommendations will be followed:

- Safety procedures, norms and guidelines (as applicable) as outlined in the document Part -7, Constructional practices and safety, 2016, National Building Code of India, Bureau of Indian Standards will be complied with.
- Clean drinking water will be provided to all the workers.
- Adequate number of decentralized latrines and urinals will be provided to construction workers.
- All parts of dangerous machinery will be guarded.
- Hoists and lifts, lifting machines, chains, ropes and other lifting tackles will be kept in good condition and protected by barricades.
- Protective equipment like helmets etc. will be provided to the workers.
- Fire extinguishers and buckets of sands will be provided in the fire-prone areas and elsewhere as measures to prevent fires.

BIOLOGICAL ENVIRONMENT

Direct Impact

The project of Construction of 630 bedded "Lohia Medical College & Hospital" at District-Supaul, Bihar, during construction and operation phase will have insignificant negative impact on biological environment. The aesthetic biodiversity of area will be enriched by the proposed project as it will involve Landscaping and greenbelt development. No direct impact is anticipated from the project.

Indirect Impact:

The major indirect impact include following.

- a) Construction activity is likely to affect the movement of the animal and birds.
- b) Increase in noise may affect the feeding, breeding and movement of animals.

- c) Likely settling of dust to be generated by movement of vehicles and construction activities on leaves may results in to stunted growth of vegetation and may also affect the capacity of production.
- d) large numbers of labor population will influx the area during construction phase. The major threat to surrounding flora is through collection of fuel wood by labor for cooking purposes and thereby loss of trees.

Cumulative Impact:

- a) Indirect and cumulative impacts are associated with various construction activities such as clearing of vegetation for establishment of various project units, movement of vehicles, construction equipment's & machineries etc., interferences due to influx of labours etc.
- b) The losses of land for various project units will also not adversely affect the fauna as similar habitat is present throughout the project immediate influenced area. Therefore, impact due to loss of habitat for birds, reptiles and mammals of the project area is not expected.
- c) Impacts on surrounding fauna due to movement of vehicles, machinery, equipment and work force may slightly interfere in animal movements. As most of the domestic animals Cows, Buffaloes, Goats, Sheep's and Donkeys are guided & controlled by the owners/ caretakers and hence any causality in terms of killing or accident are not expected.

Recommendation:

- Construction activities will be restricted to day hours only.
- Ward and watch for the animal movement in and around the project area during construction phase will be provided.
- All the vehicles delivering materials to the site shall be covered to avoid spillage of material.
- Approach road used by vehicles shall be kept clean and clear of dust.
- All earth work shall be protected to minimize dust generation.
- All crusher used in construction shall confirm to relative dust emission devises.

Impacts

- Impact of labor colonies/ camps on nearby vegetation.
- Impact of dumping of construction debris on nearby vegetation.
- Impacts on landscape of the area and loss of top soil.

Mitigation Measures:

- Cutting, uprooting, coppicing of trees or small trees present in and around the project site for cooking, burning or heating purposes by the laborers will be prohibited and suitable alternative fuel arrangement shall be made.
- Proper disposal of construction material shall be done and disposal of the same at vegetated shall be avoided.

- Along the major construction work the peripheral Greens belt should be developed, so that; it will grow to become a full-fledged green cover by the time the construction is over.

EMPLOYMENT POTENTIAL

Most of the employment would be generated at the time of generated at the time of construction and during operational phase also there would be generation of employment in the field of facility management, security staff, Store Manager, Watchman, Housekeeping, Gardeners, Labours for maintenance of building premises, service management, maintenance, etc.

11.5.1 Raw Material Consumption at the Time of Construction

List of building materials to be used at site:

1. Coarse Sand
2. Fine Sand
3. Stone aggregate
4. Stone for masonry work
5. Cement
6. Fly Ash
7. Reinforcement steel
8. Plywood & steel shuttering
9. Pipe scaffolding (cup lock system)
10. Bricks
11. Marble
12. P.V.C. conduit
13. MCBs/DBs
14. PVC overhead water tanks
15. Pave tiles
16. GI pipe
17. Waste water lines
18. S.W. sewer line up to main sewer
19. PVC rain water down take
20. Stainless steel sink in kitchen
21. Insulated glass on external facade with ACP
22. Joinery hardware

11.6 IMPACT ASSESSMENT

The Proposed Construction of 630 bedded "Lohia Medical College & Hospital" at District- Supaul, Bihar, would not have any major impact on the environmental parameters. During construction phase, source of pollution would also be fugitive dust emission due to vehicular movements & material handling, sewage and solid waste generation from the labour camp and generation of construction waste material. During the operation phase the source of pollution would be (i) Sewage generation; (ii) Waste (Non-hazardous) generation; and (iii) Noise generation from the DG sets. All these impacts will be controlled and prevented by adopting suitable technologies. The Pollution control and preventive measures are described in details in the subsequent section. There would not be any impact on the flora and fauna of the area. Also there would not be any effect on the surface drainage. Details of the Environmental Impacts due to the proposed project are described in details in the following section.

