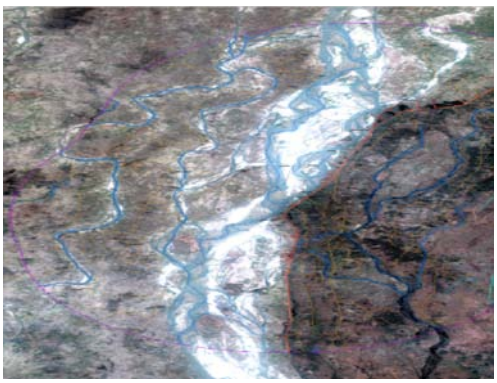
August 2014









ENVIRONMENTAL IMPACT ASSESSMENT FOR PROTECTION & RESTORATION OF KOSI RIVER EMBANKMENTS IN BIHAR

Final EIA Report

Submitted to

FLOOD MANAGEMENT IMPROVEMENT SUPPORT CENTRE

Prepared by

IL&FS ENVIRONMENTAL INFRASTRUCTURE & SERVICES LIMITED

IL&FS | Environment

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ENVIRONMENTAL IMPACT ASSESSMENT FOR PROTECTION AND RESTORATION OF KOSI RIVER EMBANKMENTS IN BIHAR: Final EIA Report

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Abbreviations

AAQ	Ambient Air Quality
APO	Accident Prevention Officer
BAPEPS	Bihar Aapada Punarwas Evam Punarnirman Society
BKFRP	Bihar Kosi Flood Recovery Project
BOD	Biochemical Oxygen Demand
BSPCB	Bihar State Pollution Control Board
CHWTSDF	Common Hazardous Waste Treatment Storage and Disposal Facility
COD	Chemical Oxygen Demand
CPCB	Central Pollution Control Board
DG	Diesel Generator
DPR	Detailed Project Report
EC	Environmental Clearance
EIA	Environmental Impact Assessment
EKE	Eastern Kosi Embankment
EMG	Environmental Management Group
EMP	Environment Management Plan
EPI	Environmental Performance Indicator
ESMF	Environmental and Social Management Framework
FGD	Focus Group Discussion
FMISC	Flood Management Improvement Support Centre
GIS	Geographical Information System
GoI	Government of India
GoB	Government of Bihar
GPS	Geographical Positioning System
KCC	Kisan Credit Card
Km	Kilometer
IEISL	IL&FS Environmental Infrastructure & Services Limited
LPG	Liquified Petroleum Gas
LULC	Land use and Land cover
MoEF	Ministry of Environment and Forests
NAAQS	National Ambient Air Quality Standards
NABARD	National Bank for Agriculture and Rural Development
NABL	National Accreditation Board for Testing and Calibration Laboratories
NOC	No Objection Certificate
NO_x	Nitrous Oxides
NRHM	National Rural Health Mission
PHC	Public Health Center
PHD	Public Health Department
$PM_{2.5}$	Particulate Matter 2.5 micrometers or less in diameter
PM_{10}	Particulate Matter 10 micrometers or less in diameter
PUC	Pollution Under Control
RBM	River Bed Material
ROW	Right of Way
SEAC	State-Level Expert Appraisal Committee
SEIAA	State Environment Impact Assessment Authority
SO_2	Sulphur Dioxide
SPM	Suspended Particulate Matter
SSB	Seema Suraksha Bal
ToR	Terms of Reference
WB	World Bank
WRD	Water Resources Department
WSD	Water and Sanitation Department

ENVIRONMENTAL IMPACT ASSESSMENT FOR PROTECTION AND RESTORATION OF KOSI RIVER EMBANKMENTS IN BIHAR: Final EIA Report

EXECUTIVE SUMMARY

PROJECT OVERVIEW

The River Kosi, known as Kaushiki in Sanskrit scriptures, is one of the major left bank tributaries of the River Ganga. The Kosi River is known as the "Sorrow of Bihar" as the annually recurring floods endanger lives and cause serious damage to crops, livestock and infrastructure as well as the frequent shifting of the river course. The Government of Bihar (GoB) had requested for a financial assistance from the World Bank (WB) to address the emergency needs of the population, as well as the longer term challenges of flood risk management, vulnerability reduction, connectivity, and agricultural productivity.

The GoB, with the financial assistance from the WB, is implementing the Bihar Kosi Flood Recovery Project (BKFRP) involving multi-sector engagement, focused on reducing risk and vulnerability by improving the flood risk management capacity to unlock the agricultural potential of the area ravaged by frequent floods. This approach involves reinforcement of flood control infrastructure such as the Kosi River embankments and their management.

“Bihar Aapada Punarwas Evam Punarnirman Society” (BAPEPS) has been entrusted with various works related with flood control infrastructure development and its sustainable management. These works involve renovation, reinforcement, protection and restoration of the embankment system in consensus with the broader objectives of strengthening the Flood Control Measures in the Kosi River basin.

Considering probable impacts on the natural environment (physical and aquatic), the BAPEPS recommended to conduct an Environmental Impact Assessment (EIA) Study to identify potential environmental impacts due to the proposed restoration and protection of embankments and draw an Environmental Management Plan (EMP) to mitigate the identified issues and impacts in consultation with the project stakeholders.

Flood Management Improvement Support Centre (FMISC) [the “Client”] of Water Resources Department (WRD), GoB is the Administrative Authority for monitoring the progress and completion of the EIA/EMP Study. The FMISC has entered into a Contract Agreement (No:-BKFRP/WRD/Consultancy/02/2013-14, dated January 8, 2014) with M/s. IL&FS Environmental Infrastructure & Services Ltd. (IEISL) to undertake the proposed EIA Study and draw an EMP as per the Environmental and Social Management Framework (ESMF) of the BKRFP and Safeguard Policies of the WB.

This Report presents the Final EIA and EMP and has been finalized after incorporating the comments raised during the review of the Draft Final Report by Standing Review Committee and discussions held with the FMISC Officers.

BRIEF DESCRIPTION OF THE PROPOSED FLOOD PROTECTION WORKS

The Water Resources Department (WRD) of the GoB has planned to restore and strengthen two stretches of the Eastern Kosi River Embankments (EKE), falling within Chainage 0.00 km to 28.20 km and Chainage 78.00 km to 84.00 km. The above stretches of the EKE fall under Supaul and Saharsa Districts of the Bihar State. A copy of the Detailed Project Report (DPR), prepared by the

WRD, to improve flood risk management capacity and reinforcement of the EKE was made available to the IEISL.

OBJECTIVES OF THE EIA STUDY

The objectives of the Study are to identify potential environmental risks and minimize adverse environmental impacts of the proposed restoration and strengthening of the EKE works in their area of influence and to ensure that impacts are minimized.

STUDY AREA

Study Area 1 – EKE 0.00 to 28.20 km chainage, close to the Kosi Barrage in the North (District Supaul, Bihar) and

Study Area 2 – EKE 78.00 to 84.00 km chainage in the South (District Saharsa, Bihar)

SCOPE OF THE EIA STUDY

Detailed field reconnaissance of the proposed alignment, with strip maps presenting all the environmental features and sensitive receptors (trees and structures in the Right of Way (ROW) of the embankments, Reserve Forests, Sanctuaries / National Parks, Rivers, Lakes / Ponds, Religious Structures, Archaeological monuments, Natural Habitats, Schools, Irrigation Canals, Utility Lines, other sensitive structures) along the corridor of the embankments. Conduct a base line Environmental Monitoring of various Environmental Attributes such as ambient air quality, noise levels, water quality (surface water and groundwater), ecological profile, etc. Carry out an assessment of environmental impacts of the Project, including analysis of alternatives for both “with the Project” and “without the Project” scenarios.

Draw Environmental Management and post Project Monitoring Plan with associated detailed cost estimates, bill of quantities and necessary drawings (wherever necessary) for all the identified impacts. The EMP will also provide key criteria for environmental quality monitoring in the project implementation area and suggest an institutional framework for the implementation and monitoring of the recommended measures.

METHODOLOGY

The EIA study has been conducted by a team of experts led by IEISL. The team included experts from various fields such as Environmental Impact Assessment, Ecology, Soil and Geology, GIS and Remote Sensing and Socio-economics. The Study was undertaken in accordance with the requirements of the WB safeguard policies, procedures of project financing by the WB, the ESMF prepared by the BAPEPS for the BKFRP-II and the Guidelines of the Ministry of Environment and Forests (MoEF), GoI for the EIA Study.

A study on the existing status of environment along the two stretches of EKE was conducted. This included the desktop studies and the field surveys. Various environmental components (viz, physical, biological and social) were covered during the Study to gather the baseline data of the Project Area.

The environmental assessment of the Project was conducted using cause-effect relationships, i.e., the project activities-environmental interactions. The identified environmental and social impacts were evaluated against various criteria such as temporality, reversibility, etc., for impact assessment in a better way.

An EMP has been proposed to address the various environmental impacts identified and assessed. The EMP presents project specific guidelines on (1) environmental management strategies, (2) air, water and soil quality management and protection, noise prevention and control, soil erosion control and slope stabilization, management and disposal of wastes, flora and fauna protection, and socio-economic and welfare considerations.

Prior to preparing a detailed methodology for the proposed Study, the IEISL Team met the FMISC Senior Officers in Patna to gather details of the proposed Project Area and the deliverables/outputs of the Study. The IEISL Team undertook the preliminary reconnaissance of the Study Area with the WRD Officers. Based on the observations and discussions during initial site reconnaissance of the Study Area, IEISL detailed out the methodology for the proposed Study. During the course of Study, IEISL held several Focus Group Discussions (FGD) and Public Consultations within the Study area, to understand the views and perceptions of the local inhabitants so that their suggestions / observations / comments on the proposed project activities could be considered while assessing the impacts due to implementation of the Project and accordingly integrate those in the EMP.

BASELINE ENVIRONMENT AND POTENTIAL IMPACTS

Environmental Parameters

Baseline environment monitoring was done to measure and document existing environmental conditions in order to assess the impacts of the proposed works. The environmental assessment was conducted in the Project Area, in 5 km on either sides (country and river side) of the EKE. The existing environmental status and likely impacts on the environment during the construction and post-construction phases of the Project are presented in ***Table 1***.

Landuse / Land Cover

Landuse Land Cover Map was prepared for the Study Area based on satellite imagery dated 2012. It can be seen from the ***Figure 1*** that the major landuse in the Study Area is Fallow Land. Other main prominent landuses include river bed, agricultural lands and open land. Some low density vegetation, inland water bodies and settlements are also seen in the Study Area.

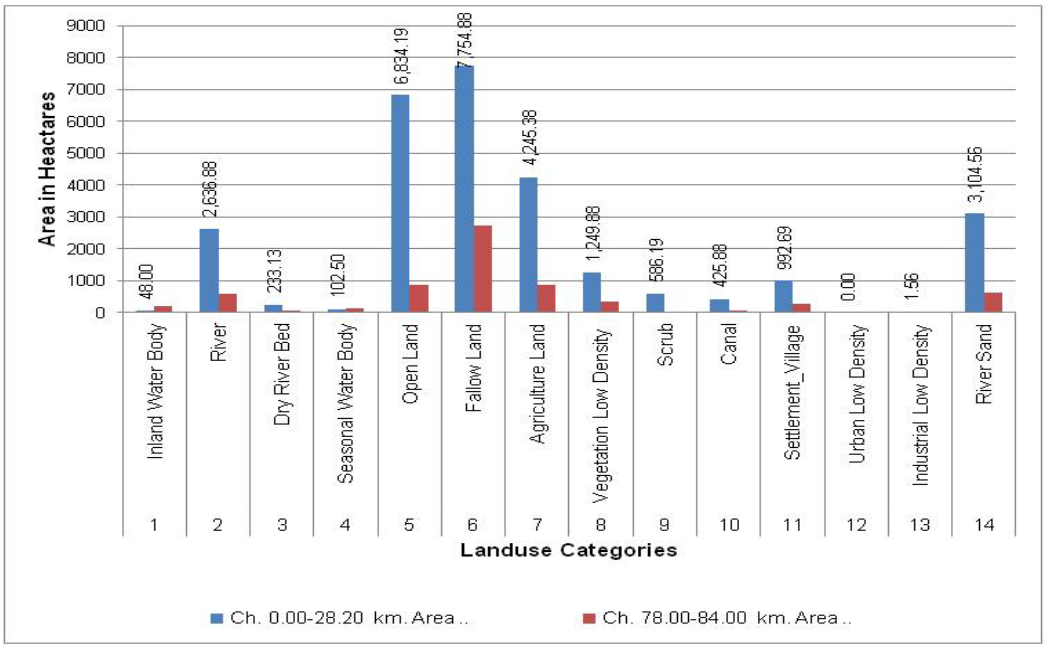


Figure 1: Landuse Land Cover (2012) in the Study Area

Table 1: Baseline Environmental Status and Potential Impacts in the Study Area

S. No.	Environmental Attributes	Existing Environmental Status	Likely Impacts on Environment
1.	Climate	The Project Region falls under "Moist Sub-humid" classification. The area receives plenty of rainfall and has a tropical climate. The area experiences summer season from March to May, monsoon season from June to October and winter season from November to February. Generally, January is the coldest month with an average minimum temperature of the order of 9^0C and May /June are the hottest month with maximum temperature of 42^0C to 43^0C. Southwest monsoon, extending from mid-June to mid-October is mainly responsible for the rainfall in the Kosi River Catchment and the rainfall during these months is about 90% of the total annual rainfall. During winter, there is another short spell of precipitation experienced under the influence of Western disturbances. The average annual rainfall in the region is 1300 mm.	A project of this nature will not have any impact on the climate of the region either during construction or operation phases of the project.
2.	Land Environment	The Project Area lies in the lower region of the Kosi River Valley and can be considered as a large inland delta formed by sandy deposit of the Kosi River. There are many water logged areas on the country side of EKE in both the chainages. These are mainly formed due to seepage from the Kosi River and support aquatic fauna and weeds. The Kosi River Catchment is in the Himalayan Region and is rich in acidic minerals. As a result, the soils of this zone are non calcareous. There is an accumulation of sodium salts and sodium adsorption ratio is on the higher side in the areas where the drainage is poor. Salinity and alkalinity are however, on an increase in the permanently water logged areas. The results of the soil testing indicate that the soil is	**Construction Phase:** • Increase in soil erosion • Pollution by construction spoils • Solid and liquid waste from labour camps **Post construction Phase:** • No impact is envisaged

S. No.	Environmental Attributes	Existing Environmental Status	Likely Impacts on Environment
		in the neutral range. The EC values indicate low salinity levels in the area. The organic carbon indicates moderate to high soil productivity	
3.	Groundwater and Surface Water Quality	The groundwater samples for testing of groundwater quality were collected from six (6) hand pumps located in different places within the Study area. The groundwater monitoring results show that except Iron content, which was higher at four of the sampled locations, all other parameters are well within the permissible limits of the Drinking Water Standards IS:10500. Local enquiry also reveals the presence of Iron in the groundwater in the region and also corroborates with the data received from the WSD, Government of Bihar. Samples for testing of surface water quality were collected from six (6) locations within the Study area from the Kosi River, as a part of this Study. The surface water monitoring results show that there is no pollution load in the Study area and sufficient flow is available in the river for dilution.	**Construction Phase:** • Increase in turbidity of river water • Degradation of water quality due to disposal of wastes from construction sites and labour colonies. **Post construction Phase:** • No impact is envisaged
4.	Air Quality	The status of the Ambient Air Quality (AAQ) was established through a scientifically designed six (6) AAQ monitoring locations, within the two stretches of the EKE, twice a week for a period of one week, at each of the identified locations. Based on the findings of the one-time AAQ monitoring program, it is concluded that at the time of sampling in the month of February, i.e., in winter season, the air quality was observed to be quite good in the Study area. All the parameters including NOx, SO_2, PM_{10} and $PM_{2.5}$ were **within the** permissible limits for residential and rural areas in the NAAQS standards 2009. The absence of industries, low vehicular traffic and low population density could be attributed to good AAQ in the Project Area.	**Construction Phase:** • Pollution due to emissions from increased vehicular movement, use of construction equipment, D.G. sets and labour colonies **Post construction Phase:** • No impact is envisaged

S. No.	Environmental Attributes	Existing Environmental Status	Likely Impacts on Environment
5.	Noise Level	The ambient noise levels monitoring was carried out at six locations, based on the understanding of the proposed routes of material transportation for the restoration works, on 24 hour basis within the Study area. The average ambient noise levels at all the monitoring locations during the day and night time are generally within the permissible limits indicating that the area is not impacted due to high noise levels.	**Construction Phase:** • Rise in noise level due to increased vehicular movement and use of D.G. sets and construction equipment **Post construction Phase:** • No impact is envisaged
6.	Aquatic Ecology	Nearly 20 major fish species are reported in the Kosi River. There are no commercial fisheries in the Project Area and local fishermen fish in the Kosi River and the water logged areas on both sides of the EKE by using local nets and fishing gear either to sell the fish in the local market or for household consumption. During site reconnaissance, presence of turtles in the river was observed indicating a possibility of Turtle Nesting grounds in the area especially on the sandy shoals.	**Construction Phase:** • Marginal reduction in productivity of fish and other aquatic fauna due to increased turbidity levels and over fishing by the labour population • Temporary disturbance to the wetland bird fauna due to noise from the construction equipment, vehicular movement to transport construction materials and establishment of temporary material storage areas **Post construction Phase:** • No impact is envisaged
7.	Terrestrial Ecology	The Project area is devoid of forests, grassland or climax vegetation. The vegetation in the area is akin to that of sub-tropical vegetation. The area is dominated by wild herbs, bushy shrubs and scattered trees. The area is flood prone and no strong climax vegetation is found. Some of them are planted in small patches on the road side/bund; however, their numbers are very few. Most of the species are utilized by the villagers for fodder and fuel.	**Construction Phase:** • Impact due to fuel wood requirement by laborers • Temporary adverse impact on flora and fauna due to increased influx of human population **Post construction Phase:** • No impact is envisaged
8.	Public Health	General sanitation in the Study area is very poor. Only about 2% of the households are covered with individual toilets.	**Construction Phase:** • Increased incidences of water borne diseases • Transmission of diseases by immigrant labour

S. No.	Environmental Attributes	Existing Environmental Status	Likely Impacts on Environment
		The Project area has limited health care facilities. The Study Area has only 1 public health institution per 10,000 population[1]. The Study Area has a very high under-5 mortality rate at nearly 90%.	population **Post construction Phase:** • No impact is envisaged
9.	Socio-Economic Aspects	The Study Area falls under the Supaul and Saharsa Districts. As per Census 2011, total population in these Districts is 41.25 Lakhs, with nearly 90% of the population in rural areas. Average literacy rate in the Districts is about 57% which is lower than the State average of 63%. The economy of this region is largely an agriculture oriented and service oriented base. The Percentage Distribution of Medium, Small and Micro Enterprises Registered in 2011-12 in the Kosi Division (including the two Districts of Supaul and Saharsa) are very low and accounts to only 3.6%. This region has limited infrastructural facilities like all weather roads / transportation services, electricity, safe drinking water and health care centers, etc.	**Construction Phase:** • Increase in employment potential and development of allied sectors leading to boost in economy • Negative impact on existing infrastructure facilities like road and drainage • Cultural conflicts and law and order related issues due to immigration of labour population **Post construction Phase:** • The socio economic benefits of construction phase will not sustain post construction period

[1] *Source: State Health Society, Government of Bihar*

Geology, Hydrogeology and Geomorphology

Geologically, the Study area is underlain by a highly uneven basement formed by the major tectonic features or "fore deeps" named as "Purnea Depression." The sediments are deposited in the Purnea depression or fore deeps into several meters of thicknesses and forms the Eastern Gangetic Alluvial plains. The deposits of Eastern Gangetic alluvial plains comprise of Older Alluvium (Middle-Pleistocene age) such as coarse gravels, calcareous nodule, etc. This is overlain by Newer alluvium of Quaternary age comprising of carbonaceous and micaceous deposits in fine grained sand particles derived from the process of erosion, aggradation, sedimentation and deposition forming the mega alluvial fans.

In the Study area, the hydrogeology (groundwater accumulation, movement and quality) is controlled by the host sediments that store and transmit groundwater. The groundwater condition changes as per the nature of sediments; accordingly the groundwater flow regime will also change. The avulsive shifting nature of the Kosi River also has its impact on the groundwater movement and flow directions in the project area.

Hydrological data analysis shows that the Kosi River displays very high discharge variability and difference between monsoonal and non- monsoonal discharge is of the order of 5. This results in an enormously excess discharge during monsoon months which the river cannot carry within its shallow alluvial channels and overbank / flooding occurs frequently. Significant siltation has also been noticed within the river courses leading to severe reduction in capacity of the river sections and such high sediment load also tend to raise the bed level and encourage overbank flooding during the monsoon seasons.

Topographically/geomorphologically, the vast plain on which the Kosi mega fan has been formed have a general slope from North to South and West to East, being steeper in the North (55-75 cm/km) and flatter in the south (6cm/km). Thus, the entire fan surface is nearly flat, which is dissected by numerous 'Dhars' (small channels) representing paleo-channels of the Kosi River. Some of the paleo channels are vegetated and muddy due to monsoon water and dry season discharges. The entire alluvial plain is extensively cultivated. There are undulations and innumerable depressions called "chaurs", where water remains accumulated for most parts of the year. Some of these waterlogged patches in the lower reaches are very close to the embankments and are very large which may be related to seepage along the embankment but may partly represent accumulation of floodwater after overbank flooding during the floods in 2008. Changes in river geomorphology due to scouring and deposition of transported sediment can affect the stability of embankment sections and spurs.

The present proposed revetment work on Eastern Kosi Embankment from 0.0 km to 28.20 km and 78.0 km to 84.0 km using Reno Mattresses and Gabion Mattresses should conserve the stability of embankment structure and spurs and mitigate the under scouring effect of the eddies/flow current of the Kosi River.

No significant impact due to the project on the geological, hydrogeology and geomorphology setting of the area is expected.

Environmental Impacts

The proposed restoration of the EKE would not have serious negative impacts on the environment and ecology of the area where the proposed works are to be carried out and a few negative impacts, which will be temporary, shall be limited to only during the construction phase of the project. Interaction of the project activities with environmental attributes is presented as Activity-Impact Matrix in ***Table 45*** of this Report.

The "with" and "without" project scenarios are analyzed with respect to necessity of the proposed restoration of the EKE. A comparison of both the scenarios is presented in ***Table 46*** of this Report.

Positive Impacts of the Proposed Project Interventions

1. The proposed installation of Reno Mattresses and Gabion Mattresses may eventually help in reducing pressure on existing/conventional methods in the long run.
2. Improved public safety
3. Improved agricultural land protection
4. Reduced infrastructure damage during the monsoon season
5. The proposed strip map showing all the environment sensitive locations and receptors marked within 5 km buffer on either side of the central line of embankment within the area of intervention will serve as a handy guide for further environmental planning and its protection in the project area and within 5 km on both sides of the EKE
6. Improved technical examination, rehabilitation, monitoring and maintenance of spurs and embankment with community participation
7. Post construction positive impacts on terrestrial ecology are expected due to the increase in vegetation and landscaping

The mitigation measures for each of the envisaged negative impacts are presented in Chapter 6: Environmental Management Plan (EMP).

PUBLIC CONSULTATIONS

During the course of the Study, IEISL held several Focus Group Discussions and Public Consultations within the Study area, to appreciate the views and perceptions of the local inhabitants so that their suggestions / observations comments on the proposed project activities could be considered while assessing the impacts due to project and integrate them in the EMP.

Focus Group Discussions were conducted at nine (9) different locations within the Project area during the reconnaissance surveys. The Focus Group Discussions were held with the locals to identify the sensitive receptors on either side of the EKE up to a distance of 5 km. The Focus Group Discussions were held on the EKE and in the nearby agricultural fields and residential /settlement areas to the EKE including one of the Shoals, during 6th to 9th February 2014.

Public consultations were organized at six different locations in the project area between chainages 0.00 km to 28.20 km and 78.00 km to 84.00 km. These public consultations were held on 5th and 6th April 2014, respectively.

The Public Consultations were conducted in accordance with the World Bank Guidelines (OP/BP 4.01) to inform the local inhabitants of the area, residing within 5 km on either sides of the EKE, about the project, its environmental aspects and likely environmental and social impacts due to proposed EKE restoration and strengthening and seek their views/concerns for consideration while conducting the EIA study and preparation of an implementable EMP.

IEISL along with the WRD officers coordinated with the local Panchayat Heads to inform them about the process and to seek their support in identifying suitable venue for the meetings. The

local residents were invited to attend the Public Consultations. The officers from the EKE Division, WRD from Birpur and Supaul were also present during public consultation meetings.

In general the local people present at the Focus Group discussions and Public consultations did not raise any concern on the environmental impacts of the proposed Kosi EKE restoration and strengthening. The main questions were on drinking water supply, vector borne diseases in the EKE area and compensation or rent, respectively, if the land is acquired or used for temporary storage of construction materials. The public at large supported the restoration and strengthening of the Kosi EKE since the proposed Project will safe guard them from floods and protect their agricultural lands.

The proceedings of all the Public Consultations and the attendance sheets are presented in ***Annexure 9*** of this Report.

PROPOSED ENVIRONMENTAL MANAGEMENT PLAN

The key environmental management objectives for the project are to avoid significant environmental impacts and to ensure that wherever impacts do occur they are mitigated. In addition, the proposed EMP aims to meet the following specific objectives:

- To adopt construction and operational methods which will limit the environmental degradation
- To protect physical environmental components such as air, water and soil
- To conserve terrestrial and aquatic flora and fauna
- To incorporate the views and perceptions of the local inhabitants in the project
- To generate employment opportunities wherever possible and feasible
- To provide environmental guidelines and stipulations to the contractors to minimize the construction related impacts
- To provide adequate safety system to ensure safety of public at large
- To establish post construction monitoring program to monitor effects of the project on the environment
- To audit activities during the construction and to assess implementation of management measures

Various impacts during planning / pre-construction and construction phases and their mitigation measures are presented in ***Table 2*** and ***Table 3***, respectively.

The planning, implementation and management of the various project activities during the construction phase shall be undertaken in line with the WB policies on Environmental and Social safeguards and the suggestions proposed in the Environment management plan, so that most of the environmental impacts, which are of temporary in nature, will be minor and easily mitigated. No potentially adverse, irreversible or long term negative impacts are envisaged due to the proposed project interventions in either of the project phases.

Table 2: Proposed Mitigation Measures for the Impacts during Planning/Pre-construction Phase

S. No.	Impacts	Mitigation Measures
1.	Loss of agricultural land and hutments	Adoption of package to compensate for loss of land, crops and resettlement of the outstees from the existing dwelling places unless those are encroachments on the Government land.
2.	Identification of land for material storage yard/construction camp/labour camp	The proposed activity may require conversion of some agricultural land for material storage/construction camp/labour camps/access roads, etc. The exact requirement of land for these purposes will need to be assessed by the Implementing Agency and the Contractor. The land in question shall not be closer to the water bodies, water logged areas or the wetlands to avoid any impact on the water sources and the associated fauna. The identified agricultural land shall have minimum loss in its productivity.
3.	Damage to existing ecosystem due to borrow activities	Since the borrow areas will be outside the State, the impacts cannot be gauged and EMP prepared on that aspect. However, it is important to note that borrowing / quarrying area shall be selected considering minimum loss of productive land and feasibility of restoration to productive use. The Contractor will have to obtain the Environmental Clearance for the mining of rocks and minor minerals from those areas as per the MoEF guidelines from the concerned State SEAC and SEIAA.
4.	Identification of road stretch/network for construction material transportation	The construction material should be transported in the covered trucks through existing network of roads that needs to be defined / proposed by the Implementing Authority prior to the initiation of proposed works.
5.	Pollution due to debris disposal/wastes generated from construction camps and site office	Suitable area shall be identified to dispose of the wastes from labour camps and the same shall be disposed of in a scientific manner. This will be the responsibility of the Implementing Agency and the Contractor.

Table 3: Proposed Mitigation Measures for the Impacts during Construction Phase

S. No.	Aspect	Proposed Mitigation Measures
1.	Borrow Area Management	Since the borrow areas will be outside the State, the impacts cannot be gauged and EMP prepared on that aspect. However, a few important mitigation measures are being suggested that need to be considered by the WRD / BAPEPS while identifying the borrow areas in consultation with the Contractor. • The Contractor will have to obtain the Environmental Clearance (EC) for the mining of rocks and minor minerals as per the MoEF guidelines from the concerned State SEAC and SEIAA and comply with the EC conditions during the operation of the borrow areas. This needs to be incorporated as a condition in the Contract Agreement to be signed between the Implementing Agency and the Contractor. • Borrow pits should be selected from barren land / wasteland and borrowing from agricultural land shall be minimized to the extent possible. • Borrowing / quarrying area shall be selected considering minimum loss of productive land and feasibility of restoration to productive use. • Borrow pits along the roads, areas nearby to the river embankments or spurs should be avoided. Further, no earth shall be borrowed from already low lying areas. • To the extent possible borrow areas should be sited away from inhabited areas. • The depths in borrow pits to be regulated so that the sides may be limited to 25% steepness. • Borrow areas shall be leveled with salvaged material or other filling materials which do not pose contamination of soil. Else, it shall be converted into fish pond in consultation with local fishery Department and the land owner/community.
2.	Slope Stabilization and Erosion Control	• Road embankment and slope protection / stabilization measures such as use of geo-textile matting, hydro-seeding, etc. should be taken at erosion prone areas. • Provision of side drain to guide the water to natural outfalls • Provision of stone pitching wherever necessary all along the embankment slope. • Side drains should be provided to intercept from intermediate drains serving as outlet channels to reduce the erosion all along the newly developed roads of the embankment. • Suitable strengthening measures should be taken to prevent reoccurrence of soil erosion at existing erosion prone locations and also to prevent erosion at newer locations on the roads all along the Study Area.
3.	Compaction and Contamination of Soil	• Fuel and lubricants should be stored at the predefined storage location that needs to be identified in consultation with the Implementing Agency. The storage area should be paved with gentle slope to a corner and connected with a chamber to collect any spills of the oils. • All efforts should be made to minimize the hazardous waste generation. Unavoidable hazardous waste shall be stored at the designated places prior to disposal in the nearest Common Hazardous Waste Treatment Storage and Disposal Facility (CHWTSDF). Prior to transporting the hazardous waste, its

S. No.	Aspect	Proposed Mitigation Measures
		packaging must be marked and sent to the CHWTSDF with proper manifests as required by the Hazardous Waste (Management, Handling and Transboundary Movement) Amendment Rules Act, 2013. • To avoid soil contamination at the wash-down and re-fuelling areas, "oil interceptor" should be provided. Oil and grease spill and oil soaked materials are to be collected and stored separately in labeled containers (Labeled: WASTE OIL; and hazardous sign be displayed) and sold off to BSPCB/ MoEF authorized recyclers. • To prevent soil compaction in the adjoining productive lands beyond the ROW, the movement of construction vehicles, machinery and equipment shall be restricted to the designated haulage route. • Approach roads shall be designed along the barren and hard soil area to reduce the compaction induced impact on soil. • The productive land shall be reclaimed after construction activity. • Septic tank / soak pits should be provided in the construction labor camps with the provision to use the overflow for plantation. • Domestic solid waste at construction labour camps should be segregated into biodegradable and non-biodegradable waste. The non- biodegradable, recyclable waste shall be sold off. Efforts shall be made that bio-degradable waste shall be composted through pit-composting/bin-composting. Non-biodegradable and non-saleable waste shall be disposed of by burying the waste in a secured manner.
4.	Construction / Debris Waste	• Unusable debris material should be suitably disposed off at pre-designated disposal locations, with approval of the local Panchayat. • The other wastes can be utilized for backfilling embankments, filling pits, and landscaping • The locations of dumping sites should be selected with following considerations: o Unproductive/wastelands shall be selected for dumping sites o These should be away from residential areas and located at least 1,000 m downwind of these locations o Dumping sites should not contaminate the water sources o Dumping sites should have adequate capacity equal to the amount of debris generated o Panchayats should be consulted about the location of debris disposal sites before finalizing the locations
5.	Green Belt Development Plan	• Green belt should be developed on the spurs and both edges of the EKE and its width should at least be 20 m with minimum three rows of plantation. It should be protected and no activity should be allowed in this zone. • Plantation in the area on the river side and the country side, respectively, should be as per the guidelines given in the Embankment Manual of Central Water and Power Commission (CW&PC), Ministry of Irrigation and Power (MoIP), Government of India (GoI), in the form of Vetiver grass,

S. No.	Aspect	Proposed Mitigation Measures
		Bamboo and Prophis juliflora plantation and not the avenue trees, to control the erosion of the slopes. • The trees and well established avenues, if any, existing on the slopes and near the spurs should be retained as they are to stop any loosening of the soil in the area. The roots of the dead trees should be thoroughly removed. The trees that are likely to fall should be safely removed from those areas and the ground or embankment should be properly made up. Additionally, the areas from where the dead or falling trees are removed should be used for plantation of Bamboo, Vetiver grass and Prosophis juliflora. • It is suggested that twice the number of trees cut during the construction phase should be planted in the available space as per the guidelines given in the Embankment Manual of Central Water and Power Commission, Ministry of Irrigation and Power, Government of India. • Plantation of **Casuarina** may help protection from the dust and control the EKE erosion due to wind. Since, Casuarina is a new/alien species in the Study Area, a trial pilot plantation of **Casuarina** should be carried out at any designated location and its performance evaluation should be carried out in terms of reduction of dust and erosion control.
6.	Restoration of Construction Site	• No management plan is suggested for the restoration of the construction areas and no budgetary provision is also suggested for this work as the proposed project activities do not involve large scale digging or removing of earth within the area.
7.	Construction Camps and Immigration of Workers	• Construction camps shall be sited at such locations so as to utilize the existing infrastructure. No productive land should be utilized for construction camps. All sites must be graded, ditched and rendered free from depressions to avoid water stagnation. Accommodation and ancillary facilities, including crèche facilities for the children, recreational facility for workers should be erected and maintained to standards and scales approved by the Implementing Agency. • All camps should maintain a minimum distance of 500 m from habitation and water bodies. • All construction camps shall be provided toilets with provision of septic tanks attached with soak pits. • Drains and ditches shall be treated with bleaching powder on a regular basis. • Garbage bins must be provided in the camp and regularly emptied and disposed off in a hygienic manner. • LPG cylinders or community kitchens may be provided in the labour camps to avoid any tree cutting for fuel wood. • At every workplace, the Implementing Agency/Contactor in collaboration with local health authorities will ensure that a readily available first-aid unit including an adequate supply of sterilized dressing materials and appliances is made available. • Access to the ambulatory services should be provided to approach the nearest hospital in case of an emergency. • The Implementing Agency/Contractor will ensure good health and hygiene of all workers to prevent

S. No.	Aspect	Proposed Mitigation Measures
		sickness and epidemics. • The Contractor will ensure that sufficient supply of suitable and hygienically prepared food at reasonable price is available to the workers. • The Contractor shall provide adequate and safe water supply for use by of the workers. The Contractor shall provide a crèche for the children of the workers in the labour camps. Alternately, the children could be sent to existing Balwadis in the 5 km zone on either side of EKE. • The Contractor shall ensure that all precautions to protect the workers from insect and pest to reduce the risk to sickness. This includes the use of insecticides. • Strict control over alcohol and substance abuse in the labour camps • The workers shall be screened for the health problems before being considered for employment. • Regular health check-up and immunization camps shall also be organized for the workers and nearby population.
8.	Environmental Management at the Labor Camps	In order to minimize the impact on the ecology and ecosystem, following steps are suggested as a part of EMP for the labour camps, which will be mandatorily provided by the Contractor. Accordingly, relevant clauses need to be inserted in the Contract Agreement. • Since the river water quality is good, available in plenty and potable, it should be used as a source of drinking water for the labour camps with proper disinfection. The potable water source should be identified in advance and should be dedicated for the purpose. Similarly, non- potable water source should also be identified for the labours. • There should be a provision of one community toilet for 20 persons. The sewage from the toilet should be connected to septic tanks / soak pits. The overflow from the soak pit should not be allowed to be disposed into any water body and be used only as manure for plantation near the labour camps. • The solid waste generated in the labour camp will be collected selectively, i.e., in separate containers in accordance with waste classification. The waste that can be recycled should be sent to a recycler. The inert waste and the waste that cannot be recycled should be disposed of in the lined pit and compacted to ensure deep burial of the same once the labour camps are demolished post the construction phase. The Contractor is responsible to identify locations for permanent and temporary disposal, acquire all necessary approvals and keep a register of types and quantities of waste that is generated. • The Contractor should make proper and adequate arrangements for meeting the demand of fuel supply to the labourers / workmen to prevent the illegal felling of the trees in the vicinity of the labour camps. The Contractor should be made responsible to supply fuel (Kerosene or LPG) to the workers or establish a community kitchen.
9.	Safety of Construction Workers, Health and Safety Risks to Local Community	• The Contractor should arrange the PPEs for workers, first aid and fire fighting equipments at the construction sites. An emergency plan shall be prepared and duly approved by the engineer in charge to respond to any instance of emergency and safety hazard.

S. No.	Aspect	Proposed Mitigation Measures
		• The Contractor will be required to appoint an Accident Prevention Officer (APO) who will conduct regular safety inspections at construction sites. The APO will have the authority to issue instructions and take protective measures to prevent accidents. • To avoid disruption of the existing traffic due to construction activities, comprehensive traffic management plan shall be drawn up by the concessionaire and approved by the Competent Authority. • Installation of temporary speed bumps to control speed of vehicles near designated pedestrian crossing areas/school areas/ market places/ religious places/ human habitations. • Conduct regular safety audit on safety measures adopted during construction. The audit will cover manpower and their safety, machinery, temporary works, equipment and vehicles, material storage and handling, construction procedures, environment, site safety guidelines, and miscellaneous services.
10.	Health Management Plan	• Periodic removal of water hyacinth from water logged areas will reduce the vector menace considerably. • A medical surveillance by the Birpur Hospital team once in a fortnight will help in identification of the affected patients, who can then be treated at the Birpur Hospital. • In the event it is not possible to get the medical assistance from Birpur Hospital, it will be the responsibility of the Contractor to arrange for the visit of a qualified Doctor to the labour camps.
11.	Transportation and Storage of Materials	• Appropriate permission also needs to be taken from the SSB for transportation of material on the embankment road. • All the temporary storage areas should be located at least 150 m away from the habitat and the water sources. • All equipment operators, drivers, and warehouse personnel should be trained in immediate response for spill containment and eventual cleanup. Readily available, simple to understand and preferably written in the local language emergency response procedures, including reporting, should be provided by the Implementing Agency/Contractor.
12.	Groundwater	• Requisite permission shall be obtained for abstraction of groundwater • Installation of septic tanks and soak pits in the labor camps with the provision to use the overflow for plantation in each camp to avoid groundwater contamination • Sufficient arrangements for water required for construction should be made in a manner that water availability and supply to nearby communities remain unaffected. • The MSW disposal site should be properly lined so that after the completion of the work on the project and demolition of the labour camps the site can be properly closed
13.	Siltation and Surface Water Quality of Rivers and other Water Bodies	• The labour camp should be provided with adequate sanitation facilities including the soak pits for the toilets and the overflow should be used for plantation in the labour camp area • There are water logged areas in the countryside where the labour camps will possibly be located.

S. No.	Aspect	Proposed Mitigation Measures
		Adequate care shall be taken not to establish the sanitation facility in the natural drainage areas and waste water from the camp should not be allowed to flow towards the water bodies • A site should also be designated for the disposal of solid waste from the labour camps which should not be in the natural drainage area and at last 500 m away from the camps and the water bodies in the area • Fuel and lubricant storage tanks shall be stored away from water with catchment pit for spills collection. • All equipment operators, drivers, and warehouse personnel should be trained in immediate response for spill containment and eventual cleanup. Readily available, simple to understand and preferably written in the local language emergency response procedures, including reporting, should be provided by the Implementing Agency/Contractor. • All wastes arising from the construction should be disposed in an environmentally accepted manner so as not to block the flow of water in the channels as documented above in the earlier sections. • No vehicles or equipment should be parked, washed, re-fuelled or repaired near water-bodies, so as to avoid contamination from fuel and lubricants. • All camps should maintain a minimum distance of 500 m from water bodies.
14.	Air Quality	• During construction, the diesel-fired equipment and machinery, which are sources of combustion emissions such as NOx, SO_2 and SPM, will be properly maintained and well tuned • Vehicles carrying the construction material and sand shall be covered properly. It will be ensured that all the vehicles deployed for the project possess Pollution Under Control (PUC) certificate and maintained properly to minimize emissions of contaminants • A speed limit of 40 km/hr will be maintained on the embankment to minimize dust emissions • Loading and unloading of construction materials has to be in covered areas with provisions of water fogging around these locations to minimize dust emissions. In sensitive areas, such as schools, human habitation, places of worship, water will be used to dampen work areas and thus minimize dust • Burning of solid waste, oil rags, plastics, etc. will be strictly prohibited. These materials will be collected and safely disposed of at an approved disposal site • The excavated material shall be stored properly so that it does not generate fugitive emissions • AAQ monitoring program for the same parameters, which were monitored during the baseline studies, will be implemented by the Contractor by hiring the services of a NABL accredited and MoEF Notified laboratory. The monitoring results should meet the air quality standards prescribed by the Central Pollution Control Board (CPCB). Stipulations to the effect will be provided in construction contract agreement. WRD and BAPEPS will monitor that the AAQ monitoring program is scrupulously implemented
15.	Noise Level	• Noise level monitoring during the day time near the sensitive receptors should also be made mandatory along with noise level monitoring on the material transportation routes so that increase in the ambient noise levels, if any, can be known and accordingly preventive steps could be taken. The noise

S. No.	Aspect	Proposed Mitigation Measures
		standards prescribed by the CPCB will be strictly adhered to. • The various noise- generating machinery such as diesel generators, which will be used during the construction, will be fitted with noise-attenuating devices such as silencers, baffles or mufflers. The Contractors will have to maintain the equipment and comply with occupational safety and health standards • Hearing Protection devices (ear plugs or ear muffs) should be provided to the workers who are exposed to noise • The work and traffic schedule will be planned in such a way that noise levels are minimized
16.	Biodiversity Conservation Plan (including terrestrial and aquatic ecology)	• Set up a Plant Nursery in the area, if it is not existing in the nearby area, so that seedlings of the recommended plants are readily available for the plantation on river side and country side of the EKE. • Inspection of the project area by the WRD/BAPEPS with Forest Department official, strict monitoring of laborers and associated workers for any activity related to endangering the life or habitat of wild animals and birds, fisheries is mandatory. • Supply of fuel wood to the labour camps only from the authorized source or completely replace the fuel wood use by providing free subsidized kerosene / LPG to avoid felling of the trees or provide community kitchen for the labour camps for cooking at a subsidized rate. This will have to be ensured by the Contractor and accordingly a condition be put in by the WRD/BAPEPS in the Contract Agreement for this purpose. • Camps and storage yards will be located in the areas already devoid of vegetation or has little vegetation • Restoration and revegetation process will be initiated, following a well-planned schedule, immediately after construction activities are over. Monitoring of the revegetation plan will ensure quick and effective restoration of the affected areas. • Good construction practices should be adopted to prevent increase in siltation level of water to avoid damage to the aquatic ecology.
17.	Natural Hazard Risk	• The mitigation measures recommended in the ESMF prepared by the BAPEPS under the BKFRP-II project should be adopted.

An Index Map showing locations of the proposed interventions, during the implementation phases of the works to be carried out on two stretches of EKE is presented in ***Annexure 10***.

ENVIRONMENTAL MONITORING PLAN AND IMPLEMENTATION ARRANGEMENTS

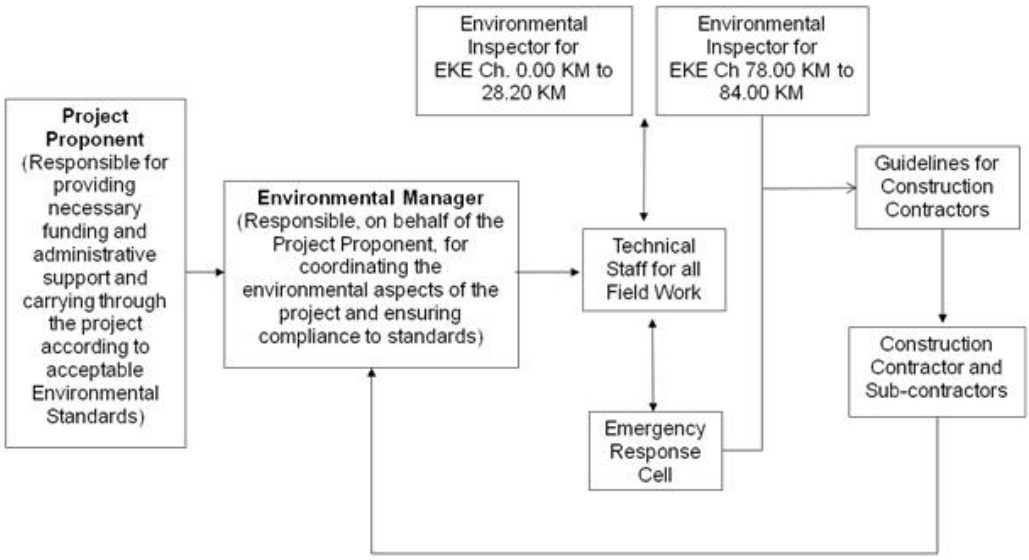
A monitoring program has been prepared to assess the status of environmental quality during the EKE protection works. The objectives of environmental monitoring plan are to:

- Evaluate the performance of mitigation measures proposed in the EMP
- Suggest improvements in the management plan, if required
- Enhance environmental quality
- Comply with the statutory and community obligations
- Warn significant deterioration in environmental quality for further preventive action

This exercise will aid implementation of mitigation measures by way of generating a continuous feedback system in structured format. At the same time, this could be used for conducting corrective action in respect to pitfalls as noticed during inspections. Effectiveness of the proposed mitigation measures during the construction period will be monitored using key environmental performance indicators; (1) Air Quality, (2) Water Quality, (3) Noise Level and (4) Erosion potential. A detailed proposed environmental monitoring program along-with responsibility matrix is documented in the Report.

Institutional/Implementation Arrangements

An organizational structure of the proposed Environmental Management Group (EMG) for environmental management and monitoring is presented below.



Organizational Structure of the Proposed Environmental Management Group

The Construction Contractor will be responsible for ensuring full compliance with environmental matters related to construction activities, as laid down in the EMP. The Construction Contractor will ensure that all the workers are properly briefed in environmental matters in terms of the DOs and DON'Ts while they work on the project. The Environmental Inspectors for each of the two EKE stretches will oversee the day to day functioning of the construction crews and also coordinate environmental testing and monitoring, and training of personnel with respect to environmental components of the project. The WRD/BAPEPS will be responsible for implementation of all the mitigation and management measures suggested in the EMP.

Progress Monitoring and Reporting Arrangements

A proper strategy is necessary for smooth implementation of the mitigation measures. One of the suggested strategy is to make the full plan (including mitigation schemes) public and transparent,

with the help of the existing local level institutions such as Gram Panchayats, if necessary, other media, such as print and electronic, could be employed. This would reduce some of the avoidable speculations.

For the implementation of proposed works under the EMP, it is proposed to have a two-level institutional framework. It is proposed to constitute an Apex Committee to oversee the overall implementation of the proposed works and a Working Level Committee to monitor the implementation of works on the ground level.

The proposed institutional framework for implementing and monitoring the works proposed under the EMP is shown in ***Figure 20*** of this Report.

CONCLUSION

The Project may cause only temporary impacts during construction phase due to the various activities involved during that phase. However, strict adherence to the various mitigation measures as identified under the EMP, strengthened by adequate environmental monitoring and auditing and good construction practices and overseeing the EMP implementation through the suggested implementing mechanism will go a long way in effectively reducing the impacts to a negligible level. Considering the overall environmental review criteria it has been observed that the proposed project would not cause:

- Unwarranted losses of precious resources
- Unwarranted accelerated use of resources for short term gains
- Unwanted hazards to flora and fauna
- Unwanted socio-economic and cultural environment

It is clear from the objectives of the Project that it will have significant positive impacts since it will:

- Provide protection of the EKE slope and protect river edge, thus minimize risks of devastating floods in future
- The proposed Project once implemented will prevent risks to the environment, loss of human lives and properties
- Create social benefits by providing temporary jobs for unskilled workers/labourers during the construction phase

Thus, it can be concluded that the proposed Project is environmentally acceptable and will bring economic, social and environmental benefits to the land users and local community in the area.

EXPENDITURE ON PROPOSED MITIGATION MEASURES

The costing for implementing EMP mitigation measures has been provided in this Report which needs to be borne by the WRD and Contractor. While preparing the estimates of expenditure on proposed mitigation measures, following assumptions were made. It is assumed that the it would take about 20 months (exclusive of monsoon) to complete the proposed works in the two EKE stretches 0.00 km to 28.20 km and 78.00 km to 84.00 km. Further detailed assumptions for each of the stretches are presented at the end of the ***Table 54*** and ***Table 55*** of this Report.

The proposed mitigation costs have been bifurcated in two parts. ***Table 4a*** below summarizes costs which may be incurred by WRD and Other Agencies on environmental measures for both EKE stretches during the entire construction and post-construction period. ***Table 4b*** presents the mitigation measures involving labour amenities, safeguards, health, safety, sanitation and welfare of the labours which is the liability of Contractor. For the suggested measures, no extra costs will be borne by the WRD. The detailed estimate of expenditure which may be incurred on proposed

environmental measures during the construction and post construction period for the EKE Chainages 0.00 km to 28.20 km and 78.00 km to 84.00 km are presented in ***Table 54*** and ***Table 55***, respectively, of this Report.

Table 4a: Expenditure on Mitigation Measures under the Scope of WRD and Other Agencies

S. No.	Component	Stage	Description	For 0.00 to 28.20 km. (Rs.)	For 78.00 to 84.00 km. (Rs.)	Total (Rs.)
A	**Mitigation & Enhancement Cost**					
1	Flora / vegetation	Construction Phase	Bamboo plantation interspersed with Vetiver grass and Prosophis	1,03,74,000.00	22,23,000.00	1,25,97,000.00
			Nursery set up	3,00,000.00	2,00,000.00	5,00,000.00
	Total of Mitigation & Enhancement Cost (A)			**1,06,74,000.00**	**24,23,000.00**	**1,30,97,000.00**
B	**Monitoring Cost**					
During Construction Phase						
1	Air (PM 10, PM2.5, SO2 & NO2)	Construction Phase	Air quality monitoring at construction sites, labour camps, material transportation routes & near habitation on monthly basis (except monsoon)	24,00,000.00	16,00,000.00	40,00,000.00
2	Water (Colour, pH, Electrical Conductivity, Dissolved Oxygen, Turbidity on NTU, Total Dissolved Solids, Total hardness as	Construction Phase	River water and groundwater from hand pumps near habitation on quarterly basis	11,76,000	7,84,000	19,60,000.00

S. No.	Component	Stage	Description	For 0.00 to 28.20 km. (Rs.)	For 78.00 to 84.00 km. (Rs.)	Total (Rs.)
	CaCO3, Calcium as Ca, Magnesium as Mg, Total Alkalinity as CaCO3, Chloride as Cl, Sulphate as SO4, Fluoride as F, Sodium as Na, Potassium as K, Boron as B, Total Phosphate as P, BOD, COD, Ammonical Nitrogen as N, Total Kjeldahl Nitrogen as N, and Total Coliform)					
3	Noise	Construction Phase	Near construction sites, where heavy machineries are working, material transportation routes & near habitation/sensitive receptors on monthly basis	4,80,000.00	3,20,000.00	8,00,000.00
4	Soil Microbiology	Construction Phase	Randomly selected locations between EKE & River on quarterly basis	4,20,000.00	2,80,000.00	7,00,000.00

S. No.	Component	Stage	Description	For 0.00 to 28.20 km. (Rs.)	For 78.00 to 84.00 km. (Rs.)	Total (Rs.)
Post Construction Phase						
1	Water (parameters, as above)	Post Construction Phase	River water and groundwater from hand pumps near habitation for one time	1,68,000.00	1,12,000.00	2,80,000.00
			Total of Monitoring Cost (B)	**46,44,000.00**	**30,96,000.00**	**77,40,000.00**
			Total: (A) + (B) - TOTAL BUDGET FOR EMP IMPLEMENTATION	**1,53,18,000.00**	**55,19,000.00**	**2,08,37,000.00**

Notes:

1. Implementation of mitigation and enhancement measures with respect to air, water, noise, solid waste management and traffic management, labour amenities, safeguards, health, safety, sanitation and welfare of the labours, etc. shall be the liability of the Contractor and the implementing agencies appointed for EKE protection and restoration works. Hence, for the above measures, no extra cost will be borne by the WRD. Suitable clause(s) should be incorporated in the contract document so that the contractor is aware about the mitigation and enhancement measures to be implemented by him. The bid/contract price should cover all costs associated with such mitigation measures. No additional payment, whatsoever, shall be paid to the Contractor in this regard.

2. During Construction phase, protection of embankment with grass sods and soil erosion measures may have to be undertaken before the onset of monsoon as per the site requirement in accordance with the recommendations made in the Embankment Manual of CW&PC, MoIP, GoI.

3. Please refer individual sheets for cost detailing and assumptions made while arriving at the estimates.

Table 4b: Expenditure on Mitigation Measures under the Scope of Contractor

S. No.	Component	Stage	Description	Unit	For 0.00 to 28.20 km.	For 78.00 to 84.00 km.	Total
MITIGATION & ENHANCEMENT COST							
1	Air	Construction Phase	Dust management with water bowser fitted with sprinkler	Day	500	500	1000
			Covers for vehicles transporting construction material	Each Trip	Mandatory	Mandatory	Mandatory
2	Water	Construction Phase	Oil interceptor & soak pit at machineries shed/garage	Each	2	2	4
			Toilet/wash area/urinals at each of the labour camps	Each	36	15	51
			Septic tank & soak pit at each of the labour camps	Each	8	4	12
			Supply of potable water at labour camps and construction sites	Day	600	600	1200
			Storage facility for potable water at labour camps and construction sites	Each	4	2	6
3	Noise	Construction Phase	Ear plugs for labourers/supervisory staff/acoustic enclosures for DG sets	Pair	363	150	513
4	Solid Waste Management	Construction Phase	Waste storage/collection bins	Each	8	4	12
			Manpower for SWM	Person	160	80	240
			Solid waste disposal system *(Burial pit with lining system at each of the camps. The pit will be scientifically closed by putting liner system at the end of the project completion)*	Job	Mandatory	Mandatory	2 Facilities
5	Traffic Management	Construction Phase	Traffic managers	Person	120	80	200
			Road Signs / Road Furniture	Each	55	37	92

Note: Implementation of mitigation and enhancement measures with respect to air, water, noise, solid waste management & traffic management, labour amenities, safeguards, health, safety, sanitation and welfare of the labours, etc. shall be the liability of the Contractor and the implementing agencies appointed for EKE protection and restoration works. Hence, for the above measures, no extra cost will be borne by the WRD. Suitable clause(s) should be incorporated in the contract document so that the contractor is aware about the mitigation and enhancement measures to be implemented by him. The bid/contract price should cover all costs associated with such mitigation measures. No additional payment, whatsoever, shall be paid to the Contractor in this regard.

1 INTRODUCTION

1.1 PROJECT OVERVIEW

The Kosi River, known as Kaushiki in ancient Sanskrit scriptures, is one of the major left bank tributaries of the River Ganga. Rising at an altitude of 7000 meters in the higher Himalayas, the Kosi is the third biggest Himalayan River, being next only to the Indus and the Brahmaputra. The river system lies between 85°- 89° E Longitude and 25°- 29° N Latitude. The upper catchment of the river lies in Nepal and Tibet, while the lower catchment falls in India.

The Kosi River is known as the *"Sorrow of Bihar"* as the annual floods endanger lives and cause serious damage to crops, livestock and infrastructure as well as cause the frequent shifting of the river course. The Kosi Project – 1953, completed in the sixties, eased the distress to a considerable extent but further measures are still needed to provide a sustained long-term solution to the concurrent problems faced by the people living in the zone of influence.

In view of the devastation caused due to frequent shifting of the course of Kosi River, the Government of Bihar (GoB) had requested for a financial assistance from the World Bank (WB) to address the emergency needs of the population, as well as the long term challenges of flood risk mitigation, vulnerability reduction, connectivity, and agriculture productivity.

The GoB, with the financial assistance from the WB, is implementing the Bihar Kosi Flood Recovery Project (BKFRP) Phase-II, involving multi-sector engagement, focused on reducing risk and vulnerability by improving flood risk mitigation capacity in order to unlock the agricultural potential of the area ravaged by the frequently occurring devastating floods. This approach involves reinforcement of flood control infrastructure, the Kosi embankments and their management.

“Bihar Aapada Punarwas Evam Punarnirman Society” (BAPEPS) has been entrusted with various works related with flood control infrastructure development and sustainable management of the infrastructure. The works involve appropriate renovation, reinforcement, protection and restoration of the Kosi Embankment system in consensus with the broader objectives of strengthening the Flood Control Measures in the Kosi River basin.

Considering probable impacts on the natural environment (physical and aquatic), the BAPEPS recommended to conduct an Environmental Impact Assessment (EIA) study to identify potential environmental impacts due to the proposed restoration and protection of the Kosi embankments and prepare an Environmental Management Plan (EMP) to mitigate the identified issues and impacts with stakeholders involvement.

Flood Management Improvement Support Centre (FMISC) [the “Client”] of Water Resources Department (WRD), GoB is the Administrative Authority for monitoring the progress and completion of the EIA/EMP Study. The FMISC has entered into a Contract Agreement (No:-BKFRP/WRD/Consultancy/02/2013-14, dated January 8, 2014) with M/s. IL&FS Environmental Infrastructure & Services Ltd. (IEISL) to undertake the EIA Study and prepare an EMP as per the Environmental and Social Management Framework (ESMF) of the BKRFP and Safeguard Policies of the WB.

A Final EIA Report has been prepared by IEISL to document the findings of the EIA study (the “Study”) and present an EMP to mitigate the identified impacts as per the sanctioned

Terms of Reference (ToR) of the Study. This Report presents the Final EIA and EMP and has been finalized after incorporating the comments raised during the review of the Draft Final Report by Standing Review Committee and discussions held with the FMISC Officers.

1.2 BRIEF DESCRIPTION OF THE PROPOSED FLOOD PROTECTION WORKS

1.2.1 General

The Water Resources Department (WRD) of the GoB planned to restore and strengthen the two stretches of the Eastern Kosi River Embankments (EKE), falling within 0.00 km to 28.20 km and 78.00 km to 84.00 km chainage. The above stretches of the EKE fall under Supaul and Saharsa Districts of the Bihar State. Study Area is discussed in detail in subsequent sections of this Chapter.

A copy of the Draft Detailed Project Report (DPR), prepared by the WRD, to improve flood risk management capacity and reinforcement of the EKE was made available to IEISL. In the Draft DPR, the WRD proposed to undertake the following river edge / spur / embankment protection works for the stretches between 0.00 km to 28.20 km, and 78.00 km to 84.00 km of the EKE.

1.2.2 Proposed Components of Works for EKE Chainage 0.00 km to 28.20 km

1. River edge protection works where river edge is more than 50 m to 500 m by Gabion filled with boulders of thickness 0.50 m above on Geo-Gabion box filled with Geo Bags filled by local sand in width of 30 m. The kilometer-wise proposed river edge protection works are as below:

Table 5: Length of the EKE Chainage

Chainage (km)	Length (m)
0.00 – 2.03	2,700
4.00 – 5.40	1,600
6.94 – 7.85	1,000
9.25 – 10.35	1,360
13.45 – 16.64	3,800
18.27 – 23.32	6,050
25.14 – 28.20	4,060
TOTAL	**20,570**

The edge protection is proposed in 30 m X 0.5 m by Gabions of size 3.0 m X 1.0 m X 0.5 m filled with boulders. Out of the 30 m width, 12 m width in dry portion is proposed by crane and balance and the balance18 m (30 m – 12 m = 18 m) is proposed by barge and crane (in water portion). These Gabions are filled with boulders on Geo-Gabion base of size 1.8 m X 1.8 m X 1.0 m and Geo Bag of size 1.00 m X 0.70 m filled with local sand.

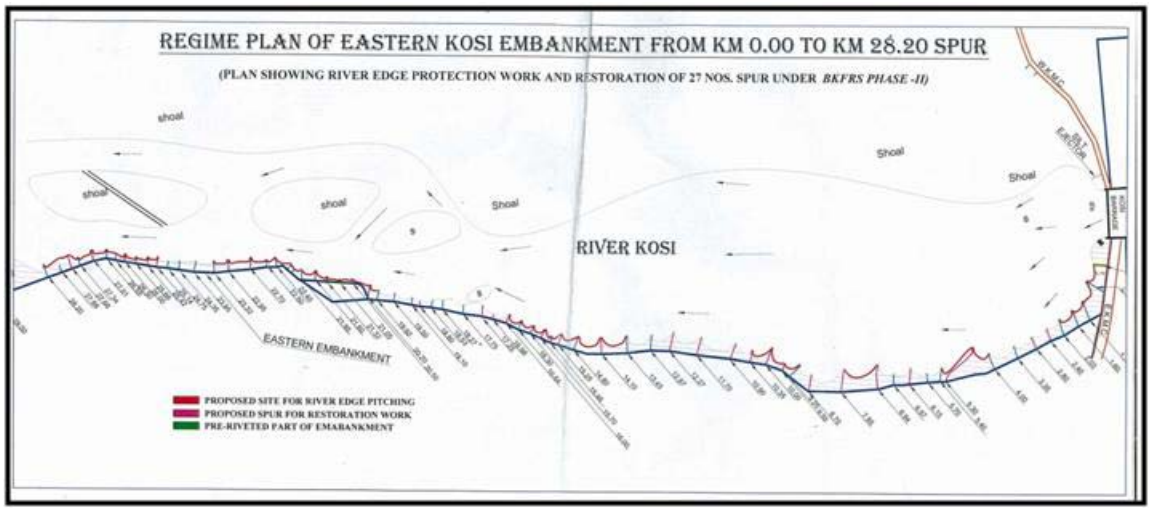
2. Nose protection of spurs by Gabion filled with boulders of thickness 0.50 m in width of 30 m.

3. Slope protection by Reno-Mattresses filled by boulders of thickness 0.23 m.

4. Restoration of 27 Spurs at the below mentioned chainage:
km 2.40 spur, km 2.80 spur, km 5.30 spur, km 6.15 spur, km 6.94 spur, km 7.85 spur, km 8.70 spur, km 9.50 spur, km 10.00 spur, km 10.35 spur, km 10.90 spur, km 11.70 spur, km 12.37 spur, km 14.10 spur, km 15.70 spur, km 16.64 spur, km 16.98 spur, km 17.25 spur, km 18.80 spur, km 21.05 spur, km 21.32 spur, km 21.60 spur, km 24.75 spur, km 25.14 spur, km 26.00 spur, km 27.01 spur, km 27.68 spur.

Figure 2 presents the proposed protection and restoration works along 0.00 km to 28.20 km

Figure 2: Proposed Protection & Restoration Works along Chainage 0.00 km to 28.20 km



Source: Water Resources Department

1.2.3 Proposed Components of Works for EKE Chainage 78.00 km to 84.00 km

1. Revetment of main EKE between 78.00 km and 84.00 km with Reno and Gabion mattresses, where the River edge distance is less than 50 m from the main embankment toe of E.K.E. (i.e., between 81.50 km to 82.50 km of EKE)

2. Revetment of River edge with Reno and Gabion mattresses, where the River edge lies at a distance more than 50 m from the main embankment.

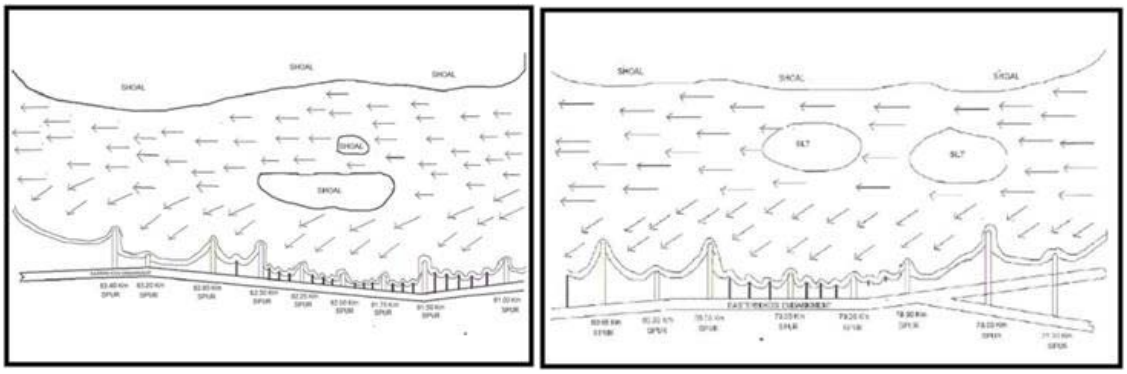
3. Protections of nose and aprons of spurs i.e., armouring of spurs.

4. Raising, strengthening of spurs and laying river bed material over them

5. Other infrastructure and ancillary works

Figure 3 presents the general arrangement of EKE and Spurs along 78.00 km to 84.00 km

Figure 3: General Arrangement of EKE and Spurs along Chainage 78.00 km to 84.00 km



1.3 OBJECTIVES OF THE EIA STUDY

The objectives of the Study is to identify potential environmental risks and impacts of the proposed restoration and strengthening of the EKE works in its area of influence. The

process will include collection and analysis of environmental data as part of baseline mapping, identification and site-specific examination of the project's potential negative and positive environmental and social impacts, which will be used to prepare an implementable EMP. The EMP will recommend measures needed to prevent, minimize and mitigate the adverse impacts and improve environmental performance. The EMP will also provide key criteria for environmental quality monitoring in the project implementation area and suggest an institutional framework for the implementation and monitoring of the recommended measures.

1.4 STUDY AREA

As per the ToR outlined in the Contract Agreement, the Study area lies within 5 km envelop on either sides of EKE alignment, the details of which are presented below in ***Figure 4***.

Study Area 1 – EKE 0.00 km to 28.20 km chainage, close to the Kosi Barrage in the North (District Supaul, Bihar) and

Study Area 2 – EKE 78.00 km to 84.00 km chainage in the South (District Saharsa, Bihar)

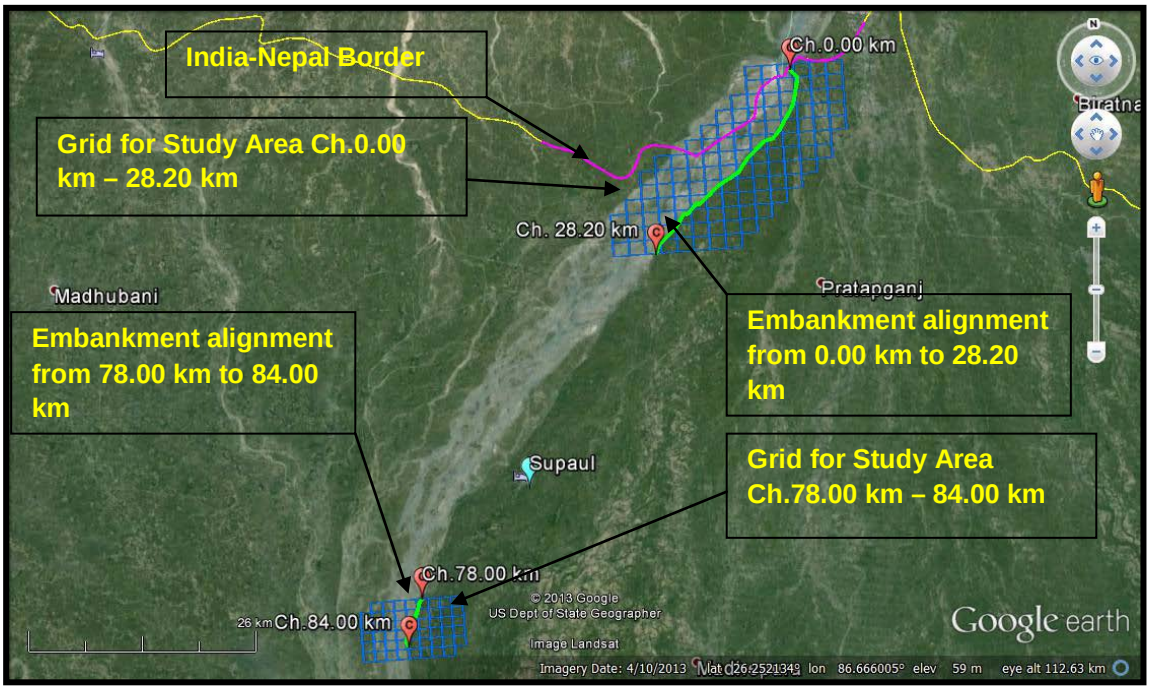


Figure 4: Study Area

1.5 SCOPE OF THE EIA STUDY

The scope of the Study, as outlined in the Contract Agreement, is presented below:

1. Preparation of an environmental profile of the Project Influence Area, within 5 km distance on either sides of the alignment of the EKE with details of all the environmental features and sensitive receptors such as Reserve Forests, Sanctuaries / National Parks, Rivers, Lakes / Ponds, Religious Structures, Archaeological monuments, Schools, Irrigation Canals, Utility Lines, Trees and Structures in the Right of Way (ROW) of the embankments.

2. Detailed field reconnaissance of the proposed alignment, with strip maps presenting all the environmental features and sensitive receptors (trees and structures in the ROW of the embankments, Reserve Forests, Sanctuaries / National Parks, Rivers, Lakes / Ponds, Religious Structures, Archaeological monuments, Natural Habitats, Schools, Irrigation Canals, Utility Lines, other sensitive structures) along the corridor of the embankments. Recording of the environmental features clearly on the strip maps indicating their distance from the centre line of the proposed alignment.

3. Carry out a base line Environmental Monitoring of various Environmental Attributes such as ambient air quality, noise levels, water quality (surface water and groundwater), ecological profile, etc. The monitoring surveys shall be carried out for one round of sampling depending on the sensitivity of the environmental attributes (such as settlements, schools, cultural/ heritage sites, etc.) and the probable impacts of the project.

4. Conduct an assessment of environmental impacts of the Project, including analysis of alternatives for both "with the Project" and "without the Project" scenarios.

5. Suggest measures to be taken up for the mitigation of Environmental Impacts with associated detailed cost estimates, bill of quantities and necessary drawings (wherever applicable) for all the identified impacts.

6. The Public Consultation and Disclosure of the Project and its impacts as per the operational policies of the World Bank in consensus with the Implementing Agency.

7. Prepare Environmental Management and post Project Monitoring Plan with associated detailed cost estimates, bill of quantities and necessary drawings (wherever necessary) for all the identified impacts.

8. Suggest the Institutional Mechanism for the implementation and monitoring of EMP along with the role of all the agencies involved in the project implementation inclusive of community organization involvement.

1.6 METHODOLOGY

The Study was undertaken in accordance with the requirements of the WB safeguard policies and in accordance with the procedures of preparing project finance by the WB, in accordance with the ESMF prepared by the BAPEPS for the BKFRP-II and in accordance with the Guidelines of the Ministry of Environment and Forests (MoEF), GoI for the EIA Study.

Prior to preparing a detailed methodology for the proposed Study, the IEISL Team met the FMISC Senior Officers at Patna to get details on the proposed Project Area and the desired output of the Study. Post the kick-off meeting; the IEISL Team undertook the preliminary reconnaissance of the Study Area with the WRD Officers. Based on the observations and discussions during initial site reconnaissance of the Study Area, IEISL detailed out the methodology for the proposed Study.

Proposed methodology for the Study is presented in ***Figure 5***.

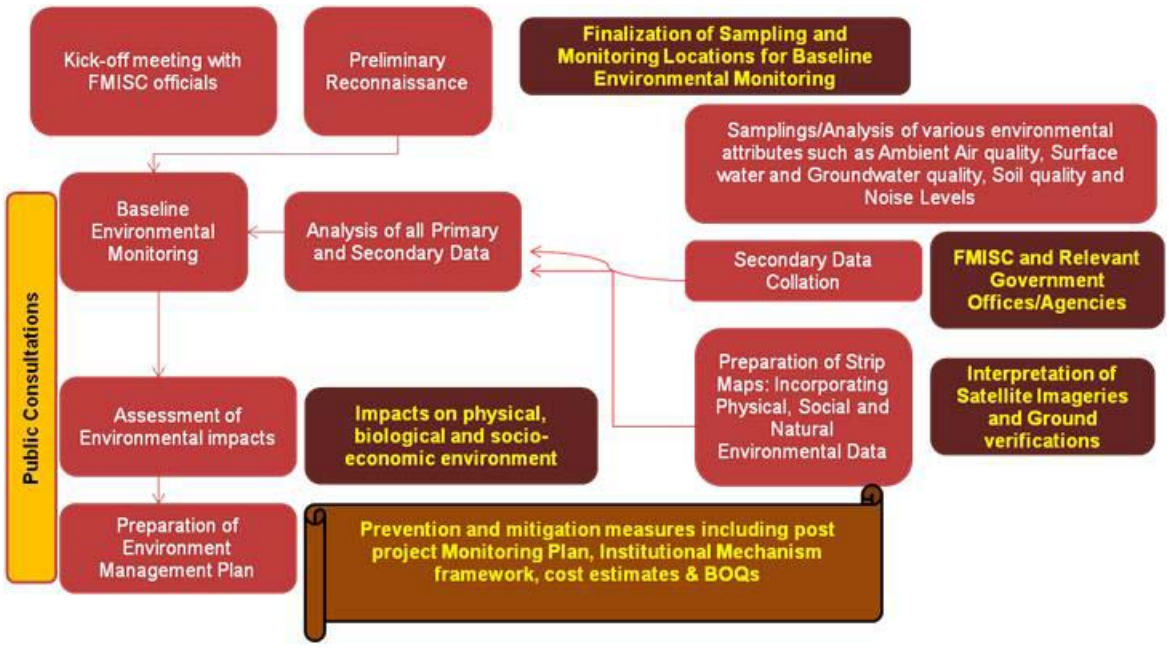


Figure 5: Proposed Methodology for the Study

1.7 STAKEHOLDER INTERACTIONS AND MILESTONES ACHIEVED

This section describes the interactions between the IEISL Project Team and the Project Stakeholders including Senior Officers of the FMISC, Water Resources Department (WRD) and the Government of Bihar from the date of signing of agreement between FMISC and IEISL. As laid down in the Contract Agreement, IEISL has carried out all tasks and achieved all the milestones including site visits, preparation of reports, presentations and stakeholder interactions at various stages of the Project as presented below in ***Table 6***.

