DEDICATED FREIGHT CORRIDOR CORPORATION OF INDIA LIMITED

ENVIRONMENTAL ASSESSMENT

FOR

Khurja – Dadari Section

OF

PROPOSED EASTERN DEDICATED FREIGHT CORRIDOR

Nov 2014

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ABBREVIATIONS

AAQ	Ambient Air Quality
ADB	Asian Development Bank
AFs	Affected Families
AIDS	Acquired Immunodeficiency Syndrome
ASI	Archaeological Survey of India
BIS	Bureau of Indian Standard
BOD	Biological Oxygen Demand
Cc	Cubic Centimeter
CF	Conservator of Forest
Cl	Chlorine
CO	Carbon Monoxide
CPCB	Central Pollution Control Board
CPRs	Common Property Resources
CS	Construction Supervision
dB	Decibel
DFC	Dedicated Freight Corridor
DFCCIL	Dedicated Freight Corridor Corporation of India Limited
DFO	Divisional Forest Offices
DO	Dissolved Oxygen
DR	Detailed Railway
EA	Environmental Assessment
EAC	Expert Appraisal Committee
EIA	Environment Impact Assessment
EMAP	Environment Management Action Plan
EMP	Environmental Monitoring Plan
EMU	Environment Management Unit
ESIMMS	Environmental and Social Impact Mitigation Measures Study
EWG	Environmental Working Group
Fe	Iron
GoI	Government of India
Hg	Mercury
HIV	Human Immunodeficiency Virus
ICCP	Information and Community Consultation Programme
ICD	Inland Container Depot
IS	Indian Standards
LA_E	Exposure Noise Level
LAeq	Equivalent Noise Level
LPG	Liquefied Petroleum Gas
MLA	Member of Legislative Assembly
MoEF	Ministry of Environment & Forests
MP	Member of Parliament
N	Nitrogen
Na	Sodium
NEP	National Environmental Policy
NGO	Non Government Organization
NO	Nitrogen Oxide
NPRR	National Policy on Resettlement and Rehabilitation

NRCP	National River Conservation Plan
OM	Organic Matter
OP	Operational Policy
PAFs	Project Affected Families
PAPs	Project Affected Person
Pb	Lead
PCCF	Principal Conservator of Forest
PDA	Passenger Diesel A (Plain Route) Train
PUC	Pollution Under Control Certificate
RAP	Resettlement Action Plan
ROB	Railway Over Bridge
ROW	Right of Way
RPM	Respiratory Particulate Matter
RRP	Resettlement and Rehabilitation Plan
RUB	Railway under Bridge
SC	Scheduled Caste
SDOE	State Department of Environment
SEIA	State Environment Impact Assessment
SIA	Social Impact Assessment
SPCB	State Pollution Control Board
SPM	Suspended Particulate Matter
SR	Sensitive Receptors
ST	Scheduled Tribe
TOR	Terms of Reference
VRC	Village Rehabilitation Committee
WB	World Bank
WLS	Wildlife Sanctuaries
Zn	Zinc

EXECUTIVE SUMMARY

1.0 BACKGROUND

Ministry of Railways initiated action to establish a Special Purpose Vehicle for construction, operation and maintenance of the dedicated freight corridors. This led to the establishment of "Dedicated Freight Corridor Corporation of India Limited (DFCCIL)", to undertake planning & development, mobilization of financial resources and construction, maintenance and operation of the dedicated freight corridors. DFCCIL was incorporated as a company under the Companies Act 1956 on 30th October 2006. Mumbai-Delhi and Mumbai-Howrah route have a current capacity utilization of more than 140%. This has led to the saturation of the Railways system in terms of line capacity utilizations on these corridors, which are specifically called the Western and Eastern corridor respectively. Dankuni -Sonnagar-Ludhiana section has been identified as part of the eastern corridor while from JNPT to Dadri via Vadodara – Ahmedabad - Palanpur-Phulera - Rewari is called western corridor. These corridors encompass a double line (except Khurja- Ludhiana section which is single line at present) electrified traction corridors. The total length of EDFC works out to 1843 Kms. The present EIA study confines to 49.69 km stretch from Khurja to Dadari, last portion of EDFC.

2.0 OBJECTIVES OF THE ASSIGNMENT

Current regulations of Government of India does not include railway project for Environmental Clearance from the Ministry of Environment and Forests (MoEF) requiring Environmental Impact Assessment (EIA) studies. However, considering the magnitude of activities envisaged as part of EDFC, the DFCCIL has to conduct an EA and prepare an Environmental Management Plan (EMP) to mitigate potential negative impacts for the project. Environmental Management Framework (EMF) developed during earlier EA of 272 km Bhaupur-Khurja has been followed in this section also.

3.0 SCOPE OF ENVIRONMENTAL ASSESSMENT (EA)

Scope of study for the Khurja- Dadari section (about 49.69 km) includes environmental assessment, environmental management plan based on Environmental management farme work approved for Bhaupur- Khurja section..

4.0 DESCRIPTION OF PROJECT

The present project confines to the section between Khurja and Dadari. This alignment traverses through two districts namely Bullandshahar & Gautam Budh Nagar, both within the state of Uttar Pradesh. Details are given in the **Table- 1.**

Table -1 Chainage and length of Khurja-Dadari Section

District	Chainage km		Distribution of length (km)		Total
	From	To	Parallel	Bypass	Length
Buland Shahar	**1369.820**	**1394.112**	18.59	9.52	28.11
GB Nagar	**1394.112**	**1415.069**	17.83	3.75	21.58
Total (KRJ-DER)			36.42	13.27	**49.69**

Note: chainage shown here is that of IR, not DFC

5.0 KEY ENVIRONMENTAL LAWS AND REGULATIONS

Following presents the environmental regulations and legislations relevant to project.

Table 2: Environmental Regulations and Legislations

Sl. No.	Act / Rules	Purpose	Applicability to the project	Authority
1	Environment Protection Act-1986	To protect and improve overall environment	The project activities should maintain emission standards	MoEF. GoI; DoE, State Gov. CPCB; SPCB
2	Environmental Impact Assessment Notification- 14th Sep-2006 and its amendment	To provide environmental clearance to new development activities following environmental impact assessment	Railway project not included in the Notification Hence not applicable in this project	MoEF
3	Notification for use of fly ash	Reuse large quantity of fly ash discharged from thermal power plant to minimize land use for disposal	Possibility of use of fly ash shall be explored in engg. Designs	MoEF
4	National Green Tribunal Act, 2010 National Green Tribunal (Prevention and Protection) Rules 2011	Address Grievances regarding cases related to environment protection & compensation against other natural resources	Applicable	MoEF
5	Forests (Conservation) Act. 1980 The Forest (conversion) Rules 1981	To check deforestation by restricting conversion of forested areas into non- forested areas	Applicable.	Forest Department, Govt. UP (for land conversion below 5 hectare & 40 % density).
6	Wild Life Protection Act 1972, amendment	To protect wildlife through certain of National Parks and Sanctuaries	No wild life Sanctuary or National park in the project area Not Applicable	-
7	Air (Prevention and Control of Pollution) Act, 1981	To control air pollution	Applicable Emissions from construction machinery and vehicle should be checked time to time.	UPPCB

Sl. No.	Act / Rules	Purpose	Applicability to the project	Authority
8	Water Prevention and Control of Pollution) Act,1974	To control water pollution by controlling discharge of pollutants as per the prescribed standards	Applicable Various parameters in Effluents from construction sites and workshops are to be kept below the prescribed standards	UPPCB
9	Noise Pollution (Regulation and Control Act) 2000	The standards for noise for day and night have been promulgated by the MoEF for various land uses.	Applicable DG sets at construction sites and workshops should be provided with acoustics enclosures.	UPPCB
10	Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act,2010	Conservation of cultural and historical remains found in India	Not Applicable No ASI protected monument within a distance of 300 m.	Archaeological Dept GoI, Indian Heritage
11	Public Liability and Insurance Act 1991	Protection form hazardous materials and accidents.	Applicable	MoEFand UPPCB
12	Explosive Act 1884	Safe transportation, storage and use of explosive material	Applicable Respective Authorization shall be obtained from CCE	Chief Controller of Explosives
13	Minor Mineral and concession Rules	For opening new quarry.	Applicable Quarry Licenses shall be obtained by Contractors.	District Collector, State Mines Department and UPPCB
14	Central Motor Vehicle Act 1988 and Central Motor Vehicle Rules1989	To check vehicular air and noise pollution.	Applicable All vehicles in Use shall obtain Pollution Control Check certificates	Motor Vehicle Department
15	The Mining Act	The mining act has been notified for safe and sound mining activity.	Applicable Quarry Licenses shall be obtained by Contractors.	Department of mining, GoUP

Sl. No.	Act / Rules	Purpose	Applicability to the project	Authority
16	Railway (Amendment) Act, 2008	Land acquisition for special railway project	Applicable	GoI
17	The Petroleum Rules, 2002	Storage of petroleum products for operation of construction machineries	Applicable	Chief Controller of Explosive/ District Magistrate

For projects with potential to have significant adverse environmental impacts (Category 'A') an environmental impact assessment (EIA) is required. Category B projects are considered to have some adverse environmental impacts, but of lesser degree or significance than those for category 'A' projects and require an Environmental Assessment (EA) to determine whether or not significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the EA is regarded as the final environmental assessment report as is the case for this project. The subject project railway line passes through very small patches of degraded forests area. There is no presence of endangered fauna and flora along the project railway line. It may also be mentioned that diversion of marginal forest land at crossing of alignment with NH/SH may be involved. The Government of India has issued Environmental Impact Assessment Notification in 1994 and amended this Notification in 2006. These both Notifications have been issued under the ageis of Environmental (Protection) Act, 1986. The EIA Notifications have listed various activies under Category 'A' and 'B'. But Railway projects do not fall under any category requiring an environmental clearance from MoEF. Only No Objection Certificate (NOC) is required from SPCB under the Air and Water Acts.

It has been established that there is a need for improving the infrastructure capacity of the transport sector to cater the projected demand for freight and goods movement. By building up the rail infrastructure which uses 1/6th the fossil fuel consumption as compared to road, overall improvement in environmental condition is envisaged. Over and above since traction in this case would be electricity based, there is a possibility that this electricity can come from the budding nuclear capacity of the nation. Thus there can not be othermore eco-friendly and efficient transport system than rail transport to meet with the demand of India's growing economy.

Since this is a large scale project and likely to have some reversible impacts on environment during construction phases & some impact, not of much significance, during operation, this project is being considered as **'A' category project** as per the World Bank safeguard policy. This will help not only in tweaking the construction stage to be more eco-compliant but setting systems to have better and more environment friendly construction in forthcoming railway projects. DFCCIL is committed to establish most efficient and eco-friendly system.

6.0 BASE LINE ENVIRONMENT

Data was collected from secondary sources for the macro-environment setting like climate, physiographic (Geology and slope), biological and socio-economic environment within Project Influence Area, CPM Office/ Project District. First hand information has been collected to record the micro-environmental features within Corridor of Impact, (CoI). Collection of first hand (Primary) information includes

preparation of base maps, extrapolating environmental features on proposed alignment, environmental monitoring covering ambient air, water, soil, noise and vibration, tree enumeration, location and measurement of socio cultural features abutting project alignment. The environmental profile and strip plan have been prepared.

7.0 ENVIRONMENTAL SENSITIVITY OF THE PROJECT & SUMMARY OF THE ENVIRONMENTAL FEATURES ALONG THE PROPOSED ALIGNMENT

The entire environmental profile covering five km on both side of the proposed alignment has been studied, and strip plans have been prepared to cover the RoW of the proposed alignment in parallel as well as detour sections. Based on this analysis, the following conclusions can be drawn:-

1. There is no wild life sanctuary or national park located along the parallel or detour sections of the proposed DFC.
2. There is no wetland along the proposed corridor.
3. The DFC alignment, in major portion, does not pass through protected or reserved forest in Khurja- dadari section. There are small patches of land under reserved forest (3.9 Ha) The alignment also crosses some SH/NH and canals. The plantation in the RoW of roads and canals has been declared protected forest in Uttar Pradesh. Hence construction of RUBs across roads and bridges across canals will require forest land diversion and clearance. This diversion will be very minimal.
4. There are congested sections with residential / commercial structures such as Boraki , Wair, dankaur, etc. along the existing railway alignment.
5. The DFC alignment crosses Karon River and few canals. No village pond falls within the RoW of alignment specially Wair and Khurja Flyover UP lines.
6. There are of religious structures (03 temple as per RAP), 01 educational institute located along the proposed alignment. These will be directly impacted.
7. The proposed alignment may result in the cutting of estimated **2193 out of which approx. 343** trees are within Railway Properties. The major species present along the alignment are babool, neem, shisam, papal, mango, bargad, kanji, labhera, ashok, sirsa, guler, jamun, ber, eucalyptus, mahua and bel.
8. No ASI protected monument is falling within a distance of 300 m from the RoW of DFC alignment.

8.0 SOCIAL IMPACT

Social impact affecting number of PAFs/ PAPs is 1974 & 5841 respectively. Affected structures will be 121 combining two districts of Bullandshahar and Gautam Budh Nagar have been identified. Details are indicated in the relevant sections of the report. Total 211.67 Ha land will be acquired, out of which 145.59ha is private land, and balance 66.08 Ha is Govt. land. Detailed resettlement action plan report has been prepared in separate cover.

9.0 PUBLIC CONSULTATION AND DISCLOSURE

The Public Consultation meetings for the proposed section have been conducted in five places during November and December 2011. For these meetings, environmentally sensitive villages that could potentially be affected by the proposed project were selected. The overall objective of the public consultation was to provide information to the stakeholders and collect feedback from them on related environmental issues. The consultants along with DFC officials clarified all issues raised by the stakeholders. Major issues were concerning safety and facilities to cross the track. The design takes care of both the issues through provision of

adequate number of RUBs, foot ober bridgesto facilitate the crossing. The compensation related issues have been resolved through preparation of resettlement action plan (RAP). This RAP will be implemented during pre construction with the assistance of an NGO.

10.0 ANALYSIS OF ALTERNATIVES

In order to minimize land acquisition and impact on environment major portion of DFC alignment is parallel to the existing Delhi- Howrah rail line. The DFC tracks have been proposed at a distance of 12-15 m from the centre of RVNL third rail line currently under implementation from Aligarh to Ghaziabad. The detours have been proposed at Khurja Flyover up line and Wair. The laying of additional two DFC tracks is not possible due to limited space availability at these stations. There is ribbon development on either side of Wair stations. The laying of DFC tracks would have caused a large number of demolitions of structures leading to R&R problems. The DFC alignment has been kept on left side after due consideration of social and environmental issues.

11.0 POTENTIAL IMPACT

The environmental impact assessment has been conducted based on one season baseline data. This data was generated during December and January months. . EIA involves prediction of potential impacts by the development of the project on the surrounding area. Based on the baseline environmental status described and the proposed project activities, potential impacts have been assessed and predicted, and appropriate mitigation measures are suggested to avoid / reduce / compensate for the potential adverse impacts of the project and enhance its positive impacts. The impacts due to the development of the proposed Dedicated Freight Corridor (DFC) have been assessed for the planning phase, construction phase and implementation phase.

12.0 MEASURES FOR THE MITIGATION OF ENVIRONMENTAL IMPACTS

Prevention or avoidance of impact is better than mitigation of impact. Hence avoidance and reduction of adverse impacts approaches were adopted during the design stage through continued interaction between the design and environmental teams. This is reflected in the designs of the horizontal & vertical alignment, cross sections adopted, construction methods and construction materials. In-depth site investigations have been carried out so that sensitive environmental resources are effectively avoided, leading to acceptable alignment option which has minimum impact on the environment. The appropriate mitigation measures have been suggested during various phases of the project including specific measures for noise and vibration.

13.0 ENVIRONMENTAL MANAGEMENT PLAN

Environmental Management Plan is an implementation plan to mitigate and offset the potential adverse environmental impacts of the project for enhancing its positive impact. Based on the environmental baseline conditions, planned project activities and impact assessed earlier, this section enumerates the set of measures to be adopted in order to minimize adverse impact during pre-construction, construction & operation phases. Social impact mitigation and land acquisition plan are also included in this section. The process of implementing mitigation and compensatory measures, execution of these measures, agencies responsible for the implementation of these measures and indicative cost has been mentioned.

CHAPTER 1 INTRODUCTION

1.1 BACKGROUND

Indian Railway (IR) is one of the largest railway systems in the world. It serves a landmass of over 3.3 million sq.m. and a population of over one billion. The last 50 years have seen a tremendous growth in the Indian transportation sector. In the past few years, the volume of rails freight has increased by over five times and the number of passenger kilometers has increased over seven times. The tonnage handled by Indian ports has increased 16 times while the airfreight has increased 30 times. Railway freight, which was 73 MT in 1950-51, had increased to 474 MT in 2000-01, at an average annual increase of 10.98 percent. However, post 2001, the freight traffic has grown at an annual average of 8.50 percent and about 794 MT of freight was transported in 2008-09. This rapid increase in freight traffic is attributed to India's economic growth, which resulted in traffic congestion on the existing railway track.

1.2 DEDICATED FREIGHT CORRIDOR

To cater to the rapid growth and demand for additional capacity of rail freight transportation, Government of India has initiated development of 'Dedicated Freight Corridors' along eastern and western Routes, connecting the metro cities of Delhi-Kolkata and Delhi-Mumbai. Dedicated Freight Corridor Corporation of India Limited (DFCCIL) was established to undertake planning & development, mobilization of financial resources and construction, maintenance and operation of the dedicated freight corridors.

- The western corridor is of 1483 km double line track from Mumbai (JNPT) to Delhi near Dadri and connects the cities of Vadodara, Ahmedabad, Palanpur, Phulera and Rewari.
- The eastern corridor is of 1843 km track from Dankuni, near Kolkota to Ludhiana. This encompasses a double line electrified traction corridor from Sone Nagar to Khurja (820 Km), Khurja to Dadri on NCR double line electrified corridor (49.69 Km) and single electrified line from Khurja to Ludhiana (412 Km).

The eastern and western corridors are proposed to meet at Dadri, near Delhi.

1.3 CURRENT PROJECT

The current project beween Khurja and Dadari having a length of about 49.69 km is a part of Eastern Dedicated Freight Corridor (EDFC). The project starts from the end point of Khurja- Bhaupur section. The Environmental Assessment of Bhaupur –Khurja section is under progress. The decision to include Khurja- Dadari section has been taken later for inclusion in the World Bank funding, therefore, Environmental Assessment has been undertaken as per World Bank Safeguard Policies and Requirements.

1.4 OBJECTIVES OF EIA

As per the current regulations of Government of India, rail projects do not require Environmental Impact Assessment (EIA) studies and Environmental Clearance (EC) from the Ministry of Environment and Forests (MoEF). However, considering the magnitude of activities of Eastern Dedicated Freight Corridor (EDFC) of which current project is a part, DFCCIL has engaged **M/s Engineering and Technological Services**, **Delhi** an independent Consultant to conduct EA and prepare an Environmental Management Plan (EMP) to mitigate potential negative impacts for the Khurja- Dadari section. Environmental Management Framework (EMF) earlier prepared for Bhaupur-Khurja has been followed for this section also for the Environmental Assessment. .

The objectives of the EA are to:

- Identify potential environmental impacts to be considered in the design of Khurja-Dadari Section of EDFC and recommend specific measures to mitigate the impacts.
- Review the proposed alignment of Khurja-Dadari Section and identify possible environmental issues to be addressed during the planning, Design, construction and operation of the project.
- Formulate an implementable Environmental Management Plan (EMP) integrating the measures to avoid the identified impacts and an appropriate monitoring and supervision mechanism to ensure EMP implementation.
- Recommend suitable institutional mechanisms to monitor and supervise effective implementation of Environmental Management Plan (EMP).

1.5 SCOPE OF WORK

The scope of work of Environmental Assessment is as follows:

- Brief Description of the proposed project comprising various proposed activities, their phased implementation and their inter-linkages with regard to environmental impacts.
- Detailed Environmental Profile of the Project Influence Area (within 5 km on either side of the proposed alignment) with details of all the environmental features such as Reserve Forests, Sanctuaries / National Parks, Rivers, Lakes / Ponds, Religious Structures, Archaeological monuments, Natural Habitats, School, Irrigation Canals, Utility Lines, other sensitive receptors, etc. have been covered.
- Detailed Field Reconnaissance of the Proposed Alignment, with strip maps presenting all the environmental features and sensitive receptors (trees and structures in the ROW, Reserve Forests, Sanctuaries / National Parks, Rivers, Lakes / Ponds, Religious Structures, Archaeological monuments, Natural Habitats, Schools, Irrigation Canals, Utility Lines, other sensitive structures) along the project corridor. The environmental features recorded on the strip maps indicating their distance from the centre-line of the proposed alignment.
- Detailed Baseline Environmental Monitoring of various environmental attributes such as Ambient Air Quality, noise level, vibration level, water quality (surface & groundwater), ecological profile, etc.
- Assessment of Environmental Impacts of the project, including analysis of alternatives has been carried out for both 'With the Project' and 'Without the Project' scenarios. In case of detour / by pass locations the alternatives should consider alignment parallel to the existing rail line and the proposed detour / bypass alignment (s).
- Measures for the Mitigation of Environmental Impacts identified. The measures for the mitigation of impacts should consider options such as minor modification in alignment, reduction of RoW and engineering measures such as noise barrier / attenuation measure, RUBs/ ROBs, protection of water bodies, conservation of archaeological / heritage structures, etc. Opportunities for enhancement of environmental resources, cultural properties or common property resources explored and recommendations for appropriate measures for implementation.
- Public Consultation and Disclosure of the project and its impacts as per the WB operational policies.
- Environmental Management and Monitoring Plan, comprising a set of remedial (prevention, mitigation and compensation) measures have been developed by the consultant and ensure that these commensurate with nature, scale and potential of the anticipated environmental impacts with necessary Institutional Mechanism for the implementation and monitoring of EMP.

1.6 METHODOLOGY

In order to assess the environmental impacts due to the proposed project, observations were made through repeated field visits. Relevant secondary data was also collected from various government agencies such as District Collector, Indian Meteorological Department, District Statistical Office, Central Ground Water Board, Survey of India, Geological Survey of India, District Industries Centre, District Forest Office, and Archaeological Survey of India

The **environmental profile** of the project influence area and strip maps are prepared based on the following.

- **Toposheets (scale 1:50000) of Survey of India: -** Toposheets have been collected from Survey of India, Dehradun and proposed alignment has been marked on the topo sheets.
- **Field reconnaissance of the proposed alignment: -** The entire area has been surveyed to gather the information on environmental features.
- **Collecting the data of sensitive receptors during field visit: -** The details on sensitive receptors such as schools, religious structures, hospitals etc. are collected and marked on the strip map.
- **Public consultation at village level:** During public consultation, the information on sensitive receptors are also collected and marked on strip maps.

Based on the data collected, the strip maps and environmental profile was developed to present all the environmental features and sensitive receptors.

Preparation of baseline environmental profile, collection of meteorological data from nearest IMD stations (Aligarh and Delhi in this current project) and field monitoring of ambient air quality, water quality, noise, vibration, soil quality and ecological components as per relevant IS methods / Central Pollution Control Board Standards.

An **analysis of alternative** alignments was carried out and finalized based on reconnaissance survey of project impact zone, analysis of data and screening to minimize impact on environment covering settlements, sensitive receptors, and ecological components.

Series of **Public consultations** were conducted at five places with assistance / guidance of DFCC project office at Meerut.

Based on the baseline environmental status and project activities, potential impact has been identified, assessed and predicted and appropriate mitigation measures have been suggested in planning phase, construction phase and post-construction phase.

Environmental management and monitoring plan have been formulated based on the outcome of the environmental impact assessment.

1.7 ORGANIZATION OF THE REPORT

The outputs of the study are presented in ten chapters, as mentioned below.

Chapter 1 provides brief background of the project, scope of the EIA study, methodology and organization of the report.

Chapter 2 describes type of the project, salient features of the project with details on various components of the project.

Chapter 3 describes legal and administrative framework / policy relevant to the present project.

Chapter 4 covers the environmental profile of the study area within 5 km on either side of the proposed alignment and strip maps presenting all the environmental features and sensitive receptors covering trees and structures within ROW.

Chapter 5 assesses the nature, type and dimensions of the study area and describes the relevant physical, biological environmental and social components along the proposed railway corridor. The database on the environmental components relevant to decisions about project location; design and operation have been assembled from various secondary sources and primary monitoring of ambient air quality, noise and vibration levels, water and soil quality, aquatic and terrestrial ecology.

Chapter 6 assesses the various alternatives covering parallel alignment / detours options and details on selection of final alignment to minimize the negative social and environmental impacts.

Chapter 7 covers the prediction of potential environmental impacts by the development of the project on the surrounding area. The impacts due to development of the proposed Dedicated Freight Corridor are assessed for planning phase, construction phase and implementation phase.

Chapter 8 covers the mitigation measures to mitigate the negative impacts due to the development of Khurja-Dadari Section of EDFC on various components of the environment during life cycle of the project i.e. Pre Construction, Construction and Operation phases

Chapter 9 covers the details on public consultation meeting, disclosure of the project and its impacts are covered in this chapter.

Chapter 10 covers the environmental management plan for various environmental parameters, implementation details, monitoring plan and environmental budget.

CHAPTER 2 PROJECT DESCRIPTION

2.1 INTRODUCTION

This chapter presents the details of various project components and their salient features, based on the detailed project report prepared by DFCCIL.

2.2 SIZE & LOCATION OF PROJECT CORRIDOR

The project corridor is located on Northern Central Railway and is being designed for a maximum speed of 100 kmph train operation.

The Total length from Khurja to Dadari section (the section under the present study), is about 49.69 km. This section includes Khurja Junction which is an important junction on Delhi - Howrah double line electrified main trunk route of Northern Central Railway connecting the Northern, Central and Eastern regions of the country. The entire stretch of the project is located in the State of Uttar Pradesh and passes through 2 districts namely Bullandshahar and Gautam Budh Nagar.

The terrain of the project area is generally flat and no Major River crossing the alignment. The entire length lies in the Indo-Gangetic planes. Following table shows parallel & detour sections of 46 km project:

Table 2-1: Chainage and length Alignment of Khurja- Dadari Section

Stretch	District	Chainage(From)	Chainage To	Total length
Parallel	Bullandshahar	Khurja Junction Station (km 1369.82)	Start of Wair Detour (km1387.42)	36.42
	Gautam Budh Nagar	End of Wair Detour km 1390.810)	Boraki Station (km 1415.69)	
	Total length in parallel			**36.42**
Detours	Bulland Shahar	Khurja Flyover & Wair Detour		13.27
	Total length in Bypass			**13.27**
	Grand Total length (Bypass & Parallel)			**49.69 Say, 50 km**

The detours have been proposed based on the following criteria.

1. busy railway stations, where no space available to pass the DFC track after yard modification
2. Involuntary displacement of large number of people and families, dismantling of large number of structures etc.

A schematic map of Khurja – Dadari section is shown in **Figure.2.1,** while entire eastern corridor is presented in **Figure 2.2**

Figure 2-1: Schematic Map of Khurja – Dadari

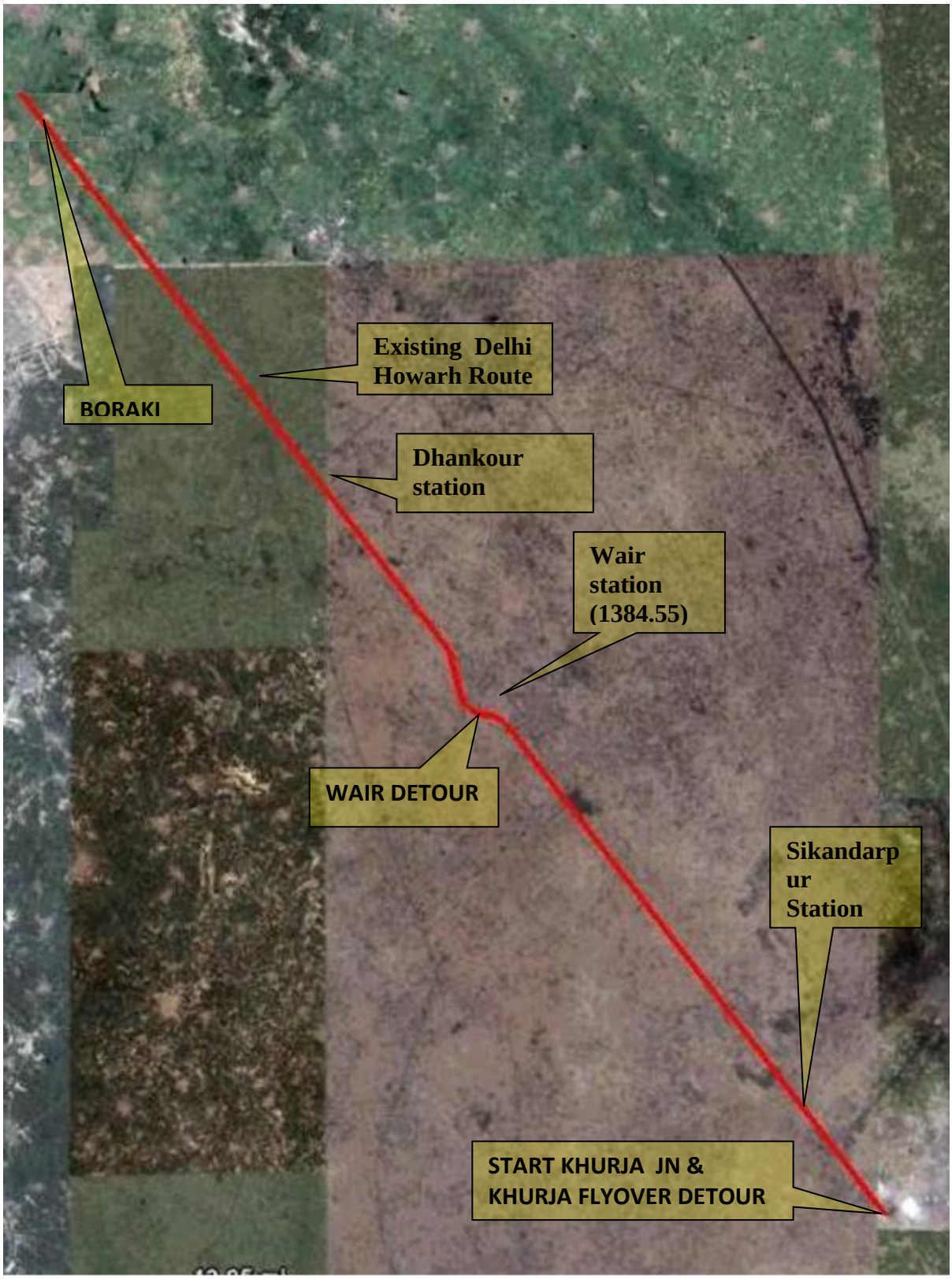
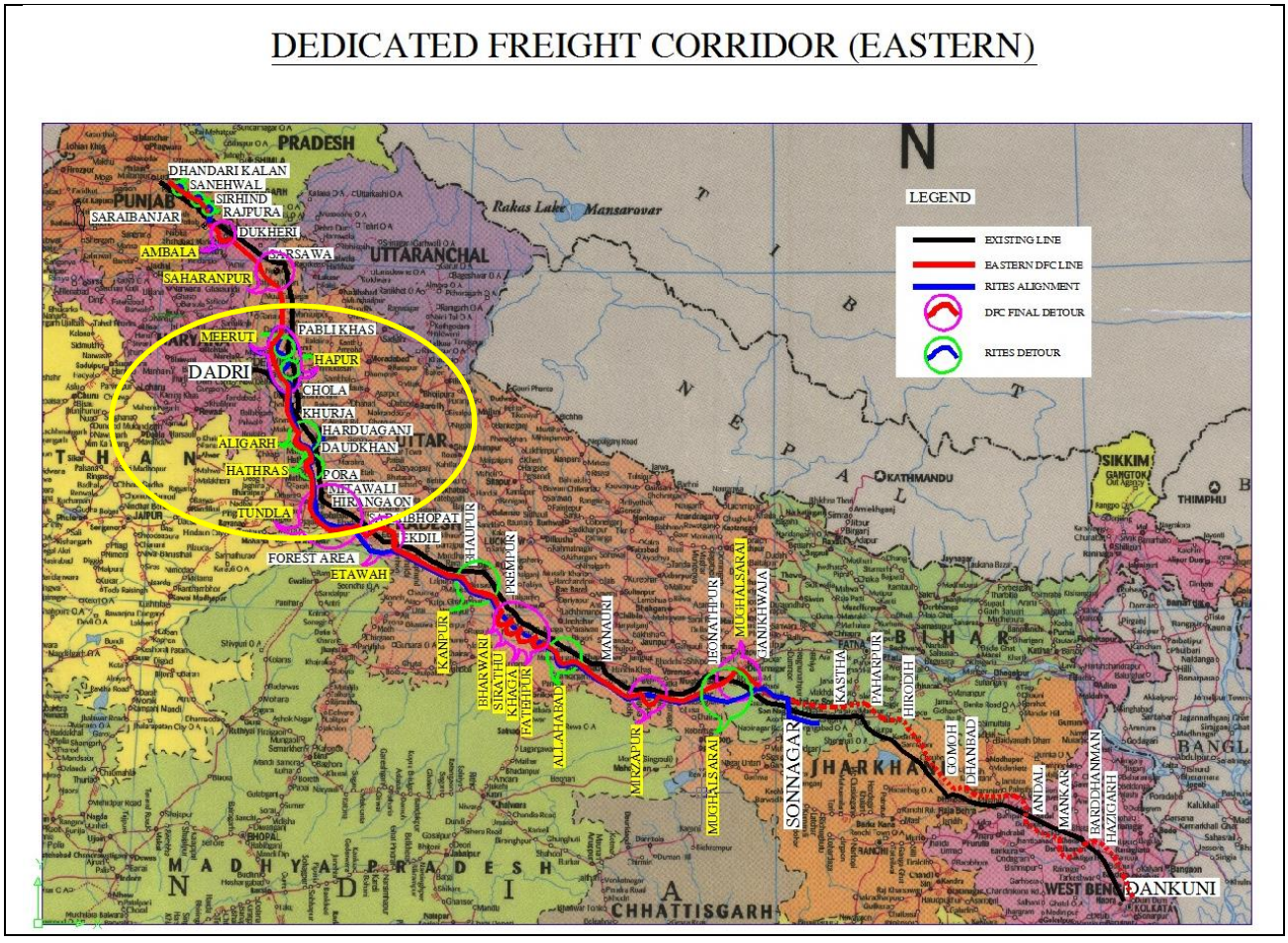


Figure 2-2: Eastern Dedicated Corridor



2.3 SALIENT FEATURES OF THE PROJECT

The salient features of the project are summarized in **Table - 2.2** below.

Table 2-2: Summarized Description of the Project

Sl.No.	Description	Details
1	Route length (km)	49.69 km, say 50km
2	Parallel:	36.42 km
3	Detour:	13.27 km
4	No. of Detours(excluding Khurja Flyover)	01 i.e., Wair Detour
5	**Gradient**	
a.	Ruling Gradient	1 in 200 (Compensated)
b.	Steepest Gradient in yards	1 in 1200, 1 in 400 in exceptional cases
6	**Standard of Construction**	
a.	Gauge	1676mm

Sl.No.	Description	Details
b.	Rails	60 Kg 90 UTS rails
c.	Sleeper	PSC, 1660 Nos./km for main line & 1540 Nos./km for loop line & sidings
d.	Points & Crossings	60 kg rail, 1 in 12 curved switches with CMS crossings on Fan shaped PSC sleepers layouts.
e.	Ballast	300 mm cushion
f.	Design speeds	100 kmph
g.	Design Axle load	Freight Traffic with 32.5 tone axle load
7	**Formation**	
a.	Bank width for Double line	13.5m.
b.	Slope on Embankment	2H:1V
c.	Cutting Width for Double line	19.25 m
d.	Earthwork	C.B.R. > 5
e.	Earthwork for Top 1m.	C.B.R. > 8
f.	Slope of cutting (ordinary Soil)	1 : 1
g.	Blanketing thickness	0.60 m
8	**Curves**	
a.	Maximum degree of curvature	2.0 degree
b.	Grade Compensation on curves	at the rate of 0.04 % per degree of curvature
9	**Track Centers (Minimum)**	
a.	Between two tracks of DFC	6 m
b.	Between Existing track and DFC	13-15m
10	**Bridges**	
a.	Standard of Loading	32.5 tonne axle load, 15 tonne/m trailing load (DFC Loading)
b.	Number of Important Bridges	Nil
c.	Number of major bridges	4 (total water way 88.45)
d.	Number of RUBs (Major)	0
e.	Number of RUBs (Minor)	15
f.	Number of Minor Bridges	49 (Total water way 97.20 m)
g.	Number of Rail Flyovers	Nil

Sl.No.	Description	Details
11	**Road Crossings**	
a.	Number of level crossings	18 (1 in Detour) To be replace by ROB/RUB
12	**Stations**	
a.	Junction Stations	01
b.	Crossing Stations	00
13	**Additional Land Required**	**211.67 hectares**

2.4 DESIGN FEATURES

2.4.1 Gauge

The proposed alignment DFC line almost is parallel to the existing line and the Gauge for the DFC line has necessarily to be Broad Gauge. (BG-1676mm).

2.4.2 Category of Line

The proposed DFC line is having a potential of maximum permissible speed of 100 kmph for goods trains to meet the anticipated traffic requirements. All bridges will be constructed to DFC loading standard with 32.5 t axle load.

2.4.3 Ruling Gradients

The ruling gradient for the proposed line has been kept as 1 in 200(compensated). Grade compensation has been provided at the rate of 0.04% per degree of curvature as per Para 418 of Indian Railway's Permanent Way Manual. The maximum length of loop and tonnage of goods trains catered for in the design are 715m and 3600T respectively.

2.4.4 Curves

For permitting maximum permissible speed of 100 kmph, a radius of 638 m (2.74º) is adequate with Cant as 140 mm and Cant deficiency as 75mm. However, maximum

Degree of curve is restricted to 2.5 degrees in the proposed corridor.

2.4.5 Section

Vertical curves as specified in para 221 of Engineering Code (Para 419 of Indian Railways Permanent Way Manual) have been provided. As per Engineering Code, vertical curves have been provided only at those locations where the algebraic difference in change of grade is equal to or more than 4mm/m i.e.0.4%. A minimum radius of the vertical curves of 4000m as applicable for 'A' category lines for BG has been adopted.

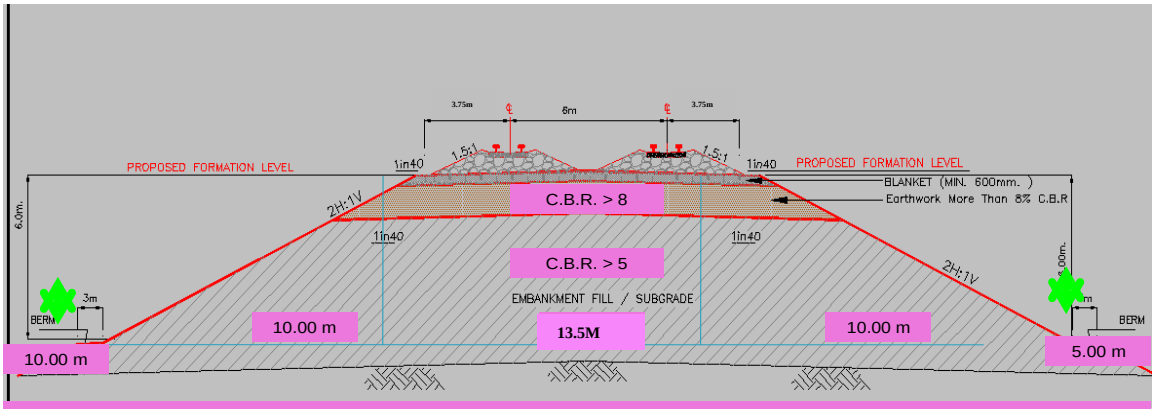
2.4.6 Spacing between Tracks

Spacing between track Centre to centre spacing of DFC tracks has been specified as 6 m and centre to centre spacing of DFC tracks from existing track has been specified as at 13m to 15m to avoid the infringement of existing IR infrastructure. However, spacing of DFC track has been reduced to 7m at thickly populated locations to reduce/avoid the displacement of inhabitants.

2.4.7 Formation

Being a double line construction, a top width of 13.5 m has been considered for embankment with side slopes of 2:1. Formation width in the cutting has been kept as 19.5 m. with side drains. Typical cross section of the proposed freight corridor is presented in **Figure-2.3.**

Figure 2-3: Cross Section of the Proposed Freight Corridor



Cross Section various Embankment Layers

2.4.8 Bank

Formation width of 13.5m.on straight alignment has been considered. The slopes on banks are proposed as 2H: 1V. Where the bank height is more than 6m, a berm of minimum 3m width has been proposed at every 6m height.

2.4.9 Cutting

A bottom width 19.90 m with 1:1 slopes including side drains on both sides have been kept. Where the cutting height is more than 6m, berm of 3m width has been proposed at every 6 m cutting height.

2.4.10 Blanketing

Blanketing layer is provided with 0.6m depth.

2.4.11 Fixed Structure Clearance

Minimum vertical clearance as per SOD for ROB and FOB would be 6.050m to accommodate OHE suitable for the designed speed of 100 kmph.

2.4.12 Permanent Way

The track structure shall consist of 60 kg/m, 90 UTS, FF new rails on PSC sleepers having 1660 nos. per km density for main line. Rails with PSC sleepers having 1540 nos/km density have been adopted for Loop lines and sidings. It is proposed to provide CWR/LWR as per the provision of the P-Way manual.

2.4.13 Points and Crossing

Points and Crossing with 60 kg rail on MBC sleepers with fan shaped Layouts, 1 in 12 on running lines and for non-running lines and sidings with curved switches and CMS crossings have been proposed.