Impact on Air Quality of the areas

The Construction phase would have the following types of impacts on the air environment:

- i. Fugitive Dust Emission
- ii. Gaseous Emission

Sources of Fugitive Dust Emission, is due to movement of vehicle and land preparation activities, loading and un-loading of construction materials. The building material carrying vehicles as well as the construction machinery generate emissions and pollute the environment. Dusts include brick and silica dusts, and from earthmoving and other vehicle movements within the site. Construction machineries pose a special threat to air quality. Source of Gaseous emission during construction phase would be DG sets. The most cost-effective dust suppressant applied to mitigate airborne dust is water, because of its efficiency as well as ready availability. Water can be applied using handheld sprays and automatic sprinkler systems depending on the location. Thus, Fugitive dust will be controlled by sprinkling of water at the site. Apart from this adequate stack height of DG sets will also be maintained as per the CPCB norms.

During the operational phase, the Diesel Generator sets to be operated for back-up power supply are the major source of air pollution. The D.G. Set emission consist of following pollutants

1. Hydrocarbon+ NO_x
2. Carbon Monoxide (CO)
3. Particulate Matter (PM)
4. Smoke

If unchecked the emissions from D.G sets will increase the concentration of above-mentioned pollutants in the atmosphere. To mitigate the polluting effects of D.G. sets following mitigation measures will be taken,

- A. Use of High-speed Diesel as a fuel to run D.G. sets
- B. Provision of stack with height as prescribed by Central Pollution Control Board.
- C. Emission test of D.G. stacks every 6 months to check the concentration of pollutants.

Impact on Water Quality

The entire water requirement will be met from the municipal water supply.

During Construction Phase, the impact on water environment is in two ways:

- Use of water
- Release of waste water

Construction activities for the proposed project can have non-significant impact on the water environment

**Water Quality of the area
During Construction Phase****(i) Impacts**

During Construction Phase, the impact on water environment is in two ways:

- Use of water for construction activity
- Release of waste water

Construction activities for the proposed project can have non-significant impact on the water environment. Potential impacts on the ground water quality have been discussed as under:

i) Wastewater generation from Construction: The wastewater generation during construction phase will be from domestic consumption in camp office and labour camp. Mainly containing high suspended solids, in case these activities are undertaken during rainy season. The wastewater generation during construction will be treated through mobile STP.

ii) Wastewater generation from Site workshop: The repair and maintenance of construction equipments / transport vehicles, DG Sets, and washing of vehicles on- site may also generate wastewater containing oil and grease (though only in minimal quantities as normally these activities are not undertaken on-site). Under good construction practices, construction wastewater shall be collected in construction pits and reused in construction activities e.g. wastewater from stone cutting, cleaning, curing, etc. Thus, no significant impacts are expected on water quality in the project area due to generation of this wastewater.

During Operation Phase**(i) Impacts**

During this phase, two basic activities related to impacts on water environment are:

(ii) Procurement of water.

During operation phase, water would be drawn from municipal water supply.

During the operational phase, ~725 KLD waste water will be generated which will be treated in the in house ETP & STP. While developing the water system for the project, utmost care would be taken to maximize the recycle/ reuse of sewage and minimize wastewater quantity. Sewage would be generated which would be treated in the STP and treated water would be reused for horticultural, DG Cooling, HVAC Cooling and for flushing purposes.

Rain Water Harvesting (RWH) system would be developed which would help in augmenting ground water.

Impact on Noise Environment During Construction Phase

During the construction phase of the site, the main source of noise pollution would be Construction equipment, transportation activities, operation of DG sets and impact of noise due to work at night.

During Operation Phase

- During operational phase the following sources of noise pollution is expected:
- Diesel generator operations
- Increase in transport noise from within the site from nearby roads.
- During operational phase of the project, the major source of noise would be 6 DG sets of 3 x 1010 KVA, 2 x 750 KVA & 1 x 625 KVA and traffic activity in and around the project site.

Impact on Water Resource Waste water Impacts

During the construction phase, waste water generated from the construction labour camps would be connected to the septic tank. There would not be any significant impact as negligible quantities generated as majority of laborers would be deployed locally.

