Environmental Impact Assessment "DRAFT"

NEP: Strategic Road Improvement Project

East-West Highway (Nadaha) – Koshi Bridge (Chatara) – East West Highway

Prepared by the Department of Road, Ministry of Physical Planning, Works and Transport Management for the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 26 September 2012)

Currency unit	–	Nepalese rupee (NR)
NR1.00	=	$0.0117164616
$1.00	=	NR85.350000

ABBREVIATIONS

AADT	–	average annual daily traffic
AC	–	asphaltic concrete
ADB	–	Asian Development Bank
ADF	–	Asian Development Fund
ADT	–	average daily traffic
AIDS	–	acquired immune deficiency syndrome
amsl	–	above mean sea level
AP	–	affected people
ARI	–	acute respiratory infection
B.S	–	Bikram Sambat
CBO	–	community-based organization
CBR	–	California bearing ratio
CBS	–	Central Bureau of Statistics
CDMA	–	code division multiple access
CF	–	community forest
CFUG	–	community forest user group
ch	–	chainage
CITES	–	Convention on International Trade in Endangered Species
CMVC	–	classified manual vehicle counts
CO	–	carbon monoxide
COI	–	corridor of impact
CR	–	critically endangered
DBST	–	double bituminous surface treatment
DCP	–	dynamic cone penetrometer
DDC	–	district development committee
DFID	–	Department for International Development, UK
DG	–	diesel generating
DFO	–	District Forest Office
DH	–	district hospital
DHO	–	District Health Office
DNPWC	–	Department of National Parks and Wildlife Conservation
DOF	–	Department of Forest
DOHM	–	Department of Hydrology and Meteorology
DOLIDAR	–	Department of Local Infrastructure Development and Agricultural Roads
DOR	–	Department of Roads
DSC	–	design and supervision consultant
DUDBC	–	Department of Urban Development and Building Construction
EA	–	executing agency
EAG	–	Environmental Assessment Guidelines
EFDRP	–	Emergency Flood Damage Rehabilitation Project – ADB
EIA	–	environmental impact assessment

EMG	–	Environmental Management Guidelines
EMP	–	environmental management plan
EMoP	–	environmental monitoring plan
EN	–	endangered
EPA	–	Environment Protection Act
EPR	–	Environment Protection Rules
ES	–	environment specialist
ESMF	–	Environmental and Social Management Framework
EWH	–	East-West Highway
FGD	–	focus group discussion
FIDIC	–	Fédération International Des Ingénieurs-Conseils
FM	–	frequency modulation
FS	–	feasibility study
FUG	–	forest user group
FY	–	fiscal year
GESU	–	Geo-Environmental and Social Unit
GHG	–	greenhouse gas
GON	–	Government of Nepal
HFT	–	Himalayan Frontal Thrust
HH	–	household
HMGN	–	His Majesty Government of Nepal
HIV	–	human immunodeficiency virus
IA	–	implementing agency
ICIMOD	–	International Center for Integrated Mountain Development
IEE	–	initial environmental examination
IUCN	–	International Union for Conservation of Nature
ISRC	–	Intensive Study and Research Center
JICA	–	Japan International Cooperation Agency
KWTR	–	Koshi Tappu Wildlife Reserve
LC	–	least concern
LR	–	lower risk
LPG	–	liquefied petroleum gas
LRMP	–	Land Resource Mapping Project
MCT	–	Main Central Trust
MFSC	–	Ministry of Forest and Soil Conservation
MHH	–	midhill highway
MoEST	–	Ministry of Environmental Science and Technology
MoPPWTM	–	Ministry of Physical Planning, Works and Transport Management
MRM	–	Mahendra Raj Marg
NAAQS	–	Nepal Ambient Air Quality Standard
NEP	–	Nepal
NGO	–	nongovernment organization
NOx	–	nitrogen oxide
NPC	–	National Planning Commission
NPWC	–	National Parks and Wildlife Conservation
NT	–	near threatened
NTFP	–	nontimber forest product
OD	–	origin-destination

OHS	–	occupational health and safety
PD	–	project directorate
PPE	–	personal protective equipment
PIP	–	Priority Investment Plan
PIU	–	project implementation unit
PPTA	–	project preparation technical assistance
RCC	–	reinforced cement concrete
RCP	–	Road Connectivity Project - ADB
RCSP	–	Road Connectivity Sector Project - ADB
REA	–	rapid environmental assessment
RIP	–	Road Improvement Project - DOR
RNDP	–	Road Network Development Project - ADB
ROW	–	right-of-way
RRRSDP	–	Rural Rehabilitation and Reconstruction Sector Development Project - ADB
RSDP	–	Road Sector Development Project - WB
SC	–	supervision consultant
SD	–	surface dressing
SDC	–	social development consultant
SPS	–	ADB Safeguard Policy Statement, 2009
SRIP	–	Strategic Road Improvement Project
SRN	–	Strategic Road Network
STD	–	sexually transmitted disease
TA	–	technical assistance
TMO	–	transport management office
TOR	–	terms of reference
TPPF	–	Transport Project Preparatory Facility - ADB
WECS	–	Water and Energy
UN	–	United Nations
UNESCO	–	United Nations Educational, Scientific and Cultural Organization
VDC	–	village development committee
VU	–	vulnerable
ZOI	–	zone of influence

WEIGHTS AND MEASURES

ºC	–	degree Celsius
cm	–	centimeter
dBA	–	decibels A
km	–	kilometer
KWH	–	kilowatt-hour
KVA	–	kilovolt ampere
m	–	meter
mg		milligram
mm	–	millimeter
µS	–	milliho
ppb	–	parts per billion
pph	–	persons per hectare
ppm	–	parts per million

GLOSSARY

Bikram Sambat (B.S)	–	Nepalese calendar year that runs from mid-April to mid-April. Unless otherwise stated, year ranges written in the form 2011/012 denote a single calendar year.

NOTES

(i) The fiscal year (FY) of the Government ends on 15 July. FY before a calendar year denotes the year in which the fiscal year ends, e.g., FY2012 ends on 15 July 2012

(ii) In this report, "$" refers to US dollars.

CONTENTS

EXECUTIVE SUMMARY

A. INTRODUCTION

1. The proposed Strategic Roads Improvement Project (SRIP) will finance improvements of two strategic high-priority highways and three feeder roads, a total of 186 km, in the eastern region of Nepal. These roads are important to provide an alternate road for the East-West Highway (EWH) and improve access to rural and hilly areas as well as to non-connected district headquarters. The project roads under SRIP are: (i) EWH (Nadaha)-Koshi Bridge[1] (Chatara)-EWH (61-km two-lane highway); (ii) Leguwaghat-Bhojpur Road (66-km intermediate-lane mid-hill highway); (iii) Halesi-Diktel Road (35-km intermediate-lane mid-hill highway); (iv) Mechipul-Chandragadhi-Birtamod Road (12-km double-lane feeder road); and (v) Manthali-Ramechhap Road (13-km single-lane feeder road).

2. This EIA report covers the EWH (Nadaha)-Koshi Bridge (Chatara)-EWH project road which is the only subproject categorized as A due to the potential for irreversible adverse impacts on the wildlife habitat in accordance with the requirements of the ADB Safeguard Policy Statement (SPS) 2009. Approximately 9.5km of the road passes through the buffer zone of the Koshi-Tappu Wildlife Reserve (KTWR) which is also a Ramsar Site. It also crosses migration routes of the Asiatic Elephant (Elephas Maximus). According to the requirements of the Nepal Environment Protection Act, 1997 and Environment Protection Rules the EWH-Koshi Bridge – EWH road is requires a detailed Environmental Impact Assessment (EIA) study. The other 4 subprojects are categorized as B and separate Initial Environmental Examination (IEE) reports have been prepared for these roads. This report was prepared to comply with the ADB SPS 2009. A separate report is being prepared by the DoR to comply with the requirements of the Ministry of Environment, Science and Technology (MoEST).

3. This report was prepared based on the information and data available in the feasibility study, preliminary engineering designs, draft socio-economic and resettlement studies; field visits, public consultations and discussions, collection of primary and secondary information and data. The study has established a core zone of direct impact (CoI) of 100 metres on either side of the existing road and up to 7 km on either side of road alignment has been considered for broader analysis of potential induced biophysical, socio-economic and cultural impacts.

B. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

4. Policies and regulations applicable to the project under the Government of Nepal (GON) include the interim Constitution of Nepal, 2007 (with amendments), the tenth plan (2003 – 2007) and three year interim plan (2007 – 2010), the Environmental Protection Act (EPA), 1996 and Environmental Protection Rules (EPR), 1997 and Road Sector Guidelines. Since a part of the road passes through the KTWR buffer zone, it is also required to follow the National Parks and Wildlife Conservation Act (1973) and its rules, the Buffer Zone Management Regulations (1996) and the Management Plan of the KTWR.

5. Under the EPA and EPR the subproject is required to prepare an EIA report and follow prescribed procedures for approval of TOR, public consultations and hearings, monitoring and auditing. The final authority for approving the EIA is the Ministry of Environment, Science and Technology (MOEST), as opposed to the respective line Ministry for the case of projects requiring an IEE report. The KTWR Management Plan and Buffer Zone Regulations specifies the type of activities that are allowed and prohibited inside the reserve and buffer zone area.

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[1] The longest crossing structure in Nepal linking the major eastern provinces to the rest of the country through EWH in Sunsari District of Koshi Province.

6. The project is also subject to sectoral laws and regulations such as the Public Roads Act, Forest Act 1993 and Forest Rules 1995, Land Acquisition Act, 1977 (amended 1985), Soil and Water Conservation Act 1982, Water Resources Act 1992, Aquatic Animal Protection Act 1961 and Motor Vehicle and Transport Management Act 1993.

C. DESCRIPTION OF PROJECT

7. The EWH (Kanchanpur)-Koshi Bridge (Chatara)-EWH (Nadaha) road lies in Saptari, Udayapur and Sunsari districts in the eastern development region of Nepal. The road alignment passes through 16 Village Development Committees (VDC) areas of the three districts. The road section starts at Nadaha (km 11+840) in Sunsari District and ends at Kanchanpur (km 71+000) in Saptari district.

8. The new Koshi Bridge in Chatara and the road upgrading project are part of a long-term plan by Government of Nepal (GON) to avoid eastern region from being cut off from the rest of the country in the event of another breach in the Koshi Barrage system. The proposed EWH-Koshi-Bridge (Chatara) - East West Highway (Kanchanpur) road section will connect the EWH with the new bridge across the Koshi River near Chatara on both sides of the river to provide an alternative route to the EWH across the Koshi Barrage. The upgrading the project road is a climate change adaptation by the GoN to address the breaching of the Koshi Barrage due to increase in glacial icemelt at the headwaters of the Koshi River and the increased siltation of the Barrage reducing its flood holding capacity. The project road is located in higher elevation that the existing EWH southern road section it intends to by-pass and the new bridge in Chatara located upstream and not prone to overtopping.

9. The existing road is mostly gravel and earthen surface with 4.0-5.0 meter carriage width, crossing numerous rivers, community forests, and buffer zone of Ramsar site Koshi Tappu Wildlife Reserve (KTWR). In the middle of project road is an on-going construction of the new Koshi Bridge (Chatara) under the ADB's Emergency Flood Damage Rehabilitation Project. The existing road will be upgraded to a 2-lane Asian Highway Class II. Key features of the project are given in the table below. The project also includes improvements in alignment, drainage, bridge approaches, traffic signs and safety, retaining structures, and junction.

Name of the Project	Strategic Road Improvement Project (SRIP)
Name of the Road Section	Improvement/Upgrading of EWH-Koshi Bridge-EWH Road
LOCATION	
Start Point	Nadaha (Bharaul VDC), Ch. 11+840
End Point	Rupnagar (EWH), Ch. 70+865
VDCs	Bharaul, Barahakshetra - Sunsari Mainamaini, Thoksila, Katunje Babla, Basaha, and Tapeshwari - Udaypur Phattepur, Kamalpur, Ghoghanpur, Pipra (Purba), Dharmpur, Kanchanpur and Rupnagar –Saptari
GEOGRAPHICAL FEATURES	
Terrain	Plain/Mountain, Plain/Rolling
Altitude	From 125 to 109 m amsl
Climate	Tropical
Road Type	
Classification of road	Asian Highway Class II (2 lane)
Length of Road	61.15 km
Type of Pavement	DBST
Design Parameters	

Right of Way	25 m (On either side from center line)
Carriageway Width	7 m
Total Formation (Road Way) Width	12 m
Shoulder Width	2.5 m
No of new bridges required	20

Ch = chainage, DBST = double bituminous surface treatment, EWH = East-West Highway, VDC = Village Development Committee.
Source: TPPF Detailed Project Report, 2012

D. DESCRIPTION OF ENVIRONMENT

1. Physical Resources

10. The project area has a tropical climate where the rainy season starts from June and ends in September. The average temperature in the project area ranges from 190C to 310C and the average rainfall is 1,863.37 mm per annum. Though there is a lack of secondary information on the air quality for the project site, the ambient air and noise quality is expected to be within the permissible standards of Nepal. Most commercial and limited industrial activities are concentrated in the Kanchanpur and Phattepur and for most of the road length the land use is dominantly agricultural and associated residential areas. The road alignment passes through the Siwaliks and Terai regions. The altitude variation of the project ranges from 125 to 109 m amsl. The soils of project area can be categorized under three land type viz. (i) high terraces, (ii) middle terraces, and (iii) low terraces. The major land use in the subproject area include forests, cultivated land (lowland) settlements/bazaar including river, stream and rivulet channels.