2.4.14 Ballast

The depth of hard stone ballast (65mm size) cushion below MBC sleepers has been kept as 300mm for main lines. Therefore, a quantity of 4.316 cum/m for straight portion is provided. Provision for wastage, curvature and Points & crossing has been considered as per the provision of para 263 of P-Way Manual.

2.4.15 Road Crossings/Level Crossing

There are about 18 level crossings on the alignment between Dadari to Khurja section. The details of the level crossings are given in the **Annexure 2.1**.

2.4.16 Stations

The Freight Corridor will have two types of stations. Stations required for normal operating requirement are called crossing stations and stations where the loads have to be transferred to/ from existing railway network have been called as Junction Stations. There is one Junction Station near Dadari. Crossing Stations have been proposed in a manner that there is at least one, either crossing station or junction station approximately at 40 km. At each station, minimum two numbers of loops, with 750 m CSR have been provided and Sand Dead Hump has been proposed. At station, necessary rooms for S & T have been proposed. Each station will comprise of a small 2-room office with basic amenities for DFC staff.

The details of the existing railway stations and proposed DFC stations are provided in the **Table - 2.3** below.

Table 2-3: Details of the Existing stations and Proposed DFC Stations along Khurja-Dadari Section of EDFC

Details of Existing Stations			
S.No.	**Station**	**Km**	**Remark**
1	Khurja JA.	1369.82	
2	Sikandarpur	1375.39	
3	Chola	1384.55	
4	Wair	1389.55	
5	Dankaur	1398.02	
6	Ajayabpur	1406.46	
7	Boraki	1411.35	
8	Dadari	1415.69	

2.4.17 Residential Accommodation

Residential accommodation is planned at stations. Maintaince Depot also has been proposed to house the essential staff.

2.5 Land

Proposed DFC track is planned at about 15m c/c from third line being constructed by Rail vikas nigam Ltd. beween Aligarh and Ghaziabad of Delhi Howrah route of North Central Railway. Formation width of proposed DFC track (double line) has been planned for 13.5m and side slopes of 2:1 in embankment and 1:1 in cutting. In addition to the above, a minimum 10m & 5m extra land from the toe of the bank is planned for the service road and maintenance purposes.

Since the detour is proposed in embankment, the land requirement is higher compared to the parallel section (about 50m to 60m depending up on height of embankment).

A land strip of about 1000 x 60 m of additional land will be acquired for the storage of construction material (dumping station) at about every 40 km. In addition to the above, about 2500m x 100m of land strip will be acquired for crossing / junction stations. Land will also be acquired for electrical installation such as S.P., S.S.P. & T.S.S as per norms of DFC Electrical Department. There is no interference with the military installations and major townships.

Table 2-4: Land Required for Various Purposes (Area in ha, length in km)

District	Chainage km		Distribution of length (km)		Total			
	From	To	Parallel	Bypass	Length	Districts	Villages	LA (Ha)
Buland Shahar	**1369.820**	**1394.112**	18.59	9.52	28.11	1	21	126.07
GB Nagar	**1394.112**	**1415.69**	17.83	3.75	21.58	1	17	85.60
Total (KRJ-DER)			36.42	**13.27**	**49.69**	**2**	**38**	**211.67**

Source: Detailed LAP, CPM Office Meerut

The proposed project stretch will involve acquisition of about 211.67 ha of land in which about 68% is under private acquisition. However, the project will require very less about 0.68 ha of built-up area which includes residential, commercial or resi-cum commercial land use. At many built-up locations land width (CoI) has been reduced to as less as 17 m., which resulted in reducing impact on the residential as well as commercial structures

2.5.1 Utilities

The project involves shifting of number of utility services such as electrical lines (HTL/LTL), transformers, tube wells, bore wells, hand pumps etc. A detailed shifting plan for each of the utilities has been prepared in the project and a summary of utilities that need to be shifted is presented in **Table 2.5** and details are presented

Table 2-5: Summary of Utilities

Name of utilities	Approx. No.
440 V electric line	22
11 KV electric line	07
33 KV electric line	03
132 KV electric line	06
220 KV electric line	2
400 KV electric line	01
500 KV DC	0
Bore well, Tube well & Hand pumps	7

Source: Consultants Field Survey

In general, a high-tension line runs parallel on south side of the existing alignment. Care has been taken to maintain the same pattern in detour sections as well.

The utilities will be shifted in consultation with the stakeholder agencies including local panchayats and owners of private utilities. Appropriate funds will be allocated in the project for utility shifting.

2.5.2 Turfing

Considering high embankments in detours sections (more than 4 m), turfing has been proposed in detour sections and in major bridge approaches.

2.5.3 Tree Plantation

The project proposes plantation of about 10 trees per km in the stretch on either side of the track.

2.5.4 Side Drains

The proposed alignment runs parallel at 15m distance from the RVNL third line between Aligarh and Ghaziabad. In between two embankments, a gully formation is expected. To avoid water logging in the gully areas, concreted side drains (0.75m width with 1:1 side slope) have been proposed. In detour section, no concrete side drain will be constructed on eitherside.

2.5.5 Retaining Walls

The project proposes retaining walls to manage site-specific issues such as lack of space or impacts on densely populated areas, etc. The location will be identified in consultation with local population considering the engineering requirements.

2.6 STRUCTURE WORK

2.6.1 Major Bridges

The linear waterway for all the major bridges has been proposed on the basis of span on existing railway line. All the major/important bridges are proposed as PSC girder bridges with substructures on pile foundations. All bridges are to be constructed to DFC Loading Standard with a maximum axle load of 32.5 MT, for the Locomotive and a trailing load of 12 t/m. There are 4 major bridges proposed along the alignment having a total 250m linear waterway.

As presented in **Table- 2.6,** the project proposes 4 major bridges at various locations.

Table 2-6: Details of the Major bridges

S. No.	Bridge No.	Proposed Location	Span Arrangement	Name of Location
1	Br No 176	1372/364.451	4x9.15	Parallel Section
1a	Br No 176a	DFC -1.440	4x9.15	Khurja flyover Up Line
2	Br No 207	1400/241.439	2x12.2	Parallel Section
3	Br. No 211	1407/484.357	3x9.15	Parallel Section

2.6.2 Minor Bridges

RCC boxes are provided at minor bridge locations. As per Railway Board's Circular Letter no. CBS/DCS dated 6.7.1989; the minimum clear span for new bridges has been kept as 1m for proper inspection and maintenance of bridges. All existing minor bridges with a span of less than 1m have been proposed to be extended up to a minimum span of 1.2m opening for crossing the proposed alignment. There are 49 nos., locations of which have been given in **Annexure-2.2.**

2.6.3 Railway Flyover

No flyover has been proposed in the current stretch. The proposed Khurja flyover is not in the current project.

2.6.4 RUBs (Major)

This type of RUB is such, which crosses National Highway or busy state Highway, where spanning arrangement is proposed with 24.4 m to 30.5 m PSC girders.

2.6.5 RUBs (Minor)

This type of RUB is proposed on detour portion only. As per the DFC policy, surface crossing on detours are to be avoided. So to facilitate the local public RUBs have been proposed on detour alignment. RUBs have been proposed at each road crossing. Effort has been made to minimize the number of RUBs by diverting the existing road to the nearest road crossing where RUB has been proposed. Spanning

arrangement has been decided as per the requirements of road traffic. A minimum of 5.5.m X 3.5 m size has been proposed for crossing village roads. The maximum size goes up to 7.5mx5.5m To cross the district roads & state highways 5.5m x 4.5m and 7.5m x 5.5m sizes have been proposed. The details of minor RUBs are given in **Annexure 2-3.**

2.6.6 P-Way Works

60 Kg/90UTS rails on PSC sleepers with a density of 1660 sleepers per km with 300

mm ballast cushion have been provided for the main line. In station yards, for the loop lines, 60Kg rails on PSC sleepers with a density of 1540 sleepers/Km with 300 mm ballast cushion has been proposed. The main line is proposed to be provided with LWR / CWR. Loop line is provided with SWR/ LWR. Entire project length is proposed for track circuiting. Glued joints are provided wherever required. 60 Kg points and crossings on PSC fan shaped layouts are proposed.

Flash butt welding is proposed to convert the single rails into LWR/CWR as per plan approved by DFCCIL such as contractor's portable road trailer mounted flash butt welding
Machine.

The required quantity of ballast to the maximum extent (not less than 4.314 cum per meter length) is to be brought by contractor's dumpers on the formation and laid on the proposed alignment by contractor's pavers. Extensive testing on the completed new tracks is proposed to be done using the track recording and oscillate graph cars for assessing track geometry and ride quality. PSC sleepers are transported from the factory by road and stacked near level crossings. Transportation charges for sleepers have been considered for a distance of 300km. Hard Stone ballast of 65 mm size with 300 mm cushion on the main line, turnouts, on loops and sidings is proposed. Nearly 4.3 cum / running meter of ballast is required for the track.

2.6.7 Electric Sub-stations

The details are given below in sub sections.

2.6.7.1 Traction Service Stations (TSS)

The basic consideration in locating the traction substations is to ensure satisfactory voltage condition on the OHE. while the maximum voltage at sub-station should not exceed 27.5 kV, the voltage of the farthest and based on the traction load conditions taking into account the traffic density, the load, the speed of the train and terrain shall not fall below 19 kV. The total 01 TSS is proposed. The total area requirement for each TSS is 140 x 85 meter and these shall be located along the railway track.

2.6.7.2 Sectioning and Paralleling Post (SP)

The conventional neutral section in the OHE at the sectioning and paralleling post is 41 m long and overlaps type. The electric locomotive coasts through this dead section in case it comes to a halt under this portion of OHE, there being no power in the OHE, the electric locomotive becomes immobile. In such a situation it needs to be pushed or pulled by another locomotive to bring it under a live OHE. The site for location of the neutral section, therefore, needs to be selected with case, so that the terrain assists the train in negotiating it. Accordingly the natural section for the sectioning post should be located on a straight track at sufficient distance from a stop signal either behind or ahead of it. In undulating terrain the neutral section should be located in a valley. Total 02 SPs are proposed. in entire length.The land area requirement for SPs is 55m x 30m meter.

2.6.7.3 Sub-Sectioning and Paralleling Post (SSP)

Between the feeding post and the sectioning post a number of intermediate sub-sectioning and paralleling posts are inserted in the OHE, to provide remote controlled switches for facilitating isolation of faulty sections of OHE. The area requirement for the SSPs are 55 x 25 meter and total 03 SSP are proposed in this section.

2.6.7.4 Tower Wagon Sheds

These are proposed at crossing stations and junction stations.

2.6.7.5 Signal and Signal Rooms

Signals are proposed at every 2 km length with a provision of one signal rooms for ten numbers of signals.

2.7 FENCING

RCC Jali fencing shall be provided on all station platforms for about 2 km Length.

2.8 SERVICE ROAD

As per the policy decided by DFC, service road has been proposed adjoining the embankment. Service road has been planned for 5.5 m width with W.B.M surface. Hume Pipe culverts have been proposed along the service road where there is a minor bridge location on proposed alignment. Service road is discontinued at Major bridges, rail flyovers and densely populated area.

2.9 LABOUR FOR CONSTRUCTION

Approx. 60 skilled and 100 unskilled will be employed for a given stretch during the construction phases. Local labour is adequately available and will be utilized during the construction phase.

2.10 WATER REQUIREMENT

The total water requirement during construction period will be about 3600 cubic meter per kilometre spread over the construction period of about 3 years. The daily requirement for per kilometre length during construction period will be about 5000 litre and will be met through local water resources specially surface water resources.

2.11 CONSTRUCTION MATERIAL

Construction material will be required in sufficiently large quantities. While sand will be obtained from River Yamuna (within 40 km from the Project alignment), rail, sleepers, cement and steel will be obtained through respective manufacturers.

The project involves about 464 million cubic meter of earthwork. Borrow earth for these activities will be obtained by the contractor from the borrow areas, as per the guidelines detailed out in the subsequent sections of this EIA report.

It is estimated that about 1106322 cubic meter of ballast would required for laying the track. The ballast would be obtained by the contractor from authorized quarries, as approved by the engineer in charge and in compliance to the guidelines detailed out in the subsequent sections of this report.

2.12 CONSTRUCTION PERIOD

The construction period for the completion of the freight corridor will be less than five years.

Annexure 2-1

List of Level Crossings

EXISTING L-XINGS								
SR. No	**LCNo./ Class Traffic / Engg**	**Location (km)**	**Between stations**		**Manned (M) /unmanned(UM)**	**TVUs of 2005**	Interlocked or NonInterlocked	Remarks
1	129/B/T	1370/5-7	KRJ	SKQ	M	599550	Interlocked	
2	130/C/E	1372/3-5	KRJ	SKQ	M	37600	No	
3	131/B/T	1375/23-25	SKQ	CHL	M	322644	Interlocked	
4	132/C/E	1378/23-25	SKQ	CHL	M	23071	No	
5	133/C/E	1381/29-25	SKQ	CHL	M	31565	No	
6	134/B/T	1384/19-21	CHL	WIR	M	271237	Interlocked	
7	135/C/E	1386/25-27	CHL	WIR	M	35888	No	
8	136/B/T	1389/1-3	CHL	WIR	M	346310	Interlocked	On Detour
9	137/C/E	1392/15-17	WIR	DKDE	M	40176	Interlocked	
10	138/C/E	1395/13-15	WIR	DKDE	M	224973	No	
11	139/B/T	1397/29-31	WIR	DKDE	M	415704	Interlocked	
12	140/C/E	1400/19-21	DKDE	AJR	M	25643	No	
13	141/C/E	1402/31-33	DKDE	AJR	M	131024	No	
14	142/C/E	1404/19-21	DKDE	AJR	M	62935	No	
15	143/C/T	1406/33-35	AJR	DER	M	87404	Interlocked	
16	144/C/E	1409/1-3	AJR	DER	M	74188	Interlocked	
17	145/C/E	1410/25-27	AJR	DER	M	101513	No	
18	146/BE	1412/11-13	AJR	DER	M	122958	No	

Annexure 2-2

Details of the Major and Minor Bridges

MAJOR BRIDGE LIST								
SR.NO.	EX.BR. NO.	Ex.CH	Ex.SPAN		PROP. CHAINAGE	PROP. SPAN		REMARK
			NO.SPAN	WIDTH		NO.SPAN	WIDTH	
1	176	1372/12-14	7	4.57	1372/364.451	4	9.15	
1a	176a	NIL			DFC -1.440	4	9.15	
2	207	1400/7-9	2	12.2	1400/241.439	2	12.2	
3	211	1407/15-17	3	9.15	1407/484.357	3	9.15	

MINOR BRIDGE LIST										
SR. NO.	BR No.	Ex.CH	Ex. Span		PROP.BR. NO.	PROP. CHAINAGE	PROPOSED. SPAN			REMARK
			NO	W			NO	W	H	
1	173	1370/33-35	1	1.83	173	1370/919.880	1	2.00	1.20	
2	174	1371/11-13	1	1.83	174	1371/364.405	1	2.00	1.20	
3	175	1371/33-35	1	4.57	175	1372/000	1	6.00	2.00	
4	177	1373/25-27	1	1.22	177	1373/790.876	1	1.20	2.00	
5	178	1375/7-9	1	1.83	178	1375/273.706	1	2.00	1.20	
6	179	1376/25-27	1	1.83	179	1376/769.566	1	2.00	1.20	
7	180	1378/33-35	1	0.91	180	1378/999.607	1	1.20	1.20	
8	181	1380/1-3	1	1.83	181	1380/058.619	1	2.00	2.00	
9	182	1382/17-19	1	1.83	182	1382/549.306	1	2.00	1.20	
10	183	1382/25-27	1	0.61	183	1382/813.941	1	1.20	1.20	
11	184	1383/5-7	1	1.83	184	1383/150.066	1	2.00	1.20	
12	186	1384/19-21	1	0.91	186	1384/494.346	1	1.20	1.20	
13	187	1385/0-1	1	1.83	187	1385/046.883	1	2.00	1.20	
14	188	1385/27-29	1	1.83	188	1385/853.99	1	2.00	2.00	
15	189	1385/33-35	1	1.83	189	1385/993.073	1	2.00	2.00	

16	190	1387/5-7	1	0.91	190	1387/135.712	1	1.20	1.20	
WAIR DETOUR										
17	191				191	1821.132	1	6.00	4.00	
18	192				192	2245.324	1	2.00	4.00	
19	193				193	2565.421	1	1.20	3.00	
20	194				194	3950	1	2.00	3.00	
PARALLEL SECTION										
21	195	1392/9-11	1	1.83	195	1392/287.728	1.00	2.00	2.00	
22	196	1392/29-01	1	0.91	196	1392/953.232	1.00	1.20	1.20	
23	197	1393/17-19	1	0.91	197	1393/529.341	1.00	1.20	1.20	
24	198	1394/7-9	1	1.83	198	1394/215.978	1.00	2.00	1.20	
25	199	1396/5-7	1	0.61	199	1396/218.33	1.00	1.20	1.20	
26	200	1396/19-21	1	1.83	200	1396/662.05	1.00	2.00	1.20	
27	201	1397/0-1	1	0.61	201	1396/964.577	1.00	1.20	1.20	
28	202	1397/17-19	1	1.83	202	1397/594.452	1.00	2.00	1.20	
29	203	1398/11-13	1	1.83	203	1398/458.491	1.00	2.00	1.20	
30	204	1398/21-23	1	0.91	204	1398/629.52	1.00	1.20	1.20	
31	205	1398/35-37	1	1.83	205	1399/059.833	1.00	2.00	1.20	
32	206	1400/1-3	1	1.83	206	1400/211.428	1.00	2.00	3.00	
33	208	1400/23-25	1	1.83	208	1400/707.719	1.00	2.00	2.00	
34	209	1401/19-21	1	1.83	209	1401/649.621	1.00	2.00	2.00	
35	210	1405/9-11	1	1.83	210	1405/321.581	1.00	2.00	1.20	
36	212	1408/0-1	1	1.83	212	1408/069.519	1.00	2.00	1.20	
37	213	1408/17-19	1	1.83	213	1408/611.855	1.00	2.00	2.00	
38	214	1408/29-31	1	0.61	214	1408/984.954	1.00	2.00	1.20	
Khurja Flyover UP Line										
39	Km1					-6570.488	1	3.0	3.0	RCC BOX
42	Km2					-5441.969	1	5.5	4.5	RCC BOX
43	Km3					-5075.632	1	2.0	4.0	RCC BOX
44	Km4					-4186.060	1	2.0	2.0	RCC BOX

45	Km5					-2198.096	1	6.0	5.0	RCC BOX
46	Km6					-2056.563	1	6.0	5.0	RCC BOX
47	Km7					-1800.000	1	6.0	5.0	RCC BOX
48	Km8					-1747.000	1	6.0	5.0	RCC BOX
49	Km9					-1700.000	1	6.0	5.0	RCC BOX

Annexure 2-3

Details of RUB

MINOR RUB LIST						
SR. NO.	**PROP. BRIDGE NO.**	**PROPOSED CHAIN AGE**	**PROPOSED SPAN**			**REMARK**
			Nos.	**W**	**H**	
WAIR DETOUR						
1	WR 1	1102.34	1	5.5	3.5	
2	WR 2	1764.43	1	5.5	3.5	
3	WR 3	2036.02	1	7.5	5.5	
4	WR 4	2139.02	1	5.5	4.5	
5	WR 5	3669.93	1	5.5	3.5	
Khurja Flyover UP Line						
6	K 1	-6182.881	1	5.5	5.0	
7	K 2	-5699.461	1	5.5	5.0	
8	K 3	-5379.316	1	5.5	3.5	
9	K 4	-4800.000	1	5.5	4.5	
10	K 5	-4566.926	1	5.0	5.0	
11	K 6	-4240.000	2	6.0	5.0	
12	K 7	-3267.787	1	5.0	5.0	
13	K 8	-2921.377	1	5.0	5.0	
14	K 9	-2759.744	1	5.5	5.0	
15	K 10	-2370.423	1	6.0	5.0	

CHAPTER 3 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

This chapter reviews the existing institutional and legislative regulations pertaining to the project both at the National and state levels. The chapter also elaborates various clearances and permissions would be required for the project from statutory authorities / bodies.

3.1 INSTITUTIONAL SETTING

The project has been initiated and is being carried out by the DFCC. The primary responsibility of the project rests with the DFCCIL in providing encumbrance free RoW to the concessionaire who shall implement the project. Main Government Ministries / Departments who are responsible to implement various environmental legislations are as under:

- Ministry of Environment and Forests, Government of India (MoEF), New Delhi formulates and regulates all country level legislations besides giving prior environmental clearances through a committee for category 'A' projects, wild life clearances and forest diversion clearances.
- State Level Environmental Impact Assessment Authority (SEIAA), at Lucknow, gives prior environmental clearances to category 'B' projects.
- Central Pollution Control Board (CPCB) monitors and implements pollution related legislations & standards.
- State Pollution Control Board monitors and implements pollution related legislations in the state besides giving NOC for establishing and operating plants under Air (Prevention and Control of Pollution) Act. 1981 and Water (Prevention and Control of Pollution) Act, 1974. SPCB also monitors implementation of other environmental laws.
- State Forests Department processes for permission for forest land diversion and felling of trees.

3.2 THE LEGAL FRAMEWORK

The Governments of India & Uttar Pradesh and the World Bank have formulated host of policy guidelines. Acts and regulations aimed at protection and enhancement of environmental resources. The following sections discuss the various legal issues associated with the project.

3.2.1 Country Level Environmental Legislations

Following provides the legislations pertaining to the project that has been framed by the Government of India.

Table 3-1: Country Level Environmental Laws & Regulations

S. No.	Law / Regulation / Guidelines	Relevance	Applicable Yes / No	Reason for application	Implementing / Responsible Agency
1	The Environmental (Protection) Act. 1986, and the Environmental (Protection) Rules, 1987-2002 (various	Umbrella Act. Protection and improvement of the environment. Establishes the standards for emission of noise in the atmosphere.	Applicable	Environmental notifications, rules and regulations are issued under the Act	DFCCIL

S. No.	Law / Regulation / Guidelines	Relevance	Applicable Yes / No	Reason for application	Implementing / Responsible Agency
	amendments)				
2	The EIA Notification, 14th September 2006 and amendments till date	Railway projects are exempted from this notification	Not Applicable	Railway project is not included	-
3	The Water (Prevention and Control of Pollution) Act, 1974	Central and State Pollution Control Board to establish/enforce water quality and effluent standards, monitor water quality, and issue licenses for construction/operation of certain facilities.	Applicable	Consent required for not polluting ground & surface water during construction. Contractor need to obtain consent to establish construction camps	Contractor / DFCCIL
4	The Air (Prevention and Control of Pollution) Act. 1981	Empowers SPCB to set and monitor air quality standards	Applicable	Consent required for establishing & operation of Construction camps, concrete batch Mix Plants, Hot Mix plants	Contractor / DFCCIL
5	Fly Ash Notification, 2003	Use of fly ash for alignment, if it falls within 100 km of thermal power plant	Applicable	No specific consent required, to be followed	Contractor / DFCCIL
6	Noise Pollution (Regulation And Control) Act, 2000	Standards for noise pollution control	Applicable	Machineries and vehicles to conform to the standards during construction & operation.	Contractor / DFCCIL
7	Forest (Conservation) Act, 1980	Conservation and definition of forest areas. Diversion of forest land follows the process as laid by the act	Applicable	Forest land diversion for the project	DFCCIL
8	Wild Life Protection Act, 1972	Protection of wild life in sanctuaries and National Park	Not Applicable	No wildlife sanctuary / national park	-

S. No.	Law / Regulation / Guidelines	Relevance	Applicable Yes / No	Reason for application	Implementing / Responsible Agency
				involved	
9	Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act,2010	To protect and conserve cultural and historical remains found.	Not Applicable	No Archaeologically Protected structure .	DFCCIL
10	Central Motor Vehicle Act. 1988	Empowers State Transport Authority to enforce standards for vehicular pollution. From August 1997 the "Pollution Under Control Certificate is issued to reduce vehicular emissions.	Applicable	All vehicles used for construction will need to comply with the provisions of this act.	Contractor
11	The Explosives Act (& Rules) 1884 (1983)	Sets out the regulations as regards to the use of explosives and precautionary measures while blasting & quarrying.	Applicable	If contractor decides to store hazardous materials such as HSD and Lubricants at project site.	Contractor / DFCCIL
12	Public Liability And Insurance Act,1991	Protection to the general public from accidents due to hazardous materials handling and storages	Applicable	For using hazardous materials	Contractor/DFCCIL
13	Hazardous Wastes (Management, Handling and Transboundary) Rules, 2008	Protection to the general public against improper handling and disposal of hazardous wastes	Applicable	Hazardous wastes shall be generated due to activities like of maintenance and repair work on vehicles at Construction camps	Contractor / DFCCIL
14	The Batteries (Management and Handling) Rules 2001, amendment 2011	To regulate the disposal and recycling of lead acid batteries	Applicable	Disposal of used lead acid batteries if likely to be used in any equipment during construction and operation stage	Contractor / DFCCIL
15	Chemical Accidents (Emergency Planning, Preparedness and	Protection against chemical accident while handling any hazardous chemicals	Applicable	Handling of hazardous (flammable, toxic and	DFCCIL/ Contractor

S. No.	Law / Regulation / Guidelines	Relevance	Applicable Yes / No	Reason for application	Implementing / Responsible Agency
	Response) Rules, 1996	resulting		explosive) chemicals during road construction	
16	Railways (Amendment) Act, 2008	Related to compensation to PAFs, PAPs, CPRs etc.	Applicable	Land acquisition is involved	DFCCIL
16	The Petroleum Rules, 2002	Applicable	Contractor may store more than the prescribed quantity at camp site	Chief Controller of Explosive	Contractor / DFCCIL

3.2.2 State Level Environmental Legislation

The consent under Air and Water Act are under the preview of UP Pollution Control Board. Moreover, clearances for setting up hot-mix plants, batching plants, etc., under the Air and the Water Acts, establishing new quarries for sand and stone and establishment of new tube-wells / bore-holes are required from SPCB, State Department of Mining and Sate Ground Water Boards / Authorities respectively.

3.2.3 Other Legislations Applicable to Railway Construction Projects

The Concessionaire shall ensure that other legislations like Child Labour (prohibition and Regulation) Act; 1986, Minimum Wages Act; 1948. The factories Act; 1948, The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 etc. are properly followed.

3.2.4 World Bank Operational Policies

The operational policies of the World Bank, both triggered and non triggered, the details and the applicability to the Project road are provided in the **Table- 3.2**. The World Bank environment assessment (EA) requirements are based on a three-part classification system such as Category A, Category B and Category C as defined by the World Bank OP 4.01. A Project designated as Category A, requires a full environmental assessment (EA) Category B projects require a lesser level of environmental investigation. Category C projects require no environmental analysis beyond that determination.

Table 3-2: World Bank Safeguard Policies

Sl. No.	Safeguard Policy	Subject Category	Triggered	Triggered By	Mitigation Measures	Documentation
1.	OP 4.01	Environment Assessment	Yes	Sensitive areas and impacts on environmental and social components	Mitigation measures incorporated	EIA and EMP prepared
2.	OP 4.04	Natural Habitats	Yes	Reserve forests issues	Incorporated	EIA and EMP
3.	OP 4.09	Pest Management	No	Not applicable	Not applicable	Not Applicable

Sl. No.	Safeguard Policy	Subject Category	Triggered	Triggered By	Mitigation Measures	Documentation
4.	OP 4.11	Physical Cultural Resources	Yes	Risk to cultural properties	Adequate mitigation measures if affected	EMP & RAP prepared
5.	OP 4.36	Forestry	Yes	Diversion of forest land	To be carried out as per Forest (conservation) Act, 1980	Not Applicable
6.	OP 4.37	Safety of Dams	No	Not Applicable	Not Applicable	Not Applicable
7.	OP 7.50	International Waterways	No	Not Applicable	Not Applicable	Not Applicable
8.	OP 7.60	Disputed Area	No	Not Applicable	Not Applicable	Not Applicable

3.2.5 Type of Project

For projects with potential to have significant adverse environmental impacts (Category A) an environmental impact assessment (EIA) is required. Category B projects are judged to have some adverse environmental impacts, but of lesser degree or significance than those for category A projects and require an Environmental Assessment (EA) to determine whether or not significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the EA is regarded as the final environmental assessment report as is the case for EDFC. The project railway line passes through a small patch of reserved forest area (1.5809 Ha area acquisition involved). However, at crossings of rail line at canals and distributories RoW vacant land will be considered as protected forest, similarly crossing of rail line at road RoW will also be considered as protected forest as road side plantation in UP has been declared as protected forest. No presence of endangered fauna and flora along the project railway line envisaged. It may also be mentioned that there is only marginal acquisition for protected forest land due to the proposed section and it is at the crossing of alignment with SH/NH. The Government of India has issued Environmental Impact Assessment Notification in 1994 as a part of Environmental (Protection) Act, 1986 and amendments in September 2006. Railway projects do not fall under any category requiring an environmental clearance from MoEF. Only No Objection Certificate (NOC) is required from SPCB under the Air and Water Acts for operating various equipment during construction works.

It has been established that there is a need for improving the infrastructure capacity of the transport sector to cater the projected demand for freight and good movement. By building up the rail infrastructure which uses 1/6th the fossil fuel consumption as compared to road, overall improvement n environmental condition is envisaged. Over and above since traction in this case would be electricity based, there is a possibility that this electricity can come from the budding nuclear capacity of the nation. Thus there can not be more eco-friendly and efficient transport system other than rail to meet with the demand of India's growth economy.

Since this is a large scale project and likely to have some reversible impacts on environment during construction phases & some impact, not of much significance, during operation, this project is being considered as **'A' category project** as per the World Bank safeguard policy. This will help not only in tweaking the construction stage to be more eco-compliant but setting systems to have better and more environment friendly construction in forthcoming railway projects. DFCCIL is

committed to establish most efficient and eco-friendly system.

3.2.6 Clearance Requirements for the Project

The summary table showing time requirements for agency responsible for obtaining clearance, and a stage at which clearance will be required is given below:

Table 3-3: Summary of Clearances & NOCs

Sl. No	Type of clearance	Statutory Authority	Applicability	Project stage	Time required	Responsibility
1	Prior Environmental Clearance	SEIAA/ EIAA	Not applicable	Pre construction	-	
2	Clearance for working / diversion of sanctuary land	Chief Wild Life Warden	Not applicable	Pre construction	-	
3	Forest Clearance	State Environment & Forest Dept. and MoEF regional office	Diversion of Forest land	Pre construction	6-8 months	DFCC
4	Tree felling permission in Private Land	Forest Department	Felling of trees	Pre construction	2-3 months	DFCC
5	NOC and Consents Under Air , Water, EP Acts & Noise Rules of UPPCB	State Pollution Control Board	For establishing plants	Construction (Prior to work initiation)	2-3 months	Concessionaire / Contractor
6	NOC And Consents Under Air , Water, EP Acts & Noise rules of SPCB for Establishment of Construction camps	State Pollution Control Board	For operating Hot mix plants, Crushers and batching plants	Construction (Prior to work initiation)	1-2 months	Concessionaire / Contractor
7	Permission to store Hazardous Materials specially fuel oil and Lubricants at Construction camps	State Pollution Control Board and Controller of Explosives	Storage and Transportation Of Hazardous Materials and Explosives	Construction (Prior to work initiation)	2-3 months	Concessionaire / Contractor

Sl. No	Type of clearance	Statutory Authority	Applicability	Project stage	Time required	Responsibility
8	Explosive license	Chief Controller of Explosives	Storage of Explosive materials	Construction (Prior to work initiation)	2-3 months	Concessionaire / Contractor
9	PUC certificate for use of vehicles for construction	Department of Transport	For all construction vehicles	Construction (Prior to work initiation)	1-2 months	Concessionaire / Contractor
10	Quarry lease deeds and license	Dept. of Geology and Mines, GoUP	Quarrying and borrowing operations	Construction (Prior to work initiation)	2-3 months	Concessionaire / Contractor
11	NOC for water extraction for construction and allied works	Ground Water Authority	Ground water extraction	Construction (Prior to work initiation)	2-3 months	Concessionaire / Contractor

3.3 CONCLUSION

Review of environmental regulations clearly indicates that the subject DFC project does not require any environmental clearance. However, clearance for the diversion of Reserved and protected forest land and permission for cutting the trees within the proposed right of way of the alignment will be required from the Forest Department. In addition to the above, the contractor would require the following NOCs & licenses from the authorities during construction:

- NOC And Consents Under Air , Water, EP Acts & Noise rules of SPCB for establishing and operating Construction Camps from UP Pollution Control Board
- PUC certificate for use of vehicles for construction from Department of Transport
- Quarry lease deeds and license and Explosive license from Dept. of Geology and Mines & Chief Controller of Explosives
- NOC for water extraction for construction and allied works from Ground Water Authority

Apart from the above clearances, the Contractors also have to comply with the following:

- Clearance of Engineer for location and layout of Worker's Camp, Equipment yard and Storage yard.
- Clearance of Engineer for Traffic Management Plan for each Section of the route after it has been handed over for construction.
- An Emergency Action Plan should be prepared by the contractor and approved by the Engineer for accidents responding to involving fuel & lubricants before the construction starts. Submit a Quarry Management Plan to the Engineer along with the Quarry lease deeds

CHAPTER 4 ENVIRONMENTAL PROFILE AND STRIP MAPS

4.1 INTRODUCTION

This section presents the environmental profile of the project influence area and its salient features. The objective is to ascertain the environmental sensitivity of the project, and identify the likely impact zones of the project.

Considering the nature of the project alignment, an area of about 5 km on either side of the corridor has been considered for studying the profile. The environmental features such as reserved forest, sanctuaries / national parks, rivers, lakes and ponds, religious structures, archaeological monuments, natural habitats, schools, irrigation canals along with other sensitive receptors were mapped in the profile through detailed field inventories and presented on the topo sheets (on a scale of 1:50,000) of Survey of India.

Addition to the above, the detailed walk through surveys were carried out to map specific environmental features within the Right of Way (RoW) of the proposed alignment. These features were presented on strip map/ strip plan. Following sections present details of these surveys.

4.2 METHODOLOGY

The methodology followed in the preparation of the environmental profile of the project influence area and strip maps comprised the following:

- **Collection of Toposheets (scale 1:50000 & 1:250000 of Survey of India** from Survey of India and demarcation of the proposed alignment on the toposheets.
- **Field reconnaissance of the proposed alignment through detailed walk through surveys**
- Mapping of **sensitive receptors** such as schools, religious structures, hospitals etc.
- Interactions with **local villagers and resource persons to understand the importance of various** sensitive features and other local resources (if any).

The data collected from the above tasks was mapped on the detailed Kilometer wise strip maps and topo sheets on a scale of 1:50,000.

4.3 ENVIRONMENTAL PROFILE OF THE PROJECT INFLUENCE AREA

The environmental profile of the influence area (within 5 km on either side of the proposed alignment) presented in **Volume-II**, indicates that

- the alignment generally runs through plain areas of indo-gangetic plains and is devoid of sensitive environmental features
- The alignment is crossing Upper Ganga canal and its distributories.
- The alignment does not cross any perennial river.

In addition to the above, no sensitive features like wild life sanctuary/ national park, wetland, etc. were observed within the project influence area.

4.4 ENVIRONMENTAL FEATURES WITHIN PROJECT RoW

The environmental features within the right of way (RoW) of the project were recorded through the kilometre wise strip maps, as presented in **Volume-II,** indicate that the proposed alignment,

- does not pass through any wild life sanctuary or sensitive natural resource like National Park
- does not affect wetland

- does not require significant acquisition of protected forest areas
- Considering dense settlements and developments along the existing railway line near the towns of Wair and Khurja Flyover UP line, the project proposes 2 detours (One for Wair and other one for Khurja Flyover UP line).
- The project alignment does not cross any pereniel river. It crosses seasonal river Karon.
- The alignment also crosses the lower Upper Ganga Canal at km 1372. The impacts on the canal however are mitigated in the design by providing adequate cross drainage works at al the locations.
- Number of religious structures (01), and 3 schools / educational institutions 2 wells, 3 tube wells, and 5 hand pumps are located along the proposed alignment. The details of these structures are presented in **Table 4.1.**
- The proposed is expected to involve the cutting of 587 trees, out of which approx. 500 trees are in Railway properties. . Most of these tree species comprise common species such as neem, papal, mango, eucalyptus, etc., and doesn't involve cutting of any sensitive / endangered species.

Table 4-1: Details Sensitive Receptors

S.N.	Type of Receptors	Name	Location/ Chainage	Parallel / detour	from the centerline of the DFCC alignment	Side (w.r.t Kanpur to Khuja)
1	Educational	School	Khurja at km 1369.82	Parallel	5	L
2	Educational	School	Dankaur km 1398.2	Parallel	10	L
3	Educational	College	Wair at km 1389.55	Parallel	500	L
4	Educational	School	Dadari at km 1415	End Point	20 m	L

4.5 VIBRATION

Vibration in railways and its impact on the sensitive receptors is an important issue. Since no national standard exists, Japanese standard has been considered for vibration measurement and deciding mitigation measure.

CHAPTER 5 BASELINE ENVIRONMENTAL PROFILE

5.1 INTRODUCTION

This chapter assesses the nature, type and dimensions of the study area and describes the relevant physical and biological environmental components along the proposed railway line. The data on various environmental components related to the project area has been assembled from various secondary sources and primary environmental surveys on ambient air quality, noise and vibration levels, water and soil quality, aquatic and terrestrial ecology. A deailed profile prepared based on the above information is presented in the subsequent sections of this chapter.

5.2 BASELINE ENVIRONMENTAL SURVEYS

As presented in **Table-5.1** below, detailed base line environemental surveys were carried out for the key components of environment (ambient air, water quality, soil, noise, vibration, terrestrial and aquatic ecological parameters) during December 2011. Data on meteorology has been collected from the nearest IMD stations at Aligarh, and Delhi. The environmental monitoring was done along the section of Khurja – Dadari section of EDFC covering detour as well as parallel sections.

Table 5-1: Details of Baseline Data Collection Schedule

Field	Parameters	No. of Sampling Locations	Sampling Duration	Frequency	Criteria for selection of no. of samples and locations
Ambient Air Quality	SO_2 NOx PM10 PM2.5 CO	3	24 hrs continuous for SO_2, NO_x, SPM, RPM and One Hour for CO	Once a Day in January 2012	Covering locations in urban, Rural and truly representative of the area. Locations have been selected at Level Crossing, sensitive receptors such as Schools, Temples, etc. These cover both parallel and detour sections.
Meteorology	Wind Speed Wind Direction Ambient Temperature Rainfall Humidity Atmospheric Pressure	02	December 2009 to February 2010 and March 2011 to May 2011	Long term data at 8:30 and 17:30 IST	Nearest IMD stations viz. Aligarh, and Delhi to represent the meteorological condition of the study area
Water Quality	Physical Parameters	04 Ground	Grab Sample	January 2012 ,	As per IS: 10500

Field	Parameters	No. of Sampling Locations	Sampling Duration	Frequency	Criteria for selection of no. of samples and locations
(Ground Water Sample)	pH, Colour and Odour, Temperature, Turbidity, TSS, TDS, Total Hardness,Total Alkalinity, Total Iron, Chlorides, Sulphates, Nitrates as NO3, Nitrite as NO2, Fluorides, Phosphates as PO4, Magnisium as Mg, Heavy Metals (Pb, Zinc, Chromuim, arsenic), Coliform, BOD	water Samples (No perennial surface water source in project stretch)		once at each location	Standards covering ground water
Noise	L_{eq}	03	24 hrs continuous	January 2012, once at each location	Noise monitoring was carried out covering all types of land uses (Senisitive, Rural , residential and commercial). The monitoring locations have been done in parallel and detour sections.
Vibration	L_{max}	03	24 hrs continuous / during passing of various trains	January 2012	The sensitive and residential locations have been covered in parallel as well as detour locations
Soil	pH, Electrical Conductivity, Texture Class, Sand, Silt and Clay Percentages, Bulk density, water Holding capacity, Nitrogen,	03	Grab Sample	January 2012	As per IS Standards to represent the soil quality in terms of fertility in the study area. Samples drawn from Agriculture

Field	Parameters	No. of Sampling Locations	Sampling Duration	Frequency	Criteria for selection of no. of samples and locations
	phosphorus and potassium Percentages, Organic,matter, Lead as Pb, Arsenic, Iron, Sulphates(Meq/100 gm), Chlorides (MEQ/100 gm)), Calcium (meq/100 gm), Copper (mg/kg), Zinc (mg/kg), Manganese (mg/kg), Moisture (%), Porosity (%), Na2CO3 /Nacl infiltration capacity(inch/hr), Alkalinity (ppm), Acidity (ppm)				fields
Ecology	Aquatic	02	Random	December 2011 and January 2012	Terrestrial by quadrate and linetransact, aquatic by plankton and phyto and zoo benthos to assess the aquatic and terrestrial ecology, secondary data from Forest Deptt.
	Terrestrial	02	Random	December 2011 and January 2012	

5.3 METEOROLOGY

The project area presents tropical climatic characteristics. There is no significant variation in climatic characteristics.The project stretch from Khurja to Dadari passess through two districts of Uttar Pradesh i.e. Bullandshahar and Gautam Budh Nagar.To understand the meterological features of the project area, data has been collected from the two nearest meteorological stations (monitored by Indian Meterological Department), at Aligarh, and Delhi in 2009 during EA of Bhaupur- Khurja Section. Fresh data has also been taken for March 2011 to May 2011. **Table-5.2** sumarizes the meteorological characteristics of the project area.

