Initial Draft Report

CUMULATIVE IMPACT ASSESSMENT OF MUGHALSARAI-LUDHIANA SECTION ON EASTERN DEDICATED FREIGHT CORRIDOR

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SUBMITTED TO:
DEDICATED FREIGHT CORRIDOR CORPORATION LTD. (DFCCIL)
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EXECUTIVE SUMMARY

DFCCIL under the World Bank financing is proposing to develop Dedicated Freight Corridors (DFC) along Eastern Dedicated Freight Corridor (EDFC) starting from Sahnewal (Ludhiyana) to Mugalsarai. This section is further divided into three phases namely EDFC-1 (393.85 kilometer from Bhaupur (Kanpur) to Khurja to Dadri), EDFC-2 (448.51 kilometer from Bhaupur to Mughalsarai) and EDFC-3(395.1 from Sahnewal (Ludhiana) to Khurja). In this context, DFCCIL intends to carry out Cumulative Impact Assessment (CIA) of Eastern Dedicated Freight Corridor (EDFC) from Mugal Sarai to Sahnewal (Ludhiyana) for: (a) analyzing the potential impacts and risks of proposed developments in the context of the potential effects of other human activities and natural environmental and social external drivers on the chosen Valued Environmental and Social Components (VECs) over time, and (b) proposing concrete measures to avoid, reduce, or mitigate such cumulative impacts and risk to the extent possible. DFCCIL has awarded M/s IRGSSA & M/s Abnaki Infrastructure Applications & Integrated Development Private Limited the task of carrying out Cumulative Impact Assessment (CIA) study. Consultants are submitting the Initial Draft Report since the startup of this assignment from 13th May 2015. **Project Inception Report &work plan was submitted to DFCCIL on 20th May 2015. As a next step, consultants were informed to submit Initial Draft Report . This report aims to describe the application of approach & methodology in one of the stretch so that it can demonstrate the achievement of objective described above as well as to identify the need for midway corrective action if required.**

The main objectives of this study include: assessment of the potential impacts and risks of a proposed andother developments over time on a chosen VEC; verification of the proposed development's cumulative social and environmental impacts and risks will not exceed a threshold that could compromise the sustainability or viability of selected VECs; Confirm that the proposed development's value and feasibility are not limited by cumulative social and environmental effects; Support the development of governance structures for making decisions and managing cumulative impacts at the appropriate geographic scale (e.g., airshed, river catchment, town, regional landscape); Ensure that the concerns of affected communities about the cumulative impacts of a proposed development are identified, documented, and addressed; and Manage potential reputation risks. Stepwise approach & methodology (A&M) include: Step 1: Identify VECs, and determine spatial and temporal Boundaries for CIA; Step 2: Identify other activities and developments affecting VECs; Step 3: Establish information on baseline status of VECs; Step 4: Assess cumulative impacts on VECs; Step 5: Assess significance of predicted cumulative impacts; Step 6: Management of cumulative impacts – design and implementation.

The proposed EDFC alignment from Sahnewal to Mughalsarai passes through Punjab, Haryana and Uttar Pradesh provinces. It runs all along the existing Indian Railway Track with certain detours. The entire stretches passes through plain terrain. The eastern corridor encompasses a double line electrified traction corridor from Sone Nagar on the East Central Railway to Khurja on the North Central Railway, Khurja to Dadri on NCR double line electrified corridor and single electrified line from Khurja to Ludhiana on Northern Railway. The project components include route (parallel & detour), gradient, standard of construction, formation, curves, track centres, bridges, road crossings, stations and additional land requirements. Baseline data has been collected from the EIA study reports of the various sections and sub-sections of the EDFC carried out in different time & seasons. Baseline compilation indicates the current status of VECs within the project study area, considered during EIA & SA of individual phase. These VECs have been identified as critical in some stretches. The inventory of these VECs partly provides basis for identifying VECs at cumulative assessment stage as well as for delineation of boundary for cumulative impact assessment (CIA).

Based on the baseline environmental status described in earlier section and the proposed project activities, potential impacts have been assessed and predicted. The impacts due to the development of the Eastern Dedicated Freight Corridor (EDFC 1, EDFC 2 &EDFC 3) have been assessed for the planning phase, construction phase and implementation phase. Impact analysis based on EIA& SA studies indicate that VECs impacted during construction and operation stage include air, water (surface & ground), soil, land, ecology & socioeconomics consisting of loss of land and community resources. All the above mentioned impacted VECs need to be assessed considering the other direct, indirect and induced activities and their zone of influence in the context of proposed development. Cumulative Impact Assessment (CIA) requires fixation of spatial and temporal boundaries in order to assess the impacts of direct, indirect and induced activities due to proposed project. In this study all the natural as well as manmade features have been taken into account and plotted spatially to delineate the boundary of the CIA. Therefore, buffer boundaries have been considered; i.e. 100 mtrs, 300 mtrs and 10 kms. The basis for delineating these three buffer boundaries are based on the EIA reports of EDFC (EDFC – 1, EDFC – 2 and EDFC – 3), IFC codes and the expert's consultation/ judgment.

Under the delineated boundaries, overlay mapping and GIS have been used for identifying the spatial distribution of VECs and hotspots. Based on the mapping method and as per IFC guidelines for Cumulative Impact Assessment and Management, **VECs have been classified** under: Physical features (Urban Agglomerations; Urban centers; Land Uses; Geology); Ecology (Wildlife Sanctuaries/ National Parks / Tiger Reserves / Bird Areas / Wetlands); Ecosystem services; Critically Polluted (air, water, soil & ground water quality); GHG emissions; Natural processes (e.g., water and nutrient cycles, microclimate); Social conditions (e.g., health, economics), or Water Bodies (Pools, wells, nalas, canals), Hospitals, Educational Institutes, Demography (R&R), Transport System; Cultural aspects; Religious / Archaeological sites. Using these sensitive receptors, the maps have been prepared for the entire stretch in strips of 50 to 75 kms for all the three parts i.e. EDFC 1, EDFC 2 & EDFC 3. Each stretch has been studied in strips to identify the **VECs and hotspots** have been identified and shown in **Figure 6.1, Figure 6.2 and Figure 6.3.**

In order to demonstrate the cumulative impacts of the EDFC alignment on the nearby areas and the existing VECs within the 10 kms boundary, a hotspot in a stretch of the EDFC has been taken as a case study for Initial Draft Report . The stretch identified for the case study is from Mirzapur to Mughal Sarai consisting of a major hotspot near Mughalsarai. This stretch is also important due to common interface of DFCCIL with NW1 and national highways and state highways. Based on the identification of the VECs, stakeholder's consultation is being carried out to confirm them as well as understand the planned overlapping interfaces. Further, the assessment of developmental works due to proposed project as well as other developmental works within the CIA boundary like railways & feeder route development, waterways, road/ highway networks, industrial area development and urbanization has been carried out. This will give insight into type and extent of impacts. An effort has been made to assess cumulative impacts on identified VECs against each identified development in the case study area. Impact assessment has been done partly on quantitative as well as qualitative basis. **The emerging scenario indicates that at a cumulative level, majority VECs are getting impacted due to indirect development like road and associated infrastructure development and induced development like urbanization. Currently, indicative mitigation measures have been recommended in the vicinity of the project area. A list of major stakeholders at national and state level has been prepared who will be implementing mitigation measures. Further, monitoring agencies have also been identified. Efforts are going on for strengthening the impact matrix using a combination of different interactive techniques, which will be described in draft final report. Further, all the five impact matrix tables (Table 8.1 to 8.6) will be combined to arrive at a holistic & cumulative view of the planned development at DFR stage.**

CHAPTER 1: INTRODUCTION & BACKGROUND

1.0 Introduction

The railway network connecting the four metros of Delhi, Mumbai, Kolkata and Chennai carries more than 55% of the freight and passenger traffic of Indian Railways (IR) and is known as 'Golden Quadrilateral' of IR. To cater the growing traffic needs of this corridor and ensure efficient transportation of freight, DFCCIL is proposing to develop Dedicated Freight Corridors (DFC) along this network. Dedicated Freight Corridor Corporation of India Ltd. (DFCCIL) has sought World Bank Loan assistance for Implementation of part of Eastern Dedicated Freight Corridor (EDFC) starting from Sahnewal (Ludhiyana) to Mugalsarai. This section is further divided into three phases namely EDFC-1 (393.85 kilometer from Bhaupur (Kanpur) to Khurja to Dadri), EDFC-2 (448.51 kilometer from Bhaupur to Mughalsarai) and EDFC-3(395.1 from Sahnewal (Ludhiana) to Khurja).

In this context, DFCCIL intends to carry out Cumulative Impact Assessment (CIA) of Eastern Dedicated Freight Corridor (EDFC) from Mugal Sarai to Sahnewal (Ludhiyana) for: (a) analyzing the potential impacts and risks of proposed developments in the context of the potential effects of other human activities and natural environmental and social external drivers on the chosen Valued Environmental and Social Components (VECs) over time, and (b) proposing concrete measures to avoid, reduce, or mitigate such cumulative impacts and risk to the extent possible. DFCCIL has awarded M/s IRGSSA & M/s Abnaki Infrastructure Applications & Integrated Development Private Limited the task of carrying out Cumulative Impact Assessment (CIA) study. Consultants are submitting the Initial Draft Report since the startup of this assignment from 13th May 2015.

1.1 Objectives

The main objectives of this study are as follows:

- Assess the potential impacts and risks of a proposed andother developments over timeon a chosen VEC;
- Verify that the proposed development's cumulative social and environmental impacts and risks will not exceed a threshold that could compromise the sustainability or viability of selected VECs;
- Confirm that the proposed development's value and feasibility are not limited by cumulative social and environmental effects;
- Support the development of governance structures for making decisions and managing cumulative impacts at the appropriate geographic scale (e.g., airshed, river catchment, town, regional landscape);
- Ensure that the concerns of affected communities about the cumulative impacts of a proposed development are identified, documented, and addressed; and
- Manage potential reputation risks

1.2 Study Area

The EDFC alignment from Sahnewal to Mughalsarai passes through Punjab, Haryana and Uttar Pradesh provinces. It runs all along the existing Indian Railway Track with certain dentures. The entire stretches passes through plain terrain. The location map of the EDFC project corridor and details overview of alignment is given in **Figure 1.1 and Table 1.**

Table 1: Details of EDFC project Alignment

Projects	Section	Length (km)	Number of Tracks	Approx. Cost (US$ m)
EDFC1	Bhaupur (Kanpur)-Khurja-Dadri	393..85	Double	1,453
EDFC2	Bhaupur (Kanpur)- Mughal Sarai	448.51	Double	1,670
EDFC3	Sahnewal (Ludhiana)-Khurja	395.1	Single	1,583
Program		1237.46		4,696

Source: RFP/ sub project EIAs

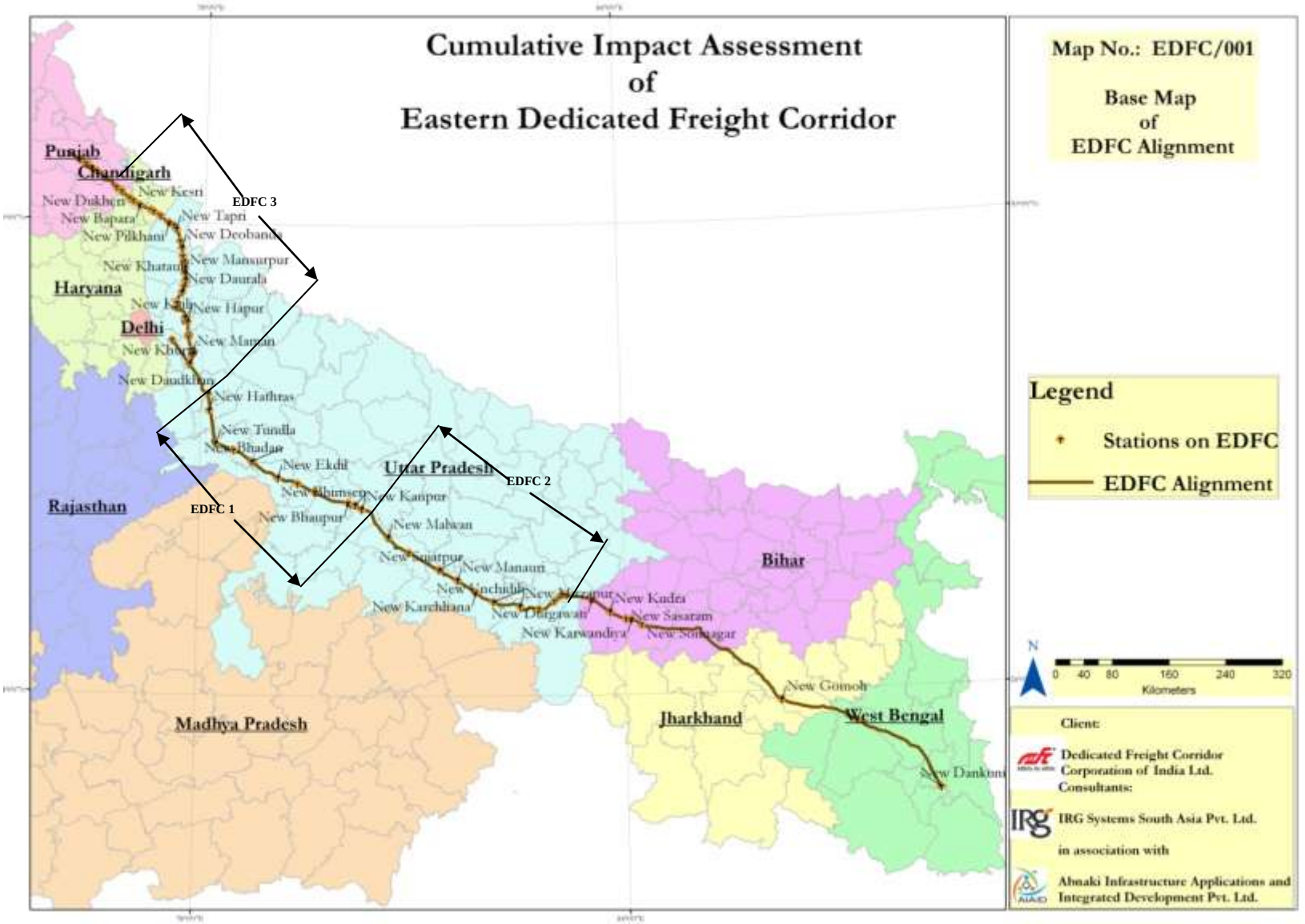

Figure 1.1: Location and Alignment of the Project

Source: IRGSSA

1.3 Approach & Methodology

Stepwise approach & methodology (A&M) is given below.

Step 1: Identify VECs, and determine spatial and temporal Boundaries for CIA
Step 2: Identify Other activities and developments affecting VECs
Step 3: Establish information on baseline status of VECs
Step 4: Assess cumulative impacts on VECs
Step 5: Assess significance of predicted cumulative impacts
Step 6: Management of cumulative impacts – design and implementation

The above step wise approach has been converted into activities and tasks as mentioned below & schematically shown in **Figure 1.2.**

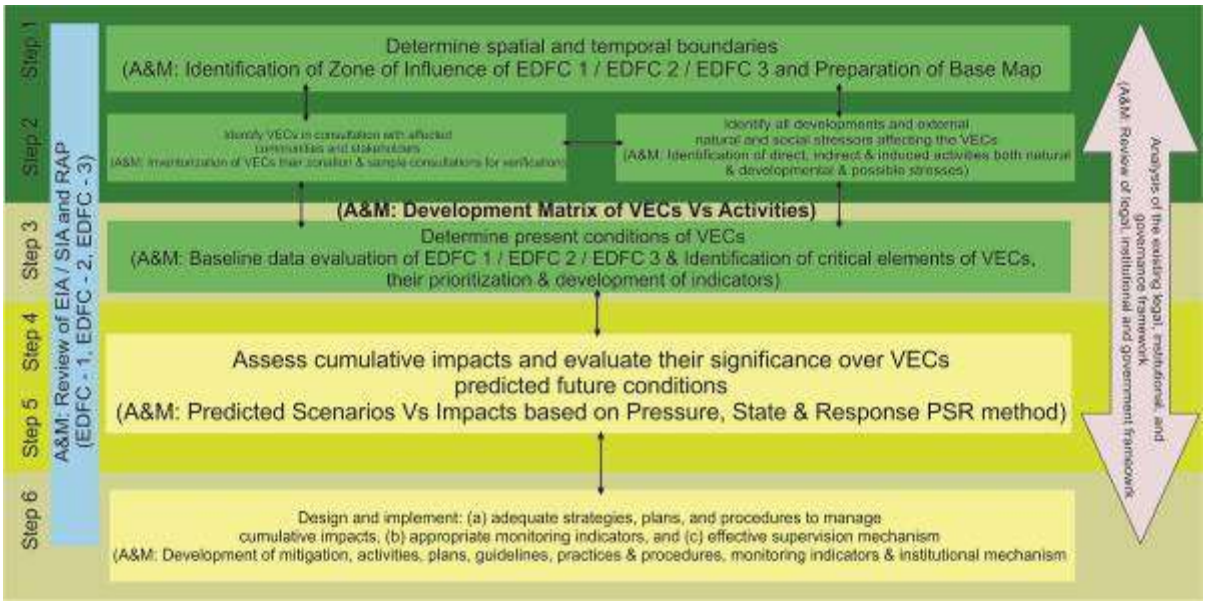

Figure 1.2: Schematic Representation of Proposed Approach & Methodology (A&M)

Activity 1: Scoping Phase I – VECs, Spatial and Temporal Boundaries

1. Identify the VECs to include in the CIA.
2. Identify the spatial boundaries of the CIA.
3. Identify the temporal extent of the CIA.

A&M: (1) Determine spatial and temporal boundaries (Identification of Zone of Influence of EDFC 1 / EDFC 2 / EDFC 3 and Preparation of Base Map) Identify VECs in consultation with affected communities and stakeholders (2) Inventorization of VECs their zonation & sample consultations for verification.

Activity 2: Other Activities and Environmental Drivers

1. Identify other existing and reasonably predictable projects and human activities that do/would affect the VECs to be included in the CIA;
2. Identify natural environmental drivers that also impact the condition of VECs identified in Step 1.

A&M: Identify all developments and external natural and social stressors affecting the VECs Identification of direct, indirect & induced activities both natural & developmental & possible stresses.

Activity 3: Establish Information on Baseline Status of VECs

1. Collect available information on the impacts of the other activities and natural drivers on the condition of the VEC;
2. Collect available information on VEC trends;
3. Collect any available information on regional thresholds for VECs (e.g. air pollution).

A&M: (1) Identify all developments and external natural and social stressors affecting the VECs Identification of direct, indirect & induced activities both natural & developmental & possible stresses (2) Development Matrix of VECs Vs Activities.

Activity 4: Assess Cumulative Impact on VECs

1. Establish indicators for expression of VEC condition. This may already be reflected in the information collected on VEC baseline status (in Step 3 above). If not, then indicators may need to be established that can be estimated from the baseline information;
2. Estimate the "future baseline" for condition of the VECs—i.e., the condition of VECs as affected by the other projects, human activities, and natural drivers; and Estimate the project impact on VEC condition. This estimation is done with the effects of planned project mitigation included; and
3. Estimate the cumulative impact on VECs—the total impact on the VECs when the impacts of the development are combined with the future baseline.

A&M: Baseline data evaluation of EDFC 1 / EDFC 2 / EDFC 3 & Identification of critical elements of VECs, their prioritization & development of indicators.

Activity 5: Assess Significance of Anticipated Cumulative Impacts

1. Assess the significance of the foreseen cumulative impacts on the VECs;

Activity 6: Management of Cumulative Impacts: Design and Implementation

1. Identify, when necessary, additional project mitigation (beyond that identified in the project ESIA) to reduce an estimated unacceptable cumulative impact on a VEC to an acceptable level. This should represent effective application of the mitigation hierarchy in environmental and social management of the specific project contributions to the expected cumulative impacts;
2. If necessary, identify the potential, or need for, additional mitigation of other

existing or reasonably predictable future projects;
3. Identify the potential for other regional strategies that could maintain VECs at acceptable conditions; and
4. Undertake best efforts to engage, enhance, and contribute to a multistakeholder collaborative approach for the implementation of management actions that are beyond the capacity of the project proponent.

A&M: (1) Assess cumulative impacts and evaluate their significance over VECs predicted future conditions (Predicted Scenarios Vs Impacts based on Pressure, State & Response PSR method). Design and implement: (a) adequate strategies, plans, and procedures to manage cumulative impacts, (b) appropriate monitoring indicators, and (c) effective supervision mechanism (2) Development of mitigation, activities, plans, guidelines, practices & procedures, monitoring indicators & institutional mechanism)

Activity 7: Stakeholder Engagement

1.4 Format of the Report

Project Inception Report &work plan was submitted to DFCCIL on 20th May 2015. As a next step, consultants were informed to submit Initial Draft Report . This report aims to describe the application of approach & methodology in one of the stretch so that it can demonstrate the achievement of objective described above as well as to identify the need for midway corrective action if required.

The Cumulative Impact Assessment (Initial Draft) report has been compiled in eight chapters. The table of contents of each chapter is given below.

Chapter 1 Introduction and Background: This chapter describes Introduction; Objective of the Study as per ToR; Study Area; Approach and Methodology.
Chapter 2 Project Description: This chapter describes components of EDFC 1, EDFC 2 & EDFC 3 in an integrated manner.
Chapter 3 Baseline: This chapter describes project baseline from EIA's of EDFC 1, EDFC 2 & EDFC 3 in an integrated manner.
Chapter 4 Environmental Impact Assessment: This chapter describes summary of EIA's of EDFC 1, EDFC 2 & EDFC 3 in an integrated manner.
Chapter 5 Delineation of CIA Boundary and VEC: This chapter describes fixation of CIA boundary & VECs. This chapter also describes example of a stretch analyzed for CIA, VEC impacts, management & mitigation measures.
Chapter 6 Other Development Proposals and Stakeholders: This chapter describes development proposals and stakeholders.
Chapter 7 Stakeholders Consultations: This chapter describes stakeholder consultation carried out so far.
Chapter 8 CIA Impact Assessment Mitigations Measures: This chapter describes impact matrix consisting of direct, indirect & induced impacts and mitigation measures.