Table 6: Summary of Stakeholder Interactions and Milestones Achieved

Sl. No.	Date	Venue	Representatives of FMISC/WRD/Govt. of Bihar	Purpose / Milestones Achieved
1	15/01/2014	FMISC Patna	Mr. B.K. Sinha, Deputy Director Mr. B. K. Gupta Assistant Director	**Signing of Contract Agreement for EIA Study**
2	20/01/2014	FMISC Patna	Mr. B.K. Sinha, Deputy Director Mr. B. K. Gupta, Assistant Director Mr. Parvez Akhatar, A.E. Mr. Sanjay Mathur, Head GIS and Spatial Database Specialist Mr. Sudeep Mukherjee, Non-Spatial Database Specialist	Kick-off Meeting and Secondary Data Collection
3	21/01/2014	EKE Birpur Divisional Office	Mr. Dinesh Yadav, SDO	Meeting and Site Reconnaissance Survey (0.00 km - 28.20 km EKE)
4	22/01/2014	EKE Birpur Divisional Office	Mr. Om Prakash, Executive Engineer	Meeting and Site Reconnaissance Survey (0.00 km - 28.20 km EKE)

Sl. No.	Date	Venue	Representatives of FMISC/WRD/Govt. of Bihar	Purpose / Milestones Achieved
		EKE Supaul Divisional Office	Mr. J. P. Ghosh, E.E. Mr. Ashok Kumar Sharma, SDO Mr. Kishor Kunal, J.E. Mr. Virendra Kumar, J.E. Mr. Ram Parvesh Singh, J.E.	Meeting and Site Reconnaissance Survey (78.00 km – 84.00 km EKE)
5	23/01/2014	EKE Birpur Divisional Office	Mr. Rajesh Kumar, Ch.Eng.	Meeting and Discussion on the Project and Secondary Data Collection
		Water and Sanitation Department, Supaul	Mr. Devendra Prasad, Executive Engineer	Secondary Data Collection
		Fisheries Department, Supaul	Mr. Iqbal Hasan	Secondary Data Collection
		Agriculture Department, Supaul	Mr. Santosh Kumar Suman, SDO	Secondary Data Collection
		District Development Commissioner (DDC), Supaul	Mr. Hari Prasad	Secondary Data Collection
6	24/01/2014	FMISC Patna	Nr. A. K. Samaiyar, Joint Director Mr. B.K. Sinha, Deputy Director Mr. B. K. Gupta, Assistant Director Mr. Parvez Akhatar, A.E. Mr. Sanjay Mathur, Head GIS and Spatial Database Specialist Mr. Sudeep Mukherjee, Non-Spatial Database Specialist	Post site reconnaissance Meeting and sharing of observations
		Department of Environment and Water Management, A. N. College, Patna	Prof. Ashok Ghosh	Secondary Data Collection
		Bihar State Pollution Control Board, Patna	Mr. Rakesh Kumar, IFS, Member Secretary Mr. S. Jaiswal, Scientist	Secondary Data Collection
7	06/02/2014	Office of Executive Engineer, WRD, Birpur Division	Mr. Om Prakash, Executive Engineer	The Baseline Environmental Monitoring along 0.00 km - 28.20 km started

Sl. No.	Date	Venue	Representatives of FMISC/WRD/Govt. of Bihar	Purpose / Milestones Achieved
8	07/02/2014	Office of Executive Engineer, WRD, Birpur Division	Mr. Om Prakash, Executive Engineer	Day to day progress of the sampling / monitoring works has been communicated to EE.
		Basantpur Block Office, Basantpur	Mr. Asarfi Sahni, BEO	Secondary Data Collection
		Public Health Dept. Office, Basantpur	Mr. Rajesh Kumar Pande, Block M&E Assistant	Secondary Data Collection
9	08/02/2014	Office of Executive Engineer, WRD, Supaul Division.	Mr. Kunal, JE	Environmental Baseline Sampling / Monitoring and Public Consultation at EKE Chainage 78.00 km to 84.00 km. started
		Fisheries Department	Mr. Iqbal Hasan	Secondary Data Collection
		Agriculture Department, Supaul	Mr. Ram Prabodh Thakur, BDO	Secondary Data Collection
		Disaster Management Department, DM office, Supaul	Sr. Clerk Mr. Awadhesh Chand Zha	Secondary Data Collection
		Statistical Department, DM office, Supaul	Sr. Clerk Mr. Ali	Secondary Data Collection
10	09/02/2014	Office of Executive Engineer, WRD, Supaul Division	Mr. Kunal, JE	Discussed about the possible routes for transportation of construction material for the proposed restoration works.
11	10/02/2014	Water and Sanitation Department, Supaul	Mr. Devendra Prasad, Executive Engineer	Secondary Data Collection. Received water quality data: Water quality data from Public Health Department for the period of July 2013 have been received. Relevant sections of Water Quality Study conducted by M/s. Envirotech East (P) Limited, Kolkata for Supaul District has

Sl. No.	Date	Venue	Representatives of FMISC/WRD/Govt. of Bihar	Purpose / Milestones Achieved
				been received
		Statistical Department, DSO office, Supaul	Mr. Bhim Sharma, DSO Statistics	Block and Village wise Census 2011 data for Supaul district have been received.
		Disaster Management Dept. DM Office, Supaul.	Mr. Kumar Arun Prakash, ADM of Disaster Management Dept.	IEISL Team had discussion on flood hazard in Supaul District. Discharge data of Kosi river has been collected.
		District Rural Development Authority (DRDA), DM office, Supaul	Mr. Kishori Prasad, officer at District Rural Development Authority (DRDA)	Secondary Data Collection
12	11/02/2014	FMISC Patna	Sanjay Mathur, Head GIS and Spatial Database Specialist	Appraised about recently completed Baseline Environmental Monitoring. River status imagery (Dec-2013) and flood map of 2008 have been received
		Bihar State Pollution Control Board Office at Patna	Mr. S. Jaiswal Scientist, Bihar State Pollution Control Board.	Water quality data of Kosi region for the period 2010 to 2013 have been received from Bihar Pollution Control Board
13	03/03/2014	FMISC Patna	Standing Review Committee Members	**Presentation on Draft Inception Report by IEISL and discussion**
14	05/03/2014 to 07/03/2014	Study Area	Shri Ram Pravesh Singh, SDO	Identification of Sensitive Receptors, Public Consultation and discussion on DPR for the 78.00 to 84.00 km EKE
15	01/04/2014	BAPEPS, Patna	Shri Awadhesh Ram, APD, BAPEPS Shri Sunil Kumar Singh, DD (Project), BAPEPS Shri Ravi Gupta, State Project Expert (Environment)	Discussion on the comments raised by BAPEPS on the Draft Inception Report post SRC meeting held on 03.03.2014
		FMISC, Patna	Mr. A. K. Samaiyar, JD Mr. B. K. Sinha, DD Mr. B. K. Gupta, AD	Discussion regarding BAPEPS comments on Inception Report and Public

Sl. No.	Date	Venue	Representatives of FMISC/WRD/Govt. of Bihar	Purpose / Milestones Achieved
				Consultation program
16	02.04.2014 to 06.04.2014	Study Area	Shri Om Prakash, EE Shri Dinesh Yadav, SDO Shri Ram Pravesh Singh, SDO	Identification of Sensitive Receptors, Public Consultation and discussion on DPR for the 0.00 to 28.00 km EKE
17	07.05.2014	FMISC, Patna	Standing Review Committee Members	**Presentation on Interim Report by IEISL**
18	27.06.2014	FMISC, Patna	Standing Review Committee Members	**Presentation on Draft Final EIA Report by IEISL**
19	27.08.2014	FMISC, Patna	Standing Review Committee Members	**Presentation on Final EIA Report by IEISL**

As can be noted from the ***Table 6*** above, IEISL conducted all the activities in consultation with the Senior Officials of BAPEPS / FMISC / WRD. The baseline environmental monitoring and transect survey to plot various sensitive receptors in the Study Area and the Focus Group Discussions and Stakeholder Consultations were held in presence of the concerned officers from the WRD Team posted at Supaul and Saharsa.

1.8 STRUCTURE OF THE REPORT

Chapter 1 of the Final EIA Report presents the background information of the Project. This chapter also presents the objectives of the EIA Study, scope of work and the methodology adopted for the Study.

Chapter 2 presents a critical discussion on the policy, legal and administrative framework applicable for this Project.

Chapter 3 presents the assessment of the baseline environmental status of the Study Area. It describes in detail the surveys / field studies carried out as part of the Project. The outcome of the surveys / field studies is presented in this Chapter.

Chapter 4 presents the impacts of the Project on the environment.

Chapter 5 documents the proceedings of the Public Consultation conducted as part of the EIA Study.

Chapter 6 presents the proposed EMP. This includes the proposed measures needed to prevent, minimize and mitigate the adverse impacts and improve environmental performance, along with the proposed Implementation Mechanism for the EMP and financial estimates for the implementation of environmental measures proposed in the EMP.

2 POLICY AND LEGAL FRAMEWORK

This chapter discusses the laws, regulations, and policies of Government of India, Government of Bihar, and the WB related to environmental and social issues pertaining to the Project.

2.1 OPERATIONAL POLICIES AND DIRECTIVES OF THE WORLD BANK

All projects funded by WB are subject to safeguard policies and procedures of WB, particularly OP/BP/GP 4.01 Environmental Assessment including public consultation requirements. These procedures describe the tools and procedures to mitigate or avoid the negative economic, social and environmental issues that may arise. The WB Safeguard Policies which are applicable to the Project are summarized in ***Table 7*** below. The Project has been designed with full compliance to the requirement of the WB Safeguard Policies.

Table 7: Operational Policies and Directives of the World Bank

The Bank Safeguard Policies related to the Protection of Environment	Applicability to the Project
Environmental Assessment (OP/BP 4.01)	**Applicable** The major environmental issues would be the construction related impacts, which would be temporary and experienced only during the construction phase of the Project. Appropriate measures are suggested in the EMP to mitigate the impacts.
Natural Habitats (OP/BP 4.04)	**Applicable** The impacts will be insignificant and localized and limited to construction phase only. Appropriate measures are suggested in the EMP to mitigate and enhance the environment of the Project Area.
Forestry (OP/BP 4.36)	**Not Applicable** The Project Area between chainage 0.00 km and 28.20 km and between 78.00 km and 84.00 km does not fall under Forest zone.
Pest Management (OP 4.09)	**Not Applicable**
Involuntary Resettlement (OP/BP 4.12)	**Applicable** The project stretching between chainage 0.00 km and 28.20 km, and 78.00 km and 84.00 km do not envisage land acquisition and physical displacement. Therefore there shall not be any impacts on the local people due to involuntary resettlement or acquisition of the land. However, material storage areas have been proposed at the construction sites and hence during the construction phase of the project, some private agricultural lands will be temporarily used for the storage of the materials. Unless the construction takes place in the post harvest season, the local farmers may experience difficulties and loss of crops to the extent the farm lands are used as material storage facility. During the Public Consultations held at six locations on both the stretches, this point was posed to the locals and farmers to garner their perception on this issue. Most of the locals who attended the Public consultations have agreed to allow their land being used for the material storage only during the post harvest

The Bank Safeguard Policies related to the Protection of Environment	Applicability to the Project
	season and with appropriate compensation as a rent for such land use.
Indigenous People (OP/BP 4.20)	**Not Applicable** The People of the study area do not exhibit any indigenous characteristics as described in the Bank's Operational Policy on Indigenous People.
Safety of Dams (OP/BP 4.37)	**Not Applicable**
Physical Cultural Resources (OP/BP 4.11)	**Applicable** Within the Project Area, there are quite a few religious places (such as Temples and Mosques) However, the proposed project will have very limited impact on these resources since the construction shall be carried out on the river banks. There could be disruptions during the Temple festivals or the weekly market days near the temples located on the embankment due to transportation of the materials, earth moving equipment and machinery on the embankment. This impact could be negated by planning the material movement and construction activities in such a manner that those do not coincide with the local festivities.
Projects in Disputed Areas (OP/BP/GP 7.60)	**Not Applicable** No part of the Project Area is under any dispute.
Projects on International Waterways (OP/BP/GP 7.50)	**Applicable** The source of the Kosi River is in Nepal, hence it is applicable. However, the proposed works will be undertaken in the Sovereign Indian territory and do not require any permission from Government of Nepal nor any impacts will be felt in Nepal due to the proposed works. Hence this Policy will not be applicable for the proposed project.
Policy on Disclosure of Information (BP 17.50)	**Applicable** The Policy deals with Disclosure of Operational information. The Bank's Policy on Disclosure of Information, has been incorporated in the Project implementation plan.

2.2 POLICY AND REGULATORY FRAMEWORK OF GoI AND GoB

The various Policies, Acts, Rules and Regulations promulgated by the Central and State Governments related to environment and social aspects are presented below.

2.2.1 Environmental Regulations

Implications of some of the environmental regulations are presented in ***Table 8*** below.

Table 8: Environmental Regulations

Rule / Regulation / Act / Policy	Implication on the Project
The Environment (Protection) Act, 1986	Indirectly applicable to proposed Project activities
Water (Prevention and Control of Pollution) Act, 1974 (as amended)	Applicable to proposed Project activities
Air (Prevention and Control of Pollution) Act & 1981 (as amended)	Applicable to proposed Project activities

Rule / Regulation / Act / Policy	Implication on the Project
Forest (Conservation) Act, 1980 (as amended)	Not relevant to proposed Project activities
National Forest Policy, 1988	Not relevant to proposed Project activities
Joint Forest Management, 1993	Not relevant to proposed Project activities
The Wildlife (Protection) Act, I972(as amended), Amendment 1991	Not relevant to proposed Project activities
EIA Notification of MoEF, 2006(as amended)	The proposed EKE protection and restoration project does not fall under any of the project categories listed in Schedule-I of the Environmental Impact Assessment Notification, 2006 (as amended) and hence does not require any formal environmental clearance either from the State Environment Impact Assessment Authority or the MoEF, GOI. The project area has not been notified as ecologically sensitive or fragile under the Environment (Protection) Act, 1986 and the Rules made there under.
Municipal Solid Waste (Management & Handling) Rules, 2000	Applicable to proposed Project activities
Hazardous Waste (Management & Handling) Rules, 2008	Applicable to proposed Project activities
The Ancient Monuments, Archaeological sites and Remains Act, 1958	Not relevant to proposed Project activities
Biological Diversity Act, 2002 and Biological Diversity Rules, 2004	Not relevant to proposed Project activities

However, relevant permissions, clearances and authorizations need to be obtained from competent authorities during the design, planning and implementation of the project as indicated below:

- Permission for felling of Trees from local Forest Office
- Location / layout of workers camps, equipment and storage yards to be finalized by WRD
- Wastewater discharges from Labour Camps will require a consent from Bihar State Pollution Control Board
- Permission for sand mining from the river bed will be required from the State Environmental Impact Assessment Authority if the area of the sand mining exceeds 5 hectare. It should be noted that MoEF, GoI has issued a Notification in this regard.

2.2.2 Social Regulations

Listed below are the regulations on social aspects that may be relevant to the Project.

- The Land Acquisition (LA) Act of 2013. This may **not be required** in view of no land acquisition involved in the project work as per the DPR
- Minimum Wages Act, 1948
- Contract Labour Act, 1970
- The Bonded Labour System (Abolition) Act, 1976
- Child Labour (Prohibition and Regulation) Act 1996 along with Rules, 1988
- Children (Pledging of Labour) Act, 1933 (as amended in 2002)
- The Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995

- The Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Rules, 1996
- Untouchability Offences Act, 1955
- The Scheduled Castes and the Scheduled Tribes (Prevention of Atrocities) Act, 1989
- The Scheduled Castes and the Scheduled Tribes (Prevention of Atrocities) Rules, 1995
- Bihar Public Land Encroachment Act, 1956
- Kosi Calamity Rehabilitation and Reconstruction Policy, 2008
- Bihar Irrigation Act, 1997
- Irrigation, Flood Management and Water Drainage Rules, 2003

3 BASELINE ENVIRONMENT

3.1 INTRODUCTION

Environmental Impact Assessment entails study of the existing environment in a Project Area. The status of environment could be studied by recording and analyzing the prevailing quality of various environmental attributes such as air, water, soil, flora, fauna and socio-economic conditions.

The objectives of baseline environment monitoring survey are to measure and document existing environmental conditions in order to assess the impact of proposed works. The environmental assessment was conducted in the Project influence area, in 5 km envelope on either sides (country and river side) of the EKE.

The following sections describe the present baseline environment.

3.2 METHODOLOGIES FOR BASELINE DATA COLLECTION

Baseline environmental study of the project area was undertaken in accordance with the requirements of the World Bank Safeguard Policies and in accordance with the Guidelines of MoEF, GoI for conducting EIA Studies. Based on the project features, site conditions, various parameters to be covered as a part of the EIA study were selected by Scoping Matrix.

Table 9 presents the summary of scoping analysis.

Table 9: Scoping Matrix

S. No.	Environmental Attributes	Likely Impacts
1	Land Environment	**Construction Phase:** • Increase in soil erosion • Pollution by construction spoils • Solid and liquid waste from labour camps **Post construction Phase:** • No impact is envisaged
2	Water Quality	**Construction Phase:** • Increase in turbidity of river water • Degradation of water quality due to disposal of wastes from construction sites and labour colonies. **Post construction Phase:** • No impact is envisaged
3	Air Quality	**Construction Phase:** • Pollution due to emissions from increased vehicular movement, use of construction equipment, D.G. sets and labour colonies **Post construction Phase:** • No impact is envisaged
4	Noise Level	**Construction Phase:** • Rise in noise level due to increased vehicular movement and use of D.G. sets and construction equipment

S. No.	Environmental Attributes	Likely Impacts
		Post construction Phase: • No impact is envisaged
5	Aquatic Ecology	**Construction Phase:** • Marginal reduction in productivity of fish and other aquatic organisms due to increased turbidity levels and over fishing by the labour population • Temporary disturbance to the wetland bird fauna due to noise from the construction equipment, vehicular movement to transport construction materials and establishment of temporary material storage areas **Post construction Phase:** • No significant impact is envisaged
6	Terrestrial Ecology	**Construction Phase:** • Impact due to fuel wood requirement by laborers • Temporary adverse impact on flora and fauna due to increased influx of human population **Post construction Phase:** • No impact is envisaged
7	Public Health	**Construction Phase:** • Increased incidences of water borne diseases • Transmission of diseases by immigrant labour population **Post construction Phase:** • No impact is envisaged
8	Socio-Economic Aspects	**Construction Phase:** • Increase in employment potential and development of allied sector leading to boost in economy • Negative impact on existing infrastructure facilities like roads and drainage • Cultural conflicts and law and order related issues due to migration of labour population **Post construction Phase:** • The socio economic benefits of construction phase will not sustain in post construction period

Based on the Scoping Matrix, baseline environmental data were collected. The project details were superimposed on baseline environmental conditions to understand the positive and adverse impacts resulting out of implementation of the proposed project.

The baseline environment status of project area was established based on detailed field survey and secondary data review. Two methods were employed in collecting and collating data and information on the existing environment. Although both the methods provide similar outputs, they vary in quality and details of information received. The methodologies comprised the following studies:

- Desktop studies
- Field studies

3.2.1 Desktop Studies

These studies included collection and analyses of secondary information, in the form of reports and other pertinent literature, research papers, documents available on the Kosi River and the various works undertaken to mitigate the flood hazards in the public domain. The basic objective of this exercise was to develop a broad understanding of the environment in the project area.

The reports from the WRD reviewed during the desktop studies included the detailed project report (*which was made available to IEISL on 07.05.2014)* prepared for the proposed works to be carried out at the two EKE stretches. For the socio-economic studies, the District Census Abstracts and District Statistical Handbooks were collected and reviewed. Literature available on the flora and fauna of the region was also examined.

IEISL collected secondary data relevant to the Study from FMISC and various Government Departments.

3.2.2 Field Studies

Three types of field studies were conducted in the project area. These studies were:

- Reconnaissance survey
- Area / topic specific surveys
- Environmental Monitoring

3.2.2.1 Reconnaissance Survey

A reconnaissance survey was conducted along the length and breadth of the two EKE stretches, to obtain a preliminary understanding of the environmental status and various issues related to the proposed project. A team comprising of the Project Team Leader, Project Manager and the experts in various fields surveyed the proposed project area to understand the environment and to identify critical areas.

3.2.2.2 Area Specific Studies

After the locations containing critical environmental components were identified, experts in the following areas were assigned with the task of conducting detailed studies:

- Ecology
- Soil, geology and hydrogeology
- Socio-economic, cultural and heritage

An ecologist conducted the ecology study, to identify and assess the impacts on the ecosystems and suggest mitigation measures. Identification of floral species along the embankment within the two stretches was also carried out.

The soil, geology and hydrogeology experts dealt with the soils and geology, hydrogeology and hydrogeomorphology.

Socio-economic assessment of the project area was done by the socio-economic expert through surveys and focus group interactions.

3.2.2.3 Environmental Monitoring

Strategic locations for samplings/monitoring of various environmental attributes were finalized with duly considering the criteria mentioned in ***Table 10***.

Table 10: Location Selection Criteria for Sampling/Monitoring

S. No.	Attributes	Location Criteria
1	Air Quality	Possible material transportation route / proximity to EKE and the human habitation
2	Noise Level	Possible material transportation route / proximity to EKE and the human habitation
3	Surface Water	Kosi River surface water from the areas where bank protection work is proposed
4	Groundwater	Bore-wells with hand pump, which are near to EKE and used by local habitants for day to day use
5	Soil	Cultivable land near the proposed work area on the river-side of EKE

The samples for ambient air quality monitoring, soil, groundwater and surface water were collected by following the standard protocols and tested for chemical analyses at Shiva Test House, Patna, Bihar, a NABL accredited and MoEF Notified Laboratory. The Noise levels were measured with a hand held monitor. The details on the results of the environmental sampling are discussed under the relevant sections.

3.3 ENVIRONMENTAL SETTING OF THE PROJECT AREA

The Project Area falls in the Agro-Climatic Zone II classification of North-Eastern Alluvial plains of Bihar state. This zone is basically the alluvial plains of the Kosi River and is slightly undulating to rolling landscape mixed with long stretches of nearly flat landscape with pockets of areas having sub–normal relief. The area is full of streams with abandoned channels of the Kosi River, which is notoriously known for its frequent and sudden change of courses and forming small lakes and shallow marshes.

The Kosi catchment is in the Himalayan Region and is rich in acidic minerals. As a result, the soils of this zone are non- calcareous. There is a rich accumulation of sodium salts and sodium adsorption ratio is on the higher side in the areas where the drainage is poor. Salinity and alkalinity are however, on an increase in the permanently water logged areas.

The Kosi River presents a challenge in terms of recurring flood hazards. A major flood in 1953-54 led to the development of `Kosi Project' which was aimed at flood control and irrigation. The project led to the creation of a barrage at Bhimnagar where the river enters into the Indian Territory and construction of the embankments, on East and West banks of the river to protect approximately 2,800 sq. km of land in North Bihar and Nepal. Despite this intervention and a long history of flood control management in the basin for more than 5 decades, the river continues to cause extensive flooding due to breaches. The history of Kosi floods is given below:

- 1963: The first breach on the Western embankment in Nepal
- 1968: Five breaches in North Bihar
- 1971: Collapse of the 1969-built Bhatania Approach Bund
- 1980: Eastern embankment breach
- 1984: Eastern embankment breach
- 1991: Breach in the Western embankment near Joginia in Nepal
- 2008: Breach in Eastern embankment which was the most devastating floods in the Kosi flood history.

In addition to floods, the project area is also vulnerable to windstorms. The flood prone districts are also exposed to geo-morphological risks from earthquakes. "Supaul District"

lies in seismic hazard Zone V while, "Saharsa District" lies in Zone IV earthquake hazard index. High hazard risk compounded by low human and economic development in the Project area with relatively insufficient capacity and resource base available for proper planning and execution of disaster reduction programs significantly increases the vulnerability in the project area.

The Project Area is devoid of major forests, grassland or climax vegetation. The entire submergence area lies within the embankments constructed along both the banks of the Kosi River. The vegetation in the area is akin to that of sub-tropical vegetation and is detailed in a separate Section. The area is dominated by wild herbs, bushy shrubs and scattered tree plantation. The small patches of the trees and mixed plantations are existing on the road side, spurs and the EKE and their numbers are moderate.

The river side villages at both the area of study are always vulnerable to floods every year. The river side village settlements are always temporary in nature and the same get shifted to appropriate safer location during floods. If the devastation is quite perilous, the entire village shifts to the land side settlements or as an encroachment along the Embankments.

The following sub-section presents the **Environmental and Social Screening Checklist** for the Project.

A. Environmental Screening

Part a: General Information

1. Location of the sub-project	
• Name of Sub-Project	Environmental Impact Assessment for Protection and Restoration of the Kosi River Embankments in Bihar
• Name of the State	Bihar
• Districts	Supaul and Saharsa
• Blocks	Basantpur, Nirmali, Raghopur, Saraigarh-Bhaptiyahi, Nauhatta.
• Villages	Bhimnagar to Kalyanpur in Ch. 0.00 km to 28.20 km. Nauhatta to Ekadh in Ch. 78.00 km to 84.00 km.
2. Implementing Agency Details (sub-project level)	
• Name of the Department/Agency	Flood Management Improvement Support Centre (FMISC), 2nd Floor, Jal Sansadhan Bhawan, Anisabad, Patna-800002
• Name of the designated contact person	Shri A. K. Samaiyar
• Designation	Joint Director, FMISC
• Contact Number	+91-9955568378
• E-mail Id	krpbihar@gmail.com

Part b: Environmental Screening

Question	Yes	No	Details
1. Is the sub-project located in whole or part within a radius of 1 km from any of the following environmentally sensitive areas?			
a. Biosphere Reserve		No	
b. National Park		No	

c. Wildlife/Bird Sanctuary		No	
d. Game Reserve		No	
e. Tiger Reserve/Elephant Reserve		No	
f. Wetland	Yes		There are water logged areas on the country side of EKE in both the chainages. (Refer the strip maps for the details on water logged areas on EKE) The water logged area on Country side of EKE near Village Sadanandpur is more prominent in its expanse. These are mainly formed due to seepage from the Kosi River and support aquatic fauna and weeds.(Birds, fish and Eichornia)
g. Natural Lake		No	
h. Swamps/Mudflats		No	
i. World Heritage Sites		No	
j. Archaeological monuments/sites (under ASI's central/state list)		No	
k. Reservoirs/Dams		No	
2. Is the sub-project located in whole or part within a radius of 500 m from the following features?			
• Reserved/Protected Forest		No	
• Migratory Route of Wild Animals/Birds		No	
• Area with threatened /rare/ endangered fauna (outside protected areas)		No	
• Area with threatened /rare/ endangered flora (outside protected areas)		No	
• Habitat of migratory birds (outside protected areas)		No	
• Historic Places (not listed under ASI – central or state list)		No	
• Regionally Important Religious Places	Yes		Dewanban Mahadeo Mandir, Near EKE Ch. 79.20 km.
• Public Water Supply Areas from Rivers/ Surface Water Bodies/ Groundwater Sources		No	
3. Information related to sub-project impacts: Will the construction, operation or decommissioning of this sub-project cause changes to or will have impacts on the following?			
a. Land Use		No	

b. Water		No	
c. Air	Yes		Temporary rise of SPM (dust) due to vehicular movements for transportation of materials during construction phase only.
Will the construction, operation or decommissioning of this sub-project produce, cause or release any of the following?			
d. Solid waste	Yes		From Labour camps and material storage area. The Solid waste from labour camps will have to be carefully handled as per the MSW (M&H) Rules, 2000. The Inert waste can be disposed of in low lying areas, post receipt of permission from the concerned Regulatory Authority. Alternately, inert material should be disposed off in a lined pit. After completion of work on the project and demolition of labor camps the site should be properly closed.
e. Noise/ vibration/ light/ heat energy/ electromagnetic radiation	Yes		Noise due to vehicular movement and construction equipment. There could some vibrations caused due to operation of earth moving equipment. However this impact will be temporary and felt only during the construction phase.
f. Accidents			Possibility of accidents on the material transportation routes and villages since human habitations and schools are abutting the narrow roads in the project area and weekly market days are also held on the EKE. Precautions necessary to prevent the accidents by adopting safe transport practices like giving advance warnings in the local newspapers or distribution of fliers or their display in the transportation route areas for the benefit of the local residents, schools, local Panchayats etc. so that they are fully aware of the project activities, transportation timings, etc.
Other			
g. Are there any areas around the project location which are used by protected, important or sensitive species of fauna or flora e.g. for breeding, nesting, foraging, resting, overwintering, migration, which could be affected by the sub-project?	Yes		The Lesser Adjutant (locally known as Garud) and other aquatic birds were spotted throughout the existing water logged areas on the country side. Those areas support their feeding, breeding, foraging etc. This bird life could be disturbed during the construction activities however; the impact may be temporary in nature and not felt on the river side. Since carcasses of dead animals are dumped on the river side, vultures visit those areas for scavenging. This habitat may be disturbed during the construction activity temporarily. No migratory birds were noticed during the study period.
h. Any other impacts?		No	

Part c: Transect Walk Map

IEISL conducted Transect Survey in both stretches of the Study area to identify the Environmental Features and Sensitive Receptors such as Reserve Forests, Sanctuaries /

National Parks, Rivers, Lakes / Ponds, Religious Structures, Archeological monuments, Natural Habitats, Schools, Hospitals, Health Centre, Irrigation Canals, Utility Lines and other sensitive receptors, etc. ***Annexure 1*** presents the list of sensitive receptors identified along the Ch. 0.00 km to 28.20 km and Ch. 78.00 km to 84.00 km and the corresponding maps showing the location of the sensitive receptors.

Part d: Result/Outcome of Environmental Screening Exercise

1	No EIA Required	
2	EIA Required	Short duration EIA
3	Regulatory Clearance Required	Since the proposed activity is not listed in the Schedule of EIA Notification, 2006, the project does not require Environmental clearance.

B. Social Screening

Part a: Social Impacts Information

1. Land Requirement for the sub-project:

Details	Unit	Quantity
Government Land	Acres	Not Applicable (NA)
Private Land	Acres	NA
Title Holders	Number	NA
Non-Titleholders – Encroachers	Number	NA
Non-Titleholders – Squatters	Number	NA

2. Agricultural Land affected due to sub-project:

Details	Unit	Quantity
Total Affected	Number	NA
Title Holders	Number	NA
Non-Titleholders – Encroachers	Number	NA
Non-Titleholders – Squatters	Number	NA
BPL Families losing Agricultural Land	Number	NA

The agricultural land where the work will be carried out on the river side may be affected if the work is undertaken during the sowing, agricultural operations, harvesting period, etc. However, these impacts will be temporary. The farmers are expecting rent for temporary use of their land for material storage and construction works.

3. Dwellings affected due to sub-project:

Details	Unit	Quantity
Total Affected	Number	NA
Title Holders	Number	NA
Non-Titleholders – Encroachers	Number	NA
Non-Titleholders – Squatters	Number	NA
BPL Families losing Dwellings	Number	NA

4. Commercial properties affected due to sub-project:

Details	Unit	Quantity
Total Affected	Number	NA
Title Holders	Number	NA
Non-Titleholders – Encroachers	Number	NA
Non-Titleholders – Squatters	Number	NA
BPL Families losing Commercial Properties	Number	NA

5. Common Property Resources Affected: (Please give each type by number)

Type	Unit	Quantity
	Number	NA

S. No.	Items	Results
1.	Total no of HH affected due to proposed project activity (Single or multiple impacts)	Not applicable
2.	Total no of vulnerable HH affected due to proposed project activity (Single or multiple impacts)	The dwellings on spurs and EKE will be affected due to project work. If those are encroachments then they will need to be removed or compensation paid to the title holders. Quantification of the households not done; however, the strip maps and primary data collected shows the presence of such habitations on the EKE and on the river side, which are likely to be affected during the project activities.
3.	Total number of Community Property Resources affected	There are no commercial and community properties on EKE; however, small shops may have to be removed or relocated temporarily during the project work. The impact may be felt by the non title holders. The title holders will need to be compensated.

Part b: Right of Way Table (A table giving the availability of government land on both sides of centre line of the embankment need to be presented at every 100 m interval for the entire embankment and certified by the concerned Superintending Engineer)

S.No.	Chainage km	Government Land from Centre line of Embankment		Proposed Embankment Base Width		Additional Land Requirement		Remarks
		Left	Right	Left	Right	Left	Right	
1	0.000							
2	0.100							
3	0.200							
4	0.300							

There is no land acquisition in the Project area and hence the information in the table above would not be applicable.

Part c: Result/Outcome of Social Screening Exercise

1.	No SA Required	Full scale SA not carried out. However, public consultations were held at 6 locations in the proposed project area. The response of the local people is favourable to the proposed Kosi EKE protection works.
2.	SA Required	No

3.3.1 Strip Mapping Using GIS

The findings of the Transect Surveys were presented in the Strip Maps prepared on the GIS platform. A strip map is a set of map pages that follows EKE. Each page of the map shows a defined geographical area of EKE centre-line up to 5 km project influence envelope on either sides of the river.

The main objective of strip mapping is to incorporate physical, social and natural environment data for the Study area. The GIS is used as an analytical tool to develop strip maps. GIS specializes in handling large scale databases, spatially referenced data, combining mapped information with other data and acts as analytical tool for research and decision making.

QB 1m high resolution satellite imagery has been analyzed for delineating the physical, social and natural environmental data of the Study area. The Study focuses on two stretches of the EKE, 0.00 km to 28.20 km and 78.00 km to 84.00 km Each stretch is divided into strips and each strip has grid numbers to show unique identity of the area.

Stepwise methodology used for preparation of Strip Maps is as follows:

1. Preparation of base map:
   High resolution satellite Imagery (QB 1m High resolution), toposheets (refer ***Table 11***) and census maps were utilized for preparation of base map. All the reference material have been incorporated for preparing base information and different layers including roads, railways, village boundaries, water bodies, river sand, canal, etc.

Table 11: List of Toposheets

AOI	TOPOSHEET NO.
Embankment 0.00-28.20 Km	72J14
Embankment 0.00-28.20 Km	72J11
Embankment 0.00-28.20 Km	72J15
Embankment 78.00-84.00 Km	72K9
Embankment 78.00-84.00 Km	72K5

2. Grid and strip distribution of the Study area:
   The Study Area of EKE stretch CH: 0.00 km to 28.20 km is divided into 13 strips starting from strip 1, strip 2…..strip 13. Each strip includes 2.5 km area along the embankment central alignment and 5 km buffer on either side of the embankment. The strip is divided further into grids of 1.8 km x 1.8 km for detailed assessment of physical, social and natural environment of the Study area. The grids are further numbered for having unique identity e.g. strip 1 has Grid A1, Grid A2,…Grid A6. Strip 2 has Grid B1, Grid B2,…Grid B6, etc. In same manner, the Study area stretch Ch: 74.00 km to 84.00 km was analyzed by dividing into 6 strips and grids of 1.3 km x 1.3 km. Refer ***Annexure 2***, Key Map with Grid index for the details.

3. Geo-reference all the input data:
   In this step, the raw satellite images were converted to specific map projections using geometric correction. Georeferencing is the process of aligning imagery (maps, air photos, etc.) with spatial data (points, lines or polygons). The process of geo-referencing essentially defines the location of an image, and assigns real-world coordinates so that it may be analyzed with geographic data. In strip mapping, raster data is geo-referenced using a control layer such as a road network; any layer that contains known coordinates can act as a point of reference.

4. Attribute assignment:
   All the information collected from secondary sources is linked to map features through GIS. Attribute data is collected through secondary sources and compiled for specific sensitive receptors like schools, colleges, anganwadi, temples, mosques, churches, health centers, banks, huts, etc.

5. LU/LC data preparation:
   QB 1 m high resolution satellite imagery is used for analysis of land use and land cover in the Study area. The Landuse Map is based on fourteen landuse classes as described below:
   4. Vegetation low density
   5. Urban area low density
   6. Village settlement
   7. Seasonal water body
   8. Scrub
   9. River sand
   10. River
   11. Open land
   12. Inland water body
   13. Industrial low density
   14. Fallow land
   15. Dry River bed
   16. Canal
   17. Agricultural land

6. Superimpose all the thematic layers:
   The information interpreted through satellite imagery, toposheets, census maps and secondary sources are part of different thematic layers. All the thematic layers are superimposed for further analysis.

7. Strip and grid wise layout preparation:
   After superimposing all the thematic layers, separate grid maps of A3 size are prepared for all the strips. All the grid maps are useful for detailed analysis of the Study area.

8. Field survey (ground truthing and data collection):
   The grid map prepared for the Study area is used for ground truthing the information. All the plotted information is verified on the field through field surveys using GPS as tool. The sensitive receptors of the Study area like schools, colleges, anganwadis, temples, mosques, churches, health centers, banks, huts, etc. is verified on ground using grid maps as a base. Also, some of the information is cross verified through available secondary data.

9. Geo-coding the field data and updating of layouts
   Using GIS as a tool, all the sensitive receptors were given code numbers which were linked as an attribute table to map features. Each sensitive receptor has been given a unique code e.g. there are 35 anganwadis in EKE stretch CH: 0.00 km to 28.20 km. Each anganwadi has been given unique code as A1, A2, A3,…A35. In the same manner, the codes have been given to other receptors like School-S, Health Centers-H, Church-C, Temple-TL, etc. After giving codes to each of the sensitive receptors in each grid, the layout maps of the grids were updated to present the real time situation.

10. GIS data updation according to ground truthing:
    Based on ground truthing exercise and geo-codes given to the sensitive receptors, all the thematic maps were updated.

11. Final layout preparation and GIS map generation as per the strips and grids:
    After updating the database, the final GIS maps were prepared based on the decided strip and grip numbers. There are 2 sets of maps prepared for EKE stretch CH: 0.00 km to 28.20 km and CH: 78.00 km to 84.00 km. One is an overall map presenting all the thematic layers including sensitive receptors and the other set of maps are the grid maps of the strips which are presenting the details of the Study area.

A sample strip map prepared for the Ch. 78.00 km to 84.00 km is presented in ***Figure 6***. Soft copy of the Strip maps prepared for both the stretches are being submitted in a CD along with this Report and the contents of the CD are listed in ***Annexure 3***.

3.4 PHYSICAL ENVIRONMENT

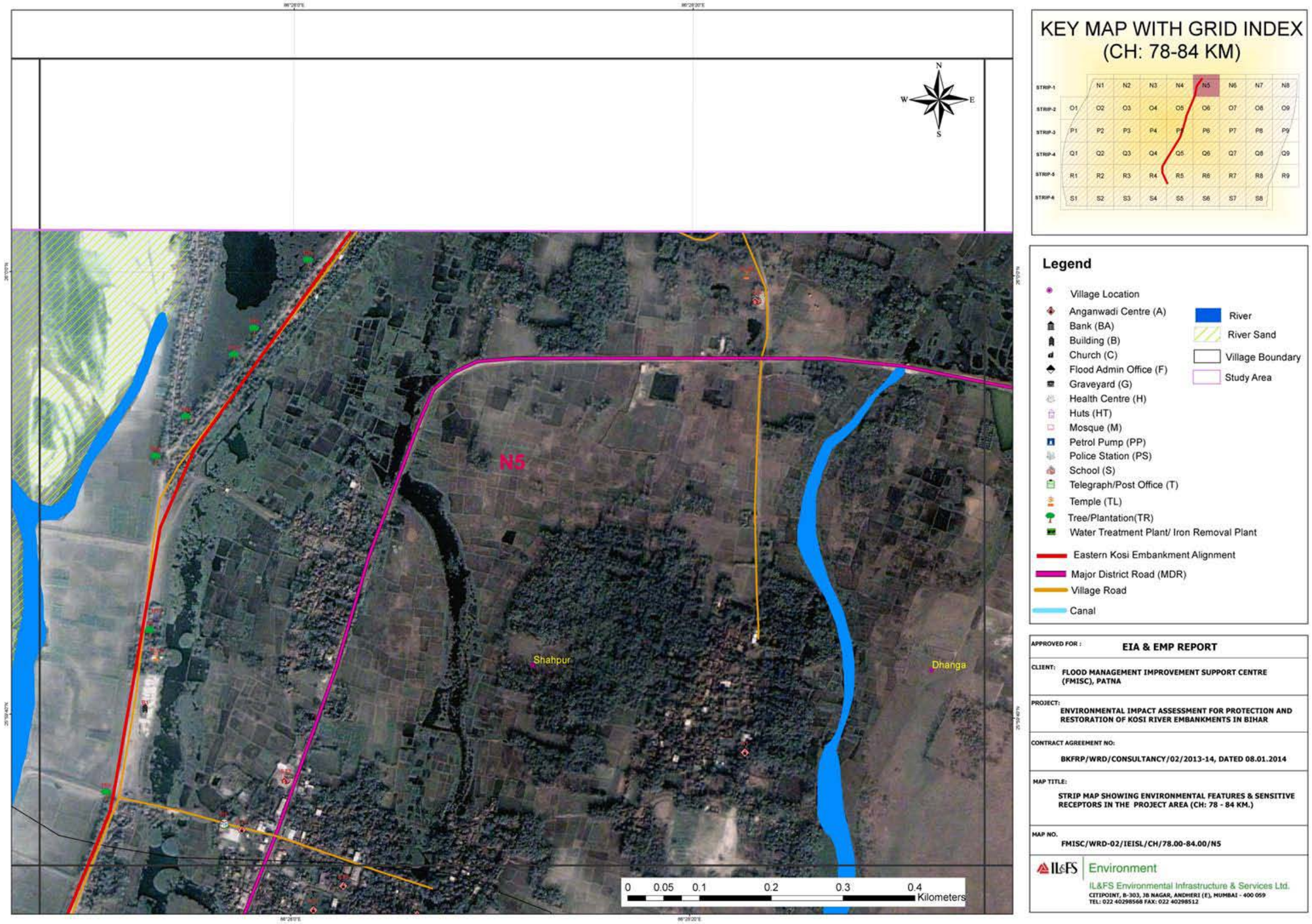
3.4.1 Physiography

The project area lies in the lower region of the Kosi River Valley and can be considered as a large inland delta formed by sandy deposit of the Kosi River, which, in the process of delta forming activity, shifted violently 112 km westwards. The Kosi Delta is of conical shape with contours running almost circumferentially, with the centre located in the vicinity of the Belka Hill. The country slope is generally Northwest to Southeast. The region forms part of the alluvium plains of the Gangetic Basin fringed by the Himalayan foot-hills of Nepal in the North. Westwards, the plains merge into the Kamla-Balan Basin and Eastwards into the Mahananda Basin. Southwards, the valley extends up to the River Ganga into which the Kosi River merges near Kursela. Changes in the river course and avulsion / cut-offs of the meander loops formed local depressions known as 'Manns'. The Kosi River Basin has numerous gullies and ridges and also saucer type natural depressions locally known as 'Chaurs'. The outfall conditions of leading trunk drains degraded due to non-functioning of sluices in the Kosi Embankments as also the substantial rise in river bed elevation near the embankments due to heavy deposition of silt. The Southern portion however, is fairly leveled and without much undulation.

3.4.2 Climate

According to Agro-Climatic Atlas of India, the Project region falls under "Moist Sub-humid" classification. The area receives plenty of rainfall and has a tropical climate. The area experiences summer season from March to May, monsoon season from June to October and winter season from November to February. Generally, January is the coldest month with an average minimum temperature of 9^0C and May/June are the hottest months with maximum temperature of 42^0C to 43^0C. Southwest monsoons, extending from mid-June to mid-October are mainly responsible for the rainfall in the Kosi catchment and the rainfall during these months is about 90% of the total annual rainfall. During winter, there is another short spell of precipitation experienced under the influence of Western disturbances. The rainfall varies considerably from year to year and month to month. There is a gradual increase in the annual rainfall from Southwest to Northeast. July and August are the wet months, together yielding over half of the Annual precipitation. The average annual rainfall in the region is 1300 mm.

Figure 6: Sample Strip Map



3.4.3 Land Use / Land Cover

Summary of Land Use and Land Cover (LULC) of the Study area, based on the Satellite imagery, 2012 is presented in ***Table 12***.

Table 12: Area Statistics of Land Use/Land Cover

S. No.	LULC Type	Ch. 0.00 km to 28.20 km Area (In Hectares)	Ch. 78.00 km to 84.00 km Area (In Hectares)
1	Inland Water Body	48	204.188
2	River	2636.88	582.688
3	Dry River Bed	233.125	70.4375
4	Seasonal Water Body	102.5	139.563
5	Open Land	6834.19	857.25
6	Fallow Land	7754.88	2734.44
7	Agriculture Land	4245.38	859.25
8	Vegetation Low Density	1249.88	352.688
9	Scrub	586.188	27.9375
10	Canal	425.875	46.625
11	Settlement/Village	992.688	268.25
12	Urban Low Density	0	18.9375
13	Industrial Low Density	1.5625	0
14	River Sand	3104.56	613.125
	Total	**28215.71**	**6775.38**

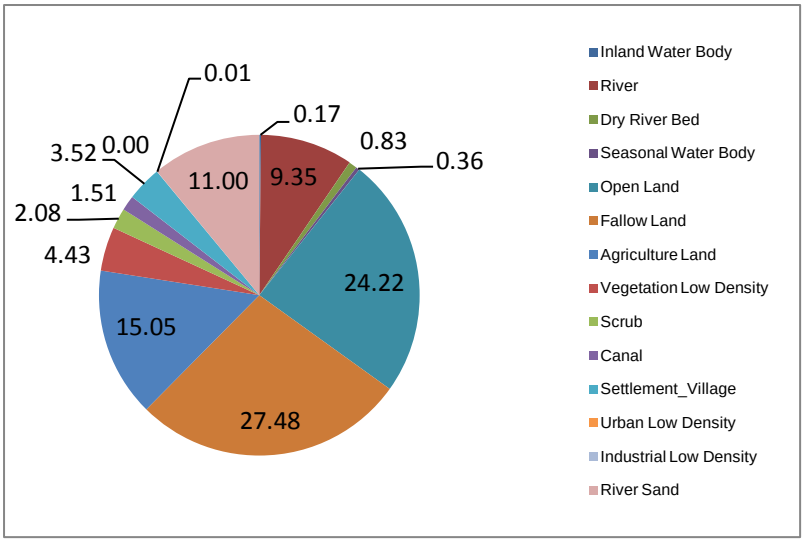


Figure 7: Area Statistics of Landuse/Land cover along Ch. 0.00 km to 28.20 km

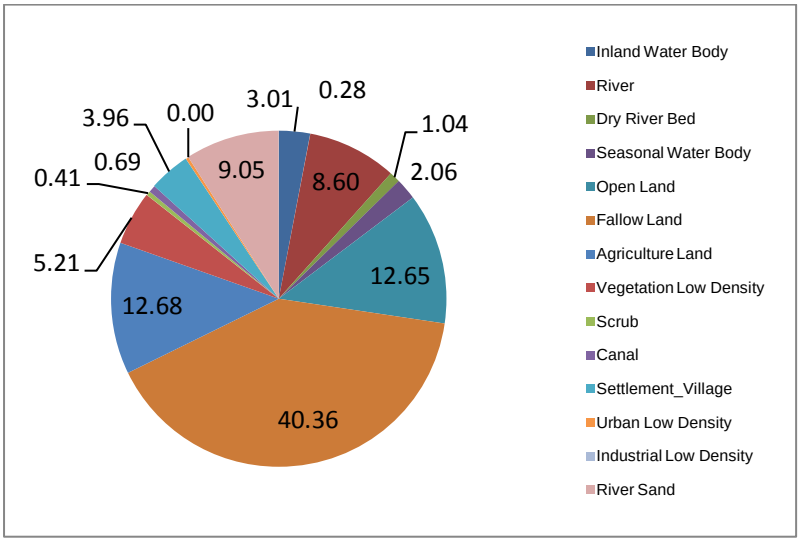


Figure 8: Area Statistics of Landuse/Land cover along Ch. 78.00 km to 84.00 km

LULC map of the Study area is appended as ***Annexure 4*** to this Report.

3.4.4 Geology, Hydrogeology and Geomorphology

3.4.4.1 Geological Characteristics of the Study Area

The area of study is underlain by a highly uneven basement formed during the major tectonic features or "fore deeps" named as "Purnea Depression". This "Graben" like formation is covered by "Two Horst/ridge like formation" namely the Mongyr-Saharsa ridge and Bansihan Uplift in the East and West parts of the Kosi River Basin. The sediments are deposited in the Purnea depression or fore deeps into several meters of thicknesses. This basement swells in its sedimentation process to from Eastern Gangetic Plains. The Eastern Gangetic plains are considered as an extension of the Lesser Himalayas (Shiwalik). The sediments are derived from the Shiwalik rock systems, which are present in the North towards Nepal. These deposits of Eastern Gangetic alluvial plain have been classified in two categories, viz. older alluvium and newer alluvium. The sediments of older alluvium, belonging probably to middle Pleistocene age, occupy generally bottom portion of the depression and comprise coarse gravel and ferruginous fines containing calcareous nodules. The newer alluvium, comprising of thick sequence of clay, silt and very fine sands, is overlain on the older alluvium. Unlike the older alluvium, these contain a higher proportion of carbonaceous material and micaceous material / deposits derived from the erosive action of the Kosi River and sedimentation processes. The area of study is characterized by large sediment aggradations in the alluvial plains and as a result, mega fans were formed in this region of the Kosi River Basin.

Besides, the Eastern Gangetic alluvial plain is neo-tectonically active and is being evidenced by occurrence of several major earthquakes in the past. Stratigraphy of the Project Area is presented in ***Table 13***.

Table 13: Stratigraphy

Group	System	Formation	Lithology
Quaternary	Recent	Newer	Clay, silts and very fine grades of sand particles
	Middle Pleistocene age	Older alluvium	Coarse gravels, ferruginous fines and calcareous nodules and coarse sand
Marked un-conformity and upliftment (Mongyr - Saharsa ridge and Bansihan Uplift and deposition in Purnea depression)			
Archean groups of rocks			

3.4.4.2 Hydrogeological Characteristics

In the study area, the hydrogeology (groundwater accumulation, movement and quality) is controlled by the lithology (host sediments) that store and transmit groundwater. The area of study is dominated by the presence of river sand, deposited as part of the Kosi River system. However, given the complexity of the flood regime in the region, there would be several complex episodes of recycling. Based on a limited set of observations and discussion from local villagers, and other such sources, it is clear that intercalations of clays in dominantly sand deposits control the behavior of groundwater, especially at a local level. The geometry of the inter-bedded clays, in all likelihood, play a crucial role in the nature of aquifers developed as well as in the recharge and discharge processes in the study area.

This observation also indicates the fact that the dynamics involved in deposition of sediments from the Kosi River and its avulsive (shifting in nature) is also quite complex; hence, various combinations of fine sand, sand, clay and gravel sequences are likely to be found within the Basin. The sedimentation sequences, especially at shallow levels, will be quite complex. There will be numerous interconnected minor channels participating in carving out features of the plains by reworking and redistributing sediments deposited by the main the Kosi River and its tributaries. The overall system of river alluvium in the region is possibly of the order of thousands of meters thick; considering that the Kosi River carries a sediment load of 130 million cubic meters annually.

The Kosi River interfluves region exhibits a fining upward grain size distribution bottoming in sand or silt and interleaved with beds of coarse silt and sand or clay sediments show post-pedogenic alterations including decomposition of plant and shell material, carbonate dissolution and precipitation, iron oxide / hydroxide accumulation of clay sediments. Such sediments usually constitute the host regime for groundwater. Accumulation and movement of water in aquifers are developed as a consequence of the geometry of overbank deposits. An understanding of such deposits becomes important in understanding groundwater accumulation, movement and quality, especially in context to the small and large habitations located in the study area.

Therefore, most significantly, due to the complex nature of flow regimes within such systems and the difficulties inherent in defining hydrological boundaries, it is often difficult to attribute changes in groundwater conditions to changes in use within specific areas as a consequence of natural and human induced fluxes. It is also difficult to understand specific recharge mechanisms for a small area. While upper unconfined systems may receive direct contributions through vertical recharge from precipitation or return flows from overlying use, lateral flows from streams and other sources are usually significant, especially in determining groundwater quality. In many situations, surface

and groundwater systems are linked in complex ways and some sections of a stream either gain or lose water from and to groundwater, respectively.

3.4.4.3 Geomorphological Characteristics

The Geomorphology of the Kosi River Basin is complex and is controlled by various factors like Hydrological, Sedimentation and Tectonic activities associated with the Himalayan mountain building activity and allied iso-static adjustments as well as response of basement structures to plate movements, regional slope, etc. The various Geomorphologic features that are conspicuously seen are active channels, inactive channels, channel bars, water-logged areas, oxbow-lakes, braided streams, etc. evolved out of Hydrological and sedimentation processes, which are undergoing rapid modifications due to channel avulsion, meandering cut-offs etc. in the study area. The Kosi River forms the largest alluvial cones or mega fans of 180 km long and 150 km wide, which is the largest mega fan built up by any river system in the world. The entire mega fan is an interesting network of interlocking channels and an interesting and principal feature to note.

The Kosi River's upper basin in Southern Tibet and Eastern Nepal has about 60,000 km² of mountainous terrain, a region that tectonic forces are elevating by about 1 cm a year. In the event erosion keeping pace with the uplifting, an estimated 600 million cum of sediment is potentially carried downstream during an average year. However, empirical measurements of the river's sediment load have given estimates of 100 million cum annually, indicating that the area is uplifting.

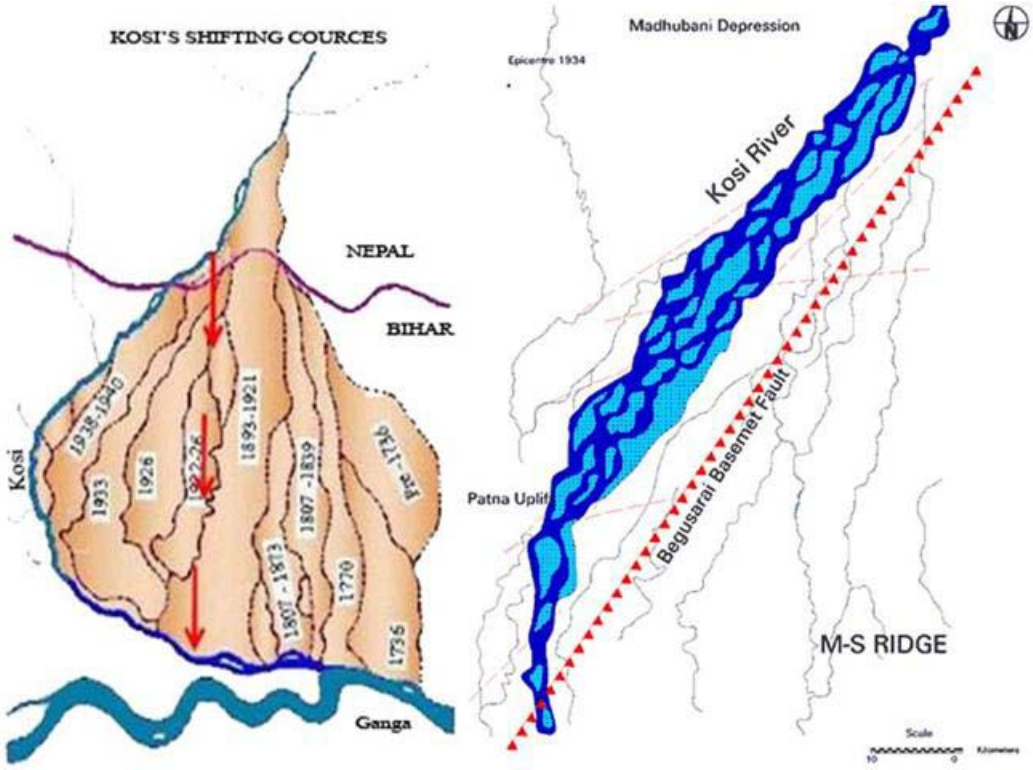
River gradient ranges from more than 10 meters/km for major upper tributaries in the mountains to as little as 6 cm/km as the lower Kosi River nears the Ganges River System. As the gradient decreases on the plains, current slows and turbulence that holds sediments in suspension diminishes. Sediments settle out and are deposited on the riverbed. This process eventually raises a channel above the surrounding terrain. The river breaks out, seeking lower terrain, which it again proceeds to elevate by deposition. This creates a cone-shaped alluvial fan.

Alluvial fan morphology is an indicator of active tectonics because the fan form reflects varying rates of tectonic processes such as uplift of the catchment on mountains along a fault or tilting of the fan surface. The fan head deposition associated with the Kosi mega fan suggests that the rate of uplifting of the mountain front is higher relative to the rate of stream-channel down cutting in the mountain.

Changes in river geomorphology, due to avulsive nature of stream, scouring and deposition of transported sediment, naturally affects the stability of embankment sections and spurs, if not maintained periodically.

The Migratory trends of the Kosi indicate that neo-tectonism and local isostatic adjustments are active in the heavily faulted river basin. The Kosi River system is the only Indian River whose hydrology is deeply influenced both by the regional geological complexities and inputs of annual precipitation, Himalayan glacier melt and rate of sedimentation. This antecedent drainage system is playing havoc every year for its migratory trends, resultant flooding, and a huge detrital load of sediments and avulsive nature of river. The entire Kosi River fan belt is etched with palaeochannels that demarcate the East-to-West and back swing of the river from the geological past. ***Figure 9*** is geo-morphological map showing shifting of the Kosi River.

Figure 9: Geomorphological Map showing Shifting of the Kosi River

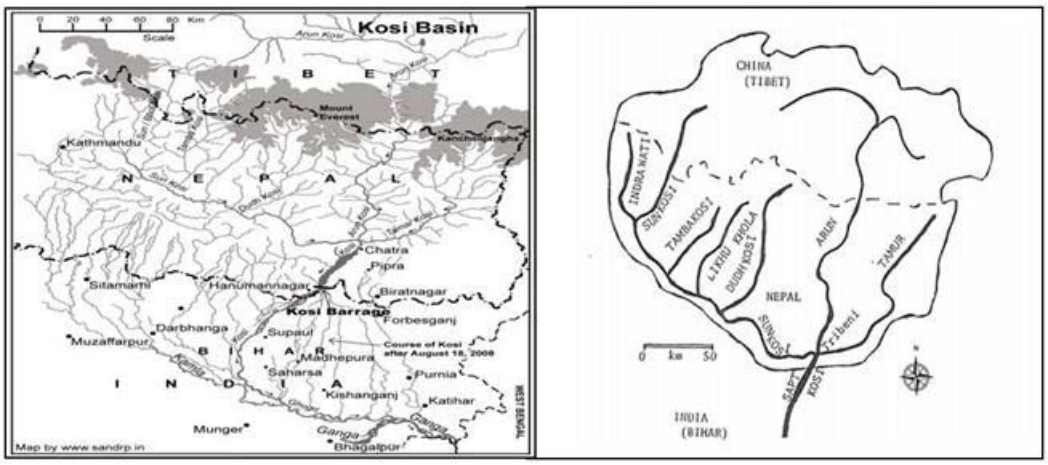


Source: Sinha et al., 2008

3.4.4.4 Hydrological Characteristics

The Kosi River is a transboundary river between Nepal and India. This is one of the largest tributaries of the Ganga River, which traverses a distance of 729 kilometers from its source to the confluence point with the Ganga River. The Kosi River flows to the South and West of Kanchenjunga with an average water flow of 2,564 cubic meters per second. The Kosi River is fed by the highest glaciers in the world. ***Figure 10*** shows the Kosi River Basin.

Figure 10: Kosi River Basin



Source: Shifting courses of the Kosi River (Gole and Chitale) and the Kosi River Basin Map from SANDRP

According to the epic, seven rivers join together to form the Saptakosi River which is called the Kosi River. The seven streams are: the Sun Kosi, the Tama Kosi or the Tamba Kosi, the Dudh Kosi, the Likhu, the Indravati, the Arun and the Tamore or the Tamar. The Saptakosi River is an important tributary of the Kosi River. It is the main water source of the Kosi River, and one of the principal sources of water for the Kosi River basin. The river descends from the hills into the plains near Chatra at Barah Kshetra in Nepal where it is known as Kosi Thereafter, flowing for another 58 km, it enters the plains of Northern Bihar near Bhimnagar. The Kosi River traverses nearly 260 kilometers within the State of Bihar. The main stream of the river flows into the Ganga River near Kursela. There are three major tributaries of the Kosi River in addition to its seven headwaters that are the Kamla, the Baghmati or the Kareh and the Budhi Gandak merging into the Kosi River in India. Certain rivulets also join the Kosi River in Nepal and India, and the Bhutahi Balan is the chief among its minor tributaries.

The Kosi River, up to its confluence with the Ganga River, drains a total area of 69,300 square kilometers along with its tributaries - 30,700 square kilometers in Nepal, 29,400 square kilometers in Tibet, a part of China and 9,200 square kilometers in India, which includes the Mt. Everest region as well as the eastern one-third of Nepal. (42.4% of this area is in China, 44.3% in Nepal and 13.3% is in India). The Kosi River is the lifeline of the Mithila region, which spreads across more than half of Bihar and the adjoining Tarai belt of Nepal. It is also one of the most dynamic rivers in the Asian region. The river changes its course continuously and in the last three hundred years shifted over 150 kms from East to West. The river which used to flow near Purnea in the eighteenth century now flows west of Saharsa. This unstable nature of the river is attributed to the heavy silt load which it carries during the monsoon season.

The Kosi River is known as the “Sorrow of Bihar”, since it remain in spate frequently. The milky river has caused widespread human suffering in the past due to flooding and frequent changes in its course. In order to control the occurrence of frequent floods and its devastation, a barrage of 1,150m length and 1.53 m crest height was built at a place called Bhimnagar (near Indo-Nepal border) with marginal flood embankments on either side of the river (144 km in the east and 125 km on the west) in the year 1961 with a view to confine its course within the embankments with spacing of embankment varying from 6 to 8 km. The Kosi Barrage has been designed for a peak flood of 27,014 cumecs or 954,000 cusecs. The Kosi River has an average water flow (discharge) of 1,564 cumecs or 55,000 cusecs. The river is embanked on both sides; the left embankment, running closer to the river, is continuous but the right bank is discontinuous, particularly in the lower reaches around the confluence with the Ganga River. The highest flood recorded in living memory is reported to be 24,200 cumecs or 850,615 cusecs on 24 August 1954. There are 56 gates including 6 Nos. of Under Sluice Gates on the left side and 4 Nos. of Under Sluice Gates on right side of the Barrage. Irrigation Canal, taking off from both sides of Kosi Barrage viz. Eastern Kosi Canal and Western Kosi Canal, spreads in the Tarai and Plain areas of the Kosi Basin, both in India and Nepal. The operation and maintenance of the Kosi barrage rests with Water Resources Dept., Govt. of Bihar. The Eastern Kosi Canal annually irrigates an area of 6.12 lakh ha (including 1.17 lakh ha under Rajpur Canal System). The command area is spread in seven districts of Bihar namely Supaul, Saharsa, Madhepura, Purnea, Kathiar, Araria and Khagaria.

The braided channel of the Kosi River flows towards Southwest after debouching into the plains but takes a sharp turn towards Southeast and then flows parallel to the Ganga River in its lowermost reaches before its final confluence with the Ganga River. The vast

plain, on which the Kosi mega fan formed, has a general slope from North to South and West to East, being steeper in the North (55-75 cm/km) and flatter in the South (6cm/km). Thus, the entire fan surface is nearly flat, which is dissected by numerous 'dhars' (small channels) representing paleochannels of the Kosi River. There are undulations and innumerable depressions called "chaurs", where water remains accumulated for major part of the year. Some of these water logged patches in the lower reaches and closer to the embankments are very large and it may be related to seepage from the river but may partly represent accumulation of floodwater after overbank flooding.

Table 14: Monitoring and Gauging Station Details of CWC in the Kosi River Basin

Discharge Parameter	Barahkshetra (m^3/s)	Birpur (m^3/s)	Baltara (m^3/s)
Average annual discharge (Q^{av})	NA	NA	2236
Average monsoonal discharge	NA	NA	5156
Average non-monsoonal discharge	NA	NA	1175
Max. observed discharge (Q_{obs})	25838 (Oct. 1968)	14833	12043
Bankfull discharge ($Q_b/Q_{1.58}$)	8023	7458	6615
Mean annual flood discharge ($Q_{maf}/Q_{2.33}$)	9925	9183	7547
100-year flood (Q_{100})	23085	21118	13992
Average sediment load (mt/yr)	NA	NA	43

Source: CWC

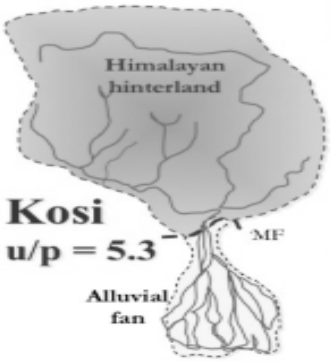
The major problematic characteristic of the Kosi River is its highly dynamic flows, which are due to the monsoonal condition in the catchment. The annual rainfall in the Kosi plains varies between 1,000 to 1,600 mm/year and the average monthly discharge is between 500 cub-m/sec and more than 6000 cub-m/sec (Reddy et al 2008, and Chakraborthy, 2010). The average annual discharge of the river is 2,236 cub-m/sec with an average monsoon discharge almost 5 times than the Non-monsoonal discharge 5156 cub-m/sec) and 1175 cub-m/sec, respectively. (Sinha, 2008)

3.4.4.5 Sedimentation and Hydrology

The Kosi River is one of the highest sediment laden rivers in the world. The river 'off loads' sediments within the confines of the embankment and the river developed a higher cross valley slope than the down-valley slope in this region. This has made the Eastern afflux bund vulnerable and pressurized the river to threshold of avulsion.

The Kosi River conveys very high sediment load and the construction of embankments and barrages resulted in the rise of river bed , so much that the river is flowing in a 'super-elevated' condition at several reaches i.e., the river bed elevation is higher than the elevation of the surrounding plains.

Figure 11: General Details of the Kosi River

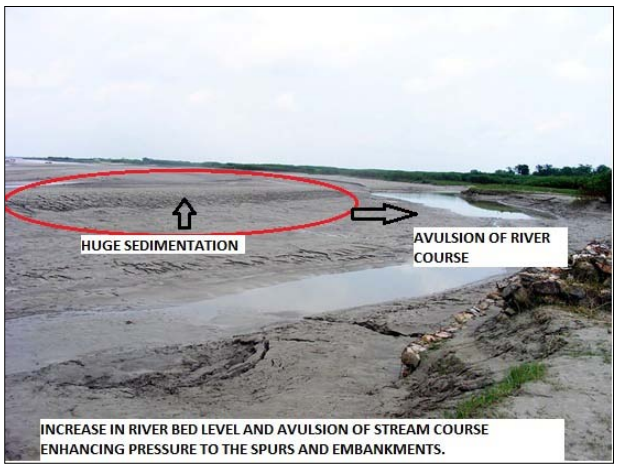


	Kosi
Catchment area (10^3 km^2)	101
Total length (km)	1216
Average Annual discharge (m^3/s)	2036
Annual sediment load (mt/yr)	43
Discharge/Area	20
Sediment yield (mt/y/km^2)	0.43

Note: u/p indicates upland to plains area ratio
Source: The Kosi River: Morphology and Hydrology; Sinha and Friends, 1994

Breaching of EKE

The Kosi River, with distinctive geomorphology and hydrological characteristics include a very dynamic regime and very high sediment load. It has long been considered as a problematic river due to recurrent and extensive flooding and frequent changes in its courses (Sinha, 2008).



The dynamics of the Kosi River, generally described as 'avulsive' shifts, has been well documented in the literature. The Kosi River shifted by approximately 120 km Eastward in August 2008 triggered by the breach at the Eastern afflux bund at Kusaha in Nepal at 12 km upstream of the Kosi barrage. One of the important factors responsible for wash out of the spurs and subsequent breaching of Eastern/Left flood embankment is formation of multiple channels upstream of barrage due to sediment deposition in the submerged area of the barrage deigned with a high afflux of 3.21 m. It is reported that nearly 85% incoming flow (4,081cumec) was flowing through the left/East channel hugging the left embankment just before the breach. The difference in bed levels between left and right bank channel is nearly 4m. Such a situation, which occurred due to silt deposition upstream of the barrage, was perhaps, never envisaged. With high flow concentration near left embankment, the spurs failed due to flow choking and consequent wash out of the spurs and subsequent breaching of the left embankment.

3.4.5 Ambient Air Quality

The status of the Ambient Air quality (AAQ) was established through scientifically designed six (6) AAQ monitoring locations, within the two stretches of the EKE, twice a week for a period of one week (starting from 05.02.2014) at each of the identified locations, as per the ToR. The meteorological conditions, representatives of the regional background air quality from the secondary sources, the proposed routes of transportation of the materials for restoration works, as cited by the FMISC and representatives of the areas likely to be affected due to project activities were considered while selecting the AAQ monitoring locations, in consultation with the local WRD officials. Four (4) AAQ monitoring locations

were selected in the chainage 0.00 km to 28.00 km and two (2) AAQ monitoring locations were selected in chainage 74.00 km to 84.00 km to monitor the baseline ambient air quality in the project area. The AAQ monitoring was carried out during the Month of February, 2014 at those locations with a frequency of two samples per AAQ monitoring station, as per the one time monitoring program mandated in the ToR for this study.

Sampling and analysis of Ambient Air samples were carried out with reference to the Bureau of Indian Standards IS: 5182. The methodology for monitoring and analysis of AAQ is presented in ***Annexure 5***.

Figure 12 and ***Table 15*** presents the location and geo co-ordinates of air monitoring stations, respectively, within the Study area. The baseline for the air quality has been generated for SPM, SO2, NOx and RSPM.

Figure 12: Map Showing Air Monitoring Stations

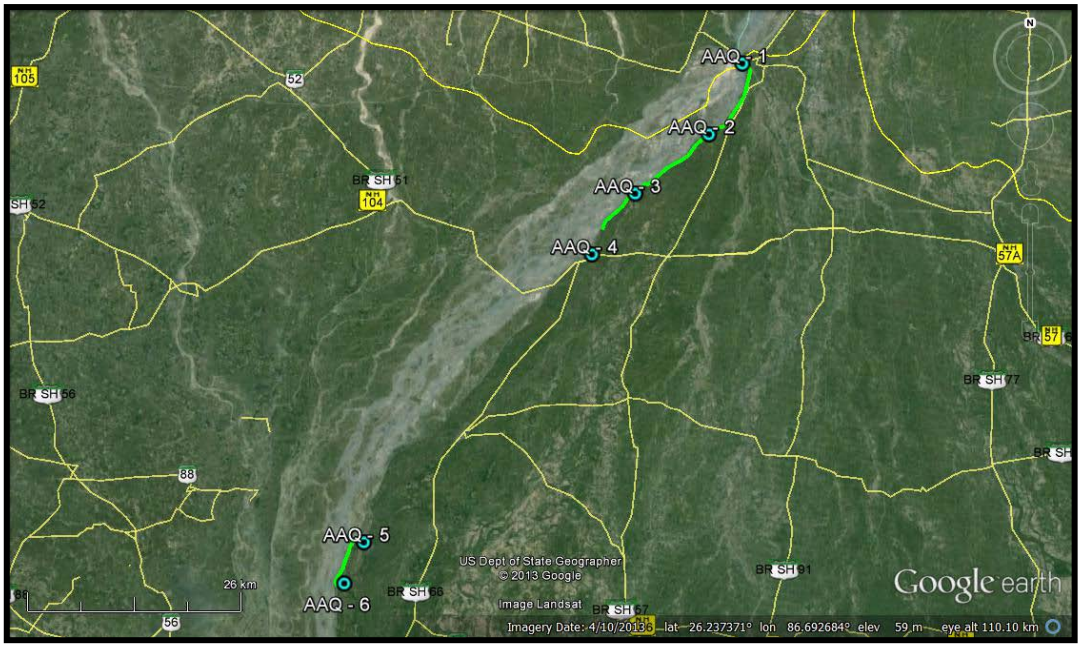


Table 15: Ambient Air Quality Monitoring Locations

Air Monitoring Station	Air Monitoring Station/Sample Code	Latitude	Longitude	Landmark Reference
EKE Chainage 0.00 km to 28.20 km				
Air Monitoring Station-1	AAQ - 1	26°31'5.89"N	86°56'9.86"E	Near silt ejector
Air Monitoring Station-2	AAQ - 2	26°26'31.81"N	86°53'44.60"E	Near Middle School at Piprahipatti beside SSB Chowki
Air Monitoring Station-3	AAQ - 3	26°22'42.66"N	86°48'25.98"E	At Ch.21.95 km
Air Monitoring Station-4	AAQ - 4	26°18'47.64"N	86°45'19.86"E	Near EKE and NH-57 junction
EKE Chainage 78.00 km to 84.00 km				
Air Monitoring Station-5	AAQ - 5	26° 0'12.68"N	86°28'59.07"E	Village Nauhatta
Air Monitoring Station-6	AAQ - 6	25°57'33.02"N	86°27'34.70"E	Village Jarahi-Muradpur

3.4.5.1 Air Quality Analyses Results

The Air Quality analyses results are presented in ***Table 16***.

3.4.5.2 Ambient Air Quality Monitoring Results

Observations on NO_X levels:

Average values of NOx ranged between 6.1 µg/m3 to 15.2 µg/m3 with low average values recorded at AAQ Station 2 (Near school at Piparahatti) and high average values at EKE junction at NH 57. The NOx value recorded at all the monitoring stations was much lower than the permissible limits of 80 µg/ m3 for residential and rural areas in the NAAQS Standards 2009.

Observations on SO_2 Levels:

Average values of SO_2 ranged between 5.6 µg/m3 to 13.6 µg/m3 with low average values recorded at AAQ Station 2 (Near school at Piparahatti) and high average values at AAQ Station 4 near EKE junction at NH 57. The SO_2 value recorded at all the monitoring stations was much lower than the permissible limits of 80 µg/ m3 for residential and rural areas in the NAAQS standards 2009.

Observations on PM_{10} Levels:

Average values of PM_{10} ranged between 63.3 µg/m3 to 92.8 µg/m3 with low average values recorded at AAQ station 2 (Near school at Piparahatti) and high average values at AAQ station 4 near EKE junction at NH 57. The PM_{10} value recorded at all the monitoring stations was much lower than the permissible limits of 100 µg/ m3 for residential and rural areas in the NAAQS standards 2009.

Observations on $PM_{2.5}$ Levels:

Average values of $PM_{2.5}$ ranged between 26.8 µg/m3 to 44.6 µg/m3 with low average values recorded at AAQ station 2 (Near school at Piparahatti) and high average values at AAQ station 4 near EKE junction at NH 57. The $PM_{2.5}$ value recorded at all the monitoring stations was much lower than the permissible limits of 100 µg/ m3 for residential and rural areas in the NAAQS standards 2009.

3.4.5.3 Conclusions

Based on the findings of the one-time AAQ monitoring program, it is concluded that during February, i.e., winter season, the air quality was quite good in the project areas in Chainage 0.00 km to 28.20 km and 76 to 84.00 km. The values of the parameters monitored at six locations are well within the permissible limits specified for the residential, rural and other areas. The absence of industries, low vehicular traffic and low population density could be attributed to good AAQ in the project area with vast carrying capacity to bear the impacts on the AAQ during the construction phase.

Table 16: Ambient Air Quality Monitoring Results

Sample No.	Limit as per IS 10500:2012		AAQ - 1		AAQ - 2		AAQ - 3		AAQ - 4		AAQ - 5		AAQ - 6	
Date of Sampling	Analysis Protocols	Specification as per NAAQS (Nov.2009)	6/2/14	7/2/14	6/2/14	7/2/14	7/2/14	8/2/14	7/2/14	8/2/14	8/2/14	9/2/14	8/2/14	9/2/14
Parameters			Concentration in µg / m3											
Particulate Matter (PM_{10}), µg / m3	IS 5182 (Part-23)	100 µg/ m3	82.8 72.0 68.2	77.4 64.6 61.3	74.1 67.3 56.2	62.1 68.7 50.2	90.4 82.1 68.5	75.7 83.8 61.2	95.1 106.4 77.0	89.0 98.6 72.0	79.6 72.2 60.3	66.6 73.7 53.9	83.7 93.6 67.8	78.3 86.8 63.4
Particulate Matter ($PM_{2.5}$), µg / m3	CPCB	60 µg/ m3	37.8 33.4 24.2	32.0 27.4 26.1	34.4 29.7 26.1	31.0 27.4 22.0	42.0 40.1 35.8	39.3 32.4 28.1	48.6 45.0 40.2	46.2 38.1 33.0	36.1 34.5 30.8	33.8 27.9 24.2	41.8 38.7 34.6	39.7 32.8 28.4
Sulphur Dioxide as SO_2, µg / m3	IS 5182 (Part-2)	80 µg/ m3	9.4 7.3 6.1 5.0 BDL 6.4	10.6 8.1 6.8 5.4 5.0 BDL	BDL 5.1 BDL 6.6 5.9 BDL	BDL BDL 6.2 5.5 5.1 BDL	BDL 6.2 5.4 8.1 7.2 5.2	5.8 5.2 BDL 6.7 5.6 BDL	13.4 10.2 11.6 10.2 12.6 14.8	10.9 14.6 16.2 15.4 11.4 13.6	8.6 10.9 9.5 14.2 12.6 9.1	10.2 9.1 8.4 11.7 9.8 7.4	11.5 8.8 10.0 8.8 10.8 12.7	9.4 12.6 13.9 13.2 9.8 11.7
Nitrogen Dioxide as NO_2, µg / m3	IS 5182 (Part-6)	80 µg/ m3	10.2 8.1 6.8 5.0 BDL BDL	12.4 9.2 7.2 6.6 6.2 BDL	BDL 6.6 5.1 8.7 7.7 5.9	6.1 5.2 7.4 6.2 5.8 BDL	5.6 8.1 6.2 10.6 9.4 7.2	7.4 6.0 5.2 8.2 6.4 5.8	18.7 15.6 14.6 12.6 13.8 16.2	14.8 12.6 16.2 10.8 16.2 15.4	9.8 14.2 10.9 18.6 16.5 12.6	13.0 10.5 9.1 14.4 11.2 10.2	16.1 13.4 12.6 10.8 11.9 13.9	12.7 10.8 13.9 9.3 13.9 13.2
24 Hrs. Average Value														
PM_{10}			74.3	67.8	65.9	60.3	80.3	73.6	92.8	86.5	70.7	64.7	81.7	76.1
$PM_{2.5}$			31.8	28.5	30.1	26.8	39.3	33.2	44.6	39.1	33.8	28.6	38.4	33.6
SO_2			6.9	7.2	5.9	5.6	6.4	5.8	12.1	13.6	10.8	9.4	10.4	11.7
NO_2			7.5	8.3	6.8	6.1	7.9	6.5	15.2	14.3	13.7	11.4	13.1	12.3
BDL : Below Detectable Limit (< 5.0 µg / m3)														

3.4.6 Groundwater and Surface Water Sampling and Analyses

The project area does not have industries and has a low population density. The cropping intensity is low with limited use of agrochemicals viz. insecticides, pesticides, weedicides and chemical fertilizers, etc. The only source of pollution is domestic sewage, which is confined mostly to the countryside area except some pollution due to habitations existing on the spurs closer to river bank; however these are sparse. The open defecation near the river bank may be responsible to bacteriological contamination of the river water near the human habitations. The sewage generation and its disposal in the river observed to be very low compared to the carrying capacity of the river since river has sufficient water availability.

Secondary data on the water quality monitoring undertaken by the Public Health Department in the vicinity of the EKE Ch. 0.00 km to 28.20 km and Ch. 78.00 km to 84.00 km was collected from the Water and Sanitation Department (WSD), Supaul. The sampling was conducted during August 2002. As communicated by the WRD, no groundwater monitoring and sampling has been conducted by them in the Study area since 2002. The sampling locations were superimposed on a map of the Study area with an objective to identify sampling locations closer to the area of interest, i.e., in the vicinity of the two EKE stretches. The superimposed maps showing the sampling locations along with the tabulated summary of the analytical results obtained from the WRD is presented in ***Annexure 6***.

The secondary data obtained from the WRD were reviewed to understand the historical quality of groundwater in the region. The results were compared with the monitoring results of the sampling undertaken by the IEISL during February 2014 to observe changes in the groundwater quality. Except four locations, which were found to be closer to the Study area (located at distance of 0.15 km to 4.0 km from the two EKE stretches) most of the sampling locations were at a distance, and hence couldn't be used for comparison. A tabulated summary comparing the analytical results for selected four locations is also presented in this ***Annexure 6.*** The groundwater monitoring results show that except Iron content, which was higher in a few locations, all other parameters are well within the permissible limits of the Drinking Water Standards IS: 10500.

In addition, secondary data on the water quality monitoring undertaken by the BSPCB and district wide water quality data collected under the National Rural Drinking Water Program of the Ministry of Drinking Water and Sanitation, GoI were also collected and studied as part of the secondary data collection exercise. However, since the groundwater sampling locations were outside the Study area, a comparative study of the water quality was not feasible, and hence these data have not been included in this report.

Since the hand pumps, locally known as *"Chhapakals"*, are the only source of water drawn in the area, the groundwater samples for testing of groundwater quality were collected from six (6) hand pumps located in different places within the Study area.

Samples for testing of surface water quality were collected from six (6) locations within the Study area from the Kosi River, as a part of this study.

Figure 13 and ***Table 17*** present the location and geo-coordinates of groundwater and surface water sampling locations, respectively, within the Study area.

The collected samples were analyzed for Color, pH, Electrical Conductivity, Dissolved Oxygen, Turbidity on NTU, Total Dissolved Solids, Total hardness as CaCO3, Calcium as

Ca, Magnesium as Mg, Total Alkalinity as CaCO3, Chloride as Cl, Sulphate as SO4, Fluoride as F, Sodium as Na, Potassium as K, Boron as B, Total Phosphate as P, BOD, COD, Ammonical Nitrogen as N, Total Kjeldahl Nitrogen as N, and Total Coliform (MPN value), as mandated in the ToR of the Study.