11. The entire project falls within the watershed of the Koshi River basin. The Koshi River is the largest trans-Himalayan river passing through Nepal. Apart from the Koshi River, a large number of rivers and rivulets or Kholas and Kholsis, flow within the project area and finally drain into the Koshi River. Although secondary information on water quality of these rivers and rivulets are not available, it is assumed that it is up to the prescribed standards as there are no sources of pollutions along the river courses. The Koshi River has a long history of breaching. After the embankments construction was completed in the 1950s, the first breach occurred in 1963, followed by others in 1968, 1971, 1980, 1984, and in 1991. The most recent and one of the most devastating breach occurred in August 18, 2008, which killed 3 people in Nepal and 6,190 in Bihar, India and displaced about 3 million people.

2. Ecological Resources

12. The project road traversed several community managed forests in Kalindra, Janjagriti, Agaha, Bhandaritar, Ramailo, Hattisar, Machhapuchhre, Gaurishankar, and Ranipandhera Deurali. A total of 9.45 kms of the proposed road section passes through these community forests, representing 15.43% of the total road length. Community Forest User Groups (CFUGs) have been organized under the present forestry sector policy responsible for the protecting, harvesting, and regenerating community forest. Forest types existing along the road is mainly Sal (*Shorea robusta*) with smaller portions of moist evergreen forest, dry deciduous forest and Khair - Sisoo (*Acacia catechu-Dalbergia sisoo*) forest. Most of the significant wildlife encountered along the entire Project road is found within 9.525 kms project road stretches within the KTWR Buffer zone.

13. KTWR is the smallest protected area in the Nepal Terai spread over 175 sq. km. However, it is one of the best sites for the conservation of many rare and endangered species such as wild water buffalo, waterfowl, elephant and other species of plants, fish, herpetofauna, resident and migratory birds and mammals. It was declared the first Ramsar Site in Nepal as it

supports a population of more than 20,000 waterfowl. In spite of being a Ramsar Site, KTWR faces a multitude of conservation challenges to protect its wildlife and natural resources. One of the major problems is crop damage and human injuries by wild water buffalo coming out of the Reserve. Some domestic cattle and buffaloes are still grazing inside the Reserve exerting intense competition for food and space with the wildlife. These feral livestock also damage crop in the peripheral agricultural fields. The domestic buffaloes are also cross breeding with wild water buffalo, which may have caused genetic pollution in the pure wild breed.

14. The Buffer Zone of KTWR is 173 sq. km distributed across 16 Village Development Committees of Sunsari, Saptari and Udayapur Districts and 49.6 sq km submerged government land between the Koshi barrage and southern boundary of the Reserve. Several User Groups (UGs) and Committees (UCs) were organized and the Buffer Zone Management Committee (BZMC) is the apex local body responsible for full ownership of the Buffer Zone development and management programme.

3. Socio-Economic Resources

15. The road alignment passes through fourteen (14) VDCs in Sunsari, Udaypur and Saptari districts. The total population of the project area is 109,229 and is female dominated (50.22%) with the average household size of 5.52. Agriculture including animal husbandry is an important economic activity in the project area.

16. District level access to improved source of drinking water for the three project districts range from 69.7% to 96.0%. All the VDCs of project area have facility of sub-health post. Telephone lines per thousand populations for the three project districts range from 1.15 to 17.54. Road is the dominant mode of transportation in the project area. The road density and population influenced per km road is 15/100 km^2 and 3275 respectively for Sansari district, 9/100 km^2 and 1600 for Udaypur and 18/100 km^2 and 2381 for Saptari. Percentage of households having electricity facility for the three districts Sunsari, Udayapur and Saptari districts are 42.7%, 41.3% and 32.2%, respectively.

17. Large scale industries in the project districts which are mainly located near the East West Highway or the start and end point of the road include agro-based and distilleries, pipe and steel, textile, tobacco and, soap and detergent while small-scale industries include cereal processing mills and wood related factories, herbal medicinal, paper, stone and brick related industries. With the proximity of the KTWR and the existence of other religious sites in the project area, there is great potential for tourism development in the project area.

E. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

18. The environmental impacts of the proposed road upgrading includes the acquisition of 188.7 hectares of land affecting 1,837 private plots, 1,245 structures and, resettlement of 7,062 individual. 1,095 trees will be cleared along the proposed carriage width and shoulders; and 28.59 hectares of agricultural land planted with rice, wheat, maize, and pulse will be permanently converted with annual loss in production estimated at 94,742.03 kgs. Land use conversion particularly of residential areas and relocation of structures within the ROW will be implemented following a meaningful consultations and acceptable compensation and relocation agreements. The trees will be compensated through afforestation at the mandatory rate of 1:25.

19. The project, as is generally the case for all road projects will enhance economic development in the project area through employment generation, improved access and easier travel enhancing tourism, local industries and trade. While beneficial impacts are mostly socio-economic in nature environmental benefits are also expected in the form of better management of the KTWR. Through the road upgrading project, key activities proposed in the protected area management plan will be implemented as part of the environmental management plan (EMP), these are: i) establishment of two check posts, forage development inside the core area, and capacity building to select members of the affected communities to become eco-

guardians and promote wildlife conservation and stewardship amongst the local people for the KTWR.

20. It is anticipated that short-term deterioration of air quality will take place during construction phase due to increase in fugitive dust emissions and noise level from earthmoving, ground shaping, unpaved transport, and emissions from heavy equipment and other mobile sources. Water suppression to control dust, use of clean fuels, changing the location and timing of construction activities and equipment will minimize these impacts. All borrow areas will comply with national laws and regulations. Impacts from the establishment and operation of the construction camps like generation and disposal of solid wastes, sewage, potable water requirements, health/hygiene, and safety is part of the contractor's responsibility highlighting the need for compliance with applicable laws. Waste and material use minimization will be promoted to decrease the volume of wastes that will be generated. Traffic safety to workers and pedestrian, particularly to children is considered through the preparation and strict implementation of a Traffic Control Plan to be prepared by the contractor prior to construction activities and in consultation with the affected communities

21. More than the short term impacts during construction, it is the long term impacts that are a bigger concern and the main reason that warranted this subproject to be categorized as A. The project has been identified to potentially threaten continued existence and movement of the Asian Elephant in the project area by contributing to enhanced emigration of private land owners to the project area through improved access brought about by the project. Improved access and potentially increased emigration to the buffer zone will magnify the already existing human-wildlife conflict involving other protected species such as wild water buffalo, deer, wild pig, monkey, common leopard, bear, jackal, hare, and common mongoose.

22. While the anticipated impacts are long term and will potentially take place during the operation stage, measures for mitigating and minimizing the impacts will need to be taken during the project construction stage. A fourfold approach will be adopted to avoid degradation of the KTWR and further reduction in the number of endangered species. The approach includes measures to facilitate elephant movement across the project road, enhance monitoring in the project area through establishment of checkposts, improve wildlife habitat through fodder plantation and build the capacity of the local community people to make them better stewards of the KTWR and the wildlife in the project area. Currently the local people are not involved at all in management and monitoring of wildlife conservation activities.

23. There are no other significant development projects or activities going on or planned for in the near future within the project area. Therefore, cumulative impacts of the project together with other activities or development projects in the project area are non-existent or insignificant. However, improvement of the road will certainly induce developments such as increase in agricultural trade, new development projects on agriculture, industries, health, education, tourism etc. All these changes and development can encourage people from urban centers or other areas to migrate or move back into the project area. While these developments will bring great socio-economic benefits for the road users and local communities, there can be many negative impacts such as increase in problems of noise and air pollution and road accidents. Mitigation measures to address these problems will be implemented through improvement in design, coordination with regulatory authorities, raising awareness on road safety and better vehicle management.

F. ANALYSIS OF ALTERNATIVES

24. The "no project" alternative versus "with project" alternative was analyzed from the financial, technical, economic, social and environmental point of view. It was found that for all cases the project area, local people and wildlife are better off with the project. While the local people will be impacted by land acquisition and resettlement required for the project, they will be benefitted in the long term due to improved access and less vulnerable conditions to flooding of the Koshi river. The project will serve as an opportunity to enhance wildlife

conservation activities and improve the current human-wildlife conflict situation. Therefore even from the environment point of view it is better to have the project than not.

Alternatives on the location of two sections on the eastern side (of the Chatara bridge) and three sections on the western side were explored. Final alternatives were selected based on the need for resettlement and environmental costs.

G. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

25. Consultations with local communities including representatives of VDC's and village leaders as well as relevant NGO's were initiated during the feasibility study stages of the project in July 2010. During the course of preparing the EIA report further consultations were held with government agencies such as the Ministry of Environment, Science and Technology (MOEST) and the Geo Environment and Social Unit (GESU) in the Ministry of Physical Planning and Works (MPPW), the Koshi Tappu Wildlife Sanctuary (KTWS) and the Buffer Zone Management Committee (BZMC). The final stakeholder consultation workshop where the draft EIA report was presented was held in September 2012.

26. While local communities supported the project, they raised concerns on maintenance of natural drainage systems, protection of religious and cultural sites, water supply systems, irrigation canals and proper compensation for acquisition of land and structures including standing crops, fruits, and fodder trees. All their concerns have been considered in the project design and Resettlement Plan (RP). The second stakeholder consultation focused on initiatives to address the wildlife conservation and involved detailed discussions and agreements between DOR and the KTWR and BZMC. It must be mentioned that further mandatory national and local level consultations and information disclosure will be carried out as required for the approval of the EIA report by MOEST. The draft EIA report will be disclosed on the ADB website as required by the SPS 2009. It will also be disclosed on the DOR website.

H. ENVIRONMENTAL MANAGEMENT PLAN AND GRIEVANCE REDRESS MECHANISM

27. An Environmental Management Plan (EMP) including activities related to addressing problems of air quality and noise, soil/erosion management, construction waste, compensatory afforestation, occupational health and safety, protecting common property resources and wildlife conservation activities in the KTWR buffer zone has been prepared. The total EMP budget for the project is NRs. 29,752,318. An Environmental Monitoring Plan (EMOP) targeted at monitoring implementation of the EMP as well as conduction of environmental quality tests is also included in the project. The EMP covering activities during the construction stage will be attached to the bidding documents that will be issued to the contractors. The EMOP will be included in the contract of the supervision consultants as they will play the key role in supervisory activities. Activities targeted at compensatory afforestation and wildlife conservation will be implemented in close coordination with the KTWR and BZMC.

28. Procedures for addressing grievances under the project have been laid out, wherein aggrieved persons/parties can approach either of the project participants and issues can be addressed at the local level or higher project authorities level depending on the complexity.

I. CONCLUSIONS

29. The existing EWH in south eastern Nepal faces a severe bottleneck of road blocks due to frequent flooding of the Koshi river creating a disconnect between communities on the eastern and western side, hence poor access to the urban centers (Biratnagar and Itahari) on the eastern side. Therefore rehabilitation of the EWH (Nadaha)-Koshi Bridge (Chatara)-EWH will bring continuous connectivity between the western and eastern side and enhance socio-economic development in the project area.

30. The project road crosses through the buffer zone of the KTWR which is also a Ramsar site. Hence the project can cause significant irreversible impacts on wildlife habitat. However, while preparing the EIA study it was found that the KTWR and its buffer zone is already facing serious issues of human-wildlife conflict and the wildlife species population has been on a rapid decline for the past few decades. While the KTWR does have a management plan, it is not fully implemented due to budget constraints. There is poor awareness on the importance of KTWR and its wildlife within the local communities.

31. The project will bring about increased disturbances to wildlife during the construction period. However, more significant is the potential for long term impacts of the project through the increase in traffic and induced emigration of people to the project area. To address these concerns, through exhaustive consultations with and advise from DOR the KTWR management and the BZMC the project includes measures to: i) improve wildlife habitat through compensatory afforestation, ii) improve monitoring for wildlife conservation through establishment of check posts, iii) improve awareness and stewardship amongst the local people for the KTWR through capacity building programs and by involving them in eco-tourism and monitoring activities and iv) enhance road design to make road users aware on the existence of important wildlife species. Given this situation, the project offers an opportunity to bring improvements to wildlife conservation in the project area.

I. INTRODUCTION

A. The Strategic Roads Improvement Project (SRIP)

1. The proposed Strategic Roads Improvement Project (SRIP) will finance improvements of two strategic high-priority highways and three feeder roads, a total of 186 km, in the eastern region of Nepal. These roads are important to provide an alternate road for the existing East-West Highway (EWH) and improve access to rural and hilly areas as well as to non-connected district headquarters. While the Project will contribute to development and expansion of the Strategic Road Network (SRN) it also includes an institutional capacity assessment, including road safety and road maintenance, which will form the basis for a capacity development program. Gender and social inclusion will be addressed through a livelihood program that will include special support that will be targeting women involved in road construction activities in the project area.

2. The Project is consistent with the Government's transport strategy and development plans. Nepal's Three Year Interim Plan (TYIP) 2007/08-2009/10 emphasizes on continuous development of SRN and strengthening EWH, while the proceeding plan, the Three Year Plan Approach Paper (TYPAP) 2010/11-2012/13, aims to (i) connect the regional centers and all 75 district headquarters (ii) complete the Mid-Hill East-West Corridor (MHC) and (iii) strengthen the system of regular maintenance and management of road structures by providing regular maintenance of 8,300 km. and periodic maintenance of 1,500 km. roads. The Sector Wide Road Program (SWRP), Priority Investment Plan (PIP) and, SRN, currently calls for the expansion of the country's road improvement program from 7,917 km of the country's total road length of 18,828 km, to 9,900 km by 2016.