Table 5-2: Meteorological Data during December 2008 to February 2009 and March 2011 to May 2011

Month	Ambient Temperature(^{0}C)		Atmospheric Pressure, hPa		Relative Humidity(%)		Average Wind Speed, km/hr.	Pre-dominant Wind Direction	Rainfall, mm
	Daily Max.	Daily Min.	At 8:30 hrs.	At 17.30 hrs.	At 8:30 hrs.	At 17.30 hrs.			
IMD Station: Aligarh (height above msl : 187 m)									
Dec. 2008	23.0	8.7	997.2	993.7	76	55	4.8	W & NW	5.2
Jan. 2009	20.2	7.1	996.4	993.2	80	55	5.4	W	12.6
Feb. 2009	25.1	9.8	994.6	992.9	72	45	6.5	W	11.2
Mar. 2011	32.4	16.3	990.8	987.4	61	33	6.9	W & NW	6.4
Apr. 2011	37.6	20.9	986.7	985.1	41	24	6.4	W & NW	5.2
May 2011	40.8	25.5	983.1	981.3	40	21	7.9	W & NW	7.7
IMD Station:Safadarjung Airport Delhi (height above msl : 216 m)									
Dec. 2008	23.0	8.2	992.7	990.2	73	47	7.4	NW	7.8
Jan. 2009	21.1	7.3	992.2	989.9	77	45	8.3	NW & W	20.3
Feb. 2009	24.2	10.1	990.1	987.6	68	37	10.1	NW	15.0
Mar. 2011	30.5	16.6	986.6	985.6	59	30	9.7	NW & W	4.8
Apr. 2011	35.3	20.8	985.2	981.5	40	22	10.2	NW & W	6.3
May 2011	38.4	26.7	972.8	978.4	39	23	10.8	NW & W	8.5

Source: IMD, Aligarh, and Delhi

5.3.1 Temperature

The meteorological data observed during the winter and summer season shows that daily maximum temperature varies from 20.2 to 40.8 ^{0}C and the temperature characteristics at both locations are similar. Both Maximum and minimum Temeratures have been recorded at Aligarh. The daily minimum temperature has been recorded as 7.1 deg. C. The lowest daily minimum temparature has been observed in January 2009 in Aligarh. During summer season, the average daily maximum temperature is around 40^{0}C during May months at both the stations.

5.3.2 Relative Humidity

The relative humidity of the project area varies from 68% to 80% at 8:30 hrs during winter season and 37% to 55% at 17:30 hrs. The relative humidity decreases during summer and varies from 39 to 61 % 0830 hours and 21 to 33 % at 0530 hours.

5.3.3 Wind Speed and Direction

Analysis of wind records shows that the winds are generally light to moderate in this area. The windrose diagrams for the period December 2008 to February 2009 (winter season) and March 2011 to May 2011 (Pre Mansoon season) at Aligarh, and Agra are presented in **Figures 5.1 to 5.4**. The pre-dominant wind directions are West in Aligarh and North-West in Agra during winter season. During summer season, the pre-dominant directions are West and North-West in Aligarh and North-West and South-West in Delhi. Average wind speed increases during summer season as compare to winter. The maximum average wind speed was observed in May 2011 at Delhi, while, December was comparatively calm. The average wind speeds are higher at Delhi.

Figure 5-1: Aligarh (December 2008 to February 2009)

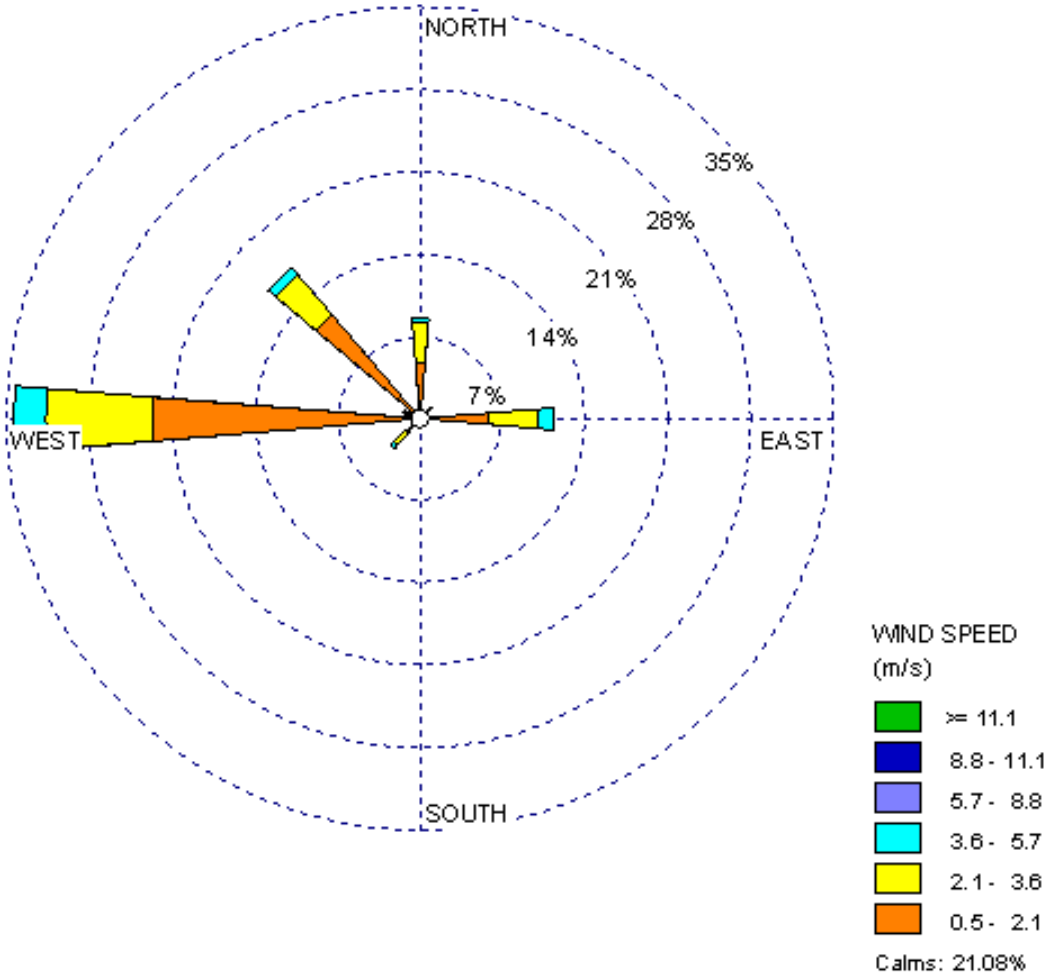


Figure 5-2: Delhi (December 2008 to February 2009)

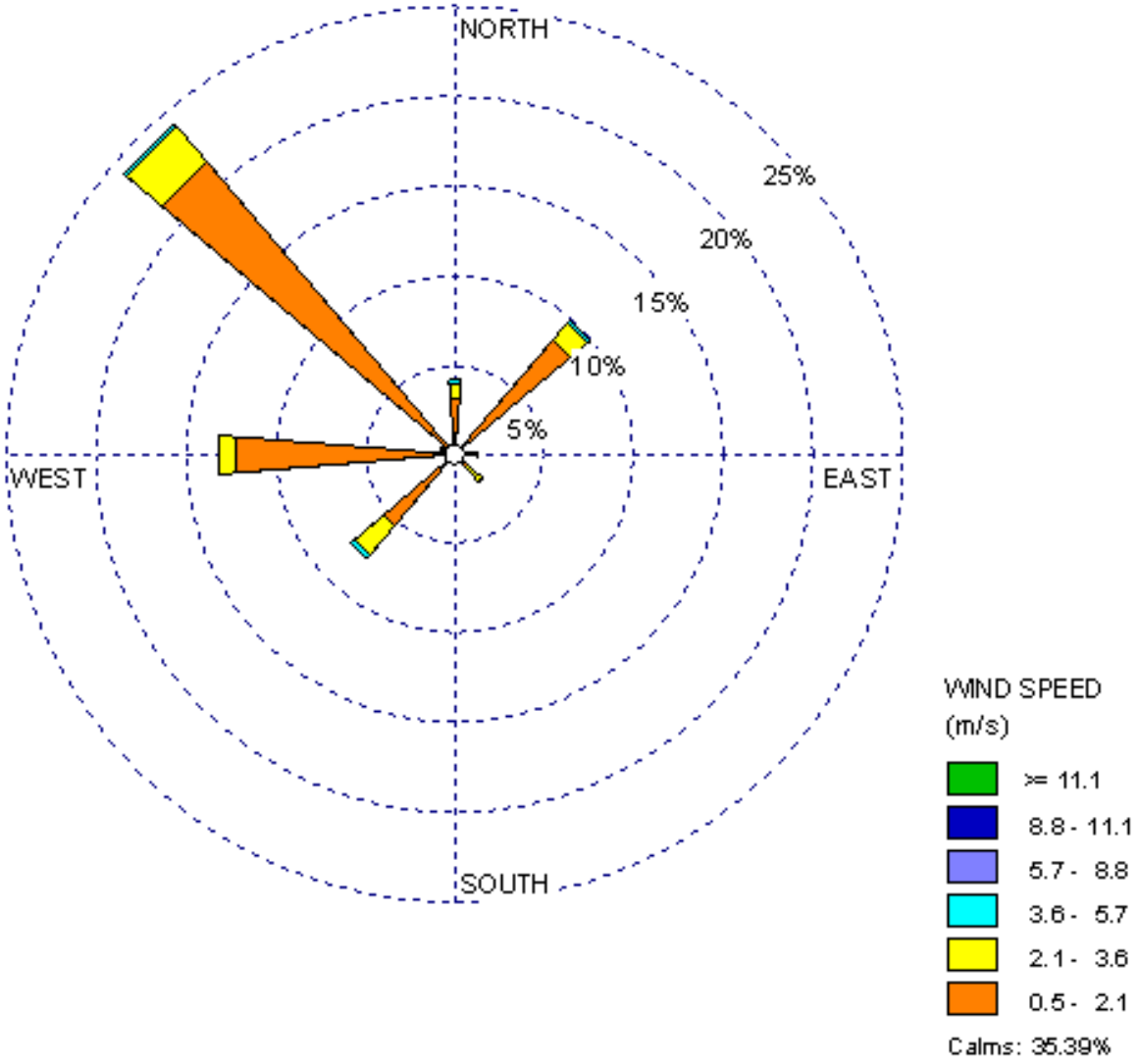


Figure 5-3: Aligarh (March 2011 to May 2011)

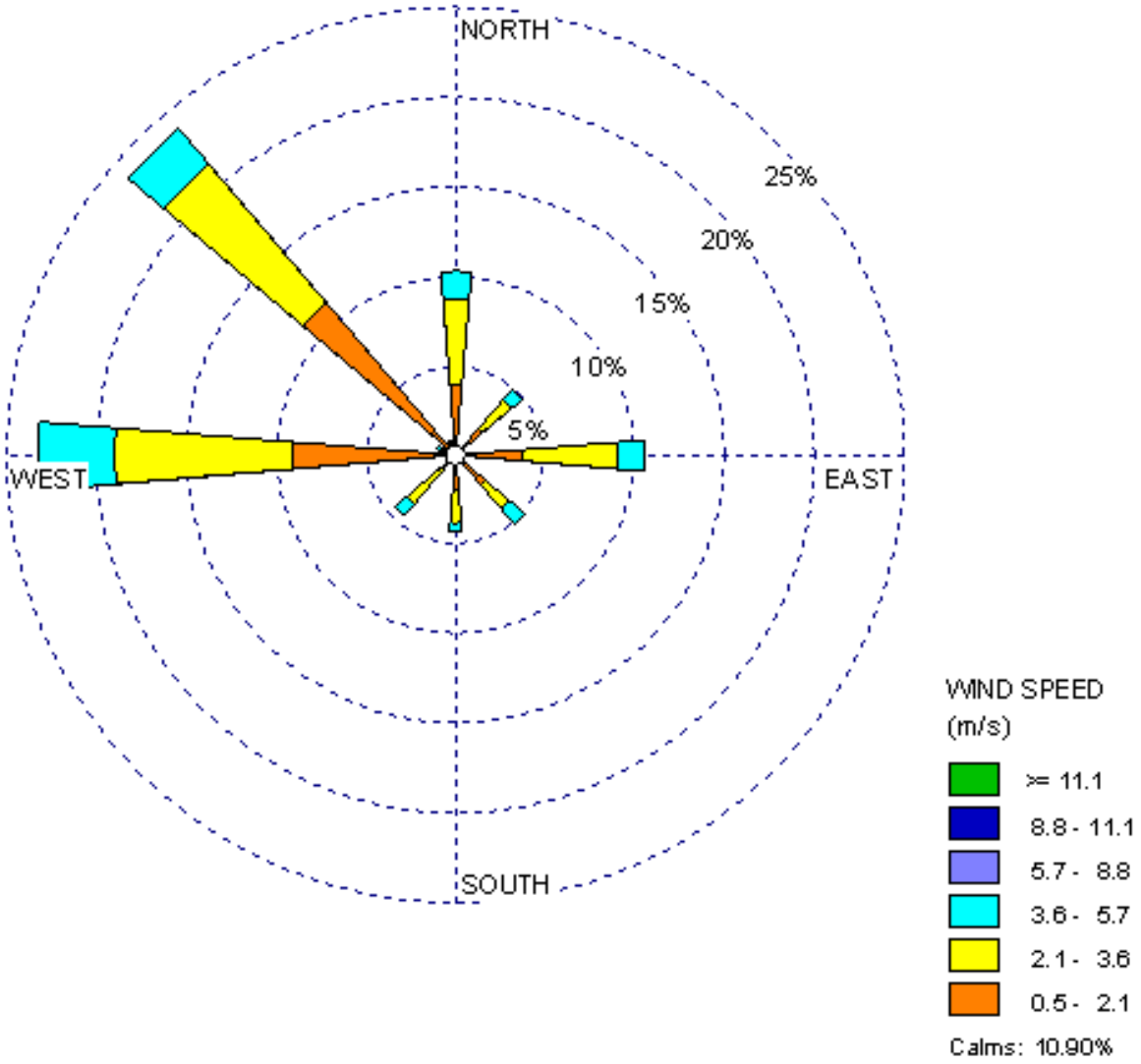
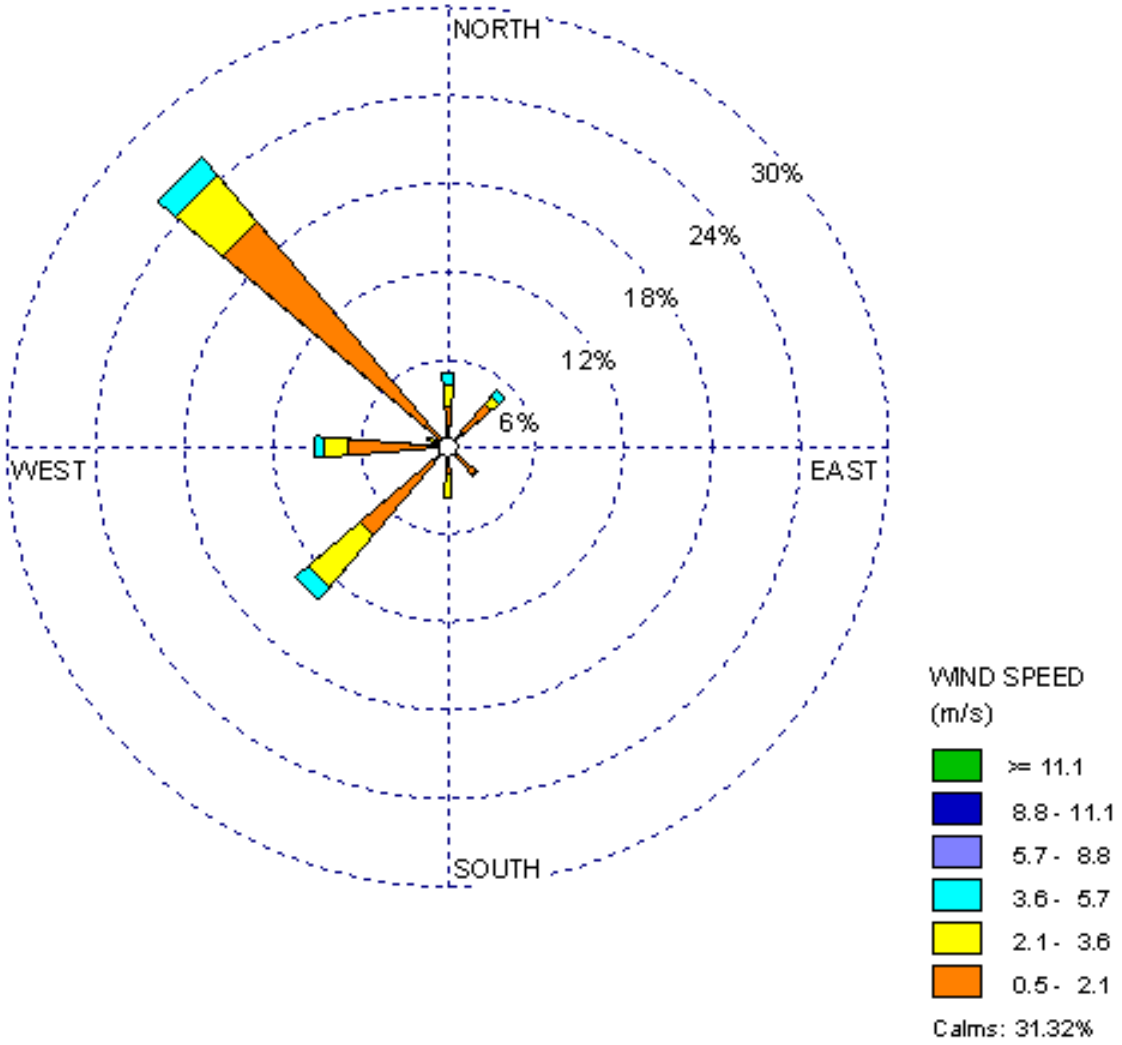


Figure 5-4: Delhi (March 20011 to May 2011)



5.3.4 Atmospheric Pressure

The minimum and maximum monthly atmospheric pressure varies from 972.8 to 997.2 hPA at 08:30hrs and from 978.4 to 978.4 hPA at 17.30hrs.

5.3.5 Rainfall

The rainfall is generally low during the non-monsoon season. The average rainfall recorded is highest (20.3 mm, Delhi) in January and lowest in December (4.8 mm, Aligarh). The month-wise total rainfall is shown in **Table -5.2**.

5.4 AMBIENT AIR QUALITY

Sulphur dioxide (SO_2), Oxides of Nitrogen (NO_x), CO, PM_{10} and $PM_{2.5}$ are the five major air pollutants, which cause concern to environment and other living beings. In order to

understand the base line trends of these pollutants in the project area, ambient air monitoring was carried out at 3 critical locations

During early January, 2012 environmental monitoring at 3 locations in the stretch has been carried out. The locations were selected based on impacted residential area, sensitive receptors both in parallel alignments and detour locations. Monitoring was carried out continuously for 24 hours at each location.

Air Quality monitoring at Dadari

5.4.1 Methodology (Air Monitoring)

The air pollution analysis techniques include the

evaluation of the following:

1. Particulate Matter ($PM_{2.5}$ and PM_{10})
2. Sulphur dioxide (SO_2)
3. Nitrogen oxides (NO_x)
4. Carbon Monoxide (CO)

As regard the techniques for Collection of sample of particulate matter, the "Respirable Dust Sampler Envirotech Model APM 460 BL" was used for air monitoring.

The dust particulate matter were collected on filter paper (size GF/A 20.3 x 25.4 cm) and dust cup and the gaseous pollutants were collected simultaneously by a known volume of air through a number of bubblers of different flow rate through appropriate solution for absorbing different gases. The gaseous air pollutant samples were collected in glass impinges filled with adsorbing solvents by passing of ambient air and analyzed according to standard method.

Calculation

For particulate matter

PM_{10} ($\mu g/m^3$) = RSPM + (final weight of cyclonic cup – initial weight of cyclonic cup) / volume of air.

$PM_{2.5}$= (Weight of Final Filter Paper-Weight of Initial Filter Paper/Volume of Air

For gaseous pollutants

SO_2 ($\mu g/m^3$) = $(A - A_0) \times 1000 \times B \times D / V$

NO_x ($\mu g/m^3$) = $(A - A_0) \times 1000 \times B \times D / 0.82V$

Where, A = Sample Absorbance,

A_0 = Reagent blank Absorbance, and

B = Calibration factor (μg/absorbance)

D = Volume of absorbance solution in impinger during monitoring / volume of absorbing solution taken for analysis.

V = Volume of Air Sample in liters.

CO was monitored by using sensor based Non Dispersive Infrared equipment which gives direct result.

Table 5-3: Ambient Air Quality of the Study Area (January 2012)

S.No	Location	Date	Category	Parameters					Remarks
				PM2.5 µg/m³	PM10 µg/m³	SO_2, µg/m³	NOx, µg/m³	CO, µg/m³	
1.	Khurja (km 1369.82)	11-01-2012	Residential & urban area	23	71	12.4	17.6	BDL	Within the limit of NAAQS
		14-01-2012		27	68	11.5	19.8	BDL	Within the limit of NAAQS
2.	Wair (km 1389.55)	12-01-2012	Residential & Rural area	19	46	14.2	18.5	BDL	Within the limit of NAAQS
		15-01-2012		20	44	13.5	16.6	BDL	Within the limit of NAAQS
3.	Dadari (km1415.69)	13-01-2012	Residential & Industrial area	28	79	16.1	23.4	BDL	Within the limit of NAAQS
		16-01-2012		26	81	15.4	22.0	BDL	Within the limit of NAAQS

Source: Field Monitoring

A review of ambient air quality data presented in **Table-5.3** above shows that air quality of the project area is generally good and all parameters of air quality are well within the limits. Overall, the result indicates that PM10 levels vary from 44-81 $\mu g/m^3$, whereas $PM_{2.5}$ varies from 19-28 $\mu g/m^3$. SO_2, NOx and CO levels are also, well within the NAAQ standards at all the monitoring locations.

5.5 NOISE LEVELS

Noise attributed to a line project depends on factors such as traffic intensity, the type and condition of the traffic. Excessive high noise levels are a concern for sensitive receptors, i.e., hospitals, educational institutions, etc. The baseline information about the existing noise level along the railway track has been collected by monitoring the noise levels. The noise monitoring was carried out in each parallel location and near the receptors in detour location by using IMV JAPAN Models 6226 and 6224 complying with Japanese Standard JIS C1509 which consists of data logger facility.

The Central Pollution Control Board has specified ambient noise levels for different land uses for day and night times. Importance was given to the timing of exposure and areas designated as sensitive. **Table 5.4** presents the noise standards specified by the Central Pollution Control Board.

Table 5-4: National Standards for Ambient Noise

Area Code	Category	Limits in Decibels (dB A)	
		Day Time	Night Time
A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45
D	Silence Zones	50	40

Note: (1) Daytime: 6 AM to 10 P.M., Night-time 10 PM to 6 AM;

(2) Silence zone is an area up to 100 m around premises as hospitals, educational institutions and courts.

Locations for noise monitoring along the project route were identified based on the criteria same as those used for air monitoring but the relative importance of each criterion carries a weight age in arriving at the final set of locations. The noise monitoring was carried out at 3 locations covering urban , residential and silence zones in January 2012 for continuously 24 hrs covering day and night as per relevant Noise standards of CPCB.

5.5.1 Methodology for Noise Monitoring

The intensity of sound energy in the environment is measured in a logarithmic scale and is expressed in a decibel (dB) scale. Ordinary Sound level meter measures the sound energy that reaches the microphone by converting it into electrical energy and then measures the magnitude in dB. In a sophisticated type of sound level meter, an additional circuit is provided, which modifies the received signal in such away that it replicates the sound signal as received by the human ear and the magnitude of sound level in this scale is denoted as dB (A) .The sound levels are expressed in dB (A) scale for the purpose of comparison of noise levels, which is accepted by Central pollution Control Board (CPCB) as per Environment (Protection) Act, 1986

The general noise monitoring was carried out within 30 m from railway track in each parallel location and near the receptors in detour location. In this mode the noise was recorded continuously for 24 Hrs. Simultaneously categories of all the trains passing through the track were recorded. The Leq during day and night (6 AM to 10 PM reckoned as Day and 10PM to 6 AM as Night) were calculated as per the National Standards for Ambient Noise levels. The measured results of this general monitoring are provided in **Table-5.5 below:**

Table 5-5: Noise Monitoring Results

S. No.	Locations	Category	Parameters				Noise Level at 30 m		
			Distance	Leq dB(A) Day	Leq dB(A) Night	dB(A) (Max.)	One train is passing, max value in dB(A)	Two trains are passing, max value in dB(A)	Date of Measurements
1.	Khurja (km 1369.82)	Silence Zone (Parallel Section) - School within 20 m	5 m	65.4	48.6	102.7	88.3	95.8	11-1-2012
2.	Wair (km 1389.55)	Start of Wair Detour	20 m	62.6	52.4	109.8	89.2	96.2	12-1-2012
3.	Dadari (km1415.69)	Silence Zone (along existing track) - Parallel Section	20 m	66.2	47.8	89.2	100.4*	95.2	13-1-201 2
4.	Ajayabpur (km 1406.46)	Rural Residential	20 m	64.4	55.1	96.6	87.6	97.0	14-01-2012

*During Whistling of Train

5.5.2 Result and Discussions based on noise monitoring

Review of noise levels presented in table 5.6 indicates that the noise levels exceed permissible standards at all the locations along the existing railway track (where DFC is proposing track parallel to the existing in parallel section). The noise levels go instantly high up to 97 dB(A) at 30 mteres when two trains are passing and 100.4 dB(A) at 30 meters when single train is passing and whistling.

Further to understand the noise attenuation patterns caused by different categories of trains with distances from the track, noise levels were also monitored at 12.5, 25 & 50 Meter from the center of the track at Chola and Boraki Stations. These results are given in **Table-5.6** below:

Table 5-6: Noise levels for different train movements

Category of Trains	Running speed (km/hr)	Railway Noise Level dB (A)					
		Leq			Lmax		
		12.5	25.0	50.0	12.5	25.0	50.0
FE1A Open Wagon	90	97	79.2	74.3	103.9	91.8	84.2
FE2A Closed Wagon	94.1	102.1	88.2	81.2	107.8	93.8	85
PEA (Super Fast)	110	94.4	80.2	72.3	97.6	89.6	80.7
PEA (Express)	105	92.1	81.3	71.2	93.7	90.6	79.4

As presented in table 5.6, above, the noise levles between passenger trains and freight trains are significantly different. The range of difference is around 12 dB(A) at 12.5 mts and reduces to around 8 dB(A) at 25 mtrs.

However, the noise attenuation was found to be ranging from about 10 dB(A) to 18 dB (A) from 12.5 to 25 m and about 5 dB(A) to 9 dB(A) from 25 to 50 m, from the centre of the railway track. Similar to noise levels, the attenuation levels both for passenger and freight trains were noted to be same. This indicates no significant impact on noise levels due to the category of train type.

5.6 VIBRATION

5.6.1 Background Information

Vibration assessments are a key element of the environmental impact assessment process for mass transit projects. Vibration may lead to damage of cultural assets and other establishments near railway tracks and also may have impact on the human health.

Experience has shown that vibration is among the major concerns with regard to the effects of a railway project on the surrounding community.

Vibration is often associated with noise but is a problem in its own right. Notwithstanding health effects to the passengers it impacts the inmates of the buildings close to the track in the form of scare, sleeplessness and postural discomfiture. It also affects the buildings in the form of short and long term impacts.

Vibration can also be affecting the train drivers and operators including drivers of specialist vehicle used during the construction phase. Appropriate mitigation measures will vary but may include design considerations for vehicles and equipment, control of exposure times, proper maintenance, protective clothing and alterations to working practices. A Detailed elaboration has been provided regarding the mitigation measures available.

Measurement

As discussed in the earlier sections, the proposed track runs in two different

alignments.

I. One parallel to the existing track, which could involve,

- Higher amplitude vibrations impacting the buildings now coming closer to railway vibrations (within critical distance) on the side of new track
- Higher amplitude vibrations impacting all close buildings and human inmates due to instances of multiple trains running at same instance of time
- Higher frequency of such multiple train running instances resulting to higher time of exposure
- Increased impact due to increased speeds of Freight Trains.
- Increased impact due to higher No of freight trains running closer

II. Detours from the existing track passing through areas of different land use:

On detours there are no existing tracks at the moment. This will necessitate *abinitio* laying of the track which will involve movement of heavy and fast moving freight trains for transportation of material and goods. In addition there will be impact due to construction activity itself.

Finally there will be impacts due to DFC operations which will be in the form of

- Creation of a new Vibration environment along the detour effecting the building and inmates present within the critical distance of impact of vibrations
- Impacts due to trains running, at higher speeds / axle loads.

As part of the base line analysis of vibration levels, data was collected through measurement of vibration levels at several locations along parallel tracks as well as detour locations, covering all the possible scenarios mentioned above.

The data collected along with the patterns of Vibration propagation with distance, speed, axle load for single, dual and multiple train operations have been estimated. The same data has been used to predict impacts on sensitive locations along the entire corridor. The highest vibration values based on the 100km/hr speed of freight trains (containers or tankers) have been used for the prediction of impacts.

5.6.2 Standards on Vibration Measurements for Railway Projects

There are no specific standards for vibaration levels in India. However there are number of international standards (as indicated below) for evaluating the potential impacts for building damage and also the human response.

ISO Standards on vibration (ISO 2631/2- 1989, ISO 8041-1990, and ISO 4866-1990)

JIS Z-8735 (Method of measurement for vibration levels) and JIS C-1510 (Standard for Vibration level meter).

BS 6472

DIN 4150

While each of the above standards have specific approach to the measurement and assessment of vibration impacts, considering the fact that the feasibility study for the project was carried out based on Japanese standards (JIS 8735 and JIS 1510) and DFC is also implementing same standards in the western corrirodor, the same standards have also been in the current study. The important features of JIS 8735 are:-

- depend on one single parameter ie Lpeak as against multiple parameters such as (VDV and PPV)
- does not require further calculations after the collection of data,
- the standards suggesets single parameter to assess the vibration impacts on buildings and the residents with one common parameter.

Considering the above, the above JIS Z 8735 have been following for measuring and prediction of vibration impacts of the project.

5.6.3 Methodology

The ambient vibration levels and railway vibration levels were measured as part of the base line surveys.

While railway vibrations were measured for various train types and speeds at varying distances, the ambient vibrations were measured on Sensitive Receptors

5.6.4 Measurement Instrument

As according to JIS C 1510, vibration meter 1220E manufactured by IMV Japan, was chosen for measuring vibration.The instrument provides vibration measurements in all the three axes and also measures velocity or acceleration parameters. The instrument also captures and stores values at predefined intervals and calculates maximum and minimum or percentile values.

Specifications of the selected instrument are below:

Features

- Conforms to JIS C1510-1995.
- Measures vibration pollution from factory, construction site and traffic
- Calculates Vibration level Lv, Vibration acceleration level Lva, Max. value Lmax, Min value Lmin, Time rate vibration level (Lx : 5-value), Power averaged level (Leq) in 3-direction and displays with selection

Model	VM-1220E
Frequency Range	1 - 80 Hz
Measuring Range	30 - 120 dB
Level Range	20 dB step, 2-range 30 -90dB, 50 -110dB
Linearity	75dB
Measured Item	Vibration level Lv, Vibration acceleration level Lva, Max. value Lmax, Min value Lmin, Time rate vibration level (Lx: 5 value), Power averaged level (Leq)
Measuring Time	1s,3s,5s,10s,1min,5min,10min,15min,30min,1h,8h,24h Manual (Max 199h59min59s)
Ambient Condition	Temperature Range: 10 -50^{0}C Humidity: 30 - 90% (not dew condensation)

5.6.5 Vibration Levels

Based on the approach formulated above, the vibration levels were measures at the following locations presented in **Tables 5.8 -5.13** along the project corridor.

Table 5-7: Ambient Railway Vibration Along Khurja- Dadari Section

S. No.	Location
1.	Khurja (km 1369.82)
2.	Start of Wair Detour (km 1389.55)
3.	Dadari (km 1415.69)

Table 5-8: Vibrations Measured at Khurja as per Japanese Standards

S.No.	Name of Location	Distance	LMAX
1	Khurja (Near School)	2 m	74.9

Table 5-9: Vibrations Measured at Start of Wair Detour (17.5m., 30.0m. & 55m) as per Japanese Standards

Speed Km/Hr	Vibration in dB at 17.5m.	Vibration in dB at 30m.	Vibration in dB at 55m.
Passenger Down Trains			
102	65.1	58.7	50.1
90	63.8	56.3	48.6
93	67.1	57.3	51.1
88	63.2	56.7	47.1
108	70.1	57.5	51.3

Source: Consultants' Field Monitoring

Speed Km/Hr	Vibration in dB at 17.5m.	Vibration in dB at 30m.	Vibration in dB at 55m.
Passenger Up Trains			
75	61.3	53.1	44.7
56.7	58.1	51.1	42.7
69	60.3	49.6	41.2
94	67.4	58.6	46.2
71	62.8	52.6	41.9
76.	65.5	54.6	45
110	70	61	52

Table 5-10: Wagon and Other Down Trains

Category of Train	Speed Km/Hr	Vibration in dB at 17.5m.	Vibration in dB at 30m.	Vibration in dB at 55m.
Closed Wagon	95	72	64	56
Closed Wagon	89	72	63	55
Open Wagon	76	71	62.4	54.1
Open Wagon	79	71	61	52
Open Wagon	98	74	65	57

Table 5-11: Vibrations Measured at Dadari at km 1415.69 as per Japanese Standards

S.No.	Name of Location	Distance	LMAX
1	Dadari (Near School)	20 m	62.3

Table 5-12: Vibrations Measured at Dadari at km 1415.69 (17.5m 30.0m & 55m) as per Japanese Standards

Speed Km/Hr	Vibration in dB at 17.5m.	Vibration in dB at 30m.	Vibration in dB at 55m.
Dadari DRP of Passenger Down Trains			
98.9	58.6	51.9	41.2
105	68.9	57.9	47.5
83	65	54.7	45.4
103.5	61.8	52.9	42.8
75	61.6	51.3	41.2
Open Wagon Freight Down Trains			
53.2	61.3	55.4	47.7
56.5	62.1	51.2	43.1
85.5	68.1	56.1	45.1

Table 5-13: Vibrations Measured at Dadari for Freight Down Trains (Others)

Category of Train	Speed Km/Hr	Vibration in dB at 17.5m.	Vibration in dB at 30m.	Vibration in dB at 55m.
Tanker	85	65.3	53.5	47.4
Cargo	81	65.6	54.8	46.1

5.6.6 Measured Vibrations Levels on Various Receptors

Measurements in residential, sensitive receptors located closest to the track / proposed track were collected. This data, collected during Railway Vibrations, on plain routes was used for calculation / extrapolation of vibration levels on SRs that were not physically covered during vibration measurement process. While doing so, it was presumed that buildings which were in the line of alignment will be removed and will not to be included in prediction. The land between the proposed track and selected receptors was identical to similar situations elsewhere. The measurements on similar locations were therefore directly transposable to similar uncovered locations in order to assess the impact on such locations.

Values of maximum vibrations recorded on those receptor / important locations which can help in prediction of vibrations on all SRs are presented in **Table 5.14**. These levels were recorded during passing of the trains.

Table 5-14: Vibration Levels on Various Receptors with Train Passing

Name of Location	Distance (m) and Side Left/Right From existing Rail Track	LMAX, dB
Houses and commercial market at Khurja parallel section at 1369.82	25 m Right Side	76.4
Houses at Dadari km 1415.69	20 m Left side	73.9
Houses at Wair (km 1389.55	30 m Left side	62.1
School at Khurja km 1369.82	5 m Left side	88.4
School at Dankaur km 1398.02	10 m Left side	79.4
College at Wair km 1389.55	500 m Left Side	27.2

Source: Consultants' Survey

Vibrations due to the rail traffic at sensitive locations such as residential areas, religious places, educational institutons, etc., located close to the track / proposed track were also measured. The measurements were carried out both with and without train crrosing the measurement location. The vibration measurements during non passing of trains at the same receptors as given in Table-5.14 are presented in **Table-5.15**. These max and min levels are however irrelevant as the levels are to be seen in relation to location of measurement ie close to existing track / detour location as well as in relation to distance of measurement point from source of vibration. Seen in this perspective data indicates high vibration levels close to the track / source of vibrationvand gradual decrease as the receptor distance increases. This data and analysis forms the basis for calculation / extrapolation of vibration levels on similar SRs that could not be measured during the field measurements.

Table 5-15: Vibration Levels on Sensitive Receptors Without Train Passing

Name of Location	Distance (m) and Side Left/Right	LMAX, dB
Houses and commercial market at Khurja parallel section at 1369.82	25 m Right sides	28.3
Houses at Dadari km 1415.69	20 m Left side	31.9
Houses at Wair (km 1389.55	30 m Left side	25.5
School at Khurja km 1369.82	5 m Left side	55.3
School at Dankaur km 1398.02	10 m Left side	48.9
College at Wair km 1389.55	500 m Left Side	21.2

5.7 WATER: HYDROLOGY AND DRAINAGE

5.7.1 Surface water & Drainage

The project area from Khurja- Dadari 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 flow in the basin is largely contributed by the southwesterly monsoon winds from July to October, as well as on the flow from melting Himalayan snows in the hot season from April to June. Tropical cyclones originating between June and October in Bay of Bengal also contribute to water flows in the basin. The average annual rainfall varies from 760 mm at the western end of the basin to more than 2,290 mm at the eastern end of this river basin.

The alignment of DFCC from Khurja to Dadari crosses Sesasonal River – Karon at km 1375.39 of Ganga Basin. This is tributary to Yamuna River. The general slope of the area was noted to be from North West to South East with elevation ranging from 201 m MSL at Khurja to 210 MSL Dadari. Passing through the districts of Bulland Shahar and Gautam Budh Nagar these areas are located in the central plains and South Western Semi Arid agro-climatic zones of Uttar Pradesh.

Karon River is crossing the alignment.

3.7.2 Ground Water

The project area is underlain by thick pile of quaternary sediments which comprises sands of various grades, clays and *kankar*. The quaternary sediments overlain the pre-existing Vindhyan Basement with the thickness varies from 286 to 380 meters. The Vindhyan basin tends to grow deeper from west to east.

The Central Ground Water Board, Bulladshahar demarcates the project area in to a three tier aquifer system occurring down to bed rock, as indicated below.

I Aquifer Group	00.00-130.00 mbgl	–	Quality fresh
II Aquifer Group	100.00 – 150.00 mbgl	–	Quality Brackish to saline
III Aquifer Group	130.00 – 300.00 mbgl	–	Quality brackish to saline

The ground water is encountered in the first aquifer group, while deeper aquifers are under semi-confined to confined conditions. Overall, the depth of ground water in the project area generally varies from 5 to 50 m below ground level, during pre-monsoon period and ranges between 3 m and 20 m below ground level during post-monsoon period. The ground water levels are observed to be rainging between 0.30 and 8.24 m, with overall fluctuations of about 2 meters.

With good to moderate water yield capacities, the first aquifer group is fit for domestic and industrial consumption. The yield is expected to be around 2000-3000 lpm through tube wells and 1000-2000 lpm through shallow tube wells.

5.8 WATER QUALITY

As presented in **Section 5.7** above, there are no major or perennial water bodies in the project area. While there is no major irrigation or drinking water uses, few domestic uses such as animal bathing, washing, etc. were observed.

Table 5-16: Water Quality Criteria and Standards for Freshwater Classification (CPCB, 1979)

Parameters	BOD mg/l	pH	D.O. in mg/l	Oil & Grease mg/l
CPCB standard Class A (drinking water without conventional treatment but after disinfections)	≤ 2.0	6.5 – 8.5	≥ 6.0	---
CPCB standard Class B (for outdoor bathing)	≤ 3.0	6.5 – 8.5	5.0	--
CPCB standard Class C (drinking water after conventional treatment and disinfections)	≤ 2.0	6 – 9	≥ 4.0	--
CPCB standard Class D (for propagation of wild life, fisheries)	--	6.5 – 8.5	≥ 4.0	≤ 0.1
CPCB standard Class E (for irrigation)	--	6.0-8.5	--	--

'--' Indicates not applicable/relevant

In order to assess the base line water quality of these water bodies, samples were collected from 3 hand pumps closed to the alignment and from Karon River. The water quality results are presented in **Tables-5.17 & 5.18**.These results show high hardness and chlorides contents.