The collected groundwater and surface water samples from the Study area were analyzed as per the Standard Test Methods and Protocols prescribed in the IS APHA. The detailed listing of protocols is presented in ***Annexure 7***.

The groundwater quality and surface water quality analyses of the samples collected from the Study area are presented in ***Table 18*** and ***Table 19*****,** respectively.

3.4.6.1 Observations on Groundwater and Surface Water Quality

The concentration of various cations and anions, e.g., calcium, magnesium, chlorides and nitrates in the groundwater was found within the permissible limits. The concentration of Iron in the groundwater samples collected from the hand pump locations GW-3, GW-4, GW-5 and GW-6 was found above the permissible limits. The Fluoride limits in the groundwater samples were well within the specified limits for the drinking water.

The total hardness in surface water samples ranged from 72-136 mg/l. The low calcium and magnesium levels are responsible for soft nature of water. The BOD values are well within the permissible limits, which indicate the absence of organic pollution loading. This is mainly due to low population density and absence of industries in the area. The low COD values also indicate the absence of chemical pollution loading in the area. Sufficient water availability the in Kosi River helps the dilution of marginal quantity of pollution load entering into the river.

3.4.6.2 Conclusions

The Groundwater monitoring results show that except the Iron content, which was higher at GW-3, GW-4, GW-5 and GW-6 locations, all other parameters are well within the permissible limits of the Drinking Water Standards IS:10500. The local enquiry also reveals the presence of Iron in the Groundwater in the region and also corroborates with the data received from the WSD, Government of Bihar.

The Surface Water monitoring results show that there is no pollution load in the study area and sufficient flow in the river is available for dilution.

Figure 13: Map Showing Groundwater (GW) and Surface Water (SW) Sampling Locations

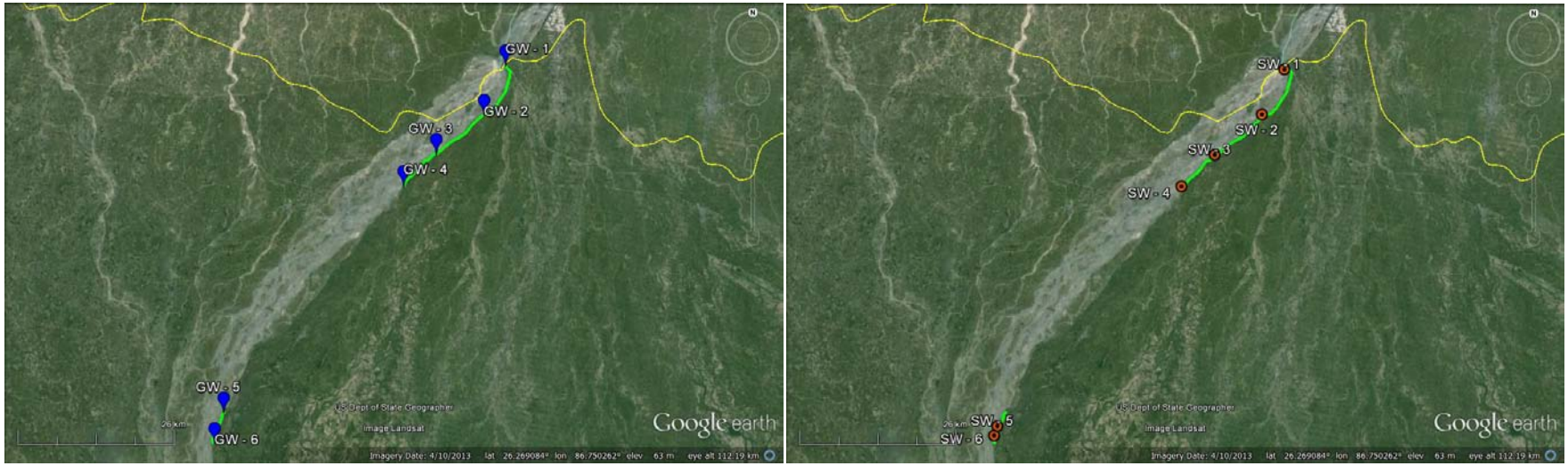


Table 17: Groundwater and Surface Water Sampling Locations

Ground/Surface Water Samples	Sample Code	Latitude	Longitude	Landmark Reference
EKE Chainage 0.00 km to 28.20 km				
Groundwater	GW - 1	26°31'7.26"N	86°56'10.50"E	Hand pump at Chainage 0.0 km
Groundwater	GW - 2	26°26'41.31"N	86°54'1.32"E	Hand pump near Chainage 10.0 km in Piparahipatti Village on countryside of EKE
Groundwater	GW - 3	26°23'10.89"N	86°49'14.47"E	Hand pump near Chainage 20.20 km in Gopalpur Village on countryside of EKE
Groundwater	GW - 4	26°20'19.04"N	86°45'58.46"E	Hand pump near Chainage 28.20 km near Kalyanpur Village on Riverside of EKE
Surface Water	SW - 1	26°30'56.99"N	86°56'0.51"E	Kosi River near Chainage 0.00 km
Surface Water	SW - 2	26°26'54.33"N	86°53'45.36"E	Kosi River near Chainage 10.00 km
Surface Water	SW - 3	26°23'17.34"N	86°49'1.55"E	Kosi River near Chainage 20.50 km
Surface Water	SW - 4	26°20'27.77"N	86°45'42.13"E	Kosi River near Chainage 28.20 km
EKE Chainage 78.00 km to 84.00 km				
Groundwater	GW - 5	26° 0'0.43"N	86°28'1.99"E	Hand pump near Chainage 79.00 km on countryside of EKE

Ground/Surface Water Samples	Sample Code	Latitude	Longitude	Landmark Reference
Groundwater	GW - 6	25°57'15.13"N	86°27'8.34"E	Hand pump near Chainage 84.00 km on countryside of EKE near Hanuman Mandir at Ekadh Village
Surface Water	SW - 5	25°58'54.66"N	86°27'19.62"E	Kosi River near Chainage 80.65 km
Surface Water	SW - 6	25°58'4.45"N	86°27'0.17"E	Kosi River near Chainage 82.50 km

Table 18: Groundwater Quality Results

Sample No.	Limit as per IS 10500:2012		GW - 1	GW - 2	GW - 3	GW - 4	GW - 5	GW - 6
Date of Sampling	Desirable	Permissible	06.02.14	06.02.14	06.02.14	06.02.14	09.02.14	09.02.14
Parameters			All results in mg/l, except pH, color in hazen limit and conductivity in µmhos/cm					
Color	5.0 hazen limit	15.0 hazen limit	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
pH	6.5 - 8.5	No relaxation	7.66	7.28	6.94	7.24	6.86	7.18
Electrical Conductivity, µmhos./cm	-----	----	381.0	234.0	212.0	283.0	326.0	278.0
Total Dissolved Solids	500	2000	232.0	146.0	132.0	176.0	204.0	166.0
Total Hardness as CaCO3	200	600	180.0	120.0	116.0	140.0	160.0	116.0
Calcium as Ca	75	200	52.9	32.0	33.6	44.9	48.4	38.6
Magnesium as Mg	30	100	11.6	9.7	7.8	6.7	9.5	4.8
Total Alkalinity as CaCO3	200	600	96.0	72.0	68.0	84.0	76.0	80.0
Chloride as Cl	250	1000	18.0	4.0	10.0	6.0	12.0	4.0
Sulphate as SO4	200	400	6.8	8.2	7.6	6.6	10.2	8.6
Fluoride as F	1.0	1.5	0.46	0.58	0.62	0.38	0.44	0.52
Boron as B	0.5	1.0	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Iron as Fe	0.30	No relaxation	0.11	0.26	0.33	0.78	1.1	0.52
Copper as Cu	0.05	1.5	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Zinc as Zn	5.00	15.0	0.48	0.32	0.26	0.54	0.30	0.42
Chromium as Cr+6	0.05	No relaxation	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Arsenic as As	0.01	0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Coliform per 100 ml.	NIL	---	NIL	NIL	NIL	NIL	NIL	NIL
E. coli per 100 ml.	NIL	----	NIL	NIL	NIL	NIL	NIL	NIL

Table 19: Surface Water Quality Results

Sample No.		SW - 1	SW - 2	SW - 3	SW - 4	SW - 5	SW - 6
Date of Sampling		**06.02.14**	**06.02.14**	**06.02.14**	**06.02.14**	**09.02.14**	**09.02.14**
Parameters	**Unit**						
Color	Hazen unit	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
pH	---	8.16	8.10	8.0	7.94	7.68	7.86
Electrical Conductivity	µmhos./cm	160.0	326.0	152.0	155.0	184.0	210.0
Dissolved Oxygen	mg/l.	9.9	9.6	9.5	9.7	9.5	9.4
Turbidity on NTU	---	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Dissolved Solids	mg/l.	98.0	204.0	92.0	96.0	108.0	122.0
Total hardness as CaCO3	mg/l.	72.0	136.0	96.0	108.0	84.0	92.0
Calcium as Ca	mg/l.	20.8	24.0	24.0	22.4	18.6	21.2
Magnesium as Mg	mg/l.	4.9	18.4	8.8	12.6	9.1	9.5
Total Alkalinity as CaCO3	mg/l.	36.0	58.0	44.0	40.0	26.0	38.0
Chloride as Cl	mg/l.	6.0	2.0	4.0	2.0	2.0	4.0
Sulphate as SO4	mg/l.	5.8	7.2	6.4	5.6	6.2	5.2
Fluoride as F	mg/l.	0.42	0.54	0.36	0.40	0.44	0.38
Sodium as Na	mg/l.	4.6	7.8	5.6	6.2	5.4	4.8
Potassium as K	mg/l.	0.8	1.4	0.6	0.2	1.2	0.4
Boron as B	mg/l.	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Total Phosphate as P	mg/l.	0.2	0.4	0.3	0.2	0.2	0.3
BOD	mg/l.	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
COD	mg/l.	4.0	8.0	4.0	6.0	4.0	4.0
Ammonical Nitrogen as N	mg/l.	< 1.0	1.2	< 1.0	< 1.0	1.2	< 1.0
Total Kjeldahl Nitrogen as N	mg/l.	2.4	3.2	2.2	1.8	2.8	1.4
Total Coliform	MPN/100ml	740	680	570	710	540	460

3.4.7 Soil Quality

3.4.7.1 Soil Sampling and Analyses

The soil samples were collected from six (6) different locations within the Study area. ***Figure 14*** and ***Table 20*** presents the location and geo-coordinates of soil sampling locations, respectively within the Study area.

Figure 14: Soil Sampling Location Map

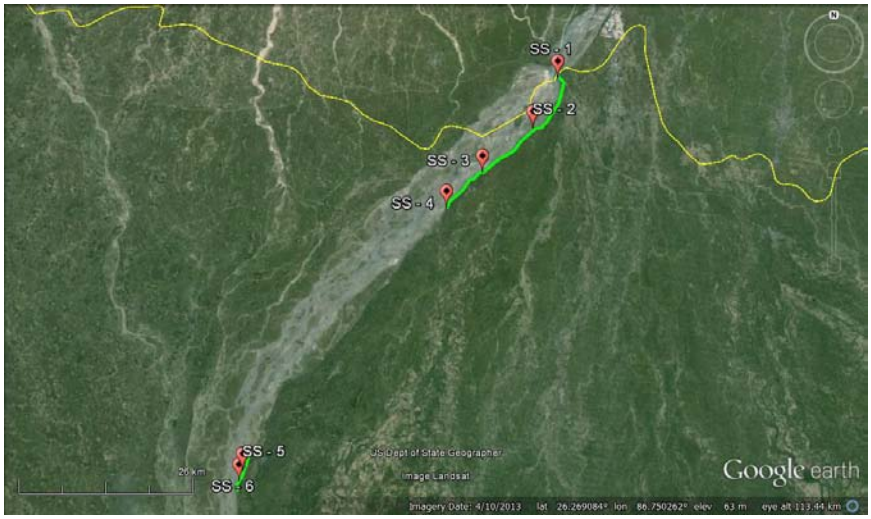


Table 20: Soil Sampling Location Details

Soil Sampling	Sample Code	Latitude	Longitude	Landmark Reference
EKE Chainage 0.00 km to 28.20 km				
Soil Sample	SS-1	26°30'59.76"N	86°56'6.72"E	Agriculture Field near Silt Ejector at Chainage 0.00 km
Soil Sample	SS-2	26°26'53.34"N	86°53'50.58"E	Agriculture Field near spur at Chainage 10.00 km
Soil Sample	SS-3	26°23'16.44"N	86°49'13.44"E	Agriculture Field near spur at Chainage 20.20 km
Soil Sample	SS-4	26°20'23.16"N	86°45'57.18"E	Agriculture Field near spur at Chainage 28.20 km
EKE Chainage 78.00 km to 84.00 km				
Soil Sample	SS-5	25°58'54.58"N	86°27'25.71"E	Agriculture Field near spur at Chainage 80.65 km
Soil Sample	SS-6	25°58'2.88"N	86°27'5.82"E	Agriculture Field near spur at Chainage 82.50 km

The collected soil samples were analyzed for Soil Texture, Particle Size Distribution, Water Holding Capacity, Electrical Conductivity, pH, Organic Carbon, available Nitrogen, available Phosphorus, available Potassium, available Sulphur, available Iron, available Manganese, available Zinc and available Copper, as per the ToR.

3.4.7.2 Soil Testing Methodology

All the soil samples were collected below surface level from 1.5 meter depth. Analyses of soil samples for different parameters were carried out as per Soil Testing Method Manual of Ministry of Agriculture, GoI. The Soil Sample Analysis results are presented in ***Table 21***.

Table 21: Soil Quality Analysis Results

Sample No.		SS - 1	SS - 2	SS - 3	SS - 4	SS - 5	SS - 6
Date of Sampling		**06.02.14**	**06.02.14**	**06.02.14**	**06.02.14**	**09.02.14**	**09.02.14**
Parameters	**Unit**						
Soil Texture	-	Silty Loam	Silty Loam	Silty Loam	Silty Loam	Silty Loam	Silty Loam
Particle Size Distribution							
Sand	%	31.4	26.4	18.7	21.6	30.2	24.6
Silt	%	48.6	56.1	60.8	53.4	46.4	58.4
Clay	%	19.2	17.1	20.2	24.8	22.6	16.8
Water Holding Capacity	%	36	42	30	38	30	40
Conductivity	µmhos./cm	256.0	278.0	224.0	240.0	262.0	248.0
pH	--	7.2	7.6	7.6	7.4	7.2	7.5
Organic Carbon	%	0.52	0.54	0.44	0.68	0.58	0.62
Available Nitrogen	mg/kg	8.4	10.6	13.2	7.6	5.8	6.2
Available Phosphorus as P_2O_5	mg/kg	3.2	4.8	5.6	2.8	2.6	4.1
Available Potassium as K_2O	mg/kg	1.6	0.8	1.1	1.4	1.2	1.0
Available Sulphur as S	mg/kg	10.2	16.4	8.6	12.8	18.4	22.8
Available Iron	mg/kg	1.6	0.8	1.2	1.0	0.6	1.4
Available Manganese	mg/kg	0.2	0.4	0.8	0.2	0.6	0.5
Available Zinc	mg/kg	1.2	1.6	0.8	1.4	1.2	1.1
Available Copper	mg/kg	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1

3.4.7.3 Conclusions

The results of the soil testing indicate that the soil is in the neutral range. The EC values indicate low salinity levels in the area. The organic carbon indicates moderate to high soil productivity.

3.4.8 Monitoring of Ambient Noise Levels

Baseline ambient noise level monitoring was done using a weighted sound pressure level meter. The survey was carried out in calm surrounding. Sound Pressure Level (SPL) measurement in the outside environment was made using sound pressure level meter. Hourly noise meter readings were taken at different sites. The survey for noise levels was conducted during February, 2014.

The ambient noise levels monitoring were carried out at six locations, based on the understanding of the proposed routes of material transportation for the restoration works, on 24 hour basis within the Study area. ***Figure 15*** and ***Table 22*** present the location and geo co-ordinates of noise monitoring locations, respectively within the Study area. The methodology for monitoring of Ambient Noise Level is presented in ***Annexure 8***.

Figure 15: Ambient Noise Level Monitoring Locations

Table 22: Noise Monitoring Location Details

Ambient Noise Level Monitoring Location	Latitude	Longitude	Landmark Reference
EKE Chainage 0.00 km to 28.20 km			
NLM - 1	26°31'1.23"N	86°56'15.77"E	On EKE between Silt Ejector and First Spur at Chainage 0.2 km
NLM - 2	26°26'34.92"N	86°53'44.82"E	On EKE near Village Piparahipatti near Chainage 10.00 km
NLM - 3	26°23'15.81"N	86°49'1.88"E	On EKE near Chainage 20.20 km
NLM - 4	26°20'19.12"N	86°45'59.55"E	On EKE near Chainage 28.20 km
EKE Chainage 78.00 km to 84.00 km			
NLM - 5	26° 0'16.62"N	86°28'17.70"E	On EKE near Chainage 78.50 km
NLM - 6	25°57'18.00"N	86°26'59.77"E	On EKE near Chainage 84.00 km

The ambient noise levels were monitored continuously from 7 AM to 6 AM at each location and hourly equivalent noise level was measured. Sound Pressure Level (SPL) measurement in the ambient environment was made using sound pressure level meter. The

day and night time equivalent noise levels are given in ***Table 23***, along with the noise standards.

Table 23: Ambient Noise Level Monitoring Results

Location Code		NLM - 1	NLM - 2	NLM - 3	NLM - 4	NLM - 5	NLM - 6
Date of Monitoring		06.02.14	06.02.14	06.02.14	06.02.14	09.02.14	09.02.14
Daytime (Hours)	7:00	39.6	35.5	45.0	42.4	50.5	40.2
	8:00	40.2	37.2	51.9	42.0	54.2	42.8
	9:00	41.4	40.0	52.2	44.1	52.1	44.7
	10:00	45.0	41.6	53.0	46.8	56.6	45.2
	11:00	48.6	43.2	53.8	42.4	60.7	50.6
	12:00	51.6	45.1	53.1	42.5	60.3	52.4
	13:00	56.4	43.1	54.2	42.2	65.0	60.2
	14:00	62.0	49.8	55.0	42.1	72.1	68.4
	15:00	66.2	53.1	54.7	41.9	69.2	71.6
	16:00	70.2	55.0	55.5	42.0	75.8	68.2
	17:00	63.7	57.2	56.3	42.7	73.9	62.0
	18:00	59.6	51.0	53.4	40.0	63.3	58.3
	19:00	55.0	47.1	51.6	38.6	55.4	52.1
	20:00	51.6	43.3	45.7	36.1	53.8	49.2
	21:00	45.0	36.8	41.0	32.8	52.4	48.6
Nighttime (Hours)	22:00	42.4	36.1	38.9	29.9	48.4	46.2
	23:00	40.2	33.9	37.1	28.4	46.2	45.0
	0:00	37.6	31.5	32.2	27.2	45.4	44.2
	1:00	36.0	29.4	30.8	25.4	44.1	42.0
	2:00	34.9	27.4	30.4	29.2	41.9	40.6
	3:00	32.2	25.7	31.7	30.8	39.0	38.4
	4:00	30.8	30.2	30.8	30.2	43.8	36.2
	5:00	34.6	31.4	33.6	32.1	46.2	37.4
	6:00	38.4	33.4	35.0	38.4	47.7	39.6
Ld		55.8	50.7	46.2	40.5	41.2	52.3
Ln		41.4	32.7	31.6	28.9	30.2	36.1
Permissible Ld		55	55	55	55	55	55
Permissible Ln		45	45	45	45	45	45

Conclusion

The average ambient Noise levels at all the monitoring locations during the day and night time are generally within the permissible limits indicating that the area is not impacted due to high noise levels.

3.5 BIOLOGICAL ENVIRONMENT

3.5.1 Study Methodology - Secondary Data Analyses

The findings in this section are based on various documents and reports available in the Public Domain. Besides, the observations recorded during reconnaissance and focus group discussions with the local people and various government officials were also used to include the information on Flora and Fauna in the project area.

Additionally, the physical survey results within 5 km envelope on either side of the EKE helped in generation of wealth of information on the biological resources in the project area and has also been included in this section as well as the Strip Maps prepared for the project area.

There is no notified ecologically sensitive area within 5 km on either side of the EKE nor there is any Wildlife sanctuary, National park, Biosphere reserve or any other ecologically sensitive area within the Project area.

3.5.2 Flora and Vegetation

The Project area is devoid of forests, grassland or climax vegetation. The vegetation in the area is akin to that of sub-tropical vegetation. The area is dominated by wild herbs, bushy shrubs and scattered trees. The interaction with officials of the Forest Department, Government of Bihar, revealed that there is no forest in Saharsa Division, which includes Supaul and Saharsa Districts. The area is flood prone and no strong climax vegetation is found. Some of them are planted in small patches on the road side/bund. However, their numbers are few, so there is no significant loss of wood. Most of the species are utilized by the villagers for fodder and fuel.

Table 24 presents the recorded Floral Species in the Study area.

Table 24: Floral Species in the Study area

Botanical Name of Species	Local Name
HERBS	
Abutilon indicum	
Acalypha indica Linn	
Aerua lanata Linn	
Aloe vera	Dhrit Kumari
Alternanthera sessilis	
Amaranthus spinosus Linn	Ktaiyasag
Anisomeles indica	
Argemone mexicana	Kataiya
Blumea lacera	
Boerhaavia diffusa	
Cassia tora Linn	
Celsia coromandeliana	
Centella asiatica Linn	Brahmi Buti
Cocculus hirsutus	
Croton bonplandianun	
Cynoglossum lanceolatum Forsk	
Cyperus rotundus	Motha
Eclipta alba Linn	Bhangaiya
Euphorbia hirta Linn	Dudhi
Evolvulus alsinoides Linn	Shankhpushpi
Gomphrena celosioides	
Heliotropium indicum Linn	Hathisur
Launaea splenifolia	
Lippia geminate	
Malvestrum coromandelianum	
Mirabilis jalpa	4 ‘O clock
Mollugo pentaphylla Linn	
Nicotiana plumbaginifolia Viv	
Oldenlandia gracilis DC	
Oxalis corniculata Linn	Khattimithi

Botanical Name of Species	Local Name
Polygonum glabaram	
Physalis minima Linn	Makoi
Phyllanthus fraternus	
Ranunculus sceleratus Linn	Jaldhania
Sida rhomboidea	
Solanum nigrum Linn	Bhatkoi
Vernonia cinerea Linn	Sahajai
Vigna radiata Linn	Moong
Xanthium strumarium Linn	
Zea mays	Maize
SHRUBS	
Adhatoda vasica Nees	Basak
Bauhinea tomentosa	
Calotropis procera (Ait) R.Br	Akwan
Cannabis sativa	Bhang
Datura alba	
Ficus glomerata	Gular
Gossypium herbaceum	
Hiptage benghalensis Linn	Gulphrosh
Jatropha curcas Linn	Jamal gota
Jatropha gossypifolia Linn	
Lantana camera Linn	Putus
Malvavisus arbortristis	
Moringa oleifera	
Solanum torvum Siu	Bab baigan
Tabernaemontana divaricata	
Tamarix dioica Roxb	Jhau
Vitex nigundo	Shiwali
Ziziphus oenoplia (Linn) Mill	Banber
TREES	
Acacia arabica	Babool
Aegle marmelos	Bel
Annona squamosa Linn.	Kathal
Azadirachta indica A.Zuss.	Neem
Bombax malbaricum	Shimal
Cassia corymbosa	
Derris pinnata	Karuini
Dulbergia disso Roxb.	Shish am
Erythrina indica	
Ficus benghalensis	Gamhaar
Ficus religiosa	Peepal
Odina wodier	Jihal
Pithecellobium dulce Roxb	Jalebi
Phyllanthus emblica	Amala
Pleumeria rubra	
Psidium guajava	Amrood
Syzygium cuminii	Jamun
Terminalia arjuna	Arjun
Thevetia peruviana	Yellow Kaner
Ziziphus jujuba	Ber
	Sharifa
	Bargad
AQUATIC MACROPHYTES	
Alternanthera philoxeroides Mart	
Eichhornia crassipes (Mart) Solmns	Jalkumbhi

Botanical Name of Species	Local Name
Hydrilla verticillata	
Ipomoea aquatica Forsk	Karmi
Ipomoea fistulosa Mart	Behaya
Lemna gibba Linn	
Nelumbo nucifera Gaertn	Kamal
Nymphaea stellata Willd	Bhent
Pistia stratiotes Linn	
Sagittaria guayanensis	
Typha angustata Bony & Chaub	
PTERIDOPHYTES	
Azolla trinnata	
Marsilea quadrifolia	
Pteris pelucida Linn	
GYMNOSPERMS	
Cupressus tortuosa Linn	
Cycas circinalis	
Thuja orientails Linn	
GRASSES	
Brachiaria ramose	
Comelina beghalensis	
Cynodon dactylon	Dub
Cyperus rotundus	Motha
Imperata cylindrica	
Setaria interrupta	Latpatwa
CLIMBERS & TWINERS	
Cayratia trifolia	
Basella alba	Poi
Cuscuta reflexa	Amarbell
Atylosia scarabaeoides	
Coccinia indica	Kundari
Dolichos lablab	Bean
Luffa cylindrica	Nenua
CEREALS, PULSES AND VEGETABLES	
Amaranthus tricolor	Lal saag
Amaranthus virdis Linn	Genhari saag
Momordica charantia	Karela
Oryza sativa	Rice
Spinacia oleracea	Palak
Vigna mungo	Urd
Vigna radiata Linn	Moong

The dominant tree species in the project area and on the EKE are *Dalbergia sissoo, Gmelina arborea, Acacia Arabica, Terminalia arjuna, Aegle marmelos* and *Pisidium gujuva.*

The dominant shrubs were *Calotropis procera, Lantana camara, Pithecolobium dulce, Tamarix diocia Evovulus alsinoides, Cynodon dactylon, Cyperus rotundus, Datura alba, Calotropis procera Lantana camara, Euphorbia hirta, Gynoglossum lanceolotum,* etc.

The vegetation reported in the project area is wild and common as in other such sub-tropical regions. The area was dominated by wild herbs, bushy shrubs and scattered trees. Most of the herbs are of common type and have some economical and medicinal value for the villagers. No rare or endangered species was reported from the project area. Trees reported in the area are also common and used for flowers, fruits and vegetables. No forest area is reported in the project area or its vicinity.

3.5.3 Fauna

The faunal species reported from the area within 5 km envelope on both the sides of EKE are presented in ***Table 25***. The avi-fauna found in the Study area are shown in the photographs below.

Table 25: Inventory of Faunal Species

Zoological Name of Species	English Name
Mammals	
Canis aureus	Jackal
Canis familiaris	Dog
Felis domesticus	Cat
Funambulus balmarum	Squirrel
Herpestes edwardsii	Indian Mongoose, Indian grey Mongoose
Mus booduga	Indian Field mouse
Mus musculus	House Mouse
Vulpes bengalensis	Indian fox
Reptiles	
Agama tuberculata	Common lizard
Bungarus caeruleus	Common Krait
Chamaleon zeylanicus	Chameleon
Naga naja	Indian cobra
Vipera russelli	Russel's viper
Birds	
Ardea cinerea	Grey Heron
Bulbulcus ibis	Cattle Egret
Casmerodius albus	Great Egret
Columba livia	Blue rock pigeon
Corvus splendens	House crow
Dinopium benghalense	Woodpecker

Zoological Name of Species	English Name
Gallinula chloropus	Moor hen
Gyps indicus	Grey Vultures/ Indian long billed vulture
Leptoptilos javanicus	Lesser Adjutant (Garud)
Milvus migrans	Cheel
Mycteria leucocephala	Painted storks and grey storks
Pavo cristatus	Common peacock
Phalacrocorax fuscicolis	Cormorant or Indian Shag
Pyenonotus jacosus	Bulbul

3.5.4 Aquatic Ecology

The phytoplankton and macrophytes represents the primary producers in the Kosi River. Zooplankton, benthos and fish represent the secondary producers.

Fish Species: The information collected from the State Fisheries Department, suggests that 20 major fish species are found in the Kosi River. *Catla catla* and *Labeo rohita* are the dominant species. During field visits, the commonly observed fish species were Catla (*Catla catla*), Rohu (*Labeo rohita*), Magur (*Clarias batrachus*), Garai (*Channa punctatus*) and Tengra (*Mystus seenghala*). There are no commercial fisheries in the Project Area and local fishermen fish in the Kosi River and the water logged areas on both sides of the EKE by using local nets and fishing gear either to sell the fish in the local market or for household consumption.

The photographs below present the fish varieties observed at the Nauhatta Market.

The list of fish species observed during field visits are presented in ***Table 26***.

Table 26: Fish Species observed during Field Visits

Zoological Name of Species	Local Name
Catla catla	Catla
Labeo rohita	Rohu
Cirrhinus mrigala	Naini
Clarias batrachus	Mangur
Channa punctatus	Garai
Mystus seenghala	Tengra
Heteropreustas fossilis	Singhi
Notopterus chilata	Moy
Wallago attu	Boari

Dolphins: A well known aquatic mammal of the Kosi River is the Gangetic dolphin, (*Platanista gangetica*) which has been placed under Schedule-I of Wildlife (Protection) Act, 1972. It is also declared as a National Aquatic Animal. Dolphins are found throughout the Ganga River and migrate to the Kosi River and other tributaries during monsoon season. In the Kosi River, 85 dolphins were sighted during 2001 (Sinha, R.K.) in discrete segments between the Kosi Barrage at India-Nepal border and Kursaila. However, during field visits between January and April, 2014, dolphins were not observed in the study area. The dolphins are not gregarious, being frequently sighted alone or in small groups of 2-3 (Jones 1982, Smith 1993).The enquiry with locals and from the available literature revealed that during the dry season from October to April, dolphins leave the Kosi River and congregate in the Ganga River only to return to the Kosi River in the following rainy season (Reeves and Brownell 1989). In the Kosi River, a decrease in abundance of dolphins during the summer season confirms a seasonal pattern of migration (Shrestha 1989). This migration seems to be associated with the dispersal of fish, which are their main prey (Kasuya and Haque 1972).

During the reconnaissance of the study area and discussion with the local people on the EKE as well as on the shoals, no basking grounds of the crocodiles were reported within the area. During the surface water sampling however, turtles were observed at a few locations on the river. This indicates the presence of turtles in the river and a possibility of turtle nesting grounds in the area especially on the sandy shoals. The available literature also suggests the presence of Turtles in the Kosi River. A detailed study will be necessary to establish the crocodile basking areas and Turtle nesting grounds in the Kosi River.

3.6 SOCIAL BASELINE

The social baseline of the districts within the Study area is based on the secondary information available in public domain and obtained from the State Government Departments. ***Table 27*** presents the social baseline of the Supaul and Saharsa Districts, within which the Project Area falls.

Table 27: Social Profile of the Districts in Study Area

Description	Supaul	Saharsa
Area, Sq. Km	2420	1696
Total population (Census 2011) (in millions)	2.22	1.89
Decadal growth rate (Census 2011) (%)	28.62	25.79
Crude Birth Rate (AHS 2010-11*)	28.5	32.1
Crude Death Rate (AHS 2010-11)	6.5	7.8

Description	Supaul	Saharsa
Natural Growth Rate (AHS 2010-11)	22	24.2
Infant Mortality Rate (AHS 2010-11)	64	62
Female Sex Ratio (Census 2011) (per 1000 males)	925	906
Schedule Caste population ('000) (2001 Census)	207	175
Schedule Tribe population (2001 census)	3,962	3,397
Literacy rate (Census 2011) (%)	59.65	54.57
Percentage of decadal growth in project District	28.62	25.79

Source: Annual Health Survey 2010-11, Census of India

3.6.1 Regional Demography

The Supaul District has very high percentage of population i.e. 94.96 % in the rural area. Population density is 735 / Sq.km. Sex ratio of the State is 920 females per 1000 males. *(Source: District Plan 2011-2012, Supaul)*

Table 28: Population Details

District	Persons	Males	Females
Supaul	22,28,397	11,57,815	10,70,582
Saharsa	18,97,102	9,95,502	9,01,600

Data Source: Census 2011

Table 29: Decadal Growth in the Project Districts

Bihar	25.05
Supaul	28.62
Saharsa	25.79

Data Source: Census 2011

Table 30: District wise SC, ST and Minority Details

Districts	Rural Population	SC (%)	ST (%)	Minority (%)
Supaul	94.9	18.9	0	11.8
Saharsa	91.7	14.8	0.7	10.1

Data Source: Census 2001

3.6.2 Literacy

As per 2011 Census, the number of literates in Bihar is 54,390,254 taking the State's literacy rate to 63.82%. Out of these male literates are 73.4% and female literates are 53.3%. The urban literacy rate is 78.75% (Male 84.42% and Female 72.36%) compared to rural literacy rate of 61.83% (Male 71.9% and Female 50.82%).

Table 31: District wise Literacy Rate

State / District	Absolute Literates			Literacy Rate		
	Persons	Males	Females	Persons	Males	Females
Bihar	54,390,254	32,711,975	21,678,279	63.82	73.39	53.33
Supaul	10,76,133	6,72,945	4,03,188	59.65	71.65	46.63
Saharsa	8,29,206	5,21,560	3,07,646	54.57	65.22	42.73

3.6.3 Economy

The economy of the project area is largely agriculture with service oriented base. The problem of low per capita income in Bihar is accentuated by considerable disparity across the districts in terms of their per capita income. In 2009-10, Patna (Rs.55,539), Madhepura (Rs. 7161) and Supaul (Rs.7213) remain at the bottom. The Saharsa and Supaul District falls in the extremely backward districts of Bihar State.

The District-wise per capita Gross District Domestic Product at 2004-05 Prices (2006-07 to 2009-10) is detailed below:

Table 32: District wise per capita Gross District Domestic Product at 2004-05 Prices

District	2006-07	2007-08	2008-09	2009-10
Saharsa	7649 (10%)	7414 (11%)	8687 (17%)	9770 (14%)
Supaul	6351 (26%)	6021 (31%)	6726 (36%)	7213 (36%)

Note: in Parentheses is the Percentage of Growth
Source: Bihar Agriculture Department and Economic survey report

3.6.3.1 Area and Production of Maize

The Project Districts are recognized for the highest production of Maize. As per the productivity ranking the top performing district during 2010-11 are Araria, Saharsa, Supaul and Samastipur Districts.

Table 33: District wise Area, Production and Productivity of Maize in Bihar (2009-10 and 2010-11)

District	2009-2010			2010-2011		
	Area ('000 hectare)	**Production ('000 Ton)**	**Productivity (Kg/ha.)**	**Area ('000 hectare)**	**Production ('000 Ton)**	**Productivity (Kg/ha.)**
Saharsa	37.9	120.2	3162	46.1	246.5	5349
Supaul	11.5	35.1	3059	12.3	60.6	4921

Source: Bihar Agriculture Department and Economic Survey Report

The crops cultivated are wheat, rice, pulses, vegetables, and fruit bearing trees like Mango, Litchi, Guava, Banana and others. The Districts are also famous for Makhana production and floriculture activities.

A good livestock and animal husbandry is also most conspicuous in the Project Districts with cows, buffalo's, goats, poultry and piggery.

In the Project Districts viz.., Saharsa and Supaul, the cooperative credit operations are negligible. (Source: State Level Bankers' Committee).

Recently, for crop loan, an amount of interest subsidy has been sanctioned by the State government. This would help farmers to obtain crop loan at 4 percent interest. The scheme is likely to be implemented with the help of NABARD. This would lead to increased flow of institutional credit to farmers during cropping season for procurement of inputs. (Source: State Level Bankers' Committee).

Kisan Credit Card (KCC) has been one of the most important instrument through which credits are channelized to farmers for agricultural operations and farmers are getting the benefits of this scheme in both the districts.

Since the Project Districts comprise of the Kosi River and its tributaries, there are many water bodies and water logged areas, which is helping the inland fisheries and it is a major source of livelihood support system.

The total number of work force and its distribution by agricultural and non-agricultural activities are listed in ***Table 35***.

Table 34: Total Work Force in the Project Districts

District / Year	Rural		Urban		Total	
	1998	2005	1998	2005	1998	2005
Supaul	22763	25066	10151	8571	32914	33637
Saharsa	17714	23382	12152	14105	29866	37487

Source: Fifth Economic Census 2005, DES, Govt. of Bihar

Table 35: District wise Distribution of Workers by Agricultural/Non-Agricultural Establishments

District / Year	Agricultural		Non-Agricultural		Total	
	1998	2005	1998	2005	1998	2005
Supaul	637	229	32277	33408	32914	33637
Saharsa	1755	909	28111	36578	29866	37487

Source: Fifth Economic Census 2005, DES, Govt. of Bihar

Table 36: District-wise Progress under MGNREGA (2010-11 and 2011-12)

District	Number of household issued job Cards		Percentage share of S.C households among house hold with job cards		Percentage of house hold demanding job employment	
	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12
Saharsa	2.94	2.96	54.18	23.84	57.59	41.15
Supaul	3.55	3.55	36.12	36.12	28.05	19.85
District	**House hold getting 100 days of Employment as percentage those obtaining employment**		**Person Days of Employment generated (Lakhs)**		**Percentage share of women in total share of employment generated**	
	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12
Saharsa	0.18	0.02	45.14	18.62	33.00	31.84
Supaul	9.0	1.17	54.35	14.45	33.46	28.72

Source: Bihar State Economic Survey Report 2012-2013

The Percentage Distribution of Medium, Small and Micro Enterprises Registered during 2011-12 in the Kosi division (comprising of Supaul, Saharsa and Madhepur Districts) are very low and accounts only 3.6%. There are only 5 units registered in Supaul district under micro industries scheme[2].

The decadal growth rate of Urbanization in project Districts is as detailed below:

Table 37: Decadal Growth Rate of Urbanization in Project Districts

District	2001	2011
Saharsa	8.3%	8.2%
Supaul	5.1%	4.7%

Source: Bihar State Economic Survey Report 2012-2013

The decadal growth rate of urbanization in Saharsa is not diversified. However, the rate of Urbanization in Supaul district shows a decreasing trend due to flood based disasters occurring every year.

[2] *Source: Bihar Economic Survey Report 2012-2013*

3.6.4 Infrastructure Facilities/Utilities

The Project Area has limited infrastructural facilities like all weather roads/transportation services, electricity, safe drinking water and health care centers, etc.

The statistical data of Supaul and Saharsa Districts presented below is taken from various government records available in the public domain.

Table 38: District-wise Results of Annual Health Survey (2011)

District	Under 5 Mortality Rate (U5MR)				
	Total	Male	Female	Rural	Urban
Supaul	89	87	91	92	-
Saharsa	91	84	98	92	83

Source: State Health Society- Government of Bihar

Table 39: Number of Health Institutions (September 2012)

District	District Hospital	Referral Hospital	Sub-Divisional Hospital	PHC	HSC	APHC	PHC+ HSC+ APHC	All Hospitals+ All Health Centre's	Population Per Health Institution
Supaul	1	2	1	11	178	20	209	213	10462
Saharsa	1	0	1	10	152	32	194	196	9679

Source: State Health Society- Government of Bihar

Table 40: District-wise Installation of Hand Pumps under National Rural Drinking Water Program

District	Number of Hand Pumps Installed					Slipped backed Habitations/Water quality problems covered	
	2007-2008	2008-2009	2009-2010	2010-2011	2011 - 2012	2010-11	2011-12
Supaul	83	652	871	886	307	628	298
Saharsa	227	590	647	935	0	426	112

Source: Public Health Engineering Department, GOB

Table 41: District-wise Achievement under Central Rural Sanitation Program in Individual Household Latrine (IHHL) during 2010-11and 2011-12

District	Percentage of total population	Number of IHHLs constructed					
		2010-11			2011-12		
		APL	BPL	TOTAL	APL	BPL	TOTAL
Supaul	2.1	1141	11424	12565 (1.7)	2474	20462	22936 (2.7)
Saharsa	1.8	6474	28740	35214 (4.8)	2316	12496	14812 (1.8)

Source: Public Health Engineering Department, GOB

Table 42: District-wise Achievement under Central Rural Sanitation Program (Sanitary Complex, School Toilets, Anganwadi Toilets) during 2010-11 and 2011-12

District	2010-11			2011-12		
	Sanitary Complex	School Toilet	Anganwadi Toilet	Sanitary Complex	School Toilet	Anganwadi Toilet
Supaul	0	294	0	0	309	0
Saharsa	2	393	0	1	358	0

Source: Public Health Engineering Department, GoB

Table 43: District-wise Primary and Upper Primary Schools (2007-08 and 2010-11)

District	Primary	Primary with Upper primary	Primary with Upper primary, Sec./higher sec.	Upper Primary Only	Upper Primary with Upper primary. Sec/higher sec.	Total
2007-08						
Supaul	1331	310	17	16	16	1690
Saharsa	949	281	2	4	3	1239
2010-11						
Supaul	1049	638	3	13	0	1703
Saharsa	747	495	9	4	0	1246

Source: Department of Rural Development, GoB

Table 44: District-wise Achievement of Kisan Credit Card (Numbers)

District	2005	2006	2007	2008	2009	2010	2011	2012
Supaul	3424	2838	5593	6296	57130	22830	16790	27256
Saharsa	2906	2135	5513	7250	13835	21763	18904	25224

Source: Department of Rural Development, GoB

After due compilation of secondary data from various Government Departments and several other sources like reports, publications, web sites, etc. it was possible to identify the key socio-economic issues prevalent in the Project Area.

A detailed field visit in terms of enumeration of Sensitive Receptors, informal discussions with the community during many field visits and six public consultations held at different locations on EKE, has provided a better understanding towards the social set up of the area. Socio-economic issues prevalent in the Project Area are summarized below:

- High population decadal growth rate.
- Low literacy rate in general
- Low Female literacy rate in particular.
- Low per capita income
- Poor housing in the EKE area in general
- Rural roads in poor condition.
- Poor health infrastructure however, it is getting improved after the introduction of National Rural Health Mission (NRHM)
- Dumping of solid waste and lack of sanitation facilities

4 IMPACTS OF THE PROJECT ON THE ENVIRONMENT

4.1 IDENTIFICATION OF IMPACTS

The EIA especially in the limited studies, such as the Kosi EKE Protection and Restoration Project, is subjective and the degree of the impacts cannot be quantified. However, based upon the available information about the project, wherever possible, the impacts were quantified and qualitative assessment has been carried out for those aspects where the information is wanting.

Probable positive and negative impacts due to implementation of the proposed protection and restoration of EKE are discussed in this Chapter. After studying the existing baseline environmental scenario, field surveys, reviewing the methods of construction and related statutory norms, the impacts were identified and assessed for the planning/pre-construction phase, construction phase and post construction phase.

The proposed restoration of the EKE generally would not have serious negative impacts on the environment and ecology of the area where the proposed works are to be carried out and a few negative impacts, which will be temporary, shall be limited to only to the construction phase of the project. These impacts could be mitigated through a precautionary engineering design, planning and management.

The following key activities shall be undertaken during the construction phase of the proposed protection and restoration of Kosi EKE.

- Site preparation
- Earthwork and excavation
- Transportation of construction material
- Storage of the construction materials
- Establishment of the Labour camps
- Disposal of construction wastes
- Disposal of the wastewater from the labour camps
- Disposal of the solid wastes from the labour camps
- Operation and maintenance of construction equipment and parking space for the machinery
- Disposal of waste generated from the maintenance of the equipment and machinery
- Operation of the Diesel Generator (DG) sets
- Allied activities and services related to the project work

Interaction of the project activities with environmental attributes is presented as Activity-Impact Matrix in ***Table 45***.

Table 45: Impact Activity Identification Matrix

S. No.	Activities	Impacts on Physical Environment					Impacts on Ecology/ Biological Environment		Public Health	Socio-Economic
		Air	Water	Noise	Soil	Topography	Aquatic	Terrestrial		
Planning / Pre-construction Phase										
1	Removal of hutments from ROW									-ve (P)
Construction Phase										
1	Quarrying (boulder/sand)	-ve (T)		-ve (T)		-ve (P)		-ve (T)		
2	Material transportation and storage	-ve (T)		-ve (T)					-ve (T)	+ve (T)
3	Earthwork for stripping of top soil/site clearance/ removal of vegetation	-ve (T)	-ve (T)		-ve (T)		-ve(T)	-ve (T)		
4	Debris management	-ve (T)								
5	Operation and maintenance of construction equipment/vehicles	-ve (T)	-ve (T)	-ve (T)			-ve (T)		-ve (T)	+ve (T)
6	Labour & Labour camp related activities	-ve(T)	-ve (T)						-ve (T)	+ve (T)
Post Construction Phase										
1	Overall Scenario	+ve (P)	+ve (P)	+ve (P)	+ve (P)	+ve (P)	+ve (P)	+ve (P)	+ve (P)	+ve (P)

+ve (T) = Temporary Positive Impacts
+ve (P) = Permanent Positive Impacts
-ve (T) = Temporary Negative Impacts
-ve (P) = Permanent Negative Impacts

4.2 WITH AND WITHOUT PROJECT SCENARIO

The “with” and “without” project scenarios were analyzed with respect to necessity of the proposed restoration of the EKE. A comparison of both the scenarios is presented in ***Table 46***.

Table 46: With and Without Project Scenario

S. No.	Parameters	Without Project		With Project	
		Positive Impacts	**Negative Impacts**	**Positive Impacts**	**Negative Impacts**
1	Employment Opportunity and Rise in Income level		No changes in economic status and living standards of people	Opportunity for unskilled/ semi-skilled/ skilled people to work in the project. Induced developments such as transportation business/ small eating places, etc., to cater to labour population may be expected during construction phase of the project	
2	Loss of Land	No loss of land and livelihood.	Continued erosion of river edge resulting into loss of cultivable land	No acquisition of land and hence no impact even with the project	
3	Community Infrastructure and services	Present infrastructure will not get affected	-		More stress on existing infrastructure facilities such as road and drainage systems due to increased vehicular movement during construction phase of the project
4	Water logging and public health		Impact on health due to susceptibility of area to floods, which in turn cause mosquito breeding / water borne diseases	Less vulnerability of the area to the effect of floods (inundation)	Increased incidences of water borne diseases and transmission of diseases by immigrant labour population during construction phase
5	Hydrology and drainage pattern	-		-	-
6	Change in environmental quality	-	Erosion of river banks will continue resulting into loss of cultivable	-	Following negative impacts may be envisaged during construction phase of the project:

S. No.	Parameters	Without Project		With Project	
		Positive Impacts	Negative Impacts	Positive Impacts	Negative Impacts
			lands and threat to the embankment and spur		**Land Environment:** Increase in soil erosion due to stripping of land in the areas near to river banks and spurs where proposed works will be undertaken Pollution by construction spoils Solid waste dumping and liquid waste discharge from labour camps. **Water quality:** Increase in turbidity of river water, especially due to work in the submergence area. Degradation of water quality due to disposal of untreated liquid wastes and solid wastes from construction sites and labour colonies. Open squatting in the areas near the river bank and river water contamination due to fecal pollution. **Air quality:** Pollution due to dust re-suspension and emissions from increased vehicular movement, use of construction equipment and labour colonies **Noise Level:** Rise in noise level due to increased vehicular movement and use of

S. No.	Parameters	Without Project		With Project	
		Positive Impacts	Negative Impacts	Positive Impacts	Negative Impacts
					construction equipment
7	Aquatic and Terrestrial Ecology		Erosion of river banks will continue resulting into loss of terrestrial and aquatic ecology.		Following negative impacts may be envisaged during construction phase of the project, which will be temporary in nature: **Aquatic Ecology:** Marginal reduction in productivity due to increase in turbidity levels and indiscriminate fishing by the labour population **Terrestrial Ecology:** Impact due to fuel wood requirement by laborers. Temporary adverse impact on flora and fauna due to increased influx of human population
8	Social Problems	-	-	-	Cultural conflicts and law and order related issues due to migration of labour population

4.3 POTENTIAL IMPACTS

A. Impacts during Planning / Pre-construction Phase

The impacts associated with planning / pre-construction phase are:

- Removal of encroachments on spurs and river bank and associated habitat loss of the local population.
- Pollution due to debris and waste disposal from construction camp and site offices

B. Impacts during Construction Phase

4.3.1 Impact on Topography and Geology

- Damage to local flora and fauna due to construction activities, vehicular movements to transport and storage of the construction materials and labour interventions.

4.3.2 Impact on Soil

The proposed EKE restoration work may require neighboring land for the material storage, machinery movement and parking, labour camps and approach to work area.

Soil erosion is mainly anticipated near embankments, loose embankment slope, earth stock-piles and wherever vegetation is cleared. Soil erosion may have cumulative effect that includes siltation, embankment damage, drainage problem, etc. The intensity of soil erosion at different locations will be influenced by the lithology, topography, soil type and site work conditions and drainage pattern. Some soil erosion during construction phase may occur at the river edges, which can be minimized by taking appropriate precaution at site.

The pictures give an idea about the soil erosion patterns observed on the EKE.

In addition to above, land may be required for access roads and construction camps for the duration of construction period. The development of the required lands for those purposes may have temporary impacts on the area like clearing of the vegetation and displacement of the terrestrial fauna.

This may also impact soil productivity. Soil in the adjoining productive lands beyond the Right of Way (ROW), haulage roads, and construction camp area may get compacted due to movement of construction vehicles, machineries, and equipments. Soil may get contaminated due to inappropriate disposal of liquid waste (lubricating oil and fuel spills, waste oil and lubricant and vehicle/equipment washing effluent) and solid waste (fuel filters, oily rags, plastic) likely to be generated from repair and maintenance of transport vehicles,

construction equipment and machinery. Soil may also get contaminated due to inappropriate disposal of domestic solid and untreated liquid waste / sullage from labour camps.

4.3.3 Impact on Drainage

- Incidence of water stagnation during the monsoon season due to obstruction of natural drainage at the material storage areas, labour colonies, vehicular maintenance and parking areas, if the locations for these facilities are not selected with due diligence of the existing natural drainage in such areas.
- Impact on water quality of the river water due to increased sediment movement caused by run-off from the construction sites.
- Contamination of river/groundwater due to untreated sewage discharge from the construction camps
- Contamination of groundwater in the areas of vehicle / equipment repair shed(s) due to oil and grease spill(s) and oil soaked rags disposal

4.3.4 Impact on Air Quality

Air quality is one of the most important environmental parameters that will be impacted during the construction phase. The project area falls in the high wind damage risk zone with basic wind speed of 47 m/s. The summer season experiences high wind velocity causing accelerated wind erosion which also contributes to the high SPM in the ambient air quality. Impacts on air quality during construction by generation of dust due to movement of vehicles and works (excavation, loading and unloading of materials), dust en-route the transportation of the materials and re-suspension is of concern. Besides, emission of sulphur-oxide, nitrogen oxides, hydrocarbon, and other particulate matter due to exhaust fumes from construction machinery and motor vehicles will also deteriorate air quality during the construction phase.

Wind velocity and soil erosion observed on EKE

Vehicular movement and generation of dust observed on the EKE

Depending on the local weather conditions, dust is expected to be generated in the form of fugitive emission. This may lead to poor visibility and deterioration of air quality in the immediate vicinity by SPM loading. The impact on air quality during construction phase will be temporary and site specific. The effects will be felt by the population inhabiting on the roads and on the country side on the routes of the material transportation. However, measures like spraying of water one roads and embankment during the construction period will considerably mitigate the impact due to dust pollution.

The operation of DG sets to meet out the power requirements during emergency is one of the sources of air pollution. The combustion of fuel (mainly Light Diesel Oil) is likely to cause air pollution on account of increased SO_2 emissions. The emissions from the DG sets are not expected to be significant to cause any major adverse impact on the existing ambient air quality since the area has a very large carrying capacity. The DG sets should be CPCB compliant to prevent air emissions. All impacts related to the site works are of a temporary nature which would return to its original state upon completion of the works.

4.3.5 Impacts on Noise Level

In a water resource project, the impacts on ambient noise levels are expected only during the project construction phase, due to earth moving machinery, etc. Movement of vehicles transporting construction material and major construction activities at the construction site will be the major source of noise pollution during construction. Material movement and associated works are the primary noise generating activities on site. These will be distributed over the entire construction period.

Construction activities are expected to produce noise levels that can affect the personnel working on site, local population and farm labours. Activities involving vehicles, plant and equipment in the close proximity of households will have an adverse impact due to noise pollution. These impacts are temporary and limited to the construction phase.

Ambient noise level may increase temporarily in the close vicinity of various construction activities, maintenance workshops and vehicles and earthmoving equipment. These construction activities are expected to produce noise levels in the range of 80 – 95 dB (A) *(at a distance of about 5 m from the source).* Although this level of noise is higher than the permissible limit of ambient noise level for residential / commercial activities but will occur only intermittently and temporarily.

This noise level will attenuate faster with increase in distance from the noise source. Impact due to noise during construction activities will be minimal to inhabitants since most of the built-up areas are small villages and spaced at considerable distances from worksite. However, the sensitive receptors like schools that are closer to the worksites will be impacted by the increased noise levels due to use of construction equipment and increased traffic in the project areas. The sensitive receptors have been separately shown on the Strip Maps presented in a section on Strip Mapping of the areas up to 5 km distance on either side of the EKE. The night time transportation of the materials will be beneficial since there would not be any disturbance on the roads although it may increase the noise levels in the habitations/ areas abutting the roads. It may also prevent accidents on the roads on which weekly markets and fairs are held and presence of the schools is noticed. The operation of heavy machinery and earth moving equipment should be allowed only during the day time to abate the noise pollution in the project areas.

4.3.6 Impacts on Local Flora

The area does not support rare and endangered species of flora as reported in the available scientific literature, research papers and the past studies. The impacts will therefore be limited to the following:

- Loss of flora due to felling of trees present in the ROW on EKE
- Deposition of fugitive dust on vegetation may lead to reduction of photosynthesis and damage the vegetation.

- The local flora may also be temporarily disturbed due to movement of vehicles and material storage.

4.3.7 Impacts on Local Fauna

The area does not support rare and endangered species of fauna as reported in the available scientific literature, research papers and the past studies. The impacts will therefore be limited to the following:

- Disturbance to fauna due to high level of dust, noise, habitat destruction and movement of vehicles, construction machinery and storage of the materials.

4.3.8 Impact of Construction / Labour Camps

- Influx of construction work-force to project area will lead to sanitation, health and hygiene related issues and their impacts on the laborers and the local people
- Untreated effluent disposal from labour camps will lead to increased incidences of water borne diseases already prevalent in the local population in the area
- Transmission of diseases by immigrant labour population
- Unscientific solid waste disposal from construction / labour camps may contaminate the groundwater and impact the existing bird population in the vicinity

4.3.9 Impact on Health and Safety Aspects

The proposed restoration project will involve boulder work, earth / sand work and deployment of heavy machinery for construction. In addition, it is also a labour intensive work and involves frequent movement of transportation vehicles to construction site from quarry locations.

The frequent movement of the material transporting trucks will be a matter of concern, considering the safety of local road users and school children. The EKE does not seem to have shoulders of adequate width and strength and therefore during the surveys, sand laden vehicles were seen stuck up in those weak areas as seen in photographs as follows . This will need adequate strengthening before the EKE can be used for transportation of the materials. There are many connecting roads from the villages on the countryside to the embankments, however those are small kutcha roads and fit only for movement of carts and small vehicles. Although these roads are provided with the culverts on the wetlands and water logged areas, they are not of adequate strength to allow the transportation of materials and movement of heavy equipment and machinery to the nearest chainage of the project area.

The EKE, at some places, has temples which hold annual fairs as also the weekly markets on the EKE and the countryside, which may render the roads and the area unfit for transportation of materials on such days and therefore a proper planning of the transportation of materials will be necessary based on exclusion of the important events scheduled in the EKE and country side areas.

Heavy truck carrying sand is stuck up on EKE

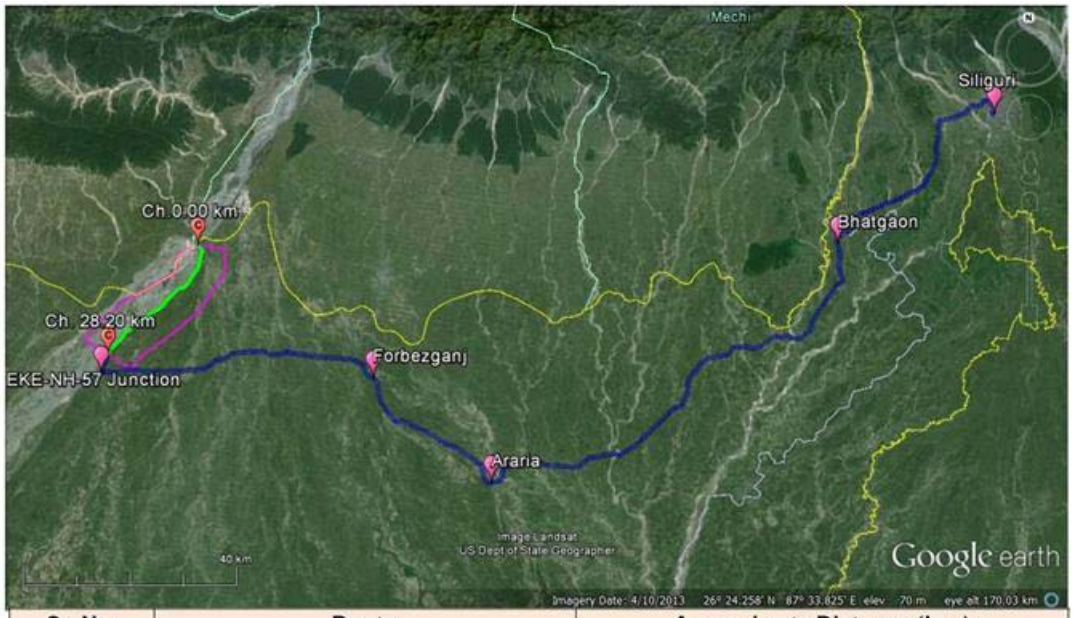
Congestion near Debanwan Mahadeo Mandir near Shahpur at Ch. 79.00 km

4.3.10 Impact on Infrastructure and Services

Material and machinery transportation to the construction site will be through National Highways, State Highways and EKE roads (refer ***Figure 16*** and ***Figure 17***). However, some village roads with direct approach to the EKE are expected to be used for movement.

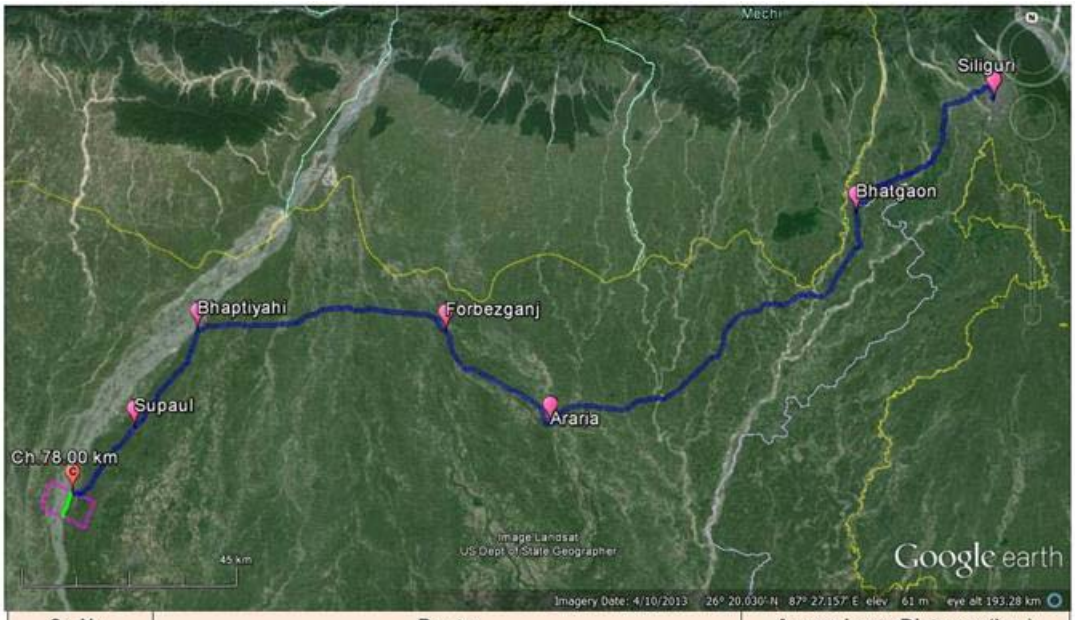
NH-57 Connectivity at EKE Ch. 31.90 km

Village road Connectivity at EKE Ch. 76.80 km



Sr. No.	Route	Approximate Distance (km.)
1	**Siliguri to EKE Ch. 28.20 km**	**226**
1.1	Siliguri to Bhatgaon (NH-31C)	47
1.2	Bhatgaon to Araria (SH-63)	90
1.3	Araria to EKE Ch. 28.20 km. (NH-57)	89

Figure 16: Possible Material Transportation Route Map from Siliguri to EKE Ch. 28.20 km



Sr. No.	Route	Approximate Distance (km.)
2	**Siliguri to EKE Ch. 78.00 km**	**269**
2.1	Siliguri to Bhatgaon (NH-31C)	47
2.2	Bhatgaon to Araria (SH-63)	90
2.3	Araria to Bhaptiyahi (NH-57)	87
2.4	Bhaptiyahi to Supaul (SH-76)	25
2.5	Supaul to EKE Ch.78 km.	20

Figure 17: Possible Material Transportation Route Map from Siliguri to EKE Ch. 78.00 km

Due to consistent movement of heavily loaded vehicles, there is a likelihood of road and CD works getting damaged.

4.3.11 Impacts on Economic, Social and Cultural Environments

4.3.11.1 Employment and Income

As discussed in the Chapter 3, the economy of the project area is agro and service based. Most of the agriculture workers migrate to other States during off season for livelihood and come back during sowing and harvesting period. The proposed EKE restoration work, being a labour intensive construction project; will require skilled, and unskilled workers. This will provide good employment opportunity to the local people. It will also increase the economic activities in the nearby villages and towns in the form of ancillary trades and businesses.

4.3.11.2 Agricultural Lands

During construction phase, minor impacts on agricultural yield is anticipated due to the proposed project intervention but the benefits to the farmers with the implementation of the project will be high, as it will protect their agriculture lands near the river banks.

Agriculture land near Spur Ch.15.70 km

Agriculture land near Spur Ch.21.60 km

Agriculture land near Spur Ch.10.70 km

Agriculture land near Spur Ch.10.90 km

Agriculture land near Spur Ch.28.20 km

Agriculture land near Spur Ch.20.20 km

4.3.11.3 Fishing and Makhana Cultivation

There is neither organized nor developed fisheries in the Project Area. . The local people of the area carry out fishing in the river and wetlands and sell the fish in the local market to earn their livelihood. From the information collected from Fisheries Department, There are 20 major species of fish available in the Kosi River. *Catla catla* and *Labeo rohita* are the dominant species. It is also seen from the secondary information available in the public domain that a total of 12 species were observed in the Kosi River. The commonly observed fish species were Catla (*Catla catla*), Rohu (*Labeo rohita*), Mangur (*Clarias batrochus*), Garai (*Channa punctatus*), and Tengra (*Mystus seenghala*), which are commonly observed in other rivers of Bihar including the River Ganga.

The Project work will be carried out on the River banks and in the flowing water and may have impacts such as damage to fish stocks and other aquatic life by destabilizing the substratum, increasing the turbidity of water, silting of the channel bottom and modifying the flow. Adequate mitigation measures like avoiding the fish breeding season to carry out the proposed work will considerably reduce the anticipated impacts on aquatic fauna.

Fishing near EKE

Makhana production is also a prominent economic activity in the water logged areas on the countryside of the EKE. Proposed project will not have any adverse effect on production of Makhana as most of the wetlands and water logged areas are located on the countryside of the EKE except in some stretches in chainage 78.00 km to 84.00 km where wetlands are also present on the river side.

Makhana Production near EKE

4.3.11.4 Involuntary Settlement

The proposed restoration project will not involve any involuntary resettlement of the local people living near to the Project Area. However, agricultural land on the riverside and countryside will be required to store the restoration materials on a temporary basis for the storage yards, labour camps, machinery parking and maneuvering area, etc.

The local population and farmers are willing to cooperate with the Government on this issue with a compensation or short lease payment to use their lands temporarily, as revealed during the Public Consultations. They also demand that the restoration works be taken up post harvest season so that farming activities are not adversely affected due to the project works.

There are sparse settlements and small shops on the riverside and EKE too. These settlements will be affected during the project work and may have to be relocated temporarily if those are on the lands of title holders. Otherwise the encroachments from riverside and EKE will need to be removed either temporarily or permanently.

4.3.12 Impacts on Socio-economic Environment

This project will have both positive as well as negative impacts on the socio-economic environment of the area. During construction phase, many allied activities will increase rapidly in the project area. During the construction phase a large labour force, including skilled, semi-skilled and un-skilled labour force is expected to migrate into the project area. Although some labour force would come from other parts of the country, locals would also be employed to work as semi- skilled or unskilled workers in the project. The labour camps will be provided for the migrant workers near the project site as a temporary settlement. This may lead to generation of filth, domestic wastewater, human waste, solid waste, etc.

The intermixing of the migrant labour force with local communities can lead to friction due to the differences in social, cultural and economic conditions among the locals and the migrant labour population. This could lead to law and order problems. Therefore, appropriate steps will have to be taken up by the Administration to ensure that the law and order in the area is maintained throughout the proposed project's completion.

Besides the direct employment, the opportunities will also be generated for indirect employment and this will provide an impetus to the economy of the local area.

The locals will avail these opportunities arising from the project and increase their income levels.

The locals in the area already suffer from the vector borne diseases. It is possible that the area may experience some more unknown diseases that are brought by migrant workers and transporters. There could be increased incidence of water borne diseases to migrant labour if the labour camps are not provided with sufficient quantity of safe drinking water and sanitation facilities. Thus, there could be negative health impacts on the local population during the construction phase. Provision of health check up of the migrant labours and locals on a regular basis is therefore necessary to understand the magnitude of health impacts due to the project activity.

4.4 POSITIVE IMPACTS OF THE PROPOSED PROJECT INTERVENTIONS

1. The proposed use of Reno Mattresses and Gabion Mattresses may eventually help in reducing pressure on existing/conventional methods, at least in the long run if these pilots are successful.

2. Improved public safety

3. Improved agriculture land protection

4. Less damage in monsoon season

5. The proposed strip maps with all the environment sensitive location and receptors marked within 5 km buffer on either side of the central line of embankment in the area of intervention will serve as a handy guide for further environmental planning and its protection in the project area and within 5 km envelope on both sides of the EKE

6. Improved technical examination, rehabilitation, monitoring and maintenance of spurs and embankment with community participation

7. Post construction positive impacts on terrestrial ecology are expected due to the increase in vegetation and landscaping

The mitigation measures to each of the envisaged negative impacts are presented in Chapter 6 titled Environmental Management Plan (EMP).

5 PUBLIC CONSULTATIONS

5.1 OBJECTIVE

Public consultations are being conducted as an integral part of EIA of the project. Environmental management is the collective responsibility of communities and the Government. Public participation is viewed as a continuous two way process, aimed at understanding the public perception and evolving a suitable mechanism through which problems associated with the development are scientifically investigated and resolved. Consultation is used as a tool to inform and educate public about the proposed project "with" and "without" the project scenario. Public consultation helps in identifying issues associated with the project and their impacts on the local people as well as their expectations from the project to meet their needs. This participatory process helps in reducing the public resistance to the project and enable the participation of the local people in the decision making process.

In the consultation process, information is gathered to fulfill the public obligations in project design and environmental considerations to minimize impacts on human health and environment in the Project area. In this study, the Public consultations were organized at six different locations in the project area between chainages 0.00 km to 28.20 km and 78.00 km to 84.00 km.

5.2 METHODOLOGY ADOPTED

The Public Consultations were conducted in accordance with the World Bank Guidelines (OP/BP 4.01) to inform the local inhabitants of the area, residing within 5 km on either sides of the EKE, about the project, environmental aspects and likely environmental and social impacts due to proposed EKE restoration and strengthening project and seek their views/concerns, for consideration while conducting the EIA study and preparation of an implementable EMP.

IEISL along with the WRD officers coordinated with the local Panchayat Heads to inform them about the process and to seek their support in identifying suitable venue for the meetings. The local residents were invited to attend the Public Consultations. The officers from the EKE Division, WRD from Birpur and Supaul were also present during the public consultation meetings. The locals were informed about the proposed EKE restoration and strengthening project and likely impacts during the construction and operational phases, based on the first had experience of the IEISL team gathered during the reconnaissance surveys, baseline monitoring and the focus group discussions held with the locals during the surveys to identify the sensitive receptors on either side of EKE up to a distance of 5 km.

The public consultations were held at six (6) different locations; out of which, five (5) locations were between the EKE stretch at 0.00 km to 28.20 km and one (1) location was between the EKE stretch 78.00 km to 84.00 km. These public consultations were held on 5th and 6th April, 2014, respectively.

Prevailing environmental and social issues in the project area and likely impacts of the projects were informed to the locals during public consultations and their concerns/suggestions/objections were recorded as proceeding of these meetings. ***Table 47*** presents the locations where the public consultations were conducted.

Table 47: Locations where the Public Consultations were conducted

S. No.	Location	Panchayat Name	Chainage	Date of Public Consultation
EKE Chainage 0.00 km to 28.20 km				
1	Kalyanpur, Near Panchayat Head's Residence	Bhapityahi	Near Chainage 28.00 km	5th April
2	Middle School, Simri (Supaul)	Chitthi Hanuman Nagar	Near Chainage 22.15 km	5th April
3	Yatri Niwas	Satanpatti	Near Chainage 16.98 km	5th April
4	Middle School, Piprahi Patti	Piprahi Patti, Basantpur	Near Chainage10.50 km	5th April
5	Near Durga Temple Premises, Samda	Bhagwanpur	Near Chainage 6.94 km	5th April
EKE Chainage 78.00 km to 84.00 km				
6	Middle School, Nauhatta	Nauhatta	Near Chainage 78.00 km	6th April

5.3 ISSUES DISCUSSED AND RESPONSES RECEIVED

The minutes of the Public Consultations have been documented and presented in ***Annexure 9***. A summary of the issues discussed and the responses/suggestions/objections/concerns and needs of the people are presented in the ***Table 48*** below.

Table 48: Summary of Public Consultation Proceedings

S. No.	Issues Discussed	Responses/suggestions Received
1	The prevailing environmental concerns in the project area Land/soil/surface water/groundwater related concerns	Seepage of water from the Kosi River to Country side area of the EKE caused 1. Water logging in country side due to seepage of the Kosi River water 2. Loss of cultivable land due to erosion 3. Sand casting in many areas following 2008 flood 4. Grass/fodder contamination, resulting in poor health of cattle, which is affecting milk production 5. Mosquito breeding in waterlogged area causing dengue/malaria and other vector borne disease burden 6. High iron content in hand pump water which is causing health problems and hence not potable 7. Unavailability of treated water for drinking 8. Other diseases like jaundice, eosinophilia, skin diseases, slow child growth 9. Fear of EKE breaching during monsoon season
	Air quality	Vehicle movement on EKE and high wind velocity blow sand and increase SPM in air leading to respiratory disorders. Tree plantation (Arjun, Pithari, Peepal, etc.) on both sides of spur and EKE can reduce air pollution.

S. No.	Issues Discussed	Responses/suggestions Received
2	Key Social and Environmental concerns associated with the proposed EKE restoration project	1. Air pollution, 2. Public health 3. Open defecation and associated Gastro Intestinal diseases
3	Kosi River Siltation, Shoal, Seepage, EKE protection	1. Siltation in the Kosi River is the most critical issue as the riverbed is rising every year and in some places the height of the sand shoals is more than the EKE 2. Channel through siltation/shoal should be created and spur should be strengthened and extended to train the River 3. Conditions of spurs should be improved. Bamboo rolls to be used to protect river edges. 4. EKE should be strengthened
4	Adequacy of road to cater to increased vehicular traffic to transport the material during the implementation of proposed project	Village roads should be strengthened before those are put to use for the material transportation.
5	Willingness to give land temporarily, in some areas on the river edge, to store the construction material, parking of the truck and equipment and temporary labour colony etc.	Ready to lease the land for temporary use with appropriate compensation. Villagers are in favour of the proposed EKE protection works.
6	Suggestions/precautions to be taken during project implementation	1. Watering/dust suppression on the transportation routes 2. Tree plantation on both sides of EKE 3. Measures should be taken for the reduction of seepage from the EKE. 4. Traffic management enroute the material transportation

In general the local people present at the public consultations and Focus Group discussions did not raise any concern on the environmental impacts of the proposed Kosi EKE restoration and strengthening. The main questions were on drinking water problems, vector borne diseases in the EKE area, compensation or rent, respectively, if the land is acquired or used for temporary storage of construction of materials. The public at large supported the restoration and strengthening of the Kosi EKE since the proposed Project will safeguard them from floods and protect their agricultural lands. The Public Consultation held at Nauhatta was also covered by the local news media and the news clipping is presented in ***Annexure 9***.

5.4 PHOTOGRAPHICAL EVIDENCE OF PUBLIC CONSULTATION FOR CH 0.00 KM TO 28.20 KM

Public Consultation at Kalyanpur (Ch. 28.00 km)

Public Consultation at Kalyanpur (Ch. 28.00 km)

Public Consultation at Simri (Ch. 22.15 km)

Public Consultation at Simri (Ch. 22.15 km)

Public Consultation at Satanpatti (Ch. 16.98 km)

Public Consultation at Satanpatti (Ch. 16.98 km)

Public Consultation at Piparahipatti (Ch. 10.50 km)

Public Consultation at Piparahipatti (Ch. 10.50 km)

Public Consultation at Samda (Ch. 6.94 km)

Public Consultation at Samda (Ch. 6.94 km)

5.5 PHOTOGRAPHICAL EVIDENCE OF PUBLIC CONSULTATION FOR CH 78.00 KM TO 84.00 KM

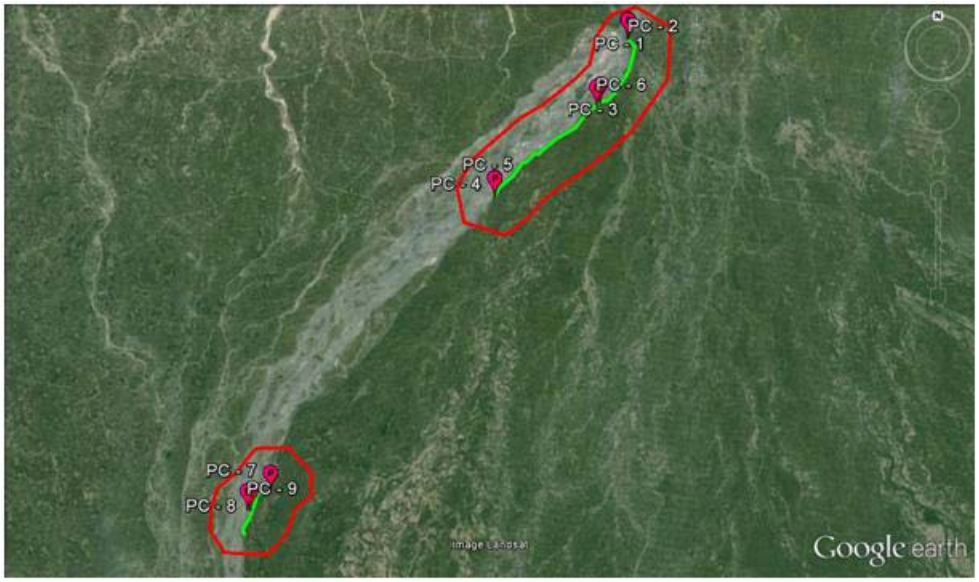
Public Consultation at Nauhatta

Public Consultation at Nauhatta

5.6 FOCUS GROUP DISCUSSION

In addition to the Public Consultations, Focus Group Discussions were also conducted at nine (9) different locations within the project area at the time of reconnaissance surveys. The Focus Group Discussions were held with the locals to identify the sensitive receptors on either side of the EKE up to a distance of 5 km. The Focus Group Discussions were held on the EKE and in the nearby agriculture fields and residential/settlement areas to the EKE including one of the Shoals, during the period 6th February to 9th February 2014. ***Figure 18*** presents the locations of these Focus Group Discussions.

Figure 18: Map Showing Locations of Focus Group Consultations Held



The summary of Focus Group Discussion is presented in ***Table 49*** below:

Table 49: Summary of Focus Group Consultations

S. No.	Information Sought	Response Received
1	How long were they residing in the project area?	Majority of the respondents were born and brought-up in the project area. During the survey, immigrated people were not observed
2	Do they get affected by the flood?	Most of the respondents opined that they were affected by the floods
3	Loss due to floods (in terms of crops, animals and houses)	Most of the respondents informed that they suffer crop losses.
4	Awareness on the proposed developmental/Restoration works	Majority of the respondents did not have information about the work to be carried out under proposed EKE Restoration and Strengthening Project
5	Reaction on the proposed EKE Restoration Works	Since most of the respondents practice agriculture on both sides of the EKE and understand that restoration of EKE will consequently benefit *(Agriculture, land erosion control and flood protection)* them, they showed positive response for flood protection and embankment restoration works. People were ready to give their land for the restoration project, temporarily if appropriate compensation/rent for the land is given by the Government.
6	Any groundwater related problems?	People are using hand pumps for day to day water use including drinking water. Respondents expressed their concern on quality of groundwater and felt that it was not fit for the drinking purpose. They also complained of the diseases like diarrhea, kidney stone, skin itching problems, etc. due to consumption of the groundwater drawn from Chhapakals
7	Any problems associated with mosquitoes, flies, insects, rodents and other pests?	Majority of respondents are facing the mosquito nuisance due to presence of wetlands, seepage water and vegetation and they feel that there will not be any reduction in the vector borne diseases

S. No.	Information Sought	Response Received
		even if the Proposed EKE Restoration work is undertaken
8	Opinion on routine EKE flood protection works undertaken by the BAPEPS/WRD/Government	Most of the residents interviewed know about the routine EKE flood protection and restoration works on the EKE and the Spurs. Some of them also participated in the protection works in the form of temporary laborers. It was mentioned that they did not face problems due to routine restoration activities. Most of the respondents were favorable with the flood protection measures in the form of construction and regular maintenance of the EKE.
9	Were they aware of any prior Public Consultations Held in the area?	Respondents in stretches 0.00 km to 28.0 km were not aware of any kind of Public Consultation(s) held prior to these Focus Group interactions. Some of the respondents in the stretch 78.00 km to 84.00 km were aware of the Public Consultation conducted by WRD on 23rd December, 2013 and 11th February 2014.