3. The project roads are: (i) EWH (Nadaha)-Koshi Bridge[2] (Chatara)-EWH a 61-km section two-lane highway providing alternate route for EWH in case of closure of the main Koshi Bridge in Sunsari District, whose substructures are prone to damages by floods; (ii) Leguwaghat-Bhojpur Road, 66-km intermediate-lane mid-hill highway, providing a connection as part of improvement to Hile-Pakhribas-Leguwaghat-Bhojpur Road, one of the major linkages along MHC; (iii) Halesi-Diktel Road, 35-km intermediate-lane mid-hill highway linking Diktel with the Hilepani-Hilesi section, which is being improved under Road Improvement Project funded by EXIM Bank of India, to complete Hilepani-Diktel Linkage of MHC. (iv) Mechipul-Chandragadhi-Birtamod Road (12-km double-lane feeder road) providing connection between EWH at Birtamod and a new bridge under construction across Mechi River, which will connect to NH31 in India and NH5 in Bangladesh; and (v) Manthali-Ramechhap Road, a 13-km single-lane feeder road providing a connection between the new Ramechhap District headquarters at Manthali in the Tamakoshi River valley and the old town of Ramechhap and former headquarters. The project roads were selected from over 80 roads identified by the Department of Roads (DOR), for improvement based on their environmental, social and economic impacts. This report focuses on the environmental assessment of the first road EWH (Nadha) – Koshi Birdge (Chatara) – EWH. Further details of each road is given in **Table 1** and a location map is provided in **Map 1.**

[2] One of the major river crossing structure in Nepal linking the major eastern provinces to the rest of the country through EWH in Sunsari District of Koshi Province.

Table 1. Nepal Strategic Road Improvement Project

Road Name	Length (km)	Districts and villages covered
EWH-Koshi Bridge (Chatara)-EWH	61.24	Bharaul, and Barahakshetra VDCs of Sunsari district, Mainamaini, Thoksila, Katunje Babla, Basaha and Tapeshwari VDCs of Udayapur district; Phattepur, Kamalpur, Ghoghanpur, Pipra (Purba), Dharampur, Kanchanpur and Rupnagar VDCs of Saptari district
Leguwghat-Bhojpur Road	65.550	Jarayotar, Yaku, Charambi, Pyauli, Tiwaribhanjyang, Shyamshila, Amtek, Bhainsipankha, and Bhojpur VDCs of Bhojpur district
Halesi-Diktel	35.431	Mahadevsthan, Lamidanda, Salle, Buipa, Arkhaule, Kharpa, Nunthala, Bamrang, and Diktel VDCs of Khotang district
Menchipul-Chandragadhi-Birtamod	12.160	Bhadrapur municipality; and Chandragadhi, Garamani and Anarmani VDCs of Jhapa district
Manthali-Ramechap	13.352	Manthali, and Ramechhap VDCs of Ramechhap district

EWH = East-West Highway, km = kilometer, VDC = Village Development Committee
Source: TPPF Detailed Engineering Design, 2012

4. The Department of Roads (DOR), the Government's agency responsible for overall development of the country's road network including SRN, is well recognized for its capacity in project management and implementation. Its institutional capacity, however, is limited in the areas of road maintenance and road safety and needs to be strengthened.

5. The Project's impact will be reduced poverty and isolation in hilly regions and increased economic activities in Terai areas of Eastern Nepal. The Project's immediate outcome will be improved accessibility to markets and district headquarters, completion of an alternative link for EWH between eastern Nepal and the remainder of the country, improved connectivity to international markets and increased income for women in the project-affected area. The outputs will be: (i) upgrading of 62 km of single-lane tracks to 2-lane national highways, (ii) upgrading of 114 km of single-lane earth roads to intermediate-lane and single-lane Mid-Hill Highway, (iii) upgrading of 12 km of intermediate-lane feeder road to double-lane feeder road, iv) 13 km long Manthali-Ramechap Road, and (v) capacity assessment and recommendation for enhancement of DOR and RBN's capacity in road safety and road maintenance, respectively.

6. The Koshi Bridge and road connections are part of a long-term plan by Government of Nepal (GON) to avoid eastern region from being cut off from the rest of the country in the event of another breach in the Koshi Barrage system. The proposed EWH-Koshi-Bridge (Chatara) - East West Highway (Kanchanpur) road section will connect the EWH with the new bridge across the Koshi River near Chatara on both sides of the river to provide an alternative route to the EWH across the Koshi Barrage. The upgrading the project road is a climate change adaptation by the GoN to address the breaching of the Koshi Barrage due to increase in glacial icemelt at the headwaters of the Koshi River and the increased siltation of the Barrage reducing its flood holding capacity. The project road is located in higher elevation that the existing EWH southern road section it intends to by-pass and the new bridge in Chatara located upstream and not prone to overtopping.

7. The Department of Roads (DOR) intends to improve this road to Asian Highway Class II[3] standards to comply with DOR requirements for future EWH improvements. The major road improvement works identified include geometry, structures, drainage, pavement, double bituminous surfaced treatment (DBST), landslide stabilization, and others.

[3] Asian Highway Class II is a category of highway adopted for Asian countries with 2 lanes and asphalt or concrete pavement.

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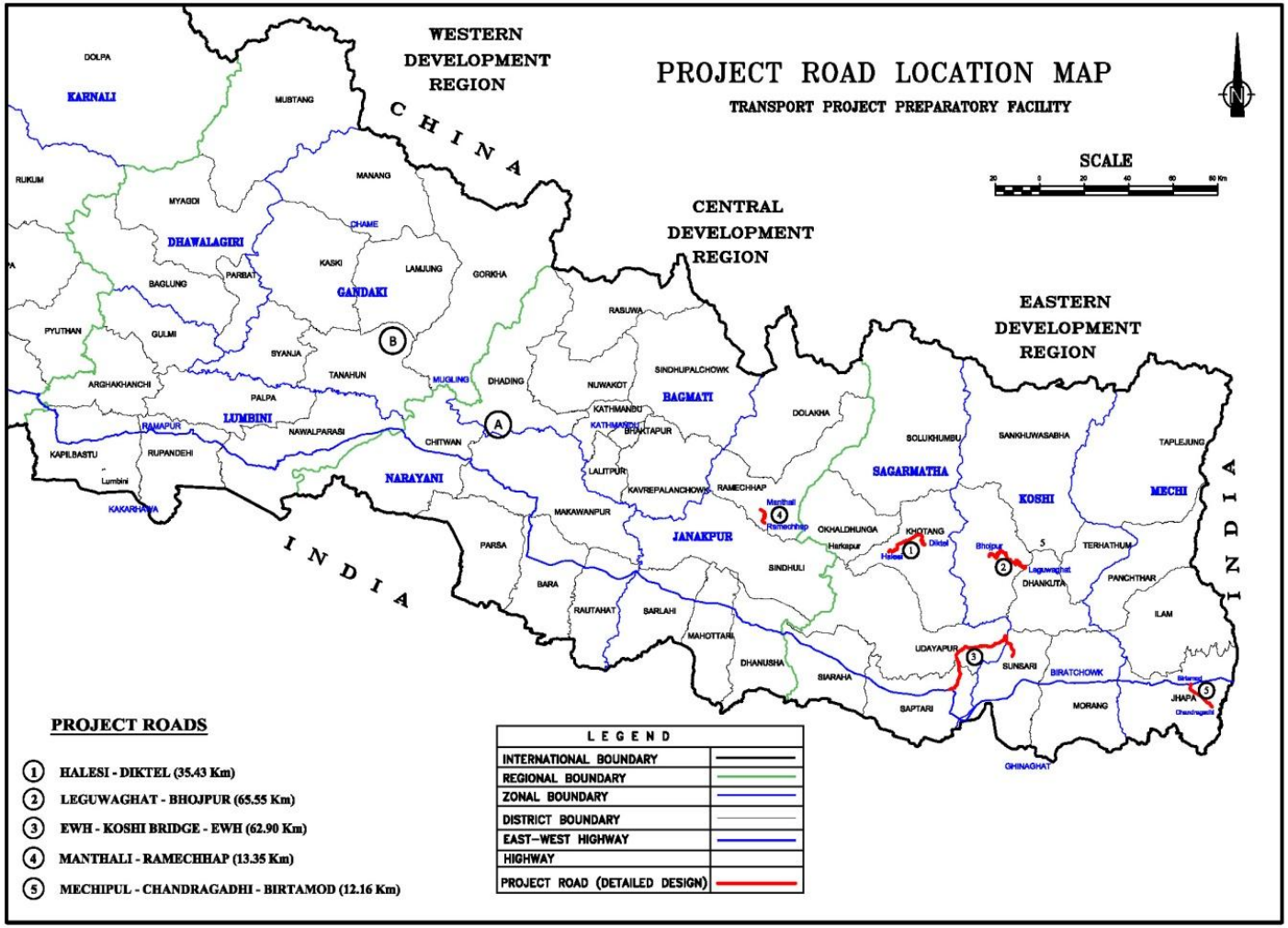
Map1. Map for Nepal Strategic Road Improvement Project



Source: TPPF Feasibility Study, 2010

B. Category of Project

8. Approximately 9.5km of the EWH-Koshi-Bridge (Chatara) - East West Highway (Kanchanpur) road section passes through the buffer zone of the Koshi-Tappu Wildlife Reserve (KTWR) which is also a Ramsar Site. In addition the road also crosses migration routes of the Asiatic Elephant (Elephas Maximus), which is listed as endangered in the IUCN red list. According to the requirements of the Nepal Environment Protection Act, 1997 and Environment Protection Rules the EWH-Koshi Bridge – EWH road is requires a detailed Environmental Impact Assessment (EIA) study. Due to the potential for irreversible adverse impacts on the wildlife habitat in the project area this sub-project road is categorized as "A" in accordance with the requirements of the ADB Safeguard Policy Statement (SPS) 2009. The other 4 subprojects are categorized as B and separate Initial Environmental Examination (IEE) reports have been prepared for these roads.

C. Purpose and Scope of the EIA

9. The main objectives of this EIA is to identify the impacts and risks from the proposed upgrading activities, ensure compliance to GoN environmental laws and regulations and the ADB safeguard requirements, and recommend appropriate measures that will mitigate as well as enhance the current condition of the environment in the project area. This report was prepared in compliance to the ADB SPS 2009. A separate report is being prepared by the DoR to comply with the requirements of the Ministry of Environment, Science and Technology (MoEST).

10. The EIA covers the proposed upgrading of the East West Highway (Nadaha)–Koshi Bridge (Chatara) - EWH (Kanchanpur) road section including ancillary facilities like camp, quarry, material storage, and plant operations but excluding the Koshi Bridge as a separate IEE was prepared for the bridge and approved under the Emergency Flood Damage Rehabilitation Project Grant (NEP G10150).

11. This report was prepared based on the information and data available in the feasibility study, preliminary engineering designs, draft socio-economic and resettlement studies; field visits, public consultations and discussions, collection of primary and secondary information and data. The study has established a core zone of impact (CoI) of 100 metres on either side of the existing road and up to 7 km on either side of road alignment has been considered for broader analysis of potential induced biophysical, socio-economic and cultural impacts.

D. EIA Report Content

12. This EIA report has 9 chapters including this Introduction, these are;

- Chapter-1: Introduction
- Chapter-2: Policy, Legal and Administrative Framework
- Chapter-3: Description of Project
- Chapter-4: Description of Environment
- Chapter-5: Anticipated Environmental Impacts and Mitigation Measures
- Chapter 6: Analysis of Alternatives
- Chapter-7: Public Consultation and Information Disclosure,
- Chapter-8: Environmental Management Plan and Grievance Redress Mechanism
- Chapter-9: Conclusion and Recommendation

E. Methods in Conducting the EIA

13. Appropriate methods were adopted in conducting the EIA. The ADB Safeguard Policy Statement (2009) were reviewed to frame the study and report. Relevant secondary data were gathered and analyzed, and data gaps particularly on Asian Elephant movements were solicited from stakeholder meetings, and key person interviews including the KTWR Wardens (both current and past), and KTWR Buffer Zone Development Committee Chairman, and recent victims of wildlife attacks. The stepwise activities comprise:

- Consultation with DOR, ADB Directorate, GESU/DOR, MPPW officials
- Consultation with TPPF Consultants
- Review of ADB and GON policy including legal requirements
- Sub-project visits and consultation with affected people and stakeholders including primary data collection
- Review of ADB TA 7411-NEP:RCP final EIA Reports including Supplementary Appendices
- Review of relevant documents for secondary information and data collection
- Preparation of Draft updated EIA Report and submit to ADB and GON for comments and feedback
- ADB Missions and field visits
- Preparation of Draft final EIA Report