CHAPTER 2: DESCRIPTION OF THE PROJECT

2.0 Introduction

This chapter presents the details of three phases, their project components and salient features, based on the detailed project report prepared by DFCCIL. At first, project description has been summarized. This is followed by summary of project components of sub projects i.e. EDFC 1, EDFC 2, EDFC 3.

2.1 Project Description

The Eastern Dedicated Freight Corridor (EDFC) is divided into three sub projects namly. EDFC-1 of 393.85 kilometer length from Bhaupur-Khurja-Dadri section, EDFC-2 of 448.51 kilometer length from Bhaupur to Mughalsarai section and EDFC-3 of 395.1 kilometer length from Sahnewal (Ludhiana) to Khurja Section.

The eastern corridor encompasses a double line electrified traction corridor from Sone Nagar on the East Central Railway to Khurja on the North Central Railway, Khurja to Dadri on NCR double line electrified corridor and single electrified line from Khurja to Ludhiana on Northern Railway.
For CIA study, section of EDFC from Mugalsarai to Khurja, Khurja to Dadri and Khurja to Ludhiyana have been considered. The total length of EDFC from Mugalsarai to Khurja, Khurja to Dadri and Khurja to Ludhiyana works out to 1237.46 Kms. The project map of Eastern Dedicated Freight Corridor (EDFC) is shown in Figure 2.1 and alignment map of EDFC is shown in Figure 1.2. The Salient features of each corridor are described in the following section.

DEDICATED FREIGHT CORRIDOR (EASTERN)

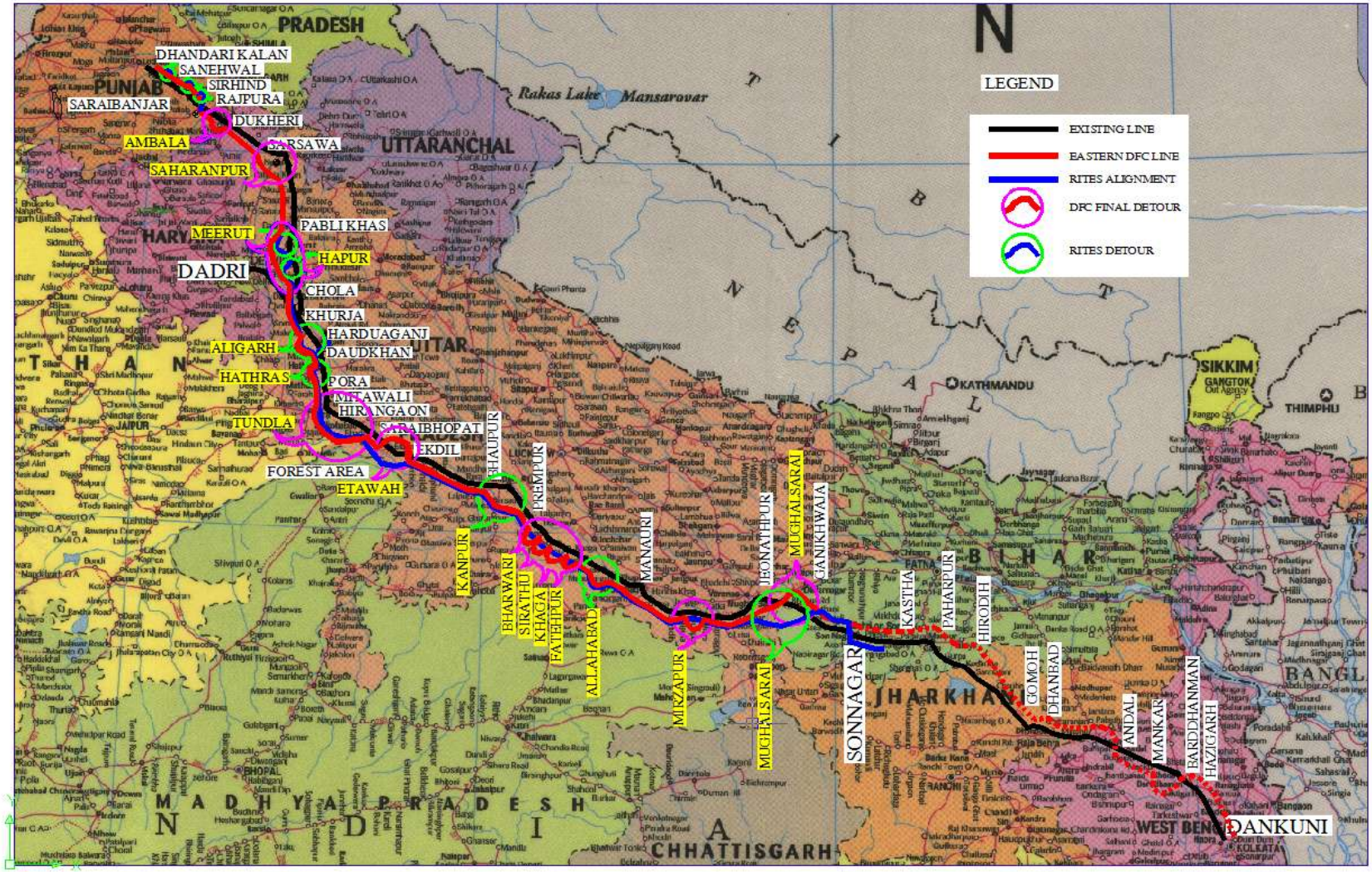

Figure 2.1: EDFC Project Map

2.1.1 EDFC-1: (Bhaupur-Khurja Section of EDFC)

EDFC-1 section, i.e. Bhaupur (Kanpur) to Khurja-Dadri is divided into three sub-sections, i.e. Khurja to Bhaupur, Kaurara to Chamrola and Khurja to Dadri for study purpose. Stretch from Bhaupur to Khurja (272 km) passes through eight districts of Uttar Pradesh i.e. Kanpur dehat, Auraiya, Etawah, Ferozabad, Hathras (Mahamaya Nagar), Agra, Aligarh and Bulandsehar. The project stretch from Kaurara to Chamraula (72.16 km) passes through two districts of Uttar Pradesh i.e. Agra and Ferozabad. The project stretch from Khurja to Dadari (49.69 km) passes through two districts of Uttar Pradesh i.e. Bullandshahar and Gautam Budh Nagar

Total length of the EDFC-1 Corridor is 393.85 Kms (Double line); out of which 120.83 Kms are in detour section & balance 273.02 Kms are in parallel to the existing North Central IR track. There are 6 junction stations and 5 crossing stations in this section. ROW width is considered majorly around 40 m in the parallel section and 60 m in detour. The alignment of Bhaupur-Khurja corridor of EDFC (EDFC-1) is shown in Figure 2.2 a, b & c.

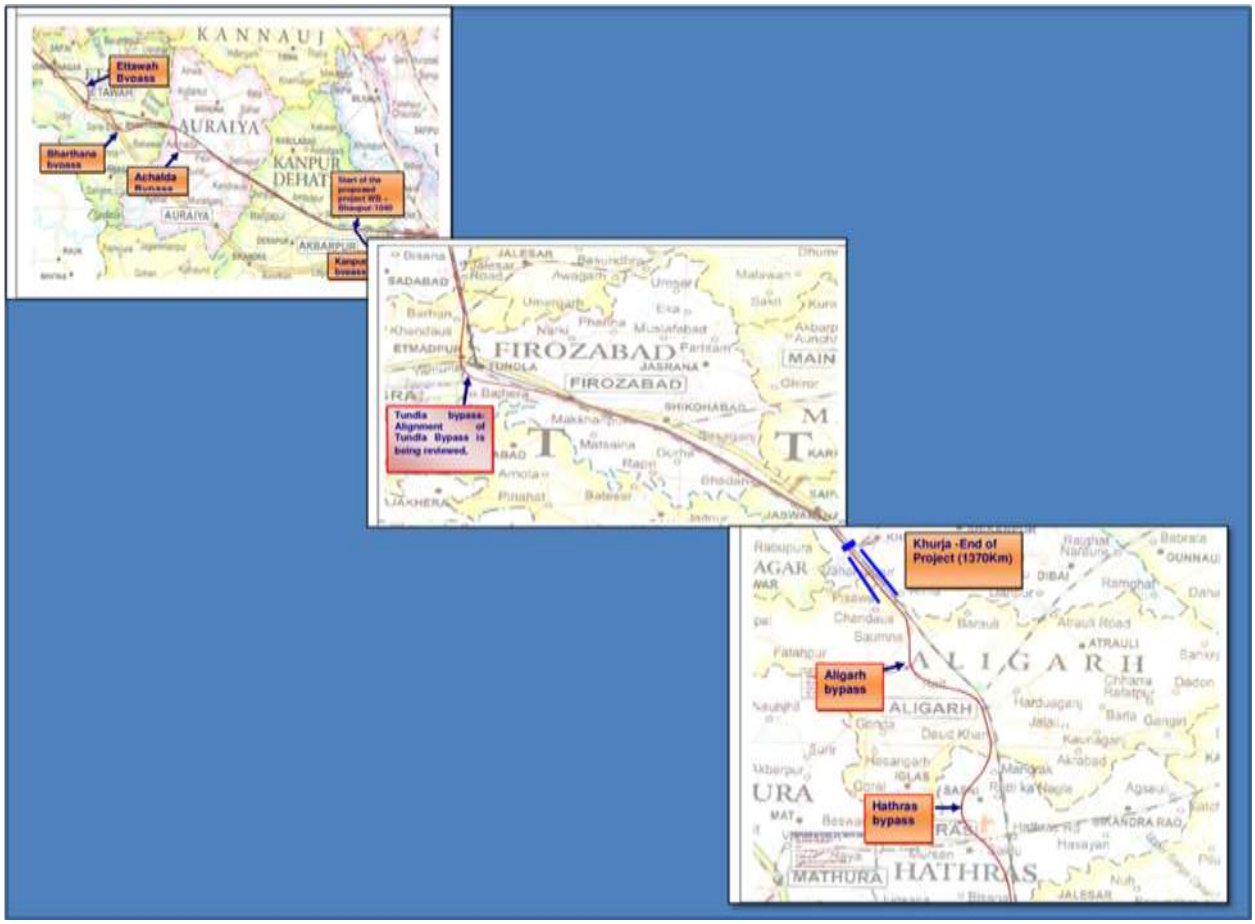

Figure 2.2 (a): Alignment of Bhaupur-Khurja Section of EDFC 1

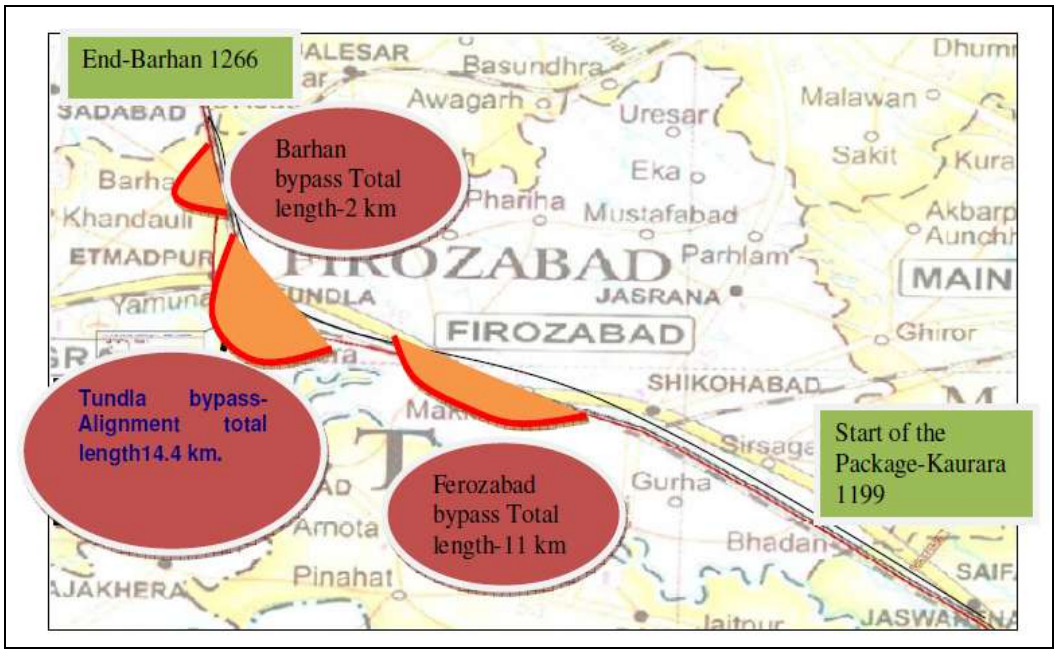

Figure 2.2 (b): Alignment of Kaurara to Chamrola Sub-Section

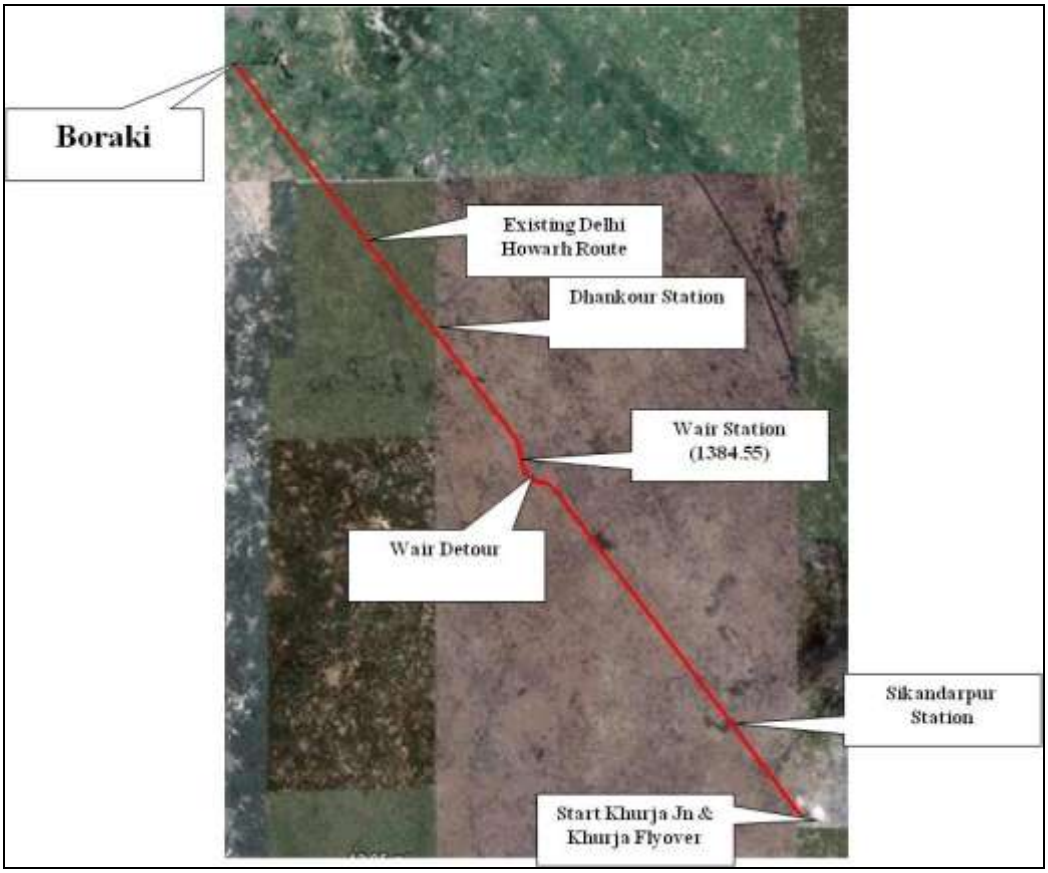

Figure 2.2 (c): Alignment of Khurja to Dadri Sub-Section

2.1.2 EDFC-2 (Kanpur- Mughal Sarai section of EDFC)

The entire stretch from Bhaupur to Mugalsarai passes through nine districts of Uttar Pradesh i.e. Kanpur Dehat, Kanpur Sadar, Fathepur, Kaushambi , Allahabad, Mirzapur and Chanduli. Total length of the Mughalsarai-Bhaupur Corridor is 448.51 Kms (Double line); out of which 191.41 Kms are in detour section & balance 257.1 Kms are in parallel to the existing North Central Railway track. ROW width is around 20-40 m in the parallel section and 40-60 m in detour. The alignment of Kanpur- Mughal Sarai corridor of EDFC is shown in Figure 2.3.

Figure 2.3: Alignment of Kanpur- Mughal Sarai section of EDFC 2

2.1.3 EDFC-3 (Ludhiana- Khurja-Dadri Section of EDFC)

EDFC-3 corridor, i.e. from Khurja to Sahnewal (395.1 km) is divided into two sub-sections, i.e. Khurja to Pilkhani (220.710 km) and Pilkhani to Sahnewal (175.0 km) for study purpose. The stretch from Khurja to Pilkhani passes through six districts of Uttar Pradesh i.e. Bulandshahr, Ghaziabad, Hapur, Meerut, Muzaffarnagar and Saharanpur. The entire stretch from Pilkhani (Uttar Pradesh) to Sahnewal (Ludhiana) passes through six districts namely Saharanpur (Uttar Pradesh), Yamunanagar, Ambala (Haryana), Fatehgarh Sahib, Patiala and Ludhiana (Punjab).

Out of total length of 395.1 kms, 123.305 kms is under detour and remaining 271.795 kms is parallel to existing IR track. The alignment of Ludhiana- Khurja corridor of EDFC is shown in Figure 2.4 a&b.

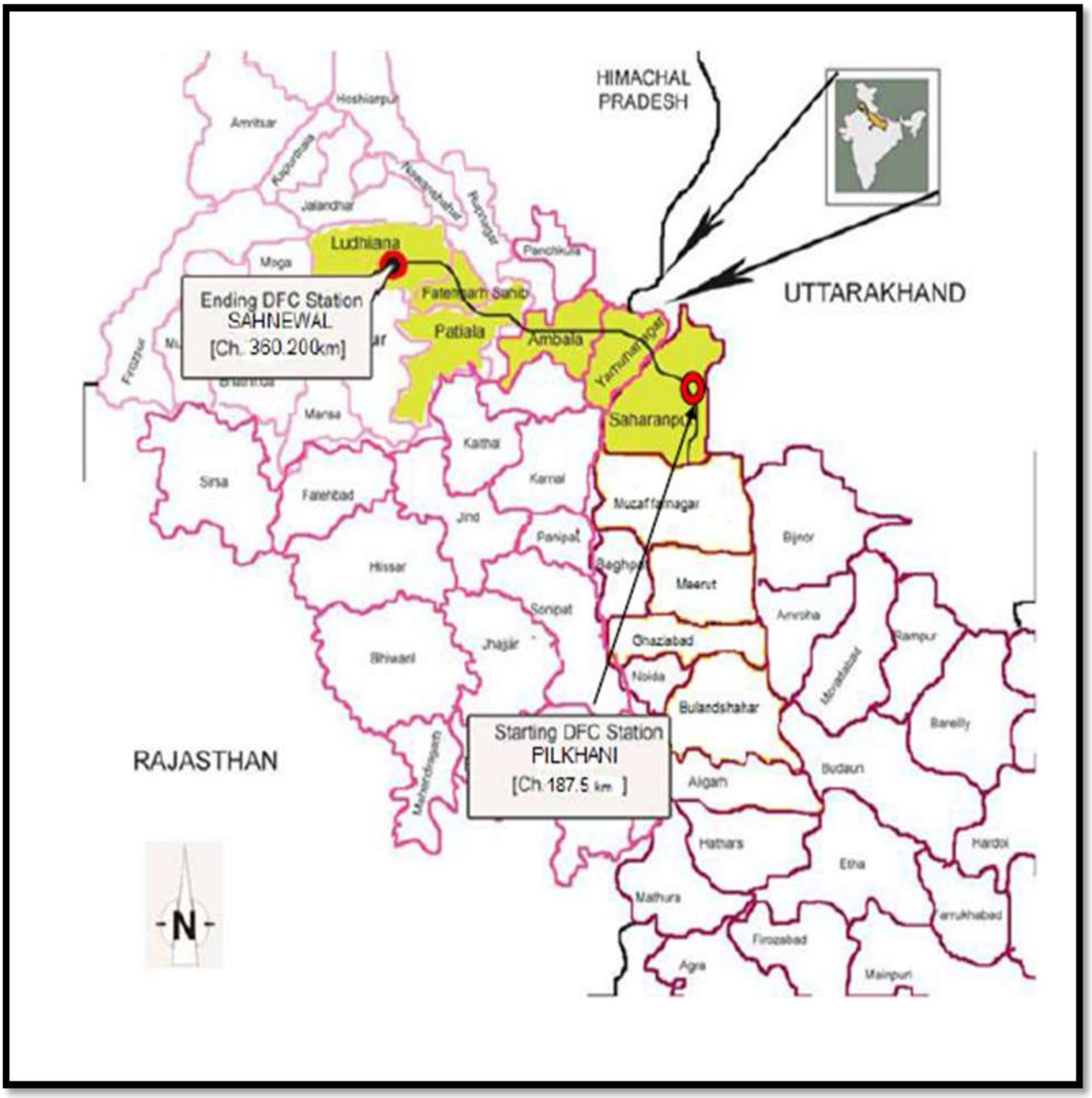

Figure 2.4 (a): Alignment of Sanehwal (Ludhiana) -Pilkhani Corridor of EDFC 3

Figure 2.4 (b): Alignment of Khurja-Pilkhani Corridor of EDFC 3

2.2 Components of the Project

Salient features of the project (EDFC 1, EDFC 2 & EDFC 3) describing project components have been summarized in Table 2.1. These project components include route (parallel & detour), gradient, standard of construction, formation, curves, track centres, bridges, road crossings, stations and additional land requirements.