5.7 PHOTOGRAPHICAL EVIDENCE OF FOCUS GROUP DISCUSSION

CHAINAGE 0.00 KM TO 28.20 KM




CHAINAGE 78.00 KM TO 84.00 KM & SHOAL

5.8 CONCLUSIONS

It can be concluded that local people are in favour of the proposed EKE protection works as gathered from the Public Consultations and Focus Group Discussions held at different places on the EKE. People are of the opinion that as long as the project work is carried out in a scientific manner without affecting their livelihood, they will whole heartedly support it. They are also willing to work in the project related works as skilled or unskilled laborers.

The concerns expressed by the local people during Public Consultations and Focus Group Discussions were duly considered while formulating the implementable Environmental Management Plan (EMP), implementation of which will not only minimize the impacts of the project on local inhabitants but also protect the environment during the construction and operation phases of the Project.

6 ENVIRONMENT MANAGEMENT PLAN

6.1 OBJECTIVES

A project's EMP consists of the set of mitigation, monitoring, and institutional measures to be taken up during pre-construction, construction and operational phases to mitigate adverse environmental and social impacts, offset them, or reduce them to acceptable levels.

While developing an EMP, it is imperative to have clear environmental objectives and deliberate on them. The key environmental management objectives for the project are to avoid significant environmental impacts and to ensure that where impacts do occur they are mitigated. In addition, the EMP aims to meet the following specific objectives:

- To adopt construction and operational methods which will limit environmental degradation
- To protect physical environmental components such as air, water and soil
- To conserve terrestrial and aquatic flora and fauna
- To incorporate the views and perceptions of the local inhabitants on the project
- To generate employment opportunities wherever possible and feasible
- To provide environmental guidelines and stipulations to the construction contractors to minimize the construction related impacts
- To provide adequate safety systems to ensure safety of public at large
- To establish post construction monitoring program to monitor effects of the project on the environment
- To audit activities during the construction and to assess implementation of management measures

After having studied the ambient environment in the proposed project area, other environmental studies conducted by different agencies in the region, information collected on various studies conducted in the area and voluminous information gathered from the secondary sources, feasible and cost-effective measures were proposed in the EMP that may reduce adverse environmental impacts to acceptable levels.

The baseline environmental monitoring during the EIA Study provided information about key environmental aspects of the project, and the likely impacts on them due to various activities of the project implementation.

To support timely and effective implementation of environmental project components and mitigation measures, the Institutional arrangement and responsibility mechanism have been proposed in the EMP. Once an EMP has been approved, it should provide the basis for environmental considerations of all the activities carried out on the site by the appointed personnel.

With respect to the various environmental impacts identified during the EIA (Chapter 4) mitigation measures to prevent or minimize the impacts are suggested for all the environmental components in Section 6.2.

6.2 MANAGEMENT OF IMPACTS

6.2.1 Mitigation Measures during Planning / Pre-construction Phase

Planning/pre-construction phase considerations relate to both environmental and social parameters. Environmental parameters include water resources, vegetation, drainage, soil erosion, air/noise quality and the social parameters related to land acquisition, resettlement and rehabilitation and livelihood considerations. Various impacts during designing phase and their mitigation are provided in ***Table 50*** .

Table 50: Mitigation Measures for the Impacts during Planning/Pre-construction Phase

S. No.	Impacts	Mitigation Measures
1	Loss of agriculture land and hutments	Adoption of package to compensate for loss of land, crops and resettlement of the outstees from the existing dwelling places unless these are encroachments on the Government land.
2	Identification of land for material storage yard/construction camp/labour camp	The proposed activity may require conversion of some agricultural land for material storage/construction camp/labour camps/access roads etc. The exact requirement of land for these purposes will need to be assessed by the Implementing Agency and the Contractor. The land in question shall not be very close to the water body, water logged areas or the wetlands to avoid any impact on the water sources and the associated fauna. The identified agricultural land shall have minimum loss in productivity.
3	Damage to existing ecosystem due to borrow activities	Since the borrow areas will be outside the State, the impacts cannot be gauged and EMP prepared on that aspect. However, it is important to note that borrowing / quarrying area shall be selected considering minimum loss of productive land and feasibility of restoration to productive use. The Contractor will have to obtain the Environmental Clearance for the mining of rocks and minor minerals from those areas as per the MoEF guidelines from the concerned State SEAC and SEIAA.
4	Identification of road stretch/network for construction material transportation	The construction material should be transported in the covered trucks through existing network of roads that needs to be defined / proposed by Implementing Authority prior to initiation of proposed works.
5	Pollution due to debris disposal/wastes generated from construction camps and site office	Suitable area shall be identified to dispose of the wastes from labour camps and the same shall be disposed of in a scientific manner. This will be the responsibility of the Implementing Agency and the Contractor.

6.2.2 Mitigation Measures during Construction Phase

The planning, implementation and management of the various project activities during construction phase shall be undertaken in line with the WB policies on environmental and social safeguards and the suggestions proposed in the present Environment Management Plan, so that most of the environmental impacts, which are of temporary nature, will be minor and easily mitigated. No potentially adverse, irreversible or long term negative impacts are envisaged due to the proposed project interventions.

6.2.2.1 Slope Stabilization and Erosion Control Measures

Soil erosion is mainly anticipated along the un-compacted embankment slopes of the existing embankment roads. Soil erosion may have cumulative effect that includes damage to embankment roads, drainage problem, etc. The intensity of soil erosion at different locations will be influenced by the lithology, topography, soil type and climatic condition (mainly rainfall) and the prevailing storm water drainage pattern. The following measures should be implemented to control soil erosion during construction:

- Road embankment and slope protection/stabilization measures should be taken at erosion prone areas. The protection measures may include use of geo-textile matting to strengthen the road embankment and slope stabilization
- Provision of side drains to guide the water to natural outfalls
- Provision of stone pitching wherever necessary all along the embankment slope.
- Side drains should be provided to intercept by intermediate drains serving as outlet channels to reduce the erosion all along the newly developed roads of the embankment/SSB.
- Suitable strengthening measures should be taken to prevent reoccurrence of soil erosion at existing erosion prone locations and also to prevent erosion at newer locations on the roads all along the area of interest from 0-28.2 and 78.84 km. This may sustain for a trouble free transportation of material to the appropriate spur locations.

6.2.2.2 Borrow Area Management

Since the borrow areas will be outside the State, the impacts cannot be gauged and EMP prepared on that aspect. However, a few important mitigation measures are being suggested that need to be considered by the WRD / BAPEPS while identifying the borrow areas in consultation with the Contractor.

- Borrow pits should be selected from barren land / wasteland to the extent possible. It is recommended that borrowing from agricultural land should be minimized to the extent possible.
- It is important to note that borrowing / quarrying area shall be selected considering minimum loss of productive land and feasibility of restoration to productive use.
- Borrow pits along the roads, areas nearby to the river embankments or spurs should be avoided. Further, no earth shall be borrowed from already low lying areas.
- To the extent possible borrow areas should be sited away from inhabited areas.
- The depths in borrow pits to be regulated so that the sides may be limited to 25% steepness.
- Borrow areas shall be leveled with salvaged material or other filling materials which do not pose contamination of soil. Else, it shall be converted into fishpond in consultation with local fishery department and the land owner/community.

- The Contractor will have to obtain the Environmental Clearance (EC) for the mining of rocks and minor minerals from those areas as per the MoEF order from the concerned State SEAC and SEIAA and comply with the EC conditions during the operation of the borrow areas. This needs to be incorporated as a condition in the Contract Agreement to be signed between the Implementing Agency and the Contractor.

6.2.2.3 Compaction and Contamination of Soil

Soil in the adjoining productive lands beyond the ROW, haulage roads, and construction camp area may get compacted due to movement of vehicles, machineries, and equipment. Soil may get contaminated due to inappropriate disposal of liquid waste, (lubricating oil and fuel spills, waste oil and lubricant and vehicle/equipment washing effluent) and solid waste (fuel filters, oily rags) likely to be generated from repair and maintenance of transport vehicles, construction equipment and machinery especially if the vehicle depots are planned in the areas near groundwater sources. Soil may also get contaminated due to inappropriate disposal of domestic solid waste and untreated sewage from construction labour camps. The following measures should be implemented to control contamination of soil during construction:

- Fuel and lubricants should be stored at the predefined storage location that needs to be identified in consultation with the Implementing Agency. The storage area should be paved with gentle slope to a corner and connected with a chamber to collect any spills of the oils.
- All efforts should be made to minimize the hazardous waste generation. Unavoidable hazardous waste shall be stored at the designated place prior to disposal in the nearest Common Hazardous Waste Treatment Storage and Disposal Facility (CHWTSDF). Prior to transporting the hazardous waste, its packaging must be marked and sent to the CHWTSDF with proper manifests as required by the Hazardous Waste (Management, Handling and Transboundary Movement) Amendment Rules, 2013.
- To avoid soil contamination at the wash-down and re-fuelling areas, “oil interceptor” should be provided. Oil and grease spill and oil soaked materials are to be collected and stored separately in labeled containers (Labeled: WASTE OIL; and hazardous sign be displayed) and sold off to BSPCB / MoEF authorized recyclers.
- To prevent soil compaction in the adjoining productive lands beyond the ROW, the movement of construction vehicles, machinery and equipment shall be restricted to the designated haulage route.
- Approach roads shall be designed along the barren and hard soil area to reduce the compaction induced impact on soil.
- The productive land shall be reclaimed after construction activity.
- Septic tank / soak pits should be provided in the construction labor camps with the provision to use the overflow for plantation.
- Domestic solid waste at construction labour camp should be segregated into biodegradable and non-biodegradable waste. The non- biodegradable and recyclable waste shall be sold off. Efforts shall be made that bio-degradable waste is composted through pit-composting/bin-composting. Non-biodegradable and non-saleable waste shall be disposed of by burying the waste in a secured manner.

6.2.2.4 Construction / Debris Waste

Debris is expected to be generated during the installation of Gabions / Reno mattresses as the surface has to be prepared to install the said components. Some debris generation is expected if dismantling of existing structures is proposed by WRD depending on the need. Waste iron bars, old stone crates (GI wires) / nylon crates constitute debris. The following measures should be implemented to manage construction / debris waste generated during construction:

- Unusable debris material should be suitably disposed off at pre-designated disposal locations, with approval of the local Panchayat.
- The other wastes can be utilized for backfilling embankments, filling pits, and landscaping
- The locations of dumping sites should be selected with following considerations.
    - Unproductive/wastelands shall be selected for dumping sites.
    - These should be away from residential areas and located at least 1,000 m downwind side of these locations,
    - Dumping sites should not contaminate the water sources.
    - Dumping sites should have adequate capacity equal to the amount of debris generated.
    - Panchayats should be consulted about the location of debris disposal sites before finalizing the locations.

6.2.2.5 Green Belt Development Plan

In order to improve the overall environment in the area, it is suggested that green belt development should be in accordance to the Embankment Manual of Central Water and Power Commission, Ministry of Irrigation and Power, Government of India. Plantation in the area on the river side and the country side, respectively, should be as per the above guidelines, in the form of Vetiver grass, Bamboo and Prophis juliflora plantation and not the avenue trees, to control the erosion of the slopes.

The trees and well established avenues, if any, existing on the slopes and near the spurs should be retained as they are to stop any loosening of the soil in the area. The roots of the dead trees should be thoroughly removed. The trees that are likely to fall should be safely removed from those areas and the ground or embankment should be properly made up. Additionally, the areas from where the dead or falling trees are removed should be used for plantation of Bamboo, Vetiver grass and Prosophis juliflora.

Currently, there are mixed plantations on the country and river side of the EKE either planted through Government scheme implemented by Department of Forest or trees planted by the local inhabitants. These include fruit and trees. There are many trees on the ROW of the EKE with sufficiently large girth and those will need to be cut for smoother transportation of the materials to EKE for the project work. Hence, it is suggested that twice the number of trees cut during the construction phase be planted in the available space. The green belt development shall prevent land degradation due to activities during construction phase, enhance the tree cover in the area and thus help increase biodiversity of the area, provide aesthetic value to the project site and prevent soil erosion in the area. The area experiences high velocity winds and sand clouds from the shoals which affects the residents staying both on the EKE and the countryside.

Trees on the ROW of the EKE


Peepaal Tree on EKE between 28.20 and 30 km


It is suggested that a plantation of **Casuarina** on the available government land in the vicinity of the EKE and the spurs may help protection of the EKE erosion. This species was not noticed during the field survey on the EKE and if it is decided to plant this species, it would mean introduction of an alien species in the area. Therefore, it is suggested that a trial pilot plantation of **Casuarina** be carried out and its performance evaluation be carried out in terms of its help to reduce the erosion control. The State Forest Department shall be involved in finalization of the tree species to be planted in the area including suitability of **Casuarina** for plantation.

6.2.2.6 Restoration of Construction Site

The work under the proposed project activities does not involve large scale digging or removing of the earth from the area where the restoration and strengthening of the EKE will take place. The boulders, sand and other construction material will be procured from outside the State and hence there will be no borrow areas or quarries in the region. Therefore, no management plan is suggested for the restoration of the construction area and no budgetary provision is made for this work. The green belt development in the area will largely help in protecting the environment and aesthetics in the region.

6.2.2.7 Construction Camp and Immigration of Workers

Poor siting and improper management of construction camps may lead to adverse impacts on environment viz. (i) loss of vegetation due to use of wood as fuel for cooking (ii) deterioration of water quality in nearby surface water bodies due to discharge of untreated waste water and solid waste dumping (iii) compaction and contamination of

soil due to uncontrolled disposal of solid waste (iv) Poor sanitation may result in transmission of communicable diseases among the workers and the host communities. The following mitigation measures may be implemented to minimize impacts during the construction phase of the Project:

- Construction camps should be sited at such locations so as to utilize the existing infrastructure. No productive land should be utilized for construction camp. All sites must be graded, ditched and rendered free from depressions to avoid water stagnation. Accommodation and ancillary facilities, including crèche facilities for the children, and recreational facility for workers should be erected and maintained to the standards and scales approved by the Implementing Agency
- All camps should maintain a minimum distance of 500 m from habitation and water bodies.
- All construction camps should be provided sanitary toilets with provision of septic tanks attached with soak pits.
- Drains and ditches should be treated with bleaching powder on a regular basis.
- Garbage bins must be provided in the camps and regularly emptied and disposed off in a hygienic manner.
- LPG cylinders or community kitchens may be provided in the labour camps to avoid any tree cutting for fuel wood.
- At every workplace, the Implementing Agency/Contactor in collaboration with local health authorities will ensure that a readily available first-aid unit including an adequate supply of sterilized dressing materials and appliances is made available.
- Access to the ambulatory services should be provided to approach the nearest hospital in case of an emergency.
- The Implementing Agency/Contractor will ensure good health and hygiene of all workers to prevent sickness and epidemics.
- The Contractor will ensure that sufficient supply of suitable and hygienically prepared food at reasonable price is available to the workers.
- The Contractor should provide adequate and safe water supply for the use of the workers. The Contractor should provide a crèche for the children of the workers in the labour camps. Alternately, the children could be sent to existing Balwadis within the 5 km zone on either side of EKE.
- The Contractor should ensure that all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides.
- Strict control over alcohol and substance abuse in the labour camps
- The workers should all be screened for the health problems before being considered for employment.
- Regular health check-up and immunization camps should all also be organized for the workers and nearby population.

6.2.2.8 Environmental Management at the Labor Camps

There will be a large number of construction labours staying in the camps established for them. It can put additional stress on the ecosystem in the area. In order to minimize the impact on the nearby ecology, following steps are suggested as a part of EMP for the labour camps, which will be mandatorily provided by the Contractor. Accordingly, relevant clauses need to be inserted in the Contract Agreement.

- Since the river water quality is quite good, available in plenty and would not require any additional treatment for its potable use, it should be used as a source for drinking water for the labour camps with proper disinfection. The potable water

source should be identified in advance and should be dedicated for the purpose. Similarly, non potable water source should also be identified for the labours.

- There should be a provision of one community toilet for 20 persons. The sewage from the latrine should be connected to septic tanks / soak pits. The overflow from the soak pit should not be allowed to be disposed into any water body and be used only for the plantation near the labour camps.
- The solid waste generated in the labour camp will be collected selectively, i.e., in separate containers in accordance with waste classification. Collected waste must not be incinerated in the open. The waste that can be recycled should be sent to a recycler. The inert waste and the waste that cannot be recycled should be disposed in the lined pit and compacted to ensure deep burial of the same once the labour camps are demolished post construction phase. The Contractor is responsible to identify locations for permanent and temporary disposal, acquire all necessary approvals and keep a register of types and quantities of waste that he generates
- The Contractor should make proper and adequate arrangements for meeting the demand of fuel supply to the labourers / workmen to prevent illegal felling of trees in the vicinity of the labour camps. The Contractor should be made responsible to supply fuel (Kerosene or LPG) to the workers or establish a community kitchen.

6.2.2.9 Safety of Construction Workers Health and Safety Risks to Local Community

The safety aspects like (i) safety of construction workers, (ii) safety of road users including pedestrians and cyclists (iii) safety to cattle; (iv) safety of local community (iv) unsafe/ hazardous traffic conditions due to construction vehicle movement need to be considered during the construction stage. Children are most vulnerable to injury due to vehicular accidents.

Proposed Mitigation Measures:

- During the construction phase, contractors should be required to adopt and maintain safe working practices during (i) construction works (ii) handling of large construction equipments and machineries, etc.
- The Contractor should arrange the PPEs for workers, first aid and fire fighting equipments at construction sites. An emergency plan should be prepared duly approved by the engineer in charge to respond to any instances of emergency and safety hazard.
- The Contractor will be required to appoint an Accident Prevention Officer (APO) who will conduct regular safety inspections at construction sites. The APO will have the authority to issue instructions and take protective measures to prevent accidents.
- To avoid disruption of the existing traffic due to construction activities, comprehensive traffic management plan should be drawn up by the concessionaire and get the approval from the Competent Authority for the same.
- Installation of temporary speed bumps to control speed near designated pedestrian crossing areas/school areas/ market places/ religious places/ human habitations.
- Conduct regular safety audit on safety measures adopted during construction. The audit will cover manpower and their safety, machinery, temporary works, equipment and vehicles, materials storage and handling, construction procedures, environment, site safety guidelines, and miscellaneous services.

6.2.2.10 Health Management Plan

The proposed project work will be carried out on the riverside of the EKE; however, the labour camps, especially those that will be located on the lower elevations on the

country side, may face the water borne or the vector diseases due to stagnant water pools, disposal of the waste water, etc. if adequate preventive measures are not taken during the construction phase of the project. Fumigation in the labour camps to control the vectors and spraying of anti-mosquito breeding pesticides in the nearby water bodies should be carried out.

The water logged areas are also infested with Water Hyacinth, an aquatic weed, which gives shelter to vectors. Periodic removal of water hyacinth will reduce the vector menace considerably. The nearest hospital is at Birpur; however, a medical surveillance by the hospital team once in a fortnight will help in identification of the affected patients, who can then be treated at Birpur Hospital. No separate dispensary is recommended for the work sites as a part of the Health Management Plan for the labours residing in the camps. A separate room may be made available to the visiting medical team from Birpur at each labour camp. In the event it is not possible to get the medical assistance from Birpur Hospital, it will be the responsibility of the Contractor to arrange for the visit of a qualified Doctor to the labour camps. No separate budget is therefore suggested in the EMP for Health Management.

A crèche is however necessary in the labour camps so that children can be taken care of during the day time, if the labours are also mothers. The children in the crèche may be screened for vector borne and other diseases by the Medical team from Birpur when they visit the labour camp.

6.2.2.11 Transportation and Storage of Materials

The construction material primarily will consist of boulders, pre-casted gabions, sand, lubricating oil and fuel for vehicle and construction equipments. These will be stored temporarily at construction camps. The oil and fuels should be stored on concreted platforms with spills collection pits. All these temporary storage areas should be located at least 150 m away from the habitat and the water sources.

Appropriate permission also needs to be taken from the SSB for transportation of material on the embankment road.

The likely impacts due to transportation and storage including fugitive emissions have already been covered under different sections.

6.2.2.12 Groundwater

Groundwater resources are not scarce in the project area. However, following measures have to be adopted to minimize groundwater related impacts.

- Requisite permissions shall be obtained for abstraction of groundwater for the project
- Installation of septic tanks and soak pits in the labor camps with the provision to use the overflow for plantation in each camp to avoid groundwater contamination
- Sufficient arrangement for water required for construction should be made in a manner that water availability and supply to nearby communities remain unaffected.

6.2.2.13 Siltation and Surface Water Quality of Rivers and other Water Bodies

There is no major construction work proposed under this project, which can cause siltation. Moreover, all other proposed activities will generate a small quantity of construction debris / other waste that could be managed immediately after completion of construction and dispose of as suggested above. Soil erosion has direct bearing on

siltation. The siltation is likely to be caused due to bank erosion. The following measures should be implemented to prevent water pollution from various sources during construction:

- Fuel oil shall be stored away from water with catchment pit for spills collection.
- All equipment operators, drivers, and warehouse personnel should be trained in immediate response for spill containment and eventual cleanup. Readily available, simple to understand and preferably written in the local language emergency response procedures, including reporting, should be provided by the Implementing Agency/Contractor.
- All wastes arising from the construction should be disposed in an environmentally accepted manner so as not to block the flow of water in the channels as documented above in the earlier section.
- No vehicles or equipment should be parked, re-fuelled or repaired near water-bodies, so as to avoid contamination from fuel and lubricants.
- Large construction camps should be avoided along the embankments and road alignments, and should be located away from habitation and river course.
- Construction labourers should be drawn preferably from local population.
- The labor camps should be provided with adequate sanitation facilities including soak pits for toilets and the overflow should be used for plantation in the labour camp area.
- Adequate care should be taken not to establish the sanitation facility in the natural drainage areas and the wastewater from the camps should not be allowed to be discharged into existing surface water bodies, wetlands, water logged areas or river. The open defecation near the water bodies should not be permitted.

6.2.2.14 Air Quality

Emissions due to fuel combustion from the operation of construction equipment, diesel generating sets and machines, fugitive emissions from vehicles used for the transportation of construction materials and localized increased traffic congestion in construction areas will generate air emissions. Since diesel will be used as fuel in most of the equipment and vehicles, the major air pollutant emitted from these sources will be SO_2.

During the construction phase, there will be increased vehicular movement for the transportation of materials to the project site. Large quantity of dust is likely to be generated on the EKE and the proposed transportation routes of the construction materials. There could be marginal increase in SO_2 and NOx levels in the area for a short time. However, these emissions may not travel to a long distance and considering the large carrying capacity of the ecosystem, no major impact is envisaged on the Ambient Air Quality in the project area or along the material transportation route. The impacts due to emissions from DG sets will also be minimal.

The Central Pollution Control Board (CPCB) has set up standards with regard to the ambient air quality levels and emission levels. These standards will have to be met, and stipulations to the effect will be provided in construction contract agreement. In addition, the following measures should be implemented to minimize impacts on air quality at the time of construction:

- Use of minimal area for the construction.
- The Contractor will have to obtain EC for borrow areas and sand procurement from where it is mined and comply with the EC conditions during the operation of the borrow areas.

- Vehicles carrying the construction material and sand shall be covered properly. It will be ensured that all the vehicles deployed for the project possess Pollution Under Control (PUC) certificate and maintained properly to minimize emissions of contaminants.
- Loading and unloading of construction materials has to be in covered area with provisions of water fogging around these locations.
- The excavated material shall be stored properly so that it does not generate fugitive emissions. Storage areas should always be located downwind of the habitation area.
- Stockpiling of the construction material and wet spraying of the stockpile to prevent fugitive emissions should be ensured by the Contractor
- Wetting, of transportation routes / earthworks periodically, wherever practicable.
- Regular maintenance of machinery and equipment is essential; vehicular pollution check should be made mandatory.
- The crushers to be installed, if any, to reduce the boulder size as per the requirement of gabion work, should be sited at least 500 m in the downwind direction from the nearest settlement and that too only after receiving a No-Objection Certificate (NOC) from the BSPCB as per the recommendations given in Operational Guidelines of World Bank 4.1
- Kerosene/ LPG should be used as fuel source in construction camps instead of wood and tree cutting
- Water sprinkling of unpaved haulage roads to suppress dust
- Mask and other PPE should be provided as a Mandatory effort to the construction workers
- DG sets shall be CPCB compliant and fitted with chimney of adequate height as per regulations (Height of stack = height of the building + 0.2 √KVA).
- Low sulphur diesel should be used in DG sets as well as machineries.
- As far as possible, it is recommended to transport the material during night time (8 pm to 5 am) and the prior permissions from the SSB should also be obtained for the personnel engaged in transportation and those staying in the labour camps in order to keep a check on the Security issues. This should be included as part of the Contract conditions to be signed with the Contractor
- Air quality monitoring for the same parameters, which were monitored during the baseline studies, will be implemented by the Contractor by hiring the services of the NABL accredited and MoEF Notified laboratory. WRD/BAPEPS will monitor that the AAQ monitoring program is scrupulously implemented. If monitored parameters are above the prescribed limit, suitable control measures like spraying of the haulage roads, labour camps, material storage areas and EKE should be undertaken.

6.2.2.15 Noise Level

Ambient noise level may increase temporarily in the close vicinity of various construction activities, maintenance workshops of vehicles and earthmoving equipment. These construction activities are expected to produce noise levels in the range of 80 – 95 dB at a distance of about 5 m from the source of operation. Although this level of noise is higher than the permissible limits for ambient noise level for residential/ commercial settlements but the noise will occur only intermittently and temporarily.

This noise level will attenuate fast with increase in distance from the noise source. Impact due to noise during construction activities will be minimal to inhabitants since most of the built-up areas are small villages and spaced at considerable distance from

each other. However, there may be sensitive locations especially schools that are closer to the worksites where increase in the noise level may be felt due to use of construction equipment and increased traffic movement. Noise levels may also increase due to night transportation of the materials as proposed and may affect the inhabitants abutting the roads. The CPCB has set up standards for ambient noise levels in various activity zones. Suitable conditions will be incorporated in the construction contract agreement, to ensure compliance of these standards. In addition, the following measures should be adopted to minimize impact of noise during the construction phase:

- The Contractors will have to maintain the equipment and comply with occupational safety and health standards.
- Noise level monitoring during the day time near the sensitive receptors should also be made mandatory along with noise level monitoring on the material transportation routes so that increase in the ambient noise levels, if any, can be known and accordingly preventive steps could be taken.
- Stationary noise making equipments should be placed at un-inhabited places; noise level will be one of the considerations in equipment selection which will favor lower sound levels.
- The provision of temporary noise suppression devices / noise barriers should be used near identified sensitive locations or near the source during construction.
- Hearing Protection devices (ear plugs or ear muffs) should be provided to the workers who are exposed to noise.
- The DG sets and other construction equipment and machinery should be fitted with acoustic enclosures and a routine maintenance of the DG sets and other construction equipments should be carried out to control the noise levels from these sources.
- Develop a mechanism to record and respond to complaints on noise.

6.2.2.16 Biodiversity Conservation Plan

Terrestrial Ecology

Since there is no reserve or protected forests in the project area, the forest land will not be diverted for the project work. There are a number of trees on the ROW on Kosi EKE, which are located only on the stretch of the chainage 0.00 km to 28.20 km (refer ***Table 51***). These trees will have to be cut to provide unhindered route for the transportation of the material to the project site. There are also trees on ROW in the Chainage between 28.20 km to 31.00 km, closer to the intersection of the NH-57, which will need to be cut, although this area is not part of the works to be undertaken in the Project. As can be seen from the ***Table 51***, approximately, 39 number of trees, both small and big, would need to be cut and in place of these trees it is suggested that twice the number of trees be planted.

Table 51: List of Trees on ROW of EKE (Ch. 0.00 km to 28.20 km)

Receptor Code	Strip Map No.	Description	Latitude	Longitude
TR4	E6	Pithecolobium-1	26° 27' 50.5"	86° 55' 26.3"
TR7	E6	Pithecolobium -1-Girth: 0.94 m	26° 27' 47.9"	86° 55' 24.4"
TR11	E5	Pithari-1-Girth: 1.26 m	26° 27' 42.6"	86° 55' 20.7"
TR15	E5	Pithecolobium Trees-15-(Girth0.94-3.14 m)	26° 27' 39.5"	86° 55' 18.4"
TR16	E5	Pithecolobium -5-(Girth0.94-1.88 m)	26° 27' 35.8"	86° 55' 16.0"

Receptor Code	Strip Map No.	Description	Latitude	Longitude
TR17	E5	Pithecolobium -1	26° 27' 27.1"	86° 55' 10.0"
TR19	E5	Acacia -1-Girth: 0.93 m	26° 27' 17.4"	86° 55' 0.3"
TR21	F6	Pithecolobium -2	26° 27' 6.7"	86° 54' 49.2"
TR22	F6	Pithecolobium -4	26° 26' 59.3"	86° 54' 41.7"
TR24	F6	Pithecolobium -2, near Spur Ch.8.7 km	26° 26' 57.4"	86° 54' 39.6"
TR25	F6	Pithecolobium -5-(Girth: 0.1.26-2.8m)	26° 26' 56.2"	86° 54' 37.8"
TR26	F6	Pithecolobium -1-1m,	26° 26' 54.8"	86° 54' 29.0"
TR28	F5	Pithecolobium -2, near Spur: 9.5 km	26° 26' 51.4"	86° 54' 10.0"
TR30	F5	Peepal-1-Girth: 6.59m.	26° 26' 47.6"	86° 54' 2.2"
TR33	F5	Pithecolobium -1	26° 26' 38.7"	86° 53' 49.3"
TR38	G7	Peepal-1-3.5m	26° 26' 17.0"	86° 53' 21.9"
TR39	G7	Pithecolobium -2	26° 26' 11.0"	86° 53' 14.0"
TR42	G6	Pithecolobium -2	26° 25' 54.4"	86° 52' 52.9"
TR51	G6	Pithari-1-Girth: 1.26m	26° 25' 35.4"	86° 52' 34.8"
TR52	H7	Ber (Ziziphus) -1-Girth: 0.63 m, Pithecolobium -1-Girth: 0.63 m, Peepal-1-Girth: 4.71 m	26° 25' 28.1"	86° 52' 28.9"
TR54	H7	Pithecolobium - 1- Girth: 0.94m	26° 25' 23.0"	86° 52' 24.8"
TR57	H7	Pithari -2- (Girth: 1.88-2.5 m)	26° 25' 20.2"	86° 52' 22.4"
TR58	H7	Pithecolobium -1	26° 25' 18.3"	86° 52' 21.0"
TR60	H7	Pithecolobium -1-Girth: 1.57m	26° 25' 13.7"	86° 52' 17.3"
TR73	H6	Pithari-1-Girth: 6.28m	26° 24' 37.9"	86° 51' 20.8"
TR81	I6	Peepal Tree	26° 24' 26.1"	86° 50' 56.0"
TR83	I5	Peepal Tree-1-Girth: 4.71m near Spur Ch. 16.98 km	26° 24' 20.5"	86° 50' 43.7"
TR87	I5	Peepal Tree-1	26° 23' 58.0"	86° 50' 14.0"
TR108	K5	Banyan Tree, Peepal Tree-1-Girth: 9.6m	26° 22' 42.7"	86° 48' 25.8"
TR119	L4	Kadamb Tree-1-Girth: 1.57m	26° 21' 36.1"	86° 47' 10.6"
TR120	L4	Pithecolobium -1-Girth: 1.257m	26° 21' 34.7"	86° 47' 8.8"
TR124	L4	Acacia -1	26° 21' 32.0"	86° 47' 5.2"
TR127	L4	Pithari-1-Girth: 1.727m	26° 21' 25.6"	86° 46' 57.2"
TR191	D5	Pithecolobium -2-(Girth: 1.57-1.88 m)	26° 28' 51.3"	86° 56' 9.9"
TR193	D5	Pithecolobium -5	26° 28' 48.3"	86° 56' 8.0"
TR194	D5	Pithecolobium -2-Girth: 0.94 m	26° 28' 46.6"	86° 56' 6.9"
TR196	D5	Pithecolobium -2-Girth: 0.63 m	26° 28' 45.9"	86° 56' 6.0"
TR202	D5	Pithecolobium -1-Girth: 1.57m	26° 28' 38.5"	86° 56' 1.7"
TR208	D5	Anona-6-(Girth: 0.31-0.63 m)	26° 28' 20.1"	86° 55' 48.2"

The cost of such afforestation program is estimated to be Rs. 68 Lakhs (Rs. 56 Lakhs for EKE 0.00 km to 28.20 km and Rs. 12 Lakhs for EKE 78.00 to 84.00 km). The Department of Forest, Government of Bihar, is implementing the Agro Forestry scheme in the State and benefit of this scheme could be taken to raise the required plantation in the EKE area in a scientific manner. It is also suggested to set up a Plant Nursery in the area if it is not existing in the nearby area so that saplings will be readily available for the plantation on river and country sides of the EKE.

The other measures to conserve biodiversity in the project area include inspection of the project area by the WRD/BAPEPS with Forest Department officials, strict monitoring of

laborers and associated workers for any activity related to endangering the life or habitat of wild animals and birds, fisheries, supply of fuel wood to the labour camps only from the authorized sources or replacement of fuel wood by subsidized kerosene / LPG from the nearby depots to avoid felling of the trees or provide Community kitchen for the labour camps for cooking at a subsidized rate. This will have to be ensured by the Contractor and accordingly a condition be put by the WRD/BAPEPS in the Contract Agreement for this purpose.

Positive impacts on terrestrial ecology are expected post project completion due to the increase in vegetation and landscaping. The WRD should coordinate with the local communities to maintain and enhance the trees planted along the roads.

Aquatic Ecology

Commercial fishing was not observed in this area. There is no planned fishing, in the project area. Therefore, no substantive loss of fish habitat due to construction of EKE project is envisaged and hence no specific EMP has been prepared for this sector. The impacts on fisheries will be seen only during the construction phase, due to increase in the turbidity level through sedimentation, however, these impacts will be purely temporary in nature and the fishing will be restored post completion of the construction phase. Good construction practices should be adopted to prevent increase in siltation in water.

The material proposed for the proposed restoration and protection of the EKE / spurs is supposed to be “eco friendly” and hence it will not have any deleterious impact on aquatic fauna or ecology of the region.

6.2.2.17 Natural Hazard Risk

The project area is at risk from floods and Geo- morphological risks from Earthquakes. The Supaul District lies in seismic hazard Zone V while Saharsa District in Zone IV. This clearly indicates the moderate to High natural hazard index of the project study area. The mitigation measures recommended in the ESMF prepared by the BAPEPS under the BKFRP-II project should be adopted.

6.3 ENVIRONMENTAL MONITORING PLAN AND IMPLEMENTATION ARRANGEMENTS

An effective monitoring program is necessary to assess the status of environmental quality during the EKE protection works. The objective of environmental monitoring plan is to:

- Evaluate the performance of mitigation measures proposed in the EMP
- Suggest improvements in management plan, if required.
- Enhance environmental quality
- Comply with the Statutory and community obligations
- Warn significant deteriorations in environmental quality for further preventive action

This exercise will aid implementation of mitigation measures by way of generating a continuous feedback system in structured format. At the same time, this could be used for conducting corrective action in respect of pitfalls as noticed during inspections.

Effectiveness of the proposed mitigation measures during the construction period will be monitored using key environmental performance indicators, which are described below.

Environmental Performance Indicators

The key Environmental Performance Indicators (EPIs) that will be used to evaluate the effectiveness of the proposed environmental safeguards in relation to community health and safety in the project area are:

- Air Quality
- Water Quality
- Noise Level
- Erosion Potential

6.3.1 Air Quality Monitoring

The air quality monitoring is recommended through NABL accredited and MoEF approved laboratory during the construction phase of the project. The monitoring of air shall be conducted at the location of worksite, material stockyards, and haul roads. The parameters recommended for monitoring during construction are:

- Particulate Matter, PM_{10}, $PM_{2.5}$
- Sulphur Oxide
- Nitrogen Oxides
- Carbon Monoxide

Air quality shall be monitored on a monthly basis except in the monsoon season and compared with the AAQ monitoring results obtained during the baseline monitoring to record changes in the AQ and undertake suggested measures to mitigate the adverse impacts.

6.3.2 Water Quality Monitoring

Water quality shall be monitored on a quarterly basis throughout the project duration to cover seasonal variations and one year after the completion. Water quality shall be monitored through NABL accredited and MoEF approved laboratory.

The groundwater shall be collected from hand pumps on the countryside, from where water is being used by the villagers. Also, hand pumps located near labour camps and machinery maintenance shed shall be considered for monitoring.

Similarly, the Kosi River water quality shall be monitored once in three months to observe changes compared to the baseline data. Both Surface and groundwater should be monitored for the parameters of IS:10500.

6.3.3 Noise Level Monitoring

The monitoring of noise shall be done at the location of work sites, haul routes, near the sensitive receptors, which are within 500 m from the work sites. The noise levels will be monitored on a monthly basis, and the data obtained will be compared with the values of noise standards and baseline information collected during the study.

6.3.4 Erosion Potential

Soil erosion rates, slope stability of land faces, sediment load in water and effectiveness of soil conservation measures should be monitored twice in a year by the WRD.

In addition to the above, regular monitoring shall be carried out for surveillance and maintenance of safety during construction to avoid accidents. The following measures should be taken during construction:

- Construction Sites - Caution boards, Ribbon band, Delineator
- Temporary Diversion - Diversion Board, Barricading
- Drainage - Caution boards, Ribbon band, Delineator
- Safety for the Workers - Helmets, Safety-Shoes, Goggles, Ear muffs/Ear plugs, Dust mask

6.3.5 Environmental Monitoring Program and Responsibility Matrix

A detailed proposed environmental monitoring program along-with responsibility matrix is presented in ***Table 52***.

Table 52: Proposed Environmental Monitoring Program and Responsibility Matrix

S. No.	Environmental Component	Environmental Monitoring Program			Responsibility Matrix	
		Parameters	Locations	Frequency	Implementation	Supervision
During Project Construction Phase						
1	Air Quality	PM10, PM2.5, SO2, NOx, CO	Construction sites, material transportation routes and near habitation	24 hrs Sampling. Monthly, except monsoon	Contractor	WRD/ BAPEPS
2	Water Quality	As per IS 10500	River water near construction sites, groundwater from hand pumps near habitation/vehicle, equipment garage	Quarterly at least once in each season	Contractor	WRD/ BAPEPS
3	Noise Level	Noise Level in dB(A) Day – max and min Night – max and min	Near construction sites, where heavy machineries are working, material transportation routes and near habitation/sensitive receptors	Monthly	Contractor	WRD/ BAPEPS
4	Borrow Area Management	Borrow area redevelopment and top soil management	Identified and approved borrow areas	Twice in a month	Contractor	WRD/ BAPEPS
5	Haul Road & hauling mode	Maintenance of haul roads and hauling mode as per the best practices	All haul roads	Twice in a week	Contractor	WRD/ BAPEPS
6	Soil Erosion	Visual inspection	Entire project stretch and agricultural fields	Pre-monsoon and post monsoon period	Contractor	WRD/ BAPEPS
7	Plantation	Numbers of plants	As per the Guidelines in the Embankment Manual	Every six months to assess the adequacy	Contractor	WRD/ BAPEPS in consultation with the Forest / Horticulture

S. No.	Environmental Component	Environmental Monitoring Program			Responsibility Matrix	
		Parameters	Locations	Frequency	Implementation	Supervision
						Dept.
Post Construction Phase						
1	Water Quality	As per IS 10500	River water groundwater from hand pumps near habitation	At specified locations, for one year after construction completion	WRD/ BAPEPS	WRD/ BAPEPS in consultation with BSPCB
2	Erosion and Sedimentation	Soil erosion rate and stability of river bank & EKE	Critical spots as per visual inspection	Pre-monsoon & post monsoon period, every year	WRD/ BAPEPS	WRD/ BAPEPS

The Index Map showing proposed locations for various mitigation measures recommended in the EMP are presented in ***Annexure 10*** for chainages 0.00 km to 28.2 km and 78.00 km to 84.00 km.

6.4 INSTITUTIONAL/IMPLEMENTATION ARRANGEMENTS

Figure 19 presents the organizational structure of the proposed Environmental Management Group (EMG) for environmental management and monitoring.

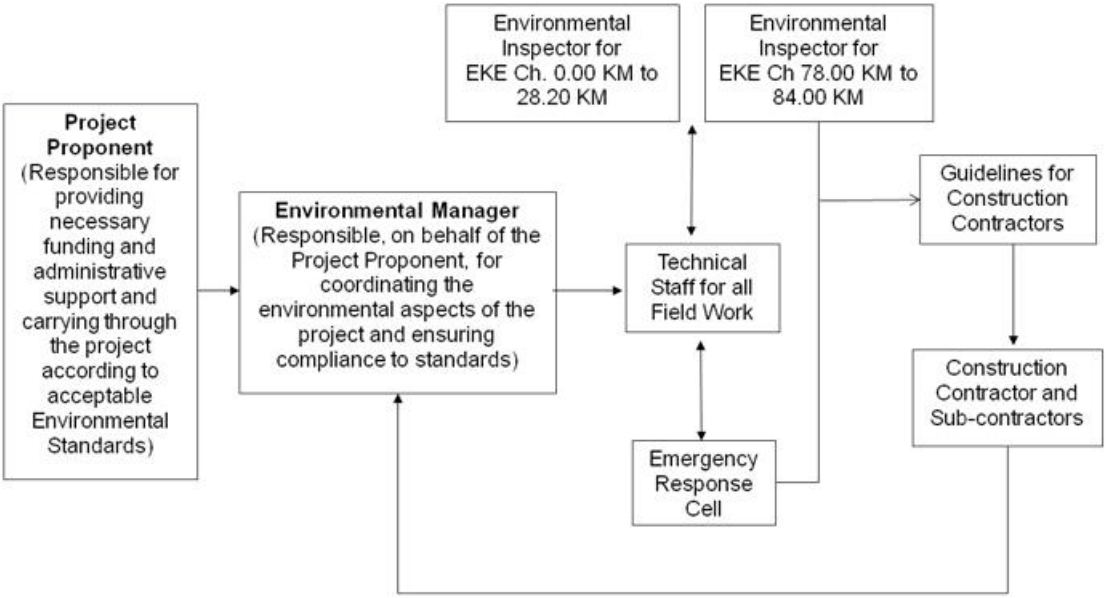


Figure 19: Organizational Structure of the Proposed Environmental Management Group

The various players responsible for execution of the EMP and associated monitoring and inspections, and their designated levels of responsibilities are delineated below:

- The **Project Proponent or Sponsor** will be responsible for providing all the necessary funding and administrative support to the EMP; and be ultimately responsible for carrying out the project with total commitment to environmental matters
- The **Environmental Manager**, working on behalf of the Project Proponent, will be responsible for coordinating the activities of a technical staff responsible for monitoring and managing compliance of the EMP. The responsibilities include

technical, community and administrative matters related to the EMP, including liaison with the general public in the project area, other partiers and regulatory bodies on environmental issues related to the project. The person will also be responsible for keeping the local communities informed of the environmental compliance of the project and properly address any issues of their concern.

- The **Environmental Inspectors** (one in each of the two EKE Stretches) with the help of the technical staff, will be responsible for monitoring the compliance of the EMP and must report to the Environmental Manager.
- The **Construction Contractor** will be responsible for ensuring full compliance with environmental matters related to construction activities, as laid down in the EMP. The Construction Contractor will ensure that all his workers are properly briefed in environmental matters in terms of the Dos and DON'Ts while they work on the project.

The Environmental Inspectors for each of the two EKE stretches will oversee the day to day functioning of the construction crews. The Environmental inspectors will also coordinate environmental testing and monitoring, and training of personnel with respect to environmental components of the project. The job will require significant visual observations of day to day work and interaction with project personnel.

The BAPEPS will be responsible for implementation of all the mitigation and management measures suggested in the EMP.

The technical staff of the project will be given adequate training by the BAPEPS, in line with the following, to help the Environmental Manager, the Environmental Inspectors and the Construction contractors and sub-contractors, meet the guidelines of the EMP prior to commencement of the work.

- Pre-start work induction
- Pre-start activity meeting
- Provision with leaflets, posters in camps, environmental health and safety meetings

The objective will be to teach and encourage a culture that will help the workers to identify and minimize unwanted damage to the environment while working on the project.

Progress Monitoring and Reporting Arrangements

A proper strategy is necessary for smooth implementation of the mitigation measures. One of the suggested strategy is to make the whole plan (including mitigation schemes) public and transparent, with the help of the existing local level institutions such as Gram Panchayats, if necessary, other media, such as print and electronic, can be employed. This would reduce some of the avoidable speculations.

For the implementation of proposed works under the EMP, it is proposed to have a two-level institutional framework. It is proposed to constitute an Apex Committee to oversee the overall implementation of the proposed works and a Working Level Committee to monitor the implementation of works on the ground level.

The Apex Committee shall comprise of the senior officials from FMISC, WRD, the World Bank and Project Head from BAPEPS. The Apex Committee shall be the decision and policy making body to implement the suggested environmental mitigation measures. The Apex Committee will report the progress of the works to the World Bank on a quarterly basis. Under the Apex Committee, it is proposed to constitute a Working Level Committee to monitor the implementation of the EMP by the appointed Contractor.

The Working Level Committee shall comprise of the Contractor, Project Management Consultant, Field Level Officers from BAPEPS and WRD. The Working Level Committee shall be responsible for implementation of all the proposed mitigation measures on the ground level and will ensure periodic monitoring of environmental parameters outlined in the EMP. It shall ensure full participation of all key stakeholders and meaningful coordination in planning and time bound implementation of the mitigation measures proposed under the EMP. It shall be responsible for laisioning with the local administrative bodies and the representatives of the local community. It shall also oversee the day to day work of all the contractors appointed under this Project and provide a monthly progress report to the Apex Committee.

The proposed institutional framework for implementing and monitoring the works proposed under the EMP is shown in ***Figure 20***.

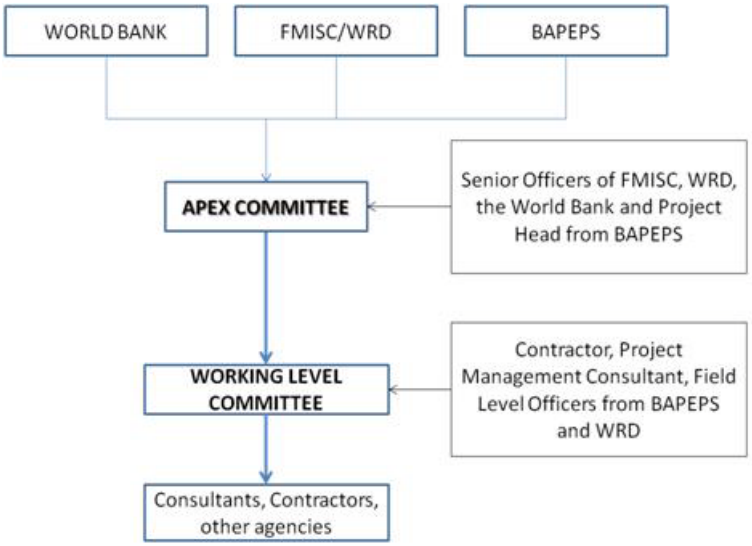


Figure 20: Proposed Institutional Framework for Monitoring of EMP

6.5 CONCLUSIONS

The project can cause impacts only during the construction phase due to various activities involved during the construction. However, strict adherence to various mitigation measures as identified under the EMP, strengthened by adequate environmental monitoring and auditing, and good construction practices will go a long way in effectively reducing the impacts to a negligible level.

Considering the overall environmental review criteria it has been observed that the proposed project would not cause:

- Unwarranted losses of precious natural resources
- Unwarranted accelerated use of natural resources for short term gains
- Unwanted hazards to flora and fauna
- Unwanted socio-economic and cultural environment

It is clear from the objectives of the Project that it will have significant positive impacts since it will:

- Provide protection of the EKE slope and protect river edge, thus preventing risks of floods in future
- The proposed Project once implemented will prevent risks to the environment, loss of human lives and properties

- Create social benefits by providing temporary jobs for unskilled workers/labourers during the construction phase

Thus it can be concluded that the proposed project is environmentally acceptable and will bring economic, social and environmental benefits to the land users and local community in the area.

6.6 EXPENDITURE ON PROPOSED ENVIRONMENTAL MITIGATION MEASURES

The costing for implementing EMP mitigation measures has been provided in this Report which needs to be borne by the WRD and Contractor. While preparing the estimates of expenditure on proposed mitigation measures, following assumptions were made. It is assumed that it would take about 20 months (exclusive of monsoon) to complete the proposed works in the two EKE stretches 0.00 km to 28.20 km and 78.00 km to 84.00 km.

The proposed mitigation costs have been bifurcated in two parts ***Table 53*** summarizes costs which may be incurred by WRD and Other Agencies on environmental measures for both EKE stretches during the entire construction and post-construction period. ***Table 53b*** presents the mitigation measures involving labour amenities safeguards, health, safety, sanitation and welfare of the labours which is the liability of Contractor and Agencies. For the suggested measures, no extra costs will be borne by the WRD.

Table 54 and ***Table 55*** present a detailed break-up of the estimate of expenditures, which may be incurred on environmental measures during the construction and post construction period for the EKE Chainages 0.00 km to 28.20 km and 78.00 km to 84.00 km, respectively.

The Rate Analysis for various components such as dust suppression, toilet blocks, wash areas, urinals and solid waste disposal are presented in ***Annexure 11***.

Table 53a: Expenditure on Mitigation Measures under the Scope of WRD and Other Agencies

S. No.	Component	Stage	Description	For 0.00 to 28.20 km. (Rs.)	For 78.00 to 84.00 km. (Rs.)	Total (Rs.)
A	**Mitigation & Enhancement Cost**					
1	Flora / vegetation	Construction Phase	Bamboo plantation interspersed with Vetiver grass and Prosophis	1,03,74,000.00	22,23,000.00	1,25,97,000.00
			Nursery set up	3,00,000.00	2,00,000.00	5,00,000.00
	Total of Mitigation & Enhancement Cost (A)			**1,06,74,000.00**	**24,23,000.00**	**1,30,97,000.00**
B	**Monitoring Cost**					
During Construction Phase						
1	Air (PM 10, PM2.5, SO2 & NO2)	Construction Phase	Air quality monitoring at construction sites, labour camps, material transportation routes & near habitation on monthly basis (except monsoon)	24,00,000.00	16,00,000.00	40,00,000.00
2	Water (Colour, pH, Electrical Conductivity, Dissolved Oxygen, Turbidity on NTU, Total Dissolved Solids, Total hardness as	Construction Phase	River water and groundwater from hand pumps near habitation on quarterly basis	11,76,000	7,84,000	19,60,000.00

S. No.	Component	Stage	Description	For 0.00 to 28.20 km. (Rs.)	For 78.00 to 84.00 km. (Rs.)	Total (Rs.)
	CaCO3, Calcium as Ca, Magnesium as Mg, Total Alkalinity as CaCO3, Chloride as Cl, Sulphate as SO4, Fluoride as F, Sodium as Na, Potassium as K, Boron as B, Total Phosphate as P, BOD, COD, Ammonical Nitrogen as N, Total Kjeldahl Nitrogen as N, and Total Coliform)					
3	Noise	Construction Phase	Near construction sites, where heavy machineries are working, material transportation routes & near habitation/sensitive receptors on monthly basis	4,80,000.00	3,20,000.00	8,00,000.00
4	Soil Microbiology	Construction Phase	Randomly selected locations between EKE & River on quarterly basis	4,20,000.00	2,80,000.00	7,00,000.00

S. No.	Component	Stage	Description	For 0.00 to 28.20 km. (Rs.)	For 78.00 to 84.00 km. (Rs.)	Total (Rs.)
Post Construction Phase						
1	Water (parameters, as above)	Post Construction Phase	River water & ground water from hand pumps near habitation for one time	1,68,000.00	1,12,000.00	2,80,000.00
			Total of Monitoring Cost (B)	**46,44,000.00**	**30,96,000.00**	**77,40,000.00**
			Total: (A) + (B) - TOTAL BUDGET FOR EMP IMPLEMENTATION	**1,53,18,000.00**	**55,19,000.00**	**2,08,37,000.00**

Notes:

1. Implementation of mitigation and enhancement measures with respect to air, water, noise, solid waste management & traffic management, labour amenities, safeguards, health, safety, sanitation and welfare of the labours, etc. shall be the liability of the Contractor and the implementing agencies appointed for EKE protection and restoration works. Hence, for the above measures, no extra cost will be borne by the WRD. Suitable clause(s) should be incorporated in the contract document so that the contractor is aware about the mitigation and enhancement measures to be implemented by him. The bid/contract price should cover all costs associated with such mitigation measures. No additional payment, whatsoever, shall be paid to the Contractor in this regard

2. During Construction phase, protection of embankment with grass sods and soil erosion measures may have to be undertaken before the onset of monsoon as per the site requirement in accordance with the recommendations made in the Embankment Manual of CW&PC, MoIP, GoI.

3. Please refer individual sheets for cost detailing & assumptions made while arriving at the estimates

Table 53b: Expenditure on Mitigation Measures under the Scope of Contractor

S. No.	Component	Stage	Description	Unit	For 0.00 to 28.20 km.	For 78.00 to 84.00 km.	Total
MITIGATION & ENHANCEMENT COST							
1	Air	Construction Phase	Dust management with water bowser fitted with sprinkler	Day	500	500	1000
			Covers for vehicles transporting construction material	Each Trip	Mandatory	Mandatory	Mandatory
2	Water	Construction Phase	Oil interceptor & soak pit at machineries shed/garage	Each	2	2	4
			Toilet/wash area/urinals at each of the labour camps	Each	36	15	51
			Septic tank & soak pit at each of the labour camps	Each	8	4	12
			Supply of potable water at labour camps and construction sites	Day	600	600	1200
			Storage facility for potable water at labour camps and construction sites	Each	4	2	6
3	Noise	Construction Phase	Ear plugs for labourers/supervisory staff/acoustic enclosures for DG sets	Pair	363	150	513
4	Solid Waste Management	Construction Phase	Waste storage/collection bins	Each	8	4	12
			Manpower for SWM	Person	160	80	240
			Solid waste disposal system *(Burial pit with lining system at each of the camps. The pit will be scientifically closed by putting liner system at the end of the project completion)*	Job	Mandatory	Mandatory	2 Facilities
5	Traffic Management	Construction Phase	Traffic managers	Person	120	80	200
			Road Signs / Road Furniture	Each	55	37	92

Note: Implementation of mitigation and enhancement measures with respect to air, water, noise, solid waste management & traffic management, labour amenities, safeguards, health, safety, sanitation and welfare of the labours, etc. shall be the liability of the Contractor and the implementing agencies appointed for EKE protection and restoration works. Hence, for the above measures, no extra cost will be borne by the WRD. Suitable clause(s) should be incorporated in the contract document so that the contractor is aware about the mitigation and enhancement measures to be implemented by him. The bid/contract price should cover all costs associated with such mitigation measures. No additional payment, whatsoever, shall be paid to the Contractor in this regard.

Table 54: Expenditure on Proposed Works for CH. 0.00 km to 28.20 km

S. No.	Component	Stage	Description	Unit	Unit Cost (Rs.)	Quantity	Total cost (Rs.)	Remark	Reference for Unit Rate
A	**Mitigation & Enhancement Cost**								
1	Air	Construction Phase	Dust management with water bowser fitted with sprinkler (25 days of working per month & 20 months construction period assumed to arrive at quantity of 300 days (25 x 20 = 500 days)	Per day	83,245	500	4,16,22,666.67	WRD shall cover the cost under Engg. Estimates / BOQ. No separate payment shall be made to the Contractor	Refer Rate Analysis sheet ***"RA for dust supression"***
			Covers for vehicles transporting construction material	Lump sum			-	SoR rates for material covers the cost for this component; hence separate provision has not been made. WRD shall add suitable clause in the tender document in this regard.	
2	Water	Construction Phase	Oil interceptor & soak pit at machineries shed/garage	Each	1,00,000	2	2,00,000.00	Oil will be separated & stored for further disposal & water will be let out into soak pit	Indicative cost provision
			Toilet/wash area/urinals at each of the labour camps Dimension of one unit = 2m x 1.5 m.	Each	15,000	36	5,43,750.00	@ One toilet unit per 20 persons. Total persons assumed = 725	Refer Rate Analysis sheet ***"RA for Toilet & Wash"***

S. No.	Component	Stage	Description	Unit	Unit Cost (Rs.)	Quantity	Total cost (Rs.)	Remark	Reference for Unit Rate
			Septic tank & soak pit at each of the labour camps	Each	50,000	8	4,00,000.00	Two units at each of the camps. Each camp may accommodate maximum of 200 persons	As per the prevailing cost of construction
			Supply of potable water at labour camps and construction sites @10 ltr per person for 725 persons for 20 months (10 ltr x 725 persons x 600 days) Water cost per day = Rs. 0.236 x 7250 = Rs. 2832	Per day	1,711	600	10,26,600.00	for 20 months @ Rs. 236 per KL	RCD, Govt. of Bihar SoR, pg. no. xxxii, construction material rate, Sr. no. M-189, Schedule-M-1A
			Storage facility for potable water at labour camps and construction sites	Each	10,000	4	40,000.00	PVC water tanks	As per the market rate
3	Noise	Construction Phase	Ear plugs (approximate noise reduction rating 29dB) for labourers/supervisory staff/acoustic enclosures for DG sets Cost of ear plugs = Rs. 500 per unitNumber of persons = 363 (only 50% persons will be provided)Rs. 3 lakh provision for acoustic enclosures to DG sets	Lump sum			4,81,500.00		Indicative cost provision

S. No.	Component	Stage	Description	Unit	Unit Cost (Rs.)	Quantity	Total cost (Rs.)	Remark	Reference for Unit Rate
4	Soil	Construction Phase	Redevelopment of borrow areas	As per Good Engineering Practices & Local Regulations			-	WRD shall cover the cost under Engg. Estimates/BOQ. Generally, unit rate for boulder shall cover the cost towards redevelopment of borrow areas	
			Slope/ embankment/ protection with grass sods *(During Construction phase, protection of embankment with grass sods and soil erosion measures may have to be undertaken before the onset of monsoon as per the site requirement in accordance with the recommendations made in the Embankment Manual of CW&PC, MoIP, GoI)* (25m. width for 28 km stretch)	Sqm.	53	7,00,000	3,71,00,000.00	Indicative budgetary allocation (28 m x 25 m). WRD may decide to execute this item if the site conditions demand for the same.	RCD, Govt. of Bihar SoR, pg. no. 52, Sr. no. 3.22
5	Flora/ vegetation	Construction Phase	Provision for Bamboo plantation interspersed with Vetiver grass and Prosophis along EKE stretch as per guidelines of WRD on plantation	Hectare	1,48,200	70	1,03,74,000.00		Market Rate

S. No.	Component	Stage	Description	Unit	Unit Cost (Rs.)	Quantity	Total cost (Rs.)	Remark	Reference for Unit Rate
			(25m. width for 28 km stretch)						
			Nursery set up	Lump sum			3,00,000.00	If necessary	Indicative cost provision
6	Solid Waste Management	Construction Phase	Waste storage/collection bins Two bins at each of the camp. Number of camps 4. Total number of bins = 2 x 4 = 8	Each	5,000	8	40,000.00	Considering waste generation @ 0.25kg/person, waste qty. of 45kg/day/camp is worked out	Market Rate
			Manpower for SWM 2 persons at each of the camps for SWM related works. Construction period 20 months. So, number of persons = 2 persons x 4 camps x 20 months = 160 persons	Each	5,280	160	8,44,800.00		RCD, Govt. of Bihar SoR, pg. no. xi, Labour Rate, Schedule 1, Sr. no. 1
			Solid waste disposal system	Lump sum			9,00,000.00	Burial pit with lining system at each of the camps. The pit will be scientifically closed by putting liner system at the end of the project completion.	Refer Rate Analysis sheet ***"RA for MSW disposal"***

S. No.	Component	Stage	Description	Unit	Unit Cost (Rs.)	Quantity	Total cost (Rs.)	Remark	Reference for Unit Rate
7	Traffic Management	Construction Phase	Road strengthening	Lump sum			-	This item is deleted from EMP budget as WRD is undertaking road strengthening work under separate contract package	
			Traffic managers 6 persons for 20 months of actual construction are considered. (6 persons x 20 months = 120 persons)	Each	6,330	120	7,59,600.00		RCD, Govt. of Bihar SoR, pg. no. xii, Labour Rate, Schedule 1, Sr. no. 69
			Road Signs / Road Furniture as per the site condition. For costing, 2 boards per km, has been assumed	Each	10,937	55	6,01,524.00		RCD, Govt. of Bihar SoR, pg. no. 151, Item no. 8.5
	Total of Mitigation & Enhancement Cost (A)						**9,52,34,440.67**		
B	**Monitoring Cost**								
During Construction Phase									
1	Air (PM 10, PM2.5, SO2 & NO2)	Construction Phase	Air quality monitoring at construction sites, labour camps, material transportation routes & near habitation on monthly basis (except monsoon)	Each	10,000	240	24,00,000.00	Assuming 12 spots and construction period of 20 months	Market Rate

S. No.	Component	Stage	Description	Unit	Unit Cost (Rs.)	Quantity	Total cost (Rs.)	Remark	Reference for Unit Rate
2	Water (Colour, pH, Electrical Conductivity, Dissolved Oxygen, Turbidity on NTU, Total Dissolved Solids, Total hardness as CaCO3, Calcium as Ca, Magnesium as Mg, Total Alkalinity as CaCO3, Chloride as Cl, Sulphate as SO4, Fluoride as F, Sodium as Na, Potassium as K, Boron as B, Total Phosphate as P, BOD, COD, Ammonical Nitrogen as N, Total	Construction Phase	River water & ground water from hand pumps near habitation on quarterly basis	Each	7,000	168	11,76,000.00	Assuming 12 samples each for GW & SW and construction period of 20 months	Market Rate

S. No.	Component	Stage	Description	Unit	Unit Cost (Rs.)	Quantity	Total cost (Rs.)	Remark	Reference for Unit Rate
	Kjeldahl Nitrogen as N, and Total Coliform)								
3	Noise	Construction Phase	Near construction sites, where heavy machineries are working, material transportation routes & near habitation/sensitive receptors on monthly basis	Each	2,000	240	4,80,000.00	Assuming 12 spots and construction period of 20 months	Market Rate

S. No.	Component	Stage	Description	Unit	Unit Cost (Rs.)	Quantity	Total cost (Rs.)	Remark	Reference for Unit Rate
4	Soil Microbiology	Construction Phase	Randomly selected locations between EKE & River on quarterly basis	Each	5,000	84	4,20,000.00	Assuming 12 spots and construction period of 20 months	Market Rate
Post Construction Phase									
1	Water (parameters, as above)	Post Construction Phase	River water & ground water from hand pumps near habitation for one time	Each	7,000	24	1,68,000.00	Assuming 12 samples each for GW & SW	Market Rate
	Total of Monitoring Cost (B)						**46,44,000.00**		
	Total: (A) + (B) - TOTAL BUDGET FOR EMP IMPLEMENTATION						**9,98,78,440.67**		

Assumptions / Notes:

1. Number of persons/labourers to be deployed for construction = 725 per day
2. Construction period of 20 months excluding monsoon season
3. Number of construction camps = 4
4. Number of toilets/wash area calculated @ 1 unit for 20 persons
5. Number of monitoring locations for air/water/noise & soil assumed are 12 nos.
6. Frequency of monitoring (During Construction Phase)

   Air - on monthly basis
   Water - on quarterly basis
   Noise - on monthly basis
   Soil - on quarterly basis

6. Frequency of monitoring (Post Construction Phase) - Only water quality to be monitored at 12 locations for one time after completion of construction works

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Table 55: Expenditure on Proposed Works for CH. 78.00 km to 84.00 km

S. No.	Component	Stage	Description	Unit	Unit Cost (Rs.)	Quantity	Total cost (Rs.)	Remark	Reference for Unit Rate
A	**Mitigation & Enhancement Cost**								
1	Air	Construction Phase	Dust management with water bowser fitted with sprinkler (25 days of working per month & 20 months construction period assumed to arrive at quantity of 300 days (25 x 20 = 500 days)	Per day	30,434	500	1,52,16,888.89	WRD shall cover the cost under Engg. Estimates/BOQ. No separate payment shall be made to the Contractor	Refer Rate Analysis sheet ***"RA for dust supression"***
			Covers for vehicles transporting construction material	Lump sum			-	SoR rates for material covers the cost for this component; hence separate provision has not been made. WRD shall add suitable clause in the tender document in this regard.	
2	Water	Construction Phase	Oil interceptor & soak pit at machineries shed/garage	Each	1,00,000	2	2,00,000.00	Oil will be separated & stored for further disposal & water will be let out into soak pit	Indicative cost provision
			Toilet/wash area/urinals at each of the labour camps Dimension of one unit = 2m x 1.5 m.	Each	15,000	15	2,25,000.00	@ One toilet unit per 20 persons. Total persons assumed = 300	Refer Rate Analysis sheet ***"RA for Toilet & Wash"***

S. No.	Component	Stage	Description	Unit	Unit Cost (Rs.)	Quantity	Total cost (Rs.)	Remark	Reference for Unit Rate
			Septic tank & soak pit at each of the labour camps	Each	50,000	4	2,00,000.00	Two units at each of the camps. Each camp may accommodate upto 200 persons	As per the prevailing cost of construction
			Supply of potable water at labour camps and construction sites @10 ltr per person for 300 persons for 20 months (10 ltr x 300 persons x 600 days) Water cost per day = Rs. 0.236 x 3000 = Rs. 708	Per day	708	600	4,24,800.00	for 20 months @ Rs. 236 per KL	RCD, Govt. of Bihar SoR, pg. no. xxxii, construction material rate, Sr. no. M-189, Schedule-M-1A
			Storage facility for potable water at labour camps and construction sites	Each	10,000	2	20,000.00	PVC water tanks	As per the market rate
3	Noise	Construction Phase	Ear plugs (approximate noise reduction rating 29dB) for labourers/supervisory staff/acoustic enclosures for DG sets Cost of ear plugs = Rs. 500 per unitNumber of persons = 150 (only 50% persons will be provided)Rs. 2.5 lakh provision for acoustic enclosures to DG sets	Lump sum			3,25,000.00		Indicative cost provision

S. No.	Component	Stage	Description	Unit	Unit Cost (Rs.)	Quantity	Total cost (Rs.)	Remark	Reference for Unit Rate
4	Soil	Construction Phase	Redevelopment of borrow areas	As per Good Engineering Practices & Local Regulations			-	WRD shall cover the cost under Engg. Estimates/BOQ. Generally, unit rate for boulder shall cover the cost towards redevelopment of borrow areas	
			Slope/embankment/protection with grass sods *(During Construction phase, protection of embankment with grass sods and soil erosion measures may have to be undertaken before the onset of monsoon as per the site requirement in accordance with the recommendations made in the Embankment Manual of CW&PC, MoIP, GoI)* (25m. width for 6 km stretch)	Sqm.	53	1,50,000	79,50,000.00	Indicative budgetary allocation. WRD may decide to execute this item if the site conditions demand for the same.	RCD, Govt. of Bihar SoR, pg. no. 52, Sr. no. 3.22
5	Flora/vegetation	Construction Phase	Provision for Bamboo plantation interspersed with Vetiver grass and Prosophis along EKE stretch as per guidelines of WRD on plantation (25m. width for 6 km stretch)	Hectare	1,48,200	15	22,23,000.00		Market Rate
			Nursery set up	Lump sum			2,00,000.00	If necessary	Indicative cost provision

S. No.	Component	Stage	Description	Unit	Unit Cost (Rs.)	Quantity	Total cost (Rs.)	Remark	Reference for Unit Rate
6	Solid Waste Management	Construction Phase	Waste storage/collection bins Two bins at each of the camp. Number of camps 3. Total number of bins = 2 x 2 = 4	Each	5,000	4	20,000.00	Considering waste generation @ 0.25kg/person, waste qty. of 40kg/day/camp is worked out	Market Rate
			Manpower for SWM 2 persons at each of the camps for SWM related works. Construction period 20 months. So, number of persons = 2 persons x 2 camps x 20 months = 80 persons	Each	5,280	80	4,22,400.00		RCD, Govt. of Bihar SoR, pg. no. xi, Labour Rate, Schedule 1, Sr. no. 1
			Solid waste disposal system	Lump sum			5,50,000.00	Burial pit with lining system at each of the camps. The pit will be scientifically closed by putting liner system at the end of the project completion.	Refer Rate Analysis sheet ***"RA for MSW disposal"***
7	Traffic Management	Construction Phase	Road strengthening	Lump sum			-	This item is deleted from EMP budget as WRD is undertaking road strengthening	

S. No.	Component	Stage	Description	Unit	Unit Cost (Rs.)	Quantity	Total cost (Rs.)	Remark	Reference for Unit Rate
								work under separate contract package	
			Traffic managers 4 persons for 20 months of actual construction are considered. (4 persons x 20 months = 80 persons)	Each	6,330	80	5,06,400.00		RCD, Govt. of Bihar SoR, pg. no. xii, Labour Rate, Schedule 1, Sr. no. 69
			Road Signs / Road Furniture as per the site condition. For costing, 2 boards per km on EKE and 25 extra boards along approach road keeping in view the safety of people in enroute villages, have been assumed	Each	10,937	37	4,04,661.60		RCD, Govt. of Bihar SoR, pg. no. 151, Item no. 8.5
	Total of Mitigation & Enhancement Cost (A)						**2,88,88,150.49**		
B	**Monitoring Cost**								
During Construction Phase									
1	Air (PM 10, PM2.5, SO2 & NO2)	Construction Phase	Air quality monitoring at construction sites, labour camps, material transportation routes & near habitation on monthly basis (except monsoon)	Each	10,000	160	16,00,000.00	Assuming 8 spots and construction period of 20 months	Market Rate
2	Water(Colour,	Construction	River water & ground water	Each	7,000	112	7,84,000.00	Assuming 8	Market Rate

S. No.	Component	Stage	Description	Unit	Unit Cost (Rs.)	Quantity	Total cost (Rs.)	Remark	Reference for Unit Rate
	pH, Electrical Conductivity, Dissolved Oxygen, Turbidity on NTU, Total Dissolved Solids, Total hardness as CaCO3, Calcium as Ca, Magnesium as Mg, Total Alkalinity as CaCO3, Chloride as Cl, Sulphate as SO4, Fluoride as F, Sodium as Na, Potassium as K, Boron as B, Total Phosphate as P, BOD, COD, Ammonical Nitrogen as N, Total Kjeldahl Nitrogen as N, and Total Coliform)	Phase	from hand pumps near habitation on quarterly basis					samples each for GW & SW and construction period of 20 months	

S. No.	Component	Stage	Description	Unit	Unit Cost (Rs.)	Quantity	Total cost (Rs.)	Remark	Reference for Unit Rate
3	Noise	Construction Phase	Near construction sites, where heavy machineries are working, material transportation routes & near habitation/sensitive receptors on monthly basis	Each	2,000	160	3,20,000.00	Assuming 8 spots and construction period of 20 months	Market Rate
4	Soil Microbiology	Construction Phase	Randomly selected locations between EKE & River on quarterly basis	Each	5,000	56	2,80,000.00	Assuming 8 spots and construction period of 20 months	Market Rate
Post Construction Phase									
1	Water (parameters, as above)	Post Construction Phase	River water & ground water from hand pumps near habitation for one time	Each	7,000	16	1,12,000.00	Assuming 8 samples each for GW & SW	Market Rate
	Total of Monitoring Cost						**30,96,000.00**		
	Total: (A) + (B) - TOTAL BUDGET FOR EMP IMPLEMENTATION						**3,19,84,150.49**		

Assumptions / Notes:

1. Number of persons/labourers to be deployed for construction = 300 per day
2. Construction period of 20 months excluding monsoon season
3. Number of construction camps = 2
4. Number of toilets/wash area calculated @ 1 unit for 20 persons
5. Number of monitoring locations for air/water/noise & soil assumed are 8 nos.
6. Frequency of monitoring (During Construction Phase)

Air - on monthly basis

Water - on quarterly basis

Noise - on monthly basis

Soil - on quarterly basis

6. Frequency of monitoring (Post Construction Phase) - Only water quality to be monitored at 8 locations for one time after completion of construction works

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List of References

Specific References:

1. *Bihar Kosi Flood Recovery Project-ESMF*, 2012. World Bank, Report Number: E3099.
2. *World Bank Operational Manual*
3. *Bihar Kosi Flood- 2008, Needs assessment report, 2012.* Government of Bihar, World Bank and Global facility for Disaster Reduction and Recovery.
4. *General guidelines for preparing river morphological reports*. 2009. Central Water Commission, Ministry of Water Resources, Government of India.
5. *Handbook for flood protection, ant-erosion and river training works*, 2012, Central Water Commission, Government of India.

Documents collected from Government Offices:

1. *Water quality data from Public Health Department, collected by private laboratory Envirotech East (P) Limited, Kolkata vied work order No. b/WQ-1023/06-1411 dated 22.08.2002,* received from Mr. Devendra Prasad, Ex. Engineer, Water and Sanitation Department, Supaul
2. *Water quality data of Kosi Region for the period 2010 to 2013*, received from Mr. S. Jaiswal, Scientist, Bihar State Pollution Control Board
3. *Data of disaster due to breach of Eastern Kosi Embankment (EKE) in 2008*, received from Disaster Management Dept., Supaul
4. *EKE Restoration Map*, received from Mr. Om Prakash, E.E. EKE, Birpur Division
5. *2008 Flood video*, received from Mr. Kumar Arun Prakash, ADM Disaster Dept., Supaul District
6. *Aapada Maps*, received from Mr. Kumar Arun Prakash, ADM Disaster Dept., Supaul District
7. *Supaul Census Data 2011*, received from Mr. Bhim Sharma, DSO, District Statistics Officer
8. *Flood 2008 Map*, received from Mr. Mathur, FMISC
9. *Present Kosi River Status Map*, received from Mr. Mathur, FMISC
10. *Report of District Disaster Management Works, 2013*, received from Disaster Management Dept., Supaul
11. *Block Map of Basantpur, Raghopur, Saraigarh-Bhaptiyahi*, received from BDO Office
12. *DPR prepared by WRD for Ch. 0.00 km to 28.20 km and Ch. 78.00 to 84.00 km*, received from SDO, EKE Division, Birpur and Supaul Divisions

General References:

1. *Bihar Kosi Flood (2008) Needs Assessment Report*, June 2010. Govt. Of Bihar and the World Bank, Global Facility for Disaster Reduction & Recovery.
2. *Socio- Economic and infrastructural baseline in the project District of Supaul and Saharsa*, Government of Bihar.
3. Ranu Sinha, Martin Burton, *Strengthening the institutional framework for flood and water resources management in Bihar*: Developing a strategy for reform (Phase I), International Finance Corporation
4. *Economics of fish farming in flood prone areas of Bihar with special reference to Kosi river system*, Vide. F.No. 0-15012/49/05 SER), Planning Commission, Govt. of India, New Delhi.
5. *Kosi Flood, how we coped, what we need now?,* 2009, UNDP.
6. Harbhajan Singh, B. Prakash, K. Gohain. 1993. *Facies analysis of the Kosi mega fan deposits* Geology Section, Oil and Natural Gas Commission, ERBC, Nazira (Assam)-785 685, India; Department of Earth Sciences, University of Roorkee, Roorkee, India; Geological Department, Oil India Ltd., Duliajan (Assam). India.
7. Rajiv Sinha. 2009. *Dynamics of a River System– the Case of the Kosi River in North Bihar*. Engineering Geosciences Group, Department of Civil Engineering Indian Institute of Technology, Kanpur.
8. S. K. Mazumdar, 2008. *Protection of flood embankments by spurs with reference to Kosi River.* Individual Consultant, New Delhi
9. *River dynamics and flood hazard assessment with special reference to the Kosi River*. 2011. Institute of Hazard, Risk and Resilience, Durham University.
10. Dilip Kumar, *Millennium strategy for the Kosi River.* Asstt. Professor of flood management Walmi, Patna.