F. Sources of Information and Data

14. Important sources of information have been presented in **Table 2**.

Table 2. Primary and Secondary Sources of Information and Data

Environmental Components	Sources of Information and Data
Engineering Report: Project technical details, Objectives, Present road condition, Proposed improvement activities and Other technical aspects	WSP-GEOCE Consultants, Inception Report - May, 2010, Interim Report - July, 2010 and Draft Final Report - Sept, 2010; Management Plan for KTWR & Buffer Zone, 2009-2013.
Physical Environment: Climate, Geology, Soil, Topography, River Hydrology and Morphology, Drainage and Flooding Patterns, Land Use, Soil Erosion/Landslides, Sedimentation, etc	DoHM, District Profiles, CBS/ Environmental Statistics of Nepal, Nepal Biodiversity Strategy, NPC, Topographic Maps of the respective districts, Sub-project walkover survey/group discussions, Engineering Report; Management Plan for KTWR & Buffer Zone, 2009-2013.
Biological Environment: Flora (trees, shrubs and herbs) and Fauna (mammals, birds, butterflies, reptiles, amphibians and fishes)	DOF, DFO, DNPWC, IUCN, ICIMOD, CITES, District Profiles, CBS/Environmental Statistics of Nepal, Nepal Biodiversity Strategy, Field visits and consultation including group discussions; Management Plan for KTWR & Buffer Zone, 2009-2013.
Socio-economic and Cultural Environment: Economic Characteristics, Industrial Development, and Social and Cultural Resources	NPC, CBS, ISRC, Environmental, Social and Resettlement surveys, 2012; District profiles

CBS = Central Bureau of Statistics, CITES = Convention on International Trade in Endangered Species, DFO = District Forest Office, DOF = Department of Forest, ICIMOD = International Center for Integrated Mountain Development, ISRC = Intensive Study and Research Center, IUCN = International Union for the Conservation of Nature, KWTR = Koshi Tappu Wildlife Reserves.
Sources: TPPF Feasibility Study, 2010; TPPF Detailed Engineering Design, 2012

G. Information Disclosure and Public Consultation

15. Extensive consultations were held with all stakeholders from local communities and village development committees, reserve management, and national agencies. These consultations started in the feasibility study stage[4] focusing mostly at the local levels. During this stage consultation valuable inputs from the stakeholders were gathered and included n the preliminary design. Regulatory consultations, in the form of scoping meetings with the GESU-DOR and KTWR Warden were conducted to ensure compliance and provide guide in the conduct of the EIA. During detailed engineerin design when specific features of the road like alingments, material requirements, labor demands, scale of resettlements, and pavement characteristics are defined with greater accuracy, a second round of consultations was conducted by DOR, this time focusing on the adequacy of mitigation and monitoring measures, compliance to applicable laws and regulations, and accomplishment of public participation milestones.

[4] July 2010

II. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

16. This section briefly presents the international, national, and local legal and institutional requirements that shaped the conduct of this environmental assessment. This section starts with a description of project-related Government of Nepal environmental safeguards system starting with the Constitution on the right for clean environment, environmental impact assessment requirements, and sectoral laws governing the development of roads. This is followed by descriptions of special laws requiring the conduct of environmental impact assessment and sectoral laws prescribing mitigations measures. The ADB environmental safeguards requirement presented next more particularly as the EWH (Nadaha) -Koshi Bridge (Chatara) – EWH is environmental Category A posing potential significant adverse impacts to the biodiversity of the Koshi-Tappu Wildlife Reserve Buffer Zone. Finally, the GoN is one of the leading countries supporting international treaties, agreements, and covenants in the protection of biodiversity and these are briefly examined.

A. Government of Nepal Environmental Policies, Laws, and Institutions

1. Interim Constitution of Nepal, 2007 (with amendments)

17. The Interim Constitution of Nepal provides the right for every person to live in a clean environment and the State shall make necessary arrangements to maintain the natural environment. The State shall give priority to special protection of the environment, and rare wildlife, and prevent further damage due to physical development activities, by increasing awareness of the general public about environmental cleanliness.

2. The Tenth Plan (2002-2007) and Three Year Interim Plan (2007/8-2009/10)

18. The Tenth Plan (2002-2007) identified EIA as a priority area and emphasized environmental monitoring, the need to set-up national environmental standards and promote local participation in environment conservation through the local bodies and making them responsible and capable to manage local natural resources.

19. The environmental strategies of the Interim Plan are to launch development programs by internalizing environmental management; mobilize non-government private sector, local agencies and the public in increasing public awareness on environment; determine and implement additional by -laws on air, water, soil and sound pollution; and make action plans that prioritize and implement Treaties and Conventions on environment, which Nepal has endorsed.

20. Two key policies highlighted in the Interim Plan are the institutionalization of environmental monitoring and auditing under the EIA/IEE system and the all costs related to the clearing off the forest, its transportation to the approved location and works related to environmental mitigation shall be borne by the project itself.

3. Environmental Impact Assessment System

a. Environment Protection Act (EPA), 1996; Environmental Protection Rule, 1997; and Road Sector Guidelines

21. The Act obliges the proponent to undertake IEE and EIA of proposals, plans or projects which may cause changes in existing environmental condition and authorizes Ministry of Environment to clear all EIA and line Ministry for IEE study; and empowers Ministry of Environment to prohibit the use of any matter, fuel, equipment or plant, which has adverse

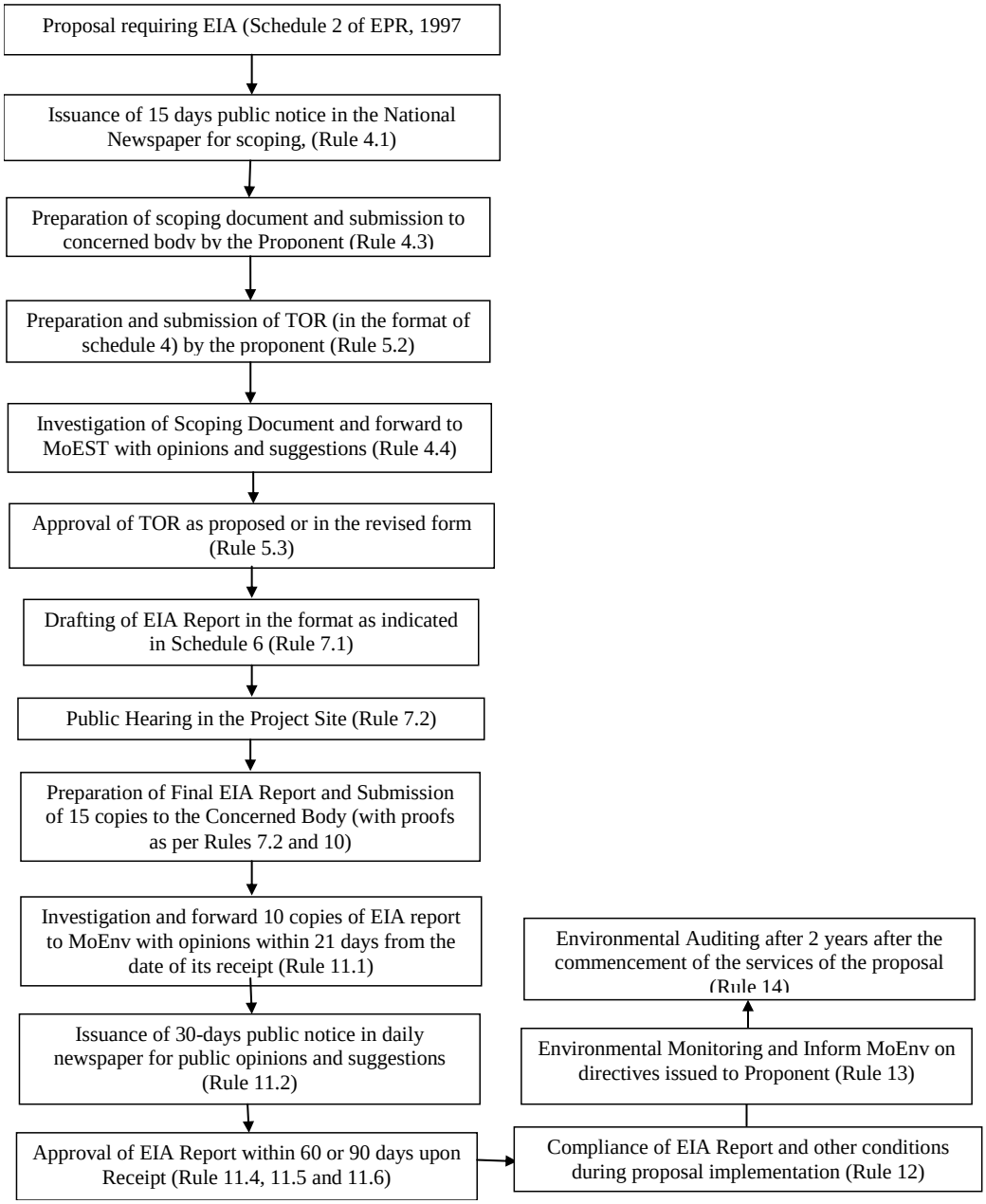
effects on the environment. Polluter-pay-principle is promoted by requiring polluters to compensate affected persons from polluting activities and empowers government to provide additional incentives to any industry, occupation, technology or process, which has positive impacts on environmental conservation. The Act empowers Ministry of Environment to approve EIA report. Similarly, in case of IEE level study, line Ministry, which is Ministry of Physical Planning and Works is authorized to approve the Final IEE Report.

22. Coming into force in 1997, the Rule contains elaborate provisions prescribing the process to be followed during the preparation and approval of projects requiring EIAs and IEEs. This process includes scoping documents, terms of reference, public consultations and hearings, and environmental monitoring and auditing. The coverage of the system was defined in the EPR published lists of types of development activities requiring IEE or EIA study. It also gives an outline of content of the terms of reference document for IEE and EIA report.

23. EIA sectoral guidelines were issued for proponents and preparers in conducting impact assessments. Two of these guidelines are the draft EIA Guidelines for Road Sector, 1996 and the DOR Environmental Management Guidelines (EMG), 1997. These guidelines provide detailed environmental mitigation measures on the management of quarries, borrow pits, stockpiling of materials and spoil disposal, earthworks and slope stabilization, and location of stone crushing plant. Other guidelines regarding environmental management and road development are: i) Reference Manual for Environmental and Social Aspects of Integrated Road Development; MPPWD/DOR.HMGN,2003, ii) Environmental Management Guidelines for Roads and Bridges, GEU/DoR,1997, iii) Public Work Directives, HMGN,2002, iv) Guide to Road Slope Protection Works, DoR, and v) Environmental Guidelines for Local Development – Ministry of Local Development.

24. The MoEST has categorized the proposed upgrading of the EWH-Koshi Bridge-EWH as environmental category A requiring the conduct of an EIA by complying with the procedural and technical requirements illustrated in Figure 1. To date, the DoR has submitted the proposal for the EIA, terms of reference approved by MoEST, and in the process of organizing the first public hearing. The approval of the EIA report by the MoEST is a pre-requisite of GoN prior to the start of construction and ADB disbursement.

Figure 1. EIA Report Approval Process



EIA = environmental impact assessment, EPR = Environmental Protection Rules, MoEST = Ministry of Environment, Science and Technology, TOR = terms of reference.
Source: Adapted from ESMF GESU (2007)

4. Protection of Wildlife and the Koshi-Tappu Wildlife Reserve

a. National Parks and Wildlife Conservation Act (NPWCA), 1973 and Rules

25. The NPWC (1973) requires permission (i) to any person to move inside the park and reserves, (ii) hunting, (iii) construction of houses and huts, and (iv) damage to plants and animals. The Act alos listed 26 species of mammals, 9 species of irds and 3 species of reptiles under protection.

b. The Koshi Tappu Wildlife Reserve

26. The NPWC Act, 1973, defines a Reserve as an area set aside for the conservation and management of wildlife including bird, vegetation, and landscape together with the natural environment.

27. The Koshi Tappu was established as one of six Royal Hunting Reserves in 1969. At that time the dense riverine forest and tall grasses harbored diversity of animal species, including the Bengal tiger (*Panthera tigris*), leopard (*Panthera pardus*), Asiatic wild elephant (*Elephas maximus*), Wild Water Buffalo (*Bubalus arnee*), Nilgai (*Boselaphus tragocamelus*), dolphin (*Platinista gangetica*), and swamp partridge (*Houbaropsis bengalensis*). The establishment of the Wildlife Conservation Office in 1972, promulgation of the National Parks and Wildlife Conservation Act, 1973, and recognition of diminishing biodiversity in Koshi Tappu, the area was gazetted as Wildlife Reserve in 1976. In 1979, about 12,000 people were resettled out of the KTWR. In 1980 with greater commitment to wildlife conservation, a separate Department of National Parks and Wildlife Conservation was established and in 1987 the KTWR was declared as a wetland of international importance or Ramsar Site as GoN joined the Convention on Wetland of International Importance especially as Waterfowl Habitat.

28. In 1994, Department of National Parks and Wildlife Conservation (DNPWC) prepared biodiversity database of KTWR providing the basis for the issuance of the Buffer Zone management regulations in 1992 and guidelines in 1996. The DNPWC initiated the formulation of conservation strategy and integrated management planning of KTWR and its vicinity in 1998. The Buffer Zone of KTWR was declared in August 2004 incorporating 77,950 people, 10,693 household 215 settlements, and 108 wards of 16 VDCs.

29. The KTWR and Buffer Zone Management Plan 2009-2013 was a culmination of government and people partnership to address the conservation issues of the reserve. The Plan identified crop damage and human harassment, cross-breeding and genetic loss, decrease in population of terrestrial and aquatic species, and inadequate international support for fund and revenue generationas the principal problems leading to the degradation of the KTWR. Detailed strategies, actions, and concomitant budgets were drawn to address the degradation issues which were grouped into 4 themes: wildlife habitat conservation, species conservation, strengthening organizational capacity, and buffer zone management.

c. The Buffer Zone Management Reguation, 1996

30. This Regulation prohibits the following activities without permission from the Warden: (i) squatting, (ii) cutting of trees, clear forest or cultivate forestland, (iii) any activity that could damage forest resources like setting fire, (iv) excavating stone, earth, sand, (v) use of harmful poison or explosive substances into the river, stream or source of water flowing in the buffer zone, and (vi) hunting or any activity damaging to wildlife.