Table 2.1: Salient Features of EDFC Project

Sl. No.	Description	Details						
		EDFC-2 Mugalsarai to Bhaupur		EDFC-1 (Bhaupur to Khurja)			EDFC-3 (Khurja to Sahnewal)	
		Bhaupur-Prempur	Premur-Karchana-Mugalsarai	Bhaupur to Khurja	Detour Kaurara to Chamrola	Khurja to Dadri	Khurja to Pilkhani	Pilkhani to Sahnewal
1	**Route Length (km)**	56.51	392	272	72.16[1]	49.69 km, say 50 km	220.710	175
2	**Parallel (km)**	8.50	249	194	42.6	36.42 km	110.195	162.21
3	**Detour (km)**	48.41	143	78	29.56	13.27 km	110.515 (+0.2) Excludes Khurja Flyover	12.79
4	**No. of Detour**	1	7	5	3	1	2	3
5	**Gradient**							
a	Ruling Gradient	1 in 200 (Compensated)	1 in 200 (Compensated)	1 in 200 (compensated)	1 in 200 (Compensated)	1 in 200 (Compensated)	1 in 200 (Compensated)	1 in 200 (Compensated)
b	Steepest Gradient in yards	1 in 1200, 1 in 400 in exceptional cases	1 in 1200, 1 in 400 in exceptional cases	Normally 1 in 1200, 1 in 400 in exceptional cases	1 in 1200, 1 in 400 in exceptional cases	1 in 1200, 1 in 400 in exceptional cases	1 in 1200 (1 in 400 in Exceptional cases)	1 in 1200 (1 in 400 in Exceptional Cases)
6	**Standard of Construction**							
a	Gauge	1676 mm	1676 mm	1676 mm	1676 mm	1676 mm	1676 mm	1676 mm
b	Rails	60 Kg 90 UTS rails	60 Kg 90 UTS rails	60 Kg 90 UTS rails	60 Kg 90 UTS rails	60 Kg 90 UTS rails	60 Kg 90 UTS rails	60 Kg 90 UTS rails
c	Sleeper	PSC, 1660 Nos./km for main line &	PSC, 1660 Nos./km for main line & 1540 Nos./km for loop	PSC, 1660 No./km for main line &	PSC, 1660 Nos./km for main line &	PSC, 1660 Nos./km for main line & 1540	PSC, 1660 Nos./km for main line & 1540	PSC, 1660 Nos./km for main line & 1540 Nos./km for loop line &

[1] 55 kms stretch out of 72.6v Km falls under Taz Trapezium Zone (TTZ). TTZ is defined for the protection of TAZ protected monument. There are restriction for certain emissions in this zone.

Sl. No.	Description	Details						
		EDFC-2 Mugalsarai to Bhaupur		EDFC-1 (Bhaupur to Khurja)			EDFC-3 (Khurja to Sahnewal)	
		Bhaupur-Prempur	Premur-Karchana-Mugalsarai	Bhaupur to Khurja	Detour Kaurara to Chamrola	Khurja to Dadri	Khurja to Pilkhani	Pilkhani to Sahnewal
		1540 Nos./km for loop line & sidings	line & sidings	1540 Nos./km for loop line & sidings	1540 Nos./km for loop line & sidings	Nos./km for loop line & sidings	Nos./km for loop line & sidings	sidings
d	Points & Crossings	60 kg rail, 1 in 12 curved switches with CMS crossings on Fan shaped PSC sleepers layouts.	60 kg rail, 1 in 12 curved switches with CMS crossings on Fan shaped PSC sleepers layouts.	60 kg rail, 1 in 12 with CMS crossing on PSC Sleepers Layouts.	60 kg rail, 1 in 12 curved switches with CMS crossings on Fan shaped PSC sleepers layouts	60 kg rail, 1 in 12 curved switches with CMS crossings on Fan shaped PSC sleepers layouts	60 kg rail, 1 in 12 curved switches with CMS crossings on Fan shaped PSC sleepers layouts.	60 kg rail, 1 in 12 curved switches with CMS crossings on Fan shaped PSC sleepers layouts.
e	Ballast	300 mm cushion	300 mm cushion	300 mm cushion	300 mm cushion	300 mm cushion	350 machine crushed	300 mm Machine crushed
f	Design Speeds	100 kmph	100 kmph	100 kmph	100 kmph	100 kmph	100 kmph	100 kmph
g	Design Axle load	Freight Traffic with 32.5 tonne axle load	Freight Traffic with 32.5 tone axle load	Freight Traffic with 32.5 tone axle load	Freight Traffic with 32.5 tone axle load	Freight Traffic with 32.5 tone axle load	Freight Traffic with 32.5 tone axle load	Freight Traffic with 25 tonnes axle load on formation of 32.5 tonnes
7	**Formation**							
a	Bank width for Single line	13.5m.	13.5 m.	13.5 m	13.5 m	13.5 m	7.6m.	8.10 m.
b	Slop on Embankment	2H:1V	2H:1V	2H:1V	2H:1V	2H:1V	2H:1V	2H:1V
c	Cutting width for Single line	19.25 m	19.25 m	19.25 m	19.25 m	19.25 m	7.5 m	7.5 m (Excluding side drains)
d	Earthwork	C.B.R. > 5	C.B.R.>5	C.B.R.>5	C.B.R.>5	C.B.R.>5	C.B.R. > 5	C.B.R. > 5
e	Earthwork for	C.B.R. > 8	C.B.R.>8	C.B.R.>8	C.B.R.>8	C.B.R.>8	C.B.R. > 8	C.B.R. > 8

Sl. No.	Description	Details						
		EDFC-2 Mugalsarai to Bhaupur		EDFC-1 (Bhaupur to Khurja)			EDFC-3 (Khurja to Sahnewal)	
		Bhaupur-Prempur	**Premur-Karchana-Mugalsarai**	**Bhaupur to Khurja**	**Detour Kaurara to Chamrola**	**Khurja to Dadri**	**Khurja to Pilkhani**	**Pilkhani to Sahnewal**
	Top 1m.							
f	Slope of cutting (ordinary Soil)	1 : 1	1 : 1	1 : 1	1 : 1	1 : 1	1 : 1	1 : 1
g	Blanketing thickness	0.60 m	0.60 m	0.60 m	0.60 m	0.60 m	60 cm	60 cm
8	**Curves**							
a	Maximum degree of curvature	2.5 degree	2.5 degree	2.5 degree	2.5 degree	2.0 dregree	2.5 degree	2.5 degree
b	Grade compensation on curves	at the rate of 0.04 % per degree of curvature	at the rate of 0.04 % per degree of curvature	at the rate of 0.04 % per degree of curvature	at the rate of 0.04 % per degree of curvature	at the rate of 0.04 % per degree of curvature	at the rate of 0.04 % per degree of curvature	at the rate of 0.04 % per degree of curvature
9	**Track Centres (Minimum)**							
A	Between Two Tracks of DFC	6 m	6 m	6 m	6 m	6 m	6 m	6 m & 6.25 m
b	Between Existing track and DFC	15.0 m	13-15.0 m (Minimum 7 m at thickly populated locations to avoid displacement of inhabitants)	13 to 15 m normally 13-15m but places including yard it is less than 6m due to space constraints	13 to 15 m	13-15 m	12-33 m	6.0 m minimum and 7.925 m recommended and in general.
10	**Bridges**							
a	Standard of Loading	32.5 tone axle load, 15	32.5 tone axle load	32.5 tonnes axle load,15	32.5 tonne axle load, 15	32.5 tonne axle load, 15	32.5 tonne axle load, 15	25 tonnes axle load on formation of 32.5

Sl. No.	Description	Details						
		EDFC-2 Mugalsarai to Bhaupur		EDFC-1 (Bhaupur to Khurja)			EDFC-3 (Khurja to Sahnewal)	
		Bhaupur-Prempur	**Premur-Karchana-Mugalsarai**	**Bhaupur to Khurja**	**Detour Kaurara to Chamrola**	**Khurja to Dadri**	**Khurja to Pilkhani**	**Pilkhani to Sahnewal**
		tone/m trailing load (DFC Loading)		tonnes/m trailing load(DFC loading)	tonnes/m trailing load (DFC Loading)	tonnes/m trailing load (DFC Loading)	tonnes/m trailing load (DFC Loading)	tonnes, 15 tonnes/m trailing load (DFC Loading)
b	Number of Important Bridges	Nil	2	Nil	Nil	Nil	Nil	4
c	Number of Major Bridges	4	53	5	5	4	42	44
d	Number of RUBs	2- major 40-minor	89	4- major 82-minor	1- major 35-minor	15	407	27
f	Number of Minor Bridges	50	321	197	32	49	295	133
g	Number of Rail Flyovers	1	3	6	1	Nil	4	4
h	No. of ROBs	Nil	2	Nil	Nil	Nil	Nil	50
11	**Road Crossings**							
a	Number of level crossings	2	72	74	19	18	58	77
12	**Stations**							
a	Junction Stations	3	4	3	2	1	0	5
b	Crossing Stations	-	8	4	1	0	21	14
13	**Additional Land required**	249 hectares	1151 ha (includes 0.998 Ha. forest land)	1182 ha	258.87 ha.	211.67 ha	829.08 ha.	355.34 ha.

The construction material (ballast) is sourced from licensed quarries in the nearby region and earth for formation is sourced from local areas following predefined borrow earth management plan and with due permission from regulatory authorities concerned.

2.3 Applicable Legislation and World Bank Operational Policies

There are four World Bank operational policies applicable to EDFC Ludhiana to Mugalsarai corridor. These are listed at Table 2.2 Required mitigation measures have been incorporated in project design/Environmental management plans.

Table 2.2: Salient World Bank Safeguard Policies

Sl. No.	Safeguard Policy	Subject Category	Triggered	Triggered By	Mitigation Measures
1.	OP 4.01	Environment Assessment	Yes	Sensitive areas and impacts on environmental and social components	Mitigation measures incorporated
2.	OP 4.04	Natural Habitats	Yes	Protected forests issues	Incorporated
3.	OP 4.11	Physical Cultural Resources	Yes	Risk to cultural properties	Adequate mitigation measures if affected
4.	OP 4.36	Forestry	Yes	Diversion of protected forest land	To be carried out as per Forest (conservation) Act, 1980

India has well defined environmental and social legislation framework. Applicability of these regulations depends on nature of project and activities. The summary of various Laws and Regulation applicable to EDFC project is summarized at Table 2.3.

Table 2.3: Summary of Clearances & NOCs

Sl. No	Act/Rules and Type of clearance	Purpose and Type of clearance	Applicability	Project stage
1	Environment Protection Act-1986	To protect and improve overall environment, Prior Environmental Clearance, Environment Clearance for opening new	applicable	Pre construction

Sl. No	Act/Rules and Type of clearance	Purpose and Type of clearance	Applicability	Project stage
		quarries and borrow areas, NOC for water extraction for construction and allied works		
2	Ancient Monuments and Archaeological Sites and Remains(Amendment & Validation Act , 2010	Conservation of cultural and historical remains found in India , Permission for Activities near archaeological protected area	Not applicable	Pre construction
3	Wild Life Protection Act under	Protection of Wild Life Clearance for working / diversion of sanctuary land	Not applicable	Pre construction
4	The Forest (Conservation) Act 1927 The Forest (Conservation) Act. 1980 The Forest (conversion) Rules 1981	To check deforestation by restricting conversion of forested areas into non- forested areas Forest Clearance	Diversion of Protected Forest land	Pre construction
5	MoEFCC circular (1998) on linear Plantation on roadside, canals and railway lines modifying the applicability of provisions of forest (Conversation) Act, to linear Plantation	Protection / planting roadside strip as avenue/strip plantations as these are declared protected forest areas. Tree felling permission	Applicable for Felling of trees	Pre construction

Sl. No	Act/Rules and Type of clearance	Purpose and Type of clearance	Applicability	Project stage
6	Air (Prevention and Control of Pollution) Act, 1981 and Noise Pollution (Regulation and Control Act), 2000 Under Air ,	To control air pollution by specifying the emission standards NOC And Consents for setting up air polluting plants Control of Ambient noise levels through adherence of prescribed day and night standards	Applicable , For operating Hot mix plants, Crushers and batching plants Provision of acoustics enclosures. For DG sets and other noise sources	Construction (Prior to work initiation)
7	Water Prevention and Control of Pollution) Act, 1974	To control water pollution by controlling discharge of pollutants as per the prescribed standards	Applicable For discharge of effluents from construction sites and workshop	Construction (Prior to work initiation)
8	Hazardous waste (Management, Handling & Transboundry) Rules, 2008	Management and storage of hazardous waste. Permission to store Hazardous Materials	Applicable For storage and Transportation Of Hazardous Materials (Like waste oils) and Explosives	Construction (Prior to work initiation)
9	Explosive Act 1984 & the Explosives Rules, 2008	Safe transportation, storage and use of explosive material Explosive license	Applicable Storage of explosive materials(Diesel Fuel)	Construction (Prior to work initiation)

Sl. No	Act/Rules and Type of clearance	Purpose and Type of clearance	Applicability	Project stage
10	Central Motor Vehicle Act 1988 and Central Motor Vehicle Rules1989 & Amendment Rules, 1999	To check vehicular air and noise pollution PUC certificate for use of vehicles for construction	Applicable For all construction vehicles	Construction (Prior to work initiation)
11	Minor Mineral and concession Rules	For opening new quarry or borrow areas Permission for opening new Quarry lease deeds and license	Applicable for Quarrying and borrowing operations	Construction (Prior to work initiation)

2.4 Conclusion

Project component details summarized above give information about basic design & engineering features which have been envisaged for three phases (EDFC 1, EDFC 2 & EDFC 3). These details further provide rationale for baseline description and environmental & social impact assessment carried out earlier at project level and summarized in Chapter 3 & Chapter 4.

CHAPTER 3: CUMULATIVE BASELINE STUDY

3.0 Introduction

The environmental status around the proposed project site is described for valued environmental resources/components (VECs) viz., air, water, land, noise, soil, and ecology and socio-economic along the proposed alignment within study area of 5 Km and core area of 100 meters either side of the corridor. This information has been compiled and integrated based on the EIA reports of EDFC 1, EDFC 2 and EDFC 3. The baseline provides the basis for integrated assessment of impact (likely changes in the baseline conditions) due to the proposed interventions.

3.1 Site Descriptions and Its Environs

Eastern dedicated freight corridor starts from Sanhewal (Ludhiyana) and ends at Dankuni. The current project includes the EDFC section from Sanehwal to Mugalsarai only. Total length of the corridor from Sanehwal to Mugalsarai is 1237.46 kms. Out of the 1237.46 kms, 802.705 kms is parallel to existing IR track and 434.755 kms is detour. Detours are planned to minimize disturbance due to project in busy towns and cities. Map showing the EDFC alignment is given below in **Figure 1.2**. EDFC section from Sanehwal to Mugalsarai is divided into three major sections, i.e. EDFC-3 (from Sanehwal to Khurja), EDFC-1 (khurja to Bhaupur) and EDFC-2 Bhaupur to Mugalsarai. These sections are further sub-divided into sub-sections further for study purpose.

EDFC-1 section (Bhaupur to Khurja): It is subdivided into Khurja to Bhaupur, Karora to Chamrola and Khurja to Dadri. Khurja to Dadri is connecting link between western and eastern dedicated freight corridor

- Sub-section Bhaupur to Khurja passes through eight districts of Uttar Pradesh i.e. Kanpur dehat, Auraiya, Etawah, Ferozabad, Hathras (Mahamaya Nagar), Agra, Aligarh and Bulandsehar
- The project stretch from Kaurara to Chamraula passes through two districts of Uttar Pradesh i.e. Agra and Ferozabad
- The project stretch from Khurja to Dadari passess through two districts of Uttar Pradesh i.e. Bullandshahar and Gautam Budh Nagar

EDFC-2 section (Bhaupur to Mugalsarai): The entire stretch from Bhaupur to Mugalsarai passes through nine districts of Uttar Pradesh i.e. Kanpur Dehat, Kanpur Sadar, Fathepur, Kaushambi , Allahabad, Mirzapur and Chanduli.

EDFC-3 section (Sanehwal to Khurja): It is sub-divided into Sanehwal to Pilkhani and Pilkhani to Khurja for study purpose

- The stretch from Khurja To Pilkhani passes through six districts of Uttar Pradesh i.e. Bulandshahr, Ghaziabad, Hapur, Meerut, Muzaffarnagar and Saharanpur.
- The entire stretch from Pilkhani (Uttar Pradesh) to Sahnewal (Ludhiana) passes through six districts namely Saharanpur (Uttar Pradesh), Yamunanagar, Ambala (Haryana), Fatehgarh Sahib, Patiala and Ludhiana (Punjab)

3.2 Baseline Data

Baseline data has been collected for the present report from the EIA study reports of the various sections and sub-sections of the EDFC carried out in different time & seasons. Data on environmental and social attributes is given in sections below.

3.2.1 Meteorology

EDFC corridor from Sanhewal to Mugalsarai extends upto approximately 1238 kms. Corridors pass majorly through state of Uttar Pradesh, 2 districts of Haryana and 3 districts of Punjab. Entire corridor presents sub-tropical climatic characteristics; however, variations exist due to the difference in altitudes between various locations.

The climate of Uttar Pradesh (U.P.) is primarily defined as humid subtropical with dry winter (cwa) type with parts of Eastern U.P. as semi-arid (BS) type. Alternatively, some authors refer to it as tropical monsoon. Variations do exist in different parts of the large state, however the uniformity of the vast Indo-Gangetic Plain forming bulk of the state gives a predominantly single climatic pattern to the state with minor regional variations. U.P. has a climate of extremes. With temperatures fluctuating anywhere from 0 °C to 50 °C in several parts of the state and cyclical droughts and floods due to unpredictable rains, the summers are extremely hot, winters cold and rainy season can be either very wet or very dry. Meteorology of the area passing through the state of Uttar Pradesh is taken from IMD and is given below in **Table 3.1.**

Table 3.1: Meteorology Data from Nearest IMD stations for Project Area Passing Through State of Uttar Pradesh2

Stations/Climatic factors	Allahabad	Kanpur	Agra	Aligarh	Delhi	Meerut	Roorkee
Mean Daily Max Temp (^{0}C)	32.6	32.1	32.6	31.4	31.3	31.4	30.4
Mean Highest Temp (^{0}C)	45.9	42.6	46.4	44.2	43.8	44.0	43.9
Hottest Month	May	May & June	June	June	June	May & June	May & June
Mean Daily Min Temp (^{0}C)	19.6	19.0	19.2	18.2	18.8	17.3	16.3
Mean Lowest Temp (^{0}C)	3.9	3.2	3.5	3.8	4.0	3.1	2.1
Coldest Month	January	January	January	January	January	January	January
Annual Rainfall (mm)	976.1	802.1	731.5	762.6	799.5	893.0	996.4
Month for maximum rainfall	July	August	August	August	August	August	August

[2] These data are taken from IMD and not from existing EIA reports as data presented in EIA reports pertains to different seasons.

Stations/Climatic factors	Allahabad	Kanpur	Agra	Aligarh	Delhi	Meerut	Roorkee
(mm)							
Relative Humidity (%)	19-84%	26-86%	42-81%	25-79%	22-75%	43-84%	27-85%
Atmospheric pressure (hPa)	984.3-1006.6	990.2 - 1003.2	977.2-997.9	974.7-996.3	971.6-992.8	974.3-992.2	966.0-986.1
Wind speed (km/hr)	2.5-8.5	4.7-20.7	2.1-4.8	4.8-8.2	7.4-10.8	5.0-8.0	4.1-22.4
Wind direction	West	West	NW followed by SW	West	West	West	NW followed by SE

Source: Climatologically Normal 1961-1990, IMD

The climate of Haryana is similar to other states of India lying in the northern plains. It is extremely hot in summer, around 45 °C (113 °F) and mild in winters. The hottest months are May and June and the coldest being December and January. Rainfall is varied, with the Shivalik region being the wettest and the Aravali Hills region being the driest. About 80% of the rainfall occurs in the monsoon season (July–September) and sometimes causes local flooding. Meteorology of the area passing through the state of Haryana is given in **Table 3.2.**

Table 3.2: Meteorology Data from Nearest IMD stations for Project Area Passing Through State of Haryana

Stations/Climatic factors	Yamunanagar	Ambala
Mean Daily Max Temp (^{0}C)	31.4	30.5
Mean Highest Temp (^{0}C)	48.8	43.8
Hottest Month	May & June	June
Mean Daily Min Temp (^{0}C)	19.2	17.4
Mean Lowest Temp (^{0}C)	6.8	2.8
Coldest Month	January	January
Annual Rainfall (mm)	1107	955.5
Month for maximum rainfall (mm)	July	July
Relative Humidity (%)	23-79%	27-83%
Atmospheric pressure (hPa)	968.2-991.2	965.1-985.4
Wind speed (km/hr)	4.4-7.6	5.0-8.0
Wind direction	SE followed by NW	SE followed by NW

Source: Climatologically Normal 1961-1990, IMD

Climate of Punjab is tropical, semi arid, hot and subtropical monsoon type with cold winter and hot summer. State experience four seasons Cold Season from November to March, hot season from April to June, Monsoon season from last week of June to the first week of September and post monsoon or transition season from Sept till beginning of November. Hot season i.e April to June weather is relatively dry and uncomfortable. June is the hottest month with mean maximum temperature of 41 °C. January is the coldest month with mean minimum temperature of 5.5 °C. The relative humidity is generally high through the year except during months of April to June. Meteorology of the area passing through the state of Punjab is given at **Table 3.3.**

Table 3.3: Meteorology Data from Nearest IMD stations for Project Area Passing Through State of Punjab

Stations/Climatic factors	Ludhiana	Patiala
Mean Daily Max Temp (^{0}C)	29.8	30.3
Mean Highest Temp (^{0}C)	44.6	44.2
Hottest Month	June	June
Mean Daily Min Temp (^{0}C)	16.2	17.3
Mean Lowest Temp (^{0}C)	1.2	2.1
Coldest Month	January	January
Annual Rainfall (mm)	775.2	819.1
Month for maximum rainfall (mm)	July	July
Relative Humidity (%)	26-91%	28-85
Atmospheric pressure (hPa)	966.0-992.1	967.2-988.0
Wind speed (km/hr)	2-5	2.5-7.6
Wind direction	SE followed by NW	NW

Source: Climatologically Normal 1961-1990, IMD

3.2.2 Ambient Air Quality

Ambient air quality monitoring has been carried out along each section/sub-section during environment impact assessment study. Study has been carried out in different season for different sections/sub-section. Cumulative data on ambient air quality for each section of respective study period is given in **Table 3.4** below.