Table 5-17: Water Quality Results for Surface Water-Karon River

Parameters/ units	Test Method	Location Karon River (km 1375.39)
Colour(hazen)	IS:3025-Pt:4	Light Green
Odour	IS:3025-Pt:5	Pungent Smell
Temperature(° C)	IS:3025-Pt:9	26
Turbidity	IS:3025-Pt:10	74

Parameters/ units	Test Method	Location Karon River (km 1375.39)
pH value	IS:3025-Pt:11	8.5
Total hardness as $CaCO_3$	IS:3025-Pt:21	270
Iron (mg/l)	A.A.S	1.7
Chlorides (mg/l)	IS:3025-Pt:32	164.70
Fluoride (mg/l)	IS:3025	<0.2
Total Dissolved solids (mg/l)	IS:3025-Pt:16	21.70
Magnesium as Mg	IS:3025	1.0
Sulphates (mg/l)	IS:3025-Pt:24	534.32
Nitrates (mg/l)	IS:3025-Pt:34	<1.0
Coliform (MPN/100ml)	IS:1662	10.0
BOD (mg/l)	IS:3025-Pt:44	11.9
Phosphate(mg/l)	APHA	<0.2
Nitrites (mg/l)	IS:3025	<1.0
Arsenic As	A.A.S	<0.01
Lead (mg/l)	A.A.S	<0.05
Zinc (mg/l)	A.A.S	<1.0
Chromium (mg/l)	A.A.S	<0.05
Alkalinity (mg/l)	IS:3025-Pt:23	727.20
Total Suspended Solids (mg/l)	IS:3025-Pt:17	97

Table 5-18: Water Quality Results for Ground Water

Parameters/ units	Test Method	Locations		
		Khurja (km 1369.82)	Start of Wair Detour(km1389.55)	Dadari (km 1415.69)
Colour(hazen)	IS:3025 -Pt:4	Colourless	Colourless	Colourless
Odour	IS:3025 -Pt:5	Unobjectionable	Unobjectionable	Unobjectionable
Temperature(° C)	IS:3025 -Pt:9	26	25	24
Turbidity	IS:3025	<1.0	<1.0	<1.0

Parameters/ units	Test Method	Locations		
		Khurja (km 1369.82)	Start of Wair Detour(km1389.55)	Dadari (km 1415.69)
	-Pt:10			
pH value	IS:3025 -Pt:11	8.2	8.3	8.1
Total hardness as $CaCO_3$	IS:3025 -Pt:21	140	145	190
Iron (mg/l)	A.A.S	<0.2	<0.2	<0.2
Chlorides (mg/l)	IS:3025 -Pt:32	46.17	41.60	35.63
Fluoride (mg/l)	IS:3025	<0.2	<0.2	<0.2
Total Dissolved solids (mg/l)	IS:3025 -Pt:16	664	695	554
Magnesium as Mg	IS:3025	21	19	21
Sulphates (mg/l)	IS:3025 -Pt:24	98.22	95.11	45.36
Nitrates (mg/l)	IS:3025 -Pt:34	<1.0	<1.0	<1.0
Coliform (MPN/100ml)	IS:1662	Absent	Absent	Absent
BOD (mg/l)	IS:3025 -Pt:44			
Phosphate(mg/l)	APHA	<0.2	<0.2	<0.2
Nitrites (mg/l)	IS:3025	<1.0	<1.0	<1.0
Arsenic As	A.A.S	<0.01	<0.01	<0.01
Lead (mg/l)	A.A.S	<0.05	<0.05	<0.05
Zinc (mg/l)	A.A.S	<1.0	<1.0	<1.0
Chromium (mg/l)	A.A.S	<0.05	<0.05	<0.05
Alkalinity (mg/l)	IS:3025 -Pt:23	556.38	543.0	405.78
Total Suspended Solids (mg/l)	IS:3025 -Pt:17	16.0	6.0	<5.0

Source: Consultants' Field Monitoring

5.9 GEOLOGY

As discussed earler, the proposed alignment of the project is a part Ganga plain lying between the rocky Himalayan belt in the north and the southern hilly tract comprising Pre-Cambrian rocks. Flexing of the Indian lithosphere in response to the compressive forces due to collision, and thrust fold loading produced the Ganga Plain foreland basin. The basin is filled with recent alluival sediments which are at places more than 1,000 m, thick and an amalagam of sand, silt, clay in varying proportions. As presented in **Figure-5.6**, the project alignment from Khurja to Dadari is located in the younger alluvium of Ganga Basin and generally there is no significant variation in geology.

Figure 5-5: Geological Map of Uttar Pradesh

Source: - Directorate of Geology and Mining, U. P.

5.10 GEOGRAPHY AND 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 The project area and surroundings have well developed irrigation systems.

However, being alluvial the land is very fertile and cultivation of rice, wheat, millets, gram, barley and sugar cane, etc is the main crops of the region. The project area is famous for vegetational crop.

In order to establish the base line soil samples were collected from four locations, spread across the project area. As presented in **Table 5.19** below, the soil in the project area is good for agricultural and plantation purposes and Nitrogen, Phosphorus and Potassium (NPK) ratio is favourable. The soil in the study area is fertile in nature.

Table 5-19: Soil Analysis Report

S. No.	Test Parameter/ units	Locations		
		Khurja (km 1369.82)	Start of Wair Detour (km1389.55)	Dadarii (km 1415.69)
1	Soil Texture	Medium- loam	Medium-Loam	Medium-Loam
a)	Sand Size Fraction (%)	39	37	36
b)	Silt Size Fraction (%)	41	41	43
c)	Clay Size Fraction (%)	16	21	19
d)	Gravel Size Fraction (%)	3	9	2
2	pHValue	7.42	7.44	7.36
3	Bulk Density (gm/cm3)	1.71	1.750	1.681
4	Water Holding Capacity (%)	30.16	28.92	31.0
5	Nitrogen (as N)(kg/ha)	0.02	0.06	0.04
6	Phosphorous (%)	11.6	12.3	15.8
7	Potassium(meq/100g)	0.62	0.49	0.48
8	Organic Matter (%)	0.66	0.70	0.67
9	Lead (as pb)(ppm)	ND	ND	ND
10	Arsenic(ppm)	ND	ND	ND
11	Iron (%)	2.98	3.42	2.45
12	Sulphate(meq/100g)	0.21	0.18	0.20
13	Chloride(meq/100g)	0.17	0.19	0.15
14	Calcium(meq/100g)	9.90	9.95	9.31
15	Copper (mg/kg.)	2.98	3.16	3.28
16	Zinc (mg/kg.)	31.12	31.24	31.22
17	Manganese (mg/kg.)	3.1	3.2	3.02
18	Moisture (%)	11.2	13.5	13.4
19	Porosity (%)	44.18	49.79	51.21
20	Electrical Conductivity (mhos/cms)	240	220	231

Source: Consultants' Field Monitoring

5.11 LAND USE

General Land Use Pattern of the area along the proposed DFC corridor is predominantly under agriculture use. The alignment passes through 32 villages in the districts of Bullandshahr (21) and Gautam Budh Nagar (17) in Uttar Pradesh.

The land use of the area comprises of agriculture and cropping (72.3 percent), non-agricultural use (9%), forest (7.2%) and current fallow (2.3%) and the remaining land under residential and other uses. The average size of the land holding in the project area ranges between 0.70 to 1.19 hectares and the economy of the project areas is dependent on subsistence agriculture with wheat, maize and Potato cultivation.

As presented in **Table 5.20**, the project involves acquisition of about 211.67 ha of land. The detailed breakup of land is covered in Social Impact Assessment Report.

Table 5-20: Land Use of Affected Area

District	No. of Villages	Land(area in ha)
Bullandshahar	21	126.07
Gautam Budh Nagar	17	85.60
Total	**38**	**211.67**

Source: Primary Cesus survey by Social Assessment Study

To minimize the impacts on the PAPs, a separate social assessment studies have been commissioned by DFCCIL and a project specific Rehabilitation Action Plan is under preparation.

5.12 ECOLOGY

Any project has some impacts on the flora and fauna in the project area. Plant and animal communities are indicators of the environment. They respond not only to one environmental factor, but also to an interacting group of factors. These communities influence and react sensitively to change in the balance of environmental stresses.

Therefore, a detailed knowledge of the diversity of the area definitely helps in managing the area properly following suitable practices. The study was conducted in the project area to assess all possible consequences on the biological environment.

Floral and faunal surveys conducted for assessing the biological diversity and its status over a period of time that forms an integral part of Impact Assessment Techniques. The present study is highlighting the various issues pertaining to floristic diversity and the faunal wealth including Ethno-botany and silvicultural issues in the submergence area and also the area beyond the limit of the submergence. Accordingly, for the Environmental Impact Assessment (EIA) studies, the total area has been sub-divided into the following areas;

- Dedicated Freight Corridor Chainage
- About 1km surrounding area of DFC
- Natural vegetation in the study area.
- Forest area (Protected/Reserved)
- Rivers and Ponds in vicinity

Site Selection Criteria:

Three sampling locations were selected to study the terrestrial eco-system, with due consideration to the following points.

a) Major affected area

b) Natural vegetation in the study area.

c) National Park, Wildlife Sanctuary, Wetland in the study area.

d) Natural Water Body in the study area

Terrestrial Study was conducted at two locations across the Chainage. The biological study of terrestrial flora, fauna and aquatic biota has been done for different transects. However, the surveys have also been created for the entire area in the vicinity of proposed DFCC alignment.

5.12.1 OBJECTIVES

The biological study of the area has been conducted in order to understand the ecological status of the existing flora and fauna to generate baseline information and evaluate the probable impacts on the biological environment.

Terrestrial Ecology

The study was undertaken with a view:

- To assess nature and distribution of the vegetation in the area.
- To assess the frequency, frequency class, relative frequency, abundance, density, diversity index.
- To evaluate the dominant species of plant and animal.
- To list the endangered species (both flora and fauna).
- To mark the wetlands and other ecologically sensitive areas such as national parks/ sanctuaries
- To asses the effect of construction and operation of the project on existing ecology
- To recognize the diversity indices of the terrestrial and aquatic communities.
- To Asses the spawning and feeding habitats of aquatic species with respect to time and location.

Aquatic Ecology

The study was carried out in the project site aiming at:

- Inventory of different aquatic species (plankton (phyto & zoo), benthos, fishes).
- Population density of the macro invertebrates and fishes in the river.
- To identify the feeding and breeding grounds of economically important fishes.
- To assess the existing status of endangered species.

5.12.2 Methodology

Floral Study

The vegetation sampling was carried out by using the least count quadrate method and line transacts cutting method across different habitats. The line transact method was useful to describe general vegetation pattern over large area and the quadrants are useful for quantification of density and abundance of the vegetation in the study area. The size and number of quadrates needed were determined using the species area curve (Mishra, 1968) and the running mean method (Kershaw, 1973). Summarization of previously used methods and recommendations led to the use of more than often (10x10m) quadrates laid out for sampling the tree stratum and 1x1m quadrates for herbs, grasses and seedlings of tree species. However, for examining the shrub species 3x3m sample plots were laid out. The enumeration of the vegetation was done by measuring both individually in case of woody vegetation, and collar diameter in case of herbs and grasses using the tree caliper and electronic digital caliper. In case of grasses and sedges, each erect shoot is considered by a plant tiller, and the enumeration was done by laying 1m x 1m quadrates at random, further subdivided into 10 x 10 cm segments. Four such segments selected at random were analyzed from each quadrate by counting the tillers individually as per the method used was that of Singh and Yadava (1974).

The vegetation data collected for phytosociological information were quantitatively analyzed for density, frequency, abundance and specific diversity index according to Curtis and McIntosh (1950). The relative values of frequency, density and dominance of all the species were summed up to represent Importance Value Index (IVI). The followings are the formulae to derive frequency, density, dominance, IVI etc.

$$\text{Frequency} = \frac{\text{Total number of quadrats in which species occurred}}{\text{Total number of quadrats studied}}$$

$$\text{Abundance} = \frac{\text{Total number of individuals of species in all quadrats}}{\text{Total number of quadrats in which species occurred}}$$

$$\text{Density} = \frac{\text{Total number of individuals of a species}}{\text{Total number of quadrats studied}}$$

IVI = Relative frequency + Relative dominance (basal area) + Relative density

$$\text{Relative Frequency} = \frac{\text{Frequency of the species}}{\text{Total frequency of all species}} \times 100$$

$$\text{Relative Density} = \frac{\text{Density of the species}}{\text{Total density of all species}} \times 100$$

$$\text{Relative Dominance} = \frac{\text{Dominance of the species}}{\text{Total dominance of all species}} \times 100$$

$$\text{Relative Abundance} = \frac{\text{Abundance of the species}}{\text{Total abundance of all species}} \times 100$$

Diversity of the Forest Vegetation

The tree species diversity for each stand in different forest types was determined using Shannon Wiener information function (Shannon and Wiener, 1963), which is:

$$\bar{H} = \sum_{i=1}^{S} \left(\frac{Ni}{N}\right) log_{10} \left(\frac{Ni}{N}\right)$$

Where, Ni is the total number of individuals of species i and N is the total number of all species in a stand.

Concentration of dominance

Concentration of dominance (Cd) was measured by Simpson Index (Simpson, 1949):

$$CD = \sum_{i=1}^{S} \left(\frac{Ni}{N}\right)^2$$

Where, Ni and N were the same as for Shannon Wiener information function. This index ranges from one, if all the individuals belong to one species, to (1/s) if they are equally divided among species (S).

Faunal Study

Terrestrial Fauna

A ground survey was carried out in the impact zone of the proposed project section. Important animal groups: butterflies (insects), birds and mammals inhabiting the area were surveyed.

For sampling butterflies, the standard '*Pollard Walk method'*; for birds '*point sampling*' along the fixed transect (foot trails) and for sampling mammals, '*direct*

count on open width (20m) transect', were used on fixed transects. Sampling was carried for 3 ha in each of the tree transects at every site.
Seasonal variation in species diversity of different groups of animals (butterflies and birds) were evaluated using Shannon-diversity Index (***H'***) to know the season of peak diversity in the area amongst the post monsoon seasons studied.

$$H' = -\Sigma^{N}_{1} \text{ Pi In Pi}$$

(From species 1 to n; n= total number of species)

Where, **Pi** is the proportion of the individual species in the total population.

Aquatic Fauna

Zooplankton

For zooplankton analysis, 20L of subsurface water was strained through 53µ Nytex plankton net and the concentrate was transferred to labelled plankton bottle after rinsing the net with distilled water. The planktons were immediately preserved in 4% neutral formaldehyde solution for subsequent examination and quantification.

Zooplankton samples were observed in a sedimentation chamber under an inverted plankton microscope. Planktons were identified with the help of standard keys and references. For quantification, an aliquot of the concentrate was suitably diluted. After thorough mixing, one ml of the sample was transferred to a clean Sedgwick-Rafter cell and examined under the inverted microscope. Planktons were counted under the various genera identified. Three replicates were taken and averaged. The number of organisms per litre under each genus was calculated by the following formula:

No. of organisms L^{-1} = Vol. of conc. (ml) X No. of organism / Vol. of conc. Examined (ml) X Vol. of water filtered (L)

Phytoplankton

Similarly, for phytoplankton analysis, water sample were taken directly from the sites in 100 ml sampling bottles and preserved with Lugol's solution immediately. Then the samples were centrifuged in the laboratory followed by removal of desired amount of supernatant from the centrifuge tube to make the required concentration. Phytoplanktons were then analysed using a compound microscope and haemocytometer in the concentrates. The number of organisms per litre was calculated as follows:

No. of organisms L^{-1} = No. of organism X 10^{7} / Concentration factor X No. of slides examined

Benthos

For the benthic organism study, sediment samples were taken from the bottom of Karon River manually and brought to laboratory for analysis. The samples were washed through sieves to harvest the organisms and then preserved in sampling vials using formal dehyde as preservative. Benthic organisms were enumerated using a simple microscope/ hand lens.

Fishes

Fisheries data has been collected through consultation with local fishermen and throwing nets.

Macrophytes

Macrophytes were studied visually in the field. Photographs were taken for identification assistance. The diversity was noted in visual method (1-5 grade point scale).

Phytoplankton Productivity

Phytoplankton productivity was measured using Light and Dark bottle method of

Gaarder and Grann. The dissolve oxygen measurement for this purpose was done by Winkler's Iodometric method.

5.12.3 Flora of the Project Area

General survey of flora has been carried out district in both the districts. On the basis of Survey and secondary data collected from forest office a large variety of Trees, herbs and shrubs found suited to climatic condition. The structure and type of vegetation depends on climatic conditions and physiographic conditions, as well as requirements of the local inhabitants of the area. The vegetation in the study area is deciduous in nature. Mainly three types of forests were found in the study area.

i. Tropical Moist Deciduous Forests:

These forests are found in the moist region of Terai. They grow in regions that record 100 to 150 cm. of rainfall annually, have an average temperature between 26˚-27˚ C. and have considerable degree of humidity.

A special feature of the forests is that deciduous trees of uneven size grow in higher altitude regions. Lower regions have several species interspersed with Bamboo, Climbers, Cand and ever green shrubs. Main trees are Sal, Ber, Gular, Jhingal, Palas, Mahua Semal, Dhak, Amla, Jamun, etc.

ii. Tropical Dry Deciduous Forests:

These forests are found in all parts of the plains, and usually in central eastern and western regions. The trees are mostly deciduous. Since sunlight reaches the ground in abundance, shrubs and grasses also grow here. Large tracts of these forests have been cleared for cultivation. Important trees are Sal, Palas, Amaltas, Bel, Anjeer etc. Neem, Peepal, Sheesham, Mango, Jamun, Babool, and Imli (Tamarind) etc. grow along riverbanks and in other moist regions.

iii. Tropical Thorny Forests:

These are mostly found in south-western parts of the State. Such forests are confined to the areas with low annual rainfall (50-70 cms), mean annual temperature between 25˚C to 27˚C and low humidity (less than 47%). Widely scattered thorny trees, such as Babool, Thorny, Legumes and Euphorbias, are found here. During rains, short grasses are also found here. The trees are generally small, forming open dry forests. Important trees of these regions are Phulai, Khair, Kokke, Dhaman, Danjha, Neem, etc. Various types of resin and gum are also obtained from these trees.

The study area enjoys sub-tropical climatic conditions with four seasons, pre monsoon (March to June), monsoon (July to September), post monsoon season (October and November) and winter season (December to February). List of plant species and its ecological importance based on secondary data is listed below.

Table 5-21: List of Plant Species based on Secondary data in the Study Area

Plant Species	Vernacular Name	Enthanobotanical Values
Azadirachta indica	Neem	Medical, Timber, Fuel
Acacia nilotica	Kikar	Timber, Fuel
Acacia leucophloea	Babul	Timber, Fuel
Albizzia lebbek	Siras	Timber, Fuel
Acacia catechu	Khair	Medical, Timber, Kattha
Aegle marmelos	Bel	Food, Timber, Mythological
Bauhinia variegate	Kachnar	Ornamental
Cassia fistula	Amaltas	Aesthetic, Fuel
Dalbergia sissoo	Shisham	Timber, Fuel
Delonix regia	Gulmohar	Aesthetic, Recreational
Eucalyptus hybrid	Safeda	Timber, Fuel
Emblica officinalis	Amla	Mythological, Fuel Timber,
Polyalthia longifolia	Ashok	Aesthetic, Recreational

Plant Species	Vernacular Name	Enthanobotanical Values
Prosopis julifera	Kabuli kikar	Timber, Fuel
Phoenix dactylifers	Khajur	Food, MFP (Fan)
Populus sp.	Poplar	Timber
Pongamia glabra	Karanj	Medicinal
Ficus religiosa	Papal	Mythological, Timber
Ficus benghalensis	Bargad	Timber, Fuel
Holoptelea intgrifolia	Papri	Timber, Medicinal
Morus alba	Shahtoot	Food, Timber
Morus raphii	Philkhan	Timber, Fuel
Mangifera indica	Aam	Mythological, Timber, Fuel
Syzygium cumini	Jamun	Food, Timber
Tarminalia arjuna	Arjuna	Aesthetic, Recreational
Teminalia belerica	Baheda	Medicinal, Timber
Anisomeles ovata	Jangali Tulsi	Medicinal
Achyranthes aspera	Apmarg	Drugs, Medicinal
Calotropis procera	Aak	Medicinal
Mimosa pudica	Chiumui	Aesthetic
Nerium indica	Kaner	Aesthetic, Recreational
Opuntia dillenii	Nagphani	Medicinal
Sathura matel	Datura	Poison, Medicinal
Tribulus terrestris	Gokharu	Medicinal
Zizyphus numularia	Jahrberi	Food, Fodder
Cynodon dactylon	Dub	Fodder
Desmostachya bipinnata	Dab	Huts
Erianthus munja	Munj	Huts
Saccharum spontaneum	Kans	Huts
Cuscuta reflexa	Amarbel	Medicinal
Butea monosperma	Palash	Aesthetic
Tectona grandis	Teak	Timber
Ocimum gratissimum	Ram Tulsi	Medicinal
Delonix regia	Gulmohar	Ornamental
Calotropis procera	Akman	

S ource: Data collected from Forest Deptts

iv. Tree Cutting

The proposed alignment may cause cutting of approximately 2193 trees. The list has been given in **Table-5.22**. The major species present along the alignment are babool, neem, shisam, papal, mango, bargad, kanji, labhera, ashok, sirsa, guler, jamun, ber, eucalyptus, mahua and bel. As these trees are located all along the proposed alignment of 46 km, it is assumed that cutting of these trees will not have significant ecological impacts.

Table 5-22: Girthwise List of Trees to be cut

A. Parallel Section

			Girth Size (m)					
S.No.	Chainage (km)	Name of Trees	0 To 0.3 m	0.3 To 0.6 m	0.6 To 0.9 m	0.9 To 1.2 m	Above 1.2 m	Total
District Bullandshahar, Tehsil Khurja								
1	1369.82 - 1370.0	Neem		7	19	7		33
2		Babool			14			14
		Total	**0**	**7**	**33**	**7**	**0**	

			Girth Size (m)					
S.No.	Chainage (km)	Name of Trees	0 To 0.3 m	0.3 To 0.6 m	0.6 To 0.9 m	0.9 To 1.2 m	Above 1.2 m	Total
1	1370-1371	Shisham	14	13	16	13		56
2		Babool		15	4		11	30
		Total	**14**	**28**	**20**	**13**	**11**	
1	1371-1372	Jamun				12	4	16
2		Babool	1	22	11			34
3		Neem	2		10			12
		Total	**3**	**22**	**21**	**12**	**4**	
1	1371-1372	Shisham			4	23	3	30
2		Khajoor		22		4	2	28
		Total	**0**	**22**	**4**	**27**	**5**	
1	1372-1373	Neem		24		12	1	37
2		Babool	214		2	3	2	221
3		Mango			11		10	21
4		Pakar		109		27		136
		Total	**214**	**133**	**13**	**42**	**13**	
1	1373-1374	Babool		11	1			12
2		Neem		1	12			13
3		Jamun			19	20		39
4		Shisham		1		2		3
		Total	**0**	**13**	**32**	**22**	**0**	
1	1374-1375	Mango	4	1	11	13		29
2		Jamun		2	19	2		23
3		Shisham	12	1	3			16
4		Neem		2	19	11	1	33
5		Sirsa		11	1			1
6		Jungli Babool		1	12		1	14
7		Labhera			8		2	10
		Total	**16**	**7**	**73**	**26**	**4**	
1	1375-1376	Pakar	24		11	2	2	39
2		Lakar		9		16	2	27
3		Neem				8	1	9
		Total	**24**	**9**	**11**	**19**	**5**	
1	1376-1377	Neem				24	1	25
2		Mango		3	7	5		15
		Total	**0**	**3**	**7**	**29**	**1**	
1	1377-1378	Jungli Babool			6	13		19
		Total	**0**	**0**	**6**	**13**	**0**	
1	1378-1379	Shisham	31				12	43
		Pakar		11	14	2		27

			Girth Size (m)					
S.No.	Chainage (km)	Name of Trees	0 To 0.3 m	0.3 To 0.6 m	0.6 To 0.9 m	0.9 To 1.2 m	Above 1.2 m	Total
		Total	**31**	**11**	**14**	**2**	**12**	
1	1379-1380	Shisham			11			11
		Neem		3		12		15
		Total	**0**	**3**	**11**	**12**	**0**	
1	1380-1381	Pakar						0
2		Kanji						0
		Total	**0**	**0**	**0**	**0**	**0**	
1	1381-1382	Sisham						0
		Neem						0
		Total	**0**	**0**	**0**	**0**	**0**	
1	1383-1384	Neem						0
		Total	**0**	**0**	**0**	**0**	**0**	
1	1384-1385	Neem		13	2	19	15	49
2		Pipal		2	1		2	5
3		Babool			1	9		9
4		Mango		8			3	11
5		Shisham	29		9	3	1	42
		Total	**29**	**23**	**12**	**31**	**21**	
1	1385-1386	Neem			29			29
2		Sisham		13		19	1	33
		Total	**0**	**13**	**29**	**19**	**1**	
1	1386-1387	Khajoor		11		9		20
3		Shisham		10		12		22
4		Mango					17	17
5		Kanji				3		3
		Total	**0**	**0**	**0**	**3**	**17**	
1	1387-1387.420	Neem			12	1		13
		Total	**0**	**0**	**12**	**1**	**0**	
	1390.810-1391.000		No Tree					0
		Total	**0**	**0**	**0**	**0**	**0**	
1	1391-1392	Neem			15	1		15
		Total	**0**	**0**	**15**	**0**	**0**	
1	1392-1393	Neem		11	5	21		37
2		Shisham			3			3
		Total	**0**	**11**	**8**	**21**	**0**	
1	1393-1394	Neem					1	1
		Total	**0**	**0**	**0**	**0**	**1**	
1	1394-1395	Sisham			21			21

			Girth Size (m)					
S.No.	Chainage (km)	Name of Trees	0 To 0.3 m	0.3 To 0.6 m	0.6 To 0.9 m	0.9 To 1.2 m	Above 1.2 m	Total
2		Neem			1	19	1	21
3		Kanji		3	1			4
		Total	**0**	**3**	**23**	**19**	**1**	
1	1395-1396	Mango		5			1	6
2		Neem		11		4		15
3		Sisham			31		1	32
		Total	**0**	**16**	**31**	**4**	**2**	
1	1396-1397	Neem		1		31	1	33
2		Sisham			21			21
3		Mango		5			1	6
		Total	**0**	**6**	**21**	**31**	**2**	
1	1397-1398	Neem		9	16		1	26
		Total	**0**	**9**	**16**	**0**	**1**	
1	1398-1399	Kanji	4	16	36	1		56
2		Neem			14			14
		Total	**4**	**16**	**50**	**0**	**0**	
1	1399-1400	Neem		1	26	0		27
2		Sisham		24	21			45
3		Babool	18				1	19
		Total	**18**	**25**	**47**	**0**	**1**	
1	1400-1401	Neem	No Tree					0
		Total	**0**	**0**	**0**	**0**	**0**	
1	1401-1402	Sisham	2		11			13
		Total	**2**	**0**	**11**	**0**	**0**	
1	1402-1403	Neem			1			1
		Total	**0**	**0**	**1**	**0**	**0**	
1	1403-1404	Neem		21				21
		Total	**0**	**21**	**0**	**0**	**0**	
1	1404-1405	Neem			31	3	1	35
		Total	**0**	**0**	**31**	**3**	**1**	
1	1405-1406	Neem		35		21		56
		Total	**0**	**35**	**0**	**21**	**0**	
1	1406-1407	Kanji	6				1	7
		Total	**6**	**0**	**0**	**0**	**1**	
1	1407-1408	Neem		14		11	1	26
		Total	**0**	**14**	**0**	**11**	**1**	
1	1408-1409	Sisham	9		11			20
2		Neem		1	31			32

			Girth Size (m)					
S.No.	Chainage (km)	Name of Trees	0 To 0.3 m	0.3 To 0.6 m	0.6 To 0.9 m	0.9 To 1.2 m	Above 1.2 m	Total
		Total	**9**	**1**	**42**	**0**	**0**	
1	1409-1409.266	Nil						
1	1412.509-1413	Sisham			1	1	2	1
		Total	**0**	**0**	**1**	**0**	**0**	
1	1413-1414	Shisham	5			19	1	25
2		Neem				1		1
		Total	**5**	**0**	**0**	**20**	**1**	
1	1414-1415	Babool	22		11			33
2		Sisham		3	31			34
		Total	**22**	**3**	**42**	**0**	**0**	
1	1415-1415.69	Shisham		11	21			32
		Total	**0**	**11**	**21**	**0**	**0**	
		Grand Total	**397**	**465**	**658**	**408**	**106**	**2083**

B. Wair Detour

			Girth Size (m)					
S.No.	Chainage (km)	Name of Trees	0 To 0.3 m	0.3 To 0.6 m	0.6 To 0.9 m	0.9 To 1.2 m	Above 1.2 m	Total
1	1387.42-1388	Shisham		3		2		5
2		Neem			6		6	12
		Total	0	3	6	2	6	
1	1388-1389	Babool				11		11
2		Beri		7		5		12
3		Babool					1	1
4		Neem		9		5		14
		Total	0	16	0	21	1	
1	1389-1390	Jamun		2	4	3	7	16
2		Babol			9		3	12
3		Jamun				3	1	4
		Total	0	2	13	6	11	
1	1390-1390.810	Neem					4	4
		Babool		7	5		7	19
		Total	0	7	5	0	11	
	Grand Total		**0**	**28**	**24**	**29**	**29**	**110**

5.12.4 Biodiversity Profile

District-wise secondry data collected from Forest Department on tree, shrubs and other species are presented below in **Tables 5.23 & 5.24:**

Table 5-23: Bio-Diversity Profile of Project Region

S. No.	Botanical Name	Common Name
1.	*Butea frondosa*	Dhak
2.	*Butea monosperma*	Palas
3.	*Saccharum munja*	Munj
4.	*Eulaliopsis binta*	Baib
5.	*Desmostachya bipinnata*	Dab
6.	*Saccharum spontaneum*	Kans
7	*Cynodon dactylon*	Doob

Source: Forest Department

Table 5-24: Bio-Diversity Profile of Project Region

Sl. No.	Botanical Name	Common Name
1.	*Syzygium cumini*	Jamun
2.	*Shorea Robusta*	Sal, Shakhu
3.	*Anogeissus latifolia*	Bakli, Dhaura
4	*Mallotus philippensis*	Rohini
5.	*Modhuca longifolia var. latifolia*	Mahua
6	*Dalbergia sissoo*	Sheesham
7	*Ficus religiosa*	Peepal
8	*F. auriculata*	Timla
9	*F. semicordata*	Khainu
10	*F. virens*	Pakad
11	*F. benghalensis*	Bargad
12	*Acacia catechu*	Khair
13	*Albizia lebbeck*	Siris
14	*Terminalla alata*	Asna, Asain
15	*T. bellirica*	Bahera
16.	*Holoptelea integrifolia*	Dhamina
17.	*Streblus asper*	Sehore
18.	*Butea monosperma*	Dhak, Palas
19.	*Cassia fistula*	Amaltas
20	*Lannea coromandelica*	Jigma, Jhingan
21	*Pongamia pinnata*	Karanj

Source: Forest Department

5.12.5 Quantitative Analysis of Tree, Shrub and Herb by Quadrate Method

Location No.1: Wair Detour (Start of Detour)

Acasia nilotica was found to be the most dominant species, followed by *Prosopis juliflora, Butea monosperma and Melia azedarach*. *Parthenium hysterophorous* was very common in the study area. It may be observed that *Acacia nilotica* is the most abundant specie. The overall species diversity index for study area was computed as 0.51.

Location No.2: Parallel Section Ahead of Wair Station

During the study 18 species were observed. *Acasia nilotica* was found to be the most dominant species, followed by *Prosopis juliflora and Butea monosperma*. Density and diversity index of different species observed during the studies was 0.695. It may be observed that *Prosopis juliflora* is the most abundant species followed by *Dalbergia sisoo, Delonix regia*.

The diversity, abundance and species diversity index of both locations are given in **Annexure No. 5.1.**

5.12.6 Quantative Analysis of Tree, Shrub and Herb by Line Transact Method

Location No.1: Bichaula Reserved Forest (R. F.)

Tree species recorded in the area included *Tactona grandis, Cedrus deodara, Pistacia integerina* and *Quercus ilex. The density of Tactona grandis (104 trees/ha) was found highest followed by Cedrus Deodara (37 trees/ ha) and Pinus Wallichiana (21 trees/ha). The IVI of Olea cuspidate (38.43) was found maximum.*

Table 5-25: Phytosociological analysis of the tree species

S. No.	Name of the Species	Density/ha	Abundance	Frequency (%)	Importance Value Index
1.	*Tactona grandis*	104	1.1	65	105
2.	*Alnus nitida*	7	1.0	8	12
3.	*Cedrus deodara*	25	1.2	25	37
4.	*Pistacia integerina*	23	1.0	23	22
5.	*Punica granatum*	21	1.0	21	20
6.	*Olea cuspidata*	14	1.0	21	41
7.	*Pinus wallichiana*	21	1.3	26	29
	Total	215			274

Source: Consultant Survey

The common understorey species in the area include *Plectranthus rugosus, Rubus lasiocarpus, Urtica dioica, Daphne oleoides* and *Debreagasia hypoleuca.* Amongst these *Plectranthus rugosus* showed high dominance with density 2163 plants/ha and IVI of 81.7 followed by *Myrsine Africana* (2080 plants/ha; IVI: 61.85). Species diversity index ' was 1.6 .

Table 5-26: Phytosociological analysis of the under storey species

S. No.	Name of the Species	Density/ha	Abundance	Frequency (%)	Importance Value Index
1.	*Debraegesia hypoleuca*	814	1	76.54	33.22
2.	*Prinsepia utilis*	997	1.98	39	21.77
3.	*Plectranthus rugosus*	2663	2.75	76	76.57
4.	*Urtica dioica*	505	1.08	44.5	19.62
5.	*Rubus ellipticus*	330	1.1	23	9.02
6.	*Myrsine africana*	2165	2.5	68.5	56.85
7.	*Daphne oleoides*	1554	1.22	65.5	41.11
	Total	9028			276.04

Source: Consultant Survey

The common herbs found in the area included *Solanum nigrum, Oxalis corniculata, Viola serpens, Achyranthes bidentata, Trifolium repens, Malva* sp, *Chenopodium album, Plantago* sp, *Dicliptera roxburghiana, Euphorbia* spp and *Fragaria vesca. The species Thymus linearis (0.43 plants/m^2), Origanum vulgare (0.43 plants/m^2) and Euphorbia sp. (0.43 plants/m^2) have the maximum density followed by Rumex hastatus (0.38 plants/m^2). Plantago lanceolata showed an IVI of 48.97 considerably more than Euphorbia sp (30.71) and Origanum vulgare (20.91).* Species diversity H' was observed to be 1.75**.**

Table 5-27: Phytosociological analysis of the herbacious species

S. No.	Name of the Species	Density/ m^2	Abundance	Frequency (%)	Importance Value Index
1.	*Ajuga bracteosa*	0.21	1.46	15	8.36
2.	*Euphorbia sp*	0.39	1.2	23.33	28.71
3.	*Artemisia gmelli*	0.21	1.3	26.67	9.41
4.	*Chenopodium album*	0.11	1.5	7.33	4.7
5.	*Cynodon dactylon*	0.3	2	18	8.7
6.	*Origanum vulgare*	0.39	1.24	26	16.91
7.	*Mentha longifolia*	0.09	1.3	7.33	7.88
8.	*Micromeria biflora*	0.25	1.5	14.67	11.25
9.	*Nasturtium officinale*	0.06	1.47	4	3.12
10.	*Plantago lanceolata*	0.15	1.41	9.67	41.94
11.	*Plantago major*	0.04	2	2.33	2.71
12.	*Poa sp*	0.31	1.49	19.67	16.31
13.	*Polygonum capitatum*	0.2	1.4	11.33	8.3
14.	*Rumex hastatus*	0.34	1.44	19.33	17.07
15.	*Rumex nepalensis*	0.21	1.46	10.67	10.25
16.	*Solanum nigrum*	0.16	1.47	10.67	6.04
17.	*Tagetes minuta*	0.29	1.52	19.67	14.32
18.	*Thymus linearis*	0.37	1.46	23.33	14.32
19.	*Trifolium pratense*	0.31	1.6	17.67	12.37
20.	*Trifolium repens*	0.19	1.63	12	8.24
21.	*Viola canescens*	0.11	1.2	7.33	4.33
	Total	4.69			240.92

Source: Consultant Survey

5.12.7 Fauna

The domestic animals observed in the study area are mainly mammals and avis as listed in the **Table 5.28**. In absence of natural forest (National parks and Sanctuary), there is a dearth of wild animals in the study area. Peacocks can be easily seen in the study area, even in villages. A list of birds, reptiles, amphibians and rodents based on information gathered from local enquiries and Forest department is presented in **Table 5.29.**

Table 5-28: List o Domestic Fauna Observed in the Study Area

S. No.	Zoological Name	Common Name	Schedule
1.	*Bos indicus*	Cow	
2.	*Bubalus indicus*	Buffalo	
3.	*Boselaphus tragocamelus*	Nilgai	III
4.	*Cains familieris*	Dog	
5.	*Capra hircus*	Goat	
6.	*Equus cabilus*	Horse	
7.	*Equus hermionus*	Ass	
8.	*Felis domesticus*	Cat	
9.	*Ovius polic*	Sheep	
10.	*Sus cristatus*	Pig	
11.	*Suborder ruminantia*	Camel	
12.	*Nigicollis*	Monkey	
13.	*Lepus ruficandatus*	Hares	
14.	*Vulpes bengalensis*	Indian fox	

Source: Consultant Survey & Data from Forest Department

Table 5-29: List of Birds, Reptiles, Amphibians and Rodents

Observed in the Study Area

S. No	Scientific Name	Common Name	Schedule
Birds			
1.	*Alcedo atthis*	Common Kingfisher	IV
2.	*Cucculus micropterus*	Indian Cuckoo	IV
3.	*Columba livia*	Rock Pigeon	IV
4.	*Corvus splendens*	House Crow	V
5.	*Eudynomys scolopacea*	Asian Koel	
6.	*Prinia hodgsonii*	Grey-breasted Prinia	
7.	*Pycnotus jacosus*	Red-whiskered Bulbul	IV
8.	*Ploceus philippinus*	Baya Weaver	
9.	*Pavo cristatus*	Peafowl	I
10.	*Polyplectron bicalearaturn*	Peacock pheasants	I
11.	*Streptopelia chinensis*	Spotted Dove	IV
12.	*Grus nigricollis*	Crane	I
Reptiles			
1.	*Calotes versicolor*	Garden lizard	
2.	*Varanus monitor*	Monitor lizards	
3.	*Bangarus caearulus*	Karait	
Amphibian			
1	*Bufo malanostidus*	Toad	
2	*Rana cynophlyctis*	Frog	
3	*Rana tigrina*	Frog	
Rodent			
1	*Bandicota indica*	Bandicoot rat	V
2	*Mus muscatus*	Mouse	V
3	*Ratus ratus*	House rat	V
4	*Ratufa indica*	Squirrel	

Source: Consultant Survey & Data from Forest Department

Endangered / Sensitive Species of Fauna:

As per list of **The Indian Wildlife (Protection) Act, 1972,** Fauna coming under the **schedule - I** is treated as endangered species. The **schedule - I** fauna as per reconnaissance survey are *Pavo cristatus, Polyplectron bicalearaturn, Grus nigricollis.* Although these are very common species and found in every locality, even in villages, certain steps should be taken to conserve the critical wild life:

1. Programs for the conservation of wildlife will be formulated and implemented outside the protected areas by educating the local communities with help of local public agencies, and other stakeholders including the environment division officers of our company, in order to reduce the scope of man-animal conflict.
2. It will be ensured that human activities on the fringe of the protected areas do not degrade the habitat.

Over all, the status of wildlife in a region is an accurate index of the state of ecological resources, and thus, of natural resources base of human well-being. This indicates the interterdependent nature of ecological entities in which wild life is a vital link and a base of eco-tourism. Thus, the importance of conserving and protecting wildlife will be spread among the local people.

5.12.8 Aquatic Ecology

There are no aquatic resources of significance in the study area. The common fishes in the village ponds and low lying areas are summarized below. The Karon river is seasonal.

List of Fishes in the Study Area

Fish species reported in the area are listed in **Table 5.30**. Main fishes are *Notopterus notopterus, Catla catla, Labeo calbasu, Labeo rohita, Labeo bat, Mystus vittatus, Rita rita, Barbus spp*. and *Cirrinus raba*.

Table 5-30: List of Fishes Reported in the Study Area

S. No.	Fish Species
1	*Notopterus notopterus*
2	*Catla catla*
3	*Labeo calbasu*
4	*Labeo rohito*
5	*Labeo bata*
6	*Cirrihinus mrigala*
7	*Cirrihinus raba*
8	*Clarius batrachus*
9	*Wallago attu*
10	*Heteropneustres fossiliis*
11	*Mystus vittatus*
12	*Mystus aor*
13	*Barbus spp.*
14	*Rita rita*

Source: Consultant Survey

Rare and Endangered Species

In reference to Red Data Book of Botanical Survey of India and Wildlife (Protection) Act 1972, no endangered species of flora and fauna have been found during the study period.

Ecologically Sensitive Areas

There are no ecologically sensitive locations within the study area.

5.13 SOCIO-ECONOMIC CHARACTERISTICS OF THE STUDY AREA

5.13.1 Socio -Economic Characteristics of the Project Area

Most of the people in the project districts are dependent on the agricultural activities. The **Table-5.31** below indicates that the project area has poor performance on important development indices such as work participation rate. The socio-cultural indicators point to low development indices. Total literacy is 68%. Socio-economic position of both Bullandshahar & Gautam Budh Nagar districts is given in **table 5.33**.

Table 5-31: Social and Economic Indicators of the Project Districts

Project District	Economic		Social& Demographic			
	Work Participation Rate (%)	% Non-Workers	Literacy			Decadal Growth Rate
			Total	Male	Female	
Bullandshahar	26.22	71.77	62.18	72.39	48.75	31.44
Gautam Budh Nagar	27.18	72.81	59.20	71.20	45.25	29.27

Source: Census of India, 2001

5.13.2 Social Stratification Profile of the Project

Most important religious group in the project area is Hindu. Other important religious

communities are Muslim, Jain and Sikh. There is a presence of several important scheduled castes of the state constituting about 7% of the total population of both the districts. Three Schedule Tribe families are present in project influenced area. Some of the important scheduled castes of the area are Chamars, Kori, Khatiks and Balmiki. Some of the important scheduled tribes of the area are Bhotia, Juansari and other generic tribes. However, none belong to 'indigeneous category' as per the WB safeguard policy.

Table 5-32: Social Stratification in the Project Districts

Project District	Scheduled Castes					Scheduled Tribes				
	Chamar	Dhanuk	Khatik	Balmiki	Kori	Bhotia	Juansari	Tharu	Raji	Generic Tribes
Bullandshahar	☑		☑		☑	☑	☑			☑
Gautam Budh Nagar	☑			☑	☑	☑	☑			☑

Source: Census of India, 2001

5.13.3 Social Profile of the PAPs

(i) Age-Sex Composition: Among families that will loose agricultural land due to the project, there are 33749 males (57.77%) and 2467 females (42.23%). It is examined from **Table 5.33** that the sex ratio is 731 for the project stretch.