5. Sectoral Laws Requiring Environmental Management and the Conduct of Impact Assessment

a. Public Roads Act, 1974

31. The Department of Roads may temporarily acquire the land and other property adopting compensatory measures during the construction, rehabilitation and maintenance of the public roads according to the Act (Article 14 &15). The Act also empowers the DOR to operate quarries, borrow pits and other facilities during the road construction (Article 17). In sum, the Act facilitates the acquisition of land and property for the extraction of construction materials and development of other facilities as well as to maintain greenery along the roadside with adoption of compensatory measures.

32. DOR has prepared key environmental and social policy papers and guidelines related to road design and construction, these are: (i) Environmental Assessment in the Road Sector of Nepal: A Policy Document, January 2000; (ii) Environmental Management Guidelines, July 1997; (iii) Reference Manual for Enviromental and Social Aspects of Integrated Road Development, 2003; (iv) The National Transport Policy, 2001; (v) Land Infrastructure Development Policy, 2004; and (vi) GON Policies Supporting Vulnerable Communities.

33. The Environmental Management Guidelines (1997) was made part of operational practices for all road maintenance, rehabilitation, and construction activities under DOR including requirements for public participation and socio-economic considerations. The environmental mitigation measures are broken down into twelve categories including: (i) quarries, (II) borrow pits, (iii) spoil and construction waste disposal, (iv) work camp location and operation, (v) labor camp location and operation, (vi) earthwork/slope stabilization, (vii) use of bitumen, (viii) stockpiling of materials, (ix) explosive, combustible and toxic materials management, (x) setting up and operation of stone crushing plants, (xi) water management, and (xii) air and water pollution. The Guideline suggests methods for determining how and when the public should be included in the environmental analysis. The guidelines also advise on socio-economic impacts and strategies for reducing or avoiding the potential negative impacts and for maximizing the beneficial impacts to local residents. The socio-economic impacts include important issues of land acquisition and compensation and other economic impacts with markets for agriculture production, agriculture inputs, nutrition, extraction of natural resources beyond replenishment, migration and influx of migrants, land speculation, illegal logging and mining, and portering.

b. Forest Management (Forest Act, 1993; Forest Rule, 1995; and Forest Products Collection and Sales Distribution Guidelines, 2001)

34. The Forest Act, 1993, (with amendment) contains several provisions ensuring the development, conservation, management, and sustainable use of forest resources based on approved work plan. The work plan contains a list of activities that needs to be implemented in the different forest categories - national forests, community forests, leasehold forests, private forests, and religious forests. Section 49 of the Act prohibits reclaiming lands, setting fires, grazing cattle, removing and damaging forest products, felling trees, wildlife hunting, and extracting boulders, sand and soil from the National forest without prior approval. However, the government may enforce Section 68 of the Forest Act to provide parts of any type of forest for the implementation of a national priority plan with the assurance that it does not adversely affect the environment significantly. As provided under the Act, while clearing the forest on the RoW of road, the implementing authority will co-ordinate with the District Forest Office. If necessary, the compensatory re-plantation will also be carried out at the rate of 1:25.

35. The Forest Rules 1995 (with amendment) further elaborated legal measures for the conservation of forests and wildlife. Based on forest legislation, thirteen plant species are included in the protection list which banned the felling, transportation and export of Champ (*Michelia champaca*), Khayar (*Acacia catechu*), and Sal (*Shorea robusta*). The Rule also stipulates that the entire expenses for cutting and transporting the forest products in forest area to be used by the approved project shall be borne by the proponents of the project.

36. Clauses 3 to 10 of the Guideline specified various procedures and formats for getting approvals for vegetation clearance, delineation of lands for vegetation clearance, evaluation of the wood volume. These also identified government offices and officials responsible for the approval, delineation and valuation.

c. Land Acquisition

37. The Land Acquisition Act (1977, as amended 1993) guides the compulsory acquisition of land. GoN can acquire land at any place and in any quantity by giving compensation pursuant to the Act for the land acquired for any public purpose(s) or for operation of any development project initiated by GoN institutions

d. Soil and Watershed Conservation Act, 1982

38. Soil and Watershed Conservation Act makes provision to control floods landslides (Watershed Conservation Rules, 1985). The Watershed Conservation Office is the authority and District Watershed Conservation Committee must implement watershed conservation practices and promote public participation for soil and land protection.

e. Water Resources Act, 1992

39. Water Resources Act (1992) provides for the rational use of surface and underground water. The Act seeks to prevent environmental and hazardous effects from the use of water and prohibit water pollution from chemicals and industries wastes. Water may only be used in manner that does not permit soil erosion, landslide, or flood. Pollution of drinking water is prohibited under the Nepal Drinking Water Corporation Act (1989).

f. The Aquatic Animal Protection Act, 1961 (with amendment)

40. This Act indicates an early recognition of the value of wetlands and aquatic animals. Section 3 renders punishment to any party introducing poisonous, noxious or explosive materials into a water source, or destroying any dam, bridge or water system with the intent of catching or killing aquatic life. Under Section 4 of the Act, Government is empowered to prohibit catching, killing and harming of certain kinds of aquatic animals by notification in Nepal Gazette.

6. Motor Vehicle and Transportation Management Act, 1993

41. Sets standard for vehicles emission and mechanical condition for vehicle registration by the Transport Management Office (TMO) and the TMO can deny a permit based on environmental factor. Standards are set for petrol and diesel engine under the Nepal Vehicle Mass Emission Standard 1999.

B. ADB Safeguard Policy Statement, 2009

42. The ADB SPS, 2009 aims to avoid, minimize or mitigate harmful environmental and social impacts and help the borrower strengthen their safeguard system. It also provides a platform for participation by affected community in project design and implementation.

43. All roads proposed to be upgraded under the Strategic Road Improvement Project (SRIP) were screened and categorized using Rapid Environmental Assessment (REA). The REA consist of questions relating to: (i) the sensitivity and vulnerability of environmental resources in the project area, and (ii) the potential for the project to cause significant adverse environmental impacts. These roads are then classified into one of the following categories:

- **Category A.** Projects with potential for significant adverse environmental impacts. An environmental Impact Assessment (EIA) is required to address significant impacts.
- **Category B.** Projects judged to have some adverse environmental impacts, but of lesser degree and/or significance than those for category A projects. An IEE is required to determine whether or not significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.
- **Category C.** Projects unlikely to have adverse environmental impacts. No EIA or IEE is needed although environmental implications are still reviewed.

44. All project roads under the SRIP were classified as Category "B" except for EWH-Koshi Bridge (Chatara)-EWH road which is categorized as "A".

45. All ADB investments are subject to an environmental assessment to address environmental impacts and risks. The environmental assessment starts with screening and categorization; followed by baseline data collection, impact analysis, environmental management planning, information disclosure, consultation and participation, grievance redress mechanism development, EMP implementation, and reporting.

C. Key Environmental Institutions in Road Development

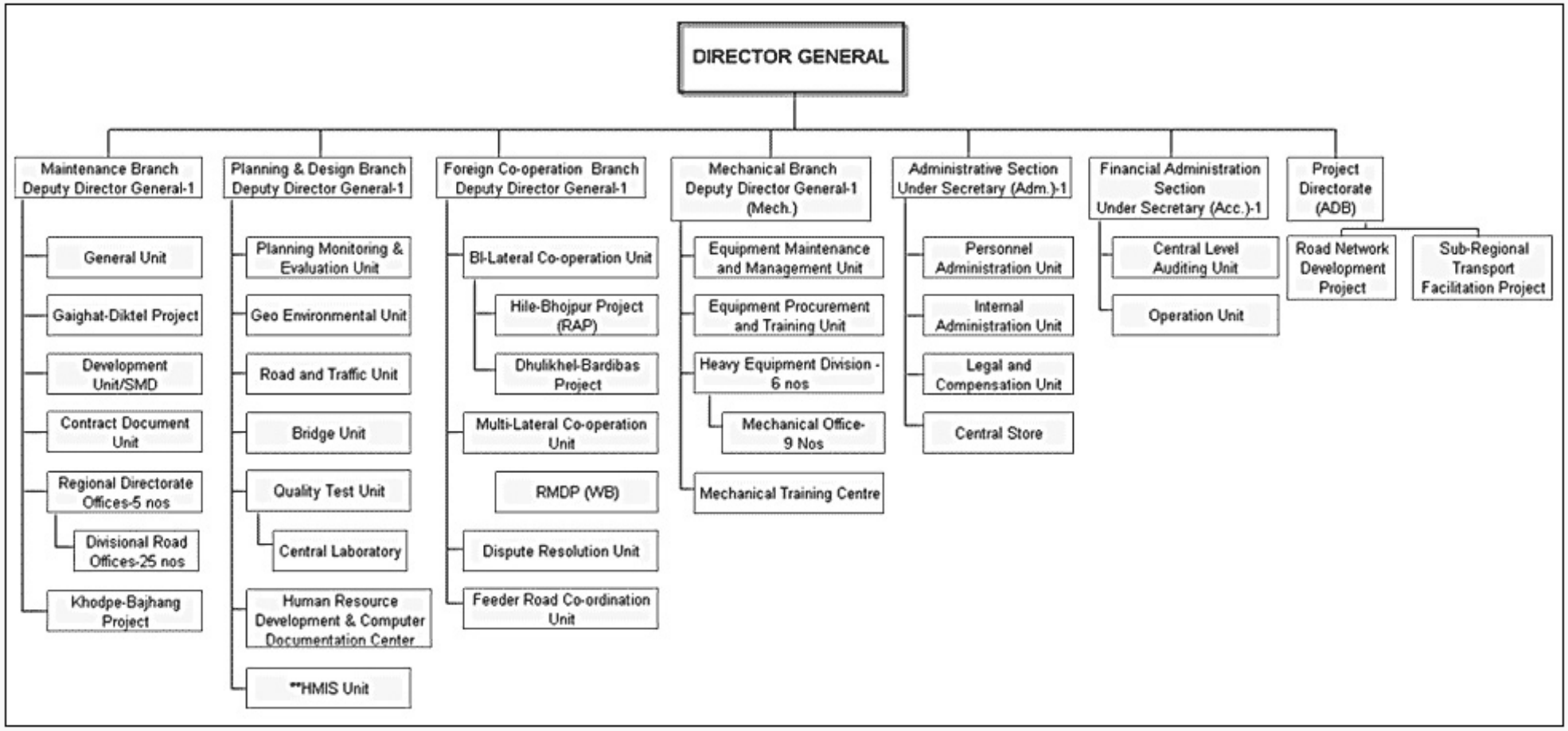
1. The Ministry of Physical Planning and Works (MoPPW)

46. The MoPPW coordinates with the National Planing Commission (NPC) and Ministry of Finance (MoF) in the Strategic Road Network (SRN) prioritization and budget allocation. The MoPPW undertakes planning and construction of these roads through the Department of Roads (DoR). Integrate to planning and construction, is to ensure environmental management of road construction which is being handled by the Geo-Environment and Social Unit, DOR.

a. The Department of Roads (DOR)

47. The DOR is the main implementing agency of the SRN Program, responsible for planning, surveying, and supervision. The DOR has 7 branches; Maintenance, Planning and Design, Foreign Co-operation, Mechanical, Administrative, Financial, and the ADB Project Directorate. Enviromental management is handled in the Planning and Design Branch by the Geo-Environment and Social Unit (GESU).

Figure 2: Organizational Chart of Nepal Department of Roads



Source: Department of Roads, 2012

b. The Geo-Environment and Social Unit (GESU), DOR

48. GESU provides guidance to the DOR on the social and environmental safeguards of road design and construction by increasing awareness through workshops and guidelines. It is responsible for the preparation of IEE and EIA reports for all road projects undertaken by the DOR, monitor compliance and conduct audits.

2. Ministry of Enviroment, Science and Technology (MoEST)

49. The MoEST provides regulations ad policies on environmental protection and management. Under the EPA (1996), the MoEST will review and approve or reject environmental assessment reports from proponents that are required to conduct an EIA. The MoEST has reserve supervision and enforcement authorities for project that are deemed critical posing severe social and environmental impacts and at its discreation conduct environment and socio-economic audits 2 years after project completion to verify fidelity with planned safeguard measures.

a. Department of National Parks and Wildlife Conservation (DNPWC)

50. Under the MoEST is the DNPWC tasked with the following: i) Conservation of endangered and other wildlife species; ii) scientific management of habitat for wildlife species, iii) creation of buffer zones in and around parks and reserves for the sustainable management of forest resources, iv) regulation of eco-tourism to improve socio-economic condition of local communities, and v) creating awareness of the importance of wildlife conservation through conservation education. The Department presently works with a networks of 9 National Parks, 3 Wildlife Reserves, 3 Conservation Areas, 1 Hunting Reserve including 11 Bufferzones around National Parks, covering a total of 28,998.67 sq.km or 19.70 % of the country's total land[5].

b. KTWR Warden/Conservation Office

51. The KTWR Warden/Conservation Office is a unit under the DNPWC in-charge with the reserve management with a reserve and buffer zone management units. In 2009, the Office has a total of 87 approved staff positions, 16 of which are deputed in the Chitwan (Hattisar) National Park, reducing tha actual staff involve in KTWR to 71. Further, of the 71 staff directly involved in KTWR, only 27 are filled-up. Most of the vacant positions are technical like rangers and scouts. From 1995-2007 the average GoN budget to KTWR was NRs.5.3 M or about US$58,000 which is sufficient only to cover staff salary and maintenance works. In contrast, the KTWR Management Plan implemention for the period of 2009-2013 requires NRs194 million. The Conservation office also suffers from lack of resources to maintain facilities and equipment. Most of the the buildings and vehicles need repair.

c. Buffer Zone Management

52. A Buffer Zone Management Committee was organized pursuant to the Buffer Zone Regulation (1996) and Buffer Zone Management Guidelines (1999) to foster participatory conservation by preparing and implementing the Buffer Zone Management Plan. Through the DNPWC, participatory approach to buffer zone management and income sharing of 30-50% of park income is allowed to support communities implement development activities. The Committee is headed by a Chairperson with the Warden serving as Member Secretary, and joined by representatives of the various user groups and jurisdicational DDCs. As of 2011, KTWR has 531 user groups.