Table 3.4: Ambient Air Quality Data Along the Project Alignment

Parameters/Project Sections	EDFC-2 (Bhaupur to Mugal Sarai)	EDFC-1 (Bhaupur to Khurja)			EDFC-3 (Sanhewal to Khurja)		NAAQS, 2009
	(Bhaupur to Mugal Sarai) Mar-Apr, 2011	(Bhaupur to Khurja) May, 2009	Kaurara to Chamrola May, 2011	Khurja to Dadri Jan, 2012	Khurja to Pilkhani Feb-Mar, 2015	Pilkhani to Sanhewal Dec-Feb, 2010	
Max. PM_{10}	108	83	78	81	140	162	100
Min. PM_{10}	51	56	65	44	84	118	
Max. $PM_{2.5}$	55	--	23	28	56	45	60
Min. $PM_{2.5}$	23	--	18	19	33	18	
Max. SO_2	22	14	19.2	16.1	14.5	23	80
Min. SO_2	12	8	16.2	11.5	7.1	10	
Max. NO_x	31	25	22.5	23.4	26.6	18	80
Min. NO_x	10	14	19.3	17.6	13.0	8	
Max. CO	--	529	--	--	--	--	2000
Min. CO	--	98	--	--	--	--	

Source: EIA reports of EDFC1,2,3 ***(All Units are µg/cum)***

As per the ambient air quality data given in table above, it is found that all the parameters along the project alignment are within the permissible limits of NAAQS, 2009, CPCB except PM_{10}/RPM value. Levels are found higher along Bhaupur to Mugalsarai and Pilkhani to Sanhewal section.

3.3.3 Ambient Noise Level & Vibration

Ambient air quality w.r.t noise level was monitored along each section/sub-section during environment impact assessment study. Study has been carried out in different season for different sections/sub-section. Noise levels for each section/sub-section of respective study period is given in **Table 3.5.**

Table 3.5: Ambient Noise Levels along the Project Alignment

Parameters/Project Sections	EDFC-2 (Bhaupur to Mugal Sarai)	EDFC-1 (Bhaupur to Khurja)			EDFC-3 (Sanhewal to Khurja)	
	(Bhaupur to Mugal Sarai) Mar-Apr, 2011	(Bhaupur to Khurja) May, 2009	Kaurara to Chamrola May, 2011	Khurja to Dadri Jan, 2012	Khurja to Pilkhani Feb-Mar, 2015	Pilkhani to Sanhewal Dec-Feb, 2010
Leq Day time	47.6-69.1	50.6-72.7	62.6-76.8	62.6-66.2	48.5-56.6	47.3-78.0
Leq Night Time	36.5-64.8	37.8-65.2	49.6-56.8	47.8-55.1	40.1-47.5	32.7-60.7
Leq Max	54.7 -91.8	70.7-92.9	89.2-110.2	89.2-109.8	--	65.0-82.0
While One Train Passing	84.0-87.9	85.1-89.0	86.2-102.4	87.6-100.4	78.2-82.5	--
While Two Train Passing	88.3-91.8	91.4-93.0	94.0-98.2	95.2-97.0	--	--
Leq-While Train passing at Distance of 12.5 m	72.1-76.0	73.8-75.9	89.1-104.1	92.1-102.1	--	--
Lmax-While Train passing at Distance of 12.5 m	90.7-94.0	90.6-94.3	92.7-109.8	93.7-107.8	--	--
Leq-While Train passing at Distance of 25 m	66.1 -70.1	66.3-70.1	78.2-90.2	79.2-88.2	--	--
Lmax-While Train passing at Distance of 25 m	86.4 -90.0	86.3-90.3	87.6-95.8	89.6-93.8	--	--
Leq-While Train	60.3 -62.1	59.8-62.1	70.2-83.2	71.2-	--	--

Parameters/Project Sections	EDFC-2 (Bhaupur to Mugal Sarai)	EDFC-1 (Bhaupur to Khurja)			EDFC-3 (Sanhewal to Khurja)	
	(Bhaupur to Mugal Sarai) Mar-Apr, 2011	(Bhaupur to Khurja) May, 2009	Kaurara to Chamrola May, 2011	Khurja to Dadri Jan, 2012	Khurja to Pilkhani Feb-Mar, 2015	Pilkhani to Sanhewal Dec-Feb, 2010
passing at Distance of 50 m				81.2		
Lmax-While Train passing at Distance of 50 m	71.9 -78.2	71.1-78.6	78.4-87.0	79.4-85.0	--	--
Ambient noise Levels standards (dB(A)	Residential Area		Commercial		Industrial	
Day time	55		65		75	
Night Time	45		55		70	

Source: EIA reports of EDFC1,2,3 (All **Units are in dB(A))**

The stretches passes through residential and commercial areas primarily. The ambient noise levels are mostly found within the permissible ambient Noise levels at most of the places. However these levels exceed the level temporarily when train passes through such areas.

VIBRATIONS

Vibration level was monitored along the existing track in each parallel section/sub-section during environment impact assessment study. Study has been carried out in different season for different sections/sub-section. Cumulative data on vibration levels for each section/subsection of respective study period is given in **Table 3.6** below.

Table 3.6: Vibration Levels along the Existing IR Track Along the Project Corridor

Parameters/Project Sections	EDFC-2 (Bhaupur to Mugal Sarai)	EDFC-1 (Bhaupur to Khurja)			EDFC-3 (Sanhewal to Khurja)	
	(Bhaupur to Mugal Sarai) Mar-Apr, 2011	(Bhaupur to Khurja) May, 2009	Kaurara to Chamrola May, 2011	Khurja to Dadri Jan, 2012	Khurja to Pilkhani Feb-Mar, 2015	Pilkhani to Sanhewal Dec-Feb, 2010
Passenger Train-12.5 m from track	63.7-80.1	63.7-79.8	54.6-76.5	63.2-71.3	75.9-79.1	52.0-68.8
Passenger Train-25	51.2-66.7	51.0-65.5	46.2-68.1	56.3-	60.5-62.1	51.3-62.9

Parameters/Project Sections	EDFC-2 (Bhaupur to Mugal Sarai)	EDFC-1 (Bhaupur to Khurja)			EDFC-3 (Sanhewal to Khurja)	
	(Bhaupur to Mugal Sarai) Mar-Apr, 2011	(Bhaupur to Khurja) May, 2009	Kaurara to Chamrola May, 2011	Khurja to Dadri Jan, 2012	Khurja to Pilkhani Feb-Mar, 2015	Pilkhani to Sanhewal Dec-Feb, 2010
m from track				61.2		
Passenger Train-50 m from track	36.2-61.3	40.3-59.6	38.5-56.8	47.1-51.3	--	--
Open Wagon-12.5 m from track	65.2-77.2	64.9-78.5	62.3-75.3	58.1-70.0	--	54.8-74.7
Open Wagon-25 m from track	47.1-65.3	47.3-65.6	55.3-66.8	49.6-58.6	--	46.7-66.6
Open Wagon-50 m from track	41.2-63.2	41.2-62.4	47.8-58.4	41.2-52.0	--	--

Source: EIA reports of EDFC1,2,3

3.3.4 Ground Water Scenario & Quality

Ground water aquifers data on depth and quality for each section/sub-section is given below in **Table 3.7.**

Table 3.7: Ground Water Data on Depth and Level

Parameters/Project Sections	EDFC-2 (Bhaupur to Mugal Sarai)	EDFC-1 (Bhaupur to Khurja)			EDFC-3 (Sanhewal to Khurja)	
	(Bhaupur to Mugal Sarai) Mar-Apr, 2011	(Bhaupur to Khurja) May, 2009	Kaurara to Chamrola May, 2011	Khurja to Dadri Jan, 2012	Khurja to Pilkhani Feb-Mar, 2015	Pilkhani to Sanhewal Dec-Feb, 2010
Depth of water level-Pre monsoon (mbgl)	2.57 - 21.00	2.57 - 21.00	5-50	5-50	10-30	10-30
Depth of water level-Post monsoon (mbgl)	2.13 - 16.73	2.13 - 16.73	3-20	3-20	13-40	13-40
Yield capacity	Good-moderate	Good-moderate	Good-moderate	Good-moderate	Good-moderate	Good-moderate
Yield shallow tubewell (lpm)	1000-2000	1000-2000	1000-2000	1000-2000	1000-2000	1000-2000
Yield depth	2000-3000	2000-3000	2000-3000	2000-3000	2000-3000	2000-3000

Parameters/Project Sections	EDFC-2 (Bhaupur to Mugal Sarai)	EDFC-1 (Bhaupur to Khurja)			EDFC-3 (Sanhewal to Khurja)	
	(Bhaupur to Mugal Sarai) Mar-Apr, 2011	(Bhaupur to Khurja) May, 2009	Kaurara to Chamrola May, 2011	Khurja to Dadri Jan, 2012	Khurja to Pilkhani Feb-Mar, 2015	Pilkhani to Sanhewal Dec-Feb, 2010
tubewell (lpm)						
Use	Domestic & Agriculture	Domestic & Agriculture	Domestic & Agriculture	Domestic & Agriculture	Domestic & Agriculture	Domestic & Agriculture
pH	6.8-7.9	6.8-8.1	7.62-8.16	8.1-8.3	7.25-7.89	7.4-8.3
BOD (mg/l)	<2	0	0	0	0	0
Chloride (mg/l)	6-64	28.06-547.21	22.63-56.57	35.63-46.17	8-96	7.1-120
Fluoride (mg/l)	0.6-1.6	0.2-0.6	<0.2	<0.2	0.48-0.94	0.2-0.6
Sulphate (mg/l)	21.0-69.04	74.51-614.72	19.36-533.12	45.36-98.22	7-116	14-78
Iron (mg/l)	0.09-0.42	0.02-0.42	<0.2	<0.2	0.02-0.36	0.08-0.67
Total Hardness (mg/l)	84-346	184.06-454.27	100-356	140-190	140-490	231-278

Source: EIA reports of EDFC1,2,3

3.3.5 Surface Water Status & Quality

The project alignment is a part of the Ganges basin, which contains the largest river system on the subcontinent comprising the Rivers of Ganga, Yamuna and number of other rivers. The proposed alignment of EDFC from Bhaupur to Mugalsarai cross perennial rivers of Yamuna and Tonse part of Ganga Basin . Important rivers and streams in the project area are part of Yamuna drainage basin and comprises of River Tonse, Arind and its tributaries.

The proposed alignment of EDFC from Kaurara to Chamrola does not cross any of the perennial rivers of Ganga Basin or any other river systems. Important rivers and streams in the project area are part of Yamuna drainage basin and comprises of River Kuwari, Sengar and its tributary Sirsa, Arind and its tributaries Ahenya, Puraha and Pandu. These rivers seasonal in nature and does not serve any irrigation or drinking water requirements of the reason.
The alignment of EDFC from Khurja to Dadari crosses Seasonal River – Karon at km 1375.39 of Ganga Basin. This is tributary to Yamuna River. The proposed alignment of EDFC from Khurja to Pilkhani cross river Hindon and Kali which are tributary to River Yamuna

The proposed alignment of EDFC from Pilkhani to Sahnewal crosses many surface water bodies of the Ganga-Yamuna basin. Some of the important rivers and canals crossing the alignment are: Yamuna (at Kalahari in Yamunanagar), Tangri (Dukheri), Markanda (at Ambala), Chaudah Dhara

and Ghaghhar. However, except Yamuna all other rivers are found to be non-perennial. Surface water quality data for each section/sub-section is given in **Table 3.8.**

Table 3.8: Surface Water Data on Depth and Level

Parameters/Project Sections	EDFC-2 (Bhaupur to Mugal Sarai)	EDFC-1 (Bhaupur to Khurja)			EDFC-3 (Sanhewal to Khurja)	
	(Bhaupur to Mugal Sarai) Mar-Apr, 2011	(Bhaupur to Khurja) May, 2009	Kaurara to Chamrola May, 2011	Khurja to Dadri Jan, 2012	Khurja to Pilkhani Feb-Mar, 2015	Pilkhani to Sanhewal Dec-Feb, 2010
pH	7.1-7.5	7.3-7.5	8.26	8.5	7.04-8.59	7.4-8.2
BOD (mg/l)	10-42	16.84-32.67	Not monitored-water polluted	11.9	2.2-14.8	0-18
Chloride (mg/l)	12-31	29.42-43.08	160.30	164.70	6-112	10-12
Fluoride (mg/l)	0.11-0.32	0.1-0.6	<0.2	<0.2	0.46-0.96	0-0.5
Sulphate (mg/l)	12.31-41.12	47.82-74.80	670.32	534.32	18-24	8-14
Total Hardness (mg/l)	61-181	145.02-190.0	260	270	50-340	128-260

Source: EIA reports of EDFC1,2,3

3.3.6 Soil Quality

Since the project is situated in the younger alluvium of Ganga Basin, the soil is prone to erosion. The entire alluvial plain along the alignment can be divided into three sub-regions. These include, the eastern tract know as scarcity areas with highest population density and lower per capita land, the central tract and western tract comprising well developed irrigation system. However, being alluvial the land is very fertile and cultivation of rice, wheat, millets, gram, barley and sugar cane, etc are the chief crops of the region.

Soil quality data for each section/sub-section has been carried out during EIA study of each section/sub-section and is given at **Table 3.9.**

Table 3.9: Soil Quality Data

Parameters/Project Sections	EDFC-2 (Bhaupur to Mugal Sarai)	EDFC-1 (Bhaupur to Khurja)			EDFC-3 (Sanhewal to Khurja)	
	(Bhaupur to Mugal Sarai) Mar-Apr, 2011	(Bhaupur to Khurja) May, 2009	Kaurara to Chamrola May, 2011	Khurja to Dadri Jan, 2012	Khurja to Pilkhani Feb-Mar, 2015	Pilkhani to Sanhewal Dec-Feb, 2010
pH	6.8-7.9	6.1-8.1	7.44-7.8	7.36-7.44	7.12-9.97	5.1-8.2
Nitrogen	0.12-0.98 mg/kg	0.108-0.726 mg/kg	0.02-0.06 mg/kg	0.02-0.06 mg/kg	138-206 kg/ha	0.42-0.71
Phosphate/Phosphorus	0.09-0.36 mg/kg	0.001-0.119 mg/kg	12.8-16.8%	11.6-15.8%	40.4-44.6 kg/ha	0.28-0.45 mg/kg
Potassium	15.1-91.0 kg/ha	12.02-89.53 kg/ha	0.511-0.792 meq/100	0.48-0.62 meq/100	164-194 kg/ha	14-56 kg/ha
Sodium	42.78-150.22 kg/ha	36.9-160.52 kg/ha	--	--	--	13-150.1 kg/ha
Texture	Silty clay	Silty clay	Silty sand	Silty sand	Clay loam	Clay loam

Source: EIA reports of EDFC1,2,3

3.3.7 Ecology

No ecological sensitive area is found along the project alignment and the study area. The vegetation in the study area is deciduous in nature. Mainly three type of forests were found in the study area, i.e. tropical moist deciduous forest, tropical dry deciduous forest and tropical thorny forest. Tree species found in area are Jangali tulsi, Apmarg, Neem, Kikar, Babul, Siras, Khair, Bel, Palash, Kachnar, Amaltas, Gulmohar, Shisham, Safeda, Poplar, Karanj, Philkhan, Shahtoot, Aam, Dhak, Jamun, Datura etc. Shrubs such as Kuri, Gandela, Ber, Makoi, Binda, Timur, Bansa etc. are found along the project alignment.

Details of nos. of tree to be fell in each section/sub-section is given in **Table 3.10** below. Trees to be cut are majorly Babool, Neem, Khajoor, Shisham, Mango, Jamun, pakar, Lakar, Pipal, Labhera, Kanji, Beri, Papri, Gular, Bakain, Safeda, Chilbil, Lasohar, Bamboo, Mlo Shri, Mahua, Chameli, Lemon, Ashok, Bel, Guawa, Wakayan, *Eucalyptus*, Bakayan & Siras.
Macrphytes like *Eichhornia, hydrilla, Typha angustata* etcs are found in the rivers of study area. Fish species like catla *catla, Labeo rohito, Cirrihinus sp., Clarius batrachus, wallago attu, Hira ilisha* etc. are found in the rivers of the study area.

Some of the fish species found in the rivers of the area are: *Catla catla, Labeo sp., Cirrihinus sp., Clarius batrachus, Wallago attu, Hilra ilisha* etc. .
Mammals identified in the area are cow, buffalo, horse, Indian fox, ass, camel, monkey, pig, sheep, goat, dog, Nilgai, Buffalo, cat, hares etc. Birds found in the area are kingfisher, peafowl, cuckoo, pigeon, crow, koel , crane, spotted dove, baya weaver, red whiskered bulbul etc. White rumped vulture found in the Pilkhani to Sanhewal area and it is schedule 1 species and sarus crane is vulnerable species in the area. Reptiles found in the area are garden lizard, monitor lizard and karait.

Table 3.10: Detail of Tree Cutting

Nos. of trees to fell/Project Sections	EDFC-2 (Bhaupur to Mugal Sarai)	EDFC-1 (Bhaupur to Khurja)			EDFC-3 (Sanhewal to Khurja)	
	(Bhaupur to Mugal Sarai) Mar-Apr, 2011	(Bhaupur to Khurja) May, 2009	Kaurara to Chamrola May, 2011	Khurja to Dadri Jan, 2012	Khurja to Pilkhani Feb-Mar, 2015	Pilkhani to Sanhewal Dec-Feb, 2010
Nos. of Trees to fell	17,000	1966	4352	2193	27556	28617
Eco-Sensitive Area	No	No	No	No	No	No
Any other sensitive zone			49 km of total falls in TTZ Area & one ASI site-Budhiya ka Taal			

3.3.8 Socio-Economic

The project area passes through the flat terrain and fertile land area. Brief summary of socio-economic and physical aspects of project area is summarized in Table 3.22 below.

Table 3.11: Socio-Economic and Physical Features of Project Area.

Parameters/Project Sections	EDFC-2 (Bhaupur to Mugal Sarai)	EDFC-1 (Bhaupur to Khurja)			EDFC-3 (Sanhewal to Khurja)	
	(Bhaupur to Mugal Sarai) Mar-Apr, 2011	(Bhaupur to Khurja) May, 2009	Kaurara to Chamrola May, 2011	Khurja to Dadri Jan, 2012	Khurja to Pilkhani Feb-Mar, 2015	Pilkhani to Sanhewal Dec-Feb, 2010
Land Use	Majorly agriculture followed by built-up	Majorly agriculture followed by built-up	Majorly agriculture	Agriculture	Agriculture	Agriculture
Nos. of Districts & Villages Through which alignment Passes	7 districts & 372 villages Districts: Chandauli, Mirzapur, Allahabad, Kaushambi, Fatehpur, Kanpur (Nagar) and Ramabainagar	8 districts & 229 villages Districts: Kanpur dehat, Auraiya, Etawah, Ferozabad, Hathras (Mahamaya Nagar), Agra, Aligarh and Bulandsehar	2 districts & 73 villages Districts: Agra and Ferozabad	2 districts & 32 villages Districts: Bulandshahr & Gautamn Budh Nagar	6 Districts & 156 villages Districts: Bulandshahr, Ghaziabad, Hapur, Meerut, Muzaffarnagar and Saharanpur	6 Districts & 114 villages Districts: Saharanpur (Uttar Pradesh), Yamunanagar, Ambala (Haryana), Fatehgarh Sahib, Patiala and Ludhiana (Punjab)
Topography & geology	Flat terrain, younger alluvium of Ganga Basin	Flat terrain, younger alluvium of Ganga Basin	Flat terrain, younger alluvium of Ganga Basin	Flat terrain, younger alluvium of Ganga Basin	Flat terrain, younger alluvium of Ganga Basin	Flat terrain, younger alluvium of Ganga Basin
Archaeology	None within 300 m from project alignment	None within 300 m from project alignment Salempurhafi-old structure but not	Yes, Budhiya ka Taal	None within 300 m from project alignment	None within 300 m from project	None within 300 m from project alignment

Parameters/Project Sections	EDFC-2 (Bhaupur to Mugal Sarai)	EDFC-1 (Bhaupur to Khurja)			EDFC-3 (Sanhewal to Khurja)	
	(Bhaupur to Mugal Sarai) Mar-Apr, 2011	(Bhaupur to Khurja) May, 2009	Kaurara to Chamrola May, 2011	Khurja to Dadri Jan, 2012	Khurja to Pilkhani Feb-Mar, 2015	Pilkhani to Sanhewal Dec-Feb, 2010
		archaeological structure			alignment	
Other Sensitivity	None	None	49 km of the alignment falling within TTZ	None	None	None
Seismology as per BIS classification	III & IV	III & IV	IV	IV	III & IV	IV
Occupation	Agriculture	Agriculture	Agriculture	Agriculture	Agriculture	Agriculture
Transport Infrastructure	Well connected with roads, 72 level crossings. Various SH & NH parallel and crosses the alignment like NH-96, 27, 330A, 24 B, 29 SH-94, 7 etc	Well connected with roads, 74 level crossings. Various SH & NH parallel and crosses the alignment like NH-91 A, 2, 93 SH-21, 40, 83, 62 etc.	Well connected with roads, 19 level crossings. NH & SH running parallel/crossing the alignment are NH-2, AH-1, SH-81, 31 & 39	Well connected with roads, 18 level crossings. NH & SH running parallel/crossing the alignment are Surajpur Kasana road, NH-91 etc.	Well connected with roads, 61 level crossings. NH & SH running parallel/crossing the alignment are NH-91, 58, 119, SH-63, 18 etc.	Well connected with roads, 77 level crossings. NH & SH running parallel/crossing the alignment are NH-1, 95, 64, 65, 22, 73 A, SH-8, 31 etc.
Medical Facility	Well developed at district level	Well developed at district level	Well developed at district level	Well developed at district level	Well developed at district level	Well developed at district level

The project involves acquisition of both private and public land for laying DFCCIL tracks and constructing related infrastructure. Same is going to have huge social impact. The area to be acquired may be agriculture field, household, play ground, community land, community well, playground, religious structure, trees, educational institute etc. Society is dependent on all of these resources which will be partially or fully impacted due to project. Details of the land acquisition, PAFs & PAPs is given in **Table 3.12 & Table 3.13** below.