11. Ishwas S. Kale. 2008. *Himalayan catastrophe that engulfed North Bihar.* Department of Geography, University of Pune, Pune - 411 007, Email: vskale@unipune.ernet.in.
12. E. Somanathan. 2010. *Are embankments a good flood-Control strategy? A case study of the Kosi River*. Professor at the Princeton Environmental Institute, Princeton University. Professor, Planning Unit, Indian Statistical Institute, Delhi.
13. Evaluation of the Kosi Embankment a case study – 1979
14. Rashmi Kiran Shrestha, Rhodante Ahlers, Joyeeta Gupta, Marloes Bakker. 2010. *Institutional dysfunction and challenges in flood control along the transboundary Kosi River: A Case study of the Kosi Flood 2008.* UNESCO-IHE, Delft, The Netherlands, Cooperative for Climate and Water.
15. Rajiv Sinha. 2009. *Dynamics of a River System– the Case of the Kosi River in North Bihar*, Engineering Geosciences Group, Department of Civil Engineering, Indian Institute of Technology, Kanpur.
16. Nupur Bose, Ashok Kumar Ghosh, Ajay Govind Bhatt. 2009. *Changing geomorphology of the Kosi river system in the Indian subcontinent*, Department of Geography, Department of Environment and Water Management, A. N. College, Patna, India. nupur.bose@gmail.com, ashok.ghosh51@gmail.com.
17. *Rapid hazard and risk assessment of Post-flood return analysis*. 2009. UNESCO on behalf of OCHA and UNCT, NEPAL funded by UNDP Supported by ICON/ADAPT Nepal.
18. *Bihar Kosi flood recovery project (Restructuring Paper)*. 2013. World Bank.
19. R. Sinha, G.V. Bapalu, L.K. Singh, B. Rath, 2008. *Flood Risk Analysis in the Kosi River Basin, North Bihar Using Multi-Parametric Approach of Analytical Hierarchy Process (AHP). J. Indian Soc. Remote Sens. (Dec.2008) 36:293-307.*
20. Naveen Mangal Joshi, 2008. *PPT- Challenges of Kosi River Basin.*
21. Kanchan Mishra, 2013. *Geomorphological studies and flood risk assessment of Kosi river basin using remote sensing and GIS techniques.*
22. N. Sh. Chen, G. Sh. Hu ,W. Deng, , N. Khanal, Y. H. Zhu and D. Han, 2013. *On the water hazards in the transboundary Kosi River basin.*
23. Alexander Aronsson, Maria Piculell, 2011. *Hydrological Analysis of Kosi River.* Lund University, Sweden.
24. Prafulla Kumar Panda, 2012. *Hydrological and 1 D Hydrodynamic Modeling of Kosi River Paleochannel, Bihar (India).* Assistant Professor, Department of Civil Engineering, CUTM, Paralakhemundi, Odisha.
25. S.B. Pun, 2009. The Kosi Pralaya- *Could the Catastrophe have been averted? And What Next? J.HYDRO NEPAL, Issue No.4, 2009.*
26. *Evaluation of the Kosi Embankment a case study*.1979. National Flood Commission appointed in 1976, Government of India.
27. M/S Leopald and Maddocks Jr., 1955. *Morphology of the Kosi River.* United States Technical Cooperation Mission.
28. Amit Kumar Prabhakar and S. P. Roy, 2008. *Taxonomic diversity of shell fishes of Kosi region of North-Bihar (India)*. University Department of Zoology, T. M. Bhagalpur University, Bhagalpur - 812 007.
29. Ashish Kumar and Yogendra Bahadur, 2009. *Physico-Chemical Studies on the Pollution Potential of River Kosi at Rampur (India).* Department of Chemistry, Bareilly College, Bareilly, India; Department of Chemistry, Agra College, Agra, India.
30. A. K. Prabhakar and S. P. Roy, 2008. *Trade and commerce of shell fishes and their role in economy of the people of Kosi river basin of north Bihar*. University Department of Zoology, Bhagalpur University, Bhagalpur - 812 007 E-mail: drsp_roy@yahoo.com.
31. Amit Kumar Prabhakar and S. P. Roy, 2008. *Ethno-medicinal Uses of Some Shell Fishes by People of Kosi River Basin of North-Bihar, India*. University Department of Zoology, T. M. Bhagalpur University, Bhagalpur - 812 007.
32. *District Plan 2011-2012 Supaul*. District Planning Committee Supaul.
33. H. H. Haines, 1961. *The Botany of Bihar and Orissa.* C.I.E., F.C.H., F.L.S. Late conservator of forests, Bihar and Orissa.
34. *National Wetland Atlas: Bihar*, 2010. ISRO and Ministry of Environment and Forests, Government of India.
35. *Environmental Assessment and Environmental Management Framework for the Bihar Rural Livelihoods Project*, 2007. Centre for Environment Education.

ANNEXURES

ANNEXURE 1: SENSITIVE RECEPTORS IN THE STUDY AREA

Legend for the Sensitive Receptors:

A	Anganwadi	P	Plantation
B	Building	PS	Police Station
BA	Bank	PP	Petrol Pump
C	Church	S	School
CD	Culvert	T	Telegraph/Post Office
F	Flood Administration Office	TR	Tree
G	Graveyard	TL	Temple
H	Hospital/Health Centres	U	Utility Line
HT	Hutments	W	Water Treatment Plant/ Iron Removal Plant
M	Mosque	WA	Water Logged Area

Table A: Sensitive Receptors along EKE Ch. 0.00 km to 28.20 km

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
Anganwadi					
A1	M3	Anganwadi Number: 46, Kalyanpur	26° 20' 38.1"	86° 46' 23.7"	430
A2	L4	Anganwadi Number: 9, Nonpada	26° 21' 22.2"	86° 47' 27.5"	640
A3	B4	Anganwadi, Punarwas, Bhimnagar	26° 29' 53.5"	86° 56' 40.2"	290
A4	C5	Anganwadi No: 17 and Primary Health Centre, Katia Power House	26° 29' 32.1"	86° 56' 34.2"	280
A5	C5	Anganwadi Number: 8, Raniganj Village	26° 29' 41.3"	86° 57' 25.2"	1600
A6	F5	Anganwadi No: 32, Ratanpur Village	26° 26' 24.4"	86° 54' 0.9"	550
A7	D5	Anganwadi Centre: 26, Madhera Village	26° 28' 10.8"	86° 56' 16.4"	790
A8	E6	Anganwadi Number: 22, Bhagwanpur Village	26° 28' 9.2"	86° 55' 55.2"	370
A9	F6	Anganwadi Centre: 38, Ratanpur Village	26° 26' 25.0"	86° 55' 18.1"	1450
A10	F7	Anganwadi, Badhua Bahuvarva, Ratanpur Village	26° 26' 35.6"	86° 55' 47.3"	1830
A11	F7	Anganwadi Number: 27, Badhua Bahuvarva, Ratanpur Village	26° 27' 2.1"	86° 56' 2.1"	1650
A12	E6	Anganwadi No: 28, Samda Village	26° 27' 35.6"	86° 56' 14.9"	1370
A13	E6	Anganwadi (New), Samda Village	26° 27' 54.7"	86° 56' 25.1"	1300
A14	D6	Anganwadi Centre: 51, Katia Village	26° 28' 20.0"	86° 57' 4.2"	1800

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
A15	B5	Anganwadi No: 04, Vaijayanath Pur Village	26° 30' 1.3"	86° 57' 53.7"	2200
A16	C6	Anganwadi No:60, Bharatpur Village	26° 29' 0.5"	86° 58' 25.4"	3470
A17	D7	Anganwadi (New) Near Primary School, Kataiyah bus station.	26° 28' 23.1"	86° 57' 51.2"	2950
A18	F6	Adarsh Anganwadi No: 30, Ratanpur village	26° 26' 21.5"	86° 54' 41.2"	1050
A19	G6	Anganwadi, Dadha Village	26° 25' 37.1"	86° 52' 52.6"	360
A20	G6	Anganwadi, Basawanpatti Village	26° 25' 31.0"	86° 52' 54.2"	540
A21	I8	Anganwadi Centre: 14, Karjain Village	26° 24' 8.2"	86° 53' 12.1"	2470
A22	I7	Anganwadi Number: 18, Karjain Village	26° 24' 28.6"	86° 52' 33.6"	1300
A23	I6	Anganwadi Number: 45, Narpatpatti Village	26° 24' 17.8"	86° 50' 55.5"	220
A24	J6	Anganwadi Number: 23, Rupoli, Punarwas	26° 23' 39.1"	86° 50' 7.0"	300
A25	I5	Anganwadi No: 36, Narpatpatti Village	26° 23' 55.0"	86° 50' 21.7"	200
A26	J6	Anganwadi (Under construction), Chitti Village	26° 23' 9.5"	86° 50' 5.7"	990
A27	J9	Anganwadi, Jagdishpur	26° 23' 22.7"	86° 53' 22.2"	3700
A28	K6	Anganwadi No: 1, Kodali Village	26° 22' 51.2"	86° 48' 46.4"	230
A29	K6	Anganwadi, Kodali Village	26° 23' 0.9"	86° 48' 54.3"	180
A30	B5	Anganwadi Centre: 15, Lalpur, Bhimnagar	26° 30' 26.6"	86° 58' 31.7"	3100
A31	B5	Anganwadi No: 14, Lalpur	26° 30' 22.5"	86° 57' 47.9"	1800
A32	A4	Anganwadi, Shersha Chowk, Bhimnagar	26° 30' 51.5"	86° 57' 29.8"	1450
A33	K8	Anganwadi: 12, Ansari Mohalla, Chitti Village	26° 22' 46.9"	86° 50' 56.4"	2400
A34	K7	Anganwadi: 18, Chitti Village	26° 22' 32.8"	86° 50' 6.8"	2000
A35	K7	Anganwadi: 13, Chitti Village	26° 22' 28.2"	86° 50' 1.8"	1900
Building					
B1	M4	Sericulture Centre, Sadanandpur	26° 20' 48.0"	86° 47' 10.2"	1120
B2	K5	Office of Kosi Project at Spur No: 22.3	26° 22' 40.0"	86° 48' 19.4"	30
B3	C5	BSHPC, Katia	26° 29' 37.3"	86° 56' 50.9"	700
B4	E6	Public Distribution System/ration shop, Bhagwanpur Village	26° 27' 57.4"	86° 55' 46.5"	350

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
B5	E6	Flood Shelter House, Bhagwanpur Village	26° 27' 30.5"	86° 55' 25.1"	300
B6	D6	Food storage, Agricultural Society, Katia Village	26° 28' 13.6"	86° 56' 59.1"	1760
B7	K5	Community Centre, Lohaha Panchayat (MGNREGA)	26° 22' 44.7"	86° 48' 31.3"	80
B8	J5	On EKE: Brick Work	26° 23' 15.7"	86° 49' 11.9"	5
B9	K5	CS: Lokha Gram Panchayat Building	26° 22' 44.9"	86° 48' 32.2"	90
Culvert					
CD1	F5	CS: Culvert	26° 26' 22.8"	86° 53' 30.8"	30
CD2	G7	CS-Culvert	26° 26' 4.7"	86° 53' 7.6"	35
CD3	H6	CS: Culvert	26° 24' 38.2"	86° 51' 25.9"	50
CD4	I7	CS: Culvert	26° 24' 27.6"	86° 51' 3.3"	80
CD5	I5	CS: Culvert	26° 24' 10.3"	86° 50' 32.3"	20
CD6	I7	CS: Culvert	26° 24' 0.7"	86° 50' 19.8"	25
CD7	J6	CS:Culvert-2	26° 23' 43.4"	86° 49' 57.6"	45
CD8	J5	CS: Culvert	26° 23' 28.2"	86° 49' 37.9"	55
CD9	K6	CS: Culvert	26° 22' 54.3"	86° 48' 40.2"	50
CD10	K5	CS: Bridge	26° 22' 39.5"	86° 48' 12.2"	50
CD11	K5	CS-Culvert	26° 22' 18.9"	86° 47' 51.4"	40
CD12	L5	CS: Culvert, Dagmara Project Board	26° 22' 2.6"	86° 47' 39.0"	40
CD13	L4	CS: Culvert	26° 21' 36.4"	86° 47' 13.1"	60
CD14	L4	CS: Culvert	26° 21' 25.0"	86° 46' 59.1"	60
Graveyard					
G1	B4	Muslim Burial Ground (Kabaristhan), Saileshpur, Bhim Nagar	26° 30' 15.8"	86° 56' 35.3"	40
G2	K7	Burial Ground/Kabaristhan, Chitti Village	26° 22' 17.4"	86° 50' 43.0"	2880
Hospital/Health Centres					
H1	B5	Primary Health Centre, Vaijayanath Pur Village	26° 30' 6.8"	86° 57' 54.9"	2200
H2	I9	Abandoned PHC, Ragavpur Village	26° 23' 52.8"	86° 54' 42.6"	4800
H3	G6	PHC, Dadha Village	26° 25' 36.3"	86° 52' 50.1"	320
H4	G6	Hospital/ Primary Health Centre, Basawanpatti Village	26° 25' 36.3"	86° 52' 50.0"	330
H5	I7	NRHM Centre, Kobada/Kohvara, Basawanpatti	26° 24' 21.1"	86° 52' 29.8"	1420
Hutments					
HT1	J5	Spur: 21.05km CS: Habitation Hutments	26° 23' 5.4"	86° 48' 49.6"	20
HT2	M3	RS: Hutments	26° 20' 25.5"	86° 46' 2.2"	25
HT3	M3	OBS: Hutments	26° 20' 40.5"	86° 46' 8.9"	15

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
HT4	M3	RS: Hutments	26° 20' 44.0"	86° 46' 9.8"	20
HT5	M3	RS: Habitation Hutments	26° 20' 48.9"	86° 46' 12.0"	25
HT6	M3	RS: Habitation Hutments	26° 20' 59.2"	86° 46' 21.6"	20
HT7	G7	CS-Habitation Hutments	26° 26' 7.3"	86° 53' 9.1"	20
HT8	G6	CS: Hutments.	26° 25' 53.2"	86° 52' 51.4"	15
HT9	G6	CS: Hutments	26° 25' 41.1"	86° 52' 39.3"	20
HT10	K5	On EKE: Shops and Huts	26° 22' 42.7"	86° 48' 25.8"	50
Mosque					
M1	B4	Jamma Masjid, Punarwas, Bhimnagar	26° 29' 53.5"	86° 56' 40.0"	290
M2	E7	Mosque, Kataiyah Village	26° 27' 37.8"	86° 57' 30.9"	3100
M3	E8	Mosque, Kataiyah Village	26° 27' 23.4"	86° 57' 37.2"	3500
M4	I6	Mosque near EKE, Narpatpatti village	26° 24' 25.7"	86° 51' 15.1"	270
M5	J6	Jumma Masjid, Rupoli, Punarwas	26° 23' 38.8"	86° 50' 6.1"	300
M6	J6	Madrasa Ullum, Narpatpatti Village	26° 23' 40.3"	86° 50' 5.0"	245
M7	J6	Masjid, Narpatpatti Village	26° 23' 32.2"	86° 50' 9.0"	515
M8	J6	Juma Masjid, Gopalpur	26° 23' 19.7"	86° 50' 9.5"	830
M9	J6	id-gha, Chitti Village	26° 22' 55.0"	86° 49' 56.0"	1050
M10	K7	Masjid, Chitti Hanuman Nagar Village	26° 22' 50.8"	86° 50' 2.2"	1340
M11	K6	id-gha, Chitti Village	26° 22' 51.6"	86° 48' 41.8"	130
M12	H9	id-gha, Chitti Village	26° 24' 54.4"	86° 54' 22.3"	3050
M13	J7	Jumma Masjid Chitti Village	26° 22' 57.9"	86° 50' 53.7"	2100
M14	K7	Jumma Masjid, Chitti Village	26° 22' 7.9"	86° 50' 40.1"	3000
M15	K7	Juma Masjid, Chitti	26° 22' 25.4"	86° 50' 2.4"	2000
M16	K7	Choti Masjid, Chitti	26° 22' 32.8"	86° 50' 7.0"	1870
M17	J5	Masjid	26° 23' 1.2"	86° 48' 54.0"	170
School					
S1	G8	DISE CODE:0101806, MADRASA MAJHARUL OLUM, RATANPUR	26° 25' 40.0"	86° 55' 11.0"	2850
S2	D7	DISE CODE:0104301, PS BARANTPUR, BARANTPUR	26° 28' 55.0"	86° 58' 17.0"	3390

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
S3	C4	DISE CODE:0100301, P/S RANIGANJ, RANIGANJ	26° 29' 2.3"	86° 56' 21.5"	180
S4	D6	DISE CODE:0100401, P/S SHIVNAGAR, SHIVNAGAR	26° 28' 52.5"	86° 56' 32.8"	560
S5	E6	DISE CODE:0101302, P/S MANDAL TOLA SAMDA, SAMDA	26° 27' 23.4"	86° 56' 27.5"	1900
S6	A5	DISE CODE:0100203, P/S NAYA TOLA LALPUR, LALPUR, NAYA TOLA	26° 30' 56.6"	86° 57' 56.4"	2230
S7	B5	DISE CODE:0103702, P/S PASWAN TOLA, LALPUR, LALPUR, PASWAN TOLA	26° 30' 32.0"	86° 58' 31.3"	3000
S8	B6	DISE CODE:, NPS MUSLIM TOLA LALPUR, LALPUR, MUSLIM TOLA	26° 29' 56.7"	86° 58' 48.0"	3700
S9	A4	DISE CODE:0104902, P/S MUSHAR MEHTA TOLA BHIMNAGAR, BHIMNAGAR, MUSHAR MEHTA TOLA	26° 30' 41.2"	86° 56' 57.2"	580
S10	G9	DISE CODE: PS ANSARI TOLA SONAPUR, DERBANDHE, ANSARI TOLA	26° 25' 38.3"	86° 56' 19.8"	3700
S11	D6	DISE CODE:0104102, PS KATAIA HINDI, KARAIA	26° 28' 14.0"	86° 56' 58.0"	1840
S12	E8	DISE CODE:0104101, PS KATAIA URDU, KATAIA	26° 27' 48.9"	86° 57' 54.2"	3540
S13	D7	DISE CODE:0105702, PS SHARMA TOLA, KARAIA	26° 28' 17.7"	86° 58' 40.2"	4350
S14	D7	DISE CODE:0105304, PS RISHIDEV TOLLA KATAIA, KARAIA, RISHIDEV TOLLA	26° 28' 21.8"	86° 57' 49.9"	2950
S15	H9	DISE CODE:0101801, PS KANYA RATANPUR, RATANPUR	26° 25' 22.6"	86° 55' 8.9"	3230
S16	F6	DISE CODE:0101601, PS BAISI CHAKLA, BUCHNUCHAKLA	26° 26' 25.5"	86° 54' 50.1"	1000
S17	G9	DISE CODE:0102001, PS BAISI CHAKLA, BASI CHAKLA	26° 26' 0.1"	86° 55' 36.9"	2380
S18	F7	DISE CODE:, PS JITMHAN TOLA, RATANPUR, JITMHAN TOLA	26° 26' 32.9"	86° 55' 45.4"	1800
S19	I6	DISE CODE:0102801, PS PARSHI, PARSAHI	26° 24' 34.8"	86° 51' 16.1"	20

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
S20	G6	DISE CODE: PS TEDI BAZAR, BAHTUNIA URF SATAN PATTI, TEDI BAZAR	26° 25' 31.0"	86° 52' 31.9"	20
S21	C6	DISE CODE:0104201, UMS RAGHUNATHPUR, RAGHUNATHPUR	26° 29' 21.2"	86° 58' 2.7"	2750
S22	D5	DISE CODE:0101301, MS SAMDA, SAMDA	26° 28' 7.0"	86° 56' 22.0"	970
S23	F6	DISE CODE:0101102, UMS BHAGWANPUR - 1, BHAGWANPUR	26° 27' 6.0"	86° 55' 5.0"	330
S24	D5	DISE CODE:0101201, UMS SAHEBAN, SAHEBAN	26° 28' 2.4"	86° 55' 48.2"	315
S25	B5	DISE CODE:0100201, M/S LALPUR, LALPUR	26° 30' 23.9"	86° 57' 51.9"	2000
S26	C5	DISE CODE:0100102, US BHIMNAGAR KALONI, BHIMNAGAR, BHIMNAGAR KALONI	26° 29' 40.6"	86° 57' 24.1"	1590
S27	G10	DISE CODE:0104001, MS KAMATPUR, KAMATPUR	26° 26' 19.0"	86° 57' 27.0"	4300
S28	G7	DISE CODE:0101501, UMS BAIJNATHPUR 02, BAIKNATHPUR	26° 26' 4.8"	86° 53' 30.3"	450
S29	I5	DISE CODE:0102901, UMS NARPAT PATTI, NARPAT PATTI	26° 23' 55.4"	86° 50' 21.7"	180
S30	K10	DISE CODE:0801601, P/S PADUMNAGAR, BAURAHA, PADUMNAGAR	26° 22' 52.6"	86° 53' 47.6"	4850
S31	K8	DISE CODE:0801710, P/S SUDAMA NAGAR HARIRAHA, HARIRAHA, SUDAMA NAGAR	26° 22' 20.4"	86° 51' 8.8"	3200
S32	K8	DISE CODE:0801711, P/S PASWAN TOLA HARIRAHA, HARIRAHA, PASWAN TOLA	26° 22' 49.5"	86° 51' 34.5"	3000
S33	J7	DISE CODE:0805702, P/S KHATWAY TOLA HARIRAHA, HARIRAHA, KATWAY TOLA	26° 23' 22.2"	86° 51' 46.1"	2450
S34	J9	DISE CODE:0800604, P/S KARJAIN, KARJAIN, KARJAIN	26° 23' 23.8"	86° 53' 21.9"	3700
S35	I7	DISE CODE:0800202, P/S BASAWANPATTI, BASAWANPATTI, BASWANPATTI	26° 24' 27.3"	86° 52' 41.5"	1400
S36	H8	DISE CODE:, P/S BASWANPATTI WARD	26° 25' 30.2"	86° 53' 8.7"	860

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
		NO-1, BASWANPATTI, BASWANPATTI			
S37	H8	DISE CODE:0800609, P/S MUSHARI TOLA KARJAIN UTTR, KARJAIN, MUSHARI TOLA	26° 24' 49.5"	86° 53' 34.7"	2170
S38	I7	DISE CODE:0800403, P/S SHARMA TOLA JAGDISHPUR, JAGDISPUR, SHARMA TOLA	26° 24' 0.6"	86° 52' 34.5"	2000
S39	H7	DISE CODE:, NPS PUNARWAS BASWANPATTI, MANSAPUR, BASAWANPATTI	26° 25' 19.1"	86° 52' 51.7"	680
S40	I9	DISE CODE:0800901, M/S VAYASI GADDI, BAISI, GADDI	26° 23' 49.5"	86° 54' 41.5"	4750
S41	H9	DISE CODE:0800701, UMS DAHGAMA, BAISI, DAHGAMA	26° 24' 59.0"	86° 54' 10.3"	2600
S42	I10	DISE CODE:0800902, UMS BAYASI BRAHMAN TOLA, BAISI, BRAHMAN TOLA	26° 24' 35.6"	86° 55' 51.9"	5100
S43	J7	DISE CODE:0801705, UMS HARIRAHA BALAK, HARIRAHA, HARIJAN	26° 23' 0.6"	86° 51' 51.5"	3100
S44	K9	DISE CODE:0801703, UMS HARIRAHA DHANTA, HARIRAHA, DHANTA	26° 22' 23.1"	86° 52' 17.6"	4300
S45	J8	DISE CODE:0800401, M/S JAGDISHPUR, KARJAIN, JAGDISHPUR	26° 23' 39.0"	86° 52' 47.5"	2700
S46	L7	DISE CODE:0802101, UMS DHUDHARI, MOTIPUR, DHUDHARI	26° 21' 19.3"	86° 50' 51.6"	4350
S47	L7	DISE CODE:0901103, PS SAH 7 RAM TOLA CHHIRHI, CHHITHI HANUMAN NAGAR, CHHIRHI	26° 21' 59.0"	86° 50' 25.7"	3000
S48	L1	DISE CODE:0902601, PS SAINI, SIANI, SIANI	26° 21' 38.9"	86° 43' 31.2"	4900
S49	L1	DISE CODE: PS SIANI URDU, SIANI, SIANI	26° 21' 42.8"	86° 43' 51.2"	4320
S50	M5	DISE CODE:0901704, PS SADANAND PUR, SADANANDPUR, MUKHIYA TOLA SADANAND PUR	26° 20' 29.1"	86° 47' 44.2"	2200

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
S51	I2	DISE CODE:0900301, PS BAHUARWA, BAHUARWA, BAHUARWA	26° 23' 57.0"	86° 47' 14.1"	3050
S52	I3	DISE CODE:0900501, PS UGANIPATTI, UGANIPATTI, UGANIPATTI	26° 24' 30.6"	86° 48' 23.9"	2750
S53	M3	DISE CODE:0900901, PS KABIAHI, KABIAHI, KABIAHI	26° 20' 30.9"	86° 46' 7.6"	80
S54	M6	DISE CODE:0901402, PS PRITHVIPATTI, SHAHPUR, PIRTHIPATTI, PRITHVIPATTI	26° 20' 59.6"	86° 49' 44.3"	4000
S55	K7	DISE CODE:0901201, UMS CHHIRHI URDU, CHHITHI HANUMANNAGAR, CHHIRHI	26° 22' 24.4"	86° 50' 1.5"	2320
S56	K5	DISE CODE:0901302, MS SIMRI, SIMRI, SIMRI	26° 22' 36.3"	86° 48' 16.2"	100
S57	L4	DISE CODE:0900104, MS JANATA JAGU MEHTA BAISA, BAISA, BAISA	26° 21' 16.9"	86° 47' 12.5"	480
S58	L5	DISE CODE:, UMS NARPARA, NONPARA, NONPARA MEHTA TOLA	26° 21' 55.4"	86° 47' 47.6"	350
S59	I3	DISE CODE:0900101 UMS LOKHA PALAR, LAUKAHA LOKHA PALAR	26° 24' 24.5"	86° 48' 22.7"	2690
S60	J5	DISE CODE:0900103, MS LOKHI, LAUKAHA	26° 23' 0.6"	86° 48' 54.0"	175
S61	M6	DISE CODE:0901405, UMS LAXMIPUR, SHAHPUR PIRTHIPATTI, HARIJAN TOLA LAXMIPUR	26° 20' 34.5"	86° 49' 26.7"	135
S62	I5	Spur Ch. 16.98 km K&M English School, Narpatpatti	26° 24' 20.5"	86° 50' 43.7"	20
S63	J5	Spur: 21.05km CS: School	26° 23' 2.5"	86° 48' 53.9"	130
Telegraph/Post Office					
T1	D5	Sub Post Office, Sahiwan Village	26° 28' 3.0"	86° 55' 48.6"	300
Temple					
TL1	M3	Sri Ram Mandir, Kalyanpur	26° 20' 30.0"	86° 46' 19.0"	380
TL2	M2	Durga Mandir, Sadanandpur	26° 20' 41.9"	86° 45' 1.3"	1730

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
TL3	M4	Darga within Farm fields, Sadanandpur	26° 20' 48.3"	86° 46' 45.2"	680
TL4	L4	Sriram Janaki Mandir, Baisha Village	26° 21' 17.3"	86° 47' 10.1"	420
TL5	L5	Bagawathi Mandir and Hanuman Statue, Nonpada Village	26° 21' 28.2"	86° 47' 57.4"	1000
TL6	K5	Durga Mandir, Simri Village	26° 22' 38.1"	86° 48' 15.0"	90
TL7	K5	Hanuman Mandir, Simri Village	26° 22' 40.2"	86° 48' 20.0"	25
TL8	K5	Sri Ram Mandir. Simri Village (5 years old Temple)	26° 22' 39.1"	86° 48' 24.2"	90
TL9	B4	Hanuman Mandir, Saileshpur, Bhimnagar	26° 30' 30.5"	86° 56' 39.9"	30
TL10	B4	Devi Mandir in Farm Field, Punarwas, Bhimnagar	26° 29' 49.6"	86° 56' 28.5"	20
TL11	B4	Hanuman Mandir (Near Bus Stand) Raniganj village	26° 29' 49.6"	86° 56' 28.5"	25
TL12	C5	Durga Mandir, Katia	26° 29' 44.2"	86° 57' 2.5"	980
TL13	B4	Shiv Mandir, Katia Village (40 yrs old)	26° 29' 48.5"	86° 57' 21.8"	1450
TL14	B4	Viswakarma Mandir, Katia village, Birpur	26° 29' 48.5"	86° 57' 21.7"	1460
TL15	C5	Shiv Mandir in Farm fields, Raniganj Village	26° 29' 3.8"	86° 56' 28.9"	360
TL16	D5	Hanuman Mandir adjoining State Highway: 106, Raniganj	26° 28' 53.0"	86° 56' 19.4"	210
TL17	D5	Ram Mandir (75 Years old), Shiv nagar	26° 28' 11.5"	86° 56' 21.5"	950
TL18	D5	Mahadev Mandir, Samdha Village	26° 28' 10.5"	86° 56' 16.0"	760
TL19	D5	Durga Mandir, Samdha Village	26° 28' 10.8"	86° 56' 16.1"	780
TL20	D5	Rajaji Asthan, Samdha Village	26° 28' 10.8"	86° 56' 15.9"	790
TL21	D5	Durga Mandir, Sahiwan Village	26° 28' 13.9"	86° 55' 44.4"	20
TL22	D5	Ram Mandir, Sahiwan Village	26° 28' 14.2"	86° 55' 43.5"	10
TL23	E6	Dina Badri Mandir, Bhagwanpur Village	26° 28' 1.1"	86° 55' 57.9"	560
TL24	F6	Sriram Janaki Mandir, Bhagwanpur village	26° 27' 5.9"	86° 55' 7.2"	375
TL25	F6	Shiv Mandir, Ratanpur village	26° 26' 38.3"	86° 55' 3.5"	880
TL26	E6	Laxmi Mandir, Bhagwanpur Village	26° 27' 20.4"	86° 56' 5.4"	1420
TL27	E7	Shiv Mandir, Samdha Village	26° 28' 3.0"	86° 56' 36.9"	1400

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
TL28	D6	Shivji Mandir, Katia Village	26° 28' 12.6"	86° 56' 57.3"	1740
TL29	D6	Temple without Murthi, Katia Village	26° 28' 13.7"	86° 56' 59.2"	1810
TL30	D6	Hanuman Statue, Katia Village	26° 28' 19.6"	86° 57' 5.1"	1820
TL31	C6	Shiv Temple, Bharatpur Village	26° 29' 1.7"	86° 58' 24.8"	3480
TL35	I9	Temple/Samadhi. Ragavpur Village	26° 23' 49.4"	86° 54' 41.6"	4780
TL36	F6	Shiv Mandir, Bachnuchkla Village	26° 26' 24.6"	86° 54' 49.5"	1000
TL37	H7	Maa Durga Mandir, Dadha, Sattanpatti.	26° 25' 19.2"	86° 52' 26.7"	110
TL38	G6	Sita Mandir, Takurwadi, Basawanpatti	26° 25' 34.8"	86° 52' 53.5"	430
TL39	G6	Durga Mandir, Basawanpatti	26° 25' 31.1"	86° 52' 54.3"	520
TL40	I8	Sri Ram Mandir, Kobada/Kohvara, Basawanpatti	26° 24' 8.2"	86° 53' 12.1"	2450
TL41	I7	Swami Dayanand Shrine , Kohvara, Basawanpatti	26° 24' 25.4"	86° 52' 31.6"	1320
TL42	I7	Sri Ram Janaki Mandir (estd:1881), Kohvara, Basawanpatti	26° 24' 25.3"	86° 52' 31.6"	1370
TL43	I6	Sri Durga Mandir, Narpatpatti Village	26° 24' 16.7"	86° 50' 56.0"	250
TL44	J6	Sri Ram Mandir, Rupoli, Punarwas	26° 23' 37.6"	86° 50' 2.7"	260
TL45	J6	Hanuman Mandir, Gopalpur	26° 23' 19.8"	86° 50' 9.7"	810
TL46	J6	Temple/Shrine, Chitti Village	26° 23' 9.7"	86° 50' 5.8"	970
TL47	I7	Hanuman Mandir, Kobhara	26° 24' 6.4"	86° 52' 19.3"	1640
TL48	I7	Combined Temple of Shiv, Ram and Hanuman, Jagdishpur Village	26° 23' 50.9"	86° 52' 34.9"	2270
TL49	J8	Bajrangbali Mandir, Mahavir Chowk, Jagdishpur Village	26° 23' 18.3"	86° 53' 3.4"	3580
TL50	J9	Mandir, Jagdishpur	26° 23' 11.3"	86° 53' 10.0"	3850
TL51	J9	Ma Durga Mandir, Karjain Village	26° 23' 22.8"	86° 53' 22.1"	3700
TL52	I8	Hanuman Mandir, Karjain Village	26° 23' 49.9"	86° 53' 55.0"	3720
TL53	I8	Hanuman Mandir, Karjain Village	26° 23' 57.0"	86° 54' 1.0"	3710
TL54	J5	Hanuman Mandir, Kodali Village	26° 23' 1.2"	86° 48' 54.0"	160
TL55	K6	Temple Under construction, Kodali Village	26° 22' 46.6"	86° 48' 42.8"	260

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
TL56	K5	Durga Devi Temple, Kodali Village	26° 22' 43.9"	86° 48' 28.7"	50
TL61	K10	Hanuman Temple, Dumri Chowk, Basantpur	26° 22' 54.2"	86° 53' 17.7"	4380
TL62	A6	Hanuman Temple, Kontaha Village	26° 30' 54.6"	86° 58' 51.1"	3670
TL63	B5	Maruthi Mandir, Lalpur, Bhimnagar	26° 30' 26.9"	86° 58' 31.9"	3130
TL64	B5	Hanuman Mandir, Bhimnagar Junction	26° 30' 31.5"	86° 57' 41.0"	1730
TL65	A5	Sri ram Mandir situated on right side towards Katiya Road	26° 30' 53.0"	86° 57' 39.5"	1700
TL66	A4	Shiv Mandir, Shersha Chowk, Bhimnagar	26° 30' 50.6"	86° 57' 30.9"	1480
TL67	G6	RS: Temple Bhagwati	26° 25' 45.6"	86° 52' 40.6"	50
TL68	I5	Spur Ch. 16.98 km Hanuman Mandir	26° 24' 20.5"	86° 50' 43.7"	10
TL69	K5	On EKE: Bhagwati Mandir	26° 22' 42.7"	86° 48' 25.8"	0
Trees					
TR1	M3	OBS: Mix Plantation: Mango, Banana, Bamboo, Anona, Jackfruit, and Jamun	26° 20' 40.5"	86° 46' 8.9"	On EKE
TR2	E6	RS: Bombax-1-Girth: 1.88m, Prosophis-1-Girth: 1.26m, Mix Plant Growth	26° 27' 53.6"	86° 55' 28.1"	On EKE
TR3	E6	Spur Ch. 6.57 km, Pithecolobium and Bamboo Plantation RS: Bombax-6-(Girth: 0.94-3.14 m), CS:Culvert)	26° 27' 52.1"	86° 55' 27.0"	On EKE
TR4	E6	CS: Pithari-2- (Girth: 1.57-2.2 m), On EKE- Pithecolobium	26° 27' 50.5"	86° 55' 26.3"	On EKE
TR5	E6	CS: Rain Tree-2-(Girth: 1.92-2.51 m), Pithari-3-(Girth: 1.92-2.2 m), Culvert	26° 27' 49.2"	86° 55' 25.5"	On EKE
TR6	E6	Pithecolobium-6-(Girth: 0.94-1.88 m), Pithari-2-Girth: 0.63 m	26° 27' 48.7"	86° 55' 24.6"	On EKE
TR7	E6	On EKE: -Pithecolobium1-Girth: 0.94 m , CS: Rain Tree-1-Girth: 3.77 m	26° 27' 47.9"	86° 55' 24.4"	On EKE
TR8	E6	Simar-2-(Girth: 1.63-1.92 m), -Pithecolobium3-(Girth: 0.63-1.26 m)	26° 27' 47.4"	86° 55' 23.7"	On EKE
TR9	E6	RS: Pithecolobium-3-(Girth: 0.63-1.92 m), CS: Mix Plantation: Jackfruit, Guava, Mango,	26° 27' 45.0"	86° 55' 21.8"	On EKE

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
		Mehandi, Peepal			
TR10	E6	RS: Simar-2-Girth: 1.63 m, Pithecolobium-1-Girth: 0.93 m	26° 27' 44.3"	86° 55' 21.6"	On EKE
TR11	E5	On EKE-Pithari-1-Girth: 1.26 m	26° 27' 42.6"	86° 55' 20.7"	On EKE
TR12	M3	Spur: 27.34 km, Mixed Plantation: Mango, Bamboo, Anona	26° 20' 46.0"	86° 46' 10.6"	On Spur
TR13	E5	RS: Pithari-4-(Girth0.94-1.88 m), Pithecolobium-4-(Girth0.94-1.88 m)	26° 27' 42.2"	86° 55' 20.1"	On EKE
TR14	E5	Spur Ch.6.94 km. PithecolobiumTrees Near Spur	26° 27' 41.2"	86° 55' 19.3"	On Spur
TR15	E5	OBS: Pithecolobium (Girth0.94-1.57 m), CS: Mango, Pithari, and PithecolobiumON EKE: Trees-15-(GirthPithecolobium0.94-3.14 m)	26° 27' 39.5"	86° 55' 18.4"	On EKE
TR16	E5	On EKE: Pithecolobium-5-(Girth0.94-1.88 m), RS: Pithecolobium-22-(Girth0.94-1.88 m), CS: Pithecolobium11-Girth 0.63-4.65 m	26° 27' 35.8"	86° 55' 16.0"	On EKE
TR17	E5	On EKE: Pithecolobium-1, CSS: Mango-2, Pithecolobium-9. RS: Pithecolobium-20, Pithari-4	26° 27' 27.1"	86° 55' 10.0"	On EKE
TR18	E5	CS: Pithecolobium-1, RS: Simar-1	26° 27' 24.2"	86° 55' 6.9"	On EKE
TR19	E5	On EKE-AcaciAcacia-1-Girth: 0.93 m RS- Pithecolobium-1-Girth: 1.26 m, Pithari-1-Girth: 1.88 m	26° 27' 17.4"	86° 55' 0.3"	On EKE
TR20	E5	CS:Peepal-1-Girth: 4.71 m RS:Pithari-2-Girth: 1.88 m CS: -Pithecolobium1-1m, Pithari-1-Girth: 4.71 m	26° 27' 15.5"	86° 54' 58.3"	On EKE
TR21	F6	On EKE: Pithecolobium-2 CS: Pithecolobium-12 RS: Pithecolobium-24	26° 27' 6.7"	86° 54' 49.2"	On EKE
TR22	F6	RS: Pithecolobium-8 On EKE: Pithecolobium-4 CS: Pithecolobium10	26° 26' 59.3"	86° 54' 41.7"	On EKE
TR23	M3	Pithari Tree - Near Spur - 27.34 km	26° 20' 47.2"	86° 46' 8.6"	On Spur
TR24	F6	Spur Ch.8.7 km. On EKE: Pithecolobium-2,	26° 26' 57.4"	86° 54' 39.6"	On EKE

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
		Near Spur: Mango, Pithari, , Pithecolobium CS: Mango, Peepal, Banyan (Girth: 9.11 m)			
TR25	F6	RS: Pithecolobium-16, Pithari-2 (Girth: 0.1.26-2.8m) CS: Pithecolobium-10, Peepal-1, Culvert On EKE: Pithecolobium-5-(Girth: 0.1.26- 2.8m)	26° 26' 56.2"	86° 54' 37.8"	On EKE
TR26	F6	On EKE: Pithecolobium-1-1m, RSS: Acacia -1, Pithecolobium2, Peepal-1, Banyan-1	26° 26' 54.8"	86° 54' 29.0"	On EKE
TR27	F6	Spur Ch.9.25 km. Near Spur: Mango, Pithari, Simar, Bamboo. RS: Pithecolobium-2	26° 26' 53.1"	86° 54' 18.9"	On EKE
TR28	F5	Spur: 9.5 km, On EKE: Prosophis-2, RS: AcaciAcacia-1, Pithecolobium-5, CS: Pithecolobium-5	26° 26' 51.4"	86° 54' 10.0"	On EKE
TR29	F5	Spur Ch. 9.5km, RS: Pithari-3, Pithecolobium-2, Acacia-1, Simar-1	26° 26' 50.1"	86° 54' 7.8"	On Spur
TR30	F5	On EKE Peepal-1-Girth: 6.59m.	26° 26' 47.6"	86° 54' 2.2"	On EKE
TR31	F5	Spur Ch. 10.00 km, Spur U/S: Pithari, Pithecolobium, AcaciAcacia CS: Mix Vegetation	26° 26' 44.7"	86° 53' 56.2"	On Spur
TR32	F5	CS: Peepal-1-Girth: 6.91m. ON EKE: Old Structure, RS: Pithecolobium-1-Girth: 1.26m., CS: Mango-1-Girth: 0.5m., Anona-1-Girth: 0.47m	26° 26' 44.0"	86° 53' 55.8"	On EKE
TR33	F5	On EKE: Pithecolobium-1, CS: Pithecolobium-5, Pithari-1, Peepal-1, Farhar-4	26° 26' 38.7"	86° 53' 49.3"	On EKE
TR34	M3	RS: Mix Plantation: Mango, Coconut, Jackfruit, and Guava. Girth: 0.33-0.63m.	26° 20' 47.3"	86° 46' 11.2"	On EKE
TR35	F5	Jack Fruit Trees -1- Girth: 1.57m, Anona-2, Pithari-4	26° 26' 31.2"	86° 53' 40.0"	On EKE

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
TR36	F5	Spur: 10.9 km, Spur D/S: Pithecolobium-1, Spur U/S: Pithecolobium-1.	26° 26' 25.7"	86° 53' 32.5"	On Spur
TR37	F5	CS: Peepal Tree	26° 26' 23.8"	86° 53' 30.4"	On EKE
TR38	G7	On EKE: Peepal-1-3.5m, RS: Pithecolobium-5, CS: Pithari-10	26° 26' 17.0"	86° 53' 21.9"	On EKE
TR39	G7	On EKE: Pithecolobium-2 RS: Pithecolobium-8 CS: Acacia-3, Pithecolobium-4	26° 26' 11.0"	86° 53' 14.0"	On EKE
TR40	G7	CS-Peepal-1-(Girth: 0.63-3.7 m)	26° 26' 5.8"	86° 53' 8.0"	On EKE
TR41	G7	Pithecolobium-1 near spur	26° 26' 7.3"	86° 53' 9.1"	On EKE
TR42	G6	On EKE: Pithecolobium-2 RS: Pithecolobium-10, Pithari-5 CS: Mango-2, Pithecolobium-4, Nerium-1	26° 25' 54.4"	86° 52' 52.9"	On EKE
TR43	G6	Spur Ch.12.37km, Near Spur: Pithecolobium, Pithari, CS: Pithecolobium-1-Girth: 1.88m	26° 25' 53.2"	86° 52' 51.4"	On Spur
TR44	G6	RS: Pithecolobium-2-(Girth: 0.47-.63m), Acacia -1-Girth: 1.0 m	26° 25' 50.0"	86° 52' 47.5"	On EKE
TR45	M3	RS: Mix Plantation: Mango, Bamboo. Girth: 0.35-0.45m	26° 20' 48.0"	86° 46' 11.6"	On EKE
TR46	G6	CS: Mix Plantation: Moringa, Guava, Banana, Jack Fruit, Mango	26° 25' 46.7"	86° 52' 44.3"	On EKE
TR47	G6	RS: Peepal Tree	26° 25' 45.0"	86° 52' 42.5"	On EKE
TR48	G6	CS: Mango, Arjun, Neem (19 Trees), Bamboo Plantation	26° 25' 42.7"	86° 52' 40.9"	On EKE
TR49	G6	Spur Ch.12.87 km, Peepal Tree near spur	26° 25' 41.1"	86° 52' 39.3"	On Spur
TR50	G6	RS: Peepal Tree-1-1.2m, CS: Anona, Guava, Simar, Mango, Moringa, Mix plantation	26° 25' 39.5"	86° 52' 38.1"	On EKE
TR51	G6	On EKE: Pithari-1-Girth: 1.26m RS: Pithari -7-(Girth: 0.63-1.26m) CS: Pithari-3, Arjun-2, Jackfruit-1	26° 25' 35.4"	86° 52' 34.8"	On EKE
TR52	H7	On EKE: Bor (Ziziphus) -1-Girth: 0.63 m,	26° 25' 28.1"	86° 52' 28.9"	On EKE

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
		Pithecolobium-1-Girth: 0.63 m, Peepal-1-Girth: 4.71 m, RS: Pithari -7-(Girth: 0.94-2.5 m), Farhar CS: Banana, Anona			
TR53	H7	Spur Ch.13.45 km, Spur U/S: Pithari-25, Simar-3, Pithecolobium-2. Spur D/S: Pithecolobium, Simar, Bamboo CSS: Pithari-4, Arjun-1, Peepal-1. RSS: Pithari-7, Anona-1, Pithecolobium-1	26° 25' 25.6"	86° 52' 26.6"	On EKE
TR54	H7	On EKE: Pithecolobium-1- Girth: 0.94m RS: Pithari -2, Bamboo CS: Mango-1, Pithari-1, Arjun-1	26° 25' 23.0"	86° 52' 24.8"	On EKE
TR55	H7	CS: Anona-4, Ziziphus-1, Pithari-1, Pithecolobium-3 RS: Pithecolobium-1, Pithari-2	26° 25' 21.5"	86° 52' 23.8"	On EKE
TR56	M3	RS: Mango Tree - 1- Girth: 0.38m.	26° 20' 48.9"	86° 46' 12.0"	On EKE
TR57	H7	On EKE: Pithari -2- (Girth: 1.88-2.5 m) RS: Arjun-1 CS: Mango-1, Anona-1, Guava-1	26° 25' 20.2"	86° 52' 22.4"	On EKE
TR58	H7	On EKE: Pithecolobium-1 RS: Pithecolobium-1, Pithari-6 CS: Mango-1, Pithecolobium-11, Pithari-2	26° 25' 18.3"	86° 52' 21.0"	On EKE
TR59	H7	CS: Pithecolobium-2, Arjun-4, Hutments RS: Farming	26° 25' 15.8"	86° 52' 19.1"	On EKE
TR60	H7	On EKE: Pithecolobium-1-Girth: 1.57m RS: Pithari-1 CS: Pithecolobium- 2, Anona-2, Lemon-2	26° 25' 13.7"	86° 52' 17.3"	On EKE
TR61	H7	Spur Ch.14.10 km, Spur U/S: Pithari-9,Pithecolobium-2 Spur D/S: Pithecolobium-2, Simar-1 CS: Anona-1	26° 25' 8.8"	86° 52' 13.0"	On Spur
TR62	H7	CS: Mix Plantation-Anona, Mango, Arjun, Pithecolobium, Nimboo, ES: Bamboo, Areca	26° 25' 6.2"	86° 52' 11.2"	On EKE

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
TR63	H7	CS: Umbar-1-Girth: 0.94m, Peepal-1-Girth: 9.42m, Anona-1-4.71m, Pithari-1-Girth: 3.76m	26° 25' 4.0"	86° 52' 9.0"	On EKE
TR64	H7	CS: Mango-1, Bamboo, Anona-2, Papaya-1 RS: Anona-1, Simar-1, Wheat farming	26° 24' 58.2"	86° 51' 59.5"	On EKE
TR65	H7	CS: Mango- 4, Nimbu-1, Jackfruit-2, Hutments RS: Bamboo	26° 24' 56.5"	86° 51' 56.5"	On EKE
TR66	H6	RS: Jackfruit-1	26° 24' 55.7"	86° 51' 54.5"	On EKE
TR67	M3	RS: Mix Plantation: Anona, Banana, Bamboo, Moringa, Kadamb, Caster, Papaya and Pithari	26° 20' 49.6"	86° 46' 12.4"	On EKE
TR68	H6	Spur Ch.14.80 km, Spur U/S: Papaya-2, Pithecolobium-1, Pithari-1. Spur D/S: Peepal-1 CS: Anona-1, Mango-1, Moringa-1, Bamboo, Banana, Kanhera-1, RS: Bamboo	26° 24' 54.8"	86° 51' 53.0"	On Spur
TR69	H6	CS: Mango- 1, Jackfruit-1, Guava-1, Australian Acacia-4, Anona-1 RS: Pithari-6, Guava-2, Peepal-1-600mm, Neem-1 (Near SSB Chowki at Tehari Bazar)	26° 24' 52.4"	86° 51' 48.5"	On EKE
TR70	H6	Anona-5	26° 24' 50.0"	86° 51' 44.7"	On EKE
TR71	H6	CS: Anona-1, Culvert	26° 24' 47.9"	86° 51' 43.3"	On EKE
TR72	H6	CS: Pithari-2, Pithecolobium-1 near Spur nose. CS: Waterlogged area	26° 24' 47.6"	86° 51' 40.1"	On EKE
TR73	H6	On EKE: Pithari-1-Girth: 6.28m CS: Simar, Lemon, Anona-3	26° 24' 37.9"	86° 51' 20.8"	On EKE
TR74	I6	CS: Anona-4, Mango-2, Areca -1 RS: Pithari-7	26° 24' 37.3"	86° 51' 19.1"	On EKE
TR75	I6	Spur Ch.16 km, Spur U/S: Pithari-25, Pithecolobium-1 CS: Anona-3, CS: Temple	26° 24' 36.0"	86° 51' 16.3"	On Spur
TR76	I6	CS: Anona-2	26° 24' 34.7"	86° 51' 13.8"	On EKE

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
TR77	I6	CS: Pithari, Anona-1, Areca-1, Coconut-1, Jackfruit, Mango. RS: Pithari: 1	26° 24' 33.4"	86° 51' 11.1"	On EKE
TR78	M3	RS: Mix Plantation: Jackfruit, Mango, Banana, Areca	26° 20' 52.9"	86° 46' 14.6"	On EKE
TR79	I6	Spur: 16.30 km, Spur D/S: Bamboo, Pithari-1, Hutments. CS: Anona-1, Pithari-1, Jackfruit-1.	26° 24' 31.1"	86° 51' 6.0"	On Spur
TR80	I6	CS: Jackfruit-3, Anona-1	26° 24' 28.0"	86° 51' 0.2"	On EKE
TR81	I6	On EKE: Peepal Tree	26° 24' 26.1"	86° 50' 56.0"	On EKE
TR82	I6	Spur Ch. 16.60 km. Spur U/S: Mango-10, Guava-1, Moringa-1	26° 24' 25.9"	86° 50' 55.2"	On Spur
TR83	I5	Spur Ch. 16.98 km. On EKE: Peepal Tree-1-Girth: 4.71m, Yatri Shed-Old Structure,	26° 24' 20.5"	86° 50' 43.7"	On EKE
TR84	I5	CS: Neem-3, Pithari-2, Teak-5, Peepal-2, Mango-4, Jackfruit-1, Moringa-3, Anona-2, Temple. RS: Rain Tree-1, Mehandi-2, Anona-1, (No Photo-SSB Chowki)	26° 24' 18.2"	86° 50' 40.0"	On EKE
TR85	I5	Spur Ch. 17.25 km CS: Bamboo, Mango, Banana Spur U/S: Mehandi-1 Spur D/S: Simar-1	26° 24' 15.3"	86° 50' 35.7"	On EKE
TR86	I5	Spur Ch. 17.75 km. CS: Agriculture, School, Waterlogged area Spur D/S: Pithecolobium, Shishum Spur U/S: Pithari-5	26° 24' 5.0"	86° 50' 22.6"	On EKE
TR87	I5	On EKE: Peepal Tree RS: Agriculture	26° 23' 58.0"	86° 50' 14.0"	On EKE
TR88	I5	RS: Pithari-3 CS: Culvert, Mango, Peepal	26° 23' 57.0"	86° 50' 14.9"	On EKE
TR89	M3	RS: Mango Tree -1- Girth: 2.51m.	26° 20' 53.5"	86° 46' 15.2"	On EKE
TR90	I5	RS: Pithari-2-(Girth: 0.94-1.88m)	26° 23' 55.2"	86° 50' 10.1"	On EKE
TR91	I5	Spur: 18.17 km. Spur U/S: Bamboo, Spur D/S: Bamboo, Pithari	26° 23' 53.8"	86° 50' 8.4"	On Spur

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
TR92	I5	RS: Pithari-7, Anona-1	26° 23' 51.5"	86° 50' 5.5"	On EKE
TR93	J6	Spur: 18.53 km, Spur U/S: Pithari-1-Girth: .94m	26° 23' 47.8"	86° 50' 0.6"	On Spur
TR94	J6	RS: Peepal-2-(Girth: 1.27-1.57m) CS: Peepal-1-Girth: 2.57m	26° 23' 44.4"	86° 49' 56.5"	On EKE
TR95	J6	Spur 18.80 km Spur U/S: Small trees-2	26° 23' 41.9"	86° 49' 52.7"	On Spur
TR96	J6	Kadamb Tree-1-Girth: 3.76m RS: Agriculture	26° 23' 39.7"	86° 49' 50.3"	On EKE
TR97	J6	Spur: 19.10 km Spur U/S: Pithari-3, Spur D/S: Simar-1, Pithari-1	26° 23' 37.5"	86° 49' 47.0"	On Spur
TR98	J5	Spur: 19.50 km. Spur U/S: Pithecolobium	26° 23' 28.0"	86° 49' 34.7"	On Spur
TR99	J5	CS: Peepal Tree-1	26° 23' 14.9"	86° 49' 18.4"	On EKE
TR100	M3	RS: Jack Fruit Trees 2-Girth: 0.31m. , CS: Mango Trees 3, Girth: 0.47m	26° 20' 57.4"	86° 46' 20.2"	On EKE
TR101	J5	RS: Pithari-3, CS: Pithari-1, Mango-1, Waterlogged area,	26° 23' 14.9"	86° 49' 15.4"	On EKE
TR102	J5	Culvert	26° 23' 14.1"	86° 49' 11.5"	On EKE
TR103	J5	CS: Peepal Tree-1 Mix Plantation: Anona, Coconut, Nimboo, Mango	26° 23' 15.9"	86° 49' 2.3"	On EKE
TR104	J5	Spur, CS: Habitation Hutments, Mix Plantation: Anona, Bamboo, Banana, Pithari, Peepal RS: Pithari, Simar, Banana, Kadamb, Bamboo On EKE: Yatri Shed Structure Spur D/S: Pithari-1-Girth: 1.88m	26° 23' 12.8"	86° 48' 57.7"	On EKE
TR105	J5	Spur: 21.32km CS: Banyan-2-(Girth: 0.94-1.256) RS: Banyan-1-Girth: 0.57m	26° 22' 58.1"	86° 48' 42.0"	On Spur
TR106	J5	RS: Peepal-1, Agriculture Field	26° 22' 55.1"	86° 48' 38.4"	On EKE
TR107	K5	Spur: 21.60 km RS: Banyan Tree Spur D/S: Acacia	26° 22' 51.8"	86° 48' 34.7"	On EKE

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
TR108	K5	On EKE: Banyan Tree, Peepal Tree-1-Girth: 9.6m	26° 22' 42.7"	86° 48' 25.8"	On EKE
TR109	K5	Spur: 21.15 km RS: Mango, Banana Tree CS: Pakhad and Peepal Tree, School, Temple, SSB Chowki, Mix Plantation	26° 22' 41.5"	86° 48' 20.6"	On EKE
TR110	K5	CS: Peepal Tree	26° 22' 40.8"	86° 48' 11.9"	On EKE
TR111	M3	RS: Pithari Tree - 1- Girth: 0.94m., Banana, Bamboo (River edge very close to the EKE)	26° 20' 59.2"	86° 46' 21.6"	On EKE
TR112	K5	Spur: 22.40 km Spur U/S: Mango-1	26° 22' 41.1"	86° 48' 10.4"	On Spur
TR113	K5	Spur: 22.70 km. Spur D/S: Pithari-3 Spur U/S: Pithecolobium-1, Pithari-3	26° 22' 35.8"	86° 48' 2.6"	On Spur
TR114	K5	Spur: 22.95 km Spur D/S: Pithecolobium, Bamboo,	26° 22' 29.4"	86° 47' 57.8"	On Spur
TR115	K5	Spur: 23.95 km RS: Kadamb and Banana Tree	26° 22' 3.2"	86° 47' 37.8"	On Spur
TR116	L4	Spur: , RS: Kadamb, Peepal Tree	26° 21' 53.8"	86° 47' 30.5"	On EKE
TR117	L4	Spur: 24.75 km. CS: Mango Tree-2, Simar-1, Dry Tree-1	26° 21' 41.8"	86° 47' 17.2"	On Spur
TR118	L4	CS: Peepal Tree	26° 21' 37.6"	86° 47' 11.9"	On EKE
TR119	L4	On EKE: Kadamb Tree-1-Girth: 1.57m	26° 21' 36.1"	86° 47' 10.6"	On EKE
TR120	L4	On EKE: Pithecolobium-1-Girth: 1.257m	26° 21' 34.7"	86° 47' 8.8"	On EKE
TR121	L4	Spur: 25.14 km Spur D/S: Bamboo, Tree-2	26° 21' 33.5"	86° 47' 6.8"	On Spur
TR122	M3	RS: Peepal Tree- 1- Girth: 1.88m. , Mango Tree - 4 - Girth: 1.57m.	26° 21' 0.8"	86° 46' 24.3"	On EKE
TR123	L4	Spur: 25.00 km CS: Mango Tree-2	26° 21' 36.4"	86° 47' 10.6"	On Spur
TR124	L4	On EKE: Acacia -1, RS: Pithecolobium-1, Kadamb-1	26° 21' 32.0"	86° 47' 5.2"	On EKE
TR125	L4	Spur: D/S: Pithari-1, Moringa U/S: Pithari-2, RS: Acacia-1, Mango-1, Pithecolobium-1, Pithari-1	26° 21' 27.4"	86° 46' 59.0"	
TR126	L4	RS: Pithari-1-Girth: 2.82m	26° 21' 26.6"	86° 46' 57.9"	On EKE

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
TR127	L4	On EKE: Pithari-1-Girth: 1.727m	26° 21' 25.6"	86° 46' 57.2"	On EKE
TR128	L4	RS: Pithari-1-Girth: 2.98m	26° 21' 25.1"	86° 46' 55.5"	On EKE
TR129	M4	RS: Mango Tree - 1 - Girth: 0.63m., Hutments	26° 21' 1.9"	86° 46' 25.6"	On EKE
TR130	A3	Peepal Tree-1 Girth-3.0m Near Silt Ejector	26° 31' 5.8"	86° 56' 9.9"	On EKE
TR131	M4	Spur- 26.30 km, Pithari Tree (River edge close to EKE)	26° 21' 10.4"	86° 46' 36.6"	On Spur
TR132	M4	RS: Mixed Plantation: Anona -1- Girth: 0.35m, Bamboo, Caster, Mango, Guava and Pithari.	26° 21' 2.6"	86° 46' 26.8"	On EKE
TR133	M3	CS: Mango Tree - 1 - Girth: 1.26 m	26° 21' 3.2"	86° 46' 28.1"	On EKE
TR134	M4	RS: Peepal Tree - 1- 200, Mango Tree - 1- 110 mm at Spur - 26.55 km Mix Plantation: Bamboo, Pithari, Mango, Jackfruit	26° 21' 4.4"	86° 46' 29.1"	On Spur
TR135	M4	Wheat crop harvesting at river edge near Ch. 26.55 km- RS, CS: Mango Tree - 1 - Girth: 0.38m	26° 21' 5.5"	86° 46' 30.5"	On EKE
TR136	M4	CS: Mango Tree - 1 - Girth: 0.31m	26° 21' 5.9"	86° 46' 31.9"	On EKE
TR137	M4	CS: Lemon Tree - 1	26° 21' 6.8"	86° 46' 33.2"	On EKE
TR138	M4	RS: Mulberry Tree -1 - Girth: 0.31m	26° 21' 7.4"	86° 46' 33.2"	On EKE
TR139	M4	RS: Mango Tree - 1 - Girth: 0.63m, Mango Tree - 1 - Girth: 1.26m, RS: Mix Plantation: Jackfruit, Papaya, Areka.	26° 21' 8.7"	86° 46' 34.7"	On EKE
TR140	M4	Lemon Tree- 1-Girth: 0.63m , Mango Tree- 2-Girth: 1.26-1.57m	26° 21' 11.7"	86° 46' 38.5"	On EKE
TR141	M4	RS: Mango- 1- Girth: 0.63m	26° 21' 12.6"	86° 46' 39.3"	On EKE
TR142	L4	RS: Mango, Anona Tree	26° 21' 13.1"	86° 46' 40.2"	On EKE
TR143	L4	OBS: Peepal, Mango, Anona, Peepal, Pithari	26° 21' 13.5"	86° 46' 41.0"	On EKE
TR144	L4	Spur - 26.00 km. Mixed plantation at the Spur	26° 21' 16.4"	86° 46' 44.8"	On Spur
TR145	L4	EKE Top caving and gully erosion	26° 21' 17.5"	86° 46' 46.3"	On EKE
TR146	L4	OBS: Mix plantation at Spur 25.66 km : Peepal, Pithari, Umbar, Pithecellobium	26° 21' 23.7"	86° 46' 51.1"	On EKE

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
TR147	B4	Pithecolobium, , Habitation, Mixed Plantation: Anona, Banana, Pithari- 1- Girth: 6.28m at Ch. 1.25 km	26° 30' 31.6"	86° 56' 40.0"	On EKE
TR148	B4	RS: Bombax - Girth: 3.14-5.65 m- RS, CS: Kadamb, Mix Plantation: Anona, Neem, Jackfruit, Bamboo, Caster, Guava, Date Palm	26° 30' 28.8"	86° 56' 38.8"	On EKE
TR149	M3	CS: Mango Trees -1, Girth: 0.57m	26° 20' 26.8"	86° 46' 3.1"	On EKE
TR150	B4	CS: Peepal Tree- Girth: 3.14-6.12 m	26° 30' 27.6"	86° 56' 38.9"	On EKE
TR151	B4	CS: Pithecolobium Tree- Girth: 3.14-10.05 m	26° 30' 25.5"	86° 56' 38.3"	On EKE
TR152	B4	CS: Pithecolobium Tree- Girth: 3.14-3.45 m	26° 30' 24.2"	86° 56' 37.8"	On EKE
TR153	B4	OBS: Mix Plantation: Anona, Mango, Jamun	26° 30' 23.3"	86° 56' 37.3"	On EKE
TR154	B4	OBS: Mix Plantation: Pithari, Mango, Jamun, Areca , Jack fruit.	26° 30' 21.5"	86° 56' 37.0"	On EKE
TR157	B4	RS: Pithecolobium Tree- 1- Girth: 0.63 m	26° 30' 20.5"	86° 56' 36.4"	On EKE
TR158	B4	RS: Pithecolobium Tree- 1- Girth: 1.1 m	26° 30' 18.2"	86° 56' 35.7"	On EKE
TR159	B4	Spur- 1.6 km, Pithecolobium Tree- 1- CS, RS: Pithecolobium Tree- 5-(Girth: 2.51- 3.14 m)	26° 30' 16.7"	86° 56' 35.5"	On Spur
TR160	B4	RS: Bel Tree (Aeges) -1- Girth: 1.26 m CS: Pithecolobium Tree- 1- Girth: 2.36 m	26° 30' 15.4"	86° 56' 35.0"	On EKE
TR161	B4	RS: Pithecolobium Tree- 1- Girth: 1.35 m	26° 30' 14.4"	86° 56' 34.8"	On EKE
TR162	M3	Spur 27.88 km - Mixed Plantation: Mango, Bamboo, Peepal	26° 20' 29.5"	86° 46' 3.7"	On Spur
TR163	B4	RS: Pithecolobium Tree- 1- Girth: 1.88 m	26° 30' 12.6"	86° 56' 34.6"	On EKE
TR164	B4	CS: Mix Plantation: Moringa, Mango, Bamboo, Jack fruit	26° 30' 11.9"	86° 56' 35.0"	On EKE
TR165	B4	CS: Chafa Tree- 1- Girth: 0.38 m, Moringa Tree- 1- Girth: 0.41 m, Mango Tree- 1- Girth: 0.44 m	26° 30' 9.7"	86° 56' 35.0"	On EKE
TR166	B4	Acacia Tree	26° 30' 8.5"	86° 56' 34.5"	On EKE

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
TR167	B4	CS: Mix Plantation: Coconut, Anona, Moringa, Bamboo, Banana, Neem RS: Bamboo, Banana, Anona	26° 30' 5.9"	86° 56' 34.4"	On EKE
TR168	B4	Spur 2.03 km, Mix Plantation - Bamboo, Pithecolobium- RS, Bamboo, Banana, Mango, Anona, Neem - CS	26° 30' 2.9"	86° 56' 33.0"	On Spur
TR169	B4	RS: Mango- 1- Girth: 0.63 m, CS: Bamboo	26° 30' 2.1"	86° 56' 32.4"	On EKE
TR170	B4	CS: Rain Tree - 1- Girth: 1.35 m	26° 30' 0.8"	86° 56' 32.2"	On EKE
TR171	B4	CS: Aeges Tree - 1- Girth: 0.31 m	26° 30' 0.5"	86° 56' 31.6"	On EKE
TR172	B4	Pakhar Tree -1- Girth: 5.65 m	26° 29' 59.9"	86° 56' 31.5"	On EKE
TR173	M3	CS: Mix Plantation: Mango -1- Girth: 1.88m., Mango -1- Girth: 2.51m., Pakhed - 4.84m, Peepal - 1- Girth: 5.02m., Mango - 1- Girth: 0.31m.	26° 20' 31.8"	86° 46' 5.1"	On EKE
TR174	B4	Kadamb Tree - 1 - Girth: 0.57 m	26° 29' 59.7"	86° 56' 31.6"	On EKE
TR175	B4	Peepal Tree - 1 - Girth: 6.12 m	26° 29' 59.6"	86° 56' 31.5"	On EKE
TR176	B4	CS: Mix Plantation: Kadamb - 1 - Girth: 1.88 m, Mango- 8 - (Girth: 0.63-1.26m), Moringa-250, Pithecolobium- 3 (Girth: 0.94-1.88m). RS: Mix Plantation: Jamun - 1-Girth: 1.88m, Shirish-1-Girth: 2.2m	26° 29' 57.8"	86° 56' 30.8"	On EKE
TR177	B4	CS: Pithecolobium Tree- 1- Girth: 1.26m at EKE Ch. 2.40 km	26° 29' 50.9"	86° 56' 28.9"	On EKE
TR178	B4	Spur Ch. 2.40 km : Shrubs and Bamboo Plantation	26° 29' 51.7"	86° 56' 28.7"	On Spur
TR179	B4	RS: Pithecolobium and Peepal Tree Together - Girth: 1.73m	26° 29' 45.2"	86° 56' 27.0"	On EKE
TR180	C4	RS: Pithecolobium Tree- 1- Girth: 1.29m	26° 29' 43.1"	86° 56' 26.4"	On EKE
TR181	C4	RS: Acacia Tree-1- Girth: 1.35m	26° 29' 41.2"	86° 56' 26.1"	On EKE
TR182	C4	CS: Pithecolobium Tree- 1- Girth: 1.35m	26° 29' 29.5"	86° 56' 23.0"	On EKE

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
TR183	C4	CS: Acacia Tree-1-Girth: 1.10m- RS, Acacia Tree-1- Girth: 0.94 m	26° 29' 18.0"	86° 56' 19.4"	On EKE
TR184	M3	RS: Mango Tree -1- Girth: 3.45m. - RS, Peepal - 1-Girth: 3.5m	26° 20' 32.3"	86° 46' 4.9"	On EKE
TR185	C4	Acacia-1- Girth: 0.94 m	26° 29' 8.2"	86° 56' 16.4"	On EKE
TR186	C4	RS: Spur Ch. 3.35 km, Pithari-1-Girth: 1.26 m-RS, Pithari-1-Girth: 2.57 m	26° 29' 2.9"	86° 56' 14.5"	On EKE
TR187	C4	RS: Pithari-1-700mm-RS, Pithecolobium-3-Girth: 1.63 m, 1.41m, 1.0 m, CS: Pithecolobium-1-Girth: 1.88 m	26° 29' 0.0"	86° 56' 14.1"	On EKE
TR188	C4	RS: Pithecolobium-1-Girth: 3.45 m, CS: -1-Girth: 1.1 m	26° 28' 58.0"	86° 56' 13.0"	On EKE
TR189	D5	RS: Pithari-1-600mm, Acacia-1-Girth: 0.63 m, Pithecolobium-1-Girth: 2.51 m	26° 28' 55.1"	86° 56' 12.5"	On EKE
TR190	C4	RS: Pithari-1-Girth:1.57 m, Pithecolobium-7-(Girth: 0.94 -1.26 m), CS: Pithecolobium-5-(Girth: 0.94 -1.57 m)	26° 28' 54.2"	86° 56' 12.0"	On EKE
TR191	D5	On EKE: Pithecolobium-2-(Girth: 1.57-1.88 m), RS: Pithecolobium-2-(Girth: 0.94 -1.26 m), CS: Pithecolobium-2-Girth: 1.26 m	26° 28' 51.3"	86° 56' 9.9"	On EKE
TR192	D5	RS: Pithari-2-(Girth: 1.88-3.77 m), CS: Pithecolobium-3- Girth: 0.94 m	26° 28' 49.0"	86° 56' 8.6"	On EKE
TR193	D5	On EKE: Pithecolobium-5, RS: Pithecolobium-1, CS: Pithecolobium-8 (Girth: 0.94-1.57 m)	26° 28' 48.3"	86° 56' 8.0"	On EKE
TR194	D5	On EKE: Pithecolobium-2-Girth: 0.94 m	26° 28' 46.6"	86° 56' 6.9"	On EKE
TR195	M3	Spur 27.68 km, Mixed Plantation: Mango, Anona, Pithari Some Hutments, Brick House	26° 20' 35.3"	86° 46' 6.2"	On Spur
TR196	D5	On EKE: Pithecolobium-2-Girth: 0.63 m	26° 28' 45.9"	86° 56' 6.0"	On EKE
TR197	D5	CS: Pithecolobium-2-RS-Girth: 0.94 m, Pithecolobium-1- Girth: 1.41m	26° 28' 44.9"	86° 56' 5.7"	On EKE

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
TR198	D5	RS: Pithari-1-Girth: 1.88 m	26° 28' 43.7"	86° 56' 4.4"	On EKE
TR199	D5	RS: Pithecolobium-2	26° 28' 41.8"	86° 56' 3.4"	On EKE
TR200	D5	RS: Aeges-1-Girth: 0.94m	26° 28' 40.3"	86° 56' 2.4"	On EKE
TR201	D5	RS: Pithecolobium-2-Girth: 0.94m	26° 28' 39.4"	86° 56' 1.9"	On EKE
TR202	D5	On EKE: Pithecolobium-1-Girth: 1.57m RS: Pithecolobium-1-Girth: 0.94m CS: Pithecolobium-1-Girth: 1.26m	26° 28' 38.5"	86° 56' 1.7"	On EKE
TR203	D5	Spur Ch. 5.3 km, RS: Pithari-1-Girth: 1.26m, Aeges-1-Girth: 0.79m. CS: Anona, Areka. Mango, Simar, Anona-Spur D/S. Bamboo-Spur U/S.	26° 28' 26.3"	86° 55' 53.3"	On Spur
TR204	D5	Mix Plantation: Mango, Moringa, Jackfruit, Bamboo.	26° 28' 25.0"	86° 55' 52.7"	On EKE
TR205	D5	Spur Ch.5.4 km. Spur D/S: Anona, Bamboo Spur U/S: Mango, Pithari, Pithecolobium	26° 28' 23.3"	86° 55' 50.7"	On Spur
TR206	M3	CS: Mango -1- Girth: 0.63m.	26° 20' 39.3"	86° 46' 8.3"	On EKE
TR207	D5	RS: Mango-2, On EKE: Anona-1.	26° 28' 21.8"	86° 55' 49.9"	On EKE
TR208	D5	RS: Simar-1-800mm, Anona-2-Girth: 0.47m, Peepal-1-Girth: 1.26m, Bamboo. On EKE: Anona-6-(Girth: 0.31-0.63 m) CS: Mix Plantation: Mango, Areka, Simar, Peepal, Date Palm, Coconut, Moringa	26° 28' 20.1"	86° 55' 48.2"	On EKE
TR209	D5	Spur Ch.5.7 km Near Spur- Mix Plantation: Bamboo, Banana, Pithecolobium, Peepal, Anona CS: Primary School Dubiyahi, Durga Mandir, CS: Peepal, Mango, Ficus	26° 28' 14.6"	86° 55' 43.7"	On Spur
TR210	D5	CS: Anona-1-Girth: 0.31m, Mango-7, Pithari-1, Cactus	26° 28' 11.9"	86° 55' 41.9"	On EKE
TR211	D5	RS: Kadamb-1-Girth: 1.26m, Shirish-1-Girth:	26° 28' 7.1"	86° 55' 38.0"	On EKE

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
		1.26m, CS-Dry Tree			
TR212	D5	RS: Kadamb- 5 (Girth: 0.31-1.88 m)	26° 28' 5.1"	86° 55' 36.5"	On EKE
TR213	D5	Spur ch. 6.15 km. RS: Pithari Tree-7- (Girth: 0.63-2.2 m), CS:Culvert	26° 28' 1.8"	86° 55' 34.1"	On Spur
TR214	E6	RS: Pithecolobium-1- Girth: 1.41m	26° 27' 57.3"	86° 55' 30.9"	On EKE
TR215	E6	RS: Pithecolobium-1- Girth: 1.63m	26° 27' 56.2"	86° 55' 29.9"	On EKE
TR216	E6	RS: Pithari, CS-Jamun	26° 27' 55.0"	86° 55' 29.0"	On EKE
Utility Line					
U1	D5	CS:LT Line along EKE	26° 28' 11.9"	86° 55' 41.9"	Beside EKE
U2	A3	Electric Pole-7	26° 31' 0.1"	86° 56' 16.2"	Beside EKE
U3	A3	Electric Pole-8	26° 30' 59.0"	86° 56' 17.7"	Beside EKE
U4	A3	Electric Pole-1: Before Silt Ejector	26° 31' 7.1"	86° 56' 10.5"	Beside EKE
U5	A3	Electric Pole-2: Near Silt Ejector	26° 31' 6.3"	86° 56' 11.2"	Beside EKE
U6	A3	Electric Pole-3	26° 31' 5.0"	86° 56' 12.4"	Beside EKE
U7	A3	Electric Pole-4	26° 31' 3.9"	86° 56' 13.3"	Beside EKE
U8	A3	Electric Pole-5	26° 31' 2.8"	86° 56' 14.2"	Beside EKE
U9	A3	Electric Pole-6	26° 31' 1.6"	86° 56' 15.4"	Beside EKE
Water Logged Area					
WA1	M3	CS: Waterlogged area	26° 20' 36.3"	86° 46' 7.1"	25
WA2	M3	CS: Waterlogged area	26° 20' 51.2"	86° 46' 14.6"	20
WA3	G6	CS: Painted Stork in Water Log area	26° 25' 43.3"	86° 52' 44.4"	40
WA4	H7	CS: Waterlogged area and Aquatic Birds	26° 25' 15.8"	86° 52' 19.1"	30
WA5	H6	CS: Waterlogged area	26° 24' 54.8"	86° 51' 53.0"	30
WA6	J6	Spur 18.80 km CS: Waterlogged area	26° 23' 41.0"	86° 49' 55.4"	20
WA7	J6	Spur: 19.10 km CS: Waterlogged area and Birds	26° 23' 37.5"	86° 49' 47.0"	20

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
WA8	K5	Spur: 22.95 km CS: Waterlogged Area, Aquatic Birds	26° 22' 27.4"	86° 47' 59.2"	20
WA9	L4	Spur: 24.75 km CS: Waterlogged area and Aquatic Birds	26° 21' 38.8"	86° 47' 19.2"	30
WA10	M3	CS: Waterlogged area (Painted Stork, Cormorant, Moorhen, Pond Heron)	26° 20' 25.5"	86° 46' 2.2"	25

Figure A: Location of Sensitive Receptors along EKE Ch. 0.00 km to 28.20 km

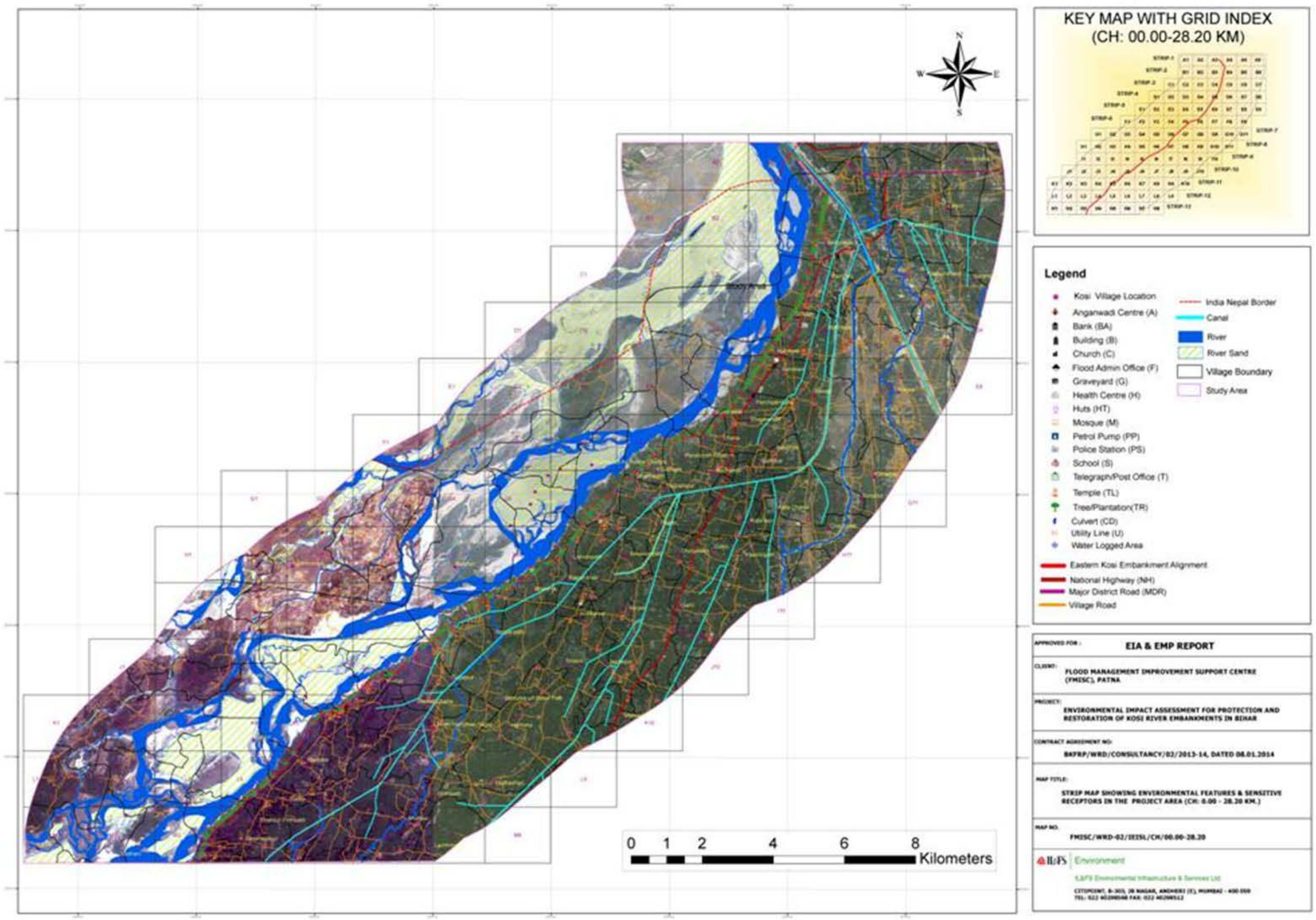


Table B: Sensitive Receptors along EKE Ch. 78.00 km to 84.00 km

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
Anganwadi					
A1	N5	Anganwadi Centre-Denka, Nauhatta	25° 59' 38.4"	86° 28' 22.8"	858
A2	Q5	Anganwadi Centre no: 94, Inayatpur, Mohanpur	25° 58' 12.0"	86° 27' 28.8"	341
A3	Q5	Anganwadi Centre no: 100, Mohummedpur	25° 57' 54.0"	86° 27' 18.0"	372
A4	R5	Anganwadi Centre no: 125, Ekadh	25° 57' 36.0"	86° 27' 14.4"	560
A5	R5	Anganwadi Centre no: 128, Ekadh	25° 57' 32.4"	86° 27' 7.2"	370
A6	R5	Anganwadi Centre no: 129, Thorai, Moradpur	25° 57' 25.2"	86° 27' 32.4"	920
A7	Q6	Anganwadi Centre no: 108, Kharha telwa Panchayat	25° 57' 54.0"	86° 28' 12.0"	1659
A8	Q6	Anganwadi Centre no 107, Pramanpur, Debra Village	25° 57' 57.6"	86° 28' 26.4"	1950
A9	R7	Anganwadi Centre no: 106, Ramoti, Debra Village	25° 57' 39.6"	86° 28' 40.8"	2580
A10	P7	Anganwadi Centre no: 60, Kar ka delva	25° 58' 30.0"	86° 28' 51.6"	2280
A11	P7	Anganwadi Centre no: 58-Kr ka Delva	25° 58' 30.0"	86° 29' 2.4"	2576
A12	N5	Anganwadi Centre-Shahpur	25° 59' 34.8"	86° 27' 57.6"	175
A13	P7	Anganwadi Centre no: 111, Brahmin Toli	25° 58' 51.6"	86° 29' 6.0"	2438
A14	P7	Anganwadi Centre no: 103, Brahmin Tolli	25° 58' 48.0"	86° 29' 9.6"	2572
A15		Anganwadi Centre no: 121, Narayanpur	25° 55' 26.4"	86° 22' 37.2"	7212
A16	S2	Anganwadi Centre no 119, Narayanpur	25° 56' 52.8"	86° 25' 4.8"	3204
A17	S2	Anganwadi Centre no 118, Narayanpur	25° 56' 38.4"	86° 25' 12.0"	2957
A18	P1	Anganwadi Centre no : 32, Naula Village	25° 58' 30.0"	86° 24' 3.6"	4965
A19	N7	Anganwadi Centre, Bengali Tolla, Nauhatta	25° 59' 49.2"	86° 30' 0.0"	2106
A20	R8	Anganwadi Centre no: 109, Karka Delwa-Teacher- Sunita Sinha	25° 57' 39.6"	86° 30' 0.0"	4568