There would not be any significant impact during the construction as the sewage generated would be used as manure for landscaping and greenbelt development.

Impact on Land Environment

Due to the proposed project, there would not be any significant impact on the surrounding area. During construction process dust would be generated due to land developmental activities. Water sprinklers will be used for dust suppression.

Impacts due to Waste Disposal

During the construction phase, solid waste generated will include biomass from land clearing activities, waste from labour camp, construction and other waste. Impact from the construction waste may arise owing to the storage of dumping sites, increase in transportation and disposal cost and environmental deterioration.

11.7 ENVIRONMENT MANAGEMENT AND MONITORING PLAN

The Environmental Management and Monitoring Plan (EMMP) incorporate a series of measures and procedures for the long-term environmental management of the proposed project. EMMP is important from the point of view of ensuring that adequate resources are allocated for implementation of suggested abatement measures/strategies and to further

ensure continual compliance with the regulatory requirements and stipulated provisions of the SPCB and other local authorities.

GREEN BELT DEVELOPMENT

Implementation of plantation program or Green Belt development is of paramount importance for any development. In addition to augmenting green cover, it also checks soil erosion, makes the climate more conducive, restores water balance and makes the ecosystem more complex and functionally more stable. In the proposed project approx. 28% greenbelt would be provided. The green belt helps to arrest the fugitive emissions and to attenuate the noise generated in the plant, apart from improving the aesthetics of the plant premises. The main objective of development of green belt is to provide a barrier between the plant and the surrounding areas.

The green belt development would be based on the on the following principles:

- The plant should be fast growing
- It should have thick canopy cover
- It should be perennial and evergreen
- It should have large leaf area index
- It should be indigenous
- It should be efficient in absorbing pollutants without significant effects on plant growth

DISASTER MANAGEMENT PLAN

Impacts:

Impacts of risk and hazard are higher during construction phase. Impacts associated with the construction & operational phase of the project are as follows:

1. Handling, storage, use or spillage of hazardous materials
2. Explosions, spillages, fires etc. from storage, handling use or production.
3. Fall from height
4. Ignition Control

Mitigation Measures:

To reduce the occurrence of risk & hazard at the construction site following are mitigation measures suggested:

- Good House Keeping
- Proper storage and handling of hazardous materials like diesel, oil, paint, gas cylinder for welding and cutting
- Use of proper scaffolds, safety belt, with double hook, safety net etc.
- Proper gradient cutting/slope cutting where there is space constraint.
- Control of electrical ignition
- Providing proper training and education to staff
- Providing resident training and education.

OCCUPATIONAL SAFETY AND HEALTH

Occupational hazards due to the construction of the proposed project do not pose a major danger to the surrounding environment in general, and nor it has any significant impact on the health of the workers who are in the exposure during the construction period. The following precautionary measures have been proposed for safety at work keeping in view day-to-day occupational hazards encountered.

The following measures would be taken care of during the construction phase:

- Regular water sprinkling is being done for which water will be made available through tanker supplied by the water supplier.
- Project proponent will also take up Green belt development as per the site plan from the first day of its project activities
- All heavy equipment will be maintained in good conditions with preventive maintenance to minimize noise pollution.
- Ear plugs will be provided to workers wherever it would be necessary.
- Road network to the site is good. However, all possible care shall be taken of transportation vehicles and heavy equipment.
- Mostly Local work force will be used other than skilled labours (if not available locally)
- No natural ecology will be disturbed and all facilities will be provided by the project proponent
- The project proponent shall establish transportation and communication facilities of its own and will further strengthen through implementation of this project
- Health Care and medical support facilities will be provided by the project proponent and will be extended to the workers and villagers surrounding the proposed project site.

PROJECT BENEFITS

The main benefits from this project shall be in terms of reducing demand and supply gap of infrastructure sector. The proposed project has significant direct and indirect employment potential.

CONCLUSIONS

Based on the EIA study and prepared EIA Report for Proposed Construction of 630 bedded “Lohia Medical College & Hospital” at District- Supaul, Bihar it is concluded that the potential adverse environmental impacts associated during construction phase and operation phase of the project can be prevented and mitigated to an acceptable level by implementation of various preventive and control measures as suggested in various chapters of the EIA Report. The benefits of the project are much more significant than its environmental impacts.

12 DISCLOSURE OF CONSULTANTS

Declaration by Experts contributing proposed project "630 bedded "Lohia Medical College & Hospital" at District- Supaul, Bihar.