Table 3.12: Land to be acquired For Various Sub-Sections/Sections

Nos. of trees to fell/Project Sections	EDFC-2 (Bhaupur to Mugal Sarai)	EDFC-1 (Bhaupur to Khurja)			EDFC-3 (Sanhewal to Khurja)	
	(Bhaupur to Mugal Sarai) Mar-Apr, 2011	(Bhaupur to Khurja) May, 2009	Kaurara to Chamrola May, 2011	Khurja to Dadri Jan, 2012	Khurja to Pilkhani Feb-Mar, 2015	Pilkhani to Sanhewal Dec-Feb, 2010
Total Land (ha)	1400	1182	258.87	211.67	829.08	355.34
Private land (ha)	1250.9	999	224.03	145.59	678.18	330.91
Public Land (ha)	149.1	183	34.84	66.08	150.9	24.43
Protected/Reserve Forest Land acquisition	0.998	7.36	4.1920	3.9	Unknown	175

Table 3.13: Nos. of PAFs/PAPs

Nos. of trees to fell/Project Sections	EDFC-2 (Bhaupur to Mugal Sarai)	EDFC-1 (Bhaupur to Khurja)			EDFC-3 (Sanhewal to Khurja)	
	(Bhaupur to Mugal Sarai) Mar-Apr, 2011	(Bhaupur to Khurja) May, 2009	Kaurara to Chamrola May, 2011	Khurja to Dadri Jan, 2012	Khurja to Pilkhani Feb-Mar, 2015	Pilkhani to Sanhewal Dec-Feb, 2010
PAFs	13034	8601	1842	1974	5926	324
Agriculture PAFs	95.64%	96.54%	94.73%	50.0%	79.86%	77%
Residential PAFs	4.36%	3.46%	5.27%	50.0%	20.14%	23%
PAPs	63968	46646	10005	5841	31526	3051
Total Structures including CPRs	623	697	205	121	241	324
CPRs Structures	55	485 identified Reduced to 22	108	11	110	8

3.4 Conclusion

The baseline compilation indicates the current status of VECs within the project study area, considered during EIA & SA of individual phase. These VECs have been identified as critical in some stretches. The Air Quality, Forester (reserved forests, Tree cutting) and Socio-Economic aspects considered important compared to other VECs considered current levels vs likely impact from project activities. The inventory of these VECs partly provides basis for identifying VECs at cumulative assessment stage as well as for delineation of boundary for cumulative impact assessment (CIA).

CHAPTER 4: IMPACT ASSESSMENT AS PER EDFC 1,2,3 EIAs

4.0 Introduction

Environmental impact assessment involves prediction of potential impacts by the development of the project on the surrounding area. Based on the baseline environmental status described in earlier section and the proposed project activities, potential impacts have been assessed and predicted. The impacts due to the development of the Eastern Dedicated Freight Corridor (EDFC 1, EDFC 2 &EDFC 3) have been assessed for the planning phase, construction phase and implementation phase.

4.1 Analysis of Environmental Attributes as per Baseline Scenario and Identification of Focus Impact Assessment of VECs Areas

Baseline study for each section and sub-section has been carried out during environment impact assessment study to collect the information of environmental conditions in pre-project development stage and presented in chapter 3. It is found that ambient air quality is within the permissible limit as per the prescribed CPCB standards except levels of RPM. Level of RPM exceeds the prescribed limit of 100 µg/cum. Thus it is required to maintain RPM levels at site especially during construction phase. **Ambient air quality is thus a valued environmental component specially from incremental impact from particulate matter prospective.**

Noise levels have been studied along the entire alignment. Noise levels have been compared with noise standards for industrial zone as per Ambient Air Quality Standards w.r.t noise, 2000. It is found that noise levels are high during day time but within the limits during night time. Noise levels are further high when trains are passing through the tracks. Noise level varies with speed and type of train. Nature of high level noise is though intermittent but significant. Also noise will further increase during construction phase due to construction activities and operation phase due to increased movement of trains. **Thus noise is another valued environment component** on which impacts are to be studied in detail. Vibrations are recorded along the proposed segments parallel to IR track. Vibrations results during passage of the trains due to contact between train wheel and track. Nature of vibration is again intermittent like noise but significant.

Ground water quality in the area has been studied and is found to be good and potable as per IS:10500, except fluoride concentration in Mugalsarai to Bhaupur section. Care is required to be taken that contamination of ground water should not occur either during construction and operation phase as the inhabitant of villages are highly dependent on ground water for domestic and agricultural use.

Project area is a part of Ganga basin, which is largest river system on subcontinent. Proposed alignment crosses several perennial and seasonal water bodies. Water quality of these water bodies

has been assessed and compared with surface water body classification criteria of CPCB. All the water bodies are falling under category D & E[3] as the BOD levels are high.

Soil samples along the project alignment have either been taken from agricultural fields or orchard. It is found that soil are fertile and fit for agriculture. Thus the impact on soil quality will affect the soil productivity, agricultural yield, income of the farmer, production potential of the area etc. Borrow earth is proposed to be sourced from nearby agriculture fields. This will therefore be a important VECs to be studied.

A significant nos. of trees will be fell down along the entire stretch. Though compensatory tree plantation is planned, however with other developments this environmental resource can be largely impacted and requires to be studied in detail as part of CIA. Thus this component is also a valued component.

Quality of life of the people will undoubtedly be impacted due to the project as the project development involves acquisition of large area of land. Land to be acquired is of agricultural, residential and commercial use. Many of the people are losing their entire land and will become landless. Many of them are completely dependent on agriculture only and are practicing agriculture since generation. These people will lose their livelihood and become unemployed. Socio-economic aspects thus be another VECs to be assessed in detail from cumulative impact prospective.

CPRs like wells, tube wells, handpumps, temple, mosque etc are required to be relocated. These Quality of life, income of the family, employment and displacement of families are identified valued social components that are to be studied in detail so as adequate mitigation measures to be taken to reduce the negative impact and enhancement plan can be prepared for bringing improvement.
Impacts on these identified valued environment & social components are assessed for each of the activity to be undertaken during construction and operation phase and due to other developments in the area. Impact identified due to EDFC project in the EIAs and level of impacts on these VECs are given in matrix form in following section.

4.2 Impact Assessment Methodology

Various direct and indirect impacts on VECs are identified in three EIA reports due to the project activities. Qualitative and quantitative methods are used for impacts assessment in all the three reports. The identified impacts significance is assessed following five scale criteria as presented in Table 4.1.

[3]CPCB has classified rivers on water quality basis and suitability of use as per classification. D category is considered fit for propagation of wild life, fisheries, irrigation, industrial cooling and controlled waste disposal. Whereas Category E is suitable for irrigation, industrial cooling and controlled waste disposal.

Table 4.1: Parameter and Scale of Impact Matrix

Parameter	Scale		Remarks	
Significance	No impact	E		
	Negligible impact	D	Positive:+	Negative:-
	Insignificant impact	C	Positive:+	Negative:-
	Relatively significant impact	B	Positive:+	Negative:-
	Significant impact	A	Positive:+	Negative:-
	Significance Scale Criteria Scale A: If National Parks, Wildlife Sanctuaries or any designated natural reserve, protected species of any kind are directly affected. Scale B: If large areas of forest, grassland, cultivable land or any natural environment for tourism are indirectly affected. Scale C: If impacts are insignificant Scale D: If impacts are negligible Scale E: No impacts or not applicable for assessment			

Following the above scale and impacts identified under EDFC 1,2,3 EIAs, impact significance matrix is compiled for construction and operation phase. Same are presented in table 4.2 and 4.3 respectively.

Table 4.2 Impact Assessment-Construction Phase

No.	Items	Overall Evaluation on the Project	Pre-construction Stage			Construction Stage											
			Surveying of Planned Areas and Sites	Selection of the Project Location and Sites	Land Acquisition and Resettlement	Extraction of Building Materials (stones, aggregates, sand, soil, etc.) at Quarries and Borrow Areas	Earth Moving: Cutting and Filling of the Construction Works	Preparation of Construction Plants, and Warehouses, Work Camps, etc.	Machines and Vehicles for Construction Works	Construction Works for railway line and related structures						Localized Employment Opportunities of the Construction Works	Localized Business Opportunities Related to the Construction Works
										Railway Lines and Installation of Related Facilities (signals,	(B) Construction Works for ICDs and Freight Logistic Parks	(C) Construction Works for Stations (Terminal, Junction and Crossing)	(D) Construction Works for ROBs and RUBs	(E) Construction Works for Bridges	(F) Construction Works for Tunnels		
1	Topography and Geology	C/D	D	D	D	C	C	C	C	C	C	D	D	C	E	E	C
2	Soil	C/D /E	D	D	E	B	B	C	C	C	C	B	D	D	E	E	E
3	Groundwater	D/E	D	D	C	D	D	D	D	D	D	D	D	D	E	E	E
4	Hydrological Condition	D/E	E	E	E	D	E	D	D	D	D	D	D	C	E	C	C
5	Fauna, Flora and Biodiversity	D	D	C	C	C	C	D	C	C	D	D	D	D	E	D	D
6	Protected Areas / sanctuaries	D	D	D	D	D	D	D	D	D	D	D	D	D	E	D	D
7	Landscape	D	D	D	D	D	D	D	D	D	D	D	D	D	E	D	D
8	Local Meteorological Conditions	D	D	D	D	D	D	D	D	D	D	D	D	D	E	D	D
9	Global Warming	D	D	D	D	D	D	D	D	D	D	D	D	D	E	D	D

Table 4.3 Impact Assessment-Operation Phase

No.	Project Activities / Items of the Environment Subject to Positive / Negative Changes	Logistic conditions of goods, raw materials, agro & industrial products	Traffic condition of roads	Operation & maintenance of railway lines & related structures	Employment opportunities (whole country / local level)	Freight oriented business opportunities	Passenger oriented business opportunities	Promoting development of surrounding areas	Increase in settlers & vision to the project area
1	Topography and Geology	D	D	D	C	C	C	C	C
2	Soil	D	D	E	E	E	C	C	C
3	Groundwater	D	D	C	D	D	D	D	D
4	Hydrological Condition	C	C	C	D	C	D	D	C
5	Coastal and Marine Environment	E	E	E	E	E	E	E	E
6	Fauna, Flora and Biodiversity	D	C	C	C	C	D	C	C
7	Protected Areas / sanctuaries	D	D	D	D	D	D	D	D
8	Landscape	D	D	D	D	D	D	D	D
9	Local Meteorological Conditions	D	D	D	D	D	D	D	D
10	Global Warming	D	D	D	D	D	D	D	D

As per the impact matrix for construction phase it is analyzed that the topography, soil, ground water, hydrology and ecology will be impacted due to project development during construction phase. Relatively significant impact is anticipated on the soil quality of the area during construction phase as soil will be excavated for construction purpose and top soil layer will be disturbed. Topography and ecology of the area will also be impacted due to construction of the raised embankment but the impact assessed is insignificant.

As per the impact matrix for operation phase it is analyzed that no significant impact on environment is anticipated during operation phase. Noise and vibration will be the most impacting resultant of the project. Project will ultimately result in reduction of emission of GHGs from the vehicles plying on the road for transportation of material due to shortage of the freight transportation facility. Impacts due to the project on each of environment and social attribute is summarized in the **Table 4.4** below.

Table 4.4 Anticipated Impacts during Construction and Operation Phase

S. No.	Impacted Parameter	Impact During Pre-Construction & Construction Phase	Type of Impact	Impact During Operation Phase	Type of Impact
1.	Topography & Geology	• Change in topography due to construction of embankment and cutting & filling operations for construction of ROB/RUB, construction of stations and other related facilities	Permanent & negative	Insignificant	--
2.	Soil	• Increase in soil erosion due to tree felling and vegetation removal • Loss of fertile agricultural soil • Loss of soil (from borrow areas) for construction of embankment • Soil erosion from borrow area due to air and water movement • Soil pollution due to disposal of construction waste, dismantling of	Permanent & negative Permanent & negative Permanent & negative Short term, localized and negative	Insignificant	--

S. No.	Impacted Parameter	Impact During Pre-Construction & Construction Phase	Type of Impact	Impact During Operation Phase	Type of Impact
		structures, spillage of oil, hazardous waste like used/spent oil and waste from construction labour camps	Short term, localized and negative		
3.	Air Quality	• Generation of dust due to construction, dismantling, loading/unloading of material, transportation of material • Emissions due to plying of vehicles, running DG sets and construction machinery • Dust generation from raw material and debris storage area • Excavation of soil from borrow areas • Emission from batching plant and pugmill (WMM plants) • Silica dust generation from laying of ballast	Short term, localized and negative Short term, localized and negative Short term, localized and negative Short term, localized and negative Short term, localized and negative Short term, localized and negative	• Emissions from material like coal if transported in open wagons • Emissions from diesel based trains • Reduction in emissions due to transportation of material by road • Reduction in emissions from diesel engines as track is electrified	Long term, negative & moderate Long term, negative & moderate Long Term, Positive and Significant Long Term, Positive and Significant

S. No.	Impacted Parameter	Impact During Pre-Construction & Construction Phase	Type of Impact	Impact During Operation Phase	Type of Impact
4.	Noise & Vibrations	• Generation of noise & vibrations due to construction, dismantling and demolition of structures, movement of vehicles, running machinery and DG sets • Generation of noise & vibrations due to excavation for under bridges & earth from borrow area • Noise generation while laying ballast on tracks • Generation of noise from batching plant	Short term, localized and negative Short term, localized and negative Short term, localized and negative Short term, localized and negative	• Noise & vibrations generation due to movement of trains on trains and whistling of trains • Noise generation while loading & unloading of materials	Intermittent, Moderate Intermittent, insignificant
5.	Water Resources	• Contamination of water quality from run-off from construction site- spillage of oil/fuel, debris, bitumen etc. • Contamination of water quality from material and waste storage yards • Contamination of water quality from labour camps • Loss of ponds • Increase in run-off due to	Short term & negative Short term & negative Short term & negative	• Washing of the cars/wagons • Washing of station area and tracks • Disposal of sewage generated at freight stations	Long term and insignificant Long term and insignificant Long term and insignificant

S. No.	Impacted Parameter	Impact During Pre-Construction & Construction Phase	Type of Impact	Impact During Operation Phase	Type of Impact
		loss of agriculture land and forest land • Water to be taken from ground & surface water sources for construction purpose may divert the water source of the inhabiting population • Discharge of water from batching plant and pugmills and other construction activities • Discharge of curing run-off from the concrete structures like culver, bridges etc.	Permanent & negative Permanent & negative Permanent &negative Permanent & negative Permanent & negative		
6.	Drainage & Hydrology	• Alteration in drainage pattern due to construction of embankment • Alteration in drainage due to construction of	Permanent & negative Temporary &	Insignificant	--

S. No.	Impacted Parameter	Impact During Pre-Construction & Construction Phase	Type of Impact	Impact During Operation Phase	Type of Impact
		temporary structures like storage yards and stock piling of materials • Construction of bridges on the water body thus change in flow	negative Permanent & negative		
7.	Ecology	• Loss of protected and reserved forest land • Felling of trees • Loss of habitat of birds, insects, butterflies, reptiles and other animals living in the impacted forest area and trees • Accidents of animals	Permanent & negative Permanent & negative Permanent & negative Permanent & negative	• Compensatory Plantation	Permanent &positive
8.	Socio-economy & Aesthetics	• Loss of livelihood of people due to loss of agriculture land • Displacement of family • Loss & relocation of common property resources like religious structure,	Permanent & negative Permanent & negative Permanent &	• Enhancing the CPRs like strengthening the embankment of nearby pond, plantation near schools, development of bathing ghats nearby ponds etc as par of CSR	Permanent & positive

S. No.	Impacted Parameter	Impact During Pre-Construction & Construction Phase	Type of Impact	Impact During Operation Phase	Type of Impact
		wells, tube wells, hand pumps, kabristan, play grounds etc. • Acquisition of the private and government land, i.e. schools, kabristan, play grounds, college etc. • Disturbance to aesthetics value and scenic beauty due to set up of construction camps, labour camps, batching plants, storage yards etc. • Impact on archeological structure (BudiyakaTaal) • Excavation of soil from agriculture fields • Establishment of plant site, labour camps, batching plant, pugmilletc may impact the life of people if set up in close vicinity to residential areas, schools, colleges, community place	negative Permanent & negative Permanent & negative Permanent & negative Temporary ad negative Temporary ad negative	activity • Increase in freight movement & thus revenue generation • Development of DFC which will reduce the burden from IR track and thus no. of passenger trains will increase significantly and thus improved connectivity • Reduction in traffic congestion as the material can be more quickly and efficiently will be transported through DFC • Reduction in air pollution • Generation of direct & indirect employment • Development of industries like TPP, warehouses, logistics etc. near to the DFC • Enhanced connect with Inland Waterways • Assistance in adopting alternate livelihood	Permanent & positive Permanent & positive Permanent & positive

S. No.	Impacted Parameter	Impact During Pre-Construction & Construction Phase	Type of Impact	Impact During Operation Phase	Type of Impact
					Permanent & positive Permanent & positive Permanent & positive Permanent & positive Positive

S. No.	Impacted Parameter	Impact During Pre-Construction & Construction Phase	Type of Impact	Impact During Operation Phase	Type of Impact
9.	Energy Conservation	• Usage of low energy intensive construction material like fly ash mixed cement & bricks • Re-usage of construction debris • Preventing idling of vehicles • No wastage of water and electricity at site • Obtaining temporary power connections during construction and running DG sets only during power failure • Usage of CFL/LED for lightning	Positive Positive Positive Positive Positive Positive	• Provision of solar lightning in station area in ratio of 1:3 • Installation of solar panels on roof-top area of station building to harness solar energy	Positive Positive

4.3 Conclusion

Impact analysis based on EIA& SA studies indicate that VECs impacted during construction and operation stage include air, water (surface & ground), soil, land, ecology & socioeconomics consisting of loss of land and community resources. Loss of land and community resources requires relocation, rehabilitation and resettlement. All the above mentioned impacted VECs need to be assessed considering the other direct, indirect and induced activities and their zone of influence in the context of proposed development.

CHAPTER 5: DELINEATION OF CIA BOUNDARY AND VECs

5.0 Introduction

Cumulative Impact Assessment (CIA) requires fixation of spatial and temporal boundaries in order to assess the impacts of direct, indirect and induced activities due to proposed project. The following sections describes the CIA boundary, the basis of its delineation, VECs within the delineated boundaries, tentative hotspots and case study.

5.1 Delineation of the CIA Boundary

Important factors which need to be considered when delineating the proposed assessment of indirect and cumulative impacts and impact interactions is the setting of the geographical or 'spatial' boundary and the temporal or 'time frame' boundary. Indirect and cumulative impacts as well as impact interactions may well extend beyond the geographical site boundaries of the project. Consideration should also be given to historical or potential future impacts. Mapping the geographical and time boundaries can be a useful tool to show areas of potential overlap and therefore where indirect and cumulative impacts as well as impact interactions may occur.
The boundary delineation exercise identifies the potential impacts considered to be significant and which require further assessment. In this study all the natural as well as manmade features have been taken into account and plotted spatially to delineate the boundary of the CIA. The natural and manmade features mapped are as follows:

- Forests;
- National parks;
- Wild Life Sanctuaries;
- Tiger Reserves;
- Birds Areas;
- Archaeological sites;
- Water bodies;
- Wetlands;
- Roads;
- Railways;
- Urban Agglomerations;
- Industrial Areas;
- Critically Polluted Areas;

To conduct the detailed study of the project, three buffer boundaries have been considered; i.e. 100 mtrs, 300 mtrs and 10 kms. The basis for delineating these three buffer boundaries are based on the EIA reports of EDFC (EDFC – 1, EDFC – 2 and EDFC – 3), IFC codes and the expert's consultation/ judgment.

- **100 mtrs buffer** – This boundary has been taken according to the EIA study conducted for the entire stretch of EDFC. Under this buffer, strip maps have been provided which shows roads, nalas / ponds, trees, wells / tube wells / hand pumps, temples / schools / hospitals / structures, high tension lines, stations / chainage and forests if any.

- **300 mtrs buffer** – According to IFC codes and applicable Indian regulations, for archeological and cultural sites a maximum distance of 300 mtrs is considered to study the impact of any upcoming developmental project. Therefore using this boundary all the cultural and archaeological sites have been located to study the influenced locations on the site.

- **10 kms buffer** – It is being considered that the extent of area of influence of the project may not go beyond 10 kms as per the expert's consultations. Therefore the farthest distance covered in the CIA boundary is 10 kms.

Hence the boundary has been demarcated considering all the above given features and buffer areas within the range of 10 kms.

5.2 Valuable Environmental and Social Components

As per literature review, VECs are environmental and social attributes that are considered to be important in assessing risks. While VECs may be directly or indirectly affected by a specific development, they often are also affected by the cumulative effects of several developments. VECs are the ultimate recipient of impacts because they tend to be at the ends of ecological pathways. VECs in general refers to sensitive or valued receptors of impact whose desired future condition determines the assessment end points to be used in the CIA process.