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
A21	O6	Anganwadi Centre-Shahpur, Nauhatta	25° 59' 31.2"	86° 28' 1.2"	301
A22	Q8	Anganwadi Centre no: 74, Ramnagar Barna	25° 57' 46.8"	86° 30' 0.0"	4494
A23	P9	Anganwadi Centre no: 79, Piprahayi	25° 58' 44.4"	86° 30' 32.4"	4756
A24	R8	Anganwadi+ Primary Advasi School, Kar ka delwa	25° 57' 18.0"	86° 30' 0.0"	4828
A25	S8	Anganwadi Centre no: 112, Karka delva	25° 57' 0.0"	86° 29' 56.4"	5023
A26	S9	Anganwadi Centre no: 132+ Middle School+ Lok Shiksha Samiti. Moradpur	25° 56' 56.4"	86° 27' 57.6"	1561
A27	O6	Anganwadi Centre no: 56, Gadiyari, Shahpur	25° 59' 27.4"	86° 28' 0.6"	330
A28	O6	Anganwadi Centre no: 52, Shahpur	25° 59' 31.0"	86° 28' 6.4"	440
A29	O6	Anganwadi Centre no: 50, Shahpur	25° 59' 32.3"	86° 28' 2.7"	331
A30	O6	Anganwadi Centre no: 93, Kumrahauli	25° 59' 22.4"	86° 27' 53.2"	210
A31	O6	Anganwadi, Majaul	25° 59' 9.6"	86° 27' 54.0"	370
A32	O6	Anganwadi Centre no: 103, Kumrahauli	25° 59' 28.4"	86° 27' 55.9"	205
A33	P5	Anganwadi Centre no: 96, Fakrahi	25° 58' 54.2"	86° 27' 47.9"	375
A34	P5	Anganwadi Centre no: 101, Parasbanna	25° 58' 49.7"	86° 27' 39.5"	192
A35	S5	Anganwadi Centre no: 124, Chandrain	25° 56' 42.1"	86° 27' 42.2"	1186
A36	S5	Anganwadi Centre no: 123, Chandrain	25° 56' 48.1"	86° 27' 27.3"	748
A37	R5	Anganwadi Centre no: 127, Ekadh	25° 57' 17.3"	86° 27' 7.8"	
A38	R6	Anganwadi Centre no: 135, Muradpur	25° 57' 11.2"	86° 28' 4.0"	1700
A39	S6	Anganwadi Centre no: 131, Muradpur	25° 56' 57.2"	86° 27' 59.3"	1593
A40	O6	Anganwadi, Shahpur.	25° 59' 16.8"	86° 27' 57.6"	376
A41	R1	Anganwadi Centre no: 114, Sattour	25° 57' 20.0"	86° 24' 15.7"	4659
A42	R1	Anganwadi Centre no: 116, Sattour	25° 57' 24.6"	86° 24' 12.2"	4767
A43	O5	Anganwadi Centre no: 95, Majaul	25° 59' 9.6"	86° 27' 46.8"	188

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
A44	O5	Anganwadi Centre no:97-Parabanah, Mohanpur	25° 58' 58.8"	86° 27' 39.6"	123
A45	Q5	Anganwadi Centre no: 92/Pasmi, Mohanpur	25° 58' 19.2"	86° 27' 28.8"	220
A46	Q5	Anganwadi Centre no: 98, Mohanpur	25° 58' 12.0"	86° 27' 32.4"	429
Building					
B1	B1	Building	25°59'40.03"N	86°27'52.73" E	10
Bank					
BA1	Q5	SBI, Mohanpur	25° 58' 8.4"	86° 27' 25.2"	322
Church					
C1	Q5	Mission Church, Naya Nagar, Santhali	25° 57' 59.4"	86° 31' 9.8"	743
Flood Administration Office					
F1	O7	Block level Supply office, Nauhatta	25° 59' 31.2"	86° 29' 13.2"	2137
F2	P1	Badh Ashray Sthal, Garhia	25° 58' 39.4"	86° 24' 32.6"	4344
F3	R4	(Moorhen) Pan Komdi	25° 57' 25.8"	86° 26' 56.1"	9
Graveyard					
G1	P5	Burial ground Mohanpur	25° 58' 48.9"	86° 27' 39.0"	195
G2	R7	Burial Ground, Debra Village	25° 57' 39.6"	86° 28' 40.8"	2585
Hospital/Health Centres					
H1	O5	PHC, Shahpur	25° 59' 6.0"	86° 27' 43.2"	140
H2	O7	PHC - SUB Centre, Kar ka delva	25° 59' 9.6"	86° 28' 37.2"	1503
H3	S6	Private Hospital, Moradpur	25° 56' 52.8"	86° 28' 15.6"	2166
H4	S6	PHC+ ANM Centre, Moradpur	25° 57' 3.6"	86° 28' 15.6"	2261
H5	N5	Primary Health Sub-Centre, Shahpur	25° 59' 35.1"	86° 27' 56.7"	157
H6	S5	Referral Hospital, Chandrain (Additional Primary Health Centre)	25° 57' 4.1"	86° 27' 27.3"	834
Hutments					
HT1	N5	Huts	25°59'44.37"N	86°27'53.31" E	20
HT2	O5	Huts	25°59'25.16"N	86°27'47.37" E	20
HT3	Q5	Huts	25°58'59.31"N	86°27'35.56" E	20

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
HT4	Q5	Huts	25°58'11.65"N	86°27'14.57" E	20
HT5	Q5	Huts	25°57'57.68"N	86°27'5.26"E	20
HT6	Q5	Wooden Structure	25°57'54.80"N	86°27'3.50"E	20
Mosque					
M1	N7	Jumma Masjid, Nauhatta (70 yrs old)	25° 59' 56.4"	86° 29' 27.6"	1288
M2	P5	Jama Masjid, Parasbanna	25° 58' 48.4"	86° 27' 44.3"	341
M3	O6	Jumma Masjid, Majaul	25° 59' 13.2"	86° 27' 54.0"	337
M4	O5	Eid-ga	25° 59' 6.0"	86° 27' 43.2"	145
M5	Q5	Mosque/Masjid Under Construction	25° 58' 15.6"	86° 27' 28.8"	295
M6	Q6	Jamma Masjid and Urdu Middle school, Debroh, Kar-ka delva Panchayat	25° 57' 50.4"	86° 28' 15.6"	1818
M7	P9	Juma Masjid, Piprahayi	25° 58' 37.2"	86° 30' 28.8"	4781
M8	R7	Jumma Masjid, Ramoti Village	25° 57' 28.8"	86° 28' 37.2"	2669
Plantation					
P1	N5	Mix tree plantation (Mango, Peepal, Bel, Nerium) on Country side slope of EKE near Debanwan Temple	25°59'43.73"N	86°27'52.95" E	14
P2	R4	Mix tree plantation (Banyan, Bamboo) on Country side toe of EKE	25°57'35.95"N	86°26'53.72" E	15
P3	R4	Peepal tree on riverside toe	25° 57' 32.9"	86° 26' 52.5"	17
P4	R4	Peepal tree on riverside toe	25° 57' 31.7"	86° 26' 52.5"	20
P5	O5	Peepal	25° 57' 25.8"	86° 26' 56.1"	16
P6	R4	Mix tree plantation (Mango, Gulmohar, Jackfruit, Katgullar, Simmar, Jamun, Rui, Peepal, Bel, Nerium) on Country side slope of EKE	25° 59' 16.4"	86° 27' 41.8"	18
P7	P5	Mix tree plantation (Peepal, Banana, Bamboo)	25°58'27.48"N	86°27'25.27" E	15

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
P8	Q5	Mix tree plantation (Mango, Bamboo) on both side of EKE.	25° 58' 12.2"	86° 27' 13.6"	17
P9	Q5	Mix tree plantation (Peepal, Mango, Zizipus, Sitafal)	25° 58' 3.2"	86° 27' 7.5"	14
P10	Q5	Mix tree plantation (Mango, Bamboo, Jack Fruit, Peepal, Nerium, Rui, Anona, Banana, Gulmohar, Ramfal) on Country side toe of EKE	25°57'51.91"N	86°27'1.70"E	16
P11		Mix tree plantation (Mango, Banyan, Bamboo, Peepal, Rui, Moringa, Date Palm) on Country side toe of EKE	25°57'47.85"N	86°26'59.05" E	18
P12	R4	Mix tree plantation (Mango, Bamboo, Peepal, Pithecolobium, Calotropis)	25°57'41.14"N	86°26'54.72" E	17
Petrol Pump					
PP1	N7	H.P Petrol Pump, Nauhatta	25° 59' 49.2"	86° 29' 45.6"	1781
Police Station					
PS1	N7	Nauhatta Police Station	26° 0' 0.0"	86° 29' 31.2"	1271
School					
S1	N7	Rajiya Sambothi High school, SS school, Nauhatta	25° 59' 56.4"	86° 29' 38.4"	1480
S2	Q5	Pustakalaya Bhavan for Saraswati Pooja	25° 58' 12.0"	86° 27' 28.8"	350
S3	Q5	Middle School+ Anganwadi No: 95, Bakua, Mohanpur	25° 57' 46.8"	86° 27' 25.2"	670
S4	O5	Primary school (up to 5th standard), Mohammed Pur	25° 59' 6.0"	86° 27' 43.2"	150
S5	R5	Ekad Primary school, Chandrayan Panchayat	25° 57' 36.0"	86° 27' 14.4"	520
S6	R5	Thorai Primary School, Moradpur Panchayat	25° 57' 25.2"	86° 27' 32.4"	970
S7	Q7	Middle school and Anganwadi, odia Ramoti, Debra Village, Karka delva Panchayat	25° 57' 54.0"	86° 28' 37.2"	2350

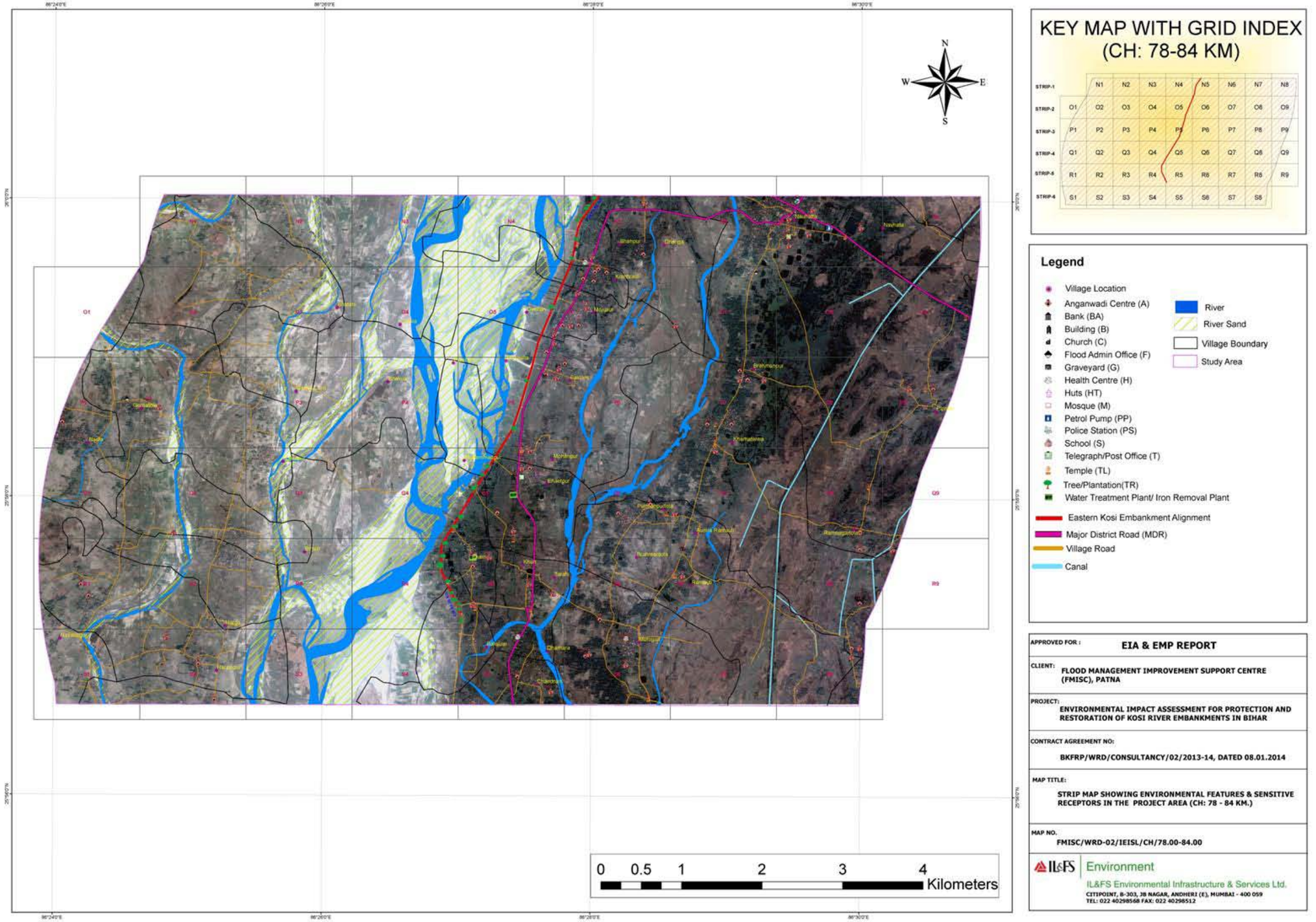
Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
S8	R7	Primary Urdu Girls School, Ramoti	25° 57' 28.8"	86° 28' 40.8"	2900
S9	P7	Primary school, Kar ka delva Panchayat (right from 1957)	25° 58' 19.2"	86° 28' 55.2"	2500
S10	P7	Middle School, Brahman Tolli	25° 58' 48.0"	86° 29' 6.0"	2520
S11	P7	Middle School Girls, Brahmin Toli	25° 58' 48.0"	86° 29' 16.8"	2780
S12	N7	Primary and middle school, Nauhatta	25° 59' 52.8"	86° 29' 27.6"	1375
S13	S2	Primary school, Under construction. Narayanpur	25° 57' 3.6"	86° 24' 50.4"	3500
S14	N7	Primary School, Bengali Tolla, Nauhatta	25° 59' 49.2"	86° 30' 0.0"	2177
S15	R9	Middle School supported by UNICEF & GoB, Ramnagar Barna.	25° 57' 39.6"	86° 30' 14.4"	4900
S16	P9	Primary School, Piprahayi.	25° 58' 44.4"	86° 30' 21.6"	4500
S17	S8	Primary School, NPS Vidyalaya. Kar ka Delwa	25° 57' 0.0"	86° 30' 0.0"	5100
S18	S8	Primary School, Sarhawah Barna (check point for 5 kms Boundary)	25° 56' 56.4"	86° 29' 56.4"	4960
S19	S6	Girls Middle School, Moradpur	25° 56' 52.8"	86° 28' 15.6"	2230
S20	N7	Ukramit Middle School	25° 59' 42.0"	86° 29' 27.6"	1785
S21	N7	Kanya Uchha Vidyalaya, Nauhatta (Project-2)	25° 59' 46.6"	86° 29' 36.5"	1740
S22	N5	Madhya Vidyalaya, Balwa	25°59'58.86"N	86°28'23.31" E	509
S23	N5	Madhya Vidyalaya, Shahpur	25° 59' 37.1"	86° 27' 59.8"	245
S24	O6	Primary School, Kumrahauli	25° 59' 22.4"	86° 27' 53.3"	176
S25	P5	Urdu Primary School (No:2401), Fakrahi	25° 58' 52.1"	86° 27' 45.2"	310
S26	P5	Urdu Primary School, Parasbanna	25° 58' 48.4"	86° 27' 44.3"	310
S27	S5	Utkramit Madhya Vidyalaya, Chandrain	25° 56' 42.1"	86° 27' 42.2"	1500
S28	O7	Primary School Denka, Nauhatta	25° 59' 9.6"	86° 28' 37.2"	1500
S29	R5	Madhya Vidyalaya, Ekadh	25° 57' 16.7"	86° 27' 7.0"	160

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
S30	R5	Uchhatar Madhyamik Vidyalaya, Dharhara	25° 57' 21.5"	86° 27' 42.9"	1300
S31	S6	Madhya Vidyalaya, Muradpur	25° 56' 57.2"	86° 27' 59.3"	1680
S32		Madhya Vidyalaya, Birjain	25° 57' 45.5"	86° 24' 53.5"	3300
S33	P2	New Primary School, Garhia	25° 58' 36.0"	86° 24' 46.9"	3919
S34	O6	Urdu Middle School, Majaul	25° 59' 9.6"	86° 27' 50.4"	320
S35	O6	UGPS Urdu Primary Girls school, Majaul	25° 59' 16.8"	86° 27' 57.6"	400
S36	O5	Hindi Middle School	25° 59' 2.4"	86° 27' 43.2"	170
S37	Q5	Indra Gandhi Training Centre, Mohanpur	25° 58' 19.2"	86° 27' 28.8"	210
S38	Q5	Middle school, Mohan Pur	25° 58' 19.2"	86° 27' 32.4"	350
Telegraph/Post Office					
T1	N7	Ground truthing/ Geo referencing of Post office in Nauhatta.	25° 59' 45.6"	86° 29' 27.6"	1500
T2	Q5	Post office, Mohanpur	25° 58' 8.4"	86° 27' 28.8"	400
Temple					
TL1	N7	Shivji and Parvathi Mandir, Nauhatta (200 years old and are renovated)	25° 59' 49.2"	86° 29' 27.6"	1430
TL2	P7	Sarvajanik Kartik Mandir - Kar ka Delva Panchayat	25° 58' 30.0"	86° 28' 55.2"	2450
TL3		Hanuman Mandir and Private School - Balia Semer (reference point to delineate the study area boundary)	25° 54' 10.8"	86° 25' 8.4"	6500
TL4	R1	Hanuman Statue, Brijian Village	25° 57' 39.6"	86° 24' 28.8"	4000
TL5	N7	Hanuman Mandir Under Construction-Nauhatta G.P.	25° 59' 45.6"	86° 29' 52.8"	2000
TL6	O9	Hanuman Mandir, Kadhayi Village	25° 59' 13.2"	86° 30' 46.8"	3900
TL7	Q8	Hanuman Mandir Under Construction-Ramnagar Barna	25° 57' 46.8"	86° 30' 0.0"	4500
TL8	N7	Durga Mandir, Nauhatta	25° 59' 45.6"	86° 29' 27.6"	1640

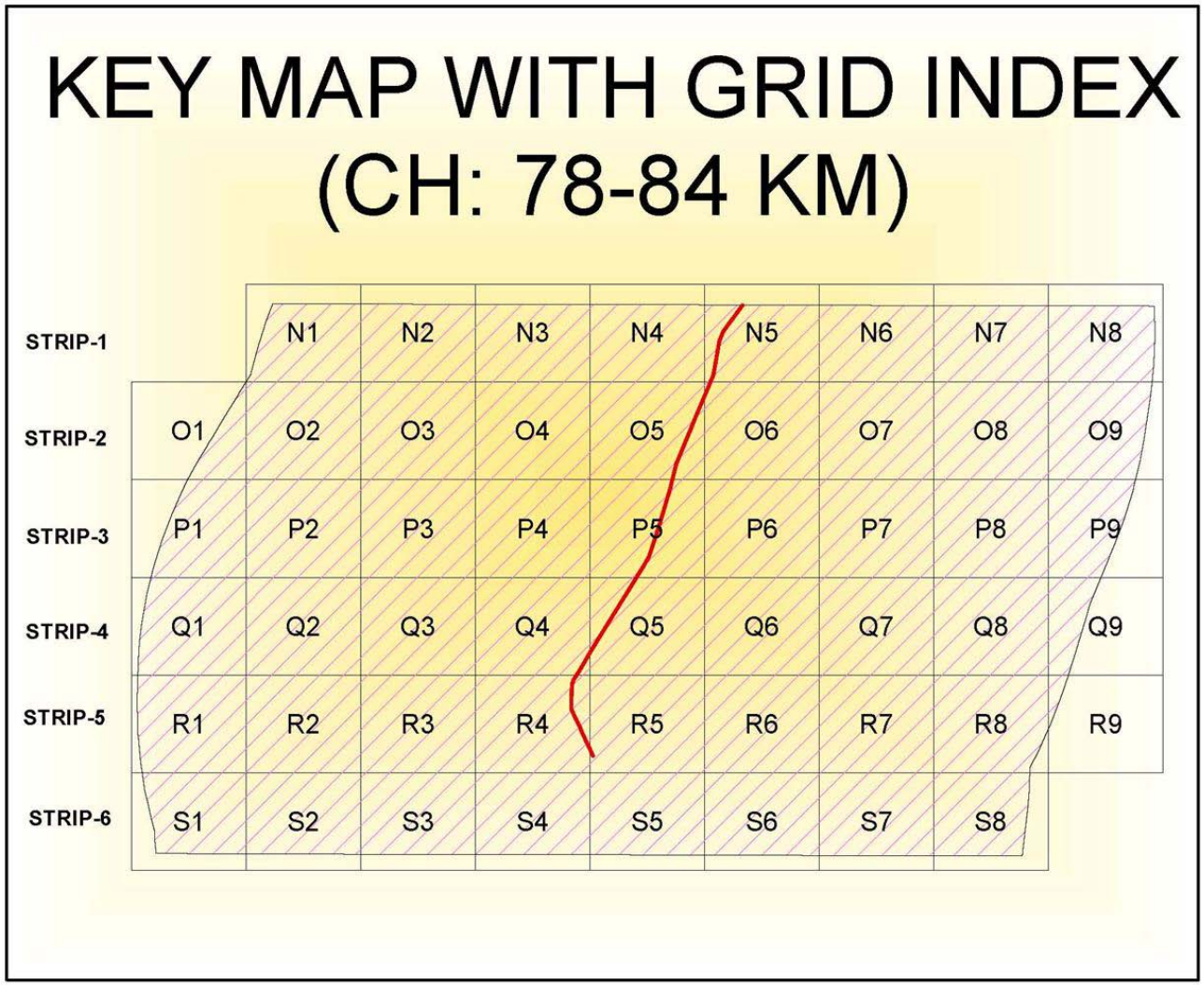
Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
TL9		Shivji and Durga Mandir, Piprahayi	25° 58' 4.8"	86° 30' 3.6"	4600
TL10	P9	Shivaji Mandir, Piprahayi	25° 58' 44.4"	86° 30' 28.8"	4670
TL11	R7	Radha- Krishna Mandir, Laxmipur, Moradpur	25° 57' 28.8"	86° 28' 37.2"	2800
TL12	S6	Lord Krishna Mandir, Moradpur (125 yrs old)	25° 57' 3.6"	86° 28' 15.6"	2300
TL13	S6	Bhole Shankar Mandir, Muradpur	25° 57' 3.6"	86° 28' 15.6"	2000
TL14	N5	Debanwan Mandir beside EKE, Shahpur	25°59'42.64"N	86°27'53.26" E	15
TL15	R5	Bajarang Bali Temple, Chandrain	25° 57' 15.2"	86° 27' 33.2"	780
TL16	R5	Bajrang Bali Temple, Ekadh	25° 57' 15.5"	86° 27' 8.3"	190
TL17	R6	Ram Janaki Temple, Muradpur	25° 57' 7.9"	86° 28' 21.3"	3670
TL18	S6	Radhakrishna Temple, Muradpur	25° 56' 39.3"	86° 28' 25.9"	2600
TL19		Hanuman Temple	25°57'47.05"N	86°26'58.32" E	10
TL20	N5	Brahma and Shivaji Mandir	26° 0' 0.0"	86° 28' 22.8"	490
TL21	Q5	Hanuman Mandir Mohanpur	25° 58' 19.2"	86° 27' 28.8"	210
TL22	Q5	Shiv Mahadev Mandir, Bakua, M.Pur	25° 57' 43.2"	86° 27' 25.2"	730
TL23	Q6	Narmadeswar Temple, Debra Village	25° 57' 54.0"	86° 28' 33.6"	2000
TL24	Q6	Bajrang Bali Temple, (35 years old)	25° 57' 54.0"	86° 28' 33.6"	2230
TL25	P7	Saraswati Mandir, Kar ka delva Panchayat	25° 58' 22.8"	86° 28' 55.2"	2470
Tree					
TR1	N5	Bell	26° 0' 0.5"	86° 28' 0.8"	18
TR2	N5	Mango	25° 59' 57.4"	86° 27' 58.1"	15
TR3	N5	Mango, Jackfruit. And Castor plants observed on both side of EKE	25° 59' 56.2"	86° 27' 57.1"	15
TR4	N5	Mango	25° 59' 53.4"	86° 27' 54.7"	15
TR5	N5	Peepal (Ficus religiosa)	25° 59' 51.6"	86° 27' 53.2"	15
TR6	N5	Peepal	25° 59' 36.4"	86° 27' 50.8"	20

Receptor Code	Strip Map No.	Description	Latitude	Longitude	Approximate Distance (m)
TR7	P5	Peepal tree on river side toe of EKE	25° 58' 46.8"	86° 27' 30.6"	20
TR8	Q5	Rui (Calotropis gigantea), Peepal	25° 58' 8.8"	86° 27' 11.3"	25
TR9	Q5	Peepal	25° 58' 4.4"	86° 27' 8.3"	30
TR10	R4	Mix tree plantation (Peepal, Rui, Jack Fruit, Mango, Bamboo, Pithecolobium, etc.) on Country side of EKE.	25° 57' 25.8"	86° 26' 56.1"	20
TR11	R4	Peepal tree on riverside slope of EKE	25° 57' 21.3"	86° 26' 57.7"	25
TR12	R4	Jackfruit tree with Cuscuta parasite on riverside slope of EKE	25° 57' 18.8"	86° 26' 58.9"	30
TR13	R4	Peepal	25° 57' 18.1"	86° 26' 59.6"	25
TR14	R4	Peepal	25° 57' 16.5"	86° 27' 0.9"	20
TR15	R4	Peepal	25° 57' 14.7"	86° 27' 1.1"	40
TR16	R5	Banyan	25° 57' 9.6"	86° 27' 2.1"	35
TR17	R5	Kadamb tree on both side slope of EKE	25° 57' 10.7"	86° 27' 2.2"	26

Figure B: Location of Sensitive Receptors along EKE Ch. 78.00 km to 84.00 km



ANNEXURE 2: KEY MAP WITH GRID INDEX



ANNEXURE 3: CONTENTS ON THE CD ENCLOSED WITH THIS REPORT

The enclosed CD contains the soft copy of all Strip Maps prepared for two stretches of the Study area, namely, EKE chainage 0.00 km to 28.20 km and EKE chainage 78.00 km to 84.00 km. The Table C below presents the list of the file names containing the strip maps.

Table C: List of Strip Maps of Environmental Features and Sensitive Receptors in the Project Area

EKE Ch. 0.00 km to 28.20 km		EKE Ch. 78.00 km to 84.00 km	
Sr. No.	**Map File Name**	**Sr. No.**	**Map File Name**
1	Key Map_Kosi Embankment-00-28 km	1	Key Map_Kosi Embankment-78-84 km
2	Kosi Embankment-00-28 km_A1	2	Kosi Embankment-78-84 km_N1
3	Kosi Embankment-00-28 km_A2	3	Kosi Embankment-78-84 km_N2
4	Kosi Embankment-00-28 km_A3	4	Kosi Embankment-78-84 km_N3
5	Kosi Embankment-00-28 km_A4	5	Kosi Embankment-78-84 km_N4
6	Kosi Embankment-00-28 km_A5	6	Kosi Embankment-78-84 km_N5
7	Kosi Embankment-00-28 km_A6	7	Kosi Embankment-78-84 km_N6
8	Kosi Embankment-00-28 km_B1	8	Kosi Embankment-78-84 km_N7
9	Kosi Embankment-00-28 km_B2	9	Kosi Embankment-78-84 km_N8
10	Kosi Embankment-00-28 km_B3	10	Kosi Embankment-78-84 km_O1
11	Kosi Embankment-00-28 km_B4	11	Kosi Embankment-78-84 km_O2
12	Kosi Embankment-00-28 km_B5	12	Kosi Embankment-78-84 km_O3
13	Kosi Embankment-00-28 km_B6	13	Kosi Embankment-78-84 km_O4
14	Kosi Embankment-00-28 km_C1	14	Kosi Embankment-78-84 km_O5
15	Kosi Embankment-00-28 km_C2	15	Kosi Embankment-78-84 km_O6
16	Kosi Embankment-00-28 km_C3	16	Kosi Embankment-78-84 km_O7
17	Kosi Embankment-00-28 km_C4	17	Kosi Embankment-78-84 km_O8
18	Kosi Embankment-00-28 km_C5	18	Kosi Embankment-78-84 km_O9
19	Kosi Embankment-00-28 km_C6	19	Kosi Embankment-78-84 km_P1
20	Kosi Embankment-00-28 km_C7	20	Kosi Embankment-78-84 km_P2
21	Kosi Embankment-00-28 km_D1	21	Kosi Embankment-78-84 km_P3
22	Kosi Embankment-00-28 km_D2	22	Kosi Embankment-78-84 km_P4
23	Kosi Embankment-00-28 km_D3	23	Kosi Embankment-78-84 km_P5
24	Kosi Embankment-00-28 km_D4	24	Kosi Embankment-78-84 km_P6
25	Kosi Embankment-00-28 km_D5	25	Kosi Embankment-78-84 km_P7
26	Kosi Embankment-00-28 km_D6	26	Kosi Embankment-78-84 km_P8
27	Kosi Embankment-00-28 km_D7	27	Kosi Embankment-78-84 km_P9
28	Kosi Embankment-00-28 km_D8	28	Kosi Embankment-78-84 km_Q1
29	Kosi Embankment-00-28 km_E1	29	Kosi Embankment-78-84 km_Q2
30	Kosi Embankment-00-28 km_E2	30	Kosi Embankment-78-84 km_Q3
31	Kosi Embankment-00-28 km_E3	31	Kosi Embankment-78-84 km_Q4
32	Kosi Embankment-00-28 km_E4	32	Kosi Embankment-78-84 km_Q5
33	Kosi Embankment-00-28 km_E5	33	Kosi Embankment-78-84 km_Q6
34	Kosi Embankment-00-28 km_E6	34	Kosi Embankment-78-84 km_Q7
35	Kosi Embankment-00-28 km_E7	35	Kosi Embankment-78-84 km_Q8
36	Kosi Embankment-00-28 km_E8	36	Kosi Embankment-78-84 km_Q9
37	Kosi Embankment-00-28 km_E9	37	Kosi Embankment-78-84 km_R1

EKE Ch. 0.00 km to 28.20 km		EKE Ch. 78.00 km to 84.00 km	
Sr. No.	**Map File Name**	**Sr. No.**	**Map File Name**
38	Kosi Embankment-00-28 km_F1	38	Kosi Embankment-78-84 km_R2
39	Kosi Embankment-00-28 km_F2	39	Kosi Embankment-78-84 km_R3
40	Kosi Embankment-00-28 km_F3	40	Kosi Embankment-78-84 km_R4
41	Kosi Embankment-00-28 km_F4	41	Kosi Embankment-78-84 km_R5
42	Kosi Embankment-00-28 km_F5	42	Kosi Embankment-78-84 km_R6
43	Kosi Embankment-00-28 km_F6	43	Kosi Embankment-78-84 km_R7
44	Kosi Embankment-00-28 km_F7	44	Kosi Embankment-78-84 km_R8
45	Kosi Embankment-00-28 km_F8	45	Kosi Embankment-78-84 km_R9
46	Kosi Embankment-00-28 km_F9	46	Kosi Embankment-78-84 km_S1
47	Kosi Embankment-00-28 km_G1	47	Kosi Embankment-78-84 km_S2
48	Kosi Embankment-00-28 km_G2	48	Kosi Embankment-78-84 km_S3
49	Kosi Embankment-00-28 km_G3	49	Kosi Embankment-78-84 km_S4
50	Kosi Embankment-00-28 km_G4	50	Kosi Embankment-78-84 km_S5
51	Kosi Embankment-00-28 km_G5	51	Kosi Embankment-78-84 km_S6
52	Kosi Embankment-00-28 km_G6	52	Kosi Embankment-78-84 km_S7
53	Kosi Embankment-00-28 km_G7	53	Kosi Embankment-78-84 km_S8
54	Kosi Embankment-00-28 km_G8		
55	Kosi Embankment-00-28 km_G9		
56	Kosi Embankment-00-28 km_G10		
57	Kosi Embankment-00-28 km_G11		
58	Kosi Embankment-00-28 km_H1		
59	Kosi Embankment-00-28 km_H2		
60	Kosi Embankment-00-28 km_H3		
61	Kosi Embankment-00-28 km_H4		
62	Kosi Embankment-00-28 km_H5		
63	Kosi Embankment-00-28 km_H6		
64	Kosi Embankment-00-28 km_H7		
65	Kosi Embankment-00-28 km_H8		
66	Kosi Embankment-00-28 km_H9		
67	Kosi Embankment-00-28 km_H10		
68	Kosi Embankment-00-28 km_H11		
69	Kosi Embankment-00-28 km_I1		
70	Kosi Embankment-00-28 km_I2		
71	Kosi Embankment-00-28 km_I3		
72	Kosi Embankment-00-28 km_I4		
73	Kosi Embankment-00-28 km_I5		
74	Kosi Embankment-00-28 km_I6		
75	Kosi Embankment-00-28 km_I7		
76	Kosi Embankment-00-28 km_I8		
77	Kosi Embankment-00-28 km_I9		
78	Kosi Embankment-00-28 km_I10		
79	Kosi Embankment-00-28 km_J1		
80	Kosi Embankment-00-28 km_J2		

EKE Ch. 0.00 km to 28.20 km		EKE Ch. 78.00 km to 84.00 km	
Sr. No.	**Map File Name**	**Sr. No.**	**Map File Name**
81	Kosi Embankment-00-28 km_J3		
82	Kosi Embankment-00-28 km_J4		
83	Kosi Embankment-00-28 km_J5		
84	Kosi Embankment-00-28 km_J6		
85	Kosi Embankment-00-28 km_J7		
86	Kosi Embankment-00-28 km_J8		
87	Kosi Embankment-00-28 km_J9		
88	Kosi Embankment-00-28 km_J10		
89	Kosi Embankment-00-28 km_K1		
90	Kosi Embankment-00-28 km_K2		
91	Kosi Embankment-00-28 km_K3		
92	Kosi Embankment-00-28 km_K4		
93	Kosi Embankment-00-28 km_K5		
94	Kosi Embankment-00-28 km_K6		
95	Kosi Embankment-00-28 km_K7		
96	Kosi Embankment-00-28 km_K8		
97	Kosi Embankment-00-28 km_K9		
98	Kosi Embankment-00-28 km_K10		
99	Kosi Embankment-00-28 km_L1		
100	Kosi Embankment-00-28 km_L2		
101	Kosi Embankment-00-28 km_L3		
102	Kosi Embankment-00-28 km_L4		
103	Kosi Embankment-00-28 km_L5		
104	Kosi Embankment-00-28 km_L6		
105	Kosi Embankment-00-28 km_L7		
106	Kosi Embankment-00-28 km_L8		
107	Kosi Embankment-00-28 km_L9		
108	Kosi Embankment-00-28 km_M1		
109	Kosi Embankment-00-28 km_M2		
110	Kosi Embankment-00-28 km_M3		
111	Kosi Embankment-00-28 km_M4		
112	Kosi Embankment-00-28 km_M5		
113	Kosi Embankment-00-28 km_M6		
114	Kosi Embankment-00-28 km_M7		
115	Kosi Embankment-00-28 km_M8		

ANNEXURE 4: LANDUSE AND LANDCOVER MAP OF THE STUDY AREA

Figure C: Landuse Land Cover (2012) in the EKE Ch. 0.00 km to 28.20 km

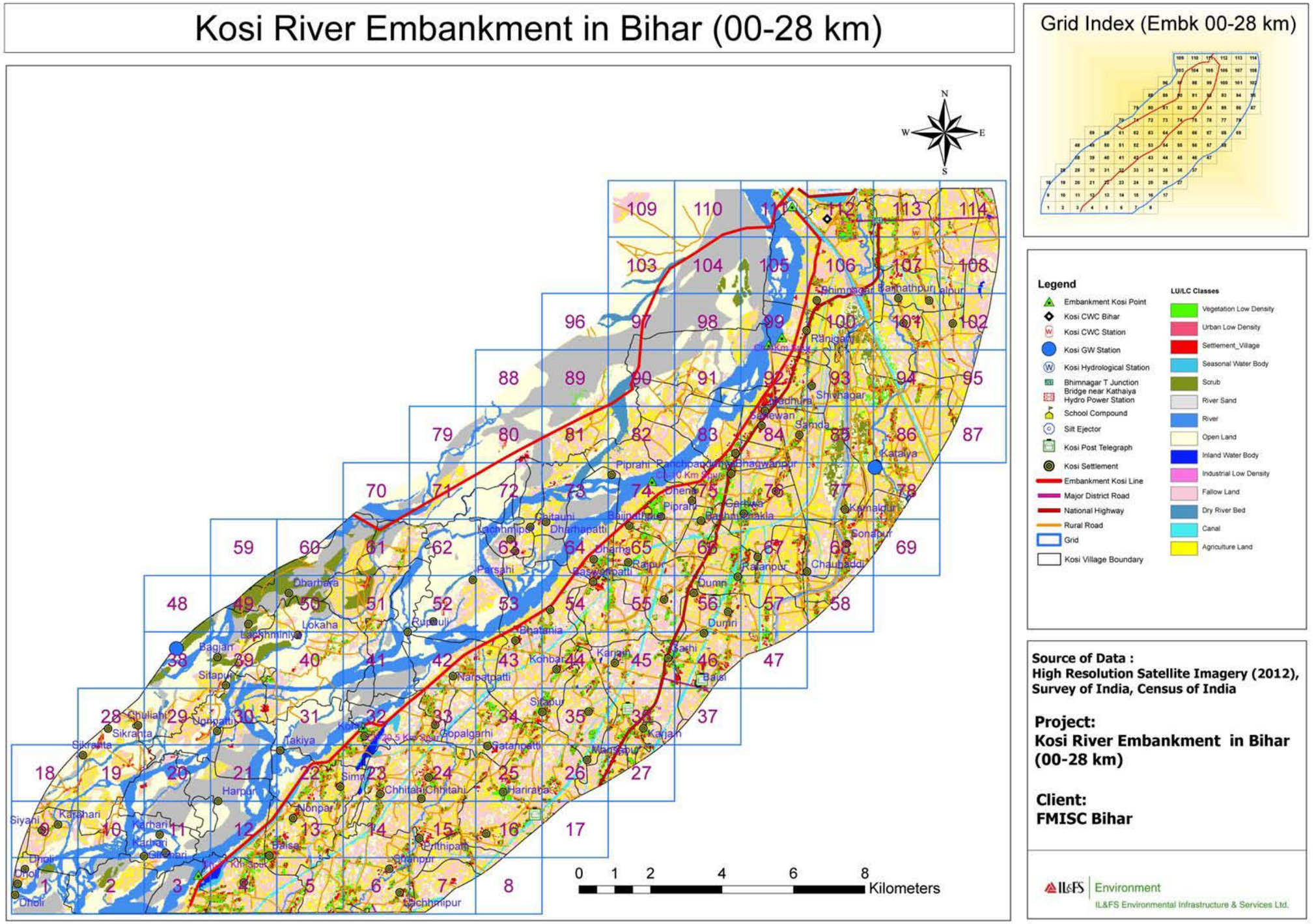
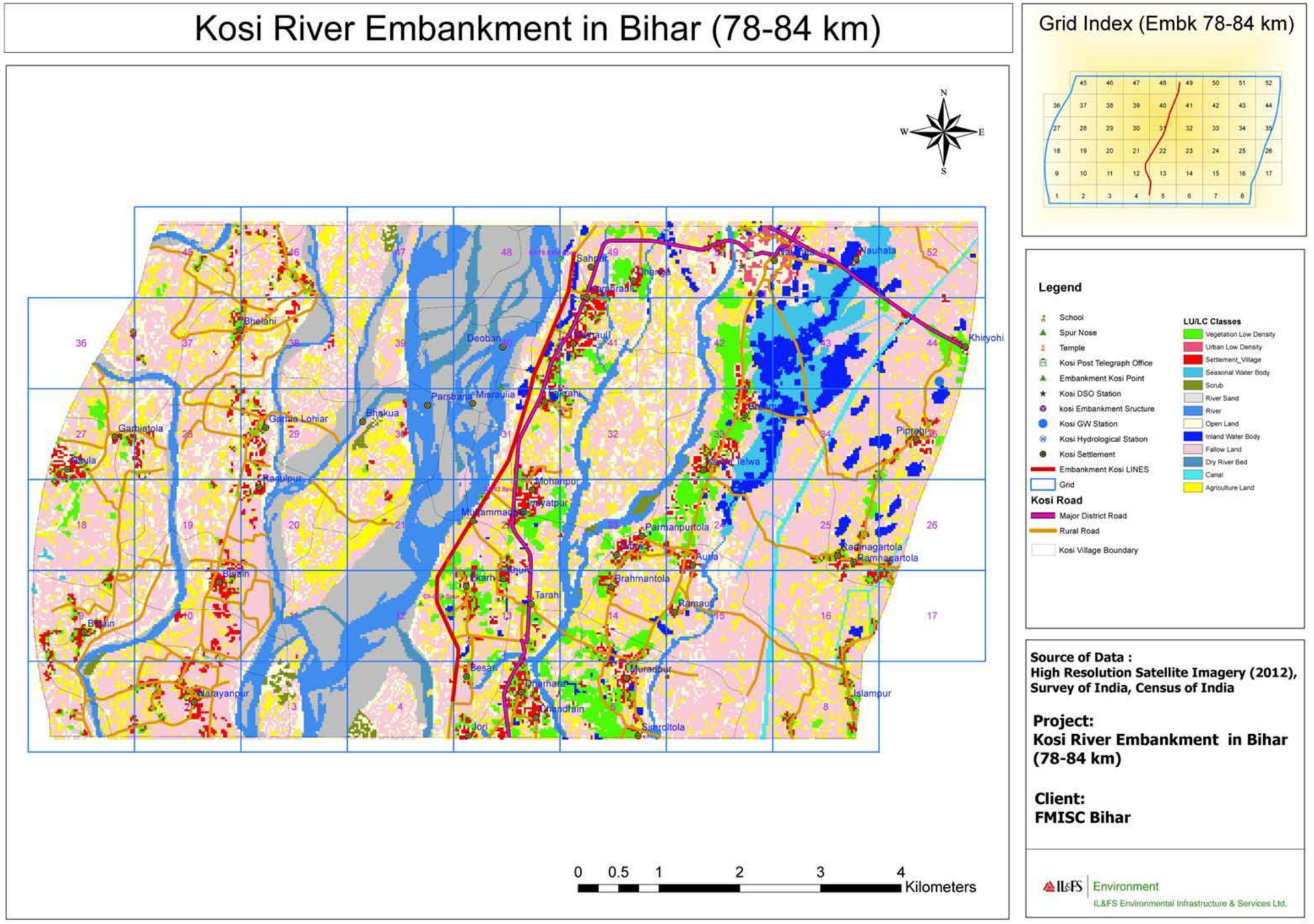


Figure D: Landuse Land Cover (2012) in the EKE Ch. 78.00 km to 84.00 km



ANNEXURE 5: METHODOLOGY FOR AMBIENT AIR QUALITY MONITORING

Sampling and analysis of Ambient Air samples were carried out with reference to the Standards by Bureau of Indian Standards IS: 5182 series. Brief methods of monitoring have been outlined in the table below.

Table D: Ambient Air Quality Monitoring Methodology

Parameters	Methodology
PM_{10}	Gravimetric method using Respirable Dust Sampler as per IS: 5182 (Part - 23), 2006
$PM_{2.5}$	Gravimetric method using FPM Sampler as per CPCB Method
SO_2	Chemical analysis by absorption of gases in Sodium Tetra-Chloro Mercurate followed by colorimetric estimation using p-Rosaniline hydrochloride and Formaldehyde as per IS: 5182 (Part - 2), 2001, Reaff. 2006
NO_2	Chemical analysis by absorption of gases in dilute sodium hydroxide and then estimated colorimetrically with sulphanilamide and N (1-Nephthyle) Ethylene diamine Dihydrochloride and Hydrogen Peroxide as per IS: 5182(Part - 6), 2000

Particulate Matter (PM_{10})

Air is drawn through a size-selective inlet and through a 20.3 X 25.4 cm (8 X 10 in) filter at a flow rate, which is typically 1.13 m^3/min. Particles with aerodynamic diameter less than the cut-off-point of the inlet are collected, by the filter. The mass of these particles is determined by the difference in filter weights prior to and after sampling. The concentration of PM_{10} in the designated size range calculated by dividing the weight gain of the filter by the volume of air sampled.

Particulate Matter ($PM_{2.5}$)

An electrically powered air sampler draws ambient air at a constant volumetric flow rate (16.7 lpm) maintained by a mass flow / volumetric flow controller coupled to a microprocessor into specially designed inertial particle-size separator (i.e. cyclones or impactors) where the suspended particulate matter in the $PM_{2.5}$ size ranges is separated for collection on a 47 mm polytetrafluoroethylene (PTFE) filter over a specified sampling period. Each filter is weighed before and after sample collection to determine the net gain due to the particulate matter. The mass concentration in the ambient air is computed as the total mass of collected particles in the $PM_{2.5}$ size range divided by the actual volume of air sampled, and is expressed in µg/m3.

Sulphur Dioxide (SO_2)

The ambient air passed through filter paper is further bubbled out through an impinger at a pre determined flow rate of 1 liter/minute (lpm). The impinger contains known volume of absorbing solution of sodium tetrachloromercurate. The absorbed solution forms a color complex of stable dichlorosulphitomercurate with p-rosaniline hydrochloride. The intensity of color developed was estimated by spectrophotometer at 560 nm called optical density (OD). The measured OD is used to determine the concentration of SO_2 from the calibration curve already been prepared against known concentrations (Modified West-Gaeke Spectrophotometric Method: IS - 5182 Part II). The volume of air sampled is the product of flow rate and sampling duration.

Nitrogen Oxides (NO_2)

The ambient air passed through filter paper is further bubbled out through an impinger at a pre determined flow rate of 1 liter/minute (lpm). The impinger contains known volume of absorbing solution of sodium hydroxide. The absorbed solution forms a stable solution of sodium nitrate with the nitrogen oxides. The nitrate ion produced during the sampling is estimated colorimetrically (Jacob and Hocheiser Modified Method: IS-5182 Part IV) by reacting with phosphoric acid, sulphanilamide and naphthyl ethylenediamine dihydrochloride (NEDA), using spectrophotometer at 540 nm.

ANNEXURE 6: SECONDARY DATA ON WATER QUALITY

Secondary data on water quality monitoring undertaken by the Public Health Department in the vicinity of the EKE Ch. 0.00 km to 28.20 km and Ch. 78.00 km to 84.00 km were collected from the Water and Sanitation Department (WSD), Supaul. The sampling was conducted during August 2002. The sampling locations for water quality monitoring are shown on ***Figures E*** and ***F*** and water quality monitoring data are presented in ***Table E***. A few of the sampling locations, sampled by the WSD were found to be in the vicinity of the samples collected by the IEISL. A tabulated comparison of the analytical results is presented in ***Table F***.

Figure E: Location of Water Sampling Points on EKE Ch. 0.00 km to 28.20 km

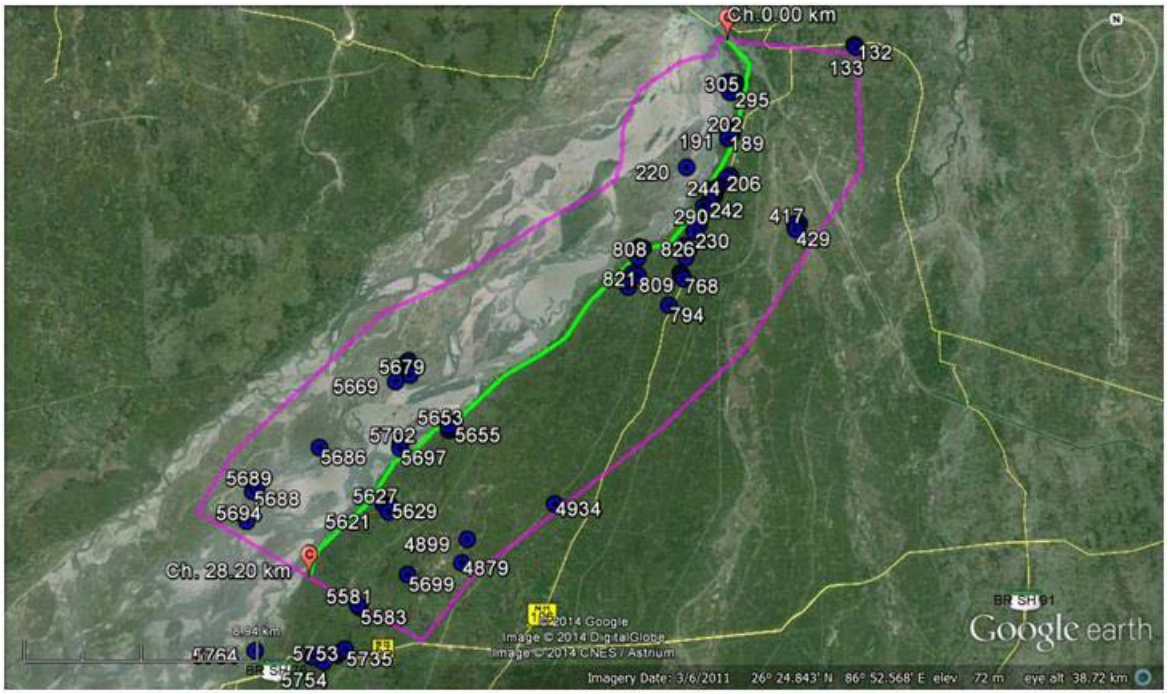


Figure F: Location of Water Sampling Points on EKE Ch. 78.00 km to 84.00 km

Table E: Water Quality Monitoring Data

QUALITY OF SPOT WATER SOURCES (DISTRICT - SUPAUL)																						
Sr.No	**Block**	**Panchayat**	**Village**	**Habitation**	**Latitude**	**Longitude**	**Sample Code No**	**Colour (Hazen Units)**	**Turbidity (NTU)**	**pH**	**Conductivity (pmhos/cm)**	**Total Hardness (as CaCO3) (mg/1)**	**Iron (as Fe) (mg/1)**	**Chloride (as Cl) (mg/1)**	**Fluoride (as F) (mg/1)**	**Total Dissolved Solids (mg/1)**	**Calcium (as Ca) (mg/1)**	**Magnesium (as Mg) (mg/1)**	**Sulphate (as SO4) (mg/1)**	**Nitrate (as N) (mg/1)**	**Arsenic (as As) (ppb)**	**Alkalinity (as CaCo3) (mg/1)**	**Total Coliform (MPN/100 ml)**
132	Basantpur	Basantpur	Khantaha	Khantaha	26.5143	86.9866	132	Colourless	BDL	7.3	1224	529	1.09	44	0.84	758	182	16	28	1.62	bdl	486	<1.1
133	Basantpur	Basantpur	Khantaha	Khantaha	26.5152	86.9859	133	5	8	7	1618	373	0.6	85	1.56	956	125	14	32	1.16	3	385	<1.1
189	Basantpur	Bhagwanpur	Raniganj	Raniganj	26.4846	86.9355	189	Colourless	8	7.3	1256	551	0.25	64	1.37	764	162	32	23	3.68	10	524	<1.1
190	Basantpur	Bhagwanpur	Raniganj	Paswan Tola .1	26.4857	86.9357	190	5	8	7.2	1621	397	1.3	29	0.35	943	118	23	11	0.1	6	382	<1.1
191	Basantpur	Bhagwanpur	Raniganj	Sahtola	26.4853	86.9369	191	15	11	7.8	538	195	9.4	16	1.86	303	66	7	14	0.1	6	209	<1.1
202	Basantpur	Bhagwanpur	Raniganj	Mehta Tola	26.4866	86.9375	202	15	19	7.5	585	242	5.41	59	0.41	339	55	25	4	0.91	10	254	<1.1
206	Basantpur	Bhagwanpur	Shibnagar	Shib Nagar	26.4707	86.9341	206	10	7	7.3	1856	574	1.17	46	1.97	1109	192	21	26	1.55	4	555	<1.1
215	Basantpur	Bhagwanpur	Shibnagar	Paswan tola .2	26.4717	86.9358	215	Colourless	BDL	8.3	302	146	0.76	8	1.67	184	49	5	BDL	5.9	4	155	<1.1
220	Basantpur	Bhagwanpur	Dubiyahi	Dubiyahi	26.4752	86.919	220	10	11	6.8	1583	460	3.39	41	0.58	982	136	28	22	5.99	6	490	<1.1
225	Basantpur	Bhagwanpur	Bhagwanpur	Bhagwanpur	26.4467	86.9186	225	Colourless	BDL	8.3	227	137	2.29	5	8.69	145	42	7	BDL	5.64	10	150	<1.1
230	Basantpur	Bhagwanpur	Bhagwanpur	Harijan tola	26.453	86.921	230	Colourless	BDL	8.3	244	158	0.88	BDL	0.74	146	49	8	BDL	3.81	10	155	<1.1
238	Basantpur	Bhagwanpur	Bhagwanpur	Mehta tola.5	26.4481	86.9172	238	5	5	7.3	1518	468	0.47	85	1.95	872	145	24	26	4.58	7	475	<1.1
239	Basantpur	Bhagwanpur	Saheban	Saheban	26.4615	86.925	239	Colourless	BDL	7.9	545	196	1.72	17	1.5	326	64	8	15	3.15	9	219	2.6
242	Basantpur	Bhagwanpur	Saheban	Mehta tola .2	26.4634	86.9271	242	10	12	6.7	1697	357	3.03	43	1.19	1029	118	14	24	6.05	10	343	<1.1
244	Basantpur	Bhagwanpur	Saheban	Tatma tola	26.4647	86.9283	244	5	6	7	1776	536	0.95	50	1.71	1086	182	18	31	5.27	5	593	<1.1
248	Basantpur	Bhagwanpur	Saheban	Mehta tola .2	26.4679	86.9308	248	15	18	7.7	523	193	5.34	29	0.22	325	65	7	11	3.37	BDL	178	<1.1
252	Basantpur	Bhagwanpur	Saheban	Magurani musahari	26.465	86.9295	252	10	6	6.7	1699	504	3.27	41	0.54	984	963	22	22	0.1	9	546	<1.1
264	Basantpur	Bhagwanpur	Saheban	Mushari Kola.3	26.4673	86.9293	264	15	13	6.7	1504	326	6.66	31	1.07	844	101	17	19	1.92	BDL	299	<1.1
290	Basantpur	Bhagwanpur	Panchparduria	Yadav Tola	26.4551	86.923	290	15	10	7.3	1514	381	9.14	81	1.1	960	117	20	30	1.81	9	403	<1.1
293	Basantpur	Bhimnagar	Bhimnagar	Sah tola no. 1	26.5041	86.9375	293	10	10	6.8	1716	480	3.05	38	1.07	978	143	29	23	1.01	11	489	<1.1
295	Basantpur	Bhimnagar	Bhimnagar	Sah tola no. 2	26.5012	86.9387	295	10	9	7.3	1954	469	2.72	89	1.38	1225	141	27	31	0.68	BDL	490	<1.1
302	Basantpur	Bhimnagar	Bhimnagar	Bhat Tola 2	26.5038	86.9394	302	10	8	7.9	5120	1299	2.81	112	0.28	3022	427	53	84	1.57	5	1203	<1.1
305	Basantpur	Bhimnagar	Bhimnagar	Musahari	26.5005	86.9371	305	15	10	8.1	512	204	3.7	30	1.33	307	61	12	14	1.19	11	197	<1.1
306	Basantpur	Bhimnagar	Bhimnagar	Paswan Tola 2	26.504	86.936	308	10	11	6.8	1839	553	1.34	21	0.52	1142	171	29	14	1.24	9	609	<1.1
417	Basantpur	Denbandhe	Kataia	Yadav Tola 1	26.4541	86.96	417	Colourless	BDL	7.7	559	209	1.46	23	0.62	327	64	11	12	1.81	7	197	<1.1
424	Basantpur	Denbandhe	Kataia	Mushari South	26.454	86.9617	424	10	11	7.2	1686	436	2.56	27	0.42	1012	138	21	11	2.95	BDL	453	<1.1
429	Basantpur	Denbandhe	Kataia	Paswan Tola	26.4522	86.9601	429	10	9	7.3	1897	555	3.12	82	1.33	1208	169	31	37	0.99	10	542	<1.1
760	Basantpur	Ratanpur	Ratanpur	Khatbe Tola 4	26.4388	86.9149	760	Colourless	BDL	7.9	525	169	1.95	32	0.24	303	52	9	12	0.45	9	185	<1.1
768	Basantpur	Ratanpur	Ratanpur	Mehtar Tola	26.4367	86.9161	768	Colourless	BDL	7.8	1442	366	1.42	88	0.21	920	112	20	28	0.49	11	381	<1.1
806	Basantpur	Ratanpur	Piprahipalti Goiari	Yadav Tola 2	26.4479	86.901	806	10	13	7	1954	545	0.43	75	1.46	1219	169	28	32	0.32	5	604	<1.1
807	Basantpur	Ratanpur	Piprahipalti Goiari	Musari.1	26.4483	86.8994	807	Colourless	BDL	8.4	295	149	1.01	8	1.02	177	50	5	BDL	0.18	3	135	<1.1
808	Basantpur	Ratanpur	Piprahipalti	Yadav Tola 2	26.447	86.8988	808	Colourless	BDL	8.4	294	135	0.2	BDL	1.47	185	47	4	BDL	0.17	5	148	<1.1

QUALITY OF SPOT WATER SOURCES (DISTRICT - SUPAUL)

Sr.No	Block	Panchayat	Village	Habitation	Latitude	Longitude	Sample Code No	Colour (Hazen Units)	Turbidity (NTU)	pH	Conductivity (pmhos/cm)	Total Hardness (as CaCO3) (mg/1)	Iron (as Fe) (mg/1)	Chloride (as Cl) (mg/1)	Fluoride (as F) (mg/1)	Total Dissolved Solids (mg/1)	Calcium (as Ca) (mg/1)	Magnesium (as Mg) (mg/1)	Sulphate (as SO4) (mg/1)	Nitrate (as N) (mg/1)	Arsenic (as As) (ppb)	Alkalinity (as CaCo3) (mg/1)	Total Coliform (MPN/100 ml)
			Goiari																				
809	Basantpur	Ratanpur	Piprahipalti Goiari	Yadav Tola 3	26.4386	86.8986	809	Colourless	BDL	7.4	1551	399	1.19	58	1.7	877	124	21	22	0.2	8	427	<1.1
814	Basantpur	Ratanpur	Piprahipalti Goiari	Thakur Tola 2	26.4392	86.8963	814	Colourless	BDL	6.9	1514	449	0.72	40	1.03	964	138	24	22	0.36	5	419	<1.1
821	Basantpur	Ratanpur	Daijnaphpur	Harijan Tola	26.4346	86.8946	821	Colourless	4	7.2	1344	188	0.82	40	1.65	851	61	8	23	0.47	BDL	170	<1.1
826	Basantpur	Ratanpur	Dhena	Dhobi Tola	26.4441	86.9173	826	Colourless	BDL	6.9	1824	437	0.54	55	1.55	1158	137	22	35	0.14	10	420	<1.1
4879	Raghopur	Motipur	Berdah	Berdah	26.3417	86.8261	4879	Colourless	BDL	7.4	522	201	1.3	36	0.69	315	69	6	12	0.65	5	200	<1.1
4899	Raghopur	Motipur	Berdah	Modi Tola	26.3498	86.8286	4899	Colourless	BDL	7.3	726	242	1.43	39	0.26	453	71	15	18	BDL	11	237	<1.1
4934	Raghopur	Motipur	Motipur	Brahman Tola 3	26.3608	86.8628	4934	Colourless	BDL	7.2	1112	506	0.39	36	0.9	659	164	22	15	0.76	4	547	<1.1
5582	Saraigarah Dhaptiyahi	Jhala Dhumri	Jhila Dhumri	Bhobe Patti Mehta	26.3288	86.7853	5581	Colourless	8	7.4	1042	381	0.29	26	0.63	602	133	11	21	1.05	BDL	400	8
5584	Saraigarah Dhaptiyahi	Jhala Dhumri	Jhila Dhumri	Bhobe Patti Amath Tola	26.3278	86.786	5583	5	8	7.8	1628	473	0.69	27	0.59	1021	161	16	18	0.45	BDL	527	8
5622	Saraigarah Dhaptiyahi	Lokha	Nonapara	Bhuniya Tola	26.3604	86.7986	5621	Colourless	BDL	7.3	461	161	BDL	14	1.38	264	54	6	BDL	0.44	BDL	151	<1.1
5628	Saraigarah Dhaptiyahi	Lokha	Nonapara	Miya Tola	26.3631	86.7968	5627	Colourless	BDL	6.9	705	268	0.53	27	0.47	423	94	7	15	1.13	BDL	270	<1.1
5630	Saraigarah Dhaptiyahi	Lokha	Nonapara	Chamar Tola 2	26.3623	86.7996	5629	Colourless	BDL	6.9	841	261	0.5	35	1.22	491	88	9	15	0.44	3	247	<1.1
5652	Saraigarah Dhaptiyahi	Lokha	Gopalpur	Gopalpur	26.388	86.823	5652	Colourless	BDL	7.9	1435	336	1.25	45	0.32	902	99	21	29	1.23	7	368	<1.1
5653	Saraigarah Dhaptiyahi	Lokha	Gopalpur	Gopalpur	26.3893	86.8231	5653	Colourless	BDL	6.7	1104	492	1.16	28	1.35	681	152	26	16	1.76	BDL	437	<1.1
5655	Saraigarah Dhaptiyahi	Lokha	Gopalpur	Mushari	26.3894	86.8251	5655	10	9	6.9	737	231	1.41	15	0.88	428	69	14	10	1.86	11	244	<1.1
5657	Saraigarah Dhaptiyahi	Lokha	Gopalpur	Batra Tola	26.3877	86.8233	5657	Colourless	BDL	7.2	436	182	0.61	19	1.27	261	55	10	7	0.99	3	166	<1.1
5658	Saraigarah Dhaptiyahi	Lokha	Gopalpur	Dhobi Tola	26.3894	86.8238	5658	Colourless	BDL	6.8	8.33	320	0.41	44	0.58	508	112	9	23	1.77	5	319	<1.1
5669	Saraigarah Dhaptiyahi	Lokha	Laukaha	Miya Tola	26.4053	86.8034	5669	Colourless	BDL	8	1416	402	0.6	45	1.34	811	137	14	24	1.07	4	380	<1.1
5677	Saraigarah Dhaptiyahi	Lokha	Laukaha	Domtola	26.4107	86.807	5677	Colourless	BDL	7.8	1435	351	1.07	25	1.17	863	114	15	20	0.3	BDL	324	<1.1
5678	Saraigarah Dhaptiyahi	Lokha	Laukaha	Domtola	26.4122	86.8087	5678	5	9	8	1472	337	0.43	38	0.59	892	107	16	20	0.81	11	359	<1.1
5679	Saraigarah Dhaptiyahi	Lokha	Laukaha	Dhobi Tola	26.4073	86.809	5679	Colourless	8	7.1	771	243	0.14	52	0.74	467	80	10	23	1.63	BDL	231	<1.1
5686	Saraigarah Dhaptiyahi	Lokha	Takia	Takiyan	26.3836	86.773	5686	10	8	7.7	2640	594	3.1	66	1.34	1646	190	27	28	1.69	6	599	<1.1
5688	Saraigarah Dhaptiyahi	Lokha	Kebishi	Chamar Tola	26.3693	86.7466	5688	Colourless	BDL	7.3	592	195	0.82	33	1.94	376	59	11	15	BDL	BDL	181	2.6
5689	Saraigarah Dhaptiyahi	Lokha	Kebishi	Chamar Tola	26.371	86.7483	5689	10	11	8	1488	399	BDL	42	0.24	946	140	11	18	0.45	9	445	<1.1

QUALITY OF SPOT WATER SOURCES (DISTRICT - SUPAUL)

Sr.No	Block	Panchayat	Village	Habitation	Latitude	Longitude	Sample Code No	Colour (Hazen Units)	Turbidity (NTU)	pH	Conductivity (pmhos/cm)	Total Hardness (as CaCO3) (mg/1)	Iron (as Fe) (mg/1)	Chloride (as Cl) (mg/1)	Fluoride (as F) (mg/1)	Total Dissolved Solids (mg/1)	Calcium (as Ca) (mg/1)	Magnesium (as Mg) (mg/1)	Sulphate (as SO4) (mg/1)	Nitrate (as N) (mg/1)	Arsenic (as As) (ppb)	Alkalinity (as CaCo3) (mg/1)	Total Coliform (MPN/100 ml)
5694	Saraigarah Dhaptiyahi	Lokha	Karhari	Chamar Tola	26.3591	86.7438	5694	Colourless	BDL	6.8	586	224	0.15	38	0.45	351	78	7	17	1.3	5	213	<1.1
5697	Saraigarah Dhaptiyahi	Lokha	Korhail	Kodhli	26.3823	86.804	5697	Colourless	BDL	7.3	828	233	BDL	27	0.52	493	74	11	11	0.44	6	228	<1.1
5699	Saraigarah Dhaptiyahi	Lokha	Korhail	Batra Tola	26.385	86.805	5699	Colourless	BDL	7.2	723	216	0.59	16	0.3	442	71	9	10	0.08	BDL	201	<1.1
5702	Saraigarah Dhaptiyahi	Lokha	Korhail	Mallah Tola	26.3839	86.8043	5702	Colourless	BDL	7.3	1080	441	1.28	64	1.44	637	154	12	27	0.37	12	412	2.6
5717	Saraigarah Dhaptiyahi	Piprakhurd	Naraenpur	Narayanpur	26.3116	86.7767	5717	Colourless	BDL	7.3	552	169	BDL	44	0.4	313	58	5	15	1.89	7	174	<1.1
5735	Saraigarah Dhaptiyahi	Piprakhurd	Naraenpur	Rajdhob Tola	26.3136	86.7798	5735	Colourless	BDL	7.3	1108	499	0.93	55	0.24	625	156	26	24	1.11	6	456	<1.1
5741	Saraigarah Dhaptiyahi	Piprakhurd	Naraenpur	Malatola	26.3128	86.7782	5741	Colourless	BDL	7.2	469	172	1.09	19	1.09	268	53	10	8	0.51	4	185	<1.1
5753	Saraigarah Dhaptiyahi	Piprakhurd	Piprakhurd	Khatbe Tola	26.3096	86.7713	5753	Colourless	BDL	6.9	450	153	0.35	15	0.97	263	47	8	4	1.31	4	142	<1.1
5754	Saraigarah Dhaptiyahi	Piprakhurd	Piprakhurd	Khatbe Tola	26.3113	86.767	5754	Colourless	BDL	6.8	462	194	0.91	BDL	1.37	289	57	11	BDL	1.34	4	203	<1.1
5764	Saraigarah Dhaptiyahi	Piprakhurd	Piprakhurd	Dhobi Tola	26.3143	86.7451	5764	Colourless	BDL	6.9	1026	352	0.35	43	0.24	621	120	12	27	1.03	3	381	<1.1
5892	Supaul	Bairo	Bairo	B. Harijan tola	26.0299	86.5155	5892	Colourless	BDL	7.4	682	199	0.94	39	1.34	395	51	17	15	1.16	6	191	<1.1
5916	Supaul	Bairo	Bairo	Brahampur	26.0192	86.5065	5916	Colourless	BDL	7	698	269	0.46	40	0.13	445	63	27	21	0.92	BDL	257	<1.1
5919	Supaul	Bairo	Bairo	Itahari	26.0168	86.5093	5919	10	10	6.9	748	308	3.41	30	1.08	471	106	9	16	1.55	12	324	<1.1
5927	Supaul	Bairo	Dhor raghopur	Dhor Raghopur	26.0064	86.5137	5927	5	7	7.4	576	183	0.63	28	0.19	350	60	8	14	0.94	3	196	<1.1
5948	Supaul	Bakaur	Parasauni	Parasauni	26.0622	86.4701	5948	Colourless	BDL	7.3	694	198	0.59	49	1.31	417	62	10	20	2.02	7	185	<1.1
6028	Supaul	Balwa	Narahia	Narahiya	26.1267	86.5124	6028	Colourless	BDL	7.3	305	109	1.21	12	0.47	147	36	4	14	0.57	8	165	<1.1

Table F: Comparison of Primary and Secondary Groundwater Quality Data

PRIMARY & SECONDARY GROUNDWATER QUALITY DATA										
Sample No.	**Limit as per IS 10500:2012**		**GW - 2**	**WQ - 808**	**GW - 3**	**WQ - 5657**	**GW - 4**	**WQ - 5581**	**GW - 5**	**WQ - 5916**
Date of Sampling			06.02.14	N.A.	06.02.14	N.A.	06.02.14	N.A.	09.02.14	N.A.
Latitude			26°26'41.31"N	26°26'40.92"N	26°23'10.89"N	26°23'15.72"N	26°20'19.04"N	26°19'43.68"N	26° 0'0.43"N	26° 1'9.12"N
Longitude			86°54'1.32"E	6°53'55.68"E	86°49'14.47"E	86°49'23.88"E	86°45'58.46"E	86°47'7.08"E	86°28'1.99"E	86°30'23.40"E
Distance (M)			157.00		300.00		2188.00		4462.00	
Parameters	**Desirable**	**Permissible**	**Results in mg/l. except. Colour, pH & Conductivity (µmhos./cm.)**							
1. Colour	5.0 hazen limit	15.0 hazen limit	< 5.00		< 5.00		< 5.00		< 5.00	
2. pH	6.5 - 8.5	No relaxation	7.28	8.4	6.94	7.2	7.24	7.4	6.86	7
3. Electrical Conductivity, µmhos./cm.	-----	----	234	294	212	436	283	1042	326	698
4. Total Dissolved Solids	500	2000	146	185	132	261	176		204	445
5. Total hardness as CaCO3	200	600	120	135	116	182	140	381	160	269
6. Calcium as Ca	75	200	32	47	33.6	55	44.9	133	48.4	63
7. Magnesium as Mg	30	100	9.7	4	7.8	10	6.7	11	9.5	27
8. Total Alkalinity as CaCO3	200	600	72	148	68	166	84	400	76	257
9. Chloride as Cl	250	1000	4	BDL	10	19	6	26	12	40
10. Sulphate as SO4	200	400	8.2	BDL	7.6	7	6.6	21	10.2	21
11. Fluoride as F	1	1.5	0.58	1.47	0.62	1.27	0.38	0.63	0.44	0.13
12. Boron as B	0.5	1	< 0.02		< 0.02		< 0.02		< 0.02	
13. Iron as Fe	0.3	No relaxation	0.26	0.2	0.33	0.61	0.78	0.29	1.1	0.46
14. Copper as Cu	0.05	1.5	< 0.05		< 0.05		< 0.05		< 0.05	
15. Zinc as Zn	5	15	0.32		0.26		0.54		0.3	
16. Chromium as Cr+6	0.05	No relaxation	< 0.05		< 0.05		< 0.05		< 0.05	
17. Arsenic as As	0.01	0.05	< 0.01	5	< 0.01	3	< 0.01	BDL	< 0.01	BDL
18. Coliform per 100 ml.	NIL	---	NIL	<1.1	NIL	<1.1	NIL	8	NIL	<1.1
19. E.coli per 100 ml.	NIL	----	NIL		NIL		NIL		NIL	

Note:	
Primary Data	
Secondary Data from PHD Supaul	

ANNEXURE 7: WATER TESTING METHODOLOGY AND PROTOCOLS

The collected groundwater and surface water samples from the Study area were analyzed as per Standard Test Methods prescribed in the IS & APHA. The detailed listing of protocols is tabulated below.

Table G: Water Testing Methodology & Protocols

Parameter	Groundwater Testing Methodologies	
	Analysis Protocols	**Methods**
1. Color	IS 3025 (Part-4)	Visual Comparison
2. pH	IS 3025 (Part-11)	Electrode Method
3. Electrical Conductivity	IS 3025 (Part-14)	Electrode Method
4. Total Dissolved Solids	IS 3025 (Part-16)	Gravimetric Method
5. Total hardness as $CaCO_3$	IS 3025 (Part-21)	Titrimetric Method
6. Calcium as Ca	IS 3025 (Part-40)	Titrimetric Method
7. Magnesium as Mg	IS 3025 (Part-46)	Titrimetric Method
8. Total Alkalinity as $CaCO_3$	IS 3025 (Part-23)	Titrimetric Method
9. Chloride as Cl	IS 3025 (Part-32)	Titrimetric Method
10. Sulphate as SO4	IS 3025 (Part-24)	Turbidity Method
11. Fluoride as F	APHA 4500 (F D)	SPANDS Method
12. Boron as B	APHA 4500 B B	Curcummin Method
13. Iron as Fe	IS 3025 (Part-53)	AAS
14. Copper as Cu	APHA (3111 B)	AAS
15. Zinc as Zn	APHA (3111 B)	AAS
16. Chromium as Cr^{+6}	APHA (3111 B)	AAS
17. Arsenic as As	APHA (3114 B)	AAS
18. Coliform per 100 ml.	IS 1622	MPN Technique
19. E.coli per 100 ml.	IS 1622	MPN Technique

Table H: Surface Water Testing Methodology & Protocols

Parameter	Surface Water Testing Methodologies	
	Analysis Protocols	**Methods**
1. Color	IS 3025 (Part-4)	Visual Comparison
2. pH	IS 3025 (Part-11)	Electrode Method
3. Electrical Conductivity	IS 3025 (Part-14)	Electrode Method
4. Dissolved Oxygen	IS 3025 (Part-38)	Winkler's Method
5. Turbidity on NTU	IS 3025 (Part-10)	Nephlo Turbidity Method
6. Total Dissolved Solids	IS 3025 (Part-16)	Gravimetric Method
7. Total hardness as CaCO3	IS 3025 (Part-21)	Titrimetric Method
8. Calcium as Ca	IS 3025 (Part-40)	Titrimetric Method
9. Magnesium as Mg	IS 3025 (Part-46)	Titrimetric Method
10. Total Alkalinity as CaCO3	IS 3025 (Part-23)	Titrimetric Method
11. Chloride as Cl	IS 3025 (Part-32)	Titrimetric Method
12. Sulphate as SO4	IS 3025 (Part-24)	Turbidity Method
13. Fluoride as F	APHA 4500 (F D)	SPANDS Method
14. Sodium as Na	IS 3025 (Part-45)	Flame Photometric
15. Potassium as K	IS 3025 (Part-45)	Flame Photometric

Parameter	Surface Water Testing Methodologies	
	Analysis Protocols	Methods
16. Boron as B	APHA 4500 B B	Curcummin Method
17. Total Phosphate as P	IS 3025 (Part-31)	Colorimetric Method
18. BOD	IS 3025 (Part-44)	Winkler's Method
19. COD	APHA 5220 B	Open Reflux Method
20. Ammonical Nitrogen as N	IS 3025 (Part-34)	Titrimetric Method
21. Total Kjeldahl Nitrogen as N	IS 3025 (Part-34)	Titrimetric Method
22. Coliform per 100 ml.	IS 1622	MPN Technique
23. E.coli per 100 ml.	IS 1622	MPN Technique

ANNEXURE 8: METHODOLOGY FOR AMBIENT NOISE LEVEL MONITORING

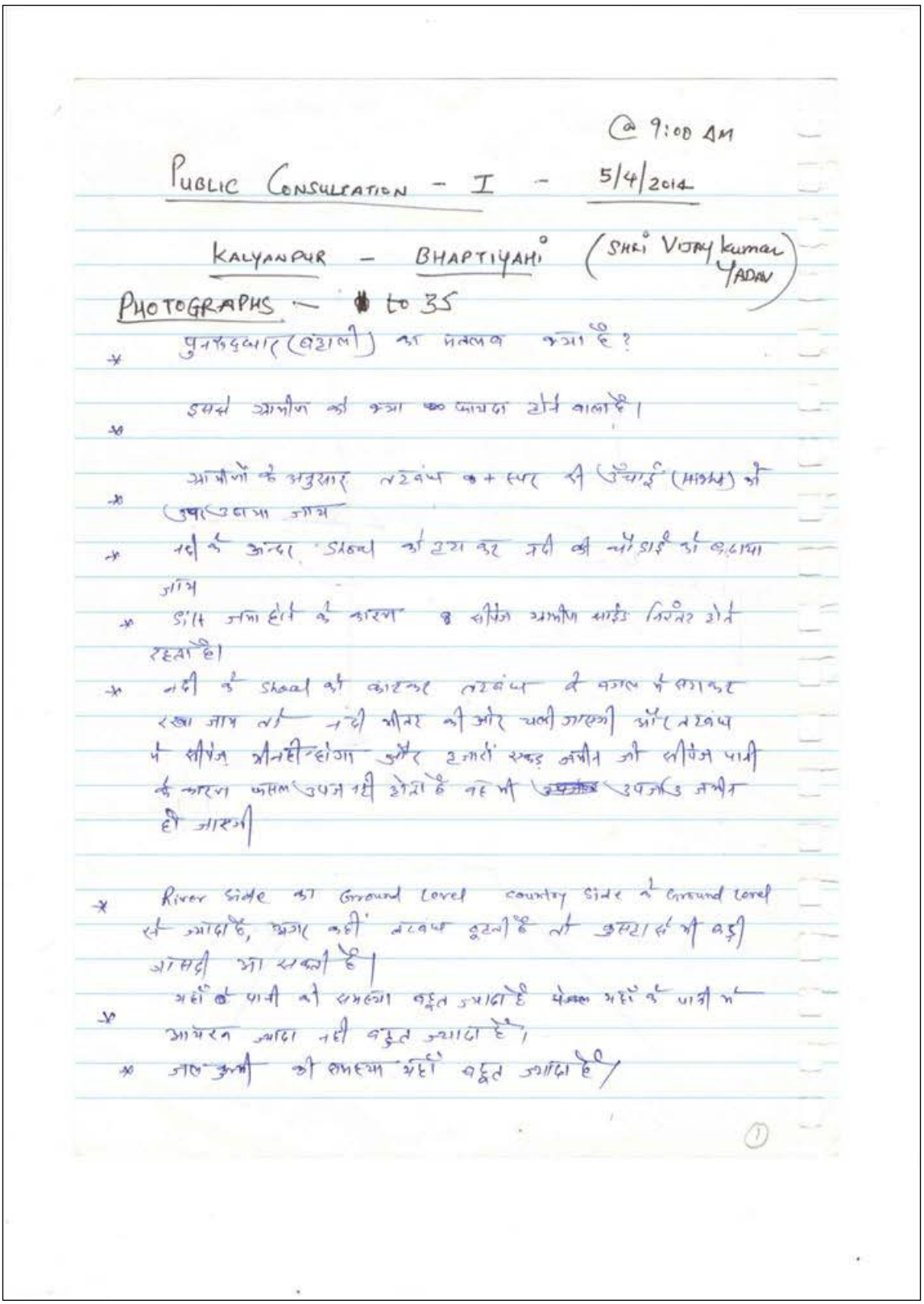
The intensity of sound energy in the environment is measured by a logarithmic scale and is expressed on a decibel (dB) scale. Ordinary sound level meter measures the sound energy that reaches the microphone by converting it into electrical energy and then measures the magnitude in dB. In a sophisticated type of sound level meter, an additional circuit (filters) is provided, which modifies signal in such a way 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 universally accepted by the international community.