The one season baseline data used in the report was collected in post-monsoon (OCT-DEC) 2023 by our empanelled lab ETS for the Proposed Construction of 630 bedded "Lohia Medical College & Hospital" at District- Supaul, Bihar.

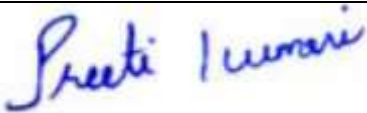
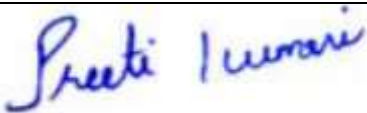
Brief profile of REPL is as given below

Director	 Mr. Muzaffar Ahmad
Name of the Consultant	Rian Enviro Pvt. Ltd., 202,
Address	Mangal Market, Sheikhpura, Patna -800014, Bihar

12.1 Personnel involved in the preparation of EIA/EMP report are stated below
Accreditation Certificate of the Consultant Engaged:

EIA coordinator:	Date
Name: Muzaffar Ahmad 	05-02-2024
Co- EIA coordinator	
Name- Bhuwan Bhaskar 	05-02-2024

Functional Area Experts:

S. No.	Functional Area	Name of the experts	Involvement Period and Task	Signature
1.	AP	Muzaffar Ahmad	Collected the ambient air data through secondary sources and suggested Air pollution control measures during both phases of project.	
2.	WP	Preeti Kumari	Estimating water requirements based on population, suggesting wastewater treatment / disposal schemes and developed the plan.	
3.	SW	Preeti Kumari	Inventory of Municipal Solid Waste, suggesting treatment options viz; organic waste convertor technology.	
4.	LU	Debarati Ghosh	Development of landuse maps of study area using GIS / related tools, site visit for ground reality survey, finalization of landuse maps, and contribution to EIA documentation.	
5.	Geo	Mohan Shriram Bhagwat	Collection of secondary data as well as drafting of report with respect to Geological Aspect.	
6.	HG		Collection of secondary data as well as drafting of report with respect to Hydro-geological condition	

S. No.	Functional Area	Name of the experts	Involvement Period and Task	Signature
			in around the study.	
7.	AQ	Sumit Verma	Collected the meteorological data and AAQ data through secondary sources and suggested air pollution control measures during both phase of project.	
8.	SC	Mrs. Nimisha Vatsyayan	Proposing the soil management practices during construction and operation phase of project.	
9.	EB	Neha Kumari	Generating the ground truthing ecological assessment with secondary data from different departments, earmarking rare and endangered species.	
10.	SE	Manish Kumar	Collected the primary and Secondary data, livestock inventory/ impacts, identified village-wise amenities/ needs.	
11.	RH	Kailash Nath Sharma	Identification of hazards materials, Fire accidents from Diesel storage and lethality damages, DMP and EPP for onsite & offsite were provided	
12.	NV (Team Member)	Bhuwan Bhaskar	Collected the ambient noise data through secondary sources and suggested Noise pollution control	

S. No.	Functional Area	Name of the experts	Involvement Period and Task	Signature
			measures during both phases of project	


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Certificate of Accreditation

Rian Enviro Private Limited (REPL)
202 & 402, Mangal Market, Sheikhpura, Raja Bazar, Patna, Bihar- 800 014

*The organization is accredited as **Category-A** under the QCI-NABET Scheme for Accreditation of EIA Consultant Organization, Version 3: for preparing EIA-EMP reports in the following Sectors –*

S. No	Sector Description	Sector (as per)		Cat.
		NABET	MoEFCC	
1	Mining of minerals (opencast only)	1	1 (a) (i)	A
2	Thermal power plants	4	1 (d)	B
3	Metallurgical industries - both primary & secondary	8	3 (a)	B
4	Cement Plants	9	3(b)	A
5	Synthetic organic chemicals industry	21	5 (f)	B
6	Distilleries	22	5 (g)	A
7	Bio-medical waste treatment facilities	32A	7 (da)	B
8	Highways	34	7 (f)	A
9	Building and construction projects	38	8 (a)	B
10	Townships and Area development projects	39	8 (b)	B

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in SAAC minutes dated May 16, 2023 posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in QCI-NABET's letter of accreditation bearing no. QCI/NABET/ENV/ACO/23/2793 dated July 07, 2023. The accreditation needs to be renewed before the expiry date by Rian Enviro Private Limited (REPL), Patna following due process of assessment.


Sr. Director, NABET
Dated: July 07, 2023

Certificate No.
NABET/EIA/2124/SA 0197

Valid up to
Sep. 11, 2024

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