5.2.1 Identification of VECs & Hotspots

Overlay mapping and GIS have been used for identifying the spatial distribution of VECs and hotspots. Based on the above mapping method and as per IFC guidelines for Cumulative Impact Assessment and Management, **VECs have been classified** under:

• Physical features,

- Urban Agglomerations;
- Urban centers
- Land Uses
- Geology
- Ecology (Wildlife Sanctuaries/ National Parks / Tiger Reserves / Bird Areas / Wetlands)

• Ecosystem services,

- Critically Polluted (air, water, soil & ground water quality)
- GHG emissions

• Natural processes (e.g., water and nutrient cycles, microclimate),

- Water Nutrient Cycles
- Micro Climate

• Social conditions (e.g., health, economics), or

- Water Bodies (Pools, wells, nalas, canals)
- Hospitals
- Educational Institutes
- Demography (R&R)
- Transport System

• Cultural aspects

- Religious / Archaeological sites

Using these sensitive receptors, the maps have been prepared for the entire stretch in strips of 50 to 75 kms for all the three parts i.e. EDFC 1, EDFC 2 & EDFC 3. Each stretch has been studied in strips to identify the **VECs and hotspots** as shown in **Figure 5.1, Figure 5.2 and Figure 5.3.**

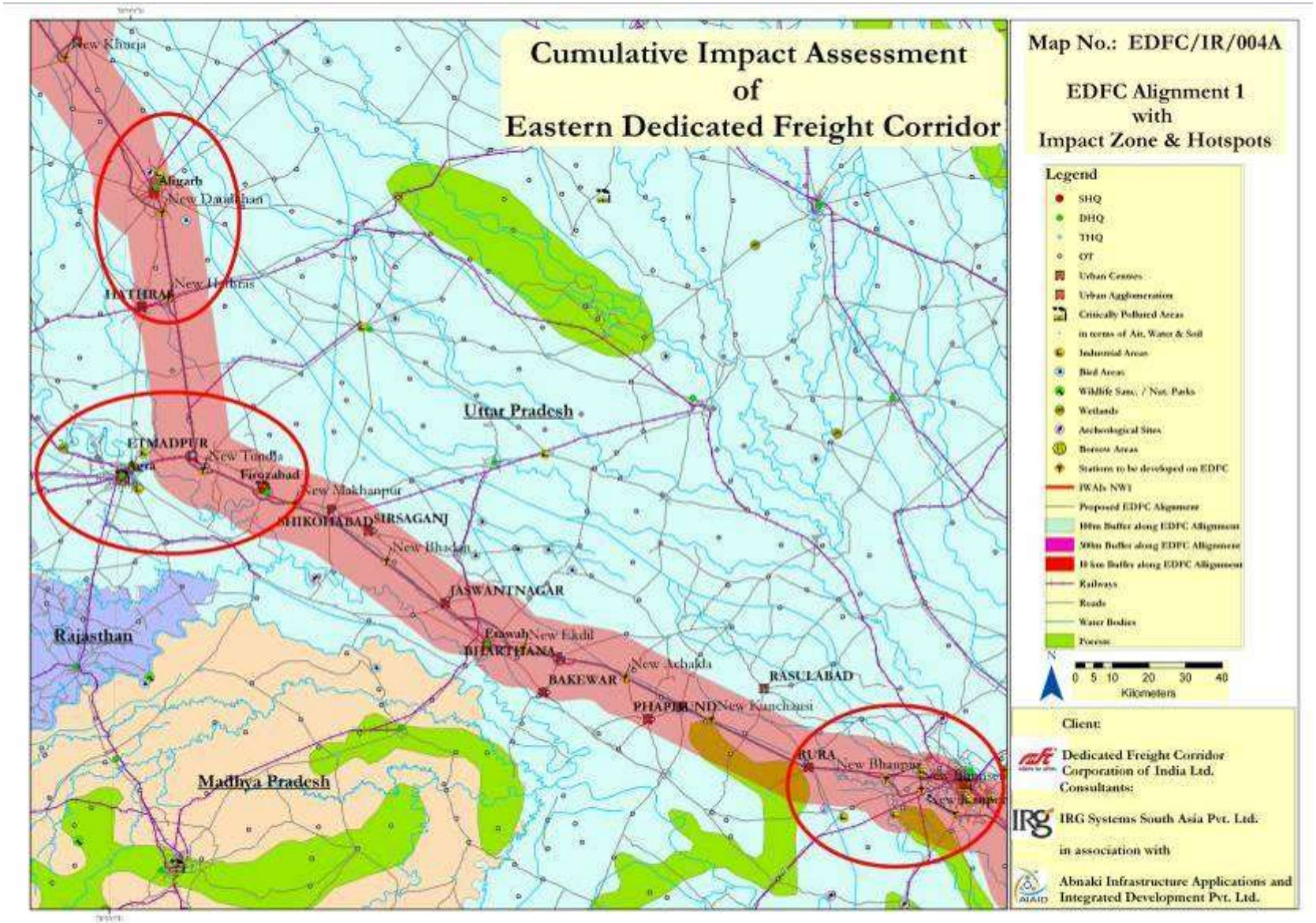

Figure 5.1: VECS and Hotspots in EDFC 1

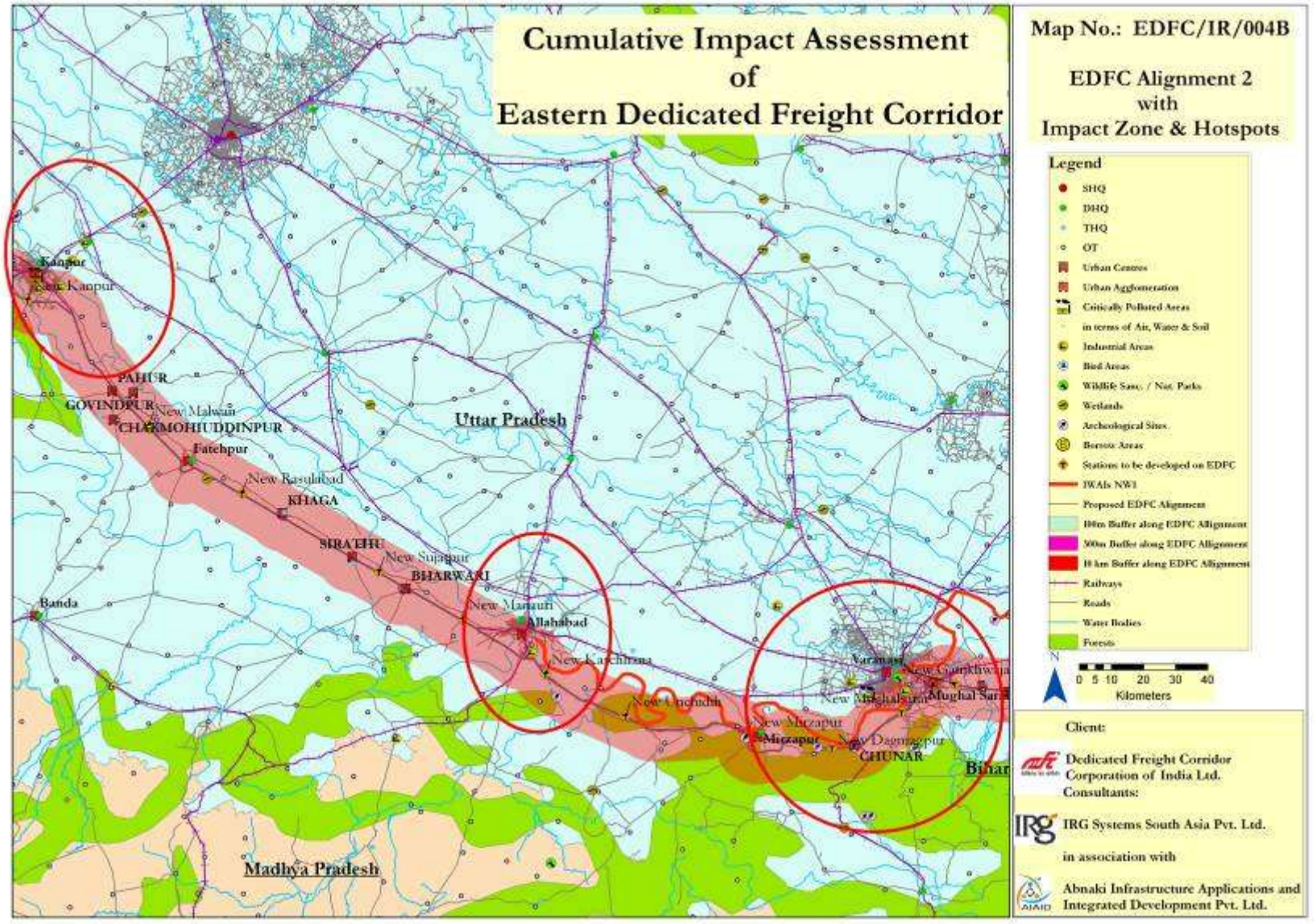

Figure 5.2: VECS and Hotspots in EDFC 2

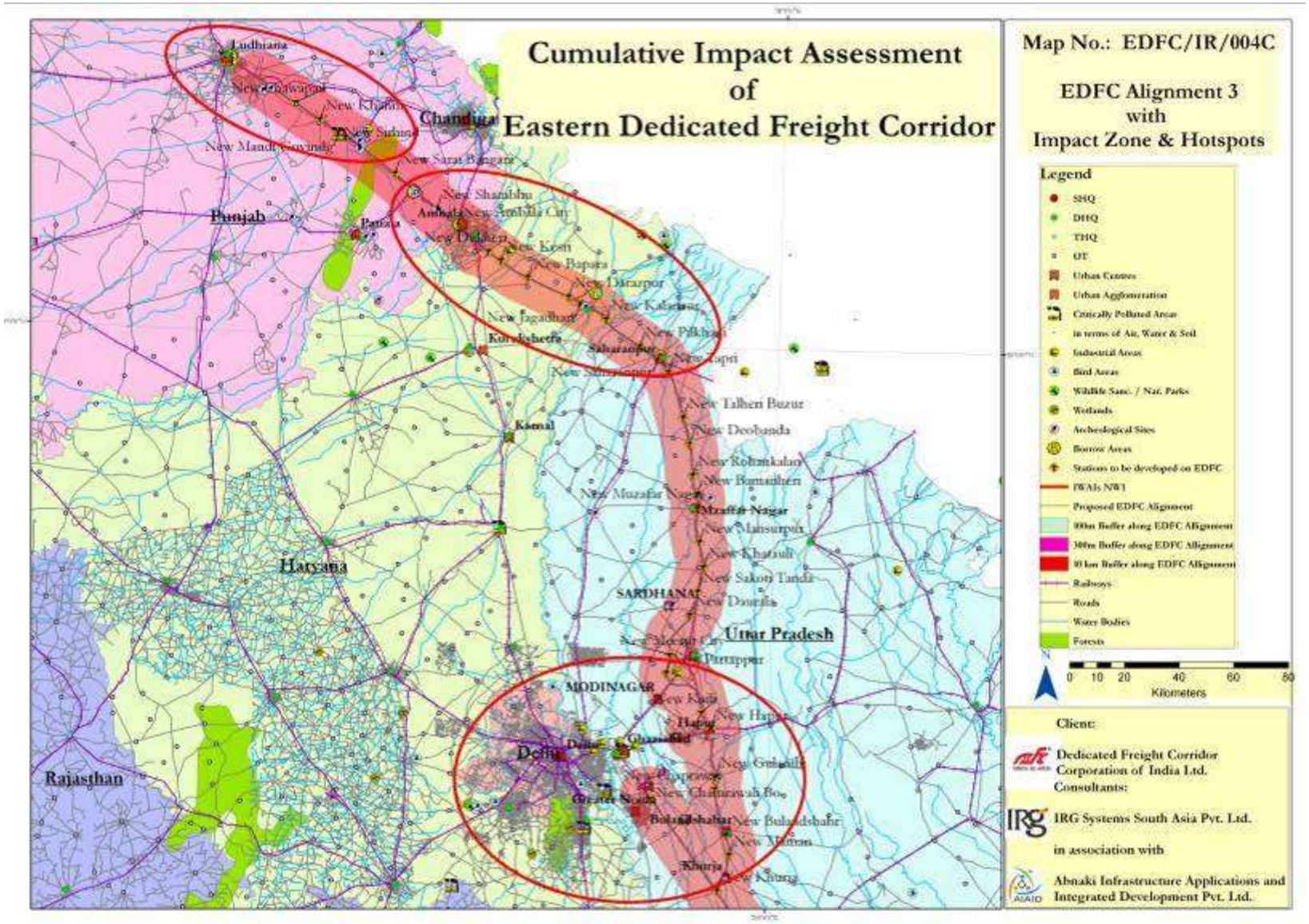

Figure 5.3: VECS and Hotspots in EDFC 3

5.3 Case Study

In order to demonstrate the cumulative impacts of the EDFC alignment on the nearby areas and the existing VECs within the 10 kms boundary, a stretch of the EDFC has been taken as a case study for Initial Draft Report . The stretch identified for the case study is from Mirzapur to Mughal Sarai consisting of a major hotspot near Mughalsarai. This stretch is also important due to common interface of DFCCIL with NW1 and national highways and state highways. This stretch contains various sensitive receptors including VECs as shown in **Figure 6.2**. Based on the EIA of EDFC-2 and the GIS maps various VECs and sensitive receptors along the stretch have been enlisted in **Table 5.1**. Below given map of the stretch shows all the important VECs spatially under the buffer of 100 mtrs, 300 mtrs and 10 kms. Stakeholder's consultation is also in progress. VECs status may modify based on the input from stakeholders consultation which will be presented in the final CIA report.

Table 5.1: Details of VECs and their Status within the CIA boundary

S. No.	VECs			0 - 100 mtrs / ROW	100 - 300 mtrs	300 mtrs - 10 kms	Remarks
1	**Physical Features**	Urban Agglomerations				Varanasi	
2		Urban Centers		Chunar	Mughal Sarai	Mirzapur, Bharwari, Sirathu	
3		Land Use		Agriculture / Residential / Forests	Agriculture / Residential / Forests	Agriculture / Residential / Forests/ Industrial Areas	
4		Physiography/ Geology		Plain Flat area with gentle slope in East and South East	Plain Flat area with gentle slope in East and South East	Plain Flat area with gentle slope in East and South East	
5		Ecology (Wildlife Sanctuaries/ National Parks / Tiger Reserves / Bird Areas / Wetlands)		None	None	Kachhua Sanctuary	
6	**Ecosystem Services**	Critically Polluted (air, water, soil & ground water quality) based on CPCB's CEPI Index		Varanasi - Mirzapur	Varanasi - Mirzapur	Varanasi - Mirzapur	Varanasi - Mirzapur identified as Critically Polluted area
7		GHG Emissions					
8	**Natural Processes**	Water / Nutrient Cycle	Soil Quality	Good	Good	Good	Good top soil. However, critically polluted stretches at Ganga are visible and documented
			Ground Water Quality	Good to moderate	Good to moderate	Good to moderate	

S. No.	VECs			0 - 100 mtrs / ROW	100 - 300 mtrs	300 mtrs - 10 kms	Remarks
			Surface Water Quality	Good	Good to moderate	Critically Polluted Stretches of Ganga	
		Micro Climate	Air Quality	Good to moderate	Critical	Critical	Varanasi - Mirzapur identified as Critically Polluted area
			Noise Pollution	Critical (except detours)	Critical	Critical	
9	**Social Conditions**	Community Resources	Water Bodies (Pools / wells / nalas / canals)	50 in number (EIA Reports)	Nalas/ Canal network	Ganga River and Nalas/ canal network	
			Hospitals	5	Exist in rural and urban areas	Exist in rural and urban areas	
			Educational	7	Exist in rural and urban areas	Exist in rural and urban areas	
			Demography (R&R)	507 Families Displaced	Densely Populated Area	Densely Populated Area	Population pressure expected to increase due to Land acquisition and Urbanization
			Transport System	Local roads and rail network	Local roads and rail network	Well-developed rail and road network	
8	**Cultural Aspects**	Religious / Archaeological Sites (Temples, Mosques)		15		Exist	Area important due to religious/ archaeological perspective

5.4 Conclusion

Delineation of CIA boundaries has been carried out along with identification of VECs, their current status and hotspots in the EDFC study area. These VECs are the ultimate recipient of impacts because they tend to be at the ends of ecological pathways. Therefore, these VECs may be directly or indirectly affected by a specific development or by the cumulative effects of several developments. Therefore, it is essential to carry out the assessment of developmental works due to proposed project as well as other developmental works within the CIA boundary. This will give insight into type and extent of impacts.

CHAPTER 6: OTHER DEVELOPMENT PROPOSALS AND STAKEHOLDERS

6.0 Introduction

Development proposals and stakeholders have been described in the context of case study given in Chapter 5. Since the case study area falls near Mughal Sarai in Chanduali district on the stretch of EDFC 2, major developmental proposals have been identified and described as direct interventions consisting of station and associated infrastructure development under EDFC and other railways network, National Waterways 1; indirect and induced activities consisting of road and industrial area development and urbanization. Further, relevant stakeholders have also been identified and described below considering the development proposals. **Figure 6.1** shows the development proposals and VECs in the study area.

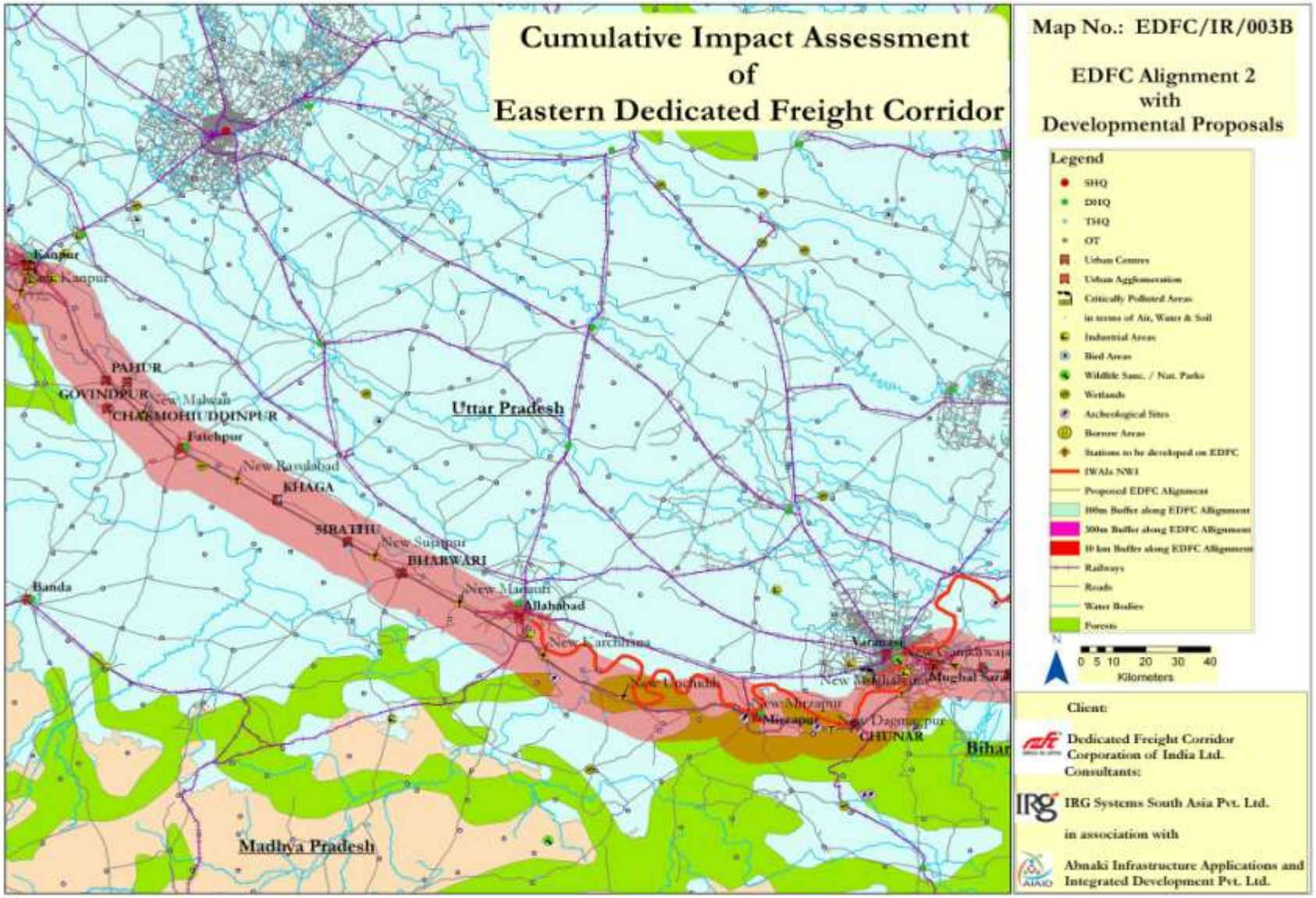

Figure 6.1: Development Proposals and VECs in the Study Area

6.1 Railways - DFCCIL & Feeder Route Development

Figure 6.1 indicates that there are three EDFC stations coming within the zone of influence, which are located at New Ahraura Road, New Mughalsarai and New Ganjkhwaja. Further, three broad gauge major railway lines passes through Mughalsarai, which are (1) Mughalsarai to Patna, which also branches out to Gaya, (2) Mughalsarai to Chunar and (3) Varanasi to Mughalsarai. **As per, business plan prepared by DFCCIL, Indian Railways (IR) will upgrade its own feeder routes connecting to DFCCIL.** Therefore, three routes may be upgraded in future depending on the traffic and the business model.

6.2 National Waterways Development (IWD)

Figure 6.1 also indicates proximity of the DFCCIL corridor with NW 1 within 10 kilometers. This indicates that there is a possibility of modal shift of the freight from NW1 to Eastern DFCCIL catering to the areas served by it. If this happens there has to be a transit point for shifting the freight. **This has been confirmed by Inland Waterways Authority of India (IWAI).**

6.3 Road Development

Case study area is served by National Highway, State Highway and other roads as shown in Figure 6.2. This road infrastructure may be upgraded to cater to freight movement in future.

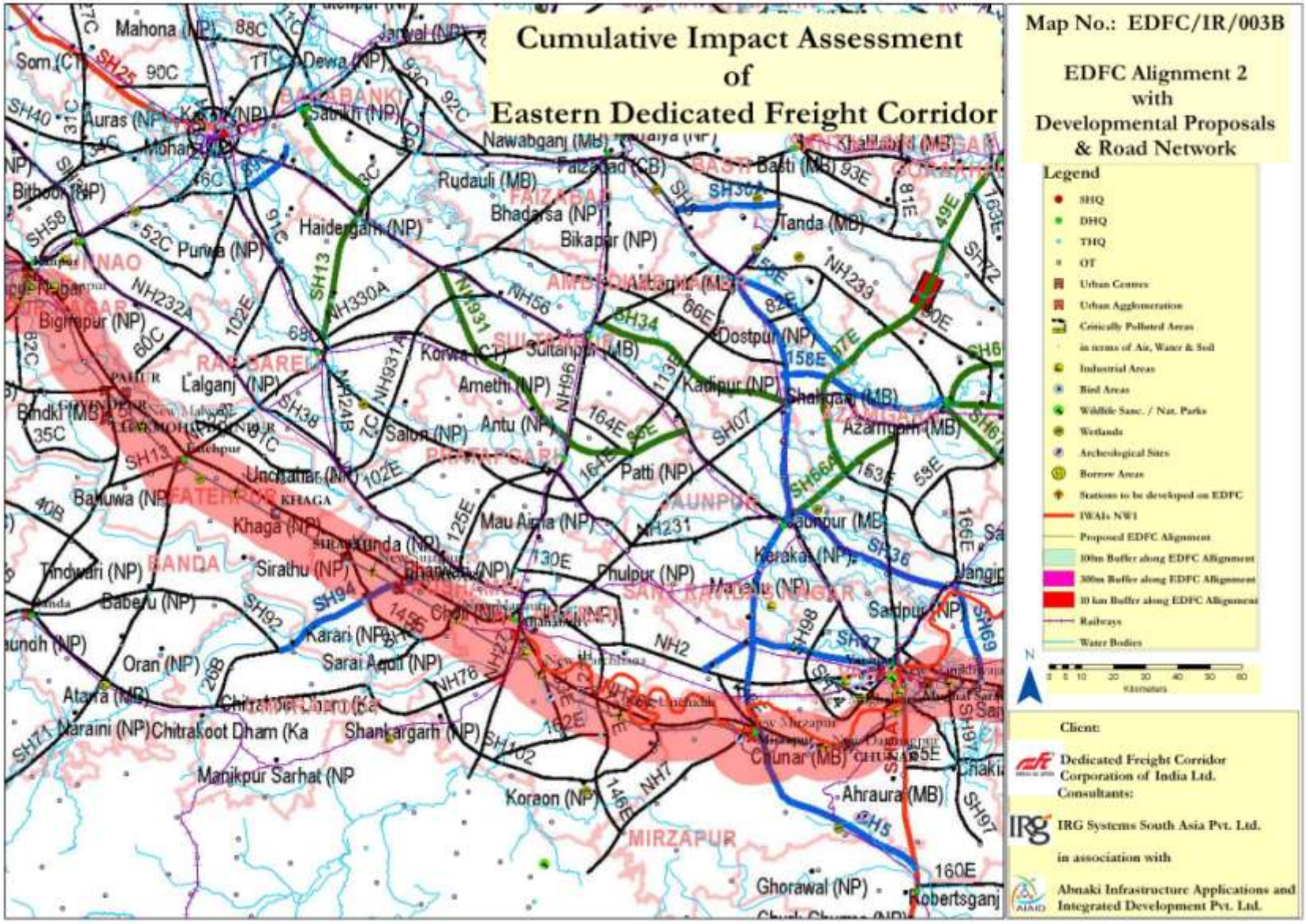

Figure 6.2: Development Proposals and Road Network in the Study Area

6.4 Industrial Development

Ram Nagar is the major industrial area, which is falling in the case study area.