Noise levels were measured using an Integrating sound level meter manufactured by Cygnet (Model No. 2023). It has an indicating mode of Lp and Leq. Keeping the mode in Lp for few minutes and setting the corresponding range and the weighting network in "A" weighting set the sound level meter was run for one hour time and Leq was measured at all locations.

The day noise levels have been monitored during 6.00am to 10.00pm and night noise levels during 10.00pm to 6.00am at all the six monitoring locations selected on stratified random sampling basis of the study area.

ANNEXURE 9: PROCEEDINGS OF THE PUBLIC CONSULTATIONS

Proceedings of Public Consultation – 1 (held near EKE Ch. 28.20 km)



@ 9:00 AM

PUBLIC CONSULTATION - I - 5/4/2014

KALYANPUR - BHAPTIYAHI (SHRI VIJAY KUMAR YADAV)

PHOTOGRAPHS — 1 to 35

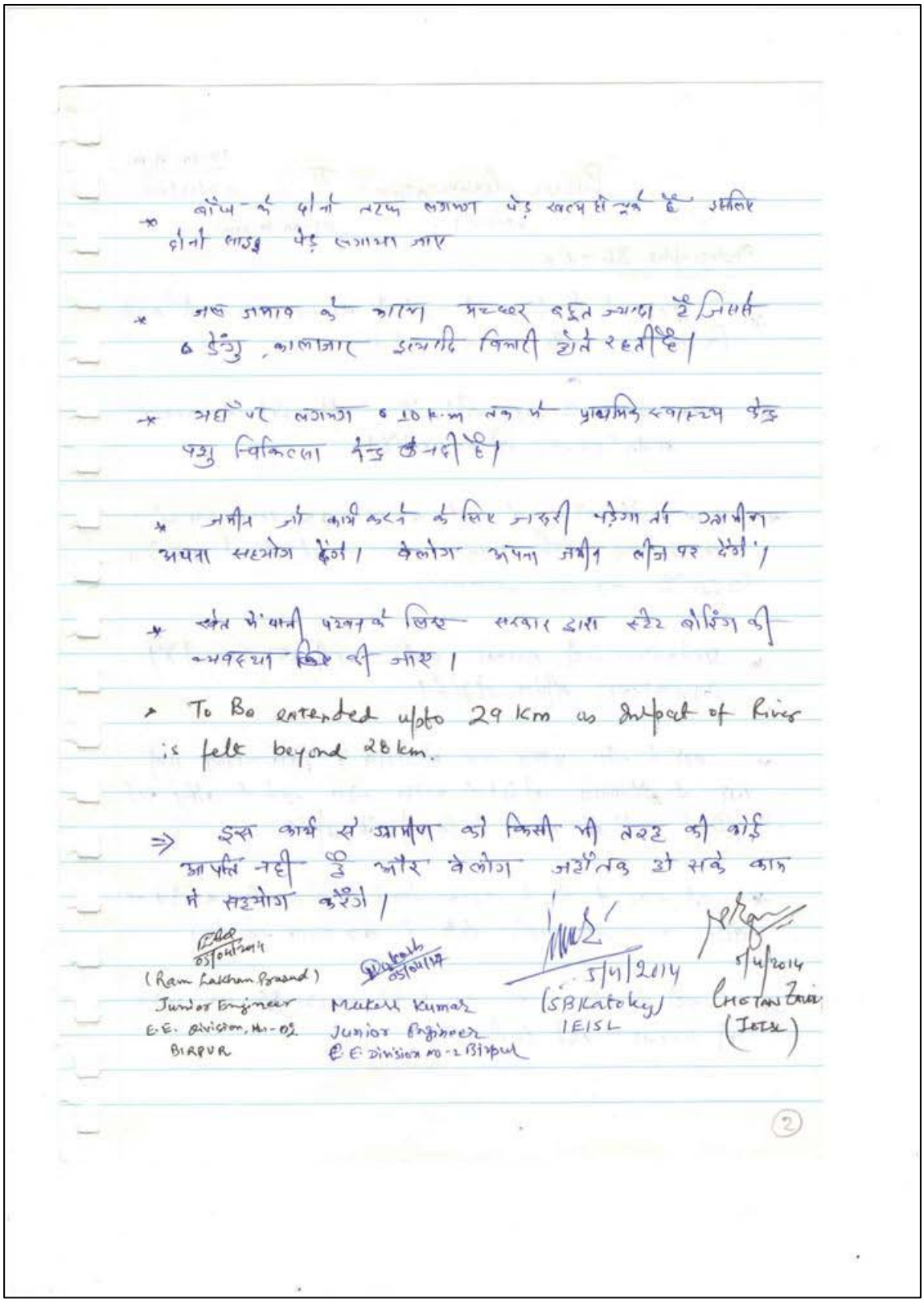
* पुनरुद्धार (बहाली) का तात्पर्य क्या है?

इससे ग्रामीण को क्या ज्यादा होने वाला है।

* ग्रामीणों के अनुसार तटबंध का + स्पर की ऊँचाई (MSL) से ऊपा-उठाया जाय
* नदी के अन्दर Shoal को हटा कर नदी की चौड़ाई को बढ़ाया जाय
* Silt जमा होने के कारण 8 सीजन ग्रामीण साईड निरंतर होते रहता है।
* नदी के Shoal को काटकर तटबंध के बगल में फाड़कर रखा जाय तो नदी भीतर की ओर चली जायेगी और तटबंध में सीपेज नहीं होगा और इससे खड़ी फसल को सीपेज पानी के कारण फसल उपज नहीं होता है वह भी उपजाऊ जमीन हो जायेगी।

* River Side का Ground Level country Side के Ground Level से ज्यादा है, अगर कहीं तटबंध टूटती है तो उसी में बड़ी जानमाल हो सकती है।

* यहाँ के पानी की समस्या बहुत ज्यादा है पेयजल यहाँ के पानी में आयरन ज्यादा नहीं बहुत ज्यादा है।
* जल जमाव की समस्या यहाँ बहुत ज्यादा है।



* बाँध के दोनों तरफ लगाया पेड़ खत्म हो चुके हैं इसलिए दोनों साइड पेड़ लगाया जाए

* गर्म प्रभाव के कारण मच्छर बहुत ज्यादा है जिससे डेंगू, कालाजार इत्यादि बिमारी होते रहती है।

* यहाँ पर लगभग 8 10 k.m तक में प्राथमिक स्वास्थ्य केंद्र पशु चिकित्सा केंद्र कुछ नहीं है।

* जमीन जो कार्य करने के लिए जरूरी पड़ेगा तो उसमें का अथवा सहयोग देंगे। केलोग अपना जमीन लेना पर देंगे।

* खेत में पानी पटवन के लिए सरकार द्वारा स्टेट बोरिंग की व्यवस्था किए की जाए।

* To Bo extended upto 29 km as impact of River is felt beyond 28 km.

⇒ इस कार्य से ग्रामीण को किसी भी तरह की कोई आपत्ति नहीं है और केलोग जहाँतक हो सके काम में सहयोग करेंगे।

05/04/2014
(Ram Lakhan Prasad)
Junior Engineer
E.E. division, No-02
BIRPUR

05/04/14
Mukesh Kumar
Junior Engineer
E.E. Division No-2 Birpur

5/4/2014
(SBKatoky)
IEISL

5/4/2014
CHETAN Zaveri
(IEISL)

(2)

Public Consultation - 1 Attendance Sheet (held near EKE Ch. 28.20 km)

(9)

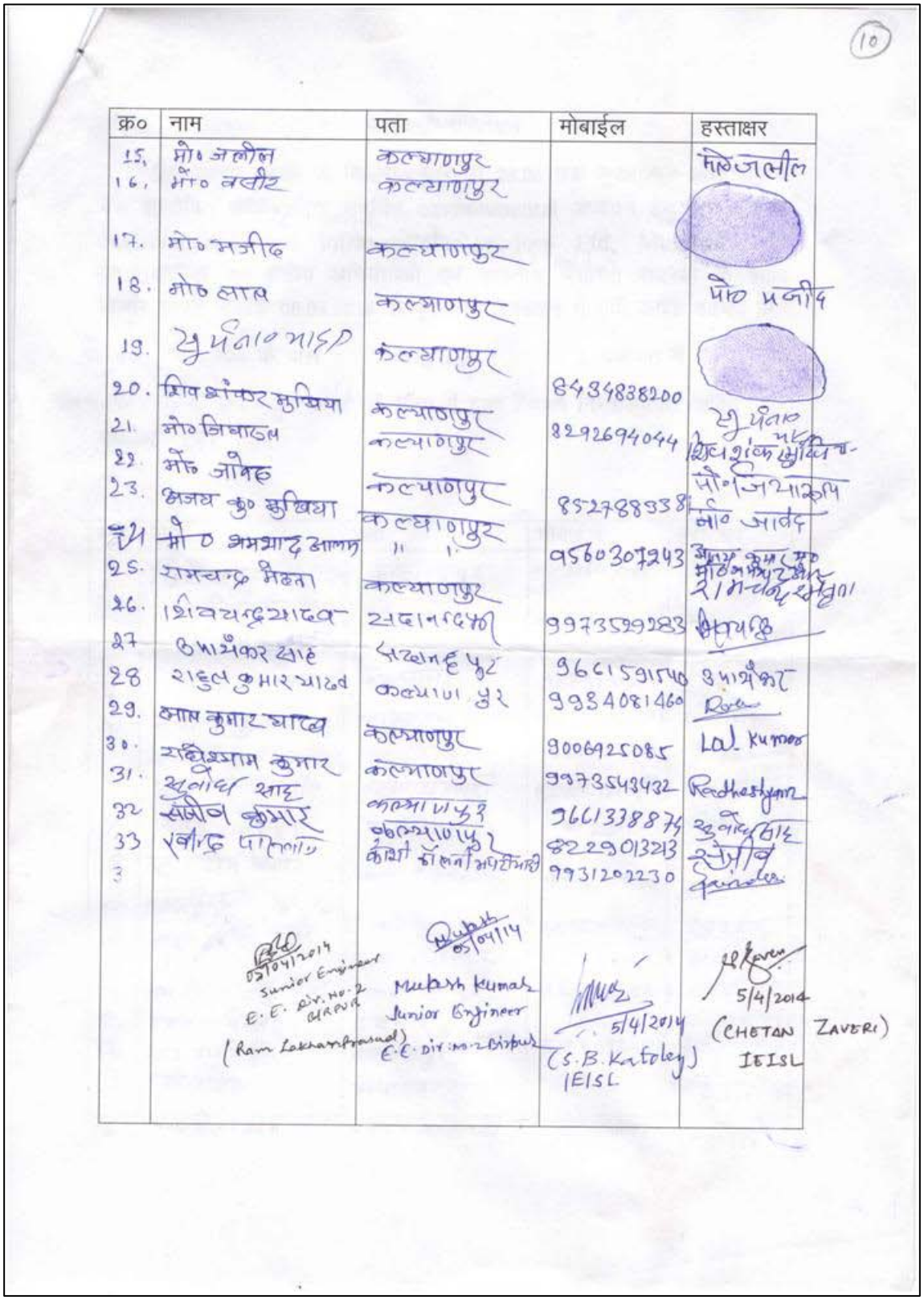
कार्यवाही प्रतिवेदन

पूर्वी कोशी तटबंध के कि०मी० 0.00 से 28.20 तक सुरक्षात्मक कार्य (विश्व बैंक सम्पोषित् फेज–II) से संबधित environmental अध्ययन हेतु I.L. & F.S. environmental and infrastructure services Ltd. Mumbai के पदाधिकारियों का क्षेत्रीय अभियंताओं एवं स्थानीय पंचायत सदस्यों के साथ विचार गोष्ठी दिनांक 05.04.2014 के पूर्वाह्न/अपराह्न में पूर्वी काशी तटबंध के

28.00 कि० मी० के पास अपहिआही पंचायत में

अरार-कलमारा उर, मुखिया जी के दरवाजे के भवन में हुआ जिसमें निम्नलिखित व्यक्ति उपस्थित हुए।

क्र०	नाम	पता	मोबाईल	हस्ताक्षर
1	विजयकुमार यादव	कल्याणपुर	9430648466	Vijay
2	मुखीयाजी सुनिता देवी	कल्याणपुर	9801142391	सुनिता देवी
3.	लक्ष्मण मेहता	कलमारा	9939093248	लक्ष्मण मेहता
4.	मनीज कुमार	लालगंज	9570725808	मनोज कुमार
5.	प्रदीप कुमार पंडित	दलानपुर	9661039538	प्रदीप
6.	जय नारायण चौधरी	कालापहाड़ीरही	8084947492	जयनारायण
7	गंगा राम मेहता	कलमारा	9006925081	गंगा राम मेहता
8	सीताराम मेहता	कल्याणपुर	9939093248	
9	अरविन्द	कल्याणपुर	8051881860	अरविन्द
10	सत्य नारायण शर्मा	कल्याणपुर		सत्य नारायण
11	जगदीश प्रसाद मंडल	कल्याणपुर	8294068618	जगदीश
12.	रामफल मेहता	कल्याणपुर		Ramphal Mehta
13.	प्रेम नाथ मेहता	कल्याणपुर	8406927118	प्रेमनाथ मेहता
14.	बद्री मंडल	अपहिआही		बद्री मंडल
15.	[illegible]	[illegible]	9201126191	[illegible]



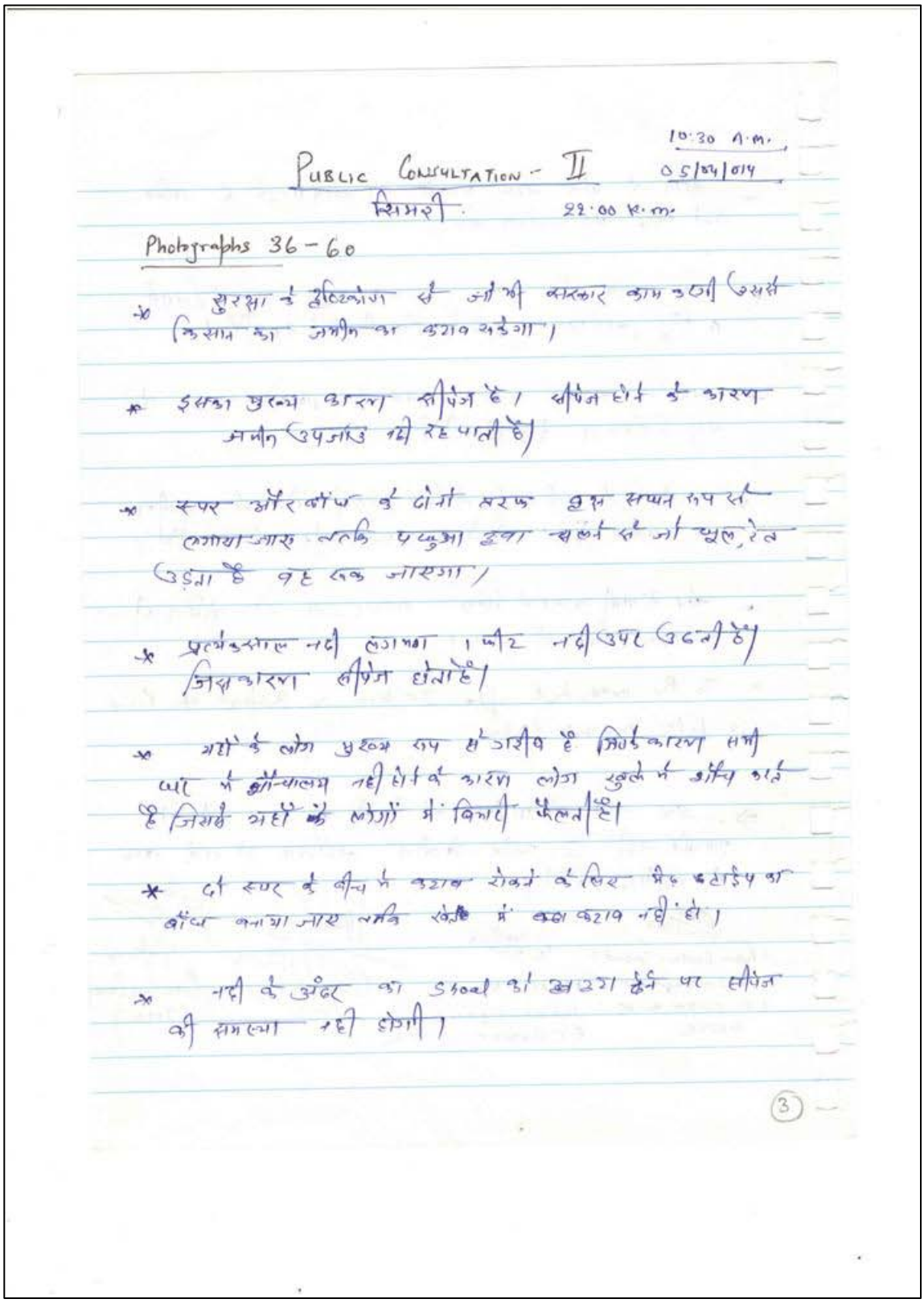
क्र०	नाम	पता	मोबाईल	हस्ताक्षर
15.	मो० जलील	कल्याणपुर		मो० जलील
16.	मो० वसीर	कल्याणपुर		
17.	मो० मजीद	कल्याणपुर		
18.	मो० लाल	कल्याणपुर		मो० मजीद
19.	[illegible]	कल्याणपुर		
20.	शिव शंकर सुखिया	कल्याणपुर	8434838200	
21.	मो० जिवाउल	कल्याणपुर	8292694044	शिव शंकर सुखिया
22.	मो० जावेद	कल्याणपुर		मो० जावेद
23.	अजय कु० सुखिया	कल्याणपुर	8527888338	
24.	मो० अमझाद आलम	कल्याणपुर	9560307243	
25.	रामचन्द्र मेहता	कल्याणपुर		
26.	शिवचन्द्र यादव	[illegible]	9973599283	
27	उमाशंकर साह	[illegible]	9661591546	उमाशंकर
28	राहुल कुमार यादव	[illegible]	9934081460	
29.	लाल कुमार यादव	कल्याणपुर	9006925085	Lal Kumar
30.	रघोश्याम कुमार	कल्याणपुर	9973543432	Raghushyam
31.	अवधेश साह	[illegible]	9661338875	अवधेश साह
32	संजीव कुमार	[illegible]	8229013213	संजीव
33	रवीन्द्र पासवान	[illegible]	9931202230	
3				

05/04/2014
Senior Engineer
E.E. Div. No. 2
BIRPUR
(Ram Lakhan Prasad)

05/04/14
Mukesh Kumar
Junior Engineer
E.E. Div. No. 2 Birpur

5/4/2014
(S.B. Kafoley)
IEISL

5/4/2014
(CHETAN ZAVERI)
IEISL



PUBLIC CONSULTATION - II 10:30 A.M. 05/04/014

सिमरी 22:00 K.m.

Photographs 36 - 60

* सुरक्षा के दृष्टिकोण से जो भी सरकार काम करती उससे किसान का जमीन का कटाव बढ़ेगा।

* इसका मुख्य कारण सीपेज है। सीपेज होने के कारण जमीन उपजाऊ नहीं रह पाती है।

* रिवर और बांध के दोनों तरफ हरा सघन रूप से लगाया जाए ताकि पछुआ हवा चलने से जो धूल रेत उड़ता है वह रुक जाएगा।

* प्रत्येक साल नदी लगाना। चौर नदी ऊपर उठती है। जिसका कारण सीपेज होता है।

* यहाँ के लोग मुख्य रूप से गरीब है जिसके कारण सभी घर में शौचालय नहीं होने के कारण लोग खुले में शौच करते है जिससे यहाँ के लोगों में बिमारी फैलती है।

* दो रिवर के बीच में कटाव रोकने के लिए पैड बढ़ाई या बाँध बनाया जाए जहाँ खेत में कटाव नहीं हो।

* नदी के अंदर का sand को अलग करने पर सीपेज की समस्या नहीं होगी।

(3)

Public Consultation - 2 Attendance Sheet (held near EKE Ch. 22.15 km)

(7)

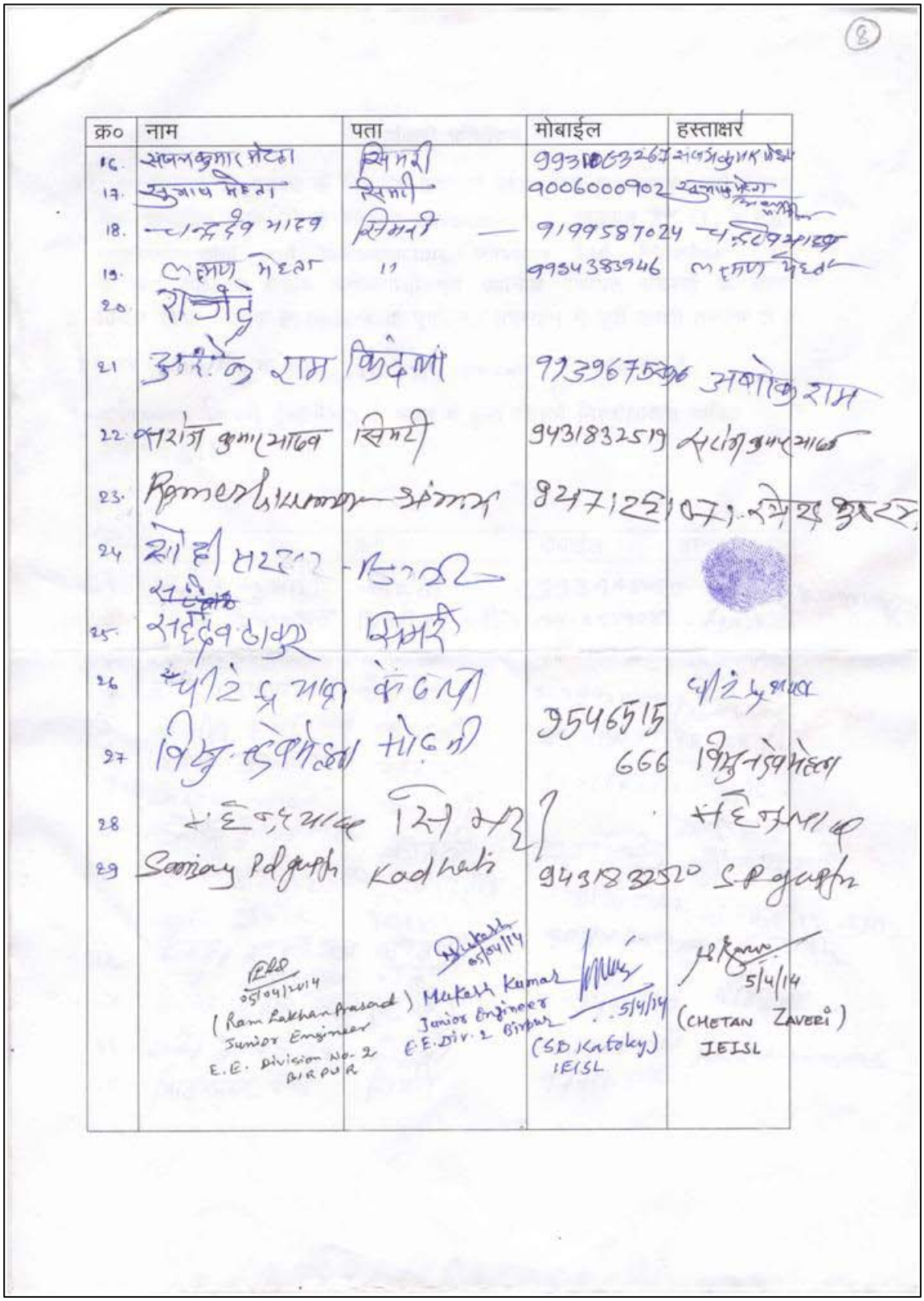
कार्यवाही प्रतिवेदन

पूर्वी कोशी तटबंध के कि०मी० 0.00 से 28.20 तक सुरक्षात्मक कार्य (विश्व बैंक सम्पोषित् फेज–II) से संबधित environmental अध्ययन हेतु I.L. & F.S. environmental and infrastructure services Ltd. Mumbai के पदाधिकारियों का क्षेत्रीय अभियंताओं एवं स्थानीय पंचायत सदस्यों के साथ विचार गोष्ठी दिनांक 05.04.2014 के पूर्वाह्न/अपराह्न में पूर्वी काशी तटबंध के

22.150 कि० मी० के पास चिखड़ही हनुमान नगर पंचायत में

मध्य विद्यालय सिमरी (सुपौल) के भवन में हुआ जिसमें निम्नलिखित व्यक्ति उपस्थित हुए।

क्र०	नाम	पता	मोबाईल	हस्ताक्षर
1.	मनोज कुमार	कोढ़ली	9934480417	Manoj Kumar
2.	दिलीप कुमार पासवान	चिखड़ही (सिमरी)	9973529282	दिलीप
3.	रमेशानन्द मेहता	कमलपुर	9546554965	रमेशानन्द मेहता
4.	इन्द्र नारायण झा	कोढ़ली	9199920411	
5.	राजीव कुमार यादव	कोढ़ली	8969024848	राजीव
6.	रमेश कुमार यादव	कोढ़ली		
7.	सरोज यादव	कोढ़ली	9801165243	रमेश
8.	देवेन्द्र कुमार सरदार	कोढ़ली	9934998[illegible]	सरोज यादव
9.	राजकिशोर कुमार	कोढ़ली	9681327842	सुरेन्द्र कुमार
10.	सुरेन्द्र कुमार	सिमरी	9084729[illegible]	राजकिशोर कुमार
12	[illegible]	[illegible]	—	[illegible]
13	मनोज कुमार मेहता	सिमरी	9934028809	रामकुमार
14	रविन्द्र कुमार यादव	कोढ़ली	9934421581	Ravindra kumar yadav
15	शिव कुमार यादव	सिमरी	9771282603	



क्र०	नाम	पता	मोबाईल	हस्ताक्षर
16.	संजलकुमार मेहता	सिमरी	9931063263	
17.	सुजाथ मेहता	सिमरी	9006000902	
18.	चन्द्रदेव यादव	सिमरी	9199587024	
19.	लक्ष्मण मेहता	11	9934383946	
20.	राजेंद्र			
21.	अशोक राम	सिंदमा	9339675	अशोक राम
22.	पारस कुमार यादव	सिमरी	9431832519	
23.	Ramesh Kumar	Simri	9471251	
24.				
25.	दादेव ठाकुर	सिमरी		
26.				
27.	विनु. [illegible]		9546515 666	
28.				
29.	Sanjay Pd gupta	Kadwahi	9431832520	S P gupta

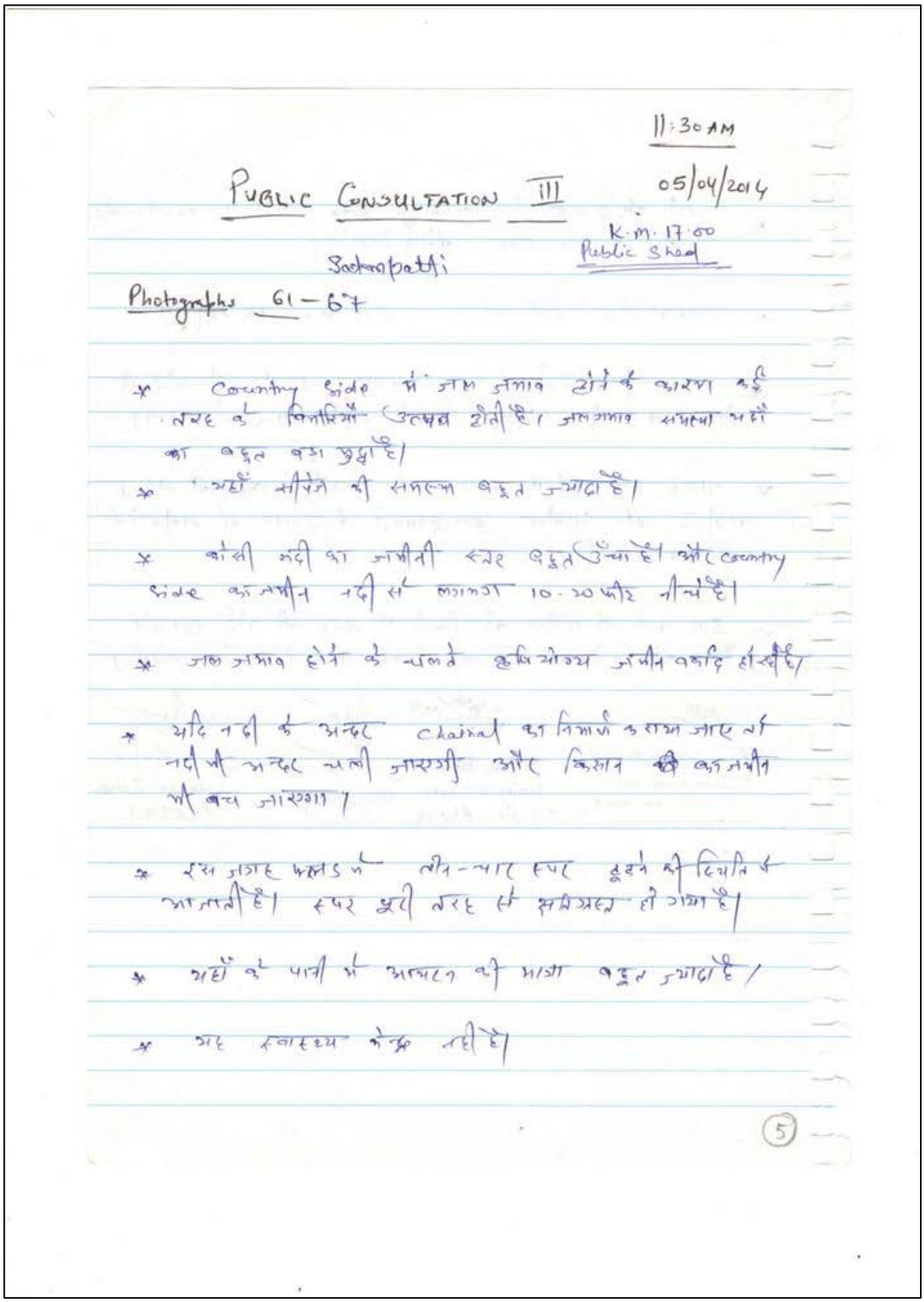
05/04/2014
(Ram Lakhan Prasad)
Junior Engineer
E.E. Division No-2
BIRPUR

05/04/14
Mukesh Kumar
Junior Engineer
E.E. Div. 2 Birpur

5/4/14
(SD Kataky)
IEISL

5/4/14
(CHETAN ZAVERI)
IEISL

Proceedings of Public Consultation - 3 (held near EKE Ch. 16.98 km)



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PUBLIC CONSULTATION III 05/04/2014

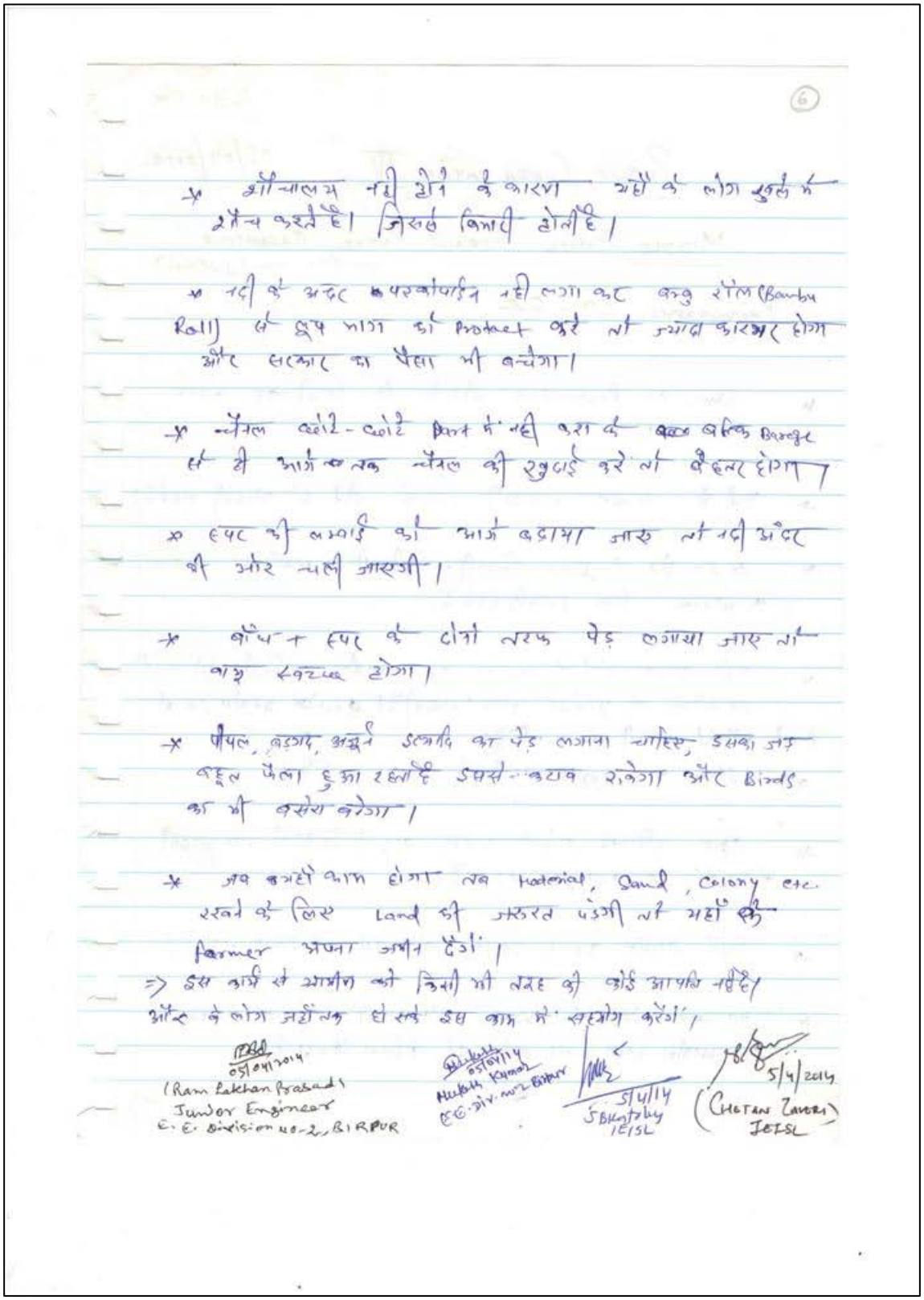
K.M. 17.00
Public Road

Sakrapatti

Photographs 61 – 67

* Country side में जल जमाव होने के कारण कई तरह के बिमारियाँ उत्पन्न होती है। जलजमाव समस्या यहाँ का बहुत बड़ा मुद्दा है।
* यहाँ सीवेज की समस्या बहुत ज्यादा है।
* कोसी नदी का जमीनी स्तर बहुत ऊँचा है और Country side का जमीन नदी से लगभग 10-20 फीट नीचे है।
* जल जमाव होने के चलते कृषि योग्य जमीन बर्बाद हो रही है।
* यदि नदी के अन्दर Chainal का निर्माण कराया जाए तो नदी के अन्दर चली जायेगी और किसान की जमीन भी बच जायेगा।
* इस जगह फ्लड में तीन-चार घर डूबने की स्थिति में आजाती है। घर धरी तरह से क्षतिग्रस्त हो गया है।
* यहाँ के पानी में आयरन की मात्रा बहुत ज्यादा है।
* यह स्वास्थ्य केन्द्र नहीं है।

5



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* आँचलम नहीं होने के कारण यहाँ के लोग कुर्सी में शौच करते है। जिससे बिमारी होती है।

* नदी के अंदर Spur का निर्माण नहीं लगा कर बम्बु रोल (Bamboo Roll) से दूर भाग को Protect करे तो ज्यादा कारगर होगा और सरकार का पैसा भी बचेगा।

* चैनल छोटे-छोटे Part में नहीं करा के एक बार Bridge से ही आगे तक चैनल की खुदाई करे तो बेहतर होगा।

* स्पर की लम्बाई को आगे बढ़ाया जाए तो नदी अंदर की ओर चली जाएगी।

* बाँध + स्पर के दोनों तरफ पेड़ लगाया जाए तो बाँध सुरक्षित होगा।

* पीपल, बड़गद, अर्जुन इत्यादि का पेड़ लगाना चाहिए, इसका जड़ फैला हुआ रहता है इससे बचाव रहेगा और Birds का भी बसेरा करेगा।

* जब कहीं काम होगा तब Material, Sand, Colony etc. रखने के लिए Land की जरूरत पड़ेगी तो यहाँ के Farmer अपना जमीन देंगे।

=> इस कार्य से आमीन को किसी भी तरह की कोई आपत्ति नहीं है। और वे लोग जहाँतक हो सके इस काम में सहयोग करेंगे।

05/04/2014
(Ram Lakhan Prasad)
Junior Engineer
E.E. Division No-2, BIRPUR

05/04/14
Mukesh Kumar
EE. Div. No-2 Birpur

5/4/14
S Bhattacharjee
IEISL

5/4/2014
(Chetan Zaveri)
IEISL

Public Consultation - 3 Attendance Sheet (held near EKE Ch. 16.98 km)

6

कार्यवाही प्रतिवेदन

पूर्वी कोशी तटबंध के कि०मी० 0.00 से 28.20 तक सुरक्षात्मक कार्य (विश्व बैंक सम्पोषित् फेज–II) से संबधित environmental अध्ययन हेतु I.L. & F.S. environmental and infrastructure services Ltd. Mumbai के पदाधिकारियों का क्षेत्रीय अभियंताओं एवं स्थानीय पंचायत सदस्यों के साथ विचार गोष्ठी दिनांक 05.04.2014 के पूर्वाहन/अपराहन में पूर्वी काशी तटबंध के

16.98 कि० मी० के पास सातनपट्टी पंचायत में

शास्त्री निवास के भवन में हुआ जिसमें निम्नलिखित व्यक्ति उपस्थित हुए।

क्र०	नाम	पता	मोबाईल	हस्ताक्षर
1	सि० नसीर	मुखिया ग्राम सातनपट्टी	9955727401	सि० नसीर
2.	RUDOLPH STRONG	SATANPATTI	7739760909	R.Strong
3	ओम प्रकाश चैहटा	सातनपट्टी	9934378904	ओमप्रकाश चैहटा
4	कयम अली	सातन पट्टी	9431281644	कयम अली
5	कलाम चैहटा वार्ड तालिम	सातन पट्टी	9006785817	कलाम चैहटा
6	सचिव कुरु दास	सातन पट्टी		
7.	चन्द्रेश्वर कुमार	सातनपट्टी	7739878411	चन्द्रेश्वर कुमार
8.	MD. Emtiyaz	Satenpatti	8292071845	Md Emtiyaz
9	ओमप्रकाश झा	सातन पट्टी	9430216741	ओमप्रकाश झा
10	मो० जुबैर	सातन पट्टी	9199158296	

05/04/2014
(Ram Lakhan Prasad)
Senior Engineer
E.E. Division No-1, BIRPUR

05/04/14
Mukesh Kumar
Junior Engineer
E.E. Div. No-2 Birpur

5/4/14
(S.B. Kataley)
IEISL

5/4/2014
(CHETAN ZAVERI)
IEISL

Proceedings of Public Consultation - 4 (held near EKE Ch. 10.50 km)

1:30 PM

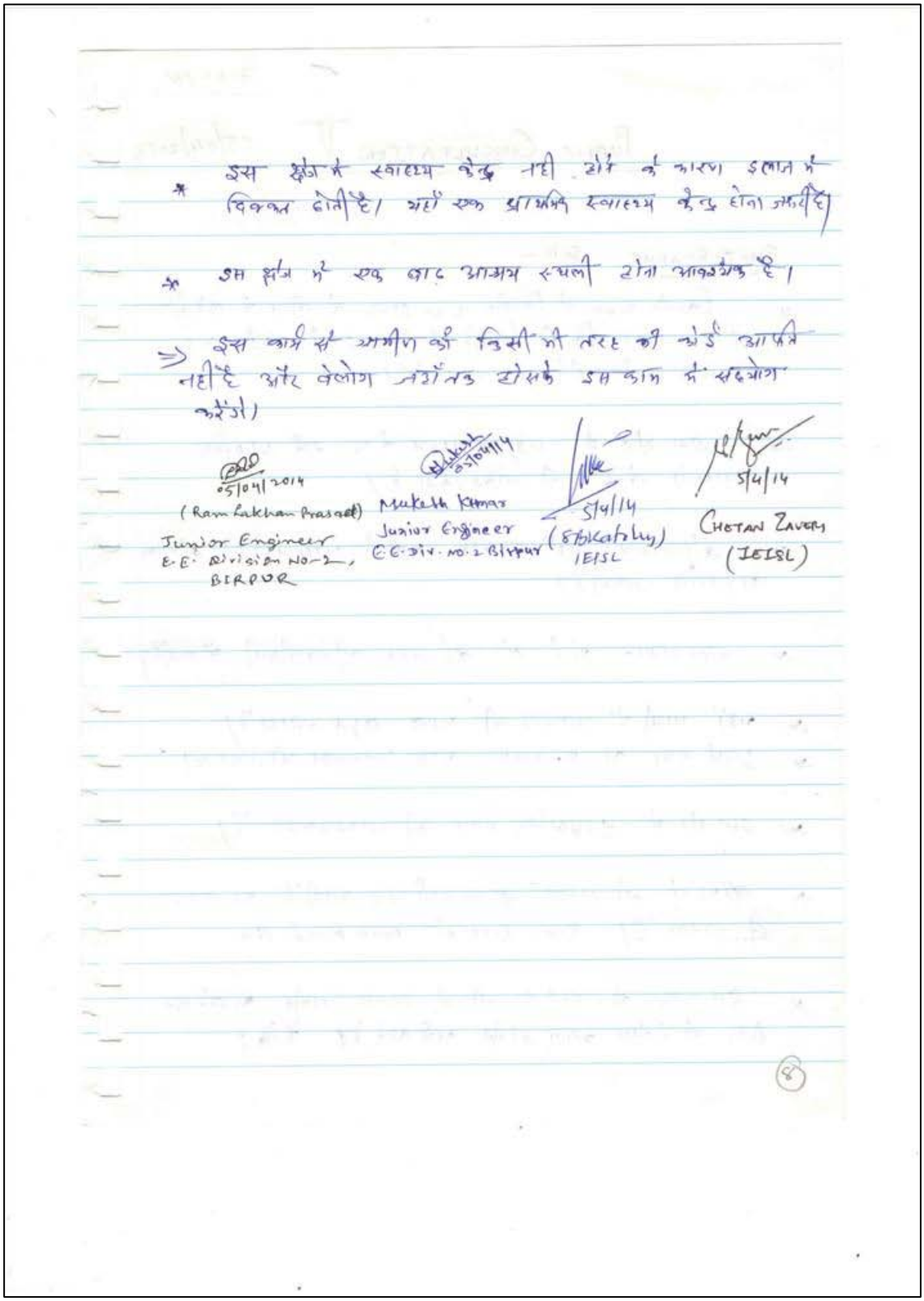
PUBLIC CONSULTATION IV 05/04/2014

MIDDLE SCHOOL PIPRAHI PATTI, BASANTPUR — (SUPAUL)

PHOTOGRAPHS 69 - 84

* Spur का Restoration होता है तो मिट्टी का कटाव रुकेगा।
* पानी में ऑक्सिजन ज्यादा है जिसको पीने से आदमी बढ़ते हैं।
* इस सेंड में मुख्यतः बिमारी मलेरिया, कालाजार, Worm हैजा इत्यादि होते हैं।
* यहाँ कटाव होने के कारण बहुत आबादी भूमिहीन हो गए हैं उन लोगों का पुनर्वास होना जरूरी है। कुछ लोग पुनर्वास हुए भी हैं तो वहाँ कोई सरकारी सुविधा नहीं है।
* Spur का length बढ़ाने की आवश्यकता है।
* Spur क्षतिग्रस्त होने के कारण बाढ़ के दिनों में आस आदमी के मध्य में डर बसा हुआ रहता है।
* यहाँ लगभग 90% आदमी के पास शौचालय नहीं है।
* जब काम होगा तो Private जमीन का भी इस्तेमाल होसकता है। इसके आसपास लोग अपना जमीन देने के लिए तैयार है।

(7)



* इस क्षेत्र में स्वास्थ्य केंद्र नहीं होने के कारण इलाज में दिक्कत होती है। यहाँ एक प्राथमिक स्वास्थ्य केंद्र होना जरूरी है।

* इस क्षेत्र में एक छोटे आकार स्कूली होना आवश्यक है।

⇒ इस कार्य से ग्रामीण को किसी भी तरह की कोई आपत्ति नहीं है और वेलोग जरूरत होने के इस काम में सहयोग करेंगे।

05/04/2014
(Ram Lakhan Prasad)
Junior Engineer
E.E. Division No-2,
BIRPUR

03/04/14
Mukesh Kumar
Junior Engineer
E.E. Div. No. 2 Birpur

5/4/14
(Bhikchaudhary)
IEISL

5/4/14
CHETAN ZAVERI
(IEISL)

Public Consultation - 4 Attendance Sheet (held near EKE Ch. 10.50 km)

(3)

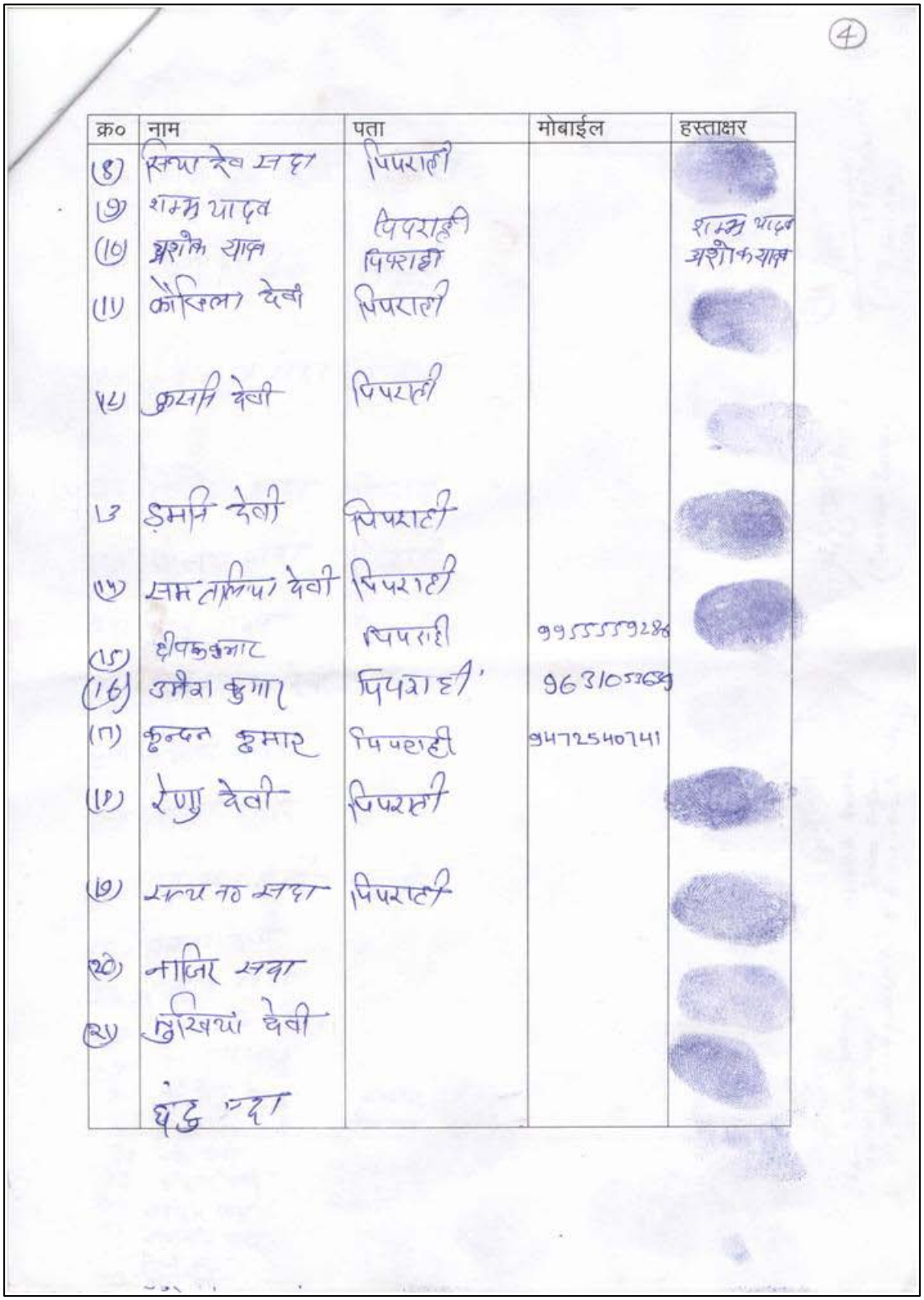
कार्यवाही प्रतिवेदन

पूर्वी कोशी तटबंध के कि०मी० 0.00 से 28.20 तक सुरक्षात्मक कार्य (विश्व बैंक सम्पोषित् फेज–II) से संबधित environmental अध्ययन हेतु I.L. & F.S. environmental and infrastructure services Ltd. Mumbai के पदाधिकारियों का क्षेत्रीय अभियंताओं एवं स्थानीय पंचायत सदस्यों के साथ विचार गोष्ठी दिनांक 05.04.2014 के पूर्वाहन/अपराहन में पूर्वी काशी तटबंध के

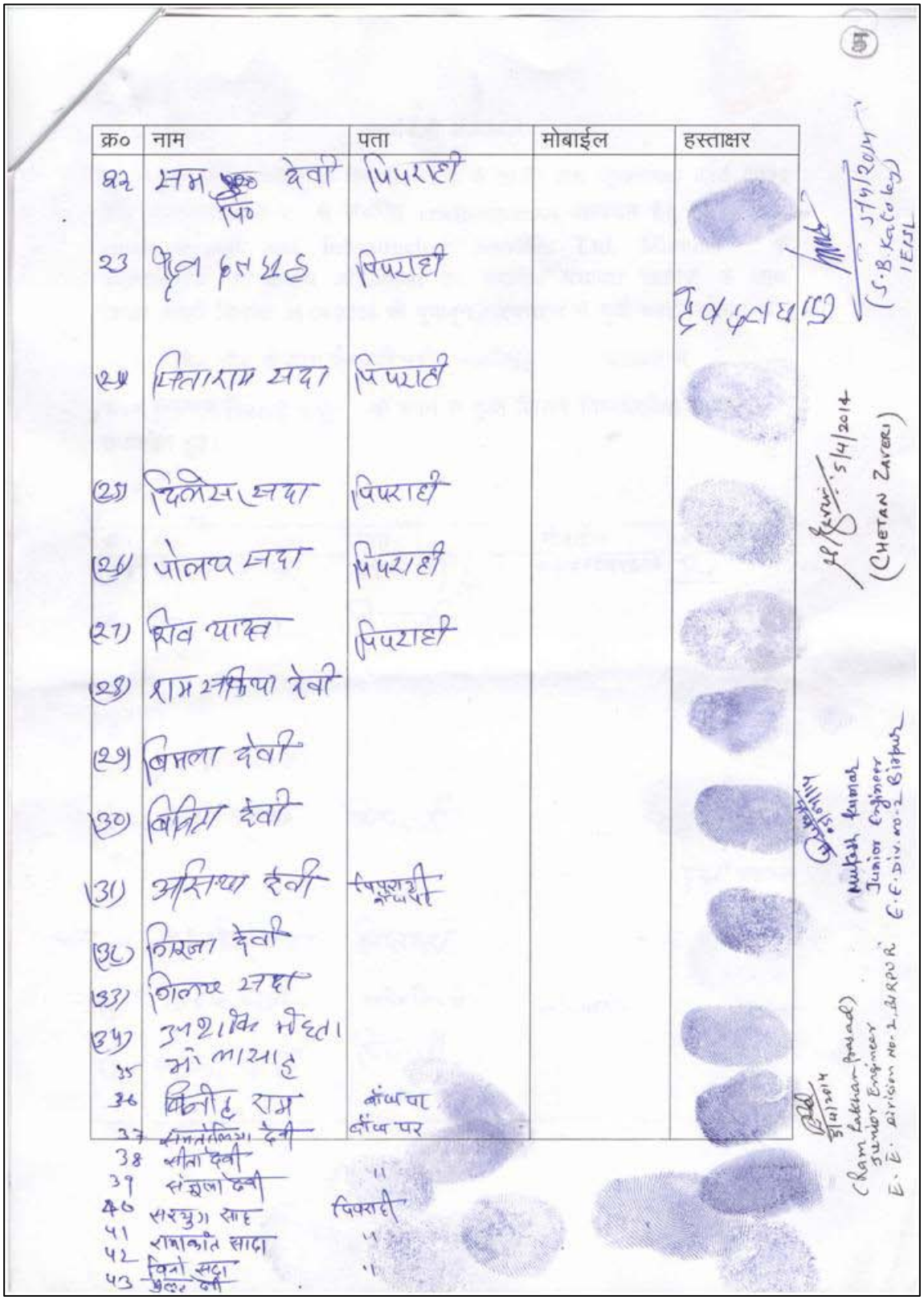
10.50 कि० मी० के पास पिपरही पट्टी बसैपुर पंचायत में

मध्य विद्यालय पिपरही पट्टी के भवन में हुआ जिसमें निम्नलिखित व्यक्ति उपस्थित हुए।

क्र०	नाम	पता	मोबाईल	हस्ताक्षर
(1)	पंचदेव ठाकुर	पिपरहटी	9470047834	Pdv
(2)	बेचु यादव	पिपरही		
(3)	जगदिश सदा			
(4)	दुखी पासवान	पिपराही		दुखी पासवान
(5)	जगदिश्वर सदा	पिपराही		
(6)	नन्दकिशोर यादव	मनिर पिपराही	8521403321	नन्दकिशोर यादव
(7)	सिकेन्द्र पाहन	पिपरही		

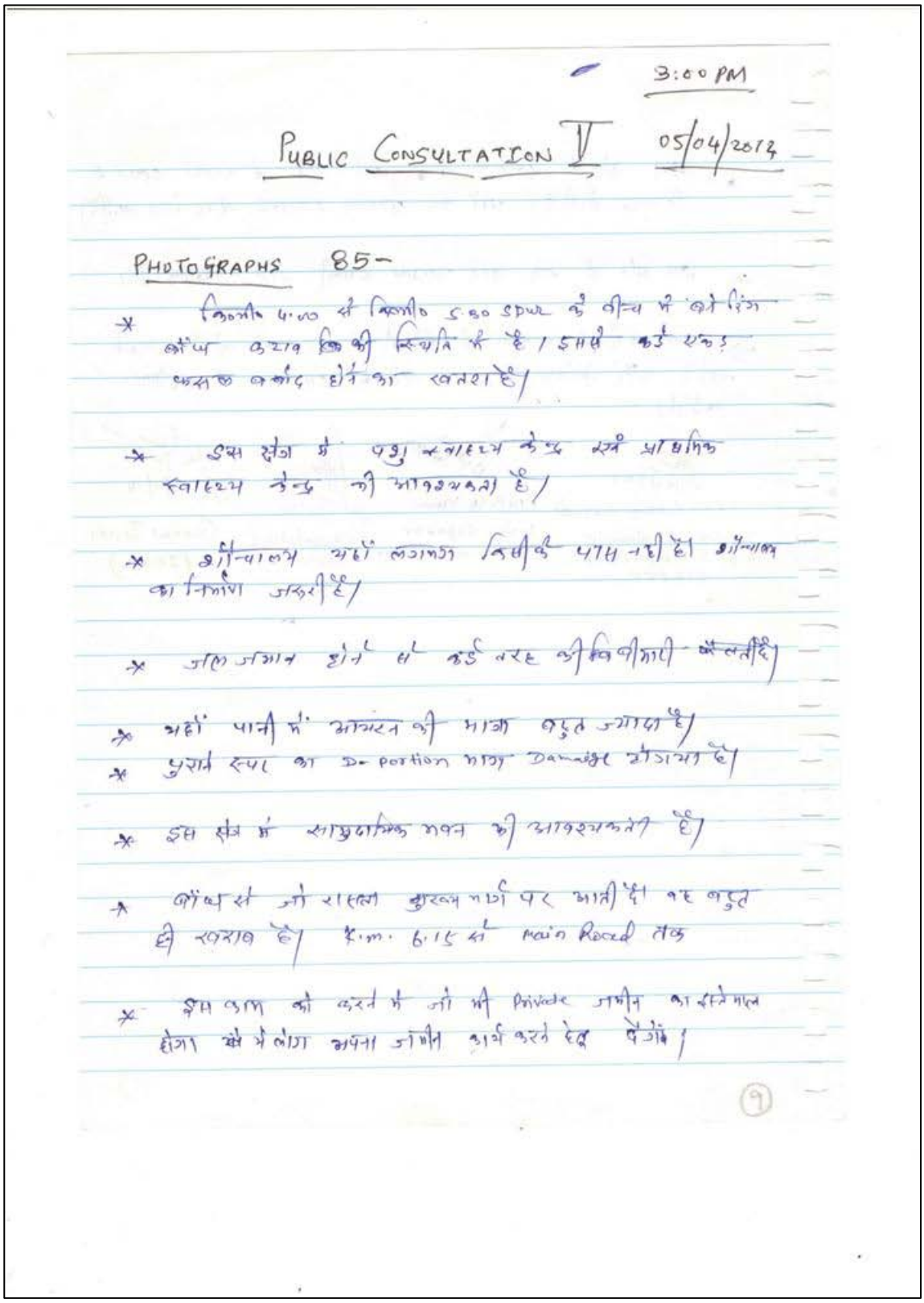


क्र०	नाम	पता	मोबाईल	हस्ताक्षर
(8)	[illegible] सदा	पिपराही		
(9)	शम्भु यादव	पिपराही		शम्भु यादव
(10)	अशोक यादव	पिपराही		अशोक यादव
(11)	कोकिला देवी	पिपराही		
(12)	[illegible] देवी	पिपराही		
13	[illegible] देवी	पिपराही		
(14)	[illegible] देवी	पिपराही		
(15)	दीपकुमार	पिपराही	9955559288	
(16)	उमेश कुमार	पिपराही	9631053684	
(17)	कुन्दन कुमार	पिपराही	9472540741	
(18)	रेणु देवी	पिपराही		
(19)	[illegible] सदा	पिपराही		
20)	नाजिर सदा			
21)	[illegible] देवी			
	[illegible] सदा			



क्र०	नाम	पता	मोबाईल	हस्ताक्षर
22	[illegible] देवी	पिपराही		
23	[illegible]	पिपराही		
24	पिताराम यदा	पिपराही		
25	दिलेस यदा	पिपराही		
26	जोलप्प यदा	पिपराही		
27	शिव यादव	पिपराही		
28	राम [illegible] देवी			
29	बिमला देवी			
30	विनिता देवी			
31	असिया देवी	[illegible]		
32	निरजा देवी			
33	गिलप्प यदा			
34	[illegible]			
35	मो मायाहु			
36	विनोद राम	बांध पर		
37	[illegible] देवी	बांध पर		
38	सीता देवी	"		
39	संझला देवी	"		
40	सरयुग साह	पिपराही		
41	रामाकांत सादा	"		
42	विनो सदा	"		
43	[illegible] देवी	"		

Proceedings of Public Consultation - 5 (held near EKE Ch. 6.94 km)



3:00 PM

PUBLIC CONSULTATION V 05/04/2014

PHOTOGRAPHS 85-

* किलो 4.00 से किलो 5.80 spur के बीच में को रिंग बाँध ठीक ठाक की स्थिति में है। इसमें कई एक जगह कटाव होने का खतरा है।

* इस क्षेत्र में पशु स्वास्थ्य केंद्र एवं प्राथमिक स्वास्थ्य केन्द्र की आवश्यकता है।

* डाँ-चालय यहाँ लगभग किसी के पास नहीं है। डाँक्टर का निर्माण जरूरी है।

* जल जमाव होने से कई जगह की फसल बर्बाद होती है।

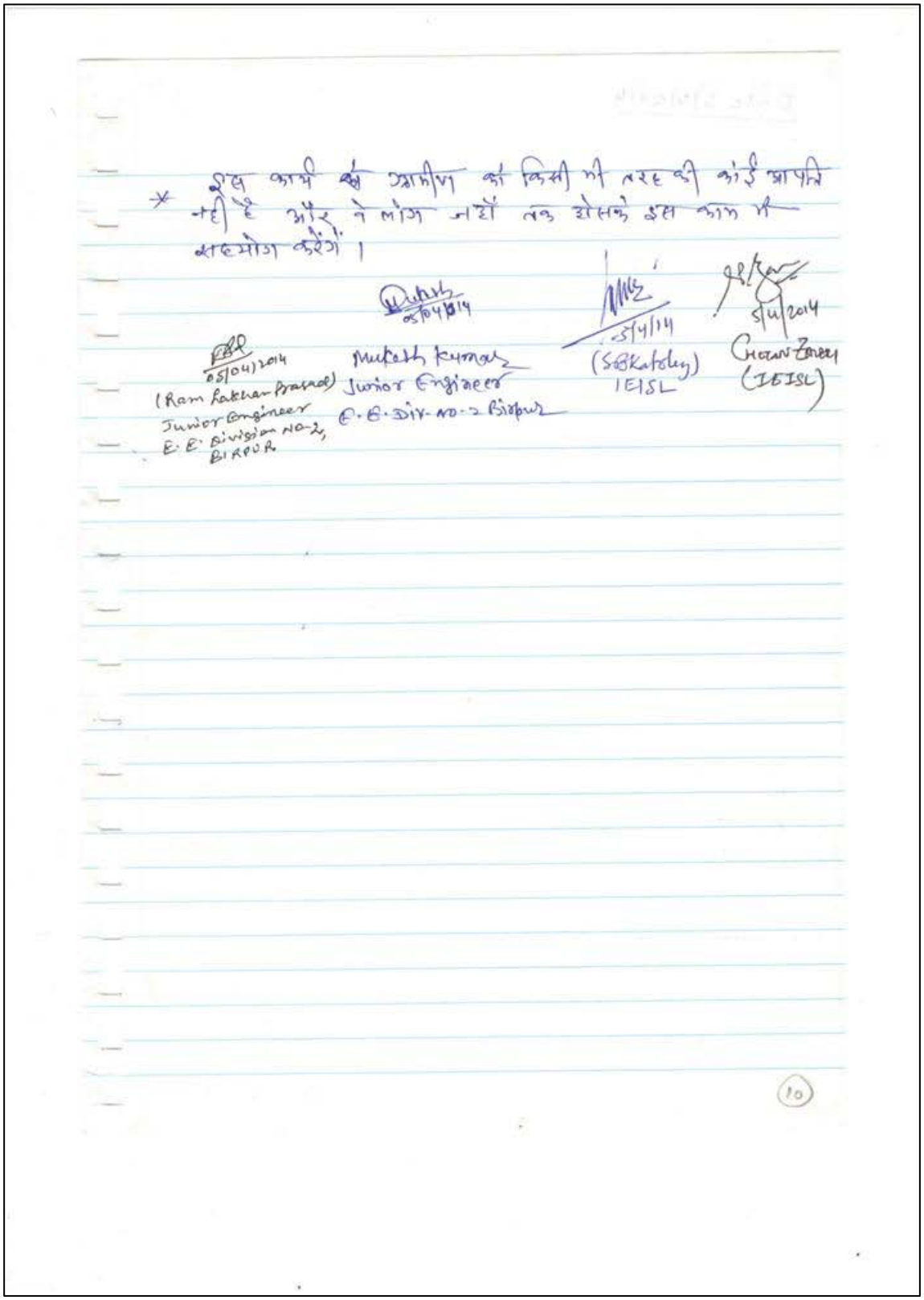
* यहाँ पानी में आयरन की मात्रा बहुत ज्यादा है।

* पुराने स्पर का D- portion मात्र Damage होजाया है।

* इस क्षेत्र में सामुदायिक भवन की आवश्यकता है।

* बाँध से जो रास्ता दुरुस्त मार्ग पर आती है वह बहुत ही खराब है। 4 km. B.I.E से main Road तक

* इस काम को करने में जो भी Private जमीन का इस्तेमाल होगा उसे में लोग अपना जमीन कार्य करने हेतु देंगे।


* इस कार्य से आसीन को किसी भी तरह की कोई आपत्ति नहीं है और वे मांग नहीं तक होसके इस काम में सहयोग करेंगे।
05/04/2014
(Ram Lakhan Prasad)
Junior Engineer
E.E. Division No-2,
BIRPUR.
Mukesh Kumar
Junior Engineer
E.E. Div. No-2 Birpur
5/4/14
(SBKatoley)
IEISL
5/4/2014
(IEISL)

Public Consultation - 5 Attendance Sheet (held near EKE Ch. 6.94 km)

(1)

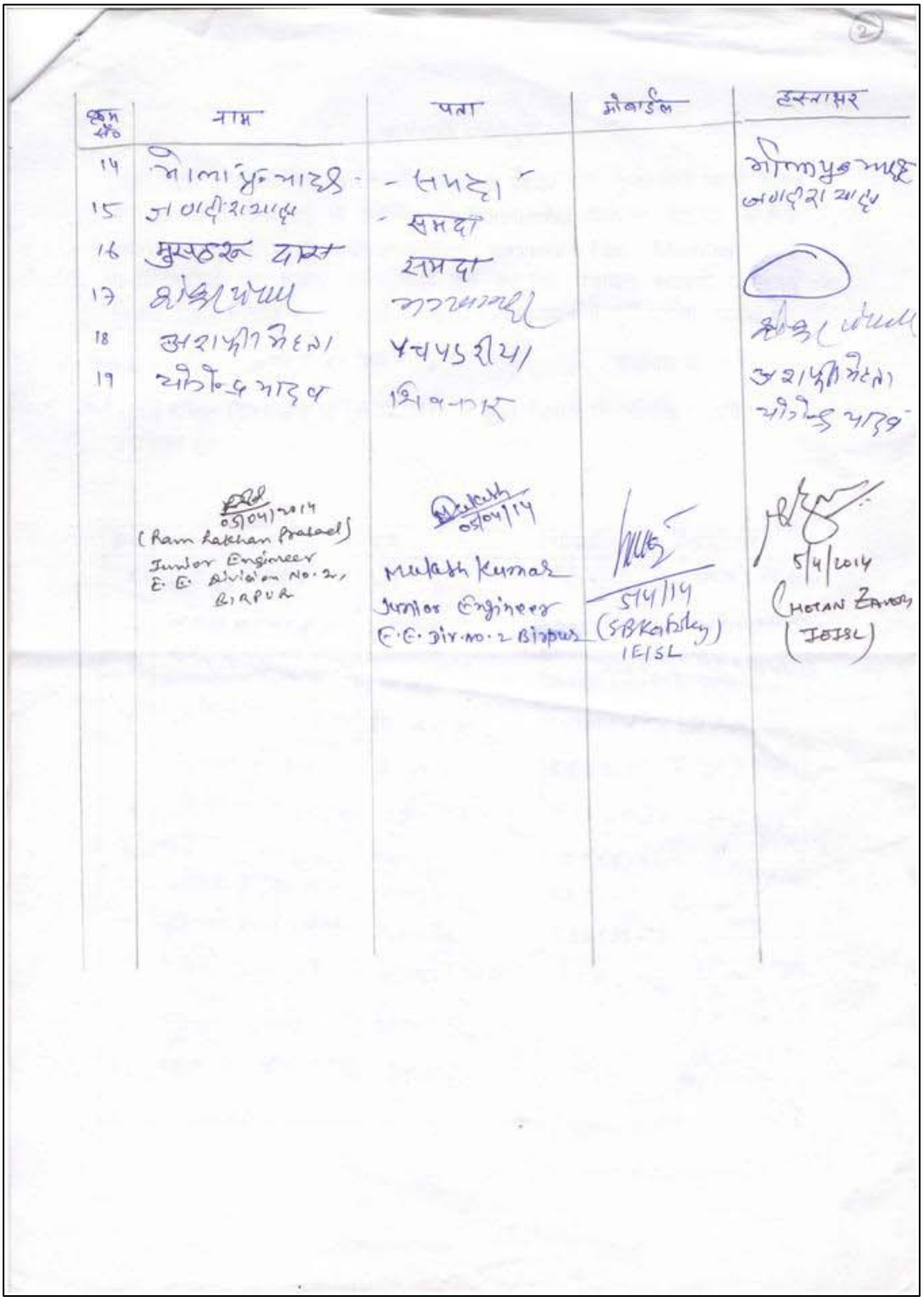
कार्यवाही प्रतिवेदन

पूर्वी कोशी तटबंध के कि०मी० 0.00 से 28.20 तक सुरक्षात्मक कार्य (विश्व बैंक सम्पोषित् फेज–II) से संबधित environmental अध्ययन हेतु I.L. & F.S. environmental and infrastructure services Ltd. Mumbai के पदाधिकारियों का क्षेत्रीय अभियंताओं एवं स्थानीय पंचायत सदस्यों के साथ विचार गोष्ठी दिनांक 05.04.2014 के पूर्वाह्न/अपराह्न में पूर्वी काशी तटबंध के

6.940 कि० मी० के पास [illegible] पंचायत में

[illegible] के भवन में हुआ जिसमें निम्नलिखित व्यक्ति उपस्थित हुए।

क्र०	नाम	पता	मोबाईल	हस्ताक्षर
1	[illegible]	[illegible]	9473284349	[illegible]
2	[illegible]	[illegible]	9955078475	[illegible]
3	[illegible]	[illegible]	9470433611	[illegible]
4	[illegible]	[illegible]	9470051204	[illegible]
5	[illegible]	[illegible]	8809488768	[illegible]
6	[illegible]	[illegible]	8002455	[illegible]
7	[illegible]	[illegible]	9934227221	[illegible]
8	[illegible]	[illegible]	8294643575	[illegible]
9	Amit Kushyadal	Sanda	9661585181	Amit Kushyadal
10	[illegible]	[illegible]	9006239253	[illegible]
11	[illegible]			[illegible]
12	[illegible]	[illegible]		[illegible]
13	[illegible]	[illegible]		[illegible]



क्रम सं०	नाम	पता	मोबाईल	हस्ताक्षर
14	[illegible]	[illegible]		[illegible]
15	[illegible]	[illegible]		[illegible]
16	[illegible]	[illegible]		[illegible]
17	[illegible]	[illegible]		[illegible]
18	[illegible]	[illegible]		[illegible]
19	[illegible]	[illegible]		[illegible]

05/04/2014
(Ram Lakhan Prasad)
Junior Engineer
E.E. Division No. 2,
BIRPUR

05/04/14
Mukesh Kumar
Junior Engineer
E.E. Div. No. 2 Birpur

5/4/14
(S.B. Kathaley)
IEISL

5/4/2014
(MOHAN ZANWAR)
(IOISL)

Proceedings of Public Consultation - 6 (held near EKE Ch. 78.00 km)

Date 6/4/2014. Venue - Midle School
Navahata (Saharsa)

Time 2 P.M to

Minutes.

(1) बाँध के किनारे Seepage का समस्या — Seepage के कारण खेती नहीं होती है, जमीन समय पर नहीं तैयार होता है। Seepage के कारण Iron की समस्या Develop हुआ।

(2) Health का checking से तो Maximum लोग Snowfelia से पीड़ित हैं जिसके कारण साँस की समस्या. Health centre में उन बीमारियों का निदान नहीं है। Snafolia एवं अन्य बीमारी का polio जैसा Govt को अभियान चलाना चाहिए। Fleria.

(3) Gabion के बदले Boulder stacing में ग्रामीणों द्वारा मरम्मत करने की बात कही गई है।

(4) पत्थर रखने से जमीन ऊसर होने की समस्या का निदान।

(5) Seepage के कारण पानी में ~~lead~~ Lade (शीशा) पाया जाता है। Seepage के कारण water logging होता है, उसका निदान होना चाहिए।

(6) ~~Research~~ Research by D.K. Mishra.