Table 5-33: PAPs Age-Sex Composition

Type of Impact	0-6		6-15		15-18		18-45		45-59		59-Above		Total	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Agricultural land	193	114	515	321	238	117	1485	1117	393	334	212	189	**3036**	**2192**
Structure	26	22	62	51	33	23	145	130	45	26	27	23	338	275
Total	219	136	577	372	271	140	1630	1247	438	360	239	212	3374	2467

(ii) Social Composition: In the families losing agricultural land in the project, the dominant religious group is Hindu constituting about 98 % of the total population. The other religious group present is Muslim, constituting about 2 % percent of the population.

Table 5-34: Social Composition of PAPs

Section	Hindu	Muslims	Others	Total
Khurja-Dadari Section	5724	117	17	5841

(iii) Social Stratification: Specific impacts on three ST families, consultation strategies and detailed mitigation measures will be dealt in SMF.

(iv) Education Status: Amongst the PAPs, there is a high degree of illiteracy in the project area.. About 19.78 % of the PAPs are basic literate. About 17.85% PAPs

have studied up to the 8th standard school level as given in **Table 5.35**. There are only 9.73% graduates in the area. Less number of professionally educated PAPs points to the lower level of opportunities in the project area. Since illiteracy level is high, awareness about social issues resettlement and rehabilitation options, compensation and project related decisions would require special attention to discuss and communicate it to the PAPs.

Table 5-35: Education Status of PAPs

Section	Education level						Total
	Un Educated	Educated	8th	10th	Inter mediate	Graduate	
Khurja Dadri	1145(19.60)	1414(24.20)	960(16.43)	1012(17.42)	654(11.19)	656(11.23)	**5841(100)**

(iv) Vulnerability Status: Table 5.36 presents number of PAPs under vulnerable categories as per NRRP 2007. Out of these, 71.78% are old people above the age of 50 years. Other significant categories are widows (11.95%) and unmarried girls above the age of 18 years (12.04%). This would become significant while planning for the women's income generation and restoration strategies. These vulnerable categories of PAPs will be supported by the project but within the purview of NRRP 2007.

Table 5-36: PAPs Vulnerability Status

Section	Project Affected Persons					Total
	Disabled / Orphan	Widow	Un Married Girls above 18 years	Abandoned Women	Person above 50 years	
Khurja Dadri	0(00)	144(15.44)	119(12.04)	0(00)	669(71.78)	**932**

Table 5-37 Vulnerability Status of the PAFs

Section	Project Affected Families BPL		
	Land	Structure	Total
Khurja Dadri	111(90.98%)	11(9.02%)	122(100)

5.14 ECONOMIC PROFILE

(i) **Occupational Background**: In the families loosing agricultural land, about 18.13% PAPs are housewives, a certain percent of whom are engaged in economic activities on mostly an informal basis, within and outside the household. Another, 12.29% are students, 9.53% PAPs are labourers in the agricultural sector or otherwise. About 4.34% of the PAPs are engaged in business activities (trade and petty business). Many of these businesses people are associated with the small economic activities such as Tiffin centers, tea centers, general stores, etc. The details are presented in **Table 5.38.**

Table 5-38: Occupation Profile of PAPs

Section	Occupation profile(PAPs)								Total PAPs
	Service	Business	Cultivator	Students	House Wife	Labour	Un-Employed	Workers	
PAPs	**665 (11.38)**	**254 (4.34)**	**1112 (19.03)**	**718 (12.29)**	**1059 (18.13)**	**557 (9.53)**	**453 (7.75)**	**1023 (17.51)**	**5841**

(ii) Income Level: Amongst the total number of 988 families losing agricultural land, 24.78% families earn less than Rs 50,000 and 75.22% families earn more than Rs 50,000. The details are presented in **Table 5.39.**

Table 5-39: PAFs Losing Agricultural Land: Income Levels

Income per year in Rs.	0-25000	25000-50000	50000-100000	above 100000	Nos. of families
Percentage	122(6.18)	365(18.49)	543(27.51)	944(47.82)	1974

Out of the total 81 families losing structures in the project area, 52 families belong to residential category in both title holders and non title holders category. **(Table -5.40).** Twenty Five families have commercial structures and balance 4 have kiosks.

Table 5-40: PAFs Losing Structures

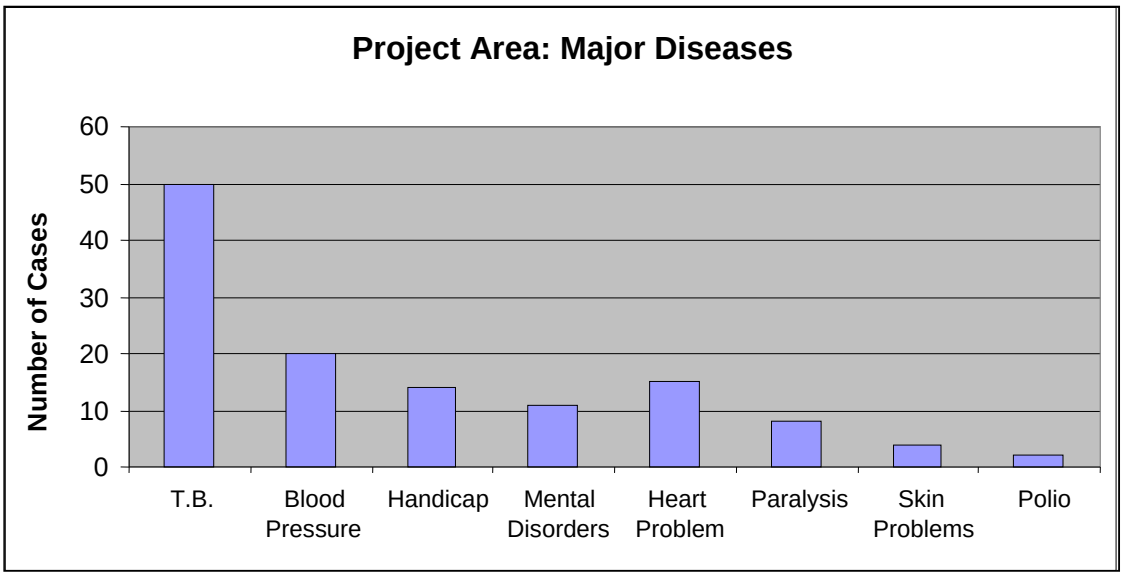
Package Wise	Titleholders		Non-Titleholders (Squatters, Tenant & Kiosks)				Total
	Resi	Comm	Resi	Comm	Tenants	Kiosks	
Khurja - Dadari	52	25	Nil	Nil	Nil	4	**81**

The details of temperatory and permanent structures and common property resources being impacted are given below.

5.15 OTHER SOCIAL STATUS

(i) Illness: The people of the project area are suffering from different diseases. Most common diseases cited are: Tuberculosis, blood pressure, heart problems, paralysis, and skin diseases. Special care has to be taken while implementing the health care system of resettlement and rehabilitation. Most of the diseases cited are illnesses requiring long-term medications like T.B, blood pressure etc., thus incurring costs for the families and increasing the vulnerability of the population.

Figure 5-6: Illness and Diseases reported by PAPs



(ii) Migration: Information of social team suggests that about 39% of the people have migrated at some point in time. About 62% of the migrants have migrated within the district. About 15% have migrated outside the district but within the same state.

About 28% of the total migrants migrate in the summer season. Another 36% migrate during winter and rainy seasons.

5.16.1 Critical stretches

The sensitive social cultural receptors viz., temples, mosque, school and hospitals along the existing RoW of existing railway line and proposed track are surveyed and details are present in environmental profile and strip plan. The summarized table of impacted receptors and sensitive locations are presented in**Table4.2.**

Annexure 5-1

Quantitative Analysis of Tree, Shrub and Herb by Quadrate Method

Location No.1: Wair (Start of Detour)
A. Diversity, Abundance and Species Diversity Index

S. No.	Name of Species	No. of Quadrate Studies										Total No. of Species (n)	Total No. of Quadrate	Density	Pi = n/N	log Pi	Pi x log Pi	Total No. of Quadrate Occurred	Abundance
		1	2	3	4	5	6	7	8	9	10								
1	*Cassia fistula*	-	7	-	-	-	-	2	-	-	-	2	10	0.2	0.0045	-2.346	-0.011	2.000	0.45
2	*Acacia nilotica*	4	3	2	6	6	3	11	9	-	1	45	10	4.5	0.100	-1	-0.10	9.000	0.79
3	*Dalbergia sissoo*	-	4	-	2	-	-	3	-	-	-	9	10	0.9	0.020	- 1.694	-0.034	3.000	0.30
4	*Delonix regia*	-	-	2	-	-	2	-	-	-	-	4	10	0.4	0.009	-2.05	-0.018	2.000	0.40
5	*Butea monosperma*	-	-	1	-	-	-	-	-	-	-	1	10	0.1	0.002	-2.698	0.005	1.000	0.10
6	*Bougainvillea glabra*	-	2	-	-	-	1	-	-	-	2	5	10	0.5	0.01	-2	-0.02	3.000	0.40
7	*Parthenium hysterophorus*	11	19	21	28	14	15	21	24	21	38	212	10	21.2	0.473	-0.325	-0.15	10.000	2.45
8	*Prosopis juliflora*	1	2	-	5	2	-	2	-	-	2	14	10	1.4	0.031	-1.51	-0.047	6.000	0.56
9	*Zizyphus mauritiana*	1	1	2	2	2	-	-	-	-	-	8	10	0.6	0.013	-1.886	-0.025	5.000	0.23
10	*Alianthus exceles*	-	-	1	1	-	1	-	-	1	-	4	10	0.4	0.009	-2.05	-0.018	4.000	0.10
11	*Madhuca indica*	-	1	-	-	-	-	-	-	-	-	1	10	0.1	0.002	-2.577	-0.005	4.000	0.10
12	*Azardirachta indica*	1	-	1	-	-	2	-	1	-	-	5	10	0.5	0.011	-1.96	-0.002	4.000	0.10
13	*Capacious Cactus*	-	-	-	-	-	-	-	-	-	2	2	10	0.2	0.004	-2.40	-0.009	1.000	0.30
14	*Acacia catechu*	-	-	2	-	-	-	-	-	-	-	2	10	0.2	0.004	-2.40	-0.01	1.000	0.20
15	*Bambusa vulgaris*	-	1	-	-	-	-	-	-	-	-	1	10	0.1	0.002	-2.69	-0.032	1.000	0.70
16	*Melia azedarach*	-	-	1	-	-	-	-	-	-	-	1	10	0.1	0.002	-2.69	-0.005	1.000	0.20
18	*Brassica oleracea*	-	-	-	-	-	-	-	38	-	-	38	10	3.8	0.085	-0.071	-0.006	1.000	4.20
19	*Daucus carota*	-	-	-	-	-	-	-	12	9	-	21	10	2.1	0.047	-1.33	-0.063	2.000	1.40
20	*Cicer arietinum*	-	-	-	-	-	-	-	-	14	-	14	10	1.4	0.031	-1.51	-0.047	1.000	1.90
21	*Orijza Sativa*	-	-	-	-	-	-	-	-	-	61	61	10	6.1	0.136	-0.87	-0.12	1.000	3.25
												448					**-0.717**		

Species Diversity Index = 0.717

B. Frequency and Frequency%

S. No.	Name of Species	No. of Quadrate Sampled										Total No. of Quadrate Occurred	Total No. of Quadrate Sampled	% Frequency	Frequency Class
		1	2	3	4	5	6	7	8	9	10				
1	*Cassia fistula*	-	+	-	-	-	-	+	-	-	-	2	10	20	B
2	*Acacia nilotica*	+	+	+	+	+	+	+	+	+	-	9	10	90	D
3	*Dalbergia sissoo*	-	+	-	+	-	-	+	-	-	-	3	10	30	B
4	*Delonix regia*	-	-	+	-	-	+	-	-	-	-	2	10	20	A
5	*Butea monosperma*	-	-	+	-	-	-	-	-	-	-	1	10	10	A
6	*Bougainvillea glabra*	-	+	-	-	-	+	-	-	-	+	3	10	30	A
7	*Parthenium hysterophorus*	+	+	+	+	+	+	+	+	+	+	10	10	100	E
8	*Prosopis juliflora*	+	+	-	+	+	-	+	-	-	+	6	10	60	C
9	*Zizyphus mauritiana*	+	+	+	+	+	-	-	-	-	-	5	10	50	C
10	*Alianthus excels*	-	-	+	+	-	+	-	-	+	-	4	10	40	A
11	*Madhuca indica*	-	+	-	-	-	-	-	-	-	-	1	10	10	A
12	*Azardirachta indica*	+	-	+	-	-	+	-	+	-	-	4	10	40	A
13	*Capacious Cactus*	-	-		-	-	-	-	-	-	+	1	10	10	A
14	*Acacia catechu*	-	-	+	-	-	-	-	-	-	-	1	10	10	A
15	*Bambusa vulgaris*	-	+	-	-	-	-	-	-	-	-	1	10	10	A
16	*Melia azedarach*	-	-	+	-	-	-	-	-	-	-	1	10	10	A
17	*Pithecellobium dulce*	-	-	-	-	-	-	+	-	-	-	1	10	10	A
18	*Brassica oleracea*	-	-	-	-	-	-	-	+	-	-	1	10	10	A
19	*Daucus carota*	-	-	-	-	-	-	-	+	+	-	2	10	20	B
20	*Cicer arietinum*	-	-	-	-	-	-	-	-	+	-	1	10	10	A
21	*Orijza Sativa*	-	-	-	-	-	-	-	-	-	+	1	10	10	A

Location No.2: Parallel Section Ahead of Wair Detour End

A. Diversity, Abundance and Species Diversity Index

S. No.	Name of Species	No. of Quadrate Studies										Total No.of Species (n)	Total No. of Quadrate	Density	Pi = n/N	log Pi	Pi x log Pi	Total No. of Quadrate Occurred	Abundance
		1	2	3	4	5	6	7	8	9	10								
1	*Cassia fistula*	-	-	-	-	6	-	-	-	-	-	6	10	0.6	0.017	-1.769	-0.030	1.000	0.50
2	*Acacia nilotica*	-	2	2	-	3	-	2	-	-	-	9	10	0.9	0.025	-1.602	-0.040	4.000	0.30
3	*Dalbergia sissoo*	-	2	-	-	-	1	-	-	1	-	4	10	0.4	0.011	-1.959	-0.022	3.000	0.40
4	*Delonix regia*	-	1	-	1	-	1	-	1	-	-	4	10	0.4	0.011	-1.959	-0.022	4.000	0.50
5	*Butea monosperma*	3	-	2	2	-	-	1	-	-	-	8	10	0.8	0.022	-1.66	-.037	4.000	0.40
6	*Thevetia peruviana*	2	-	4	-	-	1	-	1	-	-	8	10	0.8	0.022	-1.66	-0.037	4.000	0.35
7	*Pongamia pinnata*	1	2	-	-	1	-	-	1	-	-	5	10	0.5	0.014	-1.854	-0.026	4.000	0.10
8	*Parthenium hysterophorus*	9	16	15	21	43	26	14	15	15	32	206	10	20.6	0.567	-0.246	-0.139	10.000	2.40
9	*Prosopis juliflora*	2	4	3	-	3	-	2	1	-	-	15	10	1.5	0.041	-1.387	-0.076	6.000	0.38
10	*Zizyphus mauritiana*	-	-	-	-	2	-	-	-	-	-	2	10	0.2	0.006	-2.222	-0.012	1.000	0.20
11	*Ficus religiosa*	-	-	-	-	-	-	-	-	-	-	0	10	0	0	0	-0.032	0	0.23
12	*Tamrindus indica*	-	-	-	2	2	2	-	-	-	-	6	10	0.6	0.02	-1.699	-0.013	3.000	0.30
13	*Alianthus exceles*	2	2	6	-	-	3	-	-	-	2	15	10	1.5	0.04	-1.398	-0.050	5.000	0.43
14	*Azardirachta indica*	2	3	-	3	-	5	-	-	-	-	13	10	1.3	0.036	-1.444	-0.056	4.000	0.50
15	*Mangifera indica*	2	1	-	3	-	2	-	1	-	-	9	10	0.9	0.025	-1.602	-0.038	5.000	0.30
16	*Capacious Cactus*	-	1	-	2	-	2	-	-	-	-	5	10	0.5	0.014	-1.854	-0.040	3.000	0.35
17	*Acacia catechu*	-	1	2	-	-	-	1	-	-	-	4	10	0.4	0.011	-1.959	-0.022	3.000	0.15
18	*Bambusa vulgaris*	-	6	2	5	-	-	-	2	-	-	15	10	1.5	0.041	-1.387	-0.057	4.000	0.55
19	*Melia azedarach*	-	2	2	2	-	-	-	-	2	-	8	10	0.8	0.022	-1.658	-0.036	4.000	0.30
20	*Solanum melongeana*	-	-	-	-	-	-	-	0	-	-	0	10	0	0	0	0	0	1.40
21	*Brassica oleracea*	-	-	-	-	-	-	-	-	1	-	1	10	0.1	0.003	-2.522	-0.008	1.000	2.70
22	*Oryza sativa*	-	-	-	-	-	-	-	-	-	2	2	10	2.0	0.006	-2.222	-0.013	1.000	4.50
23	*Daucus carota*	-	-	-	2	-	-	-	16	-	-	18	10	1.80	0.050	-1.301	-0.065	2.000	2.10
												363					**-0.871**		

Species Diversity Index = 0.871

B. Frequency and Frequency%

Sl. No.	Name of Species	No. of Quadrate Sampled										Total No. of Quadrate Occurred	Total No. of Quadrate Sampled	% Frequency	Frequency Class
		1	2	3	4	5	6	7	8	9	10				
1	*Cassia fistula*	-	-	-	-	+	-	-	-	-	-	1	10	20	B
2	*Acacia nilotica*	-	+	+	-	+	-	+	-	-	-	4	10	30	B
3	*Dalbergia sissoo*	-	+	-	-	-	+	-	-	+	-	3	10	20	B
4	*Delonix regia*	-	+	-	+	-	+	-	-	+	-	4	10	20	B
5	*Butea monosperma*	+		+	+	-	-	+	-	-	-	4	10	30	B
6	*Thevetia peruviana*	-	-	+	-	-	+	-	-	-	-	2	10	20	B
7	*Pongamia pinnata*	+	+	-	-	+	-	-	+	-	-	4	10	10	A
8	*Parthenium hysterophorus*	+	+	+	+	+	+	+	+	+	+	10	10	100	E
9	*Prosopis juliflora*	+	+	+	-	+	-	+	+	-	-	6	10	40	C
10	*Zizyphus mauritiana*	-	-	-	-	+	-	-	-	-	-	1	10	10	A
11	*Ficus religiosa*	-	-	-	-	-	-	-	-	-	-	0	10	30	B
12	*Tamrindus indica*	-	-	-	+	+	+	-	-	-	-	3	10	20	B
13	*Alianthus excels*	+	+	+	-	-	+	-	-	-	+	5	10	30	B
14	*Azardirachta indica*	+	+	-	+	-	+	-	-	-	-	4	10	30	B
15	*Mangifera indica*	+	+	-	+	-	+	-	+	-	-	5	10	30	B
16	*Capacious Cactus*	-	+	-	+	-	+	-	-	-	-	3	10	20	B
17	*Acacia catechu*	-	+	+	-	-	-	+	-	-	-	3	10	20	B
18	*Bambusa vulgaris*	-	+	+	+	-	-	-	+	-	-	4	10	20	B
19	*Melia azedarach*	-	+	+	+	-	-	-	+	-	-	4	10	20	B
20	*Solanum melongeana*	-	-	-	-	-	-	-	-	-	-	0	10	10	A
21	*Brassica oleracea*	-	-	-	-	-	-	-	-	+	-	1	10	10	A
22	*Oryza sativa*	-	-	-	-	-	-	-	-	-	+	1	10	10	A
23	*Daucus carota*	-	-	-	+	-	-	-	+	-	-	1	10	10	A

Annexure 5-2

Chainagewise Structures and Common Property Resourses in the RoW

Utilities Details

I. Structure

Sl No.	Pole	Distance from Exg. Track CL(mtr.)	Type	Dimension	
				Length (mtr.)	Breadth(mtr.)
1	1370/3	18.50	Railway Quarter no. 1	12.00	8.00
2	1370/5	19.20	Railway Quarter no. 2	21.00	22.50
3	1370/5		Temple No.1	8.00	15.00
4	1370/5	5.10	Khurja Jn. Cabin (West)	20.50	4.50
5	1370/9	34.00	Pucca Res No. 1	35.00	12.00
6	1370/11	35.30	FCCI Godown	24.30	13.50
7	1370/25	32.00	Katcha Res. No.1	3.50	4.00
8	1371/33	21.20	Katcha Res. No.1	16.00	12.20
9	1371/33	40.10	Pucca Res No. 1	21.70	7.50
10	1372/3	32.00	Pucca Res No. 1	21.00	9.00
11	1372/3	32.00	Pucca Res No. 2	19.30	8.30
12	1372/5	32.00	Katcha Res. No.1	17.00	10.70
13	1372/5	28.00	Pucca Res No. 3	31.50	9.50
14	1372/7	51.00	Pucca Res No. 4	8.00	6.00
15	1372/7	48.00	Pucca Res No. 5	7.00	3.70
16	1374/29	42.50	Pucca Res No. 1	10.50	4.50
17	1374/31	42.50	Pucca Res No.2	8.50	4.50
18	1374/34	14.10	Pucca Res No. 3	9.10	5.50
19	1374/35	14.10	Pucca Res No. 4	13.00	6.10
20	1374/35	15.10	Pucca Res No. 5	6.70	6.20
21	1374/35	15.10	Pucca Res No. 6	8.20	2.65
22	1374/36	16.12	Pucca Res No. 7	8.10	3.00
23	1374/37	17.20	Pucca Res No. 8	4.25	3.00
24	1374/37	22.10	Pucca Res No. 9	14.50	5.30
25	1374/37	19.90	Pucca Res No. 10	2.55	2.10
26	1374/37	19.90	Pucca Res No. 11	12.80	8.30
27	1374/37	20.00	Pucca Res No. 12	11.00	7.10
28	1374/37	39.00	Pucca Res No. 13	5.60	4.50
29	1374/37	20.80	Pucca Res No. 14	19.90	5.60
30	1374/37	12.80	Pucca Res No. 15	16.80	12.80
31	1374/37	11.50	Pucca Res No. 16	11.00	8.80
32	1375/0	9.25	Railway Quarter no. 1	6.50	4.45
33	1375/1	21.50	Railway Quarter no. 2	20.00	7.40
34	1375/2	21.10	Railway Quarter no. 3	30.00	12.00
35	1375/3	18.00	Railway Quarter no. 4	10.00	7.80
36	1375/3	15.00	Railway Quarter no. 5	6.80	5.10
37	1375/13	42.00	Pucca Res. No. 1	38.00	12.00
38	1375/19	41.00	Railway Quarter no. 5	10.00	8.00
39	1375/21	15.30	Pucca Comm. Res. No.1	8.50	33.00
40	1380/3	43.61	Pucca Res. No. 1	6.55	14.00
41	1380/5	10.00	Gangrol Booking room	14.20	4.60
42	1380/13	34.14	Pucca Res. No. 2	15.00	3.50
43	1380/15	31.00	Pucca Res. No. 3	3.00	6.00

Sl No.	Pole	Distance from Exg. Track CL(mtr.)	Type	Dimension	
				Length (mtr.)	Breadth(mtr.)
44	1380/15	44.74	Pucca Res. No.4	17.50	3.50
45	1382/23	15.90	Pucca Res. No.1	10.20	8.00
46	1382/25	15.80	Pucca Res. No.2	9.50	5.00
47	1382/25	20.50	Pucca Res. No.3	8.80	7.80
48	1382/25	22.40	Pucca Res. No.4	12.80	6.00
49	1384/21	15.00	kacha Commercial No. 1	6.00	5.00
50	1386/27	16.80	Temple 3 Nos.		
51	1392/13	22.60	Pucca Res. No. 1	7.00	3.50
52	1395/3	48.00	Pucca Res. No. 1	35.00	3.00
53	1397/29	13.00	Pucca Res. No. 1	20.20	18.50
54	1397/29	13.00	Pucca Res. No. 2	16.60	18.50
55	1397/29	13.00	Pucca Comm. Res. No. 1	6.00	12.00
56	1397/31	24.00	Railway Quarter no. 1	35.00	14.50
57	1397/31	10.50	Gate lodge	18.00	4.50
58	1397/31	17.80	Railway Quarter no. 2	19.50	12.50
59	1397/31	46.00	Railway Quarter no. 3	15.00	14.50
60	1397/35	46.00	Railway Quarter no. 4	15.00	14.50
61	1397/35	46.00	Railway Quarter no. 5	15.00	14.50
62	1398/1	46.00	Railway Quarter no. 6	15.00	14.50
63	1398/2	46.00	Railway Quarter no. 7	15.00	14.50
64	1398/3	38.00	Railway Quarter no. 8	7.50	11.50
65	1398/3	37.50	Railway Quarter no. 9	25.50	14.50
66	1398/5	34.00	Railway Quarter no. 10	11.70	6.50
67	1398/18	37.50	Pucca Res. No. 2	6.75	15.00
68	1398/18	38.50	Pucca Res. No. 3	18.00	12.00
69	1398/19	29.50	Commercial No. 1	10.60	6.75
70	1398/21	29.50	Pucca Res. No. 3	12.00	10.60
71	1398/21	29.50	Pucca Res. No. 4	15.00	3.20
72	1398/21	29.50	Pucca Res. No. 5	10.00	5.90
73	1399/15	8.90	Commercial No. 1	4.50	4.00
74	1399/16	23.50	Pucca Res. No. 1	4.90	15.50
75	1399/17	23.20	Pucca Res. No. 2	6.00	16.50
76	1406/7	37.50	Pucca Res. No. 1	15.00	6.00
77	1406/9	30.40	Commercial No. 1	21.20	6.50
78	1406/9	32.00	Commercial No. 2	7.40	4.00
79	1406/13	29.20	Commercial No. 3	8.70	8.10
80	1406/15	32.00	Commercial No. 4	17.50	5.00
81	1406/15	34.00	Commercial No. 5	10.20	4.50
82	1406/15	33.00	Commercial No. 6	6.40	5.20
83	1406/16	45.00	Commercial No. 7	32.00	9.00
84	1406/23	47.00	Commercial No. 8	7.00	7.50
85	1407/3	39.10	Pucca Res. No. 1	6.10	5.80
86	1407/3	35.00	School Building	13.00	9.00

II. Bore Well/Hand Pump

SR. No.	Pole	Distance from Exg. Track CL(mtr.)	Type	REMARK
1	1372/13-15	15.00	Bour Well No. 1	
2	1376/3-5	37.00	Bour Well No. 1	
3	1380/13-15	23.47	HAND PUMP	
4	1382.25	14.05	HAND PUMP	
5	1386/27	18.00	HAND PUMP	
6	1406/03	25.50	HAND PUMP	
7	1406/23	45.28	HAND PUMP	

Annexure 5-3

Monitoring Photographs

Air Sampling Photographs

Air Sampling at Khurja

Air Sampling at Dadari

Air Sampling at Wair

Soil Sampling Photographs

Soil Sampling at khurja

Soil Sampling at Wair

Soil Sampling at Dadari

Water Sampling Photographs

Water Sampling at khurja

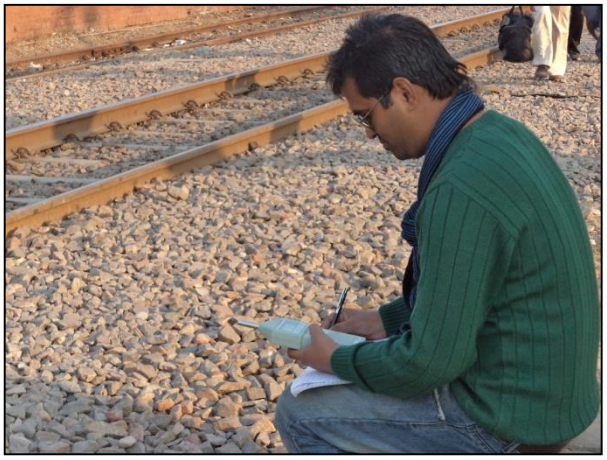
Water Sampling at Wair

Water Sampling at Dadari

Noise Sampling Photographs

Noise Sampling at Khurja

Noise Sampling at Wair



Noise Sampling at Dadari

CHAPTER 6 ANALYSIS OF ALTERNATIVES

6.1 BACKGROUND

The present project consists of laying out the double line broad gauge railway line of 49.69km length for freight trains associated facilities such as bridges (4 major bridges, 15 minor RUBs, and 49 minor bridges), electrical facilities including signal, electric sub-stations and junctions & crossing stations etc. The detailed descriptions of the facilities are presented in **Chapter-2.**

6.2 ALIGNMENT

The Khurja-Dadari section of EDFC is a part of section starting at Khurja and ending near Dadari station (km 1415.69). The detours have been planned at two locations namely Khurja Flyover UP line and Wair. The availability of RoW is not sufficient and laying of DFC lines will result into huge demolition of structures leading to huge social impacts. Keeping this in mind two detours have been planned. However, various alternatives considered in finalizing the alignments in parallel and detour section have been analyzed keeping in view environmental, social and technical requirements. The details of the parallel and detour locations are given below in the **Tables -6.1.** Both the detours are on the left side (w.r.t. existing railway alignment from Khurja to Dadari) i.e., south side of the railway track. The parallel alignment is also on left side of existing track. The alignment is not in immediate vicinity as RVNL third line under implementation is in the immediate vicinity.

Table 6-1: Locations of the Parallel Alignment

1	Khurja Jn Station	Wair Detour Start	Parallel	1369.82	1387.420	17.60
2	Wair Detour Start	Wair Detour End	Detour	1387.42/0.00	3.700	3.700
3	Wair Detour End	Boraki Station	Parallel	1390.81	1415.69	24.88
4	Khurja Flyover Up Line Start	Khurja Flyover Up Line End	Detour	-7.350	-0.270	7.080
			Total Length of section			53.26
			Section overlap(Parallel+Detour)			3.57
			Parallel Length			36.42
			Detour Length			13.27
			Net Length of section			49.69

The alignment on left side is considered keeping in view the feasibility and existing habitations, and cost considerations. The objective of examining various alternatives was to screen the manifest features of the environment and to assess which of the alternative alignments are likely to have the most significant environmental impacts. Three alternatives i.e. parallel alignment, right side alignment and left side alignment have been considered along the critical area, where environmental and social impacts are significant.

6.3 ANALYSIS OF ALTERNATIVES

The various alternatives for each detour are discussed below:-

6.3.1 Wair Detour

DFC alignment is proposed parallel to the existing track. RVNL is constructing 3rd track between Aligarh to Dadri at 6m track center from existing track. A busy level crossing is placed at ch. 1389/1-3 which is surrounded by heavy built up area. Existing railway land has been utilized for construction of 3rd line. Proposed DFC alignment is proposed at about 12-

15m track center from RVNL 3rd line. If DFC line is planed at 15m track center then there would be more land acquisition in built up area and subsequently more human displacement. To avoid this Wair Detour is proposed. The Wair Detour alternatives are shown in **Figure-6.1.** The comparision of alternatives for different attributes has been provided in **Table-6.2**

Figure 6-1: Wair Detour

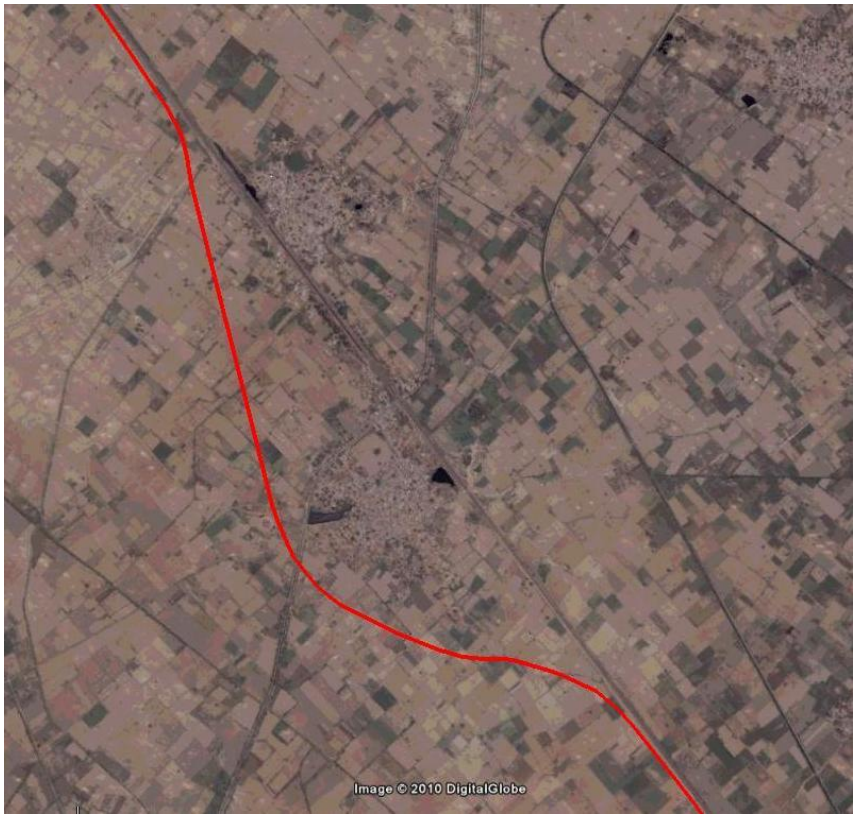


Table 6-2: Issues related to Wair Detour

S. No.	Issues	Parallel along existing IR track	On north side of existing IR track	On south side of existing IR track	Recommendation
1.	Land width	10-15 meter additional width is required	Proposed width is 60 meter	Proposed width is 60 meter	The detour is recommended on south side of the existing track.
2.	Acquisition of structures	About 32 structures and 54 families will be displaced	Passes through agriculture land and crosses some utility lines.	Passes through agricultural and barren land	
3.	Issues of ROB	Construction of ROB at LC gate will displace about 100 houses	None	None	
4.	Technical constrains	Need modification of yard	Need additional bridges along the water bodies. HT lines shall have to be shifted four times adding to the cost	Need underpasses at crossing locations	Appropriate measures to mitigate noise and vibration such as appropriate reduction of RoW and construction of noise barriers shall be taken near sensitive receptors Special attention shall be given on farmers who will lose fertile agriculture land for income restoration
5.	Public Opinion	Not favourable	Not favourable	Favourable, but loss of land and livelihood, need good communication strategies and consultation. Losses are lesser than north side.	
6.	Environmental issues covering noise, vibration and impact on sensitive receptors	Noise and vibration impact on residential and sensitive receptors as there is ribbon development along Wair town.	Impact on the surrounding residential structures due to construction of New track.	Impact are less as alignment is avoiding residential structures	
7.	Site suitability for various facilities such as freight stations, electric substation etc.	Not suitable due to congestion along the track specially at Wair station	Suitable as sufficient land will be available along the tracks as detour will have 60 m RoW	Suitable as sufficient land is available along the track	
8.	Ecological impact such as tree cutting	Not significant	Not significant	Not significant	
9.	Other impacts	Remaining after demolition (if this option opted) houses in Wair will have impacts of vibration and noise pollution	Increased noise and associated impact on residential structures	Less impacts as entire habitation have been avoided	

6.3.2 Khurja Flyover UP line

DFC alignment is proposed parallel to the existing track. RVNL is constructing 3rd track between Aligarh to Dadri. Adjoining to the RVNL 3rd line there is DFC alignment is proposed at 15m track center from RVNL 3rd line.Khurja Flyover UP line is proposed over the Khurja- Meerut Line of DFC due to Traffic solution of Section.

Khurja Flyover UP line Start at ch -7.350 km & end -0.270 km, mostly running through cultivated land. RUBs of different spans have been proposed to avoid surface crossing. Different span arrangements for proposed RUB are 12.2m to 30.5m x 5.5m for NH, 5.5m x 5.5m for State Highway, 5.5m x 4.5m for Important District Road and 5.5m x 3.5m for small Village Road/ Cart Tracks. Average Embankment height has been worked out to 4 - 7 m due to provision of RUB in Detour Portion. Total Detour Length are 7.080 km, length along the existing track calculated 5.5km. The Khurja Flyover UP line alternatives are shown in **Figure-6.2.** The comparision of alternatives for different attributes has been provided in **Table-6.3**.

Figure 6-2: Khurja Flyover UP line

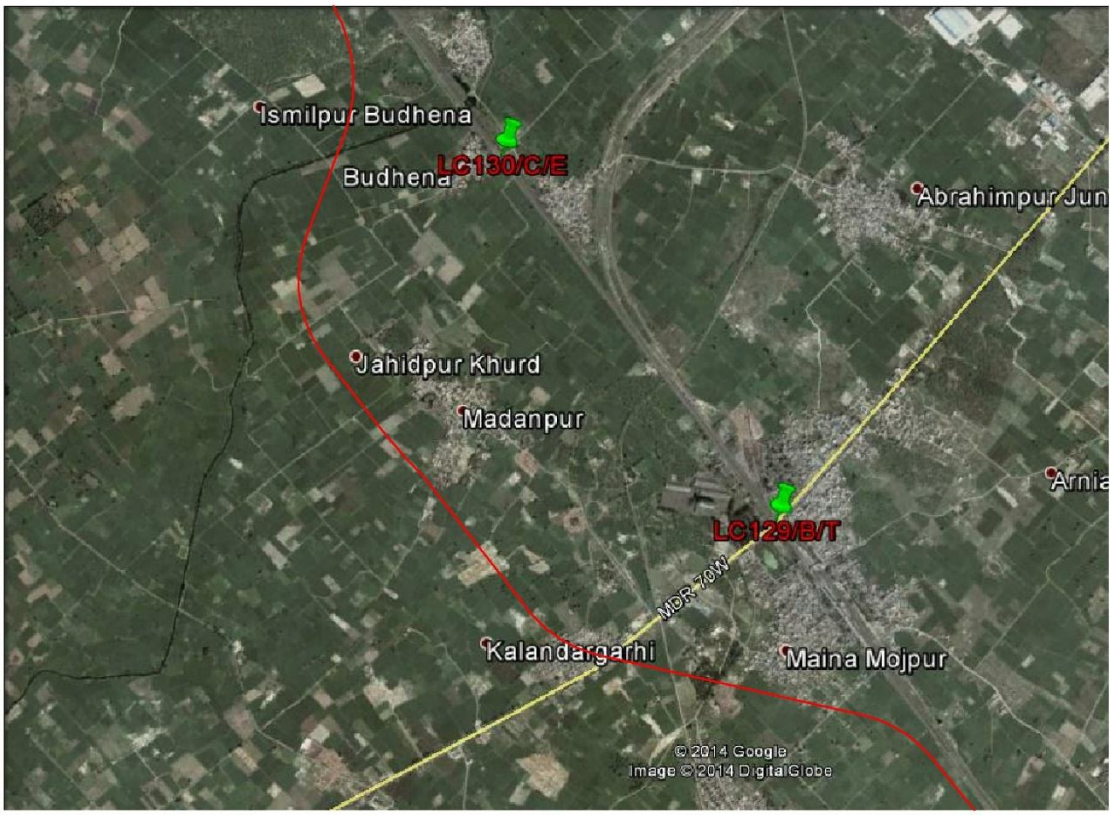


Table 6-3: Issues related to Khurja Flyover UP line

S. No.	Issues	Parallel along existing IR track	On north side of existing IR track	On South side of existing IR track	Recommendation
1.	Land width	10-15 meter additional width is required	Proposed width is 60 meter for new alignment	Proposed width is 60 meter for new alignment	The detour is recommended on south side of the existing track, considering lower impact as compared to parallel or the right side alignment, in which case project has impacts on environmentally & socially sensitive issues.
2.	Acquisition of structures	About 54 structures and 32 families will be displaced	Not possible due to existence of industrial units and other structures on right side Habitation spread is more on right side	Passes through low grade agricultural and barren land	
3.	Issues of ROB/RUB	No requirement of RUB	More numbers of RUBs and minor bridges in comparision to south side detour	There will be requirement of 5 RUBs and 4 minor bridges	
4.	Technical constrains	The constraint exist at Khurja Junction station. There will be damage to many structures at the station.	The cost of north side detour will be exhorbitant due to higher length and additional structures such as RUB, ROB and major/minor bridges	Least length and number of RUBs, major and minor bridges and social impacts.	
5.	Public Opinion	Not favourable	Not favourable as habitation spread is more on north side.	Loss of land and livelihood. This option has least environmental and social impacts.	
6.	Environmental issues covering noise, vibration and impact on sensitive	Noise and vibration impact on residential and sensitive receptors	Impacts on the surrounding villages due to construction of new	Impact are less as less structures are impacted	

S. No.	Issues	Parallel along existing IR track	On north side of existing IR track	On South side of existing IR track	Recommendation
	receptors	around town	tracks		
7.	Site suitability for various facilities such as freight stations, electric substation etc.	Not suitable due to congestion along the track specially at station	Suitable as sufficient land will be available in the proposed width of new alignment	Suitable as sufficient land is available in the proposed RoW of new alignment	
8.	Ecological impact such as tree cutting	No significant impact	No significant impact	Not significant	
9.	Other impacts	Remaining houses, commercial structures at Khurja will have impacts of vibration and noise pollution	Increase noise and associated impacts on residential and commercial structures	Less impacts, but houses are closed to the proposed line may have some vibration and noise impacts	

CHAPTER 7 ENVIRONMENT IMPACT ASSESSMENT

7.1 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 sections and the proposed project activities, potential impacts have been assessed and predicted, and appropriate mitigation measures are suggested to avoid / reduce / compensate for the potential adverse impacts of the project and enhance its positive impact. The impact due to development of the proposed Dedicated Freight Corridor has been assessed for the planning phase, construction phase and implementation phase.