6.5 Urbanization

In addition to the new stations along the DFCCIL, the area along the national and state highways in the study area will induce urbanization leading to pressure on account of population and associated infrastructure development and pollution potential.

6.6 Major Stakeholders

A list of major stakeholders at national and state level has been prepared considering the above mentioned development proposals as given in **Table 6.1**.

Table 6.1: Identification and Classification of Stakeholders

S. No.	Development Proposals	Stakeholders	
		National	State
1	Railways	DFCCIL & Indian Railways	State Pollution Control Boards, Forest Department
2	National Waterways Development	Inland Waterways Authority of India	State Pollution Control Boards, Forest Department
3	Road Development	National Highways Authority of India / Central Public Works Department / MoEF	State Public Works Department, Department of Environment, State Pollution Control Boards, Forest Department
4	Industrial Area Development	Ministry of Commerce & Industry	State Industrial Development Corporation/ State Pollution Control Boards, Forest Department
5	Urbanization	Ministry of Urban Developments / Indian Railways / DFCCIL	Municipal Corporations / Municipality / State Urban Development Authorities / State Pollution Control Boards, Forest Department

6.7 Conclusions

The assessment of development proposals not only indicate the **incremental pressures** on the existing VECs but also assist in assessing **their extent and intensity with respect to planned EDFC development**. Further, the identification of stakeholders informs about the **control (Direct & Indirect) over planned developmental activities**. These stakeholders are being/ will be consulted to understand about the proposed development.

CHAPTER 7: STAKEHOLDERS CONSULTATIONS

7.0 Introduction

An effort has been made to consult the identified stakeholders especially in the context of the case study area in order to assess the major VECs and possible impacts from their perspective. These stakeholders included National Highway Authority of India (NHAI), Uttar Pradesh PWD Department, Inland Waterways Authority (IWAI). Summary of the consultations is described below.

7.1 Consultation with National Highway Authority of India (NHAI)

The consultant's team visited NHAI on 2nd June 2015 and met with General Manager Environment to discuss about the DFCCIL project, its integration with national highways and environmental and social issues related to linear projects. Summary of major discussion points is give below.

- Major issues related to linear projects include surface run off, barrier to movement of man and animal, ecology consisting of forests, wildlife sanctuaries, wetlands, borrow areas, and land use issues especially land procurement, R& R and archaeological sites. Examples for addressing such issues particularly borrow areas and aquatic ecology can be taken from the EIA/EMP of Allahabad Bypass project especially from the component of bridge over Ganga river.

- Pollution related issues are restricted to construction period from NHAI's perspective because they don't have control over traffic movement, which is a state's subject.

- DFCCIL may reduce traffic load on National Highways especially for a short distance since tonnage by road transport is small in comparison to railway transport. This will also have positive impact not only from resource consumption perspective (fuel savings) but also GHG emissions.

DFCCIL project will also lead to upgradation of NH and other feeder roads and may induce urbanization and related development at common nodes.

7.2 Consultation with UP State PWD Department

The interaction input with Project Director, UP State PWD, World Bank Project about the DFCCIL project, its integration with state highways and environmental and social issues related to linear projects. Summary of major discussion points is give below.

- State PWD always integrates planning perspective of projects like DFCCIL with the state highway planning. Therefore, planning, design and up gradation of state highways and other such projects under their control will be implemented to cater to traffic movement as and when the need arises.

- Borrow area sourcing and management will be major issue related to such development.

7.3 Consultation with Inland Waterways Authority of India (IWAI)

Consultant's team being also part of CIA of NW 1 has been consulting with IWAI off and on related issues similar to DFCCIL as well its interface with it near Mughalsarai. Summary of major discussion points is give below.

- Major issues related to linear projects include ecology consisting of forests, wildlife sanctuaries (Kachua & Dolphin), wetlands, and land use issues especially type of land, land procurement, R& R, religious and archaeological sites.

- Connectivity issues like Jetty/ Terminal locations and their proximity with DFCCIL corridor/ station and the connecting road.

Synergistic combination of DFCCIL and NW 1 project leading to reduced GHG emissions vis a vis road transportation and overall environmental sustainability of the two projects.

7.4 Conclusions

Stakeholders' consultations indicate the confirmation of the type of VEC identified in Chapter 5. These consultations also give insight into the impacts, mitigation; management and monitoring at project level considering implementation of best practices. **This consultative exercise is both ongoing and iterative in nature and will continue for the entire stretch of EDFC 1, EDFC 2 and EDFC 3.**

CHAPTER 8: CIA IMPACT ASSESSMENT & MITIGATION MEASURES

8.0 Introduction

Literature review indicates that cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, project, or activity (collectively referred to in this document as "developments") when added to other existing, planned, and/or reasonably anticipated future ones. For practical reasons, the identification and management of cumulative impacts are limited to those effects generally recognized as important on the basis of scientific concerns and/or concerns of affected communities. Multiple and successive environmental and social impacts from existing developments, combined with the potential incremental impacts resulting from proposed and/or anticipated future developments, may result in significant cumulative impacts that would not be expected in the case of a stand-alone development. Therefore, an effort has been made to assess cumulative impacts on identified VECs against each identified development in the case study area shown in Figure 8.1 in the following sections. The development is happening all along. Effect of past development has already been captured in the baseline condition assessment while assessing the impacts due to DFCCIL presented under Chapter 4. Hence focus has been given under CIA for the current and proposed /anticipated developments activities. Since this report is at initial level, more credible information shall be available for the developments once primary data collection is completed and stakeholder consultation is completed.

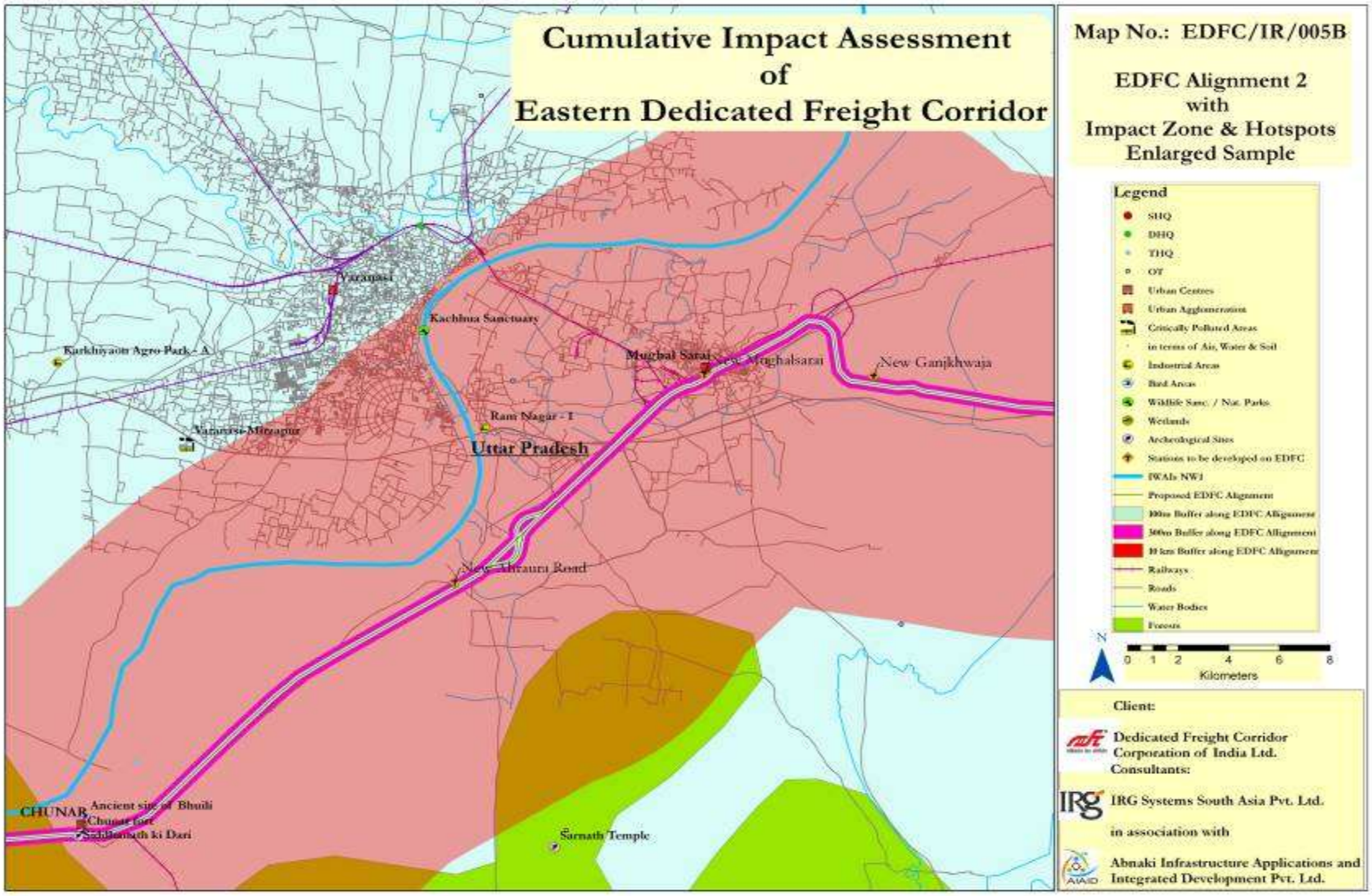

Figure 8.1: Cumulative Impact on Identified VECs

8.1 Impacts due to Railways – DFCCIL & Feeder Route Development

Cumulative Impacts due to development of three EDFC stations which are located at New Ahraura Road, New Mughalsarai and New Ganjkhwaja and three broad gauge major railway lines which are (1) Mughalsarai to Patna, which also branches out to Gaya, (2) Mughalsarai to Chunar and (3) Varanasi to Mughalsarai and which may be upgraded in future depending on the traffic and the business plan are given below in Table 8.1.

Table 8.1: Cumulative Impact Matrix due to Railways – Station & Feeder Route Development

VECs		0 - 100 mtrs / ROW	100 - 300 mtrs	300 mtrs - 10 kms	Impacts due to DFCCIL Development			Impacts due to Railways – Station & Feeder Route Development			Remarks
					0 - 100 mtrs / ROW	100 - 300 mtrs	300 mtrs - 10 kms	0 - 100 mtrs / ROW	100 - 300 mtrs	300 mtrs - 10 kms	
Physical Features	Urban Agglomerations			Varanasi	**M-**	**M-**	M-	**M-**	M-	**M-**	**Urban agglomerations will come up near stations**
	Urban Centers	Chunar	Mughal Sarai	Mirzapur, Bharwari, Sirathu	**M-**	**M-**	M-	**M-**	M-	**M-**	**Increase in pressure on existing urban centres**
	Land Use	Agriculture / Residential / Forests	Agriculture / Residential / Forests	Agriculture / Residential / Forests/ Industrial Areas	**M-**	**I**	**I**	**I**	**I**	**I**	**Restricted to DFCCIL corridor**
	Physiography/	Plain Flat	Plain Flat	Plain Flat	**I**	**I**	**I**	**I**	**I**	**I**	

	Geology		area with gentle slope in East and South East	area with gentle slope in East and South East	area with gentle slope in East and South East							
	Ecology (Wildlife Sanctuaries/ National Parks / Tiger Reserves / Bird Areas / Wetlands)		None	None	Kachhua Sanctuary	**I**	**I**	**I**	**I**	**I**	**I**	
Ecosystem Services	Critically Polluted (air, water, soil & ground water quality) based on CPCB's CEPI Index		Varanasi - Mirzapur	Varanasi - Mirzapur	Varanasi - Mirzapur	**I**	**I**	**I**	**I**	**I**	**I**	
	GHG Emissions					M+	M+	M+	M+	M+	M+	**Due to overall reduction of vehicular traffic**
Natural Processes	Water & Nutrient Cycle	Soil Quality	Good	Good	Good	**M-**	**I**	**I**	**I**	**I**	**I**	**Restricted during construction phase**
		Ground Water Quality	Good to moderate	Good to moderate	Good to moderate	**M-**	**I**	**I**	**I**	**I**	**I**	**Restricted during construction phase**
		Surface Water Quality	Good	Good to moderate	Critically Polluted Stretches of Ganga	**M-**	**I**	**I**	**I**	**I**	**I**	**Restricted during construction phase**
	Microclimate	Air Quality	Good to moderate	Critical	Critical	**M-**	**I**	**I**	**M+**	**M+**	**M+**	**Due to reduction of vehicular traffic**
		Noise Pollution	Critical (except detours)	Critical	Critical	**M-**	**M-**	**I**	**M-**	**M-**	**I**	**Due to railway traffic**

Social Conditions	Community Resources	Water Bodies (Pools / wells / nalas / canals)	50 in number (EIA Reports)	Nalas/ Canal network	Ganga River and Nalas/ canal network	**S**	**I**	**I**	**S**	**I**	**I**	**Resttricted to corridor**
		Hospitals	5	Exist in rural and urban areas	Exist in rural and urban areas	**S**	**I**	**I**	**S**	**I**	**I**	**Resttricted to corridor**
		Educational	7	Exist in rural and urban areas	Exist in rural and urban areas	**S**	**I**	**I**	**S**	**I**	**I**	**Resttricted to corridor**
		Demography (R&R)	507 Families Displaced	Densely Populated Area	Densely Populated Area	**S**	**I**	**I**	**S**	**I**	**I**	**Resttricted to corridor**
Cultural Aspects	Religious / Archaeological Sites (Temples, Mosques)		15		Exist	**S**	**I**	**I**	**S**	**I**	**I**	**Resttricted to corridor**

Legends:

S: Significant Impact
M: Medium Significance
I: Insignificant

8.2 Impacts due to development of National Waterways Development (NW1)

DFCCIL corridor with NW 1 is located within 10 kilometers distance of each other. Therefore, cumulative impacts due to modal shift of the freight from NW1 to Eastern DFCCIL catering to the areas served by it are given below in Table 8.2.

Table 8.2: Cumulative Impact Matrix due to National Waterways Development (NW1)

VECs		0 - 100 mtrs / ROW	100 - 300 mtrs	300 mtrs - 10 kms	Impacts due to DFCCIL Development			Impacts due to National Waterways Development (NW1)			Remarks
					0 - 100 mtrs / ROW	100 - 300 mtrs	300 mtrs - 10 kms	0 - 100 mtrs / ROW	100 - 300 mtrs	300 mtrs - 10 kms	
Physical Features	Urban Agglomerations			Varanasi	S-	S-	S-	S-	S-	S-	New urban agglomerations may come up in the zone of influence
	Urban Centers	Chunar	Mughal Sarai	Mirzapur, Bharwari, Sirathu	S-	S-	S-	S-	S-	S-	Expansion of already existing urban areas
	Land Use	Agriculture / Residential / Forests	Agriculture / Residential / Forests	Agriculture / Residential / Forests/ Industrial Areas	S-	S-	S-	S-	S-	S-	Land use change due to urbanization
	Physiography/ Geology	Plain Flat area with gentle	Plain Flat area with	Plain Flat area with gentle	I	I	I	I	I	I	

			slope in East and South East	gentle slope in East and South East	slope in East and South East							
	Ecology (Wildlife Sanctuaries/ National Parks / Tiger Reserves / Bird Areas / Wetlands)		None	None	Kachhua Sanctuary	**I**	**I**	**I**	**I**	**I**	**S-**	
Ecosystem Services	Critically Polluted (air, water, soil & ground water quality) based on CPCB's CEPI Index		Varanasi - Mirzapur	Varanasi - Mirzapur	Varanasi - Mirzapur	**M-**	**I**	**I**	**I**	**I**	**I**	**Restricted to corridor**
	GHG Emissions					**I**	**I**	**I**	**I**	**I**	**I**	
Natural Processes	Water & Nutrient Cycle	Soil Quality	Good	Good	Good	**M-**	**I**	**I**	**I**	**I**	**I**	**Restricted to corridor**
		Ground Water Quality	Good to moderate	Good to moderate	Good to moderate	**I**	**I**	**I**	**I**	**I**	**I**	
		Surface Water Quality	Good	Good to moderate	Good to moderate	**I**	**I**	**I**	**I**	**I**	**M-**	**Restricted to only accidental discharge into surface water body**
	Microclimate	Air Quality	Good to moderate	Critical		**M-**	**I**	**I**	**I**	**I**	**I**	**Restricted to corridor due to construction**
		Noise Pollution	Critical (except detours)	Critical		**M-**	**I**	**I**	**S-**	**I**	**I**	**Restricted to corridor due to traffic movement**
Social Conditions	Community Resources	Water Bodies (Pools /	50 in number (EIA	Nalas/ Canal network		**S-**	**I**	**I**	**I**	**I**	**I**	**Restricted to corridor**

		wells / nalas / canals)	Reports)									
		Hospitals	5	Exist in rural and urban areas		**S-**	**I**	**I**	**I**	**I**	**I**	**Restricted to corridor**
		Educational	7	Exist in rural and urban areas		**S-**	**I**	**I**	**I**	**I**	**I**	**Restricted to corridor**
		Demography (R&R)	507 Families Displaced	Densely Populated Area		**S-**	**I**	**I**	**I**	**I**	**I**	**Restricted to corridor**
Cultural Aspects	Religious / Archaeological Sites (Temples, Mosques)		15		Exist	**S-**	**I**	**I**	**I**	**I**	**I**	**Restricted to corridor**

Legends:

S: Significant Impact
M: Medium Significance
I: Insignificant

8.3 Road Development

Road development will direct linkage to DFCCIL activities. It will have positive and negative impacts both. Positive impacts are related to shift of bulk traffic from roads to DFCC. Whereas road close to fright station may increase the traffic load though in localized area. Cumulative Impacts due to development and up gradation of road infrastructure to cater to freight movement in future are given below in Table 8.3.

Table 8.3: Cumulative Impact Matrix due to Road Development

VECs		0 - 100 mtrs / ROW	100 - 300 mtrs	300 mtrs - 10 kms	Impacts due to DFCCIL Development			Impacts due to Road Development			Remarks
					0 - 100 mtrs / ROW	100 - 300 mtrs	300 mtrs - 10 kms	0 - 100 mtrs / ROW	100 - 300 mtrs	300 mtrs - 10 kms	
Physical Features	Urban Agglomerations			Varanasi	**S-**	**S-**	**S-**	**S-**	**S-**	**S-**	**New urban agglomerations may come up in the zone of influence**
	Urban Centers	Chunar	Mughal Sarai	Mirzapur, Bharwari, Sirathu	**S-**	**S-**	**S-**	**S-**	**S-**	**S-**	**Expansion of already existing urban areas**
	Land Use	Agriculture / Residential / Forests	Agriculture / Residential / Forests	Agriculture / Residential / Forests/ Industrial Areas	**S-**	**S-**	**S-**	**S-**	**S-**	**S-**	**Land use change due to urbanization**
	Physiography/	Plain Flat	Plain	Plain Flat	**I**	**I**	**I**	**I**	**I**	**I**	

	Geology		area with gentle slope in East and South East	Flat area with gentle slope in East and South East	area with gentle slope in East and South East							
	Ecology (Wildlife Sanctuaries/ National Parks / Tiger Reserves / Bird Areas / Wetlands)		None	None	Kachhua Sanctuary	**I**	**I**	**I**	**I**	**I**	**I**	**No go areas**
Ecosystem Services	Critically Polluted (air, water, soil & ground water quality) based on CPCB's CEPI Index		Varanasi - Mirzapur	Varanasi - Mirzapur	Varanasi - Mirzapur	**M-**	**I**	**I**	**M-**	**I**	**I**	**Restricted to corridor**
	GHG Emissions					**M-**	**I**	**I**	**M-**	**I**	**I**	**Restricted to corridor**
Natural Processes	Water & Nutrient Cycle	Soil Quality	Good	Good	Good	**M-**	**I**	**I**	**M-**	**I**	**I**	**Restricted to corridor**
		Ground Water Quality	Good to moderate	Good to moderate	Good to moderate	**I**	**I**	**I**	**I**	**I**	**I**	
		Surface Water Quality	Good	Good to moderate	Critically Polluted Stretches of Ganga	**I**	**I**	**I**	**I**	**I**	**M-**	**Restricted to only accidental discharge into surface water body**
	Microclimate	Air Quality	Good to moderate	Critical	Critical	**M-**	**I**	**I**	**M-**	**I**	**I**	**Resttricted to corridor**
		Noise Pollution	Critical (except detours)	Critical	Critical	**M-**	**I**	**I**	**M-**	**I**	**I**	**Resttricted to corridor**
Social	Community	Water	50 in	Nalas/	Ganga	**S-**	**I**	**I**	**S-**	**I**	**I**	**Resttricted**

Conditions	Resources	Bodies (Pools / wells / nalas / canals)	number (EIA Reports)	Canal network	River and Nalas/ canal network							**to corridor**
		Hospitals	5	Exist in rural and urban areas	Exist in rural and urban areas	**S-**	**I**	**I**	**S-**	**I**	**I**	**Resttricted to corridor**
		Educational	7	Exist in rural and urban areas	Exist in rural and urban areas	**S-**	**I**	**I**	**S-**	**I**	**I**	**Resttricted to corridor**
		Demography (R&R)	507 Families Displaced	Densely Populated Area	Densely Populated Area	**S-**	**I**	**I**	**S-**	**I**	**I**	**Resttricted to corridor**
Cultural Aspects	Religious / Archaeological Sites (Temples, Mosques)		15		Exist	**S-**	**I**	**I**	**S-**	**I**	**I**	**Resttricted to corridor**

Legends:

S: Significant Impact
M: Medium Significance
I: Insignificant

8.4 Industrial Area Development

Industrial area causes the impact primarily related to discharge of waste (liquid, solid, hazardous) to environment. It additionally increase load n transportation system. Ram Nagar is the major industrial area, which is falling in the case study area. Cumulative Impacts due to this development are given below in Table 8.4.