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[5] DNPWC (2009)

3. Ministry of Forest and Soil Conservation (MoFSC)

53. All roads that pass through forestland, conservation area, national park, wetland, buffer zone, or sensitive ecological habitats will be scrutinized by the MoFSC during the EIA or IEE reviews. All trees to be felled will seek clearance from the MoFSC to determine consistency with management plans and prescribe required compensatory measures.

4. Local District Development Committees/Village Development Committees and Ministry of Local Development (MoLD)

54. The Local Self-Governance Act, 1999 empowers the local bodies for the conservation of soil, forest, and other natural resources and implementation of environmental conservation activities. The Village Development Committees (VDCs), Municipalities and District Development Committees (DDCs) are mandated to take up the responsibilities for the formulation and implementation of a program relating to the protection of the environment and biodiversity, and to give adequate priority for the protection of the environment during the formulation of local level plans and program.

55. Authorities vested to the local commitees related to SRIP are: i) coordinate the use of public lands for quarry/borrow, spoil disposal, relocation of utilities; ii) facilitate employment of project affected persons; iii) monitor and report progress and impact to higher authorities, and; iv) participate in environmental audits.

5. Nepal Army Protection Unit

56. A Nepal Army Protection Unit is deployed in KTWR to bolster the enforcement of wildlife protection. A total of 237 soldiers are distributed across 8 posts and its headquarters in Kushaha. The Protection Unit is headed by an Army Major and authorized to apprehend and confiscate materials, and turn over to Reserve authority for further proceedings.

D. International Conventions and Treaties for Biodiversity Protection

57. Nepal is a signatory to the following international agreements and conventions related to environmental conservation:

- **The Agreement on the Network of Aquaculture Centers in Asia and the Pacific (NACA), 1988.** NACA is an intergovernmental organisation that promotes rural development through sustainable aquaculture. NACA seeks to improve rural income, increase food production and foreign exchange earnings and to diversify farm production. The ultimate beneficiaries of NACA activities are farmers and rural communities. NACA conducts development assistance projects throughout the region in partnership with governments, donor foundations, development agencies, universities and a range of non-government organisations and farmers. NACA supports institutional strengthening, technical exchange and the development of policies for sustainable aquaculture and aquatic resource management. Current member governments are Australia, Bangladesh, Cambodia, China, Hong Kong SAR, India, Indonesia, I.R. Iran, Korea (DPR), Lao PDR, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam.
- **The Plant Protection Agreement for the South East Asia and the Pacific (as amended), 1956.** Formerly the Plant Protection Agreement for South-East Asia and Pacific Region was approved by the 23rd Session of the FAO Council in November 1955 and entered into force on 2 July 1956. Principally, it provides regional implementation of the International Plant Protection Convention (IPPC),

the Agreement on the Application of Sanitary and Phytosanitary Measures, and the modern requirements for plant protection. and to strengthen the Asia and Pacific Plant Protection Commission.

- **The Convention on International Trade in Endangered Species of Wild Fauna and Flora, (CITES), 1973.** Nepal became party to CITES in 1975. CITES has facilitated international co-operation to regulate international trade in endangered wild flora and fauna with the aim of reducing or eliminating trade in species whose numbers or conditions suggest that further removal from their natural habitat would lead to their extinction. The National Parks and Wildlife Conservation (NPWC) Act, 1973 regulates the trade of species listed in CITES appendices. The Government has designated the Natural History Museum (Tribhuvan University) and the Department of Plant Resources as the scientific authorities for wild fauna and wild flora respectively. Similarly, the Government has designated the Department of National Parks and Wildlife Conservation and the Department of Forest as the management authorities for wild fauna and flora respectively. The Convention urges Parties not to allow trade in specimens of species included in the CITES Appendices I, II and III except in accordance with the provisions of the Convention.
- **The Ramsar Convention (Convention on Wetlands of International Importance Especially as Water Fowl Habitat), 1971.** The Convention on Wetlands of International Importance especially as Waterfowl Habitat, known as the Ramsar Convention, has entered into forces in 1975. It aims to protect the wetland ecosystems from further destruction. It urges the Parties to conserve the wetlands, promote their sustainable utilization, and set aside special areas as wildlife reserve. Every country is required to designate at least one wetland for inclusion on the list of wetlands. The Government of Nepal accessed the Ramsar Convention in 1987, and designated Koshi Tappu Wildlife Reserve (KTWR) for inclusion in the Ramsar list. KTWR is an important habitat for Nepal's last surviving population of wild water buffalo (*Bubalus bubalis arnee*). Similarly Beesh Hazar Lake (3200 ha in Chitwan, Jagdishpur Reservoir (225 ha) in Kapilvastu, and Ghodhaghodi Lake (2500 ha) in Kailali have also been listed as Ramsar sites. The Strategic Plan of the Ramsar Convention has emphasized on the conservation of the wetlands and urges Parties to conduct EIA of the development proposals that are likely to have significant impacts on the wetlands.
- **The Convention for Protection of the World Cultural and Natural Heritage, 1972.** The United States initiated the idea of cultural conservation with nature conservation. A White House conference in 1965 called for a 'World Heritage Trust' to preserve "the world's superb natural and scenic areas and historic sites for the present and the future of the entire world citizenry." The International Union for Conservation of Nature developed similar proposals in 1968, and they were presented in 1972 to the United Nations conference on Human Environment in Stockholm. Under the World Heritage Committee signatory countries are required to produce and submit periodic data reporting providing the World Heritage Committee with an overview of each participating nation's implementation of the World Heritage Convention and a "snapshot" of current conditions at World Heritage properties. A single text was agreed on by all parties, and the Convention Concerning the Protection of the World Cultural and Natural Heritage was adopted by the General Conference of UNESCO on 16 November 1972.

E. Permissions and Clearance Required for the Project

58. The list of required environmental clearances and permissions for the EWH-Koshi Bridge-EWH are as follows:

Table 3. Permissions and Clearance Required

S.N.	Clearance	Act/Rule/Notification/ Guideline	Concerned Agency	Responsibility
A. Pre-construction Stage				
1	Approval of the EIA Report for Category "A" projects	Environment Protection Act 1996 and Environment Protection Rules, 1997 (with amendments).	Ministry of Environment Science and Technology	Department of Roads / PD, DOR (ADB)
2	Approval of IEE Report for Category "B" projects	Environment Protection Act 1996 and Environment Protection Rules, 1997 (with amendments).	Geo Environment and Social Unit, Ministry of Physical Planning and Works	Department of Roads / PD, DOR (ADB)
3	Land Acquisition and Compensation	Land Acquisition Act, 1977(with amendments)	Ministry of Physical Planning and Works	Department of Roads / PD, DOR (ADB)
4	Forestry clearance for felling of Trees	Forest Act, 1993 (with amendment), Forest Rule, 1995, Forest Products Collection and Sales Distribution Guidelines, 2001 and Local Self-Governance Act, 1999; Buffer Zone Management Regulation, 1996.	Ministry of Forest and Soil Conservation	Department of Roads / PD, DOR (ADB); District Forest officer (DFO)
B. Implementation Stage				
5	Permission for construction material quarrying (stone, cobble, sand, gravel, soil etc)	Local Self-Governance Act, 1999 and Soil and Watershed Conservation Act, 1982 and Watershed Conservation Rule, 1985. Buffer Zone Management Regulation, 1996.EPA,1996 and EPR, 1997 (with amendments)	Concerned Project and Concerned VDC, DDC and Municipality	Contractor
6	Consent to operate Hot mix plant, Crushers, Batching Plant	Local Self-Governance Act, 1999	Concerned Project and Concerned VDC, DDC and Municipality	Contractor
7	Consent for disposal of sewage from labor camps	Water Resource Act, 1992	Concerned Project	Contractor
8	Pollution Under Control Certificate	Motor Vehicle and Transportation Management Act, 1993	Department of Transport	Contractor

ADB = Asian Development Bank, DDC = District Development Office, DFO = District Forest Office, DOR = Department of Roads, PD = Project Director.

Source: TPPF Detailed Engineering Design, 2012

III. DESCRIPTION OF THE STRATEGIC ROADS IMPROVEMENT PROJECT: EWH-KOSHI BRIDGE-EWH ROAD

A. The East-West Highway (EWH) – Koshi Bridge (Chatara)-EWH Road

59. The East-West Highway (EWH)-Koshi Bridge (Chatara)-EWH is located in Sunsari, Udayapur, and Saptari districts in the eastern development region of Nepal. The road alignment passes through fourteen (14) VDCs of the three districts. The road provides connectivity to settlements, market centers and agriculture production pockets. Total length of the project road section is 61.15 km. **Map 2** presents the Project road alignment.

60. The proposed road starts from Nadaha Chowk[6] of Bharaul VDC of Sunsari district, passing through Udayapur District and ends at Rupnagar, Kanchanpur of EWH in Saptari District. The entire road section extends from Bharaul, Barahakshetra VDCs of Sunsari district, Mainamaini, Thoksila, Katunje Babla, Basaha, and Tapeshwari VDCs of Udayapur district; and Phattepur, Kamalpur, Ghoghanpur, Pipra (Purba), Dharampur, Kanchanpur and Rupnagar VDCs of Saptari district of Sagarmatha and Koshi Zones in the Eastern Development Region of Nepal. The elevation of the project area varies between 125 to 109 m from mean sea level.

Table 4. Salient Features of the Project

Name of the Project	Strategic Road Improvement Project (SRIP)
Name of the Road Section	Improvement/Upgrading of EWH-Koshi Bridge-EWH Road
LOCATION	
Start Point	Nadaha (Bharaul VDC), Ch. 11+840
End Point	Rupnagar (EWH), Ch. 70+865
VDCs	Bharaul, Barahakshetra - Sunsari Mainamaini, Thoksila, Katunje Babla, Basaha, and Tapeshwari - Udaypur Phattepur, Kamalpur, Ghoghanpur, Pipra (Purba), Dharmpur, Kanchanpur and Rupnagar –Saptari
GEOGRAPHICAL FEATURES	
Terrain	Plain/Mountain, Plain/Rolling
Altitude	From 125 to 109 m amsl
Climate	Tropical
Road Type	
Classification of road	Asian Highway Class II (2 lane)
Length of Road	61.15 km
Type of Pavement	DBST
Design Parameters	
Right of Way	25 m (On either side from center line)
Carriageway Width	7 m
Total Formation (Road Way) Width	12 m
Shoulder Width	2.5 m
No of new bridges required	20

Ch = chainage, DBST = double bituminous surface treatment, EWH = East-West Highway, VDC = Village Development Committee.
Source: TPPF Detailed Project Report, 2012

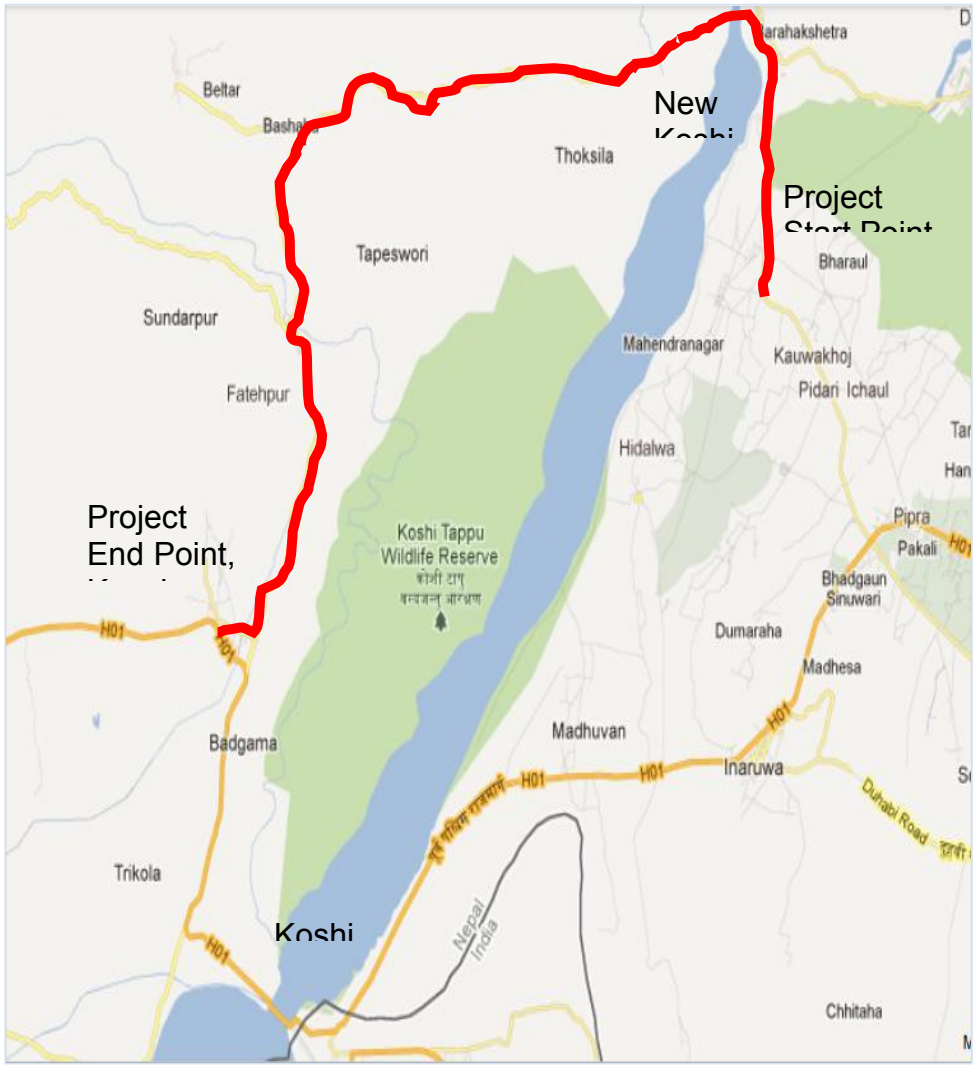
61. The existing road is mostly gravel and earthen surface with 4.0-5.0 meter carriage width, crossing numerous rivers, community forests, buffer zone of Koshi Tappu Wildlife Reserve, and several large villages. The western section of the road cuts across mountain/plain terrain while the eastern section is plain to rolling. In the middle of project road is an on-going construction of