7.2 IMPACT ASSESSMENT METHODOLOGY

To assess the impact of the project, a simple qualitative method that determines potential existence of impact has been employed. Thereby, the judgments related to the magnitude and importance of the impacts caused by the project is presented. This involves development of Matrix having summarized environmental impacts of the DFC project. The following parameters and scale is adopted for developing matrix. Parameters and scale of impact matrix is presented in **Table 7.1.**

Table 7-1: Parameter and Scale of Impact Matrix

Significance	Scale	Remarks	
No impact	E	Positive	Negative
Negligible impact	D	Positive	Negative
Insignificant impact	C	Positive	Negative
Relatively significant impact	B	Positive	Negative
Significant impact	A	Positive	Negative

For the assessment of impacts, the following criteria is adopted

Scale A: If National Parks, Wildlife Sanctuaries, wetland, ecosensitive zone 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 temporary and reversible

Scale D: If impact is hardly measurable

Scale E: No impacts or not applicable to assessment.

Sections below assess the impacts following the above method.

7.3 DESCRIPTION OF EXPECTED IMPACT

The description of impact on natural resources is as follows:

7.3.1 Impact on Topography and Geology

1) Planning Phase

The project has been planned to minimize the impact on topography by avoiding sensitive topographic features such as tunnels, rivers/hills etc. The entire length of

alignment does not cross any hillock. There is also no proposal for construction of tunnels. However, impacts dueto high embankment are expected. These high impacts will be at the location of RUBs.

2) Construction Phase

- Change in topography is envisaged due to the clearing of land, felling of trees, cutting and filling & due to the construction of structures.
- Construction of railway embankment is not likely to cause aesthetic change in the landscape. However, suitable landscaping and plantation activities, slope protection activities are envisaged to minimize the aesthetic impacts.
- Filling and excavation of earth will be required in the detour stretches, where the track traverses through undulating topography. However, changes will be limited within RoW of the track; hence overall impact will be localized.
- No impact is envisaged on geology due to the project.

3) Operation Phase

During operation phase no impacts on topography and geology are anticipated.

7.3.2 Impacts on Soil

1) Planning Phase

- The bridges across the water bodies are planned at existing levels to avoid construction of high embankment to minimize soil erosion isuue.

2) Construction Phase

- Clearing of land, cutting of trees, excavation of borrow areas are likely to trigger soil erosion. Movement of vehicle / machinery / equipments and working force is also likely to cause soil erosion.
- The detour sections are likely to traverse through agricultural and vegetated areas which will require clearing of the land.
- Soil in the agricultural regions is fertile and consists of alluvial deposits. Thus, loss of fertile soil is likely to occur.
- Borrow areas will be required for the project. Most portion of the DFC is on slightly higher level than ground level.. The borrow areas are likely to cause soil erosion and some of the borrow areas may be in agriculture areas. Appropriate measures for borrow area management are suggested in the chapter.
- Pits can be formed due borrowing, which may cause harm to local residents in the vicinity.
- Debris will be generated due to dismantling of structures. The disposal of these if not proper may have impacts on soil
- Oil spills from the operation of the diesel generator/ pump and diesel storage, during transportation and transfer, parking places and diesel generator sets may have impacts on soil at location of spillage
- Operation of the emulsion sprayer and laying of hot mix in service road will have impacts on soil quality
- Operation of the residential facilities for the labour and officers at construction camp will have impacts on soil quality if these are located on productive agriculture lands
- Storage and stock yards of bitumen and emulsion may have impacts on soil quality.

3) Operation Phase

- Due to change in land use, impact is envisaged on soil during operation phase.However, the impacts are within the ROW.

7.3.3 Impact on Air Quality

1) Planning Phase

- Currently the cargo is transported by railway and road. It is estimated one litre of fuel can move 24 ton-km of freight by road, 85 ton-km by rail. Once the DFC is operational, consumption of fuel is likely to decrease which may subsequently reduce air pollution in the area. Moreover, proposed movement of freight trains would be by electricity, therefore, emissions are negligible. By planning the freight corridor, the overall ambient air quality of the area will improve.

2) Construction Phase

- During the construction phase, the air quality is likely to be affected due to generation of dust from construction activities and gaseous emissions from construction vehicles/ DG set. However, the impact will remain localized, short-termed and reversible.

3) Operation Phase

It is basically an eco-friendly project. DFC will help to reduce dependency on road transportation of goods, thus reducing cause for Green House effect or GHG emission.

- The movement of trucks during loading / unloading may have some impact near freight stations, however, these impacts are localized and concentrated in a specified area only.
- Plantation along the DFC is likely to improve the ambient air quality of the area.

7.3.4 Impact on Ground Water

1) Planning Phase

- No impact is envisaged on ground water in planning phase as water requirement is very nominal.

2) Construction Phase

- During construction phase pollution of groundwater is likely to occur due to seepage and runoff from construction site. However, the impact will be negligible. The total water requirement during construction period will be 3600 cubic meter per kilometre spread over the construction period of about 3 years. The daily requirement per kilometre length during the construction period will be 3300 litre and will be met through the local water supply. There will be no appreciable impact on ground water. The labour camp, which may be established during construction period, should have proper sanitation facilities and discharge of wastewater through soak pit. Hence, no impact is predicted on ground water quality.
- The impact on water resources due to the proposed project is tabulated in **Table 7.2**.

Table 7-2: Impact on Water Resources due to the Proposed Project

Impacts due to construction	Indicators	Remarks
Loss of water body	Water body affected	No impact in parallel section. In detour section no water pond is being impacted.
Loss of other water sources	Number of well affected	Some tube-well and hand pumps may be shifted / compensated
Alteration of drainage, run-off, flooding	No. of cross drainage channels	May have impact on detour section, sufficient cross drainage structures are proposed

Impacts due to construction	Indicators	Remarks
Depletion of ground water recharge	Decrease in water table depth	Not appreciable impact as water requirement is not significant
Use of water supply for construction	Quantum of water used	Not significant
Contamination from fuel and lubricants	Nature and quantum of contaminations	Not significant
Contamination from improper sanitation and waste disposal in construction camp	Area of camp/disposal site and proximity to water bodies/channels	Proper sanitation facilities at construction camp will minimize it

3) Operation Phase

- No impact is envisaged on water quality during the post construction phase as no

  Waste water will be generated during operation. However, the facilities near the stations may release sewage water which shall be disposed off in a properly designed treatment facilities.

7.3.5 Hydrological Condition (Rivers / Canal and Lakes)

1) Planning Phase

- No impact is envisaged on hydrological cycle during planning phase.
- There is no perennial river crossing the present alignment. The village ponds have been avoided while planning the alignment of detour sections
- The alignment does not cross any significant water course / channel. The Karon river being crossed is seasonal. The bridge on this has been planned exactly parallel to the existing bridge to minimize ecological impact.

2) Construction Phase

- Drainage and flooding problem during construction due to stockpiling of materials, debris and construction of temporary approach road and yards would have impact of temporary nature.
- Local drainage may be affected during construction phase due to formation of embankments. The slope of project alignment is towards east. During the construction phase the embankment should be designed in such a way that the natural drainage pattern is not disturbed in order to avoid any water logging in the low lying area.

3) Operation Phase

- Local drainage is likely to be affected due to the formation of Railway Embankment as embankment will be an impediment for free flow of storm water. However, sufficient number of cross drainage structure will minimize the impact.

7.3.6 Flora

1) Planning Phase

- Tree plantation of local species is proposed during planning stage at appropriate places along the alignment.

2) Construction Phase

- The construction activity involving clearing of site, felling of trees, settlement of construction camps and office is likely to affect the flora of the area.
- The proposed alignment may cause cutting of approx. 587 trees. The major species present along the alignment are babool, neem, shisam, papal, mango, bargad, kanji, labhera, ashok, sirsa, guler, jamun, ber, eucalyptus, mahua , etc..
- Acquisition of the forest land and construction activity likely to disturb the habitat.

- The tree species likely to be affected do not fall under the rare, threatened and/or endangered category, and are common in the region.

3) Operation Phase

- No impact envisaged on flora during post construction phase. However, development of the green belt is suggested near stations and maintenance of plantation may be undertaken by Railway Dept. Plantation carried out along the alignment and as compensatory aforestation is likely to enhance the ecological condition of the area.

7.3.7 Fauna

1) Planning Phase

- No impact on fauna in planning phase as there is no wildlife sanctuary / national park is falling in the proposed alignment. The area has only domesticated fauna. There is no presence of any wild life or sanctuary within a distance of 10 km.

2) Construction Phase

- **Nilgai-Boselaphus tragocamelus** is the most common wildlife found in the study area. Construction activity is likely to affect the movement of the animal. However, to compensate, sufficient number of underpasses are provided at the detour section.
- Felling of trees is likely to affect the avifauna. However, the impact is not significant.
- Any construction near water bodies may impact the aquatic life. However no major water bodies are significantly affected due to this project.
- The impact on habitat is likely to be permanent, as the DFC will fragment the area which will restrict the movement of animals on either side.

3) Post Construction Phase

- The movement of freight train is likely to restrict the movement of animal on either side of the track, specifically in the detour section.
- Possibilities of collision of domestic animals with freight train.
- Disturbance of domestic animals due to the noise produced during the passage of trains.

7.3.8 ASI Protected Monuments

There is no presence of ASI protected monuments within 500 m of proposed alignment of Khurja –Dadari section of DFC.

7.3.9 Other Sensitive Structures

A number of sensitive structures likely to have impact as described in Table 4.2. Sensitive receptors include school, and hospitals. Some will have impact due to noise and vibration at the time of railway operation. Appropriate mitigation measures shall be undertaken as suggested in Chapter-8.

7.3.10 Impact due to Construction of Freight Station, Electric-sub Stations, various Signaling Facilities etc.

No major impact is expected because these facilities are planned on barren / agriculture land along the alignment and limited land is required for their construction. However, safety features shall be provided along these structures as per the railway manual and safety norms.

7.4 ENVIRONMENTAL MATRIX

Based of the potential impacts on natural resources in planning construction and operation phase an impact matrix has been created. The scale of impact is discussed above under individual parameter with mitigation measures. The Environmental

Impact Matrix for pre-construction and construction stages are provided in **Table 7.3 and 7.4** respectively.

Most of impacts are localized, insignificant and temporary in nature, except those related to noise and vibration during the operation phase.

Table 7-3: Impact Matrix (Pre-Construction & Construction Stage)

S.No.	Items	Overall Evaluation on the Project	Pre-construction Stage			Construction Stage											
										Construction Works for railway line and related structures							
			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.	Operation of Construction Plants, Machines and Vehicles for Construction Works	(A) Construction Works for Railway Lines and Installation of Related Facilities (signals, rails, etc.)	(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	Localized Employment Opportunities of the Construction Works	Localized Business Opportunities Related to the Construction Works
1	Topography and Geology	C	D	D	D	C	C	C	C	C	C	D	D	C	E	E	C
2	Soil	B	D	D	E	B	B	C	C	C	C	B	D	D	E	E	E
3	Groundwater	C	D	D	C	D	D	D	D	D	D	D	D	D	E	E	E
4	Hydrological Condition	D	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	E	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	D	D	D
8	Local Meteorological Conditions	E	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
9	Global Warming	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D

Table 7-4 : Environmental Impact Matrix (Post Construction Phase)

S.No.	Project Activities / Items of the Environment Subject to Positive / Negative Changes	Traffic conditions of passenger trains	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	C	D	D	D	D	C	C	C	C
2	Soil	E	D	D	E	D	E	C	C	C
3	Groundwater	E	D	D	C	D	D	D	D	D
4	Hydrological Condition	E	C	C	C	D	C	D	D	C
5	Coastal and Marine Environment	Not Applicable								
6	Fauna, Flora and Biodiversity	D	D	C	C	C	C	D	C	C
7	Protected Areas / sanctuaries	E	D	D	D	E	D	D	D	D
8	Landscape	E	D	D	D	D	D	D	D	D
9	Local Meteorological Conditions	E	D	D	D	D	D	D	D	D
10	Global Warming	E	D	D	D	D	D	D	D	D

Table 7-5: Scaling of Impacts on Natural environment due to DFC Section from Khurja- Dadari Section

IDENTIFICATION, PREDICTION & EVALUATION OF IMPACT

S.No.	Natural Environment Contents	Scaling	Reasons (during construction phase)	Reasons (after-construction phase)
1	Topography and Geology	C/ D	C-During construction marginal changes in Topography are likely to take place because of excavation, construction of bridges, embankment etc. 2) No significant change in Geology is anticipated as requirement of construction material is not significant.	D: Negligible impact, no change is expected.
2	Soil Erosion	C/D	C-During construction marginal effect on soil because of erosion is likely to take place due to the loss of upper crust of soil in the local area. The impact will be marginal only since the project is linear in nature.	D: Negligible impact
3	Ground water	D	D: Negligible impact is likely to occur There will be requirement of about 3300 litres/day for every km of length	D: Only marginal impact is supposed to be felt. As there will be requirement of water for operation of stations.
4	Hydrological Condition	D	D: negligible, no river involved	D: no significant impact.
5	Costal and Marine Environment	E	E: No impact	E: No impact
6	Fauna, Flora and bio diversity	D	Loss of marginal herbal cover. This will be due to cutting of trees and removal of vegetation from ROW	D: Only marginal impact is supposed to be felt.
7	Protected areas, Natural/ecological reserves and sanctuaries	E	E: Negligible impact, no such area is getting directly affected. It is not within 10 km radius	D: Negligible Impact
8	Landscape	D	D: Negligible impact	D: Negligible impact.
9	Local meteorological condition	E	E: No impact	D: Negligible impact
10.	Global Warming	E	E: No impact	Positive impact as shifting of freight transportation from road to rail will decrease the emission of greenhouse gaseous
11.	Air Pollution	D	D : Negligible impact	Positive impact due to shifting of freight transport from road to rail as rail transport requires six times less fuel as compared to road

7.5 IMPACTS DUE TO VIBRATIONS

Vibration is a complex phenomenon. Railway vibrations are generated by motion of heavy loads on tracks. Vibrations become more complex as speeds of motion change. Further complications are introduced by complex scenarios of multiple trains running in the same or opposite directions to each other. Vibrations require a medium for their transmission. Any variation in the medium present between the track and point of impact plays a significant role and complicates the assessment further.

Most studies in developed countries have ignored the variation due to multiple factors. Type of trains, speed has always been considered by them. However impact of variation in medium (ground) between the track and point of impact has mostly not been included in these studies. It did not bring inaccuracy in their estimations and prediction since a wide strip on both sides of the track was of only one kind / medium. They did not have the variety of the magnitudes we see in India. The advantage of this simplicity was easy to use of formulae and correlation in those studies.

We have included factor of variation in this medium in our studies and therefore been able to follow an assessment of impact that is more close to the ground scenario along the corridor.

In our study we have depended heavily on live data from real vibrations caused by the trains. From this data, we have picked up the highest vibration generating trains / speed / load / ground and situations. These are all live values and are not estimation. Having picked up these values, graphical extrapolation is used to estimate the vibration levels for train speed of 100 kmph. Thereafter, standard mathematical calculations have been applied to estimate the vibration levels due to multiple trains running together.

In chapter 4.5 we had provided a detailed justification for using Japanese ' standards 'JIS Z8735 and JIS 1510'. We have further explored the Laws relating to Factory Act, labor laws and laws for occupational health for co-relating norms. We have, however, not found any standards or limits relating to building vibrations or human annoyance due to vibrations. Most these laws cover are the whole body or hand arm vibrations caused by tools and equipment used by the workers. So we have remained aligned to Japanese standards quoted above and have used 'Db' as units of measurements. This unit also helps in calculating combined effect of two adjacent vibration levels by way of simple formula. The formula used is

$$Lmax_{eq} = Lmax_{\text{track 1}} - Lmax_{\text{track2}} + Lmax_{\text{track 3}}$$

As No of variables existing in this study are over a dozen we have not used co-relational equations to estimate as we expected it to introduce mathematical errors in the calculations. Instead we depended on Real time values and graphical assessment and extrapolation.

Methodology

We have therefore channeled our study in following steps

1- Identification of Impacts of Freight trains having different kinds of wagons.

2- Identification of category of train (wagons) causing highest vibrations.

3-.Identification of impact of train speeds on vibrations

4.-Identification of impact of train axel loads on vibrations

5 -Identifying highest vibration level from above data

6- Extrapolating this highest level of vibration for train speed of 100 km / hr

7- Calculation of change in this value of vibration of single train due to presence of multiple trains running together

8-Purifying this highest value for any effects of medium variation between the track and measurement point

9-Predicting the Maximum vibrations for plain route and for populated areas

10-Transposing vibration levels so estimated on to Sensitive Receptors identified and predicting the impact.

Identification of Impacts:

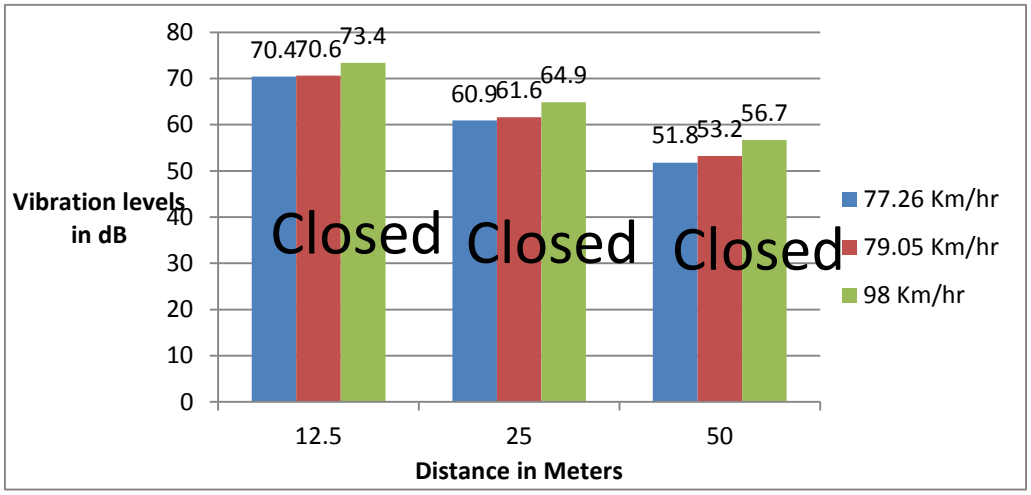
We have identified several kinds of impacts from the data collated in previous chapters Typical these impacts could be of following types

1) **Impacts in Plane areas ie** travel of Vibration; reverberations at 90 degree to the track will affect all the buildings, archeological Monuments, inmates of the building. These variations in vibrations could be due to following factors;
   - Distances from the track
   - Speed and
   - Axel loads
   - Train Crossings
2) **Impacts due to train crossings ie** trains while crossing each other or while running parallel to each other in 2 or more numbers cause overall vibrations to increase or reduce. This aspect is to be taken into consideration for estimating maximum impacts in each of the above two situations
3) **Impacts in Populated Areas ie** travel of Vibrations, reverberations through the variety of ground conditions existing between the track and point of measurement / impact assessment. Varieties existing included mix of plain, embankment, hard standing platform of building floors, and roads. .

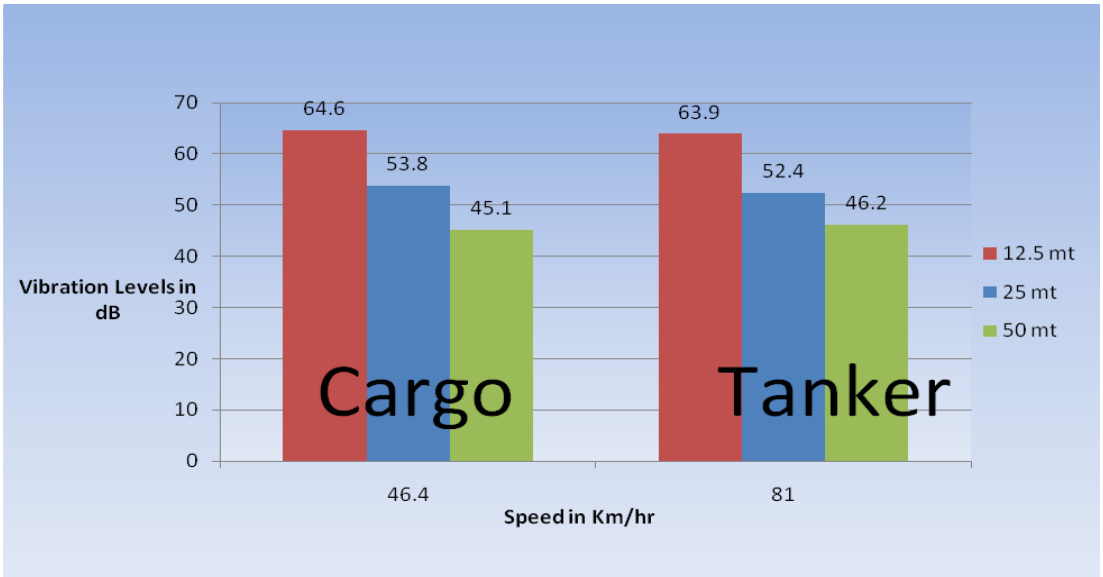
Impacts in Plain areas vis a vis distances from the track

We have compared the existing distance based vibration levels being generated by the trains running on the existing tracks. For the four categories of freight trains considered by us, the levels of vibrations generated in plane areas are provided in the figures below.

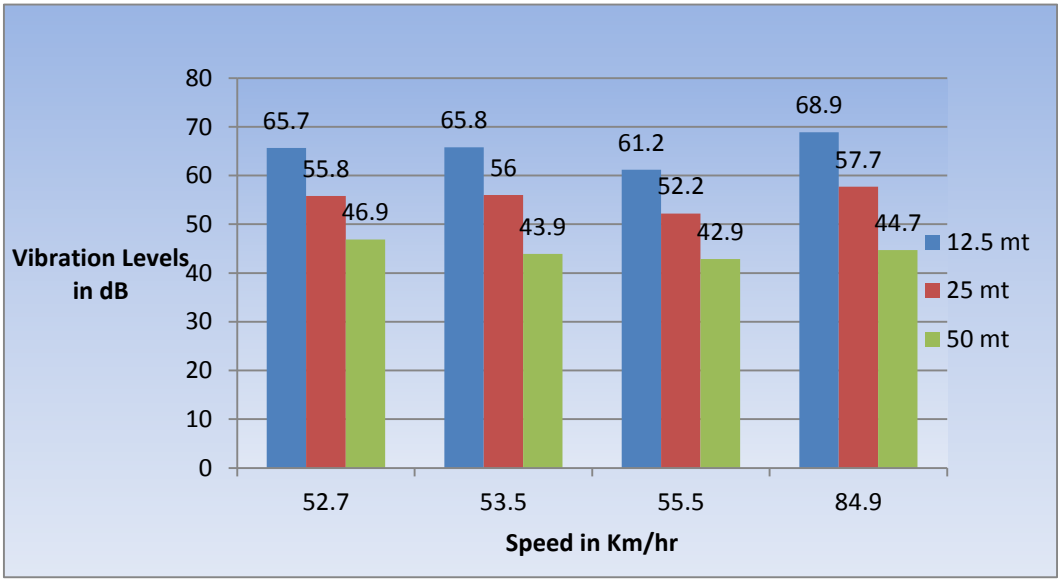
Closed Wagon



Tanker and Cargo



Open Wagon



From the graphs above, we can select the highest vibration levels of all the categories of train for one distance (say 12.5 or 25 or 50 meters) as the upper limit for that distance, for estimating the impact at 90 degree to the track. This is tabulated below.

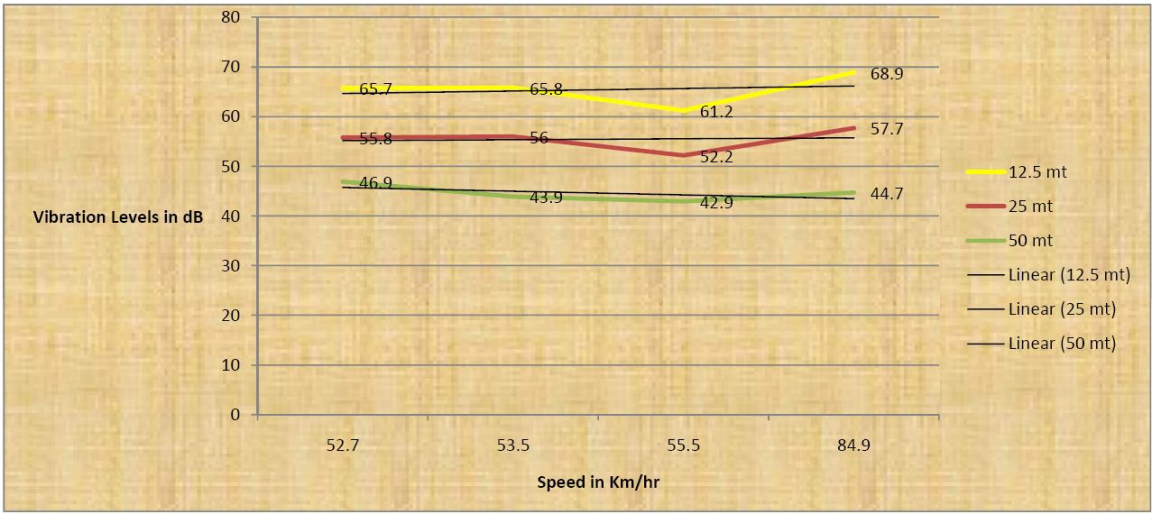
Table 7-6: Highest Vibration Levels for All Category of Trains

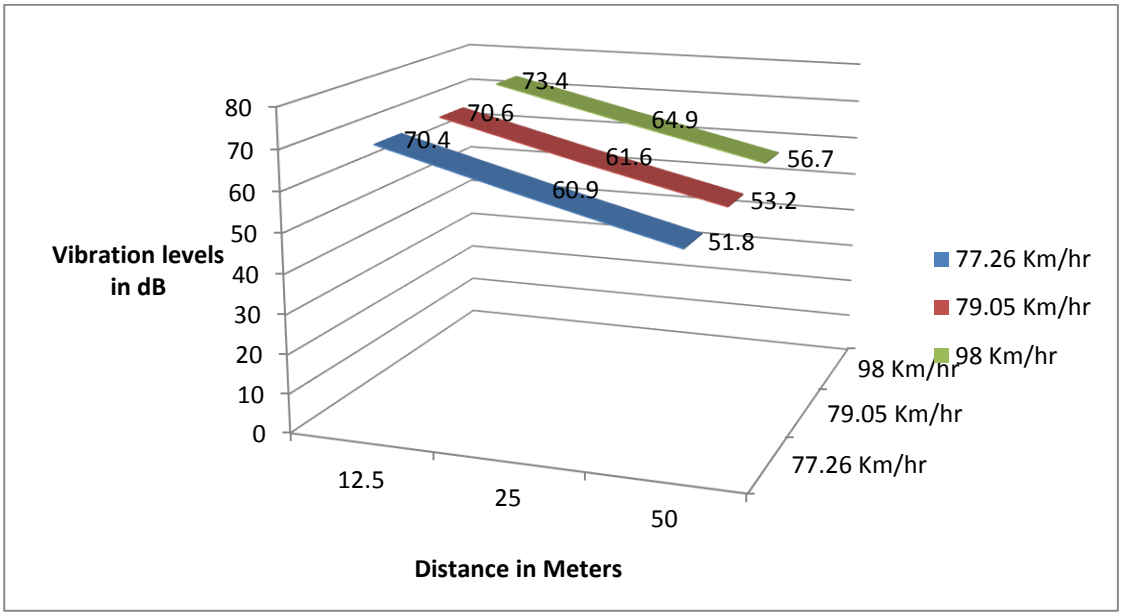
Distance	Maximum dB
12.5	73.4
25	64.9
50	56.7

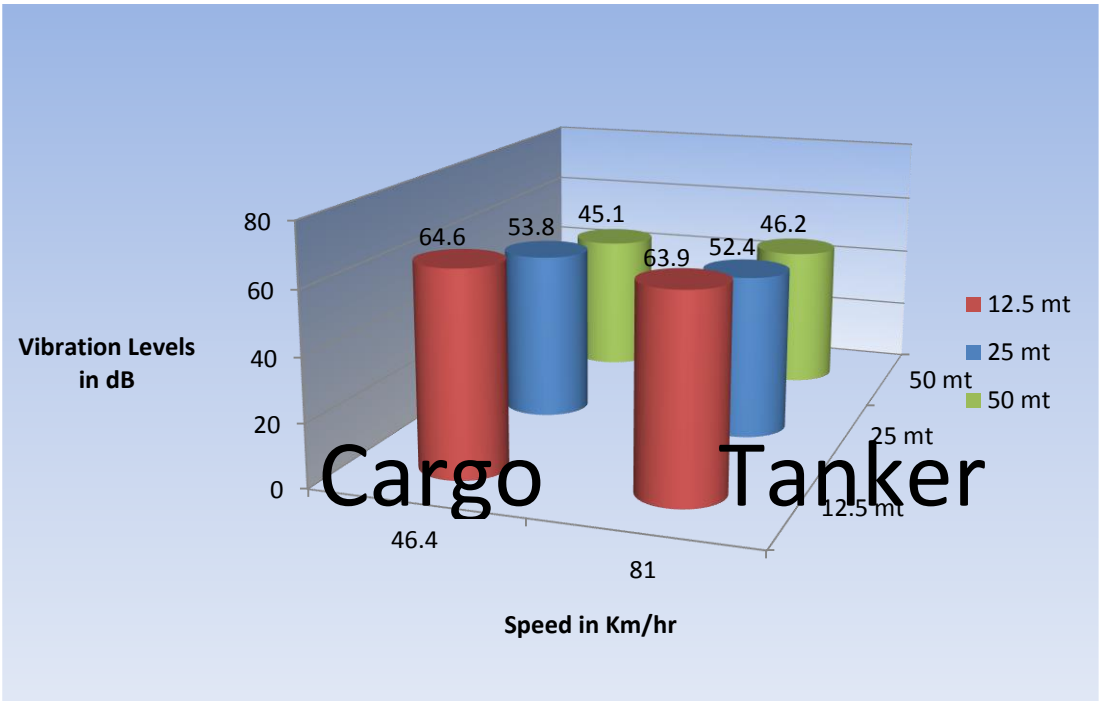
These values for all the three distances coincidentally correspond to only one categories of freight train that is **Closed Wagon**; Graph for this is produced below:

Impacts with speed and axel load were also similarly evaluated. These were identified for

- maximum speeds of trains in each category as well as for
- maximum vibration in these categories and are as placed below:

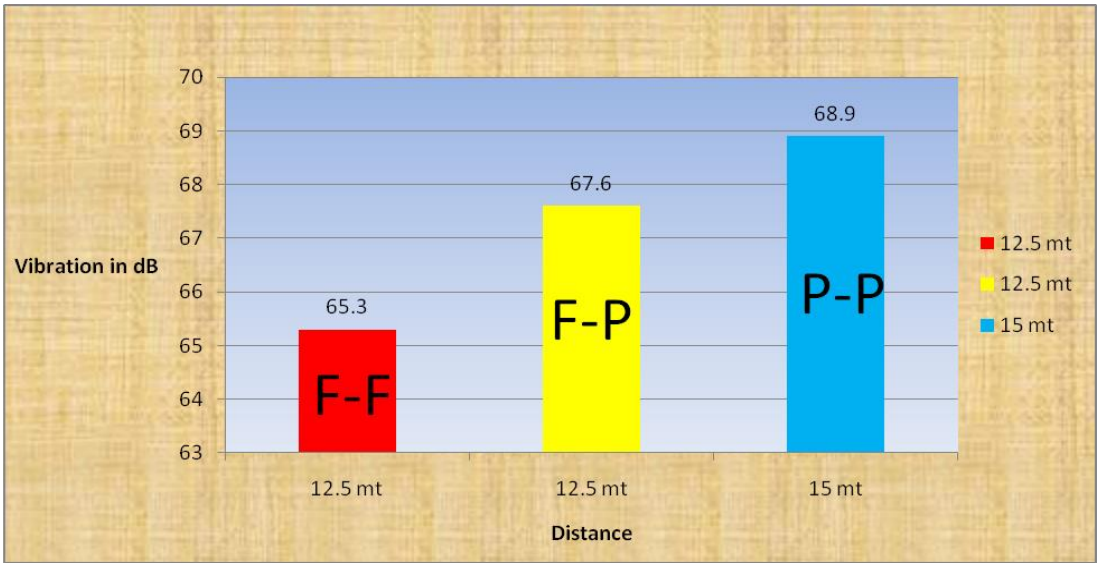






Impacts of Two Train Crossings

The data available includes several occasions of crossings of trains. These are in the form of Passenger – Passenger crossing (P-P), Passenger – Freight crossing (P-F), Freight – Passenger Crossing (F-P) and Freight – Freight crossing (F-F). These crossings are representation of similar crossing likely to take place on DFC on parallel tracks. F-F crossing is representation of similar crossing on detours.



From graphs above it is inferred that in parralel section maximum vibrations occur when two Passenger trains cross each other. The expected level is 68.9 dB at 15 Meters. For detour section this will be a crossing between 2 freight trains. Using the graph for vibration amplitude versus distance from the track, its value can be extrapolated.

Impacts in populated areas on residential / commercial / Industry/ Social structure. It is quite possible to generate similar charts for residential/ industrial / commercial complexes including sensitive receptors. However it will not be completely appropriate to use these graphs for assessing impacts on other buildings etc along the track. The variation will be due to dis-similarities of the grounds between the railway track and point of measurement for different structures considered for estimation of impacts. Additionally impact of vibration caused by road traffic and other movements in corresponding locations may further complicate the estimation. Therefore the data collected for such location has also been assigned as reference vibration levels for typical structures interfacing the track and the measurement point, The reference data is appended below in **Tabe-7.7**:

Table 7-7: Suggested Vibrations Interfacing Structures For Sensitive Receptors

S. No	Name of Location	Distance(m) from EDFC Track	Lmax	Interfacing Structure
1	School at Khurja(km 1369.82)	5	80.9	Relocation
2	School at Dankaur (km 398.200)	10	76.2	Relocation
3	College at Wair at km 1389.55	500	36.3	No need for any mitigation

These reference vibration levels for different interfacing ground studies can be transposed to impacted structures under assessment at any location with similar interfacing structure.

Prediction of Impacts

The Vibration measurements carried out fall into two groups broadly: For the portion of corridor that will run parallel to the existing track and portion of the corridor that will go through the detours. Parallel track, running of the trains will engage maximum of five parallel tracks. Of these two would be occupied by the freight trains and three by Passenger trains (including RVNL line under implementation). The corridor will be completely together and will be parallel to the existing track. Average distance between the centre of passenger and freight trains is expected to be 23 meters

The levels of vibration on 2 tracks have been examined in previous section. Since the 3rd track scenario was not available for actual evaluation in locations where trains were running at reasonable speeds, we have mathematically calculated the same. Vibrations on parallel tracks for trains running together on these tracks have also been evaluated below.

Of all possibilities, maximum vibrations will be generated by the various combinations of trains running on 3 closest tracks as these trains have maximum influence of individual vibrations on each other. From the graphs of two trains crossing each other as placed in previous section, we notice the highest Vibration Level for two train crossed is 68.9 dB for Passenger – Passenger combination. This is however very much below the levels caused by single freight train running on the nearer track. The reason for this phenomenon to occur is the fact that both the trains are running opposite to each other and are therefore canceling effect of vibration waves generated by them individually.

Calculations

Check for vibrations for 100 Km/Hr train speed:

By examining the trend of change in Vibration Levels with the increase in speed in the graphs in previous sections we notice that in most cases the vibration levels

increase with increase in speed. We have extrapolated this trend of vibration of freight container & estimated the **vibration level at 100 km/hr to be 71.4 dB**. This however is lower than the maximum vibration level for single freight train being considered by us and therefore not relevant

Check for multiple train running:

From the measurements and graphs as discussed earlier the maximum level of Vibrations occurring for any Freight container Train on any track and at 12.5 mts from the center of the concerned track (Container) = 75.3 **dB**

The Mathematically Attenuated value calculated for vibration at 35 meters in reference to the train running on the 3rd track = **72.8 dB** (Refer variation of vibrations with distance for containers)

Combined effect of these two Vibration Levels at the same measurement location that is 12.5 meters from the nearer track can be calculated as follows.

$$\mathbf{Lmax_{eq} = Lmax_{\ track\ 1} - Lmax_{track2} + Lmax_{\ track\ 3}}$$

In the light of this discussion for predictions, 75.3 **dB** as highest vibrations for freight trains have been used in our calculations below.

Predicted Vibration Levels for multiple trains running together– These estimations workout as below.

<u>On DFC side of parallel Track</u>

1. On the freight corridor side, two freight trains running in opposite directions with a gap of 5 meters from each other.
   - Highest value of Vibration level by one freight train = 75.3**dB**
   - This level attenuated to 17.5 mts for second freight train = **71.5 dB**.

For these trains running in opposite directions, resultant level is difference of the 2 vibration levels.

$$\mathbf{Lp_{F\text{-}F} = 10*LOG\ (10\text{^}(75.3/10)\text{-}10\text{^}(71.5/10))} = \mathbf{72.9\ dB}.$$

2. One freight train running closer to the 12.5 mts measurement point in the same direction from a passenger train 10 mts away
   - Highest value of Vibration level by one freight train = **75.3**
   - Highest value of Vibration level of passenger train attenuated to 35mtrs = **72.9**

   Since both the trains are running in same direction the relevant level will be addition of the two levels

$$\mathbf{Lp_F + Lp_{Psngr} = 10*LOG\ (10\text{^}\ (75.3/10) + 10\text{^}\ (72.9/10)) = 77.2}$$

3. A Freight train running on the 2nd track farther from the 12.5 meter measurement point and a passenger train running opposite to its direction in the third track.
   - Highest value of Vibration Level of Passenger train attenuated to 35 meters = **72.9**
   - Highest Value of Vibration level by one Freight train attenuated to 20 meters = **71.5**

   Since the trains are running in opposite directions. Therefore, resultant value is difference of the 2 vibration levels.

$$\mathbf{Lp_{\ F\text{-}P} = 10*LOG\ (10\text{^}\ (72.9/10)\text{-}10\text{^}\ (71.5/10)) = 67.3\ dB}$$

4. The next scenario is for vibrations on parallel tracks for three trains running together on the first three Tracks.
   - Highest Value for the Vibration Level by Freight – Passenger in First and Third Track running in same direction: **77.2**

- Highest Value of Vibration level by one Freight train running in 2nd track attenuated to 20 meters = **71.5**

Since this is a scenario of parallel running of the trains in composite manner

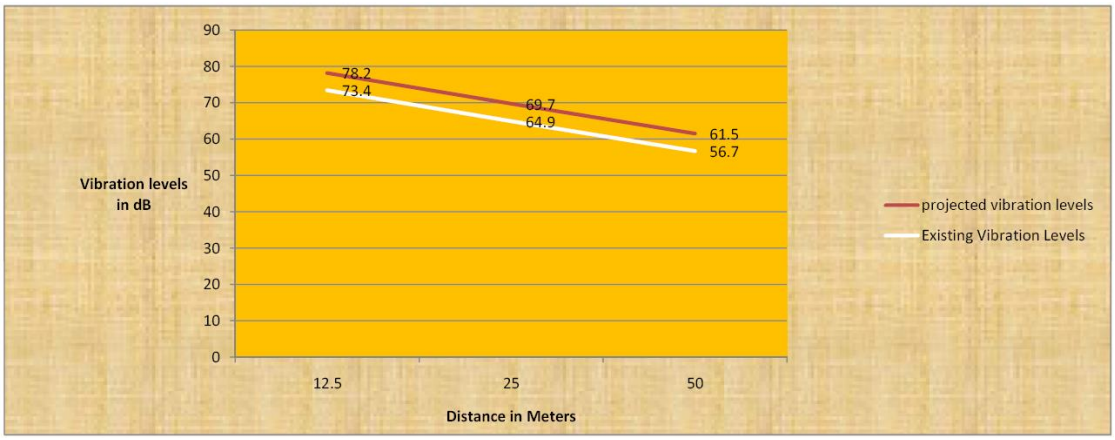
$Lp_{F\text{-}F\text{-}P}$ = 10*LOG(10^(71.5/10)+10^(77.2/10)) = 78.2 dB

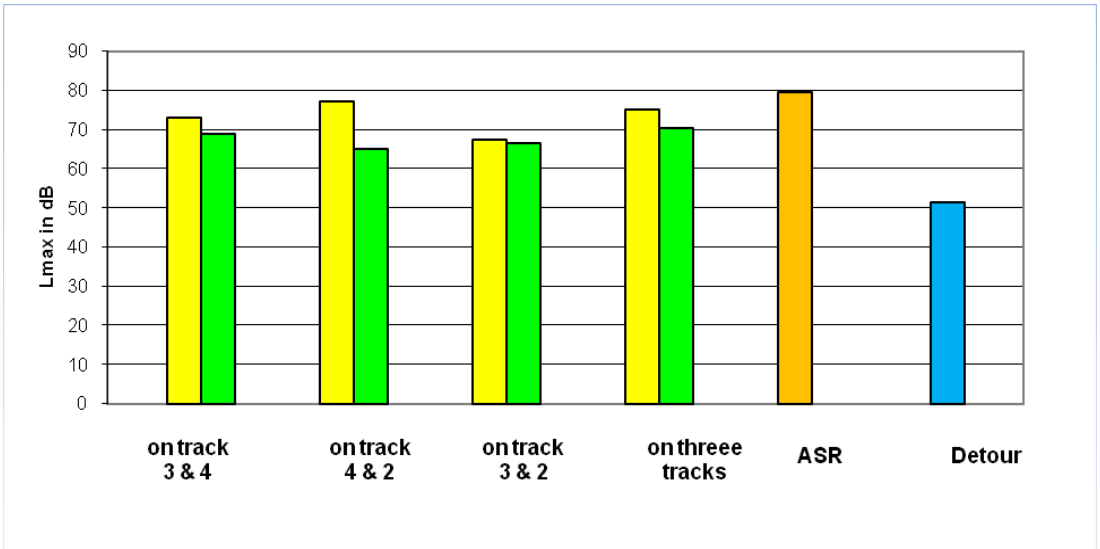
On Passenger Track Side

5. On the other side of all four tracks the situation will be driven by passenger train in similar four possibilities. The evaluated highest Lmax for these four possibilities are:
   i. 2 Passenger trains running on track 4 and 3 opposite to each other= 68.9 **dB**
   ii. 1 Passenger in track 4 and one freight on track 2 both in same direction=**65.1 dB**
   iii. 1 Passenger on track 3 and one freight on track 2 both in opposite direction- **66.5 dB**
   iv. 2 Passengers on track 4 and 3 and one freight on track 2 = **70.4 dB**
6. The other less effective combinations would be different mixes of trains running on, third and fourth tracks.