Table 8.4: Cumulative Impact Matrix due to Industrial Area Development

VECs		0 - 100 mtrs / ROW	100 - 300 mtrs	300 mtrs - 10 kms	Impacts due to DFCCIL Development			Impacts due to Industrial area development			Remarks
					0 - 100 mtrs / ROW	100 - 300 mtrs	300 mtrs - 10 kms	0 - 100 mtrs / ROW	100 - 300 mtrs	300 mtrs - 10 kms	
Physical Features	Urban Agglomerations			Varanasi	**I**	**I**	**I**	**I**	**I**	**M-**	**Urban agglomeration due to Planned Industrial development may occur at the periphery**
	Urban Centers	Chunar	Mughal Sarai	Mirzapur, Bharwari, Sirathu	**M-**	**M-**	**M-**	**S-**	**S-**	**M-**	**New industrial centres may come up which may increase the incremental pressure on already growing urban centres**
	Land Use	Agriculture / Residential	Agriculture / Residential	Agriculture / Residential	**M-**	**M-**	**M-**	**M-**	**M-**	**M-**	**Loss Of land if new industrial areas come up**

			/ Forests	/ Forests	/ Forests/ Industrial Areas							
	Physiography/ Geology		Plain Flat area with gentle slope in East and South East	Plain Flat area with gentle slope in East and South East	Plain Flat area with gentle slope in East and South East	**I**	**I**	**I**	**I**	**I**	**I**	
	Ecology (Wildlife Sanctuaries/ National Parks / Tiger Reserves / Bird Areas / Wetlands)		None	None	Kachhua Sanctuary	**I**	**I**	**I**	**I**	**I**	**I**	**No go Areas**
Ecosystem Services	Critically Polluted (air, water, soil & ground water quality) based on CPCB's CEPI Index		Varanasi - Mirzapur	Varanasi - Mirzapur	Varanasi - Mirzapur	**M-**	**M-**	**M-**	**S-**	**S-**	**S-**	**Due to DFFCIL project it may be tempoary and restrcited to construction phase. Significant if DFCCIL corridor catalyses Industrial development**
	GHG Emissions					**M+**	**M+**	**M+**	**M+**	**M+**	**M+**	**Overall GHG emissions may reduce**
Natural Processes	Water & Nutrient Cycle	Soil Quality	Good	Good	Good	**I**	**I**	**I**	**M-**	**M-**	**M-**	**Insignificant considering due to impacts during construction phase. Moderately – considering incremental pressure due to industrial area development**
		Ground Water Quality	Good to moderate	Good to moderate	Good to moderate	**I**	**I**	**I**	**M-**	**M-**	**M-**	
		Surface Water Quality	Good	Good to moderate	Critically Polluted Stretches of Ganga	**I**	**I**	**I**	**M-**	**M-**	**M-**	
	Microclimate	Air Quality	Good to moderate	Critical	Critical	**I**	**I**	**I**	**M-**	**M-**	**M-**	**Insignificant considering due to impacts during**

												construction phase. Moderately – considering incremental pressure due to industrial area development
		Noise Pollution	Critical (except detours)	Critical	Critical	**S-**	**S-**	**M-**	**S-**	**S-**	**M-**	**Incremental noise pollution**
Social Conditions	Community Resources	Water Bodies (Pools / wells / nalas / canals)	50 in number (EIA Reports)	Nalas/ Canal network	Ganga River and Nalas/ canal network	**S-**	**I**	**I**	**S-**	**I**	**I**	**Restricted to corridor**
		Hospitals	5	Exist in rural and urban areas	Exist in rural and urban areas	**S-**	**I**	**I**	**S-**	**I**	**I**	**Restricted to corridor**
		Educational	7	Exist in rural and urban areas	Exist in rural and urban areas	**S-**	**I**	**I**	**I**	**I**	**I**	**Restricted to corridor**
		Demography (R&R)	507 Families Displaced	Densely Populated Area	Densely Populated Area	**S-**	**I**	**I**	**M-**	**M-**	**M-**	**Loss of land due to corridor superimposed by Loss of land due to new industrial area development**
Cultural Aspects	Religious / Archaeological Sites (Temples, Mosques)		15		Exist	**S-**	**I**	**I**	**I**	**I**	**I**	**Restricted to corridor**

Legends:

S: Significant Impact
M: Medium Significance
I: Insignificant

8.5 Urbanization

With the development, and population growth, urbanization is increasing. DFCC and its fright station will also induce such development. Cumulative Impacts due to urbanization are given below in Table 8.5.

Table 8.5: Cumulative Impact Matrix due to Urbanization

VECs		0 - 100 mtrs / ROW	100 - 300 mtrs	300 mtrs - 10 kms	Impacts due to DFCCIL Development			Impacts due to Urbanization			Remarks
					0 - 100 mtrs / ROW	100 - 300 mtrs	300 mtrs - 10 kms	0 - 100 mtrs / ROW	100 - 300 mtrs	300 mtrs - 10 kms	
Physical Features	Urban Agglomerations			Varanasi	**s-**	**M+**	**M+**	**s-**	**M+**	**M+**	**Due to population growth and growth of service sector new urban agglomerations would come up**
	Urban Centers	Chunar	Mughal Sarai	Mirzapur, Bharwari, Sirathu	**s**	**M**	**M**	**s**	**M**	**M**	**Due to population growth and growth of service sector municipal boundaries would expand**
	Land Use	Agriculture / Residential / Forests	Agriculture / Residential / Forests	Agriculture / Residential / Forests/ Industrial Areas	**s-**	**M-**	**M-**	**s-**	**M-**	**M-**	**Land Use will change due to land acquisition and urbanization. Agriculture area would contract**
	Physiography/ Geology	Plain Flat area with gentle slope in East and	Plain Flat area with gentle slope in	Plain Flat area with gentle slope in East and	**I**	**I**	**I**	**I**	**I**	**I**	

			South East	East and South East	South East							
	Ecology (Wildlife Sanctuaries/ National Parks / Tiger Reserves / Bird Areas / Wetlands)		None	None	Kachhua Sanctuary	**I**	**I**	**I**	**I**	**I**	**I**	**Kachhua Sanctuary would be a no go area and its buffer area would be maintained**
Ecosystem Services	Critically Polluted (air, water, soil & ground water quality) based on CPCB's CEPI Index		Varanasi - Mirzapur	Varanasi - Mirzapur	Varanasi - Mirzapur	**M-**	**M-**	**M-**	**M-**	**M-**	**M-**	**CEPI Index may change moderately due to increase in overall polluton load due to urbanization**
	GHG Emissions					**M +**	**M+**	**M+**	**S-**	**S-**	**S-**	**Overall improvement is expected though GHG emissions may increase due to urbanization**
Natural Processes	Water & Nutrient Cycle	Soil Quality	Good	Good	Good	**S-**	**I**	**I**	**S-**	**M-**	**S-**	**Top soil will be lost due to planned development and urbanization**
		Ground Water Quality	Good to moderate	Good to moderate	Good to moderate	**M-**	**I**	**I**	**M-**	**M-**	**M-**	**Ground water Quality will be moderately impacted during construction period**
		Surface Water Quality	Good	Good to moderate	Critically Polluted Stretches of Ganga	**M-**	**I**	**I**	**M-**	**M-**	**M-**	**Long term impacts are expected due to effluent discharge**
	Microclimate	Air Quality	Good to moderate	Critical	Critical	**M-**	**I**	**I**	**M+**	**M-**	**M-**	**Long term impacts are expected because of emissions increase (vehicular traffic) in urban areas**
		Noise Pollution	Critical (except detours)	Critical	Critical	**M-**	**M-**	**I**	**I**	**I**	**I**	
Social Condition	Community Resources	Water Bodies	50 in number	Nalas/ Canal	Ganga River and	**S-**	**I**	**I**	**S-**	**M-**	**M-**	**S-Restricted to corridor**

s		(Pools / wells / nalas / canals)	(EIA Reports)	network	Nalas/ canal network							
		Hospitals	5	Exist in rural and urban areas	Exist in rural and urban areas	**S-**	**I**	**I**	**S+**	**S+**	**S+**	**S-Restricted to corridor; S+ due to expected increase in numbers of Hospitals**
		Educational	7	Exist in rural and urban areas	Exist in rural and urban areas	**S-**	**I**	**I**	**S +**	**S+**	**S+**	**S-Restricted to corridor; S+ due to expected increase in numbers of educational Institutions**
		Demography (R&R)	507 Families Displaced	Densely Populated Area	Densely Populated Area	**S-**	**I**	**I**	**S-**	**S-**	**S-**	**Popuation pressure will increase**
Cultural Aspects	Religious / Archaeological Sites (Temples, Mosques)		15		Exist	**S-**	**I**	**I**	**S-**	**I**	**I**	**Restricted to corridor**

Legends:

S: Significant Impact
M: Medium Significance
I: Insignificant

In addition to the new stations along the DFCCIL, the area along the national and state highways in the study area will induce urbanization leading to pressure on account of population and associated infrastructure development and pollution potential.

8.6 Mitigation Measures

Some of the mitigation measures, which are restricted to vicinity of the planned development, are given below.

- Provision of balancing culverts to prevent waterlogging and damage of embankment due to water logging
- Provision of adequate cross drainage structures especially along the agricultural fields
- Provision of longitudinal drains on slopes to facilitate drainage of water and preventing water logging on track
- Structures should be developed as per the NBC guidelines for the applicable seismic zone
- Provision of retaining walls to retain the raised embankments at the places required
- Slope stabilization: stone pitching with grass turf
- Site identified for setting up construction, labour camps and debris disposal should be 500 m away from forest area, settlement areas, educational institute and religious structures and 1 km away from any notified eco-sensitive zone
- Agricultural fertile land should be avoided for setting up construction, labour camps and debris disposal site
- Low lying area away from water body, settlements and forest area should be selected for debris disposal
- Barren land should preferable be selected
- Provision of training to workers to handle material and waste to minimize spillage an soil contamination
- Material, fuel and waste storage should be done on paved structures
- Soil should be excavated from borrow areas only after obtaining the required permission from MoEFCC
- Excavation depth in borrow area should not exceed 2 m
- Excavated earth should be stored in covered condition
- No excavation activity to be carried out during monsoon season
- Garland drains should be provided at borrow area to provided adequate drainage and prevent entry of water into borrow pit
- A berm shall be left from the boundary of adjoining field having a width equal to at least half the depth of proposed excavation
- Borrow pits along the DFC corridor should be min 5 m away from toe of embankment and along the water body should be min 15 m away from toe of the bank of water body
- Proper & immediate closure of borrow area to be done after excavation of the earth:
  - Agriculture land: leveling the area by filling earth material and laying back the top soil
  - Barren area: conversion into the pond after leveling and maintaining slope (1:2)
- Debris should be collected at a temporary storage site and segregated into reusable, recyclable and discarded material. Re-usable material at site should be re-used, recyclable material should be sold to the authorized vendors and discarded material should be transported in covered conditions to selected site for waste disposal
- Provision of longitudinal drains and chutes on high embankments for drainage and prevent soil erosion

- Slope stabilization of embankments: stone pitching with grass turf
- Soil erosion checking measures as the formation of sediment basins, slope drains, etc, will be carried out during construction phase
- Excavated top soil should be stored in covered place and should later be spread in the same area or should be used for compensatory plantation
- Construction vehicles, machinery and equipment will move, or be stationed in the designated area, to avoid compaction of soil.
- If operating from temporarily hired land, it will be ensured that the topsoil for agriculture remains preserved & not destroyed by storage, material handling or any other construction related activities.
- Restoration of the sites used for labour camps, plant site and debris disposal should be undertaken. Labour camp and plant site should be cleaned up fully at time of closure. Plantation should be carried out, if any vegetation was removed from the site at the time of setting up the camp/plant site.
- Debris disposal site should be leveled and planted with tolerant plant species
- Ballast, sleepers etc should be sourced from the agencies having valid environment clearance & NOC from PCB
- Adequate air pollution control measures should be taken while operating batching plants, pugmills and DG sets
- Water sprinkling should be carried out at construction site, labour camps, haul roads, selected plant site (where all machinery and vehicles will be parked)
- Storage & transportation of raw material and debris in covered condition
- Excavated top soil should be stored in covered place
- Exploring use of fly-ash mix cement and bricks for construction of structures like stations, culvert, bridges etc.
- Provision of wheel washing facility at exit point of the plant site
- All vehicles, equipment and machinery used for construction will be regularly maintained to ensure that the pollution emission levels conform to the SPCB norms.
- All the vehicles entering the plant site, carrying the material should carry valid PUC
- Site identified for setting up construction, labour camps and debris disposal should be 500 m away from forest area, settlement areas, educational institute and religious structures and 1 km away from any notified eco-sensitive zone
- Adequate parking facility should be provided at the site, raw material storage site and plant site to prevent idling of vehicles
- No equipment/machinery should be left running if not in use
- Material transportation should be done in non peak hours to prevent traffic congestion
- Vehicles should be given one specific route to reach the site and they should be fitted with GPS so that their movement can be tracked
- Adequate guiding signage should be provided at the site to guide the drivers and prevent idling of the vehicles
- DG sets, batching plant and pugmills should be provided with adequate stack height for dispersion of exhaust
- No open burning of fuel should be allowed at the site and at labour camps. LPG should be provided as fuel
- Only low sulphur diesel should be used as fuel

- Compensatory plantation should be carried out minimum in ratio of 1:2
- Storing fuel, paint, polish, varnishes in covered containers to minimize odour generation
- All plants and equipments used in construction shall strictly conform to the MoEFCC/CPCB noise standards.
- All vehicles and equipment used in construction will be fitted with exhaust silencers.
- Servicing of all construction vehicles and machinery will be done for exhaust silences and will be checked and if found defective will be replaced.
- All the construction sites within 150m of the nearest habitation, noisy construction work such as concrete mixing will be stopped during the night time between 10.00 pm to 6.00 am.
- No noisy construction activities will be permitted around educational institutions/health centers (silence zones) up to a distance of 100 m from the sensitive receptors.
- Noise level monitoring should be carried out at construction site, DG set location and labour camp every month
- DG sets and all the other machinery and equipments should be provided with silencers, acoustic enclosure, noise dampners, noise mufflers and should meet the standards prescribed by CPCB
- Noise barriers should be provided as proposed in each of environment assessment study
- Effective track and wheel management during operation phase will significantly reduce the vibration. Following measures can be taken up for managing track and wheels:
  - Rail grinding on a regular basis.
  - Wheel truing to re-contour the wheel, removal of wheel flats and out of roundness.
  - Implement vehicle reconditioning programs, particularly when components such as suspension system, brakes, wheels, and slip-slide detectors will be involved.
  - Install wheel-flat detector systems to identify vehicles which are most in need of wheel truing.
  - Install wheel geometry measurement devices (e.g. laser based systems installed at entrance of depot) with possibility of detecting out of soundness, difference of wheel diameter of wheels on the same axle, wheel wear. (Vibration reduces more than 10 dB)
  - Inclusion of Rail Resilient fasteners (rail and base plate pads) in track installation
- Water for construction purpose should preferably be taken from surface water bodies after obtaining required permission
- Wastewater generated from construction site should be collected and should be re-used for wheel washing, curing etc.
- Sewage generated from labour camps and toilets at site should be disposed off into septic tanks/soak pits
- Wastewater and sewage should be discharged into ground water or any surface water body.
- No mixing of wastewater and any existing water pipeline should be allowed
- Ponding of wastewater at site should not be allowed
- Plant site & labour camp should be located at min 100 m distance from water body
- Low lying area away from water body should be selected for waste disposal
- Ground water and surface water quality should be monitored at least once in six months
- Drinking water quality for construction labour should be monitored every month
- Oil & grease traps should be provided with the storm water drains in the vehicle and machinery marking area

- No canal/drain used by the public for any purpose should be blocked due to development of project
- Any well/tube well/ hand pump/pond etc, if abandoned should be replaced and relocated immediately
- Oil & grease trap should be provided with drains carrying water from washing of cars/wagon/station & track and should be disposed off into septic tank/soak pit
- Sewage generated at freight station should be disposed off into septic tank/soak pit
- Cleaning of all the existing cross drainage structures and natural drainage before onset of monsoon in order to keep all drainage unblocked.
- Earth, stones, wastes and spoils will be properly disposed off, to avoid blockage of any drainage channel.
- All necessary precautions will be taken to construct temporary or permanent structures to prevent inundation or ponding.
- The slopes of embankment leading to water bodies should be modified and re-channelized so that contaminants do not enter the water body.
- Temporary storm water drainage system should be provided at labour camp, construction camp, borrow area site and construction site
- Sedimentation basins and silt traps should be provided to collect run-off from site and trap the sediments from run-off

- Trees cutting should be limited to those identified during the survey
- Vegetation removal should be minimized
- Tree cutting should be carried out after obtaining permission from forest department
- Construction vehicles, machinery and equipment will move or be stationed in the designated area only (RoW or CoI, as applicable), to prevent compaction of vegetation outside the RoW.
- While operating on temporarily acquired land for traffic detours, storage, material handling or any other construction related or incidental activities, it will be ensured that the trampling of soil and damage to naturally occurring herbs and grasses will be avoided.
- Speed of construction vehicles should be maintained to prevent animal accidents during construction stage.
- State rules for hunting (wild life protection) will be adhered and rules for Bird catching (wild life protection) will be adhered
- Land acquisition should be carried out as per the resettlement action plan prepared for each section/sub-section
- Compensation as per RAP should be provided to each land holder and affected family before acquisition of land
- All the CPRs should be relocated immediately after dismantling keeping the cleanliness and hygiene in mind
- Way to school, hospital, temple, street should not be blocked, an alternate route should be suggested before blocking
- Minimizing the loss of CPRs by reducing the RoW requirement, if feasible
- Removal of trees, structures etc should be done as per the RAP only
- Consent of land owner should be obtained before excavation of earth from identified borrow area. Site should be restored to the condition agreed before excavation with land owner
- Construction camps/plant site should be located 500 m away from the residential areas

- Employment should be given preferably to local people to the extent possible
- Labour camps should be provided with proper bedding, drinking water facility, toilets, bathing facility, septic tanks, drainage system. Inspection of labour camp should be done every month to ensure proper functioning of these facilities
- Labour should be properly made aware for not burning wood or any other waste material. LPG should be provided as fuel for cooking
- Crèche facility should be provided, if female workers are employed
- All workers should be given material/equipment handling training and emergency situation handling training
- First aid facility should be provided at the site, plant site and labour camp. One ambulance should be kept at site to take the patient to nearest hospital, in case of accident
- A person trained in giving first-aid should be available all the times at construction and plant site
- Tie-ups should be made with local hospitals to handle emergency cases on priority if any
- Fire-fighting facility should be provided at construction site, labour camps and plant site and training for handling fire should be given to workers
- List of phone numbers of fire station, hospitals, ambulance should be available at site office
- Personal protective equipments like helmets, ear plugs, gum boots, safety jackets, masks, googles should be provided as required to all the workers at site
- Safety officers should be available at the site all the time to ensure that safety rules and precautions are being followed at site all the time
- Cautionary signage with adequate warning note in local language should be provided at the site of fuel storage area, substation area, DG set area, machinery parking area etc.
- Entry to the fuel storage area, machinery operating area should be restricted to only few trained person
- Traffic management officers should be provided at the site to manage the traffic and prevent accidents at site
- Adequate lightning should be provided at the site during night time
- No workers should be forced to work more than 8 hours in a day
- Child labour should be discouraged strictly
- All the air pollution, water pollution, noise pollution and soil pollution measures should be implemented
- Should be followed as proposed both during operation and construction phase

Additional measures which may be required to be taken along the other agencies or DFCCIL act to influence for the cause of environment protection shall be included in the final report.

8.7 Major Stakeholders for implementation of Mitigation Measures

A list of major stakeholders at national and state level has been prepared considering the above mentioned development proposals as given in **Table 8.6**

Table 8.6: Identification, Classification and responsibilities of Stakeholders for Implementation of mitigation and monitoring measures

S. No.	Development Proposals	Stakeholders	
		Implementers	Monitors
1	Railways	DFCCIL & Indian Railways, Forest Department	State Pollution Control Boards, Forest Department
2	National Waterways Development	Inland Waterways Authority of India, Forest Department	State Pollution Control Boards, Forest Department
3	Road Development	National Highways Authority of India / Central Public Works Department / MoEF, State Public Works Department, Forest Department	Department of Environment, State Pollution Control Boards, Forest Department
4	Industrial Area Development	Ministry of Commerce & Industry, State Industrial Development Corporation, Forest Department	State Pollution Control Boards, Forest Department
5	Urbanization	Ministry of Urban Developments / Indian Railways / DFCCIL/ Municipal Corporations / Municipality / State Urban Development Authorities /	State Pollution Control Boards, Forest Department

8.8 Conclusions and Next Steps

The emerging scenario indicates that at a cumulative level, majority VECs are getting impacted due to indirect development like road and associated infrastructure development and induced development like urbanization. Impact assessment has been done partly on quantitative as well as qualitative basis. Efforts are going on for strengthening the impact matrix using a combination of different interactive techniques, which will be described in draft final report. Further, all the five impact matrix tables (Table 8.1 to 8.6) will be combined to arrive at a holistic & cumulative view of the planned development.