[66] During the initial stage of feasibility study, the Project Road original start point is located in Pakali, along the EWH but was shifted to Nadaha, 11.84 kms north as the road section between Pakali and Nadaha was upgraded under ADB Rural Rehabilitation and Reconstruction Sector Development Project (RRRSDP).

the new Koshi Bridge (Chatara) under the ADB's Emergency Flood Damage Rehabilitation Project.

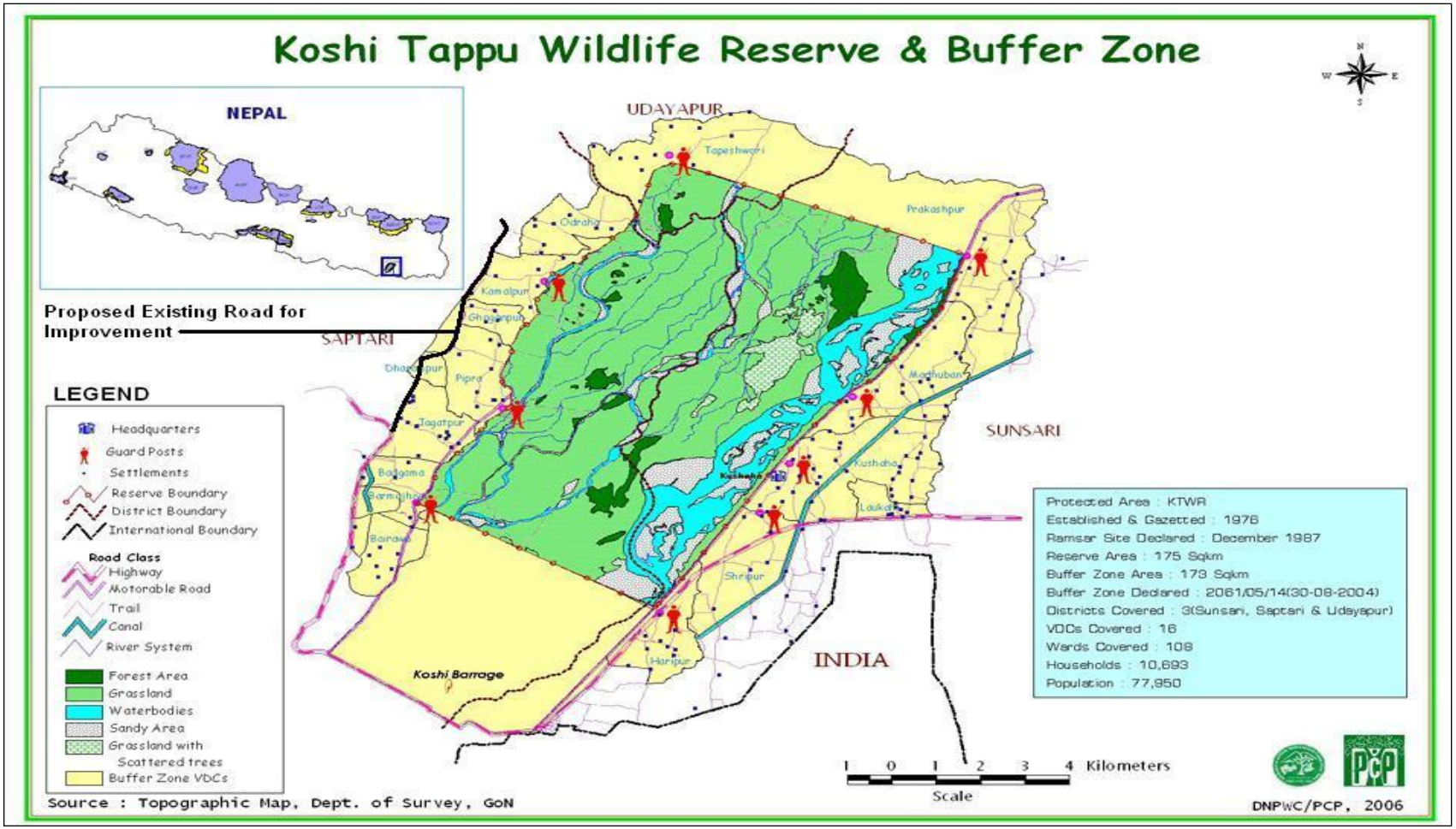
62. The existing road will be upgraded to an Asian Highway Class II, 2-lane, double bituminous surface treatment (DBST) pavement, 50m right-of-way (ROW), 12m formation width, 7m carriage width, and 2.5m shoulders. At Trijuga existing single lane bridge will be used until a new 2-lane bridge is constructed. The project also includes improvements in alignment, drainage, bridge approaches, traffic signs and safety, retaining structures, and junction. A total of 18 new bridges will be constructed along the stretch crossing significant rivers like Patnali, Karam, Gauri, Bagundre, Bairawa, Seti, Jarayo, Khar, Yasodha, Murti, Jogini, Katari, Sisuwa, Gideri, Kali, and Chandra canal.

63. About 9.525 km of the existing road passes through the KTWR buffer zone. The KTWR is a Ramsar site established in 1987 for the habitat protection of the last remaining wild Asian buffaloes. Map 3 presents the location of the Project Road vis-à-vis the KTWR, while Map 4 presents the road section inside the KTWR Buffer Zone on a bigger scale overlaid on a topographic map.



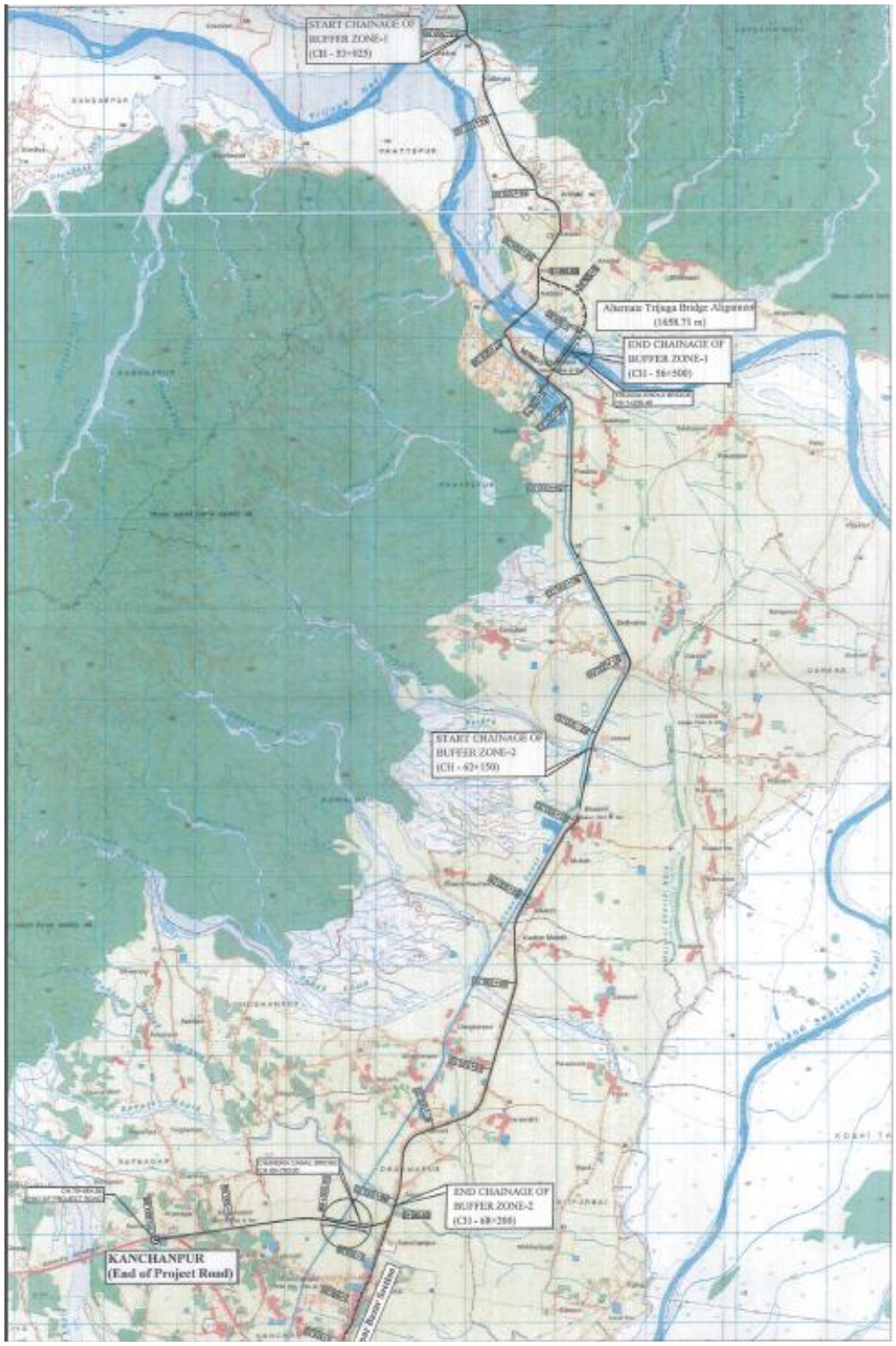
Source: TPPF Detailed Engineering Design, 2012

Map 2. Location Map of Project Road



Source: Topographic Map, Department of Survey, GON.

Map 3: EWH-Koshi Bridge (Chatara)-EWH Section Inside the Koshi Tappu Wildlife Reserve and Buffer Zone



Source: TPPF Detailed Engineering Design, 2012

Map 4: Details of the EWH-Koshi Bridge-EWH Road Project Section Inside the Koshi Tappu Wildlife Reserve Buffer Zone

B. Characteristics of the Existing Road

64. EWH-Koshi Bridge (Chatara)-EWH road section starts at Nadaha (km 11+840) in Sunsari District and ends at Kanchanpur, Rupnagar, km 70+865 in Saptari district. The section between Nadaha and Patnali River was constructed initially as a single lane rural track by local people while the section between Chatara and Koshi Bridge was built by DOR as earthen road. The third section between Koshi Bridge and Phattepur is earthen fair-weather track. The fourth section, between Phattepur and Kanchanpur in Saptari District, was constructed with Indian Assistance in mid-1970's as single lane bituminous road in Terai plains. The project road crosses several major rivers on both sides of the Koshi River.

65. **Section-1: Nadaha- Koshi Bridge Section**. The road section was opened as gravel / earthen road standard with the width of 4.0-5.0 m. The alignment initially traverses from Nadaha passing through forest and rural settlement Kharkholagaun (km17+800) and Bayarban. From there it follows existing track towards west along forest area reaching the northeast side of Chatara. The alignment runs along the north side of the settlement and reaches Bhandaritar (km 20+300) and turns north towards the on-going construction of the Koshi Bridge (km23+250) in Chatara. This bridge is being built with ADB grant assistance.

66. **Section-2: Koshi Bridge- Phattepur Section**. The road section is earthen track with width of 4.5-5.00 m. The alignment initially follows the contour passing through some rural settlements of Kothu, Champapur, and Dumre (km28+000) from where it traverses west passing through forest and settlements of Setikholagaun a major rural market centre in Udayapur District. After Rampur it again follows the existing track passing through settlements of Sisuwa, Jahada, and Galeni (km44+000). After Km 45+00, the alignment crosses Siwalik Hills with four sharp curves with high grades and then turns southwest ascending with mild grade. In this stretch, it passes through Sal forest. After Kali Khola Bridge (km48+103) it crosses paddy fields turning south towards Ambasi. At Km56+000 the section turns east and crosses Triyuga River at Km 56+500.