From all the above calculations we consider the worst case scenario for plain routes and select the maximum vibration levels as upper limit expected to be encountered , The maximum possible vibrations as calculated above = **78.2 dB. I**t occurs when 2 freight and one passenger trains run together on first 3 track of DFC track side.

We display below graphically the predicted values for various distances from the track alongwith the graph for freight train vibrations for the similar distances.





Predicted highest Vibration Levels for the Detour track – These estimations workout as below

For the detour locations the scenario will always be two Freight trains crossing each other in opposite directions for which we have calculated highest Vibration level as **71.5 dB** at 12.5 meters measurement point, when the interfacing ground is plain ground.

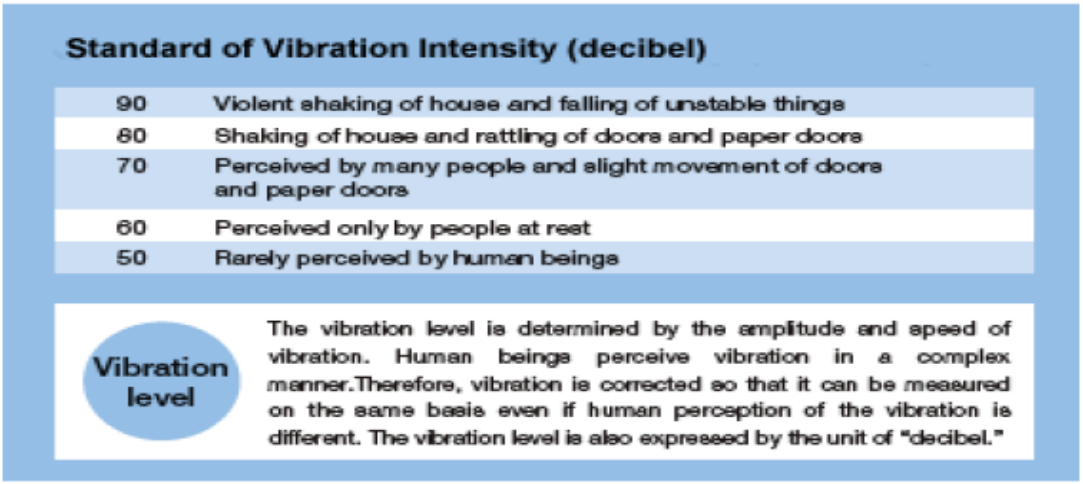
However this value is lower than the highest Vibration Levels generated by running of Single Freight train.

Therefore predicted highest vibration levels for the detour portions = **75.3dB** at 12.5 meters from nearer track for freight containers.

Evaluation of Impact

Based on the predicted values, evaluation of the impacts has been carried out in following steps:

1. We have examined the Japanese standards for Permissible Vibration values in Habituated and Plane areas. The pictorial information in this regard which also includes the level of complaints received by procure department of railway vibration in 2006 is displayed below;



From the extract above it is apparent that standards 70 dB vibration level defines the acceptability criteria in general, however in densely habituated areas the lower level

will have to be allowed based on these criteria the permissible limits for vibrations are provided below.

As worked out in the prediction process above, various highest vibration levels likely to occur in different portions of the DFC are as below:

Plain route: 78.2 as against permissible levels of 70dB at 12.5 m distance

Populated areas 78.2 as against permissible levels of 65dB at 12.5 m distance

Therefore vibration levels have to reduced by

8.2 dBs - for Plain areas

13.2 dBs - Populated areas

8.2 to 13.2 dBs - plain / SR area

In case of detour sections the ROW has been kept as 60 m. The alignment is far away from habitations; hence no vibration impacts are anticipated.

Prediction of Impacts on Sensitive Receptors

Prediction of Impacts on Sensitive Receptors based on the methodology described above has been carried out. The SRs have been identified during survey of the track alignment. From these listed receptors, those falling within the track alignment have been eliminated as they would require removal replacement or shifting. The balance receptors have been listed and predicted levels have been estimated. These details are given in **Table 7.8**.

Table 7-8: List of sensitive Receptors and Predicted Vibration Levels dB(A) on them

S.N.	Type of Receptors	Name	Location/ Chainage Nearby	Parallel / detour	Distance from the centerline of the DFCC alignment (Meter)	Side (w.r.t Kanpur to Khuja)	Predicted max Vibration before mitigation
1	Educational	School	Khurja at km 1369.82	Parallel	5	L	81
2	Educational	School	Dankaur km 1398.2	Parallel	10	L	77
3	Educational	College	Wair at km 1389.55	Parallel	500	L	37
4	Educational	School	Dadari at km 1415	End Point	20 m	L	74

Accordingly, first two have been recommended for relocation and third one does not need any mitigation as is too far to have any impact due to vibration.

7.6 PREDICTION AND EVALUATION OF IMPACTS ON NOISE ALONGSIDE RAILWAY LINES

The detailed railway noise survey was conducted at 04 locations in the entire stretch. The result shows that during train operation along the railway track the noise level always exceeds the statutory limit; however, at detour locations the noise levels are less and within the statutory limits. For the prediction purposes, the highest noise level i.e. 100.4dB (A) recorded at 12.5m from the centre of the existing track used as a reference for maximum noise level prediction. The Leq noise level recorded at 12.5 m is around 97 dB(A) from the centre of the track is taken as reference for Leq noise level prediction.

Examination of Prediction Method

1) Railway Noise

Regarding railway noise generated by conventional trains (local trains, express trains and limited express trains), main causes include (1) traction movements, (2) structures and (3) machines equipped to the train. Among them, the traction movement contributes to the generation of noise greatly.

Several types of prediction equations were proposed for various types of railway track structures, such as the elevation, embankment and cutting.

Therefore, prediction was carried out applying the actual data of railway noise level, running speed (V) of trains, and the distance from center of the nearest railway track (D).

Based on the obtained the data of railway noise, the empirical equation was extracted by using a simple regression and correlation analysis. The following equation is used for noise prediction.

Assuming V is constant, D is only one variable, and the empirical equation is shown below. A predicted railway noise level is shown in the below table.

$$L_2 = L_1\text{-}20 \text{ Log } D_2/D_1 \qquad \text{---------- (1-1)}$$

$$L_{Aeq} = 10 \text{ Log } (10^{N1/10} + 10^{N2/10} + 10^{N3/10} + \text{.....})/T$$

Where,

L_1 and L_2 are the noise levels at D_1 and D_2 distance.

N_1, N_2, N_3 are the noise pressure levels at a different time interval. T is the number of reading.

(Reference: JICA Study on DFCC Corridor)

1) Condition of Prediction

Following conditions are assumed:

- Type of traction: electrified traction (electric locomotive)
- Running operation: 150 trains/direction/day with the same time interval (approximately one train for every five minutes)
- Maximum running velocity: 100 km/h
- Majority of the existing railway line structures is the embankment structures with approximately 2 to 5 m high from the ground level at the site.
- Railway noise and vibration generation level due to planned dedicated freight train; remains the same as the existing freight train,
- DFCC plan would have various factors contributing to reduction in railway noise.

2) Prediction and Evaluation Points

a) Sites along the existing railway lines within the parallel sections of the DFCC Project.

1. Sites along the planned detour routes where no railway noise was observed as a reference point of the background level monitoring.

Prediction and Evaluation Results

1) Prediction of Railway Noise Levels

Estimated noise levels (L_{Aeq}) were evaluated by using comparative and trends from (i) the ambient noise standard in India, (ii) existing ambient noise levels at SR and (iii) existing railway noise at SR.The noises level predicted are presented in **Table 7.9**.

Table 7-9: Prediction of Noise Level on Sensitive Receptors

S.N.	Type of Receptors	Name	Location/ Chainage	Parallel / detour	Distance from the centerline of the DFCC alignment (Meter)	Side (w.r.t Kaurara to Chamraula)	Predicted max noise, dB(A)	Predicted Leq Noise Level, dB(A)	Remarks
1	Educational	School	Khurja Km 1369.82	Parallel	5	L	98	72.0	Relocation recommended
2	Educational	College	Wair	Start of Wair Detour	500	L	59	54	Noise mitigation not required due to adequate Distance
3	Educational and Residential, and Commercial	Mixed	Km 1415.69	Parallel (end Point)	20	L	77	73	Noise barrier wall recommended
4	Residential	Residential	Ajayabpur (km 1406.46)	Parallel	20	L	75	71	Noise barrier wall recommended
5	Educational	School at Dankaur (km 1398.2)	Km 1398.2	Parallel	10	L	88	83	Relocation Recommended

Analysis of Evaluated Results

The noise levels have been predicted at all the sensitive receptors located up to 150 m from the centre of the proposed track. The predicted noise level shows that noise level is considerably high at all the locations up to 100 m from the centre of the track. However, no barrier has been considered during the prediction, therefore, the actual noise level may be less due to attenuation of noise. The noise levels were also monitored at four sensitive receptors and combined impact due to the proposed DFCC project is given in **Table 7.10.**

Table 7-10: List of Sensitive Receptors

S. No.	Sensitive Receptors	Monitored Noise Level		Resultant Noise Level,		CPCB Standards ,		Remarks	Distance (m) from Track
		Day	Night	Day	Night	Day	Night		
1	School at Khurja km 1369.82	65.4	48.4	72	66	50	40	Exceeds the CPCB noise standards	5
2	Wair College km 1389.55	49.8	44.0	52	46	55	45	Too far away	500
3	School at Dadari km 1415.69	66.2	52.4	67	59	50	40	Exceeds the CPCB noise standards	20
4	School at Dankaur km 1398.2	68	55.0	70	63	50	40	Exceeds the CPCB noise standards	10

Unit- Leq, dB (A)

Note: All sensitive receptors except sl. No. 2 have been recommended for relocation.

As predicted in the table, the noise levels are going to exceed considerably near the proposed track at detour section. The noise levels at all the locations are exceeding the specified limits of CPCB. The impacts of noise levels due to construction of detours will be reduced at the habitations such as Wair and Khurja Flyover up line.

CHAPTER 8 MEASURES FOR THE MITIGATION OF ENVIRONMENTAL IMPACTS

8.1 DESCRIPTION OF MITIGATION MEASURES

The mitigation measures to mitigate the negative impacts due to the development of proposed EDFC section from Khurja to Dadari on various elements of the environment during various phases of the project are described hereunder.

8.1.1 Mitigation Measures of Land Environment

Land acquisition, soil erosion and contamination of soil have emerged as major impact on land, especially in rural areas. Proposed DFC will result in economic growth in the region over time.

Table 8-1: Mitigation Measures for Land Environment

S. No.	Item	Impact	Impact (Reason)	Mitigation / Enhancement
1.	Change in topography	Negligible impact	Due to embankment raising	Turfing will be provided on the slopes
2.	Change in geology	Direct, long term, marginal impact	Extraction of materials (borrow earth, coarse & fine aggregates)	No blasting is envisaged All quarries outside study area and only licensed quarries having redevelopment plan will be used.
3.	Change in seismology	No impact	Since marginal impact geology have been identified therefore no impact on seismology	All project related structures will be complied with earthquake safety factor
4.	**Change in Land Environment**			
a.	Loss of land	Direct, long term negative impact for acquired land	Land acquisition change in land use pattern	Land requirement been minimized as maximum length under parallel section. Only two small detours (Khurja Flyover up line and Wair) proposed.
b.	Generation of debris	Negative impact	May contaminate air, water and land, if not disposed properly	Debris may be generated during construction. Its disposal dumping sites will be identified during implementation.
c.	Soil erosion	Low , direct, long term negative impact	Slopes and spoils near the bridges Construction of new bridges and culverts quarry and borrow areas	Embankment protection with turfing Residual spoil will be disposed properly silt fencing will be provided near water coarses specially at locations of distributories., Karon river and canal
5.	Contamination of soil	Direct, long term negative impact	Discarded bituminous waste during service road construction.	Measures to prevent soil pollution will be in place. Hazardous Waste (Management and

S. No.	Item	Impact	Impact (Reason)	Mitigation / Enhancement
			Oil & diesel spills Emulsion sprayer and wastage material from hot mix plant Residential facilities for the labor and officers Routine and periodical maintenance	Handling Rules, 1989) to be enforced. Oil interceptor will be provided for accidental spill of oil and diesel Rejected material will be layed in village roads or as directed by engineer Septic tank will be constructed for waste disposal
6.	Soil quality	Limited impact restricted to area where DFC alignment proposed	To see the Effectiveness of planned mitigation measures Any unforeseen impact due to accidental spillages	Measures will be revised & improved to mitigate / enhance environment due to any unforeseen impacts Spilled material will be recovered and contaminated soil will be disposed off as per provisions Hazardous Waste (Management and Handling Rules) 2000

Plantation programme will be carried out to improve the aesthetic look of the construction area. The plantation all along the proposed DFC will be carried out to improve aesthetic look along the existing as well as detour locations. It is proposed to plant ten trees per km on either side of the alignment.

8.1.2 Mitigation Measure for Borrow Area Management

Borrow areas will be finalized either form the list of locations recommended by DPR consultants or new areas identified by contractor. The finalization of locations identified by DPR consultant or identified by contractor depends upon the formal agreement between landowners and contractor and its suitability from civil engineering angle as well as environmental considerations. Meeting the guidelines/notifications as stipulated from time to time by the Ministry of Environment and Forests, Government of India, and local authorities, as applicable shall be the sole responsibility of the contractor.

Besides this certain precaution has to be taken to restrict unauthorized borrowing by the contractor. No borrow area shall be opened without permission of the Engineer/EO. The Engineer in addition to the established practices, rules and regulation will also consider following criteria before approving the Borrow area.

i. Avoid any embankment slippage, the borrow areas will not be dug continuously, and the size and shape of borrow pit will be decided by the Engineer. Redevelopment of the borrow areas to mitigate the impacts will be the responsibility of the contractor. The contractor shall evolve site-specific redevelopment plan for each borrow area location, which shall be implemented after the approval of the Enginner-in-Charge.
ii. Ensure that the spills, which might result from the transport of borrow and quarry materials do not impact the settlements. It will be ensured that the excavation and carrying of earth will be done during day-time only. Unpaved surfaces used for the haulage of borrow materials will be maintained properly. Borrowing of earth shall be carried out at locations recommended as follows:

- **Non-Cultivable Lands**: Borrowing of earth will be carried out upto a depth of 2 m from the existing ground level.

  Borrowing of earth shall not be done continuously. Ridge of not less than 8m width shall be left at intervals not exceeding 300 m. Small drain shall be cut through the ridge, if necessary, to facilitate drainage. Borrow pit shall have slope not steeper than 1 vertical in 4 horizontal.
- **Productive Land**: Borrowing of earth shall be avoided on productive/ cultivable lands. However, in the event of borrowing from productive land, under the circumstance as described above, topsoil shall be preserved in stockpiles. The conservation of topsoil shall be carried out as described in this chapter. At such locations, the depth of borrow pits shall not exceed 45 cm and it may be dug out to a depth of not more than 30 cm after stripping the 15 cm top soil aside.
- **Elevated Land**: At locations where private owners desire their fields to be levelled, the borrowing shall be done to a depth of not more than 2 m or up to the level of surrounding field.
- **Borrow pit along Roadside**: Borrow pits shall be located 5m away from the toe of the embankment. Depth of the pit should be such that the bottom of the pit shall not fall within an imaginary line of slope 1 vertical to 4 horizontal projected from the edge of the final section of the bank. Borrow pits shall not be dug continuously. Ridge of not less than 8 m width should be left at intervals not exceeding 300 m. Small drain should be cut through the ridge to facilitate drainage.
- **Borrow pit on the River side**: The borrow pit shall be located not less than 15m from the toe of the bank, distance depending on the magnitude and duration of flood to be withstood. Flood zone of the river should be considered.
- **Community / Private Ponds**: Borrowing can be carried out at locations, where the private owners (or in some cases, the community) desire to develop lands (mostly low-lying area) for use as fishponds.
- **Borrow Area near Settlements**: Borrow pit location shall be located at least 1 km from villages and settlements. If unavoidable, they shall not be dug for more than 30 cm and shall be provided with drainage.

After identification of borrow area based on guidelines, contractor will fill reporting format as under and submit the same for approval to the “Engineer” Once approved the contractor will adhere to the recommendation for borrow area to the satisfaction of Engineer.

(1) In no case the depth of borrow area should exceed 2m from the existing ground level.
(2) Borrow pits slope should be maintained, no steeper than 1 Vertical: 2 Horizontal.
(3) Water pooling to be avoided/managed so that no disease spread or mosquito breeding due to water stagnation.
(4) Precautionary measures as the covering of vehicles will be taken to avoid spillage during transportation of borrow material.
(5) The unpaved surfaces used for the haulage of borrow materials shall be maintained properly for dust suppression.
(6) Haulage of material to embankments or other areas of fill shall proceed only when sufficient spreading and compaction facility is operating at the place of deposition, to minimize dust pollution.
(7) During rains appropriate measures shall be taken to minimize soil erosion, silt fencing shall be provided as directed by Engineer/EO.

The Contractor will keep photographic records of various stages i.e., before using materials from the location (pre-project), for the period of borrowing activities construction Phase) and after rehabilitation (post development), to ascertain the pre and post borrowing status of the area.

8.1.3 Mitigation Measures to Minimize Soil Erosion

1) Construction Phase

- Suitable protection measures consisting of bio-engineering techniques such as plantation of grass and shrubs may be provided to control erosion. The measures shall be applied along the slopes at high embankment where bridges will be constructed.
- Borrow area may be finalized considering ecological sensitivity of the area. Agriculture land shall be avoided for the borrow area as far as possible. Priority may be given to degraded area for excavation of borrow material. Rehabilitation of borrow area may be undertaken under the project.
- Construction work may be avoided during rainy season to evade erosion and spreading of loose material.
- Top soil removed from agricultural land may be stored separately in bund area and utilized during plantation or refilling of excavated area.
- Selection of borrow areas may be done considering the waste land available nearby in the district.
- A separate borrow area management plan may be made providing location, ownership details, timing of borrowing and rehabilitation measures.

2) Post-Construction Phase

- No impact is envisaged on soil during post implementation phase. Any damage or breach in embankment shall be repaired immediately.

8.1.4 Mitigation Measures to Improve the Ambient Air Quality

1) Pre Construction Phase

The dust generation due to pre-construction activities will be temporary in nature and localized. This will be effectively countered by sprinkling of water.

2) Construction Phase

In this stage, there are two major activities, **first** one is construction activities at working zone, which cause primarily dust emission and **second** are from operation of the construction plant, equipment and machinery, which cause production of gaseous pollutants. The specific mitigation measures include:

- Lose earth will be stored under cover or water will be sprinkled time to time.
- Hot Mix Plant and Crushers will be located atleast 1 km from habitations and in down wind direction.
- Vehicles delivering fine materials like loose soil and fine aggregates shall be covered to reduce spill on road.
- Water will be sprayed on earthworks, temporary haulage and diversion on a regular basis.
- Batch type hot mix plant fitted with the bag filter / cyclone and scrubber will be installed for the reduction of the air pollution.
- Pollution control system like water sprinkling & dust extractor and cover on the conveyor will be installed for the crushers.

- All vehicles, equipment and machinery used for construction will be regularly maintained to ensure that the emission level conform to the UPPCB/CPCB norms.
- Air pollution monitoring plan has been delineated for construction phase separately for checking the effectiveness of the mitigation measures adopted during the construction phase of the Contract. The monitoring will be taken up as per this plan.
- Air quality monitoring shall be conducted during construction period as per CPCB norms. The location and frequency of air monitoring are covered in Chapter-9.
- Impact on air quality is likely to be temporary and reversible.

3) Operation Phase

- Air quality of the area is likely to be improved as reduction in emissions due to shifting of freight from road transportation to railway transportation.
- Plantation along the DFC is likely to improve the air quality of the area.

8.1.5 Mitigation Measures for Water Quality

Due to the proposed project there will be some direct and indirect long term impacts on the water resources. Table below presents the major adverse impacts on the water resources and the mitigation measures proposed.

Table 8-2: Mitigation Measures for Water Quality

S. No.	Item	Impact	Impact (Reason)	Mitigation/Enhancement
1.	Loss of water bodies	Negligible as no major water bodies is being impacted.	• Part or acquisition of source of water	• Land acquisition to be minimized with provision of retaining walls • No village pond being impacted in Wair and Khurja Flyover UP lines • Relocation of ground / surface water sources
2.	Alternation of cross drainage	Negligible impact	• There is proposal for 4 minor bridges on Khurja Flyover UP line and 5 minor bridges Wair detour • Widening of minor bridges and culverts • Three major bridges planned in parallel section	• Construction of new bridges and widening of existing bridges and culverts there will be an improvement in the drainage characteristics of the project area • Adequate cross drainage structures have been planned on Khurja Flyover UP line and Wair detours
3.	Runoff and drainage	Direct impact	• Siltation of water bodies • Reduction in ground recharge due to incrased paved surface • Increased drainage discharge	• Silt fencing to be provided • Recharge well to be provided to compensate the loss of precious surface water resources • Continuous drain is provided, unlined in rural area and lined in built up areas.
4.	Water requirement for project	Direct impact	• Water requirement for construction activity. • Water requirement of labour • Water requirement	• Contractor will obtain approvals for taking adequate quantities of water from surface and ground water sources from the relevant authorities and

S. No.	Item	Impact	Impact (Reason)	Mitigation/Enhancement
			during operations at yards and stations	follow statutory guideidelines. This is required to avoid depletion of water resources. The project area is rich in ground water.
5.	Water Quality			
a.	Increased sedimentation	Direct impact	• Increased sediment laden run-off alter the nature & capacity of the watercourse	• Guidelines for sediment control will be enforced
b.	Contamination of water	Direct adverse impact	• Bitumen wastes • Oil & diesel spills • Emulsion sprayer and laying of hot mix • Production of hot mix and rejected materials • Residential facilities for the labour and officers • Routine and periodical maintenance	• Prevention will be taken to prevent pollution going into water body and ground water. • Hazardous Wastes (Management & Handling) Rules, 2000 to be enforced • Oil interceptor will be provided for accidental spill of oil and diesel • Rejected material will be layed in village roads or as directed by engineer • Septic tank will be constructed for waste disposal
6.	Water quality monitoring	Periodical checkup of surface and ground water quality	• To check the efficacy of mitigation measures • Any unforeseen impact due to accidental spillages	• Measures will be received & improved to mitigate / enhance environment due to any unforeseen impact

Contamination of water

- Oil interceptor will be provided at Construction camp sites and at Parking areas at Stations and other facilities.
- Construction work close to the stream or water body will be avoided during monsoon.
- The effluent standard notified under the Environmental Protection Act, 1986 will be strictly adhered to . All wastes arising from the project will be disposed off in a manner that is acceptable to the Uttar Pradesh Pollution Control Board (SPCB).
- Relevant provisions of the Factories Act, 1948, the Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 will be adhered to .
- Construction labourers' camps will be located at least 1000m away from the nearest habitation.
- Unless authorised by the local sanitary authority, arrangements for proper disposal of excreta at the workplace with a suitable method approved by the local medical health or municipal authorities will be provided.

- Approach roads to river and other surface water bodies need to be closed permanently to avoid vehicle washing and to avoid major pollution sources. This applicable to all areas including the secondary construction sites.
- Water quality shall be monitored regularly near the construction site.
-

8.1.6 Noise Environment – Mitigation Measures

Environmental noise particularly railway noise, is a complex phenomenon because its intensity and characteristics vary with time depending upon the frequency and speed of the trains. The noise has been identified a major impact in the project.

Table 8-3: Mitigation Measures for Noise Environment

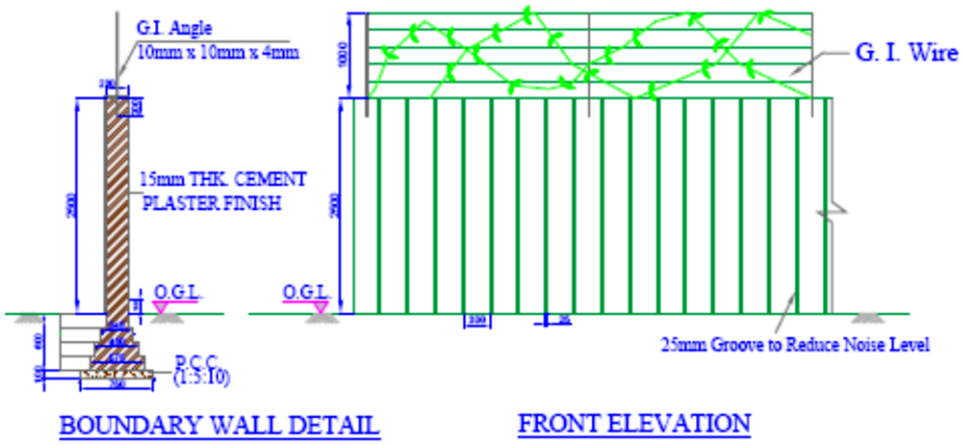
S.No.	Item	Impact	Impact (Reason)	Mitigation / Enhancement
1	Sensitive receptors	Direct impact	• Increase in noise pollution	• Two schools close to DFC alignment have been recommended for relocation.
2	Noise pollution (pre-construction)	Direct impact, short duration	• Man, material and machinery movements • Establishment of labor camps onsite offices, stock yards and construction plants	• Area specific and for short duration • Machinery to be checked & complied with noise pollution regulations. • Camps to be setup away from the settlements. • No construction activity during night time at habitations in the parallel sections
3	Noise Pollution (Construction Stage)	Temporary impact	• stone crushing, asphalt production plant and batching plants, diesel generators etc • Community residing near to the work zones	• Camps to be setup away from the settlements, in the down wind direction. • Noise pollution regulation to be monitored and enforced. • Temporary as the work zones will be changing with completion of construction
4	Noise Pollution (Operation Stage)	Insignificant impact	• due to increase in traffic (due to improved facility)	• This will be mitigated through automatic signaling and installation of noise barriers at habitations
	Noise Pollution Monitoring	Periodical noise will be monitored	• To check the efficacy of mitigation measures	• Measures will be revised & improved to mitigate/ enhance environment due to any unforeseen impact.

8.1.7 Sensitive Receptors – Mitigation Measures

School, hospital and cultural properties etc. have been identified particularly those close to DFC alignment and likely to have impact due to the project. As evident from predicted noise level that value is exceeding the specified limit at places. In order to bring the noise level within the limit, noise barrier may be considered at the identified sensitive locations. Thus noise level may be reduced by 10 to 15 dB (A). This barrier will accommodate the long term impact of the DFC traffic movement. List of sensitive receptors along the project corridor is presented in table below.

Table 8-4: Mitigation Measures for Noise Sensitive Receptors

S. No.	Chainage	Name of Receptor	Distance from the proposed track (m.)	Impact	Mitigation / Enhancement
1	Educational	School at Dadari	20	Direct impact, high noise level	Noise barrier shall be created of 200 m length as per the conceptual drawing shown below
2	Educational	School at Khurja	5	Direct impact, high noise level	Relocation Recommended
3	Educational	School at Dankaur	10	Direct impact, high noise level	Relocation Recommended



8.1.8 Mitigation Measures for Noise during Construction Phases

- Noise standards will be strictly enforced for all vehicles, plants, equipment, and construction machinery. All construction equipment used for an 8-hour shift will conform to a standard of less than 90dB (A). If required, high noise producing generators such as concrete mixers, generators, graders, etc. must be provided with acoustic enclosure.
- Machinery and vehicles will be maintained regularly, with particular attention to silencer and muffler, to keep construction noise level to minimum.

- Workers in the vicinity of high noise level will be provided earplug/ ear muff and engaged in diversified activities to prevent prolonged exposure to noise level of more than 90dB(A) per 8 hour shift.
- During construction vibratory compactors will be used sparingly within the urban areas. In case of complaints from roadside residents, the Engineer will ask the site engineer to take suitable step of restrict the working hours even further or use an alternative roller.
- Proposed tree and shrub plantations planned for avenue plantation especially close to settlement, may form an effective sound buffer during the operation stage.
- People will be convinced / educated to prevent sensitive land uses from developing up adjacent to the project corridor.

8.1.9 Mitigation Measures for Hydrological Impact

1) Construction Phase

- Provision of temporary drainage arrangement due to construction activities shall be made by contractor and suitable and strict clause shall be incorporated in general or special conditions of the contract document for effective implementation.
- Silt fencing may be provided near water bodies.
- Proper drainage may be planned in the area to avoid water logging.

2) Implementation Phase

- Local drainage is likely to be affected due to formation of Railway Embankment.
- Cross drainage structures shall be provided at appropriate locations

8.1.10 Mitigation Measures for Flora

1) Construction Phase

- Felling of trees shall be undertaken only after obtaining clearance from the Forest Dept.-forest areas, Railway Dept and local bodies outside forest area.
- Trees falling outside the ROW shall not be felled.
- Compensation for trees felled must be provided before initiating construction activity.
- Fruit bearing trees shall be compensated including 5 years fruit yield.
- Labour camps and office site shall be located outside and away from the forest area.

2) Post Construction Phase

- No impact envisaged on flora during post construction phase however, development of green belt is suggested near stations and maintenance of plantation may be undertaken by Railway Dept. The plantation carried along alignment and as compensatory afforestation is likely to enhance the ecological condition of the area. There is proposal to plant 10 trees per km on either side of rail track.

8.1.11 Mitigation Measures for Fauna

1) Construction Phase

- Crossing passages must be made for animal movement by provision of under pass followed with some plantation so that it resembles with the habitat.
- Borrow areas can be also developed as pond with grass and shrub planted around it.

- Silt fencing may be used near water body to avoid top soil runoff into the water bodies.
- Construction activity may be avoided during night hours in the forest area.
- Poaching must be strictly banned in the forest area. It may be ensured by the contractor that no hunting or fishing is practiced at the site by any of the worker and that all site personnel are aware of the location, value and sensitivity of the wildlife resources.
- Awareness programme on Environment and Wildlife Conservation may be provided to the work force. Forest Act and Wildlife Act may be strictly adhered to .

2) Post Construction Phase.

- Fencing may be provided along DFC in areas to avoid collision, wherever feasible.

8.1.12 Landscape

1) Construction Phase

Landscaping Plan may be formulated for restoration, leveling and landscaping of the area once construction activities are over. This may involve the following:-

- The stockpiles may be designed such that the slope does not exceed 1:2 (vertical to horizontal) and the height of the pile restricted to 2 m.
- Stockpiled topsoil may be used to cover the disturbed areas and cut slopes. The top soil shall be utilized for redevelopment of borrow area, landscaping along slope, incidental space etc.
- Incorporation of suitable and effective contractual clause for rehabilitation and restoration of borrow area and other temporary work and landscaping it with surrounding area immediately after its use.
- Landscaping of surrounding area with plantation, ornamental plants may be planted near stations.

2) Post Construction Phase

No impact envisaged on landscape in operation phase; however the green belt development is suggested.

8.1.13 Mitigation Measures for Vibration

In order to mitigate the negative impacts due to noise and vibration the impact area are divided in four broad categories;

- Areas identified in Reconnaissance Survey as sensitive residential, commercial industrial or social site.
- Area identified as reference location for carrying out measurements of vibration along EDFC
- Area having building and structure within existing or proposed railway land.
- Building and structure of importance for ASI or other similar historical importance.

For all these target location following scheme shall be applied:

i. Targets falling within the ROW - Pick out and exclude all such target locations from consideration of mitigation measures. These buildings and structures may be relocated.

ii. Targets located at distance falling in no impact zone are also be removed from the list of location requiring mitigation measures. For this trend line of attenuation of vibrations with distance for each type of location has been established. Using this trend distance for permissible vibration level has been

identified. All locations farther to this distance have been isolated from assessment of mitigation measures.

iii. Targets that have special character due to historical or archeological or religious importance have to be considered in special manner irrespective of level of impact assessed in their case.

Based on the above, the identified target location have reduced from >5 to 1 as listed in the table. The school at Dadari will need mitigation measures to reduce the impact.

The following mitigation measures are recommended.

It has been found that the vibration level originate at the interaction of rail and wheel

because of various factors which include the following

- The construction of Wagon
- Condition of Wagon , rail and wheel
- Design , engineering , superiority in terms of track support system, soil condition and embankment height

Efficient Track and wheel maintenance: Effective maintenance of track and wheel can reduce upto 10 dB(A) noise and vibration levels. The Condition of the rails and wheels, if not maintained in good condition, will add to vibration level. Some maintenance procedures that are particularly effective at avoiding increases in ground-borne vibration are:

- Rail grinding on a regular basis. Rail grinding is particularly important for rail that develops rail irregularities which in their turn cause impact and low frequency excitation.
- Wheel truing to re-contour the wheel, provides a smooth running surface, and removes wheel flats. The most dramatic vibration reduction results from removing wheel flats and out of roundness.
- Implement vehicle reconditioning programs, particularly when components such as suspension system, brakes, wheels, and slip-slide detectors are involved.
- Install wheel-flat detector system to identify vehicle which are most in need of wheel truing. These systems are becoming more common on railroad and intercity passenger system, but are relatively rare on transit system.
- Install wheel geometry measurement device (e.g. laser based system installed at entrance of depot) with possibility of detecting out of roundness, difference of wheel diameter of wheels on the same axle, wheel wear. (**Vibration is reduced more than 10 dB)**

Therefore we estimate that a reduction of vibration up to **7.5dB** could be achieved as compared to highest Vibration level measured on existing tracks. In such case, predicted vibration level will come down by around 7.5 dB through maintenance efficiency and planning alone.

The DFCC has already designed to operate on elevated embankment of 2m of more. This means that at least 1 m additional height all along the corridor due to embankment. Researches and studies have shown the height of embankment increases the attenuation rate by **1- 2 dB** per meter height of embankment. Therefore at least **1- 2 dB** (for one meter additional height of embankment) will be reduced for entire corridor. In portion of track where no embankment exists currently, this reduction will be possible where it is 2 meter high and reduction will be around 2-3 dB. Therefore, taking a conservative estimate, this inbuilt measure will provide reduction of Vibration levels by **2dB**.

Considering the above, we conclude that the overall vibration will be reduced by a total of 10 dB.

As discussed earlier in the evaluation process maximum vibrations permissible on any site is

Plain route or detour upto: 70dB

Sensitive Receptors: upto 65 dB

There are very few habitations along the parallel section such as Ajayabpur, Dankaur ,etc. The vibration levels at these will be reduced to 68 dB. The school at Dadari at a distance of 20 m will require some mitigation measures

Therefore, additional mitigation measure is required to take care of balance impact of 9 dBs on near the end point.

Resilient Fasteners: Resilient fasteners are very common fastening equipment used in modern track constructions. We feel these must also be included in design of track installation by DFCC. If so, these become another existing resource that will help mitigation of the impact of vibration. These fasteners are used to fasten the rail to concrete track slabs. Standard resilient fasteners are rather stiff in the vertical direction, usually in the range of 40 kN/mm (dynamic stiffness), although they do provide vibration reduction compared to classical rigid fastening system. Special fasteners with vertical dynamic stiffness in the range of 8 kN/mm will reduce vibration by as much as 15 dB at frequencies above 30 Hz. (Conservatively these could **reduce vibrations by 5 to 10 dB)**

Rail and base plate pads for rail resilient rail fasteners are used on trams, subways, light rail and main line train.

Therefore, this resource alone will be able to provide balance mitigation of track vibration. Therefore it is felt that no additional mitigation measure is required to be considered.

8.2 MITIGATION MEASURES FOR DISPLACED CPRS.

Mitigation measure and compensation for displaced Common Property Resources (CPRs) has been given in below:

Table 8-5: Mitigation Measures for Common Property Resources

S.No	Common Property Resource	Mitigation Measures
1.	2 wells, 3 tube wells and 5	The CPRs falling in Govt.. Land will be

	Handpumps in entire stretch .	relocated for those on private land necessary compensation will be paid.
2.	01 Religious structures in entire stretch in parallel and detour section is falling in proposed land to be acquired.	The religious structures will be relocated in consultations with locals and with proper rituals. Necessary provisions budget have been made for the relocation

8.3 MITIGATION MEASURES FOR ASI PROTECTED STRUCTURES AND CHANCE FINDS

There is no protected ASI structure within a distance of 300 m from the proposed RoW of Khurja-Dadari section.

The Uttar Pradesh being rich in archeological sites. There may be chance find in the form of coin or relics and some under ground structure. In case of identification of any of the chance finds mentioned above, during excavation, the contractor will stop the work and will report to DFCC. The DFCC inturn will inform Department of ASI. Pending decision from ASI work will remain suspended.

CHAPTER 9 PUBLIC CONSULTATION AND DISCLOSURE

9.1 INTRODUCTION

The Public Consultation meetings for the Dadari-Khurja Section of Eastern Dedicated Freight Corridor were conducted in the affected villages November – December 2011. The consultations were conducted along with social team who is conducting SIA of the project. The villages were selected keeping in view of environmental sensitivity and likely to be affected due to the project. The overall objective of public consultation was to provide information to the stakeholders and collect feedback on environmental issues from them at village level.

9.2 OBJECTIVES OF PUBLIC CONSULTATIONS

Public consultations intend to obtain people's participation in the project. It is an ongoing process which can improve communication, interaction and joint decision making between different stakeholders. Through public participation, all parties are well informed about the project, likely impact on environment & society as well range of views on issues and mitigation proposals. Most importantly, a good public participation process will result in better decision making process which is sensitive and responsive to public concerns and values.

It is widely acknowledged that public participation process should vary according to the size, complexity and level of interest in any one issue, policy or plan.

The broad objectives of Public Consultation Meetings (PCMs) were as follows:

- To understand the view of the people affected and Public living in surroundings of alignment
- To identify all major environmental characteristics of the villages to enable planning and implementation.
- To resolve the issue related to environment i.e. air, water, soil, noise pollution and vibration
- Disseminate information to the lowest possible hierarchy in the social system

9.3 METHODOLOGY OF ORGANIZING MEETINGS

These meetings were organized at village level through DFCC project office at Meerut and Delhi. Techical drawings and maps were procured from CPM office Meerut and these were used while disseminating information and responding to the queries of the stakeholders/ participants. Pre information for consultation was given by EIA and SIA field team to the villagers and stakeholders.

The details of the identification of villages, participants, methodology for conducting the meetings and issues emerged during the meetings are briefly described below:

Table 9-1 Schedule and Dates of Consultations

A. Selection of villages

S.No.	Name of Village and Date of Consultation	Environmental Issues Emerged During PCM
1	Ajayabpur Village in parallel section, Tehsil Dadari District Gautam Budh Nagar on 28/11/2011	Noise pollution Safety of children Vibration in Habitation
2	Rithauri Village in parallel section, Tehsil Dadari District Gautam Budh nagar on 28/12/2011	Safety Tree cutting
3	Jamalpur Village, Tehsil Sadar Gautam Budh Nagar on	Noise Impact on Village, Affect on public utilities, wells, hand pumps

S.No.	Name of Village and Date of Consultation	Environmental Issues Emerged During PCM
	12/12/2011	and tube wells. And compensation
4	Khairali Hafizpur Tahsil Sadar District Gautam Budh nagar on 21/12/2011	Acquisition of Agriculture land ,safety issue, ,drainage problem, and employment
5	Wair Village District Bulland Shahar on 30/12/2011	Safety Issue, Huge resettkement Issue, compensation and borrowing of earth

B. Participants

In the selected villages, the information was disseminated through the contact person of the project office of DFCC office in advance and the village head / influential persons was requested one day in advance to arrange the meeting by informing others in his village and nearby villages at a pre-determined place, date & time.

C. Methodology of conducting the meeting

The consultants team with the help of the technical designs of the proposed project introduced the project and its relationship with the concerned village/villages. The Environmental Engineer introduced the subject of Environment like air, water, noise, vegetation plantation, trees, birds, animals etc and possible or likely impact of the new DFCC tracks on environment. The participants expressed their views/ opinions openly w.r.t. the project & their villages.

The stakeholders turn by turn expressed their views and opinions and sometimes raised issues. Their misconceptions about the project were clarified by the Consultants & DFCCIL officials. The deliberations during PCMs were recorded in proforma sheet.

During the deliberations some participants were agitated and wanted that project should not pass through their villages. The project team members provided & explained all information and requested them for suggestions for making the project environment friendly. The record of the participants covers gender, profession etc.. It requires special mention here that few participants were apprehensive to reveal their identity.