(7) बाँध के भीतर वाले लोगों को पुनर्वास देने की बात कही गई थी, परंतु पुनर्वास नहीं मिला और न ही स्वास्थ्य, शिक्षा एवं यातायात की व्यवस्था की गई। Bairagi में सिकुड़ा तक Seepage का Problem हुआ।

(8) Seepage के कारण खेतीयोग्य जमीन बर्बाद हो गया, बागीचा बर्बाद हो गया, Seesam का पेड़ एवं आम का पेड़ बर्बाद हो गया।

(9) पानी के कारण छोटे बच्चों को Jondis हो गया, चर्म रोग उत्पन्न हो गया।

(10) Unemployment (बेरोजगारी) की समस्या आ गई, Embankment बनने के पश्चात्

(11) स्वास्थ्य का स्तर गिरा, शिक्षा का स्तर गिरा एवं आर्थिक स्थिति कमजोर हुई। 15 साल का बच्चा 35 साल

(11)

का वजूद मिटता है। Due to कुपोषण एवं गरीबी के कारण
— डा० नीरज राय

(12) कोसी को महानंदा से जोड़ा जाए तो इतना बर्बादी वाला होने बच जाएगा। Linkage to two River Kosi & Mahananda

(13) Kosi के पानी में Mica है। Mica से संबंधित Industry होना चाहिए थी, परंतु सरकार इस पर ध्यान नहीं दिया गया।

(14) कुरिया सौनगा वाली Drainage को जीर्णोद्धार किया जाए तो Seepage का Problem से निजात हो सकता है।

(15) पानी में Iron के कारण लोगों को Stone के बीमारी से ग्रसित हैं। मवेशी जिन्दा नहीं रहता है, Iron के कारण मवेशी का पेट फूल जाता है और मर जाता है, फलतः पशुधन कमजोर होता जा रहा है।

(16) पानी के कारण — Idleness एवं Freshness नहीं रहपाता है।

(17) Dolfin की मात्रा अधिक था, परंतु इसकी संख्या घटती जा रही है बरसात में।

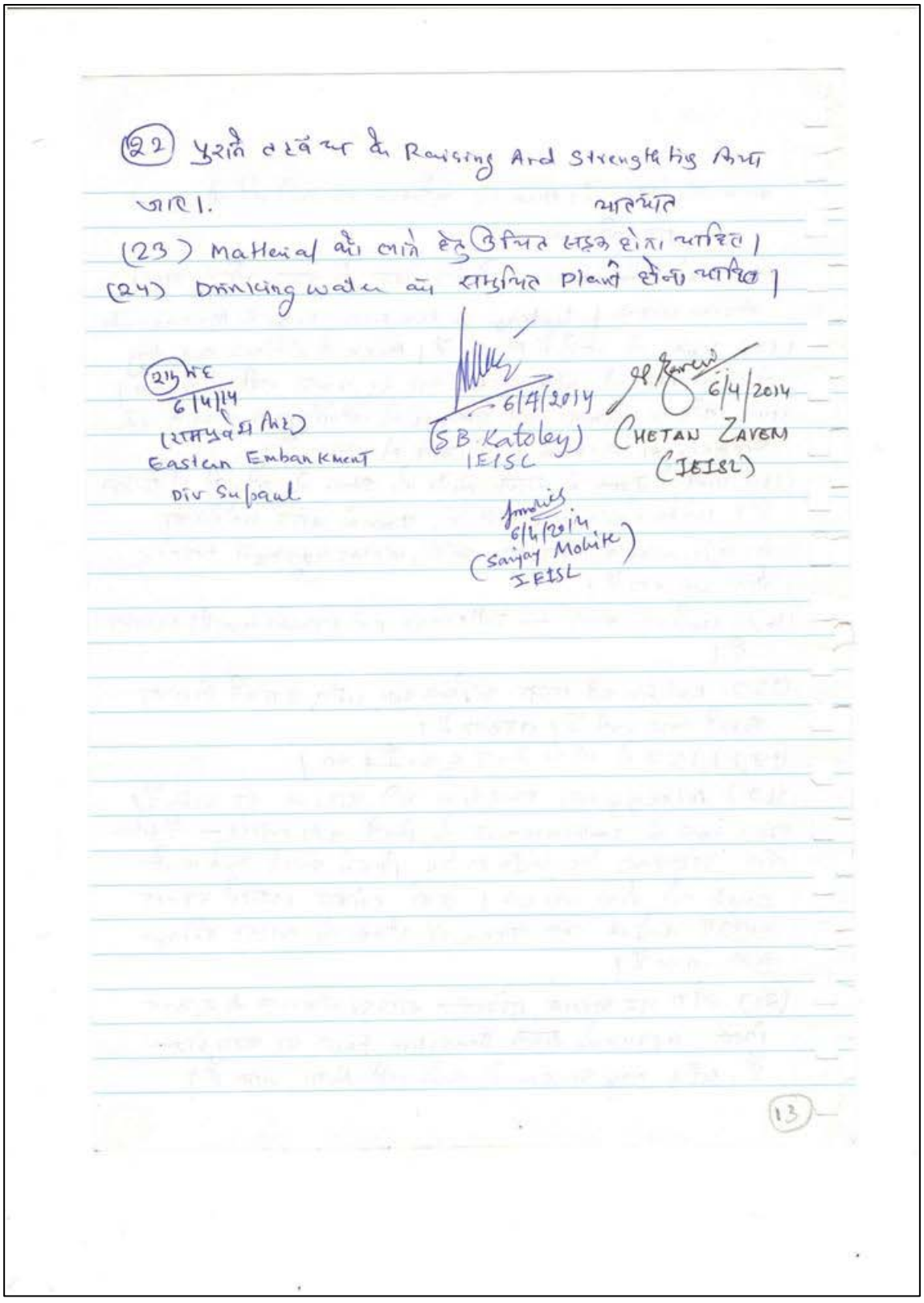
(18) 1957 में बांध तैयार हुआ ~~है~~ था।

(19) Alergy का Problem भी प्रारम्भ हो गया है।

(20) Kosi के Embankment के किनारे वृक्ष लगाए — जैसे बाँस, बरगद का पेड़, जामुन का पेड़, जिससे हवा में आने वाले Dust को रोका जा सके। वृक्ष हमेशा लगाते रहना चाहिए क्योंकि वृक्ष Tree में दीमक के कारण शीघ्र सूख जाता है।

(21) मो० नुर आलम, मुखिया, साहुगा पंचायत के सुझाव दिए बरसात के समय Sensitive point पर काम होता है, परंतु Dry Season में क्यों नहीं किया जाता है?

(12)



(22) पुराने तटबंध के Raising And Strengthing का जारी। आवश्यक

(23) Material को लाने हेतु उचित सड़क होना चाहिए।

(24) Drinking water का समुचित Plant होना चाहिए।

(25) EE
6/4/14
(सहायक अभि)
Eastern Embankment
Div Supaul

6/4/2014
(S B Katoley)
IEISC

6/4/2014
(CHETAN ZAVERI)
(IEISL)

6/4/2014
(Sanjay Mohite)
IEISL

13

Public Consultation - 6 Attendance Sheet (held near EKE Ch. 78.00 km)

Public Consultation (जनपरामर्श)

Public Consultation for Environmental Impact Assessment for Protection and Restoration of Kosi River Embankments in Bihar.
कोसी नदी पूर्वी तटबंध के पुनरुद्धार (बहाली) परियोजना के पर्यावरणीय प्रभाव आकलन के लिए जनपरामर्श.
EKE. Chainage: 78.00 to 84.00 km (@ 78.00 km) Date: 06 .04.2014 Venue: नवहट्टा (NAUHATTA)
Administrative Authority: Flood Management Improvement Support Centre (FMISC), Water Resource Department, Patna.
प्रशासनिक प्राधिकरण: बाढ़ प्रबंधन सुधार सहायता केंद्र, जल संसाधन विभाग, पटना. MIDDLE SCHOOL, NAUHATTA

Sr.No. अनुक्रम.	Name of Participants सहभागी का नाम	Occupation व्यवसाय	Place/Village जगह / गांव का नाम	Contact Number संपर्क क्र.	Signature हस्ताक्षर
1	मो० मंजूर आलम	कृषि	नवहट्टा	9006924731.	Md. Manjur Alam
2	मो० अकबर	कृषि	[illegible]	8757408803	मो० अकबर
3	अशोक कुमार सिंह	कृषि	शाहडीह (नौहट्टा)	9525786597	[illegible]
4	[illegible] आलम खान	कृषि	नवहट्टा	9973533722	[illegible]
5	डॉ० शैलेन्द्र राय	सरकारी सेवा (शिक्षा विभाग)	नवहट्टा	8987192846	[illegible]
6	पवन दास	मजदूरी	नवहट्टा	9546627407	
7	सुमन कुमार सिंह	कृषि	नवहट्टा पूर्वी	9934741709	[illegible]
8	अजय कुमार ठाकुर	सरकारी सेवा PHED	नवहट्टा	9708719962	Ajay
9	GAURAV KUMAR	STUDENT	VILL- BARHARA ANCHAL- NAUHATTA	7631897190	Gaurav Kr.
10	Aurangzeb. Khan	Student	Vill- Nauhatta Anchal- Nauhatta	7631924566	Aurangzeb Khan

Public Consultation (जनपरामर्श)

Public Consultation for Environmental Impact Assessment for Protection and Restoration of Kosi River Embankments in Bihar.
कोसी नदी पूर्वी तटबंध के पुनरुद्धार (बहाली) परियोजना के पर्यावरणीय प्रभाव आकलन के लिए जनपरामर्श.
EKE. Chainage: 78.00 to 84.00 km Date: .04.2014 Venue:
Administrative Authority: Flood Management Improvement Support Centre (FMISC), Water Resource Department, Patna.
प्रशासनिक प्राधिकरण: बाढ़ प्रबंधन सुधार सहायता केंद्र, जल संसाधन विभाग, पटना.

Sr.No. अनुक्रम.	Name of Participants सहभागी का नाम	Occupation व्यवसाय	Place/Village जगह / गांव का नाम	Contact Number संपर्क क्र.	Signature हस्ताक्षर
11	मोहन साह	पंचायत समिति सदस्य नौहट्टा	नौहट्टा	808465970	मोहन साह
12	मकबूल [illegible]	राजनीति	"	9973852147	[illegible]
13	Md Shabbir	Kushi	Nauhatta	8406095287	[illegible]
14	Abhimanyu Amar	Student	Nauhatta	7631935659	Abhimanyu Amar
15	Mohan Kumar	[illegible]	नौहट्टा	8877900367	Mohan Kumar
16	Aftab [illegible]	Teacher	Nauhatta	9904487189	[illegible]
17	Md Parwej [illegible]	Student	Nauhatta	9507358868	[illegible]
18	Prabin Kumar Singh.	Trainer	Nauhatta	9471416816	Prabin
19	[illegible] Bhagat	व्यापार	"	97093[illegible]	[illegible]
20	Md Nowsher	समाज सेवा	Nauhatta Majhaul	9973719563.	[illegible]

Public Consultation (जनपरामर्श)

Public Consultation for Environmental Impact Assessment for Protection and Restoration of Kosi River Embankments in Bihar.
कोसी नदी पूर्वी तटबंध के पुनरूद्धार (बहाली) परियोजना के पर्यावरणीय प्रभाव आकलन के लिए जनपरामर्श.
EKE. Chainage: 78.00 to 84.00 km **Date: .04.2014** **Venue:**
Administrative Authority: Flood Management Improvement Support Centre (FMISC), Water Resource Department, Patna.
प्रशासनिक प्राधिकरण: बाढ़ प्रबंधन सुधार सहायता केंद्र, जल संसाधन विभाग, पटना.

Sr.No अनुक्रम.	Name of Participants सहभागी का नाम	Occupation व्यवसाय	Place/Village जगह / गांव का नाम	Contact Number संपर्क क्र.	Signature हस्ताक्षर
21	गंगा राय	व्योपार	नौहट्टा	9931855957	
22				8651698502	
23				7631991199	
24	वैद्यनाथ दास	शिक्षक		9931734962	
25				7631897691	
26		Govt. employ	Nauhatta	9507900782	
27				9199824859	
28				9939803324	
29			6/4/2014		
30					

Public Consultation No.6 held at Nauhatta Madhya Vidyalaya on 6.April.2014

Invitation for the Public Consultation	**News of the Public Consultation**
Newspaper: Hindustan (Hindi), Bhagalpur Edition	Newspaper: Hindustan (Hindi), Bhagalpur Edition
News Date: Sunday, 6th April 2014	News Date: Tuesday, 8th.April.2014

बैठक आज

नवहट्टा। विश्व बैंक संपोषित योजना के तहत पूर्वी कोसी तटबंध के 78 से 84 कि.मी. के बीच बोल्डर रिभेटमेंट कार्य हेतु रविवार को नवहट्टा मध्य विद्यालय में बैठक होगी। एई राम प्रवेश सिंह ने जानकारी देते हुए बताया कि बैठक में वर्ल्ड बैंक के अधिकारीगण, सुपौल डिवीजन के अधिकारीगण भाग लेंगे। (ए.सं.)

आज | हिन्दुस्तान भागलपुर • मंगलवार • 08 अप्रैल 2014 04

सीपेज से मुक्ति के लिए हो ठोस उपाय

नवहट्टा | एक संवाददाता

पूर्वी कोसी तटबंध के 78 से 84 कि.मी. के बीच नदी से उत्पन्न होनेवाली खतरे के स्थायी समाधान में आड़े आनेवाली पर्यावरण मुद्दे को लेकर रविवार को स्थानीय मध्य विद्यालय प्रांगण में विश्व बैंक एवं जल संसाधन विभाग के अधिकारियों तथा ग्रामीणों की संयुक्त बैठक हुई।

कोसी नदी पूर्वी तटबंध के पुनरूद्धार परियोजना के पर्यावरणीय प्रभाव आकलन के उद्देश्य से आयोजित बैठक में अधिकारियों द्वारा ग्रामीणों से सुझाव मांगे गए। महौल गांव निवासी एवं पूर्व मुखिया मो. नुर आलम ने कहा कि वर्ष 84 की बाढ़ के बाद हमलोगों की खेतीबारी चौपट हो गई है। खेत से हर साल मजदूरों का पलायन हो रहा है। पानी के दूषित हो जाने के कारण स्वास्थ्य पर प्रतिकूल असर पड़ रहा है।

नवहट्टा के मंजूर आलम ने कहा कि चापाकल से निकलनेवाला पानी में काफी मात्रा में आयरन एवं अन्य वैक्टेरिया है। जिससे पेट सहित अनेक बीमारियों से लोग ग्रसित हो रहे हैं। तिलकेश्वर भगत ने कहा कि पूर्वी तटबंध के बाहर सारा प्रदूषण का जड़ सीपेज से मुक्ति के लिए कोई ठोस उपाय करने की उन्होंने मांग की। जीवछ राय, कनैया राय, अशोक सिंह एवं मो. सम्बीर आदि ने भी अपने विचार रखे।

बैठक में विश्व बैंक के डा. काटोली, चेतन्य इवेली, संजय मोहित, एई रामप्रवेश सिंह, अंजुम हुसैन, गंगा राय, मनिन साह, सुर्यजय कुमार सिंह, अजय ठाकुर, अधिमन्यु कुमार एवं असफाक खान आदि ग्रामीण मौजूद थे।

दूसरी तरफ सूत्रों के अनुसार 78 से 84 कि.मी. के बीच मुख्य पूर्वी तटबंध से सटे 30 मीटर चौड़ाई में 1 कि.मी. तक एवं कोसी नदी के किनारे से 25 मी. की चौड़ाई में विश्व बैंक की राशि से बोल्डर पीचिंग कर रिभेटमेंट कार्य कराने की योजना है।

इस कार्य में पर्यावरण पर क्या असर पड़ेगा, इसी उद्देश्य से यह जनपरामर्श बैठक की गई।

सुनाई समस्याएं

• ग्रामीणों की समस्याओं पर अधिकारियों ने सुझाए हल के उपाय

पासवर्ती बैठक में उपस्थित विश्व बैंक के अधिकारी व ग्रामीण। • हिन्दुस्तान

हलचल

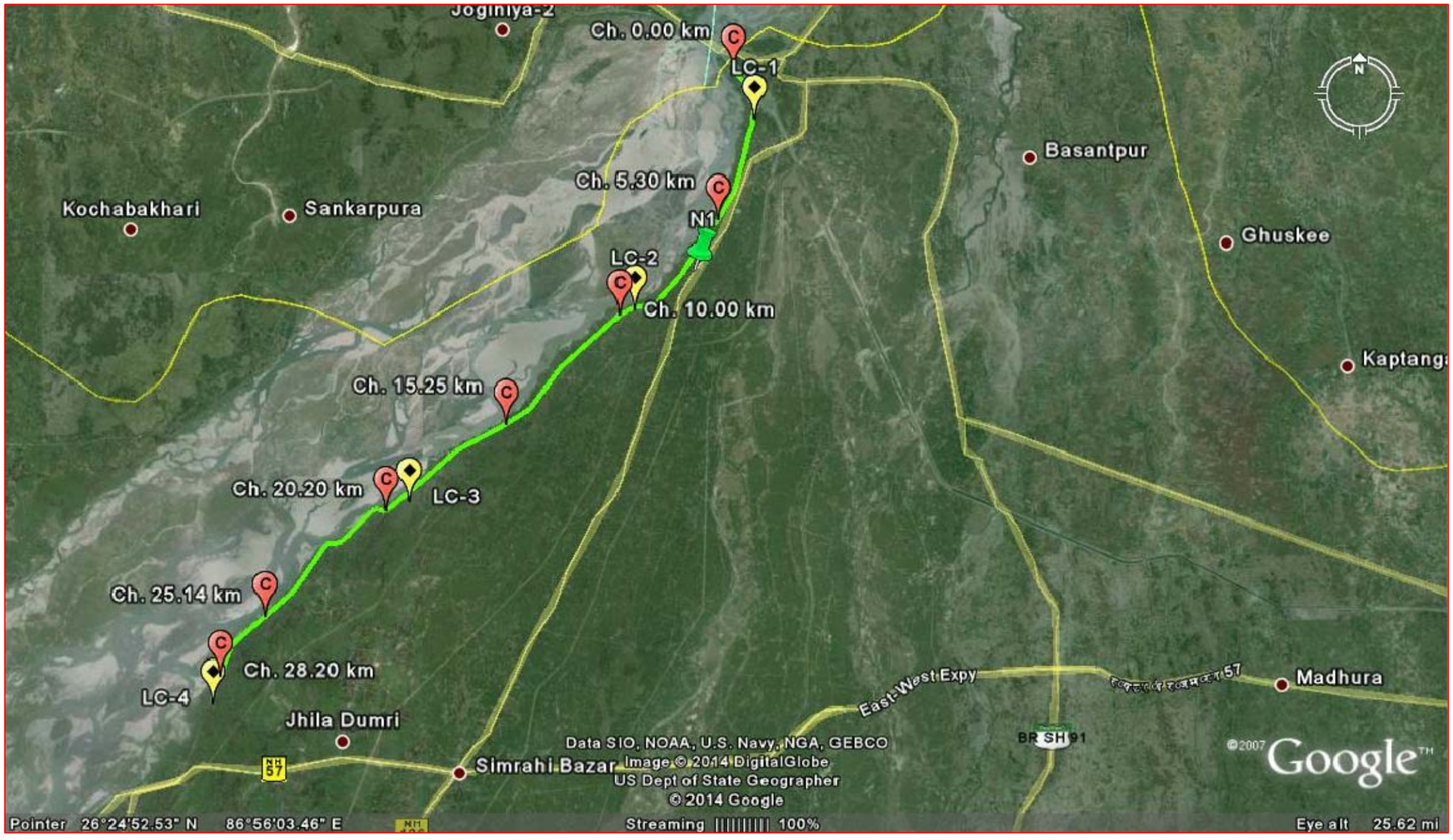
बिजली कटौती से लोग परेशान

सासर कटैया। प्रखण्ड क्षेत्र में दो दिनों से बिजली की आंख मिचौली जारी है। बार-बार बिजली गुम होने से उपभोक्ता खासे परेशान हैं। लगातार हो रहे बिजली की आंख मिचौली से लघु एवं कुटीर उद्योग पर भी प्रतिकूल असर पर रहा है। क्षेत्र के उपभोक्ताओं ने पदाधिकारी से इसमें सुधार की मांग की है ताकि लोगों को बिजली की सही सुविधा मुहैया हो सके। (ए.स)

किया निरीक्षण

नवहट्टा। बीडीओ प्रतिमा सिन्हा एवं बीएओ अरुण कुमार यादव ने सोमवार को खड़का तेलवा, मुरादपुर एवं पंडारुल पंचायत के करीब डेढ़ दर्जन से अधिक मतदान केन्द्रों का स्थलीय निरीक्षण कर मौलिक चीजों चापाकल, शौचालय आदि का सत्यापन किया। प्रखंड सूत्रों ने यह

ANNEXURE 10: INDEX MAP SHOWING LOCATIONS OF THE PROPOSED INTERVENTIONS, DURING THE IMPLEMENTATION PHASES OF THE WORKS TO BE CARRIED OUT ON TWO STRETCHES OF EKE



LABOUR CAMP (LC-1 to LC-4),
PLANTATION & NURSERY LOCATION (N-1)

NOTES FOR CH. 0.00 - 28.20 km:

1. All locations indicated in the drawing are suggestive. The locations should be decided during the project implementation phase to suit the site conditions & monitoring needs as recommended in the EMP

2. Siting criteria for the labour camps should be as given in the Section 6.2.2.7 of the EMP

3. Establishment of a nursery & plantation may be undertaken on the available Government land in the vicinity of EKE

4. Plantation in the area on the river and the country side, respectively, should be as per the guidelines given in the Embankment Manual of Central Water & Power Commission, Ministry of Irrigation & Power, Govt. of India.

5. The Side-slopes of EKE and land beyond the toe up to 20 feet on the countryside and 10 feet on the waterside should not be used for the purpose of plantation, except short grass.

APPROVED FOR:
EIA & EMP REPORT

CLIENT :
FLOOD MANAGEMENT IMPROVEMENT SUPPORT CENTRE (FMISC)

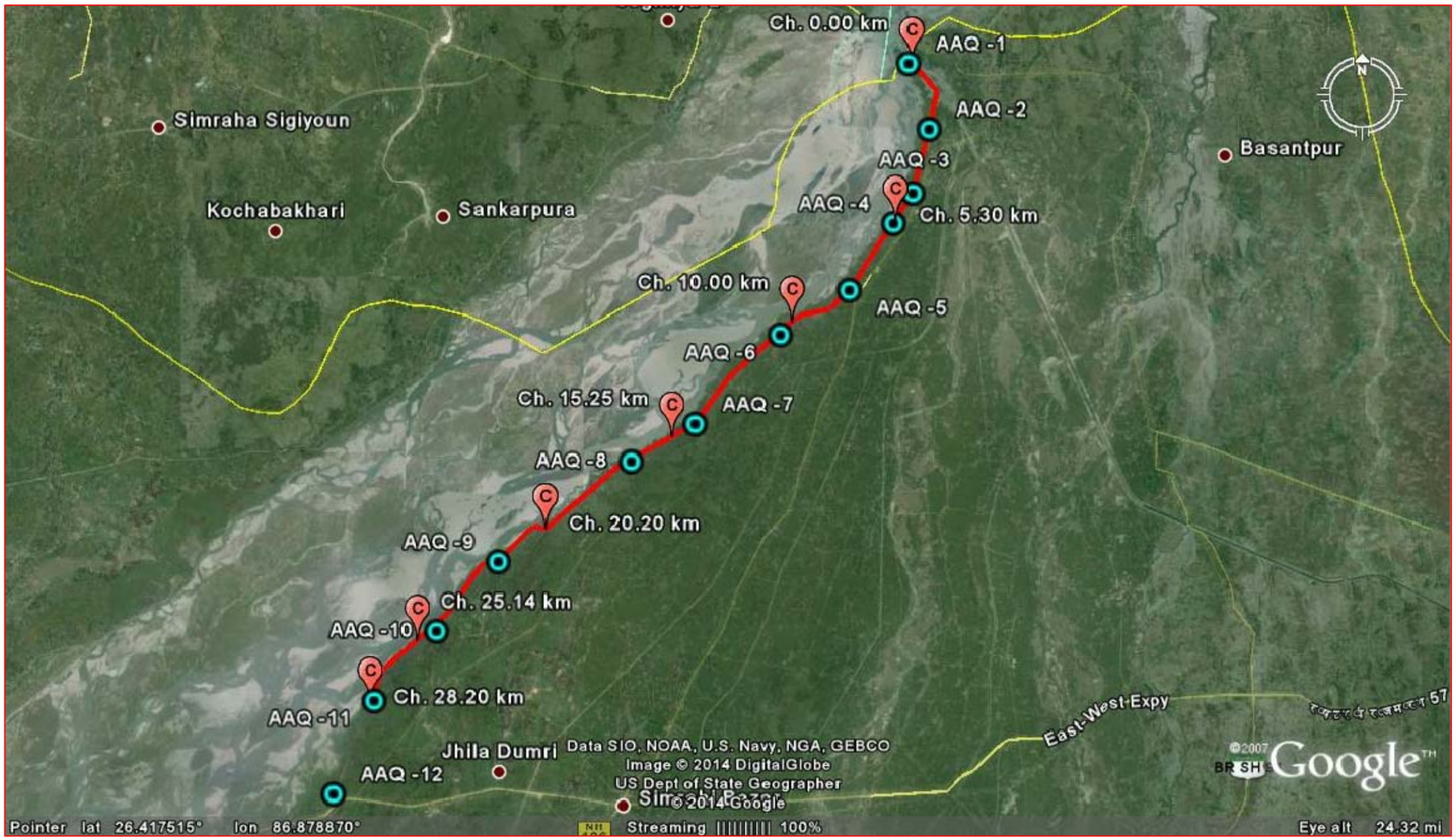
PROJECT:
ENVIRONMENTAL IMPACT ASSESSMENT FOR PROTECTION AND RESTORATION OF KOSI RIVER EMBANKMENTS IN BIHAR

CONTRACT AGREEMENT NO. :
BKFRP/WRD/CONSULTANCY/02/2013-14, DATED 08.01.2014

MAP TITLE:
INDEX MAP SHOWING PROPOSED LOCATIONS FOR LABOUR CAMP, PLANTATION, NURSERY (CH. 0.00 - 28.20 km)

MAP NO:
FMISC/WRD-02/IEISL/EMP-CH:0.00-28.20-1

CONSULTANTS :
IL&FS Environment
IL&FS Environmental Infrastructure & Services Ltd.
CITIPOINT, B-303, JB NAGAR, ANDHERI (E), MUMBAI - 400 059
TEL: 022 40298568 FAX: 022 40298512



AMBIENT AIR QUALITY MONITORING LOCATION
(AAQ-1 to AAQ-12)

NOTES FOR CH. 0.00 - 28.20 km:

1. All locations indicated in the drawing are suggestive. The locations should be decided during the project implementation phase to suit the site conditions & monitoring needs as recommended in the EMP
2. Monitoring of Ambient Air Quality should be as suggested in Table 52 of the EMP

APPROVED FOR:
EIA & EMP REPORT

CLIENT :
FLOOD MANAGEMENT IMPROVEMENT SUPPORT CENTRE (FMISC)

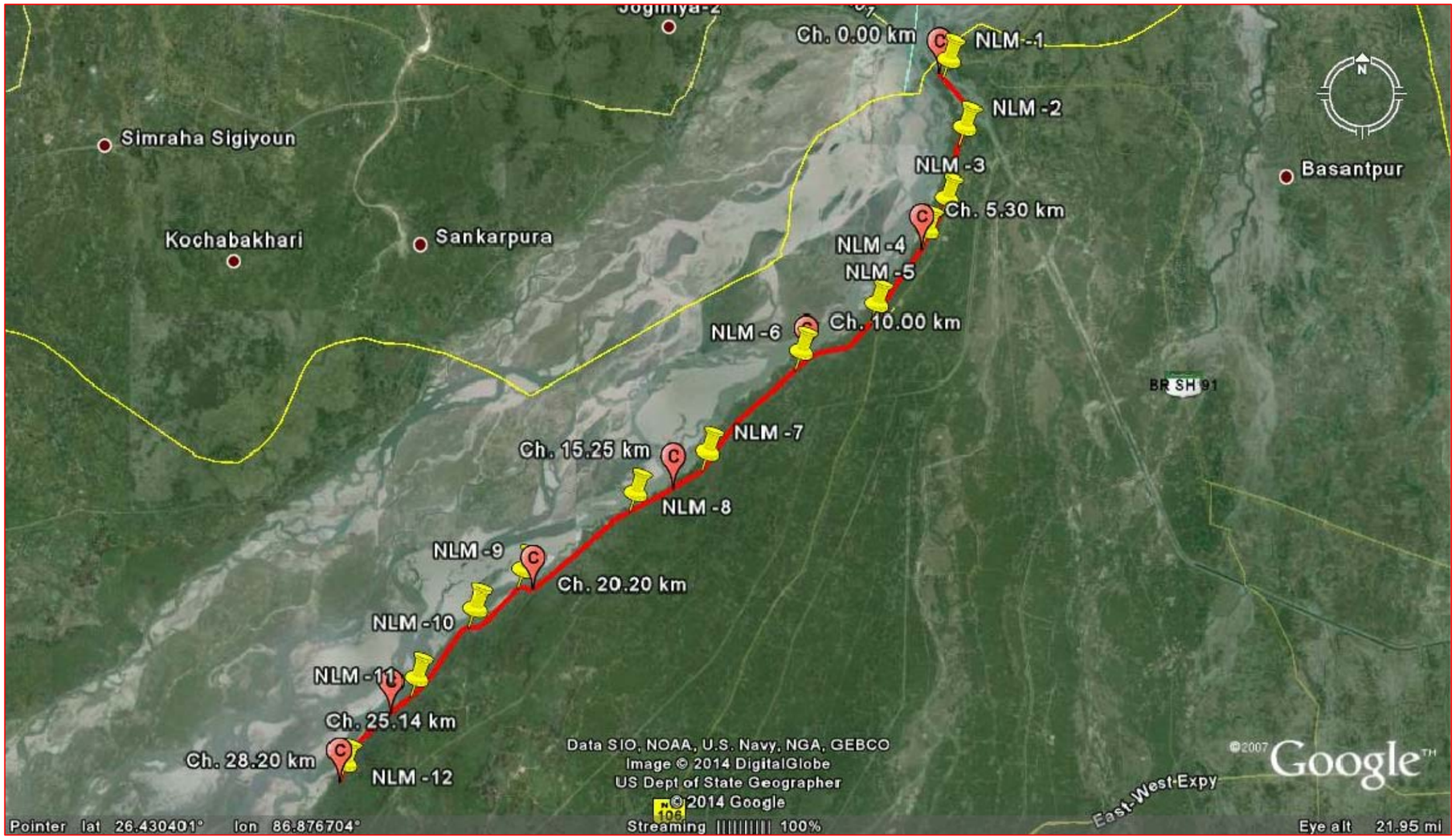
PROJECT:
ENVIRONMENTAL IMPACT ASSESSMENT FOR PROTECTION AND RESTORATION OF KOSI RIVER EMBANKMENTS IN BIHAR

CONTRACT AGREEMENT NO. :
BKFRP/WRD/CONSULTANCY/02/2013-14, DATED 08.01.2014

MAP TITLE:
INDEX MAP SHOWING PROPOSED LOCATIONS FOR AMBIENT AIR QUALITY MONITORING (CH. 0.00 - 28.20 km)

MAP NO:
FMISC/WRD-02/IEISL/EMP-CH:0.00-28.20-2

CONSULTANTS :
IL&FS Environment
IL&FS Environmental Infrastructure & Services Ltd.
CITIPOINT, B-303, JB NAGAR, ANDHERI (E), MUMBAI - 400 059
TEL: 022 40298568 FAX: 022 40298512



NOISE LEVEL MONITORING LOCATION
(NLM-1 to NLM-12)

NOTES FOR CH. 0.00 - 28.20 km:

1. All locations indicated in the drawing are suggestive. The locations should be decided during the project implementation phase to suit the site conditions & monitoring needs as recommended in the EMP
2. Monitoring of Noise Level should be as suggested in Table 52 of the EMP

APPROVED FOR:
EIA & EMP REPORT

CLIENT :
FLOOD MANAGEMENT IMPROVEMENT SUPPORT CENTRE (FMISC)

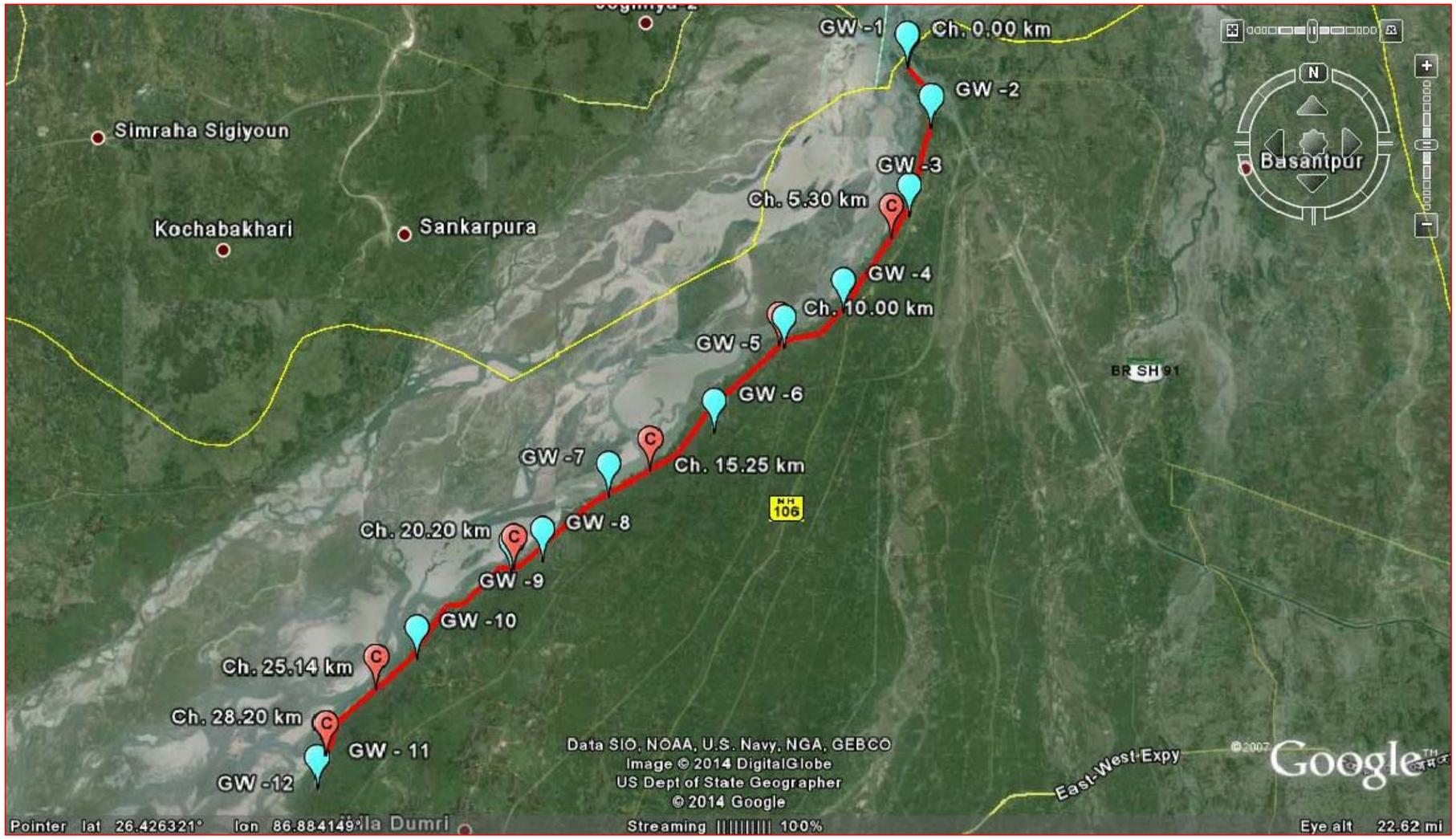
PROJECT:
ENVIRONMENTAL IMPACT ASSESSMENT FOR PROTECTION AND RESTORATION OF KOSI RIVER EMBANKMENTS IN BIHAR

CONTRACT AGREEMENT NO. :
BKFRP/WRD/CONSULTANCY/02/2013-14, DATED 08.01.2014

MAP TITLE:
INDEX MAP SHOWING PROPOSED LOCATIONS FOR NOISE LEVEL MONITORING (CH. 0.00 - 28.20 km)

MAP NO:
FMISC/WRD-02/IEISL/EMP-CH:0.00-28.20-3

CONSULTANTS :
IL&FS Environment
IL&FS Environmental Infrastructure & Services Ltd.
CITIPOINT, B-303, JB NAGAR, ANDHERI (E), MUMBAI - 400 059
TEL: 022 40298568 FAX: 022 40298512



GROUNDWATER MONITORING LOCATION
(GW-1 to GW-12)

NOTES FOR CH. 0.00 - 28.20 km:

1. All locations indicated in the drawing are suggestive. The locations should be decided during the project implementation phase to suit the site conditions & monitoring needs as recommended in the EMP
2. Monitoring of Ground-water quality should be as suggested in Table 52 of the EMP

APPROVED FOR:
EIA & EMP REPORT

CLIENT :
FLOOD MANAGEMENT IMPROVEMENT SUPPORT CENTRE (FMISC)

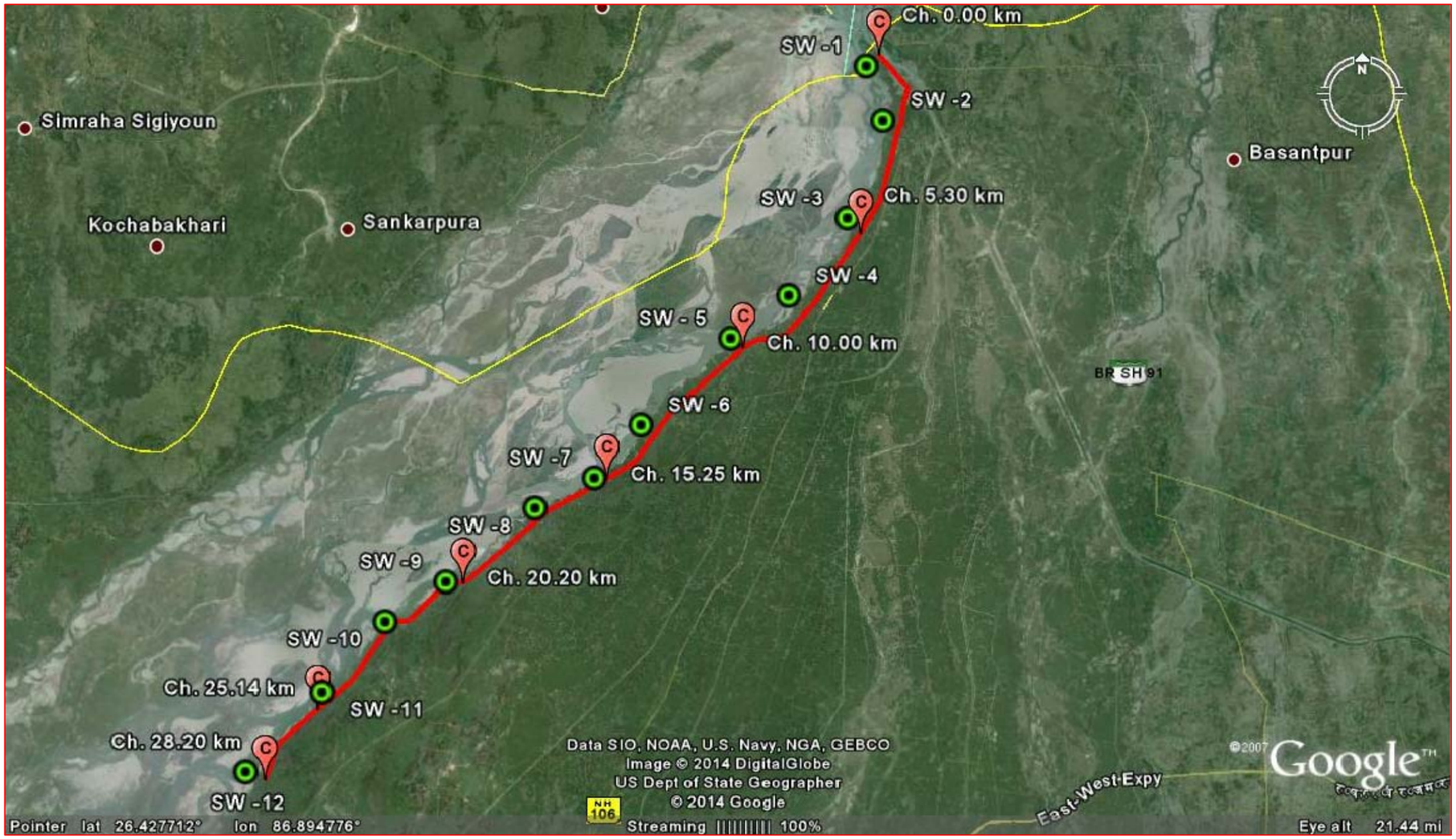
PROJECT:
ENVIRONMENTAL IMPACT ASSESSMENT FOR PROTECTION AND RESTORATION OF KOSI RIVER EMBANKMENTS IN BIHAR

CONTRACT AGREEMENT NO. :
BKFRP/WRD/CONSULTANCY/02/2013-14, DATED 08.01.2014

MAP TITLE:
INDEX MAP SHOWING PROPOSED LOCATIONS FOR GROUND WATER QUALITY MONITORING (CH. 0.00 - 28.20 km)

MAP NO:
FMISC/WRD-02/IEISL/EMP-CH:0.00-28.20-4

CONSULTANTS :
IL&FS Environment
IL&FS Environmental Infrastructure & Services Ltd.
CITIPOINT, B-303, JB NAGAR, ANDHERI (E), MUMBAI - 400 059
TEL: 022 40298568 FAX: 022 40298512



SURFACE WATER MONITORING LOCATION
(SW-1 to SW-12)

NOTES FOR CH. 0.00 - 28.20 km:

1. All locations indicated in the drawing are suggestive. The locations should be decided during the project implementation phase to suit the site conditions & monitoring needs as recommended in the EMP

2. Monitoring of Surface water quality should be as suggested in Table 52 of the EMP

APPROVED FOR:
EIA & EMP REPORT

CLIENT :
FLOOD MANAGEMENT IMPROVEMENT SUPPORT CENTRE (FMISC)

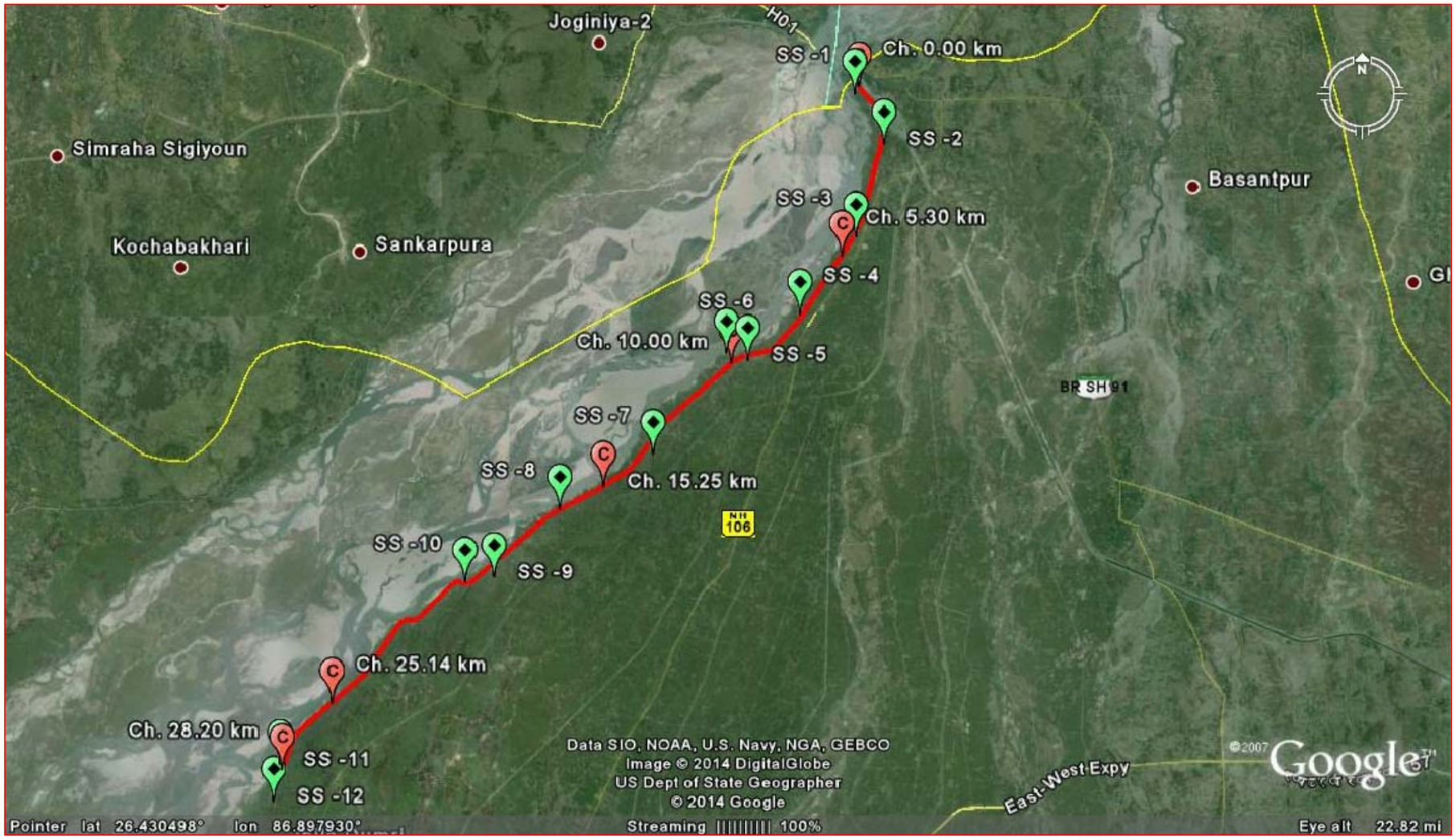
PROJECT:
ENVIRONMENTAL IMPACT ASSESSMENT FOR PROTECTION AND RESTORATION OF KOSI RIVER EMBANKMENTS IN BIHAR

CONTRACT AGREEMENT NO. :
BKFRP/WRD/CONSULTANCY/02/2013-14, DATED 08.01.2014

MAP TITLE:
INDEX MAP SHOWING PROPOSED LOCATIONS FOR SURFACE WATER QUALITY MONITORING (CH. 0.00 - 28.20 km)

MAP NO:
FMISC/WRD-02/IEISL/EMP-CH:0.00-28.20-5

CONSULTANTS :
IL&FS Environment
IL&FS Environmental Infrastructure & Services Ltd.
CITIPOINT, B-303, JB NAGAR, ANDHERI (E), MUMBAI - 400 059
TEL: 022 40298568 FAX: 022 40298512



SOIL SAMPLING LOCATION
(SS-1 to SS-12)

NOTES FOR CH. 0.00 - 28.20 km:

1. All locations indicated in the drawing are suggestive. The locations should be decided during the project implementation phase to suit the site conditions & monitoring needs as recommended in the EMP

2. Monitoring of Soil quality should be as suggested in Table 52 of the EMP

APPROVED FOR:
EIA & EMP REPORT

CLIENT :
FLOOD MANAGEMENT IMPROVEMENT SUPPORT CENTRE (FMISC)

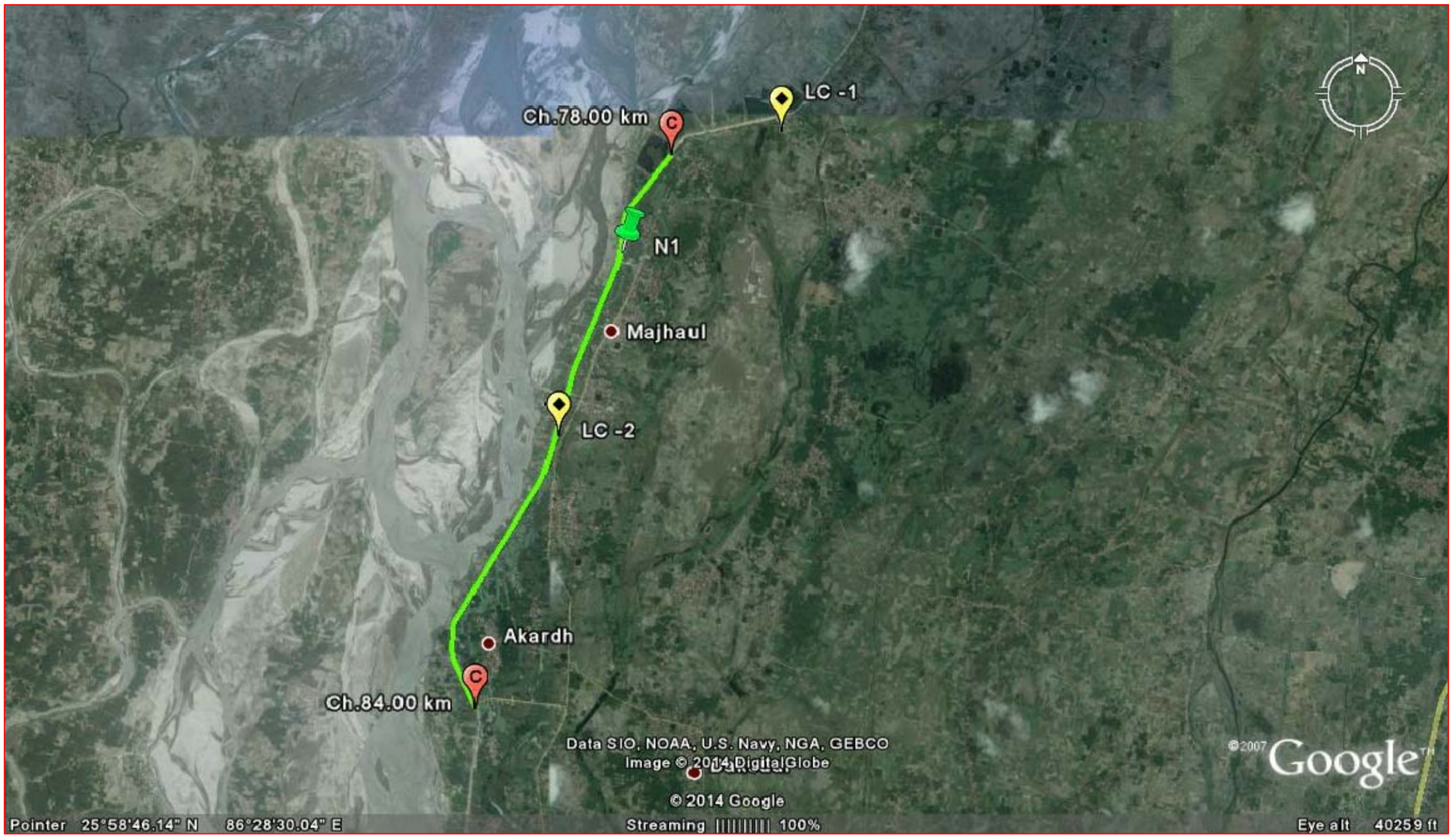
PROJECT:
ENVIRONMENTAL IMPACT ASSESSMENT FOR PROTECTION AND RESTORATION OF KOSI RIVER EMBANKMENTS IN BIHAR

CONTRACT AGREEMENT NO. :
BKFRP/WRD/CONSULTANCY/02/2013-14, DATED 08.01.2014

MAP TITLE:
INDEX MAP SHOWING PROPOSED LOCATIONS FOR SOIL QUALITY MONITORING (CH. 0.00 - 28.20 km)

MAP NO:
FMISC/WRD-02/IEISL/EMP-CH:0.00-28.20-6

CONSULTANTS :
IL&FS Environment
IL&FS Environmental Infrastructure & Services Ltd.
CITIPOINT, B-303, JB NAGAR, ANDHERI (E), MUMBAI - 400 059
TEL: 022 40298568 FAX: 022 40298512



LABOUR CAMP (LC-1 to LC-2),
PLANTATION & NURSERY LOCATION (N1)

NOTES FOR CH. 78.00 - 84.00 km:

1. All locations indicated in the drawing are suggestive. The locations should be decided during the project implementation phase to suit the site conditions & monitoring needs as recommended in the EMP

2. Siting criteria for the labour camps should be as given in the Section 6.2.2.7 of the EMP

3. Establishment of a nursery & plantation may be undertaken on the available Government land in the vicinity of EKE

4. Plantation in the area on the river and the country side, respectively, should be as per the guidelines given in the Embankment Manual of Central Water & Power Commission, Ministry of Irrigation & Power, Govt. of India.

5. The Side-slopes of EKE and land beyond the toe up to 20 feet on the countryside and 10 feet on the waterside should not be used for the purpose of plantation, except short grass.

APPROVED FOR:
EIA & EMP REPORT

CLIENT :
FLOOD MANAGEMENT IMPROVEMENT SUPPORT CENTRE (FMISC)

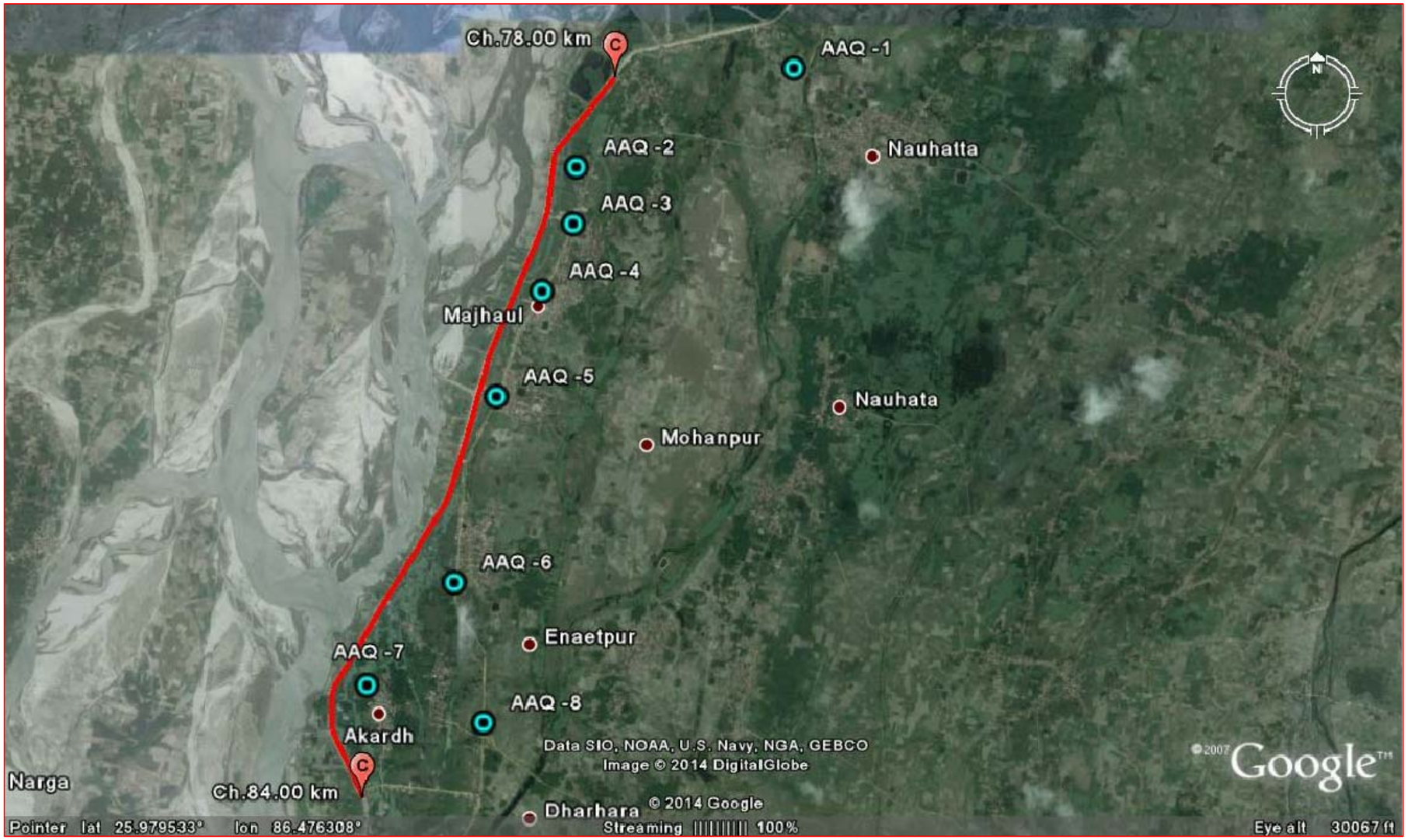
PROJECT:
ENVIRONMENTAL IMPACT ASSESSMENT FOR PROTECTION AND RESTORATION OF KOSI RIVER EMBANKMENTS IN BIHAR

CONTRACT AGREEMENT NO. :
BKFRP/WRD/CONSULTANCY/02/2013-14, DATED 08.01.2014

MAP TITLE:
INDEX MAP SHOWING PROPOSED LOCATIONS FOR LABOUR CAMP, PLANTATION, NURSERY (CH. 78.00 - 84.00 km)

MAP NO:
FMISC/WRD-02/IEISL/EMP-CH:78.00-84.00-1

CONSULTANTS :
IL&FS Environment
IL&FS Environmental Infrastructure & Services Ltd.
CITIPOINT, B-303, JB NAGAR, ANDHERI (E), MUMBAI - 400 059
TEL: 022 40298568 FAX: 022 40298512



AMBIENT AIR QUALITY MONITORING LOCATION
(AAQ-1 to AAQ-8)

NOTES FOR CH. 78.00 - 84.00 km:

1. All locations indicated in the drawing are suggestive. The locations should be decided during the project implementation phase to suit the site conditions & monitoring needs as recommended in the EMP
2. Monitoring of Ambient Air Quality should be as suggested in Table 52 of the EMP

APPROVED FOR:
EIA & EMP REPORT

CLIENT :
FLOOD MANAGEMENT IMPROVEMENT SUPPORT CENTRE (FMISC)

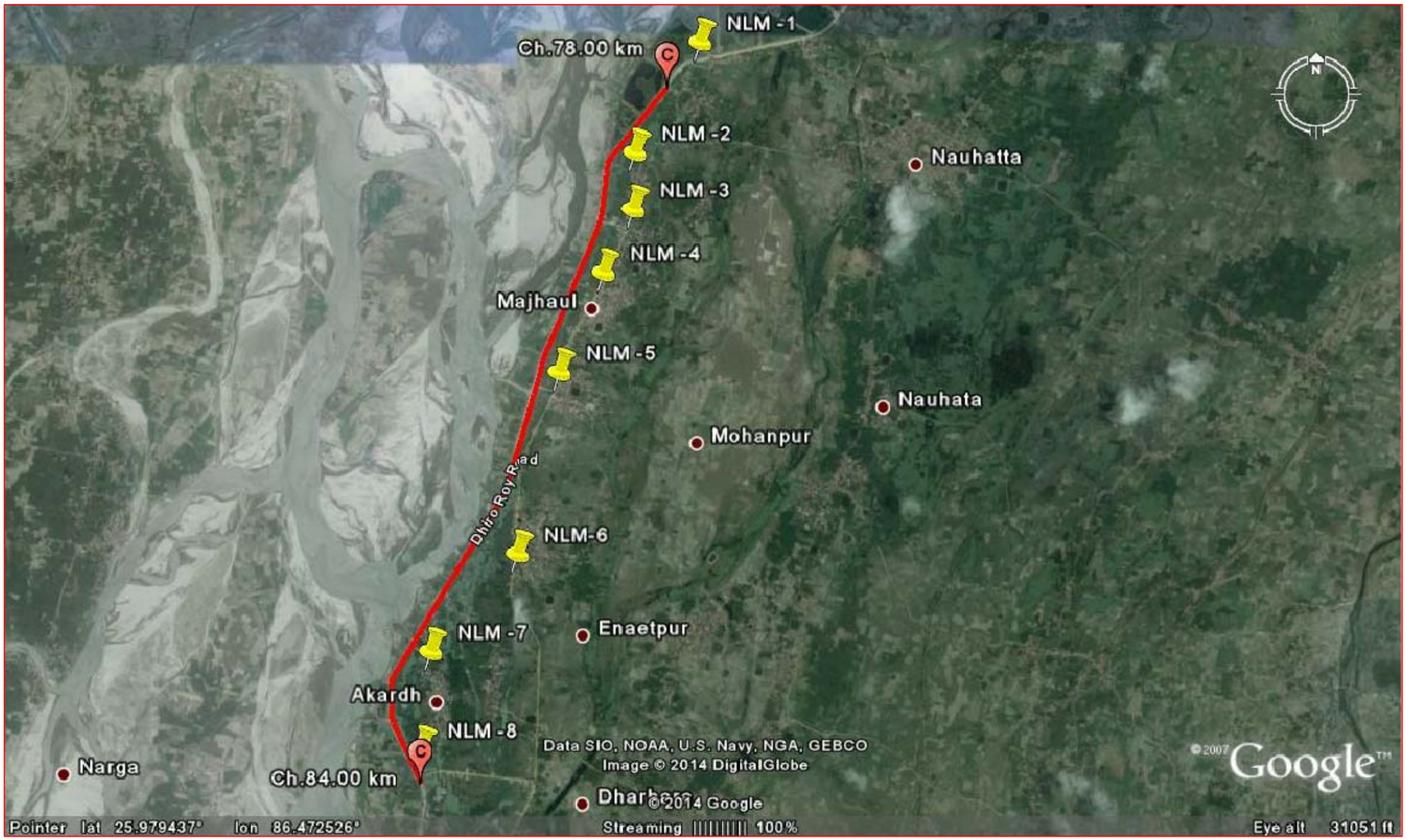
PROJECT:
ENVIRONMENTAL IMPACT ASSESSMENT FOR PROTECTION AND RESTORATION OF KOSI RIVER EMBANKMENTS IN BIHAR

CONTRACT AGREEMENT NO. :
BKFRP/WRD/CONSULTANCY/02/2013-14, DATED 08.01.2014

MAP TITLE:
INDEX MAP SHOWING PROPOSED LOCATIONS FOR AMBIENT AIR QUALITY MONITORING (CH. 78.00 - 84.00 km)

MAP NO:
FMISC/WRD-02/IEISL/EMP-CH:78.00-84.00-2

CONSULTANTS :
IL&FS Environment
IL&FS Environmental Infrastructure & Services Ltd.
CITIPOINT, B-303, JB NAGAR, ANDHERI (E), MUMBAI - 400 059
TEL: 022 40298568 FAX: 022 40298512



NOISE LEVEL MONITORING LOCATION
(NLM-1 to NLM-8)

NOTES FOR CH. 78.00 - 84.00 km:

1. All locations indicated in the drawing are suggestive. The locations should be decided during the project implementation phase to suit the site conditions & monitoring needs as recommended in the EMP
2. Monitoring of Noise Level should be as suggested in Table 52 of the EMP

APPROVED FOR:
EIA & EMP REPORT

CLIENT :
FLOOD MANAGEMENT IMPROVEMENT SUPPORT CENTRE (FMISC)

PROJECT:
ENVIRONMENTAL IMPACT ASSESSMENT FOR PROTECTION AND RESTORATION OF KOSI RIVER EMBANKMENTS IN BIHAR

CONTRACT AGREEMENT NO. :
BKFRP/WRD/CONSULTANCY/02/2013-14, DATED 08.01.2014

MAP TITLE:
INDEX MAP SHOWING PROPOSED LOCATIONS FOR NOISE LEVEL MONITORING (CH. 78.00 - 84.00 km)

MAP NO:
FMISC/WRD-02/IEISL/EMP-CH:78.00-84.00-3

CONSULTANTS :
IL&FS Environment
IL&FS Environmental Infrastructure & Services Ltd.
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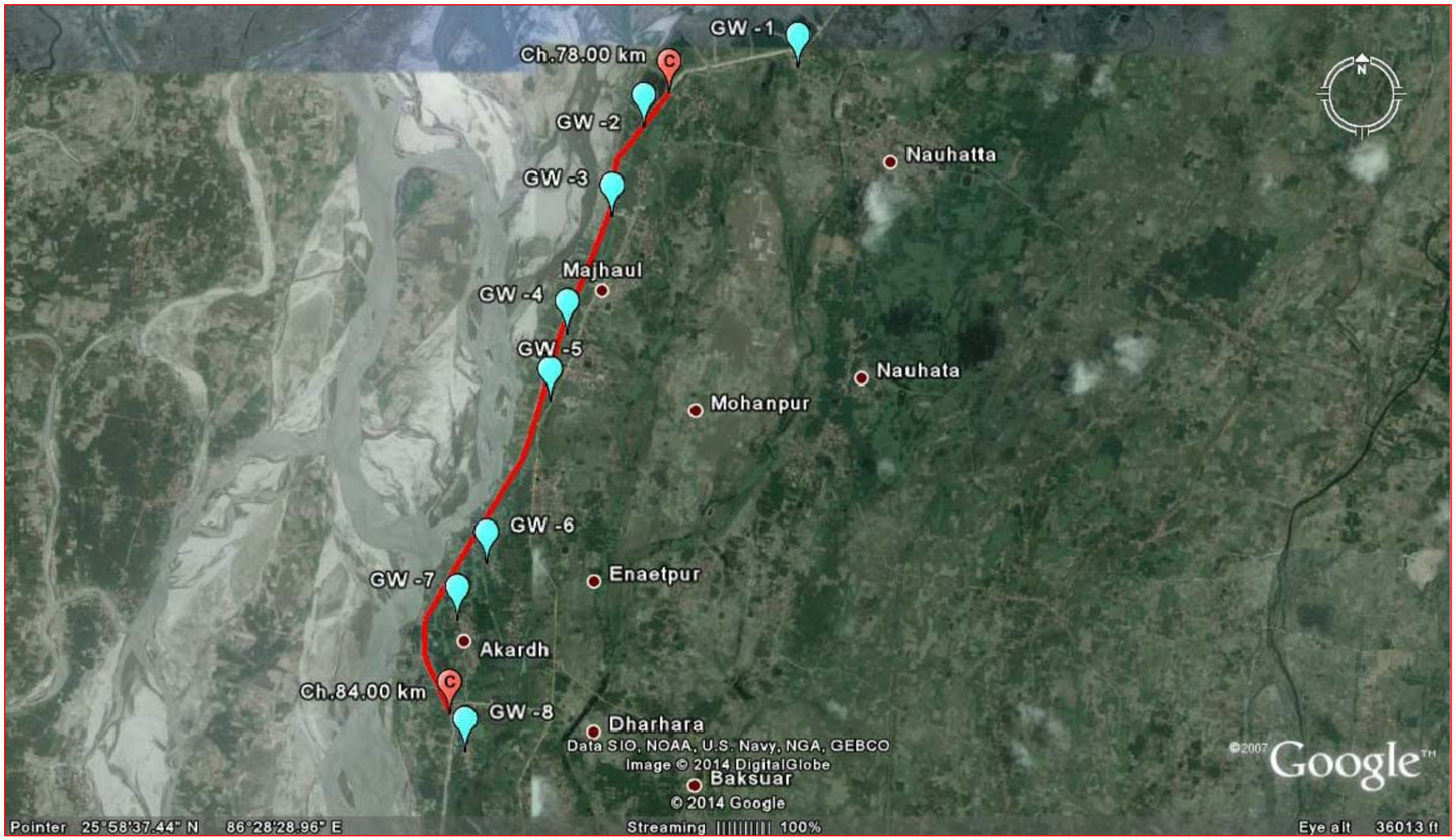

GROUNDWATER MONITORING LOCATION
(GW-1 to GW-8)

NOTES FOR CH. 78.00 - 84.00 km:

1. All locations indicated in the drawing are suggestive. The locations should be decided during the project implementation phase to suit the site conditions & monitoring needs as recommended in the EMP
2. Monitoring of Ground-water quality should be as suggested in Table 52 of the EMP

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ENVIRONMENTAL IMPACT ASSESSMENT FOR PROTECTION AND RESTORATION OF KOSI RIVER EMBANKMENTS IN BIHAR

CONTRACT AGREEMENT NO. :
BKFRP/WRD/CONSULTANCY/02/2013-14, DATED 08.01.2014

MAP TITLE:
INDEX MAP SHOWING PROPOSED LOCATIONS FOR GROUND WATER QUALITY MONITORING (CH. 78.00 - 84.00 km)

MAP NO:
FMISC/WRD-02/IEISL/EMP-CH:78.00-84.00-4

CONSULTANTS :
IL&FS Environment
IL&FS Environmental Infrastructure & Services Ltd.
CITIPOINT, B-303, JB NAGAR, ANDHERI (E), MUMBAI - 400 059
TEL: 022 40298568 FAX: 022 40298512

SURFACE WATER MONITORING LOCATION
(SW-1 to SW-8)

NOTES FOR CH. 78.00 - 84.00 km:

1. All locations indicated in the drawing are suggestive. The locations should be decided during the project implementation phase to suit the site conditions & monitoring needs as recommended in the EMP

2. Monitoring of Surface water quality should be as suggested in Table 52 of the EMP

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CLIENT :
FLOOD MANAGEMENT IMPROVEMENT SUPPORT CENTRE (FMISC)

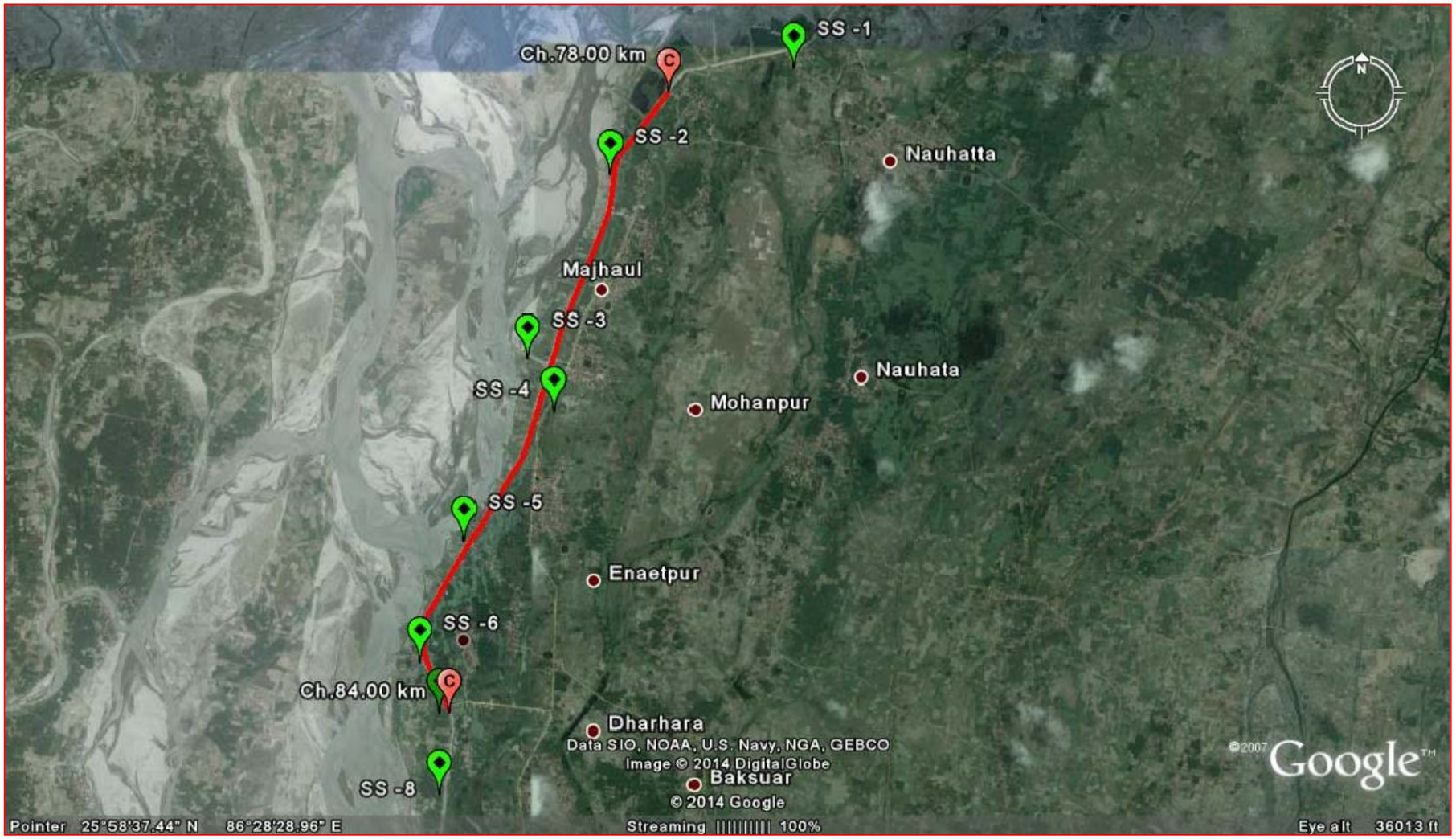
PROJECT:
ENVIRONMENTAL IMPACT ASSESSMENT FOR PROTECTION AND RESTORATION OF KOSI RIVER EMBANKMENTS IN BIHAR

CONTRACT AGREEMENT NO. :
BKFRP/WRD/CONSULTANCY/02/2013-14, DATED 08.01.2014

MAP TITLE:
INDEX MAP SHOWING PROPOSED LOCATIONS SURFACE WATER QUALITY MONITORING (CH. 78.00 - 84.00 km)

MAP NO:
FMISC/WRD-02/IEISL/EMP-CH:78.00-84.00-5

CONSULTANTS :
IL&FS Environment
IL&FS Environmental Infrastructure & Services Ltd.
CITIPOINT, B-303, JB NAGAR, ANDHERI (E), MUMBAI - 400 059
TEL: 022 40298568 FAX: 022 40298512



SOIL SAMPLING LOCATION
(SS-1 to SS-8)

NOTES FOR CH. 78.00 - 84.00 km:

1. All locations indicated in the drawing are suggestive. The locations should be decided during the project implementation phase to suit the site conditions & monitoring needs as recommended in the EMP

2. Monitoring of Soil quality should be as suggested in Table 52 of the EMP

APPROVED FOR:
EIA & EMP REPORT

CLIENT :
FLOOD MANAGEMENT IMPROVEMENT SUPPORT CENTRE (FMISC)

PROJECT:
ENVIRONMENTAL IMPACT ASSESSMENT FOR PROTECTION AND RESTORATION OF KOSI RIVER EMBANKMENTS IN BIHAR

CONTRACT AGREEMENT NO. :
BKFRP/WRD/CONSULTANCY/02/2013-14, DATED 08.01.2014

MAP TITLE:
INDEX MAP SHOWING PROPOSED LOCATIONS FOR SOIL QUALITY MONITORING (CH. 78.00 - 84.00 km)

MAP NO:
FMISC/WRD-02/IEISL/EMP-CH:78.00-84.00-6

CONSULTANTS :
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IL&FS Environmental Infrastructure & Services Ltd.
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ANNEXURE 11: RATE ANALYSIS

Rate Analysis for Sprinkling of Water for Dust Suppression			
Sr. No.	**Description**	**Ch. 0.00 to 28.20 km.**	**Ch. 78.00 to 84.00 km.**
1	Water Tanker Capacity (Ltr.)	6,000	6,000
2	EKE Length (Km.)	30	10
3	EKE Width (m)	5	5
4	Area to be sprinkled with water (Sqm.)	1,50,000	50,000
5	Water requirement per Sqm. (Ltr.)	3	3
6	Quantity of water required (Litre.)	4,50,000	1,50,000
7	Number of tanker trips	75	25
8	Number of trips per day by one vehicle	9	9
9	Number of tankers to be deployed (with standby) per day	10.33	3.78
10	All inclusive cost of water tanker (Rs./hr) *(Ref: RCD, Govt. of Bihar SoR, pg. no. xxxv, plant & machinery rate, sr. no. P&M-057)*	166	166
11	All inclusive cost of truck (Rs./hr) *(Ref: RCD, Govt. of Bihar SoR, pg. no. xxxv, plant & machinery rate, sr. no. P&M-060)*	841	841
12	All inclusive cost of tanker with truck (Rs./hr)	1,007	1,007
13	All inclusive cost of tanker with truck (Rs./day) Considering 8 hr of operation per day	8,056	8,056
14	**Total Cost of water sprinkling (Rs./Day)**	**83,245**	**30,434**

Rate Analysis for dust supression for Ch 0.00 to 28.20 km.

S. No.	Description	Unit	Length (m)	Breadth (m)	Quantity	Rate (Rs.)	Amount (Rs.)
1	Area to be sprinkled with water per day (30 km length of EKE and 5 m width considered)	Sqm.	30000	5	150000		
2	Water requirement per day [at the rate 3 ltr per sqm. Total quantity of water required per day = 150000 sqm. x 3 ltr = 450000 ltr. per day	ltr.			450000		
3	Tanker capacity of 6000 ltr. considered No. of trips = 450000 ltr / 6000 ltr = 75 vehicle trips	Vehicle trips			75		
4	Assuming one vehicle makes 9 trips per day, No. of tanker vehicles to be deployed = 75 trips / 9 trip per one vehicle = 8.3 vehicles (2 vehicles standby = 10.3 vehicles)				10.33		
5	Cost of water (Hire charges for water tanker + hire charges for vehicle) Assuming 8hrs. of operation per day, Cost works out to (Rs.166 x 8 hr. + Rs. 841 x 8 hr.) = Rs. 8056 per day **(Ref: RCD, Govt. of Bihar SoR, pg. no. xxxv, plant & machinery rate, sr. no. P&M-057 & 060)**	per day				8,056	
6	**TOTAL COST PER DAY FOR WATER SPRINKLING Number of tanker vehicles to be deployed x hire charges of tanker vehicle per day = 10.33 x 8056 = Rs. 83245 per day**				**10.33**	**8,056**	**83,245**

Rate Analysis for dust supression for Ch 78.00 to 84.00 km.

S. No.	Description	Unit	Length (m)	Breadth (m)	Quantity	Rate (Rs.)	Amount (Rs.)
1	Area to be sprinkled with water per day (10 km length of EKE and 5 m width considered) **Additional 4 km. length of approach to EKE is considered, which also requires dust suppression activity as there are enroute villages.**	Sqm.	10000	5	50000		
2	Water requirement per day [at the rate 3 ltr per sqm. Total quantity of water required per day = 50000 sqm. x 3 ltr = 150000 ltr. per day	ltr.			150000		
3	Tanker capacity of 6000 ltr. considered No. of trips = 150000 ltr / 6000 ltr = 25 vehicle trips	Vehicle trips			25		
4	Assuming one vehicle makes 9 trips per day, No. of tanker vehicles to be deployed = 25 trips / 9 trip per one vehicle = 2.78 vehicles (1 vehicle standby = 3.78 vehicles)				3.78		
5	Cost of water (Hire charges for water tanker + hire charges for vehicle) Assuming 8hrs. of operation per day, Cost works out to (Rs.166 x 8 hr. + Rs. 841 x 8 hr.) = Rs. 8056 per day **(Ref: RCD, Govt. of Bihar SoR, pg. no. xxxv, plant & machinery rate, sr. no. P&M-057 & 060)**	per day				8056	
6	**TOTAL COST PER DAY FOR WATER SPRINKLING Number of tanker vehicles to be deployed x hire charges of tanker vehicle per day = 3.78 x 8056 = Rs. 30434 per day**				**3.78**	**8056**	**30434**

Toilet / Wash Area / Urinals

S. No.	Description	Unit	Length (m)	Breadth (m)	Quantity	Rate (Rs.)	Amount (Rs.)
1	Providing toilet, wash area (bathing) & urinals Construction cost is assumed as Rs. 5000 per sqm.	Sqm.	2	1.5	3	5000	15000

Rate Analysis for Solid Waste Disposal for Ch. 0.00 to 28.20 km.		
No. of persons	725	
Waste generation rate	0.25	kg/person/day
Waste generation per day	181.25	kg/day
Waste generation for entire construction period of 365 days	66156.25	kg
	66.15625	Metric Ton
Assuming density of waste @ 0.6 Ton per cum, quantity in cum.	110.2604167	Cum.
Depth of disposal pit assumed	1	m.
Area required for disposal of pit	110.2604167	sqm.
Cost of lining & final cover with allied civil works and plantation	5000	Rs/sqm.
Cost of construction of disposal pit = 182.5 sqm. X Rs. 5000	551302.0833	
Land, Transportation & miscellaneous cost	300000	
TOTAL cost for MSW disposal	851302.0833	
Say, Rs.	**9,00,000.00**	

Rate Analysis for Solid Waste Disposal for Ch.78.00 to 84.00 km.		
No. of persons	315	
Waste generation rate	0.25	kg/person/day
Waste generation per day	78.75	kg/day
Waste generation for entire construction period of 365 days	28743.75	kg
	28.74375	Metric Ton
Assuming density of waste @ 0.6 Ton per cum, quantity in cum.	47.90625	Cum.
Depth of disposal pit assumed	1	m.
Area required for disposal of pit	47.90625	sqm.
Cost of lining & final cover with allied civil works and plantation	5000	Rs/sqm.
Cost of construction of disposal pit = 182.5 sqm. X Rs. 5000	239531.25	
Land, Transportation & miscellaneous cost	300000	
TOTAL cost for MSW disposal	539531.25	
Say, Rs.	**5,50,000.00**	