D. Issues and concerns emerged from the consultation

The issues and concerns shared and mitigation suggested in a tabulated form are given below in **Table -9.2**:

Table 9-2: Issues Raised During Consultations and Incorporation In Project Design

S. No.	Date	Venue	Issues Shared	Mitigation Measures	Remarks
1	28-11-2011	Ajayabpur Village	1. Noise and vibration issue due to additional DFCC tracks 2. Safety of children would be affected as DFC track will extend in habitation of village on left	☛ Noise and vibration mitigation planned in EIA/EMP ☛ Underpass not possible due to Engineering reasons ☛ Compensation planned at	

S. No.	Date	Venue	Issues Shared	Mitigation Measures	Remarks
			side 3. Locals demanded underpass for animal crossing 4. Compensation at 2011 circle rates	market rate	
2	28-12-2011	Rithauri Village	1. Private trees requires to be cut should be compensated 2. Tree cutting should be minimized and compensatory plantation should be taken up 3. Necessary facilities for crossing such as foot over bridges should be planned	1. The compensation for private trees will be included in compensation by revenue authorities 2 The tree cutting will be limited in RoW and compensatory plantation will be taken up 3- The safety features have been planned in the design	
3	12-12-2011	Jamalpur Village	1. Compensation should be paid as per quality of land 2. The hand pumps and wells affected should be relocated in consultation with locals 3. Increased noise and safety issues	☛ Compensation will be decided by the revenue authorities ☛ Wells and hand pumps in community use will be relocated in consultation with locals. ☛ Necessary safety measures have been built in to the project design	
4	21-12-2011	Khairali Hafizpur	1- Agriculture land acquisition 2- Safety Issue for animal Crossing	1- Land acquisition marginal as DFC tracks planned	

S. No.	Date	Venue	Issues Shared	Mitigation Measures	Remarks
			3- Drainage Issue 4 –Employment to Project affected persons	parallel to existing on left side 2- Adequate cross drainage structures planned 3- Cross drainage structures will act as underpass during non monsoon 4 –RUBs planned for local roads being crossed 5- The decision to provide employment has yet not been taken	
5	30-12-2011	Wair Village on Detour	1-Agriculture land acquisition for Detour 2- Borrowing of earth for construction work 3- Compensation should be paid first before taking possession	1- The detour length is small and agriculture land acquisition has been minimized 2- The earth will be proured from identified borrow areas. The borrow areas will be operated with the onsent 3- compensation will be paid before taking possession of land	

SUMMARY AND MAJOR FINDINGS

1. At most places stakeholders raised the concerns about noise level and suggested to construct boundary wall as noise barrier near the rail track, schools and habitation.
2. Villagers at Jamalpur demanded that common property resources such as well hand pumps and tube wells should be relocated in consultation with locals and existing ones should be dismantled only when new ones are ready.

3. In some cases issue of children's safety was raised. They apprehended that accident will increase due to the project and birds, animals & humans would be affected. They drew attention to especially Peacock and Neelgaai. They also asked for mitigation measure against noise.
4. Villagers suggested for sufficient underpasses to cross the track so that accident involving animals/birds are avoided/reduced
5. Local residents demanded that those would be rendered landless, should be provided employment by the DFCC in addition to compensation.
6. Many participants suggested for wall near the DFC track to protect animals, human lives and reduction of noise level. Boundary wall was a major suggestion.

8 Majority of the queries were related to land compensation. The villagers demanded that compensation should be paid as per market rate.

9 Participants demanded clarification on Ministry of Railways Job announcement.

CHAPTER 10 ENVIRONMENT MANAGEMENT PLAN

10.1 INTRODUCTION

Environmental Management Plan is an implementation strategy to mitigate and offset the potential adverse environmental impacts of the project and enhance its positive impacts. Based on the environmental baseline conditions, planned project activities and impacts assessed earlier, this section enumerates the set of measures to be adopted in order to minimize adverse impacts. The process of implementing mitigation and compensatory measures, execution of these measures, agencies responsible for the implementation of these measures and indicative costs are discussed in this chapter.

The project has overall positive impacts by providing a competitive, cost effective, congestion free reliable mode of dedicated freight service. It will certainly reduce the load on the roads and facilitate fast transfer of goods. Railway being an eco-friendly mode will also enhance or at least will not degrade the environmental quality.

The development of DFC entails civil work, including excavation, filling, construction of RUB/ROB, bridge and cross drainage structures, and utility shifting etc., which are likely to cause adverse impacts on natural and social environment. When the impacts can not be fully avoided, appropriate mitigation measures are suggested to minimize and compensate the potential adverse impacts and enhance positive impacts. Most of the impacts are temporary in nature and are limited to the construction phase. These impacts can potentially be minimized and managed by proper planning and execution. The environmental management plans includes activities for pre-construction, construction and operation phases.

10.2 ENVIRONMENTAL MANAGEMENT PROCESS

Environmental management is based on the potential impacts assessed for the project. Assessment of potential impacts is based on the review of secondary data substantiated by site visits i.e. environmental monitoring, public consultation, household survey and discussion with concerned Govt. Dept. The implementation of Environmental Management Plan (EMP) requires the following:-

- An organizational structure
- Assign responsibilities
- Define timings of implementation
- Define monitoring responsibilities

10.3 EMP DURING CONSTRUCTION & OPERATION

The project activities will be executed in a phased manner, pre-construction phase, construction phase and operation phase. The major activities to be undertaken are described below.

10.3.1 Construction Phase

The environmental issues during construction stage generally involve environment, safety and public health issue. The contractor is required to comply with the laws with respect to environment protection, pollution prevention, forest conservation, resettlement and safety and any other applicable law. Environmental pollution during the construction phase will be less but control of pollution during this phase is of considerable importance. The EMP is an executable part of project, and the activities are to be guided, controlled, monitored and managed as per the provision provided. Following activities require attention during construction phase.

1. Land Acquisition / Diversion Plan

Acquisition of land is indispensable for construction of DFC. The proposed alignment traverses through settlements and agriculture areas. The total land acquisition is

limited to 211.67 Ha. .At the outset as a part of the Land Acquisition Plan, the Right of Way (RoW) along the entire DFC alignment has to be established and confirmed from the State Forest, Agriculture and Land Revenue Departments.

- Diversion of forest land, if any(specially crossing of alignment at NH/SH) will be carried in compliance to Forest Conservation Act, 1980.
- The acquisition of land and private property shall be carried out in accordance to the Resettlement Action Plan (RAP).

It has to be ensured that all R & R activities including the payment of the compensation may be reasonably completed before construction activities start, on any section of the DFC. No construction work will start before total compensation has been paid to the PAPs.

2. Utility Shifting Plan

There are some utility services along the proposed DFC alignment such as electric lines, telephone lines, cable line, pipe lines etc which may be shifted on consultation with the concerned department before commencement of construction activity. There are road crossing with the DFC. Construction of bridges will be required to maintain their utility. These structures will be shifted in consultation with the concerned departments.

3. Construction / Labour Camp Management

- During the construction phase, the construction / labor camp will be located along the project area. Large numbers of labour are likely to move into the project area. A proper Construction Camp Development Plan will be formulated to control degradation of the surrounding landscape due to the location of the proposed construction camp. The contractor must provide, construct and maintain necessary living condition and ancillary facilities. These must be included in contract documents provided to the contractor.
- Sufficient supply of potable water shall be provided at camps and working sites. If the drinking water is obtained from the intermittent public water supply, then storage tanks must be provided. All water supply storage may be at least 15 m away from the toilets or drains.
- Adequate and clean washing and bathing facilities must be provided that also have sufficient drainage.
- Adequate sanitary facilities shall be provided within every camp. The place must be cleaned daily and maintain strict sanitary conditions. Separate latrine shall be provided for women. Adequate supply of water must also be provided.
- The contactor must ensure that there is proper drainage system to avoid creation of stagnant water bodies.
- Periodic health check up may be conducted. These activities may be provided by the construction contractor in consultation with State Public Health Department.
- At every camp, first aid facilities with suitable transport shall be provided to take injured or ill person to the nearest hospital.
- Adequate supply of fuel in the form of kerosene or LPG may be provided to construction labourers, to avoid felling of trees for cooking and other household activities. No open fires may be allowed in camps.
- The sites shall be secured by fencing and proper lighting.
- The construction contractor may ensure that all construction equipment, Vehicle and machineries may be stored at a separate place / yard. Fuel storage and refilling areas may be located 500 m away from the water bodies and from other cross drainage structures.

- All the construction workers shall be provided with proper training to handle potential occupation hazards and on safety and health which include the following:-
    - Environmental awareness programme
    - Medical and first aid
    - Engineering controls, work practices and use of various personal protective equipment
    - Handling of raw and processed material
    - Emergency response
- Construction / labour camps may be located away from forest areas, settlements, cultural heritage and historical sites and water bodies and dry river beds.
- It shall be ensured by the construction contractor that the camp area is cleared of the debris and other wastes after the completion of construction. On completion of construction, the land and surrounding area shall be restored back to its original/organised form.

4. Borrow Area Management Plan

An appropriate Borrow Area Management Plan will be formulated to control the degradation of the surrounding landscape due to the excavation work. The national standard which applies to the manual borrowing of earth is the IRC-10:1961.

- Borrowing of earth shall not be done continuously. Slopes of edges shall be maintained not steeper than 1:2
- Top soil (15 cm) from all areas may be preserved in stockpiles and utilized for redevelopment of borrow/quarry areas.
- Borrow pit shall be developed as far as possible from the river side, where the inner edge of any borrow pit should be not less than 15 m away from the toe bank. As per as the borrow pits on the rear on landside are considered, it is to be avoided. Where it is unavoidable a berm, at least 25 m wide shall be left between borrow pits and toe bank. The toe of the bank on the rear side shall have a cover of 0.75 m to 1.25 m over the saturation line drawn at a slope of 1:6 from the high flood level on the river side.
- Borrowing of earth shall not be carried out on productive/ cultivable land. In the event that such an occasion arises, the contractor has to obtain permission from the supervising engineer.
- Sources of borrow areas will be identified by the construction contractors in consultation with Engineer.
- No borrow area will be opened without the prior permission from the local administrative bodies like Village Panchayats, State Department of Irrigation, Agriculture and State Pollution Control Board as the case may be..
- Reclamation of borrow area shall be mandatory and must be included in the agreement made with the construction contractor.
- Borrow pits may be located at least 1 km away from the villages and settlements.
- All borrow pits may be reclaimed: -
    - The quarry and borrow area shall be reclaimed back. The pits formed shall be backfilled by construction waste and site shall be stabilized.
    - Spoils may be dumped with an overlay of stocked piled top soil with respect to MoEF/SPCB guidelines.
    - Borrow and quarry pits can be also be developed as ponds and be used for aquaculture as per local requirement. These can also serve as park or picnic/recreation spots.

- Landscaping of borrow and quarry area may be done, and the grasses, shrubs and tree species may be planted around the reclaimed area. Ornamental plants can also be planted on the access route.
- Reclamation of borrow area may included in the agreement of the construction contractor.

5. Public Health and Safety

The contractor is required to comply with all the precautions required for the safety of the workmen. The contractor must comply with all regulation regarding scaffolding, ladders, working platform, excavation, etc.

- The contractor must supply safety goggles, helmets, earplugs and masks etc. to the workers and staff.
- Adequate precaution must be taken to prevent danger from electrical equipment. Necessary light and fencing must be provided to protect the public.
- All machines and equipment used for construction purposes must conform to relevant Indian Standards (IS) codes. This equipment must be free from patent defects, in good working condition, regularly inspected, and properly maintained as per IS provisions.
- All labourers working on mixing of asphaltic material, cement, lime mortars, concrete etc should be provided with protective footwear and protective goggles. Workers involved in welding work shall be provided with welder's protective eye shields.

  No men below the age of 18 years or women of any age will be employed to work with paint products containing lead in any form. Face masks must be supplied to workers when they use any form of spray paint or work with surfaces that have been dry rubbed and scrapped with lead paint.
- All reasonable measures must be taken to prevent any damage to the public from fire, floods, etc.
- All necessary steps shallt be taken to prompt first aid treatment for injuries that may be sustained during the course of work.
- The contractor shall conform to all anti malarial instructions, including filling up of borrow pits.
- Work that affects the use of side roads and existing accesses must not be taken without providing adequate provision.
- On completion of the works, all the temporary structures may be cleared away, all rubbish disposed, excreta and disposal pits or trenches filled in and effectively sealed off and the entire site left clean and tidy.
- Prevention to Silicosis will be undertaken as explained under 'Silicosis Reduction Strategy of 'SHE' manual enclosed to the contract document.

6. Green Belt

The green belt has been recommended as one of the major components of the EMP which will further enhance the environmental quality through:

1. Mitigation of air pollution problems
2. Attenuation of noise level
3. Maintain the Green area and improve aesthetics.

It is most important to chalk out a long-term approach to keep the air in the area clean. One such measure is using the plants for absorbing and trapping the air pollutants. The hypothesis that trees are important particulate sinks is supported by evidence obtained from studies dealing with diverse particulate matter including pollen, salt, precipitation, dust and other unspecified particles. As far as gaseous

pollutants are concerned, substantial evidence is available to support the fact that plants in general, and trees in particular, function as sinks for gaseous pollutants. This is achieved through various physiological processes occurring within the plant system.

The gaseous pollutants are transferred from the atmosphere to vegetation by the combined forces of diffusion and flowing air movement. Once the gaseous pollutants come in contact with the plants, they may be bound or dissolved on exterior surface or taken up by the plants via stomata. If the surface of the plant is wet and if the gas is water soluble, the former process can be very important. As a matter of fact, plants act as bio filters for the air pollutants and play a major role in safeguarding the environment and controlling the increasing level of air and noise pollution.

A. Preparation of the Plantation Area

A green belt will be proposed along the alignment. Plantation site should be cleared from all wild vegetation. Suitable soil and water conservation measures will be adopted, if required. Since planting area is large, it shall be divided into blocks inter-linked by paths laid out in such a way that every tree is accessible for all post plantation care. The planting arrangement and size shall be based on the optimum use of the available land and quantum of irrigation water.

A tree requires sufficient space below and above the ground to spread its roots and branches. However, spacing varies with the type of trees, soil fertility, available moisture and purpose of plantation.

B. Preparation of Pits and Sapling Transplantation

The location of each pit shall be marked according to the design and distance of the plantation. The size of the pits may vary with the type of trees. While digging the pit, care shall be taken to place the topsoil on one side and bottom soil on the other side. Dug-out soil and pit should be exposed to weather for two to three months. After exposing to the weather, the pit should be filled two-third to three-fourth height with a mixture of topsoil and decayed farmyard manure.

Planting of the tree shall be done with a suitable between each. While planting the trees, care shall be taken that the installation structure shall be difficult to see through the foliage when seen from a point outside the green envelop. For preventing the horizontal dispersion of the pollutants, the trees shall be planted in alternate rows in a straight line. Tree trunks are free from foliage up to a height of 2 – 3 meters, it is advisable to grow shrubs in front of tree so as to provide coverage to the open portion.

C. Time of Plantation

Plantation shall be done two weeks after the rain starts, as the trees benefit from the seasonal rains. It is advisable to avoid planting during the dry season, as this will require watering. It is advantageous to plant trees on cloudy days.

D. Protection of Greenbelt

- No pruning or lopping of branches shall be done within the greenbelt for at least 10 – 15 years
- Gap filling in the greenbelt should be done in the same season to avoid future gaps.
- Protection of young plants from the ravages of cattle, sheep and goat and other animals.
- Timely replacements of damaged plant and thereafter care is important.

E. Selection of Tree Species

Plants possess a large surface area and their leaves exhibit an efficient pollutant trapping mechanism. It is recommended to select local species for better survival rate. The effectiveness of plants to control pollution depends upon the physiological,

morphological traits such as leaf epidermis, size, leaf orientation, internal enzyme system, etc. Systematic screening of plants for their ability to tolerate pollutant need be undertaken. For pollution abatement purposes tree species should be fast growing, wind firm, unpalatable to animals, hardy and pollutants tolerant/resistant. List of some plant species for greenbelt plantation purpose is given in Table below:-

Table 10-1: Suggested List of Tree Species for Green Belt Plantation

Sl. No.	Botanical Name	Common Name
1	*Alstonia scholaris*	Chitvan
2	*Mimusops elengi*	Bakul
3	*Cassia fistula*	Amaltas
4	*Bauhinia purpurea*	Khairwal
5	*Zizyphus mauaritiana*	Ber
6	*Cassia siamea*	Senna
7	*Ficus religiosa*	Peepal
8	*Albizia lebbeck*	Siris
9	*Pongamia pinnata*	Karanj
10	*Polyalthia longifolia*	Ashok
11	*Diospyros melanoxylon*	Tendu
12	*Ailanthus excelsa*	Mar Maharakha
13	*Melia azedarach*	Bakain
14	*Tamarindus indica*	Imli
15	*Terminalia arjuna*	Arjuna
16	*Azadirachta Indica*	Neem
17	*Grevillea robusta*	Savukkamaram
	Shrubs & Grasses	
1	*Calotropis gigantea*	Akand
2	*Nyctanthus arboriristis*	Harsighar
3	*Nerium indicum*	Kaner

F. Plantation for Noise Pollution Control

Trees having thick and fleshy leaves with petioles flexible and capacity to withstand vibration are suitable. Heavier branches and trunks of the trees also deflect or refract the sound waves. The density, height and width are critical factors in designing adequate noise screen with vegetation.

Combination of trees and shrubs together appears to be the best system for combating pollution. The following species are suggested for noise pollution:

- *Alstonia scholaris(Chitvan)*
- *Azadirachta indica(Neem)*
- *Melia azedarach(Bakain)*
- *Grevillea robusta(Savukkamram)*
- *Tamrindus indica(Imli)*
- *Terminalia arjuna(Arjuna)*

Varied plantation techniques and types will reduce noise unequally. In addition to this, it is also relies on categories of plant to block noise. Some type of trees with varying heights block noise better than trees forming a straight line, which can reduce noise up to 3.48%. The formation of plant of different heights planted such that they stand highest to lowest in straight line will have best noise blocking. Port line can reduce noise up to 4.39%. The formation of plant from the highest to lowest in alternate formation will have the best noise reduction in the fifth line which is 7.63%

(Chakee, 1989).

10.3.2 Operation Phase

During operation phase, the noise and vibration control along the sensitive and residential area is most important. Regular monitoring will be done for these parameters, and appropriate measures as suggested in the report shall be implemented.

10.4 ENVIRONMENTAL MANAGEMENT PLAN & RESPONSIBILITIES

Table 10.1 presents summary of Environmental Management Plan (EMP) with the objective to minimize adverse environmental impacts as discussed. The table covers all possible environmental issues involved in the project and the necessary mitigation measures. Taking appropriate mitigation measures for the construction phase is the responsibility of the construction contractor, and of the construction projects' Environmental Engineer who will supervise the implementation of the EMP.

The mitigation measures during the operation phase will be implemented by Environmental Management Unit (EMU) of Railway Dept / DFCCIL, which includes an Environmental In-Charge who will supervise the implementation of EMP. Thus, the overall responsibility of the implementation of mitigation measures will be with the Construction Contractor during the construction phase and with the Railway Dept during operation phase. The details of Environmental Management Programme and Environmental Management Unit (EMU) are discussed in the subsequent paragraphs.

Table 10-2: Environmental Management Plan

S. No.	Environmental Issue	Action to be Taken	Implementation By	Supervision By
Pre-construction phase				
1.	Removal of Trees	Trees are likely to be felled in the existing and acquired area for the proposed corridor The forest land along the railway line is likely to be acquired for the project will be compensated by providing value of land as per Net Present Value (NPV) Double area of land may be provided for Forest Dept for carrying Compensatory afforestation. Compensation may be provide for plantation of trees Double area of land may be provided for Forest Dept for carrying Compensatory afforestation. Compensation may be provided for plantation of trees	Forest Dept. / EMU	EMU
2.	Land Acquisition /Division	Ownership of land within the ROW and at Junction station shall be confirmed Number of Project Affected Persons (PAPs) to be identified Resettlement Action Plan to be prepared for the PAPS and provide compensation in compliance with National Resettlement and Rehabilitation (R&R) policy Information dissemination and community consultation	EMU/NGOs as collaborati-ng agency	Revenue Dept / DFCCIL

S. No.	Environmental Issue	Action to be Taken	Implementation By	Supervision By
3.	Relocation of Cultural and Religious Properties	Religious structures will be shifted only after public consensus. Relocation shall be completed before construction work is taken up.	Construction Contractor	DFCCIL
Construction Phase				
1.	Soil	Suitable protection measures consisting of bio-engineering techniques such as plantation of grasses and shrubs & check dams, may be provided to control erosion. Borrow areas may be finalized in concern with ecological sensitivity of the area. Agriculture land should not be used as as far as possible. Priority may be given to degraded area for excavation of borrow material. Rehabilitation of borrow area may be taken under the project. Construction work may be avoided during rainy season to evade erosion and spreading of loose material. Top soil removed from agricultural land may be stored separately in bunded areas and utilized during plantation or refilling of excavated area.	Construction Contractor /EMU	EMU/CS
2.	Water Bodies	Provision of temporary drainage arrangement due to construction activities shall be made by Contractor and suitable and strict clause shall be incorporated in General Conditions of Contract document for its effective implementation. Silt fencing shall be provided near water bodies Proper cross drainage structure may be planned at the crossing of the canal in consultation with Irrigation Department Proper drainage may be planned in the area to avoid water logging	Construction Contractor /EMU	EMU/CS
3.	Flora	Felling of trees must be undertaken only after obtaining clearance from the Forest Dept. forest areas, Railway Dept and local bodies outside forest areas Trees falling outside the ROW shall not be felled. Compensation shall be provided before initiating construction activity. Labour Camps and office site may be located outside & away from Forest area Green belt development may be undertaken in the wasteland near	Forest Dept./ Construction Contractor /EMU	EMU/CS

S. No.	Environmental Issue	Action to be Taken	Implementation By	Supervision By
		railway line to enhance esthetic and ecological value. Social forestry may be practiced for success of the plantation. Local people can be involved in plantation and maintenance of plantation as part of the project in consultation with Forest Department.		
4.	Fauna	Crossing passages shall be made for wildlife near forest areas such as under pass followed with some plantation so that it resembles with the habitat of wildlife and facilitate crossing of wildlife in forest area. Borrow areas can be also developed as ponds with grasses and shrubs planted around it. Silt fencing shall be used near water bodies to avoid runoff into the water bodies. Construction activity may be avoided during night hours in forest area. Poaching must be strictly banned in the Forest area. It may be ensured by the Contractor that no hunting or fishing is practiced at the site by any of the worker and that all site personnel are aware of the location, value and sensitivity of the wildlife resources. Awareness program on Environment and Wildlife Conservation may be provided to the work force. Force Act and Wildlife Act may be strictly adhered to.	Forest Dept./ Construction Contractor /EMU	EMU/CS
Chance Find				
1	Chance Find	If contractor notices coin, artifact, relics or structure during construction, then he will inform DFCC through PMC/Enginner. The DFCC in turn will inform ASI. Pending the decision work will remain suspended. The coil/artifact/relics will be preserved safely and will be handed over to ASI.	Contractor	EMU/CS
Pollution Monitoring				
1.	Air	Adequate dust suppression measures such as regular water sprinkling on construction sites, haul & unpaved roads particularly near habitation shall be undertaken to control fugitive dust. Plantation activity will be undertaken at the construction sites Workers may be provided with mask to	Construction Contractor /EMU	SPCB / SDOE/ EMU /CS

S. No.	Environmental Issue	Action to be Taken	Implementation By	Supervision By
		prevent dust related problems Trucks carrying soil, sand and stone may be duly covered to avoid spilling. Low emission construction equipment, vehicles and generator sets may be used Plants, machinery and equipment shall be handled so as to minimize generation of dust. All crusher used in construction should confirm to relative dust emission devises Air quality monitoring may be conducted at construction sites.		
2.	Water	Silt fencing may be provided near water bodies to avoid spillage of construction material. Discharge of waste from construction / labour camp into water bodies may be strictly prohibited. Construction methodologies with minimum or no impact on water quality may be adopted, disposal of construction wastes at designated sites and adequate drainage system may be provided. Project design may take care of irrigational canal and proper culverts may be proved so that irrigation setup is not disturbed Construction activity may be prohibited during	Construction Contractor /EMU	SPCB / SDOE/ EMU
3.	Soil	Asphalt emulsifier must be handled with caution and any leakage detected must be immediately rectified. Construction work shall not be done during rainy season to avoid erosion and spreading of loose material Top soil removed during excavation work should be utilized stored separately in bunded area and should be utilized during plantation or refilling of excavated area.	Construction Contractor /EMU	EMU/CS
4.	Solid Waste	Construction work shall be carried in such a way that minimum or no solid waste is generated at construction site. Extra earth material produced may be utilized for refilling of borrow areas. Rainy season may be avoided to minimize spreading of loose materials. Solid waste management may be	Construction Contractor /EMU	SPCB / SDOE/ EMU /CS

S. No.	Environmental Issue	Action to be Taken	Implementation By	Supervision By
		framed for camp areas. Dustbins may be provided in the Camps. Proper sanitation facilities must be provided in Camp by the Contractor.		
5.	Noise & Vibration	Modern technologies producing low noise may be used during construction. Construction equipment's and vehicles must be in good working condition, properly lubricated and maintained to keep noise within permissible limits. Temporary noise barriers installed at settlements and forest area, if required Noise barrier shall be provided at the location specified in Chapter-7. Plantation may be carried at the work site. Head phones, ear plugs to be provided to the workers at construction site. Noise level monitoring must be conducted during construction phase. All vehicles, equipment and machinery used in construction should be fitted by exhaust silencers. Equipments shall be maintained regularly and soundproof gadgets shall be used. Portable sound barriers shall be installed near sensitive locations near settlements and Forest area, if required Provision of ear-plugs to heavy machinery operators Plantation along the DFC should be maintained.	Construction Contractor /EMU	SPCB / SDOE/ EMU /CS
6.	Land Subsidence	Plantation must be carried to control erosion	Construction Contractor	EMU/ CS
7.	Bottom Sediment	Silt fencing may be provided to avoid runoff into the river. Construction activity shall be taken in dry season to avoid spreading of construction material and minimize impact on water quality	Construction Contractor	EMU/ CS
Operation Phase				
1.	Maintenance Plantation	Provision for maintenance of plantation shall be made for at least three years. Plantation may be taken to replace dead sapling. Survey of survival of plants may be taken annually. Lopping of branches may be undertaken to remove obstruction, if any	EMU	DFCCIL
2.	Air Quality	Plantation shall be conduct and maintained along DFC. Green belt	EMU	SPCB / SDOE

S. No.	Environmental Issue	Action to be Taken	Implementation By	Supervision By
		development with proper specifies shall be undertaken on priority basis. AAQ monitoring at all Junction station sites and along DFC under the guidance of SPCB		(State Department of Environment)
3.	Water Quality	Waste Collection facility shall be provide at all Junction station Proper drainage system shall be provided at all Junction station Water quality monitoring at the Junction stations under the directives of SPCB	EMU	SPCB / SDOE (State Department of Environment)
4.	Noise & Vibration	Noise and Vibration monitoring may be conducted in operation phase at Sensitive Receptors (SRs) mentioned in Chapter-7.	EMU	SPCB / SDOE (State Department of Environment)

10.5 ENVIRONMENTAL MONITORING

The environmental monitoring shall be undertaken during construction and operation phases as per the following details:

Table 10-3: Proposed Monitoring Programme

Construction Phase

S. No.	Environmental Component	Parameter	Standards	Location	Frequency	Implementation	Supervision
1	Air Quality	PM2.5, PM10, CO, NOx, SO2	CPCB standards	• Khurja (km 1369.82) • Wair (km 1389.95) • Dadari (km 1415.69)	3 times in a year (once in every season except monsoon) during construction period	DFCCIL through contractors	CS/EMU
2	Water Quality	As per IS:10500 standards	CPCB standards	• Karon river (km 1375.39) • Khurja (1369.82) • Start of Wair detour (km 1389.55) • Dadari (km 1415.69)	Once in a season During construction period (Excluding Monsoon Season)	DFCCIL through contractors	CS/EMU
3	Noise	Noise level on dB (A) scale	CPCB standards	• Khurja (km 1369.82) • Wair (km 1389.95) • Dadari (km 1415.69)	3 times in a year (once in every non monsoon season during construction period)	DFCCIL through contractors	CS/EMU
4	Soil Quality	Parameters are NPK, Sodium Absorption Ratio, Oil & Grease	CPCB Standards	• Khurja (km 1369.82) • Start of Wair Detour (km km 1389.55) • Dadari (km 1415.69)	Once in a year during construction period	DFCCIL through contractors	CS/EMU

Operation Phase

S. No.	Environmental Component	Parameter	Standards	Location	Frequency	Implementation	Supervision
1	Noise	Noise level on dB(A) scale	CPCB standards	• Khurja (km 1369.82) • Wair (km 1389.95) • Dadari (km 1415.69)	3 times in a year (once in every non monsoon season) for 3 years	DFCCIL through NABL Accredited Laboratoratory	CS/EMU
2	Ambient Air quality	PM2.5, PM10, CO, NOx, SO2	CPCB standards	• Khurja (km 1369.82) • Wair (km 1389.95) • Dadari (km 1415.69)	3 times in a year (once in every non monsoon season) for 3 years	DFCCIL through NABL Accredited Laboratoratory	
3	Vibration level	Vibration on dB scale respectively	-	• Khurja (km 1369.15) • Start of Wair Detour (km 1389.15) • Dadari (km 1415.69)	3 times in a year (once in every non monsoon season) for 3 years	DFCCIL throu NABL Accredited Laboratoratory	CS/EMU
4	Plantation	Survival rate	Survival rate may be calculated annually. Minimum 75% survival should be maintained. Any loss should be made up during monsoon	At compensatory afforestation site and along Khurja-Dadari Section of EDFC	Annually for 3 years	DFCCIL throu NABL Accredited Laboratoratory	CS/EMU

10.6 ORGANIZATIONAL FRAMEWORK

The proposed project will be implemented by DFCC through its Environmental Management Unit (EMU). The EMU will be coordinating with the field level implementing agencies such as the Independent Engineer, Contractor and field level DFCC officials. Role and responsibilities of important officials is mentioned below.

Table 10-4: Roles and Responsibilities of Officers

Officer	Responsibility
General Manager (SEMU)	• Overview of the project implementation • Ensure timely budget for the EMP. • Coordination with different state level committee, to obtain regulatory clearances. • Participate in state level meetings • Monthly review of the progress. • Reporting to various stakeholders (World Bank, Regulatory bodies) on status of EMP implementation
Chief Project Manager (DFCC)	• Overall responsible for EMP implementation • Coordination with PIU Staff (EMU & DFCC). • Responsible for obtaining regulatory Clearances • Review of the progress made by contractors • Ensure that BOQ items mentioned in EMP are executed as per Contract provisions.
Deputy Chief Project Manager	• Conducting need-based site inspection and preparing compliance reports and forwarding the same to the Environmental Management Unit (EMU) • Programming necessary training program on environmental issues.
Environmental Officer (PIU)	• Assisting CPM in overall implementation of EMP • Review of periodic reports on EMP implementation and advising Project Director in taking corrective measure. • Conducting periodic field inspection of EMP implementation • Assisting GM (SEMU) to reporting various stakeholders (World Bank, Regulatory bodies) on status of EMP implementation • Preparing environmental training program and conducting the same for field officers and engineers of contractor.
Engineer (Supervision Consultant)	• Act as an “Engineer” for supervising EMP implementation • Responsible for maintaining quality of EMP envisioned in detail Project Report • Maintaining progress reports on EMP implementation • Periodic reporting to PIU-DFCC about the status of EMP implementation • Work in close coordination with Asst. Project Manager (package unit) and contractor.

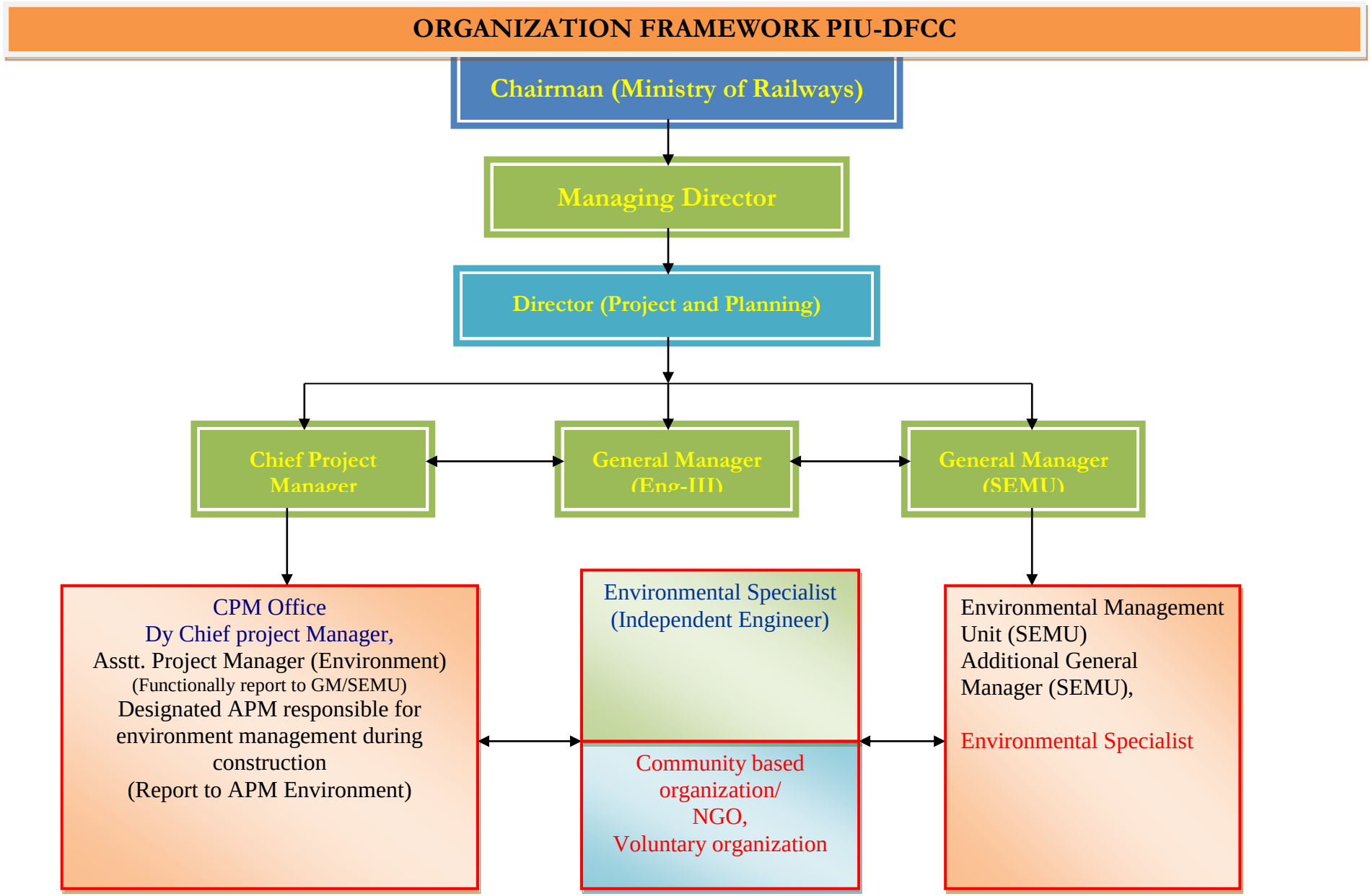
Officer	Responsibility
Asst. Project Manager(Environment)	• Working as site-representative of Chief Project Manager • Conducting regular site inspection to all onsite and offsite works • Maintaining records of all necessary statutory compliance, to be obtained from contractor. • Maintaining records of EMP implementation including photographic records • Attending environmental and social training programs • Preparing periodic reports on EMP implementation and forwarding to EE • APM (Env) will technically report to GM/SEMU at DFCC HQ
Designated APM (Env)	• He will be responsible for implementation and monitoring of EMP, safeguard policies of WB and report to APM (Env).
Environment & Safety Manger of Contractor	• As detailed below

For ensuring that EMP is implemented as per provision in the document, Contractor shall nominate a qualified and experienced Manager from the commencement to completion of the project.

The responsibilities of Environment & Safety Manager of Contractor will include the following:

- Directly reporting to the Project Manager of the Contractor;
- Discussing various environmental/social issues and environmental/social mitigation, enhancement and monitoring actions with all concerned directly or indirectly;
- Prepare Contractor's Checklist, traffic management plan and safety plan as part of their Work Program;
- Ensure Contractor's compliance with the ESMF stipulations and conditions of statutory bodies;
- Assist the project manager to ensure social and environmentally sound and safe construction practices;
- Conducting periodic environmental and safety training for contractor's engineers, supervisors and workers along with sensitization on social issues that may be arising during the construction stage of the project;
- Preparing a registers for material sources, labour, pollution monitoring results, public complaint/grievance redress, and as directed by the Engineer;
- Assisting the DFCC on various environmental monitoring and control activities including pollution monitoring;
- Preparing and submitting monthly/bio-monthly reports to DFCC on status of implementation safeguard measures ; and

- Will be responsible for getting and maintaining the approvals or clearance for various departments and Environmental office.


ORGANIZATION FRAMEWORK PIU-DFCC
Chairman (Ministry of Railways)
Managing Director
Director (Project and Planning)
Chief Project Manager
General Manager (Eng-III)
General Manager (SEMU)
CPM Office
Dy Chief project Manager,
Asstt. Project Manager (Environment)
(Functionally report to GM/SEMU)
Designated APM responsible for environment management during construction
(Report to APM Environment)
Environmental Specialist
(Independent Engineer)
Community based organization/
NGO,
Voluntary organization
Environmental Management Unit (SEMU)
Additional General Manager (SEMU),
Environmental Specialist

10.7 ENVIRONMENTAL BUDGET

The cost of compliance of environmental issues must be included in the Bill of Quantity for the implementation of EMP, although most of the aspects will be covered under the head engineer such as:

- Embankment
- Sign boards along construction sites
- Noise barrier
- Underpass for animals
- Culverts for irrigation canals

However, there are issues that are independently covered under the Environmental Budget such as plantation along DFC, monitoring, enhancement measures, noise barrier, sanitation facility at labour camp, and solid waste disposal at site. The shifting and enhancement cost of sensitive receptors such as temple, school, health facilities, etc shall be covered in R & R under community development. Mitigation measures proposed in the EMP will be implemented by the contractor. The works to be undertaken by the contractor have been quantified and the quantities included in the respective BOQ items such as earth works, slope protection, noise barriers, road safety features and shrub plantation.

Provisional quantities have also been included for additional measures that may be identified during construction and for site fencing, which will depend on the contractors work methods and site locations. Items and quantities have also been included for enhancement measures.

More general environmental management measures to be followed by the contractor have been included in the specifications and in this EMP. These cannot be quantified and are to be included in the contract rates.

The budgetary provisions for the implementation of the environmental management plan of the project are presented in **Table 10.5**

Table 10-5: Cost Estimates for Environmental Management

Sl. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)	Remarks
A. PRE-CONSTRUCTION PHASE						
1.	Tree Felling Permission	Number	-	587	-	Covered under regulatory clearances
2.	Forest Clearance and land diversion cost	ha	-	-	-	Covered under forest clearances
3.	Forest land Diversion Cost					
4.	Acquisition of land required for construction	Ha	-	132.37	-	Covered under project cost
5.	Utility Shifting	-	-	-	-	Covered under regulatory clearances, engineering cost
B. CONSTRUCTION PHASE						
1.	**Mitigation Measures other than Good Engineering practices**					
1.1	Oil interceptors at camps	Number	60,000	4	240,000	Will be provided near storage, vehicle repair section in construction camp
1.2	Soak pits for construction camp	Number	20,000	2	40,000	
2.	**Tree Plantation and Protection**					
2.1	**Avenue plantation including compensatory plantation**					
2.1.1	Plantation and maintenance of saplings for 3 years(ten Trees per km on eitherside)	Number	1,000	460	460,000	
2.1.2	Half brick circular tree guard	Number	500	460	230,000	
3.	**Monitoring of Environmental Attributes during Construction Phase**					
3.1	Monitoring of Air Quality	Per sample	10,000	45	450,000	
3.2	Monitoring of Water Quality	Per sample	6,000	60	360,000	
3.3	Monitoring of Noise Level	Per	3,000	45	135,000	

Sl. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)	Remarks
		sample				
3.4	Monitoring of Soil Quality	Per sample	6,000	45	270,000	
C. ITEMS COVERED UNDER THE RAP BUDGET						
1.	Relocation of private properties					Covered under RAP Budget
2.	Relocation of private water points (wells, tanks, water taps and hand pumps)					
3.	Relocation of graveyards, statues, motor sheds					
4.	Relocation of other community assets including temples, majar, mosque, school etc.					
D. OPERATION PHASE						
1.	Monitoring of Noise Level	Per sample	3,000	27	81,000	Initial Three years Monitoring
2.	Monitoring of vibration Level	Per sample	30,000	27	810,000	Initial 3 years Monitoring
3	Monitoring of Air quality	Per sample	10,000	27	270,000	Initial 3 years Monitoring
4	Monitoring of water quality	Per sample	6000	27	162,000	Initial 3 years Monitoring
5	Monitoring of soil quality	Per sample	6000	27	162,000	Initial 3 years Monitoring
3.	Noise mitigation measures in form of noise barrier at sensitive receptors and habitations	m	6,500	2,000	1,3000,000	
E. GOOD ENGINEERING PRACTICES						
1.	Dust suppression					Covered under contractors quoted rate under construction cost
2.	Erosion control measures (Turfing / Pitching / Seeding & Mulching)					

Sl. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)	Remarks
3.	Provision of cross drainage & side drainage structures					
4.	General borrow area management and maintenance of haul road related to borrow areas					
5.	Air / noise pollution control measures in construction equipments					
6.	Management and disposal of scarified waste bituminous material					
7.	Provision of informatory signs					
8.	Cattle crossings					
9.	Management of quarries					
10.	Redevelopment of borrow area					
11.	Construction camp management cost					
12.	Safety measures for workers					
F. TRAINING & MANPOWER						
1.	Training	Number	100,000	4	400,000	Twice in a year during construction period
2.	Provision of environmental expert	Number	100,000	24	2,400,000	
G.Common Property Resources						
1.	Relocation/ Compensation for CPRS 2 Wells,5 Handpumps,3Tube wells, 01Religious Structure					CPR relocation budget included in RAP Report.