67. **Section-3: Phattepur - Kanchanpur Section**. This road section was constructed 40 years ago under Indian assistance as single lane with carriage width of 4.00 m. bituminous road. The alignment traverses along the paddy field and rural settlements of Balardaha, Akboni, Bhagani Maleth, and Baluwa (km. 67+00) reaching Kanchanpur at km68+300 from where traverses west along northern side of the Kanchanpur Bazar crossing Chandra Main Canal. After Bhagwatpur the alignment reaches Rupnagar where it finally meets with EWH.

68. The project also includes detailed design for the improvement/rehabilitation of the existing road section (Kanchanpur Bazar area) between km 68+300 and EWH barrier. Total length of this section is 2.215 km. The alignment passes through a number of built-up areas as listed below in **Table 5.**

Table 5: Major Settlements along the Road Corridor

Number	Location	Chainage
1	Nadaha	Km 11+840
2	Kharkholagaun	Km 17+800
3	Bhandari Tar	Km 20+300
4	Setikholagaun	Km 31+300
5	Rampur	Km 34+300
6	Sisuwa	Km 37+800
7	Ambasi	Km 55+500
8	Phattepur	Km 58+000
9	Kanchanpur	Km 68+300
10	Rupnagar	Km 70+865

Source: TPPF Detailed Engineering Design, 2012

69. The detailed characteristics of the road are presented in the succeeding Table.

Table 6: Identification of Upgrading Requirements (Km. 11+840 – Km. 70+865)

Section	Chainage	Description of Existing Situation	Identification of Upgrading Requirements	Type of Upgrading Works
1	11+840 to 16+116 (Nada Chowk-Patnali Khola)	The road section takes the route of Sahid Marg, which traverses through forest at flat to gentle grade. It ends with Sahid Marg route at about 0.45 km before Patnali Khola. From this point a new alignment is proposed for crossing of Patnali Khola. It requires crossing Patnali Khola at two locations before ending at the right bank side. The formation is 4.5 to 5 m wide, flat to low height. The road is mostly natural surface. Only few culverts exist, one box culvert (shallow type) is already dislodged due to erosion/flooding. Kalindra Bazaar junction between 11+900 to 11+950	Geometry Drainage Pavement Bridges	Earthworks for alignment improvement including formation, widening, raising, reshaping, grade adjustment as needed Completion/improvement of existing culverts New culverts Drainage (side drain) at selected markets/built-up areas/junctions Junction improvement at Kalindra Bazaar Bridges at Patnali Khola (2 no) Pavement (double lane, DBST) Traffic signs and safety measures
2	16+116 to 18+056 (Patnali Khola - Gaurikhola)	This will be new alignment mostly through forest land with about 0.5 km on cultivated land before ending (at Kharkhola Gaun) at junction of Dharan-Chatara Road. It will be on embankment formation and shaped to terrain (flat to gentle and slight rolling). The alignment will cross Bagh	Geometry Drainage Pavement Major Road junction Bridges	Earthworks for new construction and improvement, if any Structures Culverts Drainage Bridge at Bagh Khola Pavement (double lane, DBST) Traffic signs and safety measures

Section	Chainage	Description of Existing Situation	Identification of Upgrading Requirements	Type of Upgrading Works
		Khola.		
3	18+056 to 19+937(Gaurikhola - Chhinamastak Khola)	The alignment in this section will take existing road track and trail direct between Kharkhola Gaun and Chatara, which goes along back side of Chatara before ending at Chhinamastak Khola. The route runs through cultivated land till Karam Khola and then through forest and vegetation. After crossing Chhinamastak Khola, it will be aligned with existing Chatara –Barahachhetra Road by about 0.250 m long approach road. The track is narrow, only partly vehicle pliable due to thick vegetation. It crosses Karam Khola (18+287), Gauri Khola (18+650), Chhinamastak Khola (19+937) and a number of gullies and rivulets.	Geometry Drainage Pavement Minor Road junction Bridge	Earthworks for new construction and improvement as needed Structures Culverts Drainage Bridges at Karam Khola, Gauri Khola and Chhinamastak Khola Pavement (double lane, DBST) Traffic signs and safety measures
4	19+937 to 23+250 (Chhinamasta Khola – Koshi Bridge Left Bank Approach Road)	It will take the route of Chatara-Barahachhetra Road, traversing lower hill slopes along left side of Koshi River. The road is generally 8 m wide, but narrow (about 6 m) through Bhandaritar (20+000 to 21+400). The grade is gentle to moderate. The hill slopes are generally stable. The road section ends at the left site approach road of proposed Koshi (Chatara) Bridge. The culverts are generally in fair condition, a number of gullies lack crossing. The road surface is graveled.	Geometry Drainage Pavement Road junction	Earthworks for improvement of part of Chatara-Barahachhetra Road as needed Repair/rehabilitation of existing structures New structures Widening/reconstruction/protection of culverts New culverts Drainage (localized) Replacement/rehabilitation of existing causeway New causeways Junction improvement Pavement (double lane, DBST) Traffic signs, safety measures

Section	Chainage	Description of Existing Situation	Identification of Upgrading Requirements	Type of Upgrading Works
5	23+250 Koshi (Chatara) Bridge +Approach Roads	A new bridge (double lane standard), steel truss bridge along with approach roads (100 m on left bank and 260 m right bank) is going to be constructed under Emergency Flood Damage Rehabilitation Project, Part D: Roads.	NOT THE PART OF THIS PROJECT	
6	22+250 to 34+000 (Koshi Bridge to Rampur)	The alignment passes along cultivated lands and settlements till Dumre Bote (28+000) at gentle to moderate grade; and then gradually ascend along hill slopes before descending to Rangmahaltol (29+000) by making a loop. It then follows rolling grade through forest patches and along cultivated tracts, settlements and crosses a number of streams (such as Bagundre Khola, Seti Khola, Jarayo Khola, Khar Khola, Bairawa Khola, etc) before reaching Rampur. The road formation is variable, generally 6 m or less. Few culverts and causeway exist in this section. Mostly, drainage is lacking.	Geometry*)* Drainage Pavement Minor Road Junctions Bridges	Earthworks for widening, reshaping, re-profiling as needed Repair/rehabilitation of existing structures New structures Widening/reconstruction/protection of culverts New culverts Drainage (localized) Replacement/rehabilitation of existing causeway New causeways Minor road junction Bridges (5 no) Pavement (double lane, DBST) Traffic signs, safety measures
7	34+500 to 45+000 (Rampur to Supade)	This section of the road passes at rolling and gentle grade along valley bottom with cultivated lands, forest patches, and settlements (e.g. Buddha Chowk, Lal Bazaar, Jahada, Ghumane, and Galeni). It crosses a number of rivers/ streams, major one being Gideri Khola before Gumane, and Murti Khola and Sisuwa Khola (carrying significant heavy bed loads). The present ford crossing at Gideri Khola passes over flood plains and thus not stable (*proposed site for bridge crossing is some 150 m downstream of existing point on right bank, which will also avoid multiple crossing*). Few culverts and causeways exist in this section. The drainage is	Geometry Drainage Pavement Minor Road Junctions Bridges	Earthworks for widening, reshaping, re-profiling as needed Repair/rehabilitation of existing structures New structures Widening/reconstruction/protection of culverts New culverts Drainage (localized) Replacement/rehabilitation of existing causeway New causeways Minor road junction Bridges (5 no) Pavement (double lane, DBST) Traffic signs, safety measures

Section	Chainage	Description of Existing Situation	Identification of Upgrading Requirements	Type of Upgrading Works
		almost completely lacking.		
8	45+000 to 51+500 (Supade to Sanibare Chowk)	After Supade, the road alignment encompasses a short hill section (of Siwalik) till Hattisar (47+350). It ascends at moderate to steep grade till saddle point (i.e. Deurali) at 46+300, after which it makes gradual descent to Hattisar and Belkha before entering river valley of Kali Khola and its tributaries, all seasonal and originating from Siwalik or Mahabharat. The present alignment goes along right bank of Kali Khola valley crisscrossed by its tributaries. The existing ford crossing of Kali Khola is through active flood plain and thus unstable during high floods. Realignment of the road is therefore proposed on high terrace from the left side of Kali Khola, which will require a single bridge crossing (span about 25 m). The length of proposed realignment will be about 2.85 km till the beginning of Sanibare Chowk. A minor realignment is also proposed below Belkha and before entering into Kali Khola valley to avoid crisscrossing of one of its tributaries. Only few culverts and some side drains exist in this section. The road surface is gravel.	Geometry Drainage Pavement Bridges	Earthworks for widening, reshaping, re-profiling, grade adjustment as needed Earthworks for new construction of realignment section Repair/rehabilitation of existing structures New structures Widening/reconstruction/protection of culverts New culverts Drainage (localized) New causeways Minor road junctions Bridge (1 no) Pavement (double lane, DBST) Traffic signs, safety measures
9	51+500 to 55+400 (Sanibare Chowk to Ambasi Chowk)	The road passes through wide built-up area of Sanibare Chowk (about 200 m in length). Further to this the road traverses largely cultivated land and settlements all along left side of Kali Khola valley before turning to Ambasi. The	Geometry Drainage Pavement Minor Road Junctions Bridges	Earthworks for alignment improvement; widening, reshaping, re-profiling as needed Repair/rehabilitation of existing structures New structures Widening/reconstruction/protection of culverts

Section	Chainage	Description of Existing Situation	Identification of Upgrading Requirements	Type of Upgrading Works
		stretch, about 0.5 km before reaching Ambasi Chowk is narrow and windy. The terrain is flat to moderate and slightly rolling before Ambasi. A number of culverts provide cross-drainage in this part of road, while many of existing gullies and drainage course remain unmanned. The road surface is variable, fair to poor and generally graveled.		New culverts Drainage (localized) New causeways Minor road junctions Pavement (double lane, DBST) Traffic signs, safety measures
10	55+400 to 58+300 (Ambasi Chowk to Siddhipur (Phattepur))	m Ambasi Chowk, will partly take of existing road from Trijuga Bridge (left bank) and then take a new alignment (length about 1.57 km) passing through cultivated land, river valley and settlements for new bridge crossing of Trijuga River and bypass for Phattepur. The realignment section will end at existing Kanchanpur-Phattepur Road after Petrol Pump at the outset of Phattepur.	Geometry Drainage Pavement Road Junctions Bridges	Earthworks for alignment improvement; widening, reshaping, re-profiling (Ambasi-Bhalmanti/Purandaha Road section or other road) as needed Earthworks for new construction of realignment section (Phattepur Bypass) Repair/rehabilitation of existing structures New structures Widening/reconstruction/protection of culverts New culverts Drainage (localized) Road junctions (including Phattepur junction at Siddhipur) Bridges (Bagaha and Trijuga) Pavement (double lane, DBST) Traffic signs, safety measures
11	58+300-68+100	Onward, the road follows existing Phattepur-Kanchanpur Road and this section is proposed to end at about 1.6 km before Kanchanpur junction on EWH. This point is proposed for the start of Kanchanpur Bypass. The existing formation is 6-8 m and sufficiently high, at places especially along major settlements it is almost flat. The grade is flat to gentle. The road section crosses culverts, canal crossing and two bridges (Gangajali and Palat). Both	Geometry Drainage Pavement Minor Road Junctions	Earthworks for widening, reshaping, re-profiling as needed Earthworks for new construction of realignment section (Phattepur Bypass) Repair/rehabilitation of existing structures New structures Widening/reconstruction/protection of culverts Repairs and protection of minor bridges/canal crossing Drainage (localized) Road junctions Pavement (double lane, DBST) Traffic signs, safety measures

Section	Chainage	Description of Existing Situation	Identification of Upgrading Requirements	Type of Upgrading Works
		bridges are double lane standard and in good condition. A number of canal crossings have waterway blocked and parapets broken. The road surface is gravel in general.		
14	Kanchanpur Bypass: Banara Bridge – Rupnagar (EWH) 68+100 to 70+864	A new alignment is proposed to off-take from right side of Phattepur-Kanchanpur, about 100 m after Banara Bridge. The proposed route will make pass over cultivated lands, make square crossing over Chandra Canal, grade flat to gentle rolling, encompass about 0.275 km of existing unsealed road before ending at EWH, some 2.6 km west of Kanchanpur junction at EWH.	Geometry Drainage Pavement Bridge Major Road Junction	Earthworks for new construction of realignment section Structures Culverts Bridge (length about 50 m for Chandra Main Canal crossing) Junction improvement at EWH at the start point Pavement (double lane, DBST) Traffic signs, safety measures
15	68+100-EWH	The existing alignment will be improved passing the right side of Kanchanpur and intersecting EWH at Beriya	Geometry Drainage Pavement Bridge Major Road Junction	Earthworks Structures Culverts Bridge (about 15 m span on canal crossing) Junction improvement at EWH at the start point *Pavement (double lane, DBST)* Traffic signs, safety measures

DBST = double bituminous surface treatment, EWH = East-West Highway, km = kilometer.
Source: TPPF Detailed Engineering Design, 2012

70. The summary of existing and proposed drainage and retaining structures of the proposed project are presented in the succeeding Table.

Table 7: Summary of Existing and Proposed Works

Item	Particulars	Nadaha-Kharkhola Gaun (Km 11.840-18.050)	Kharkhola Gaun-Koshi Bridge (Chatara) (Km 18.050-23.860)	Total
Existing Road Works				
1	Side Drains	700	163	763
	Unlined Side Drains, (m)	0	224	224
	Lined Side Drains, (m)	0	0	0
	Requiring Repair and Rehab			
2	Cross Drainage Structures	4	7	11
	Pipe Culverts, (no)	0	0	0
	Slab Culvert, (no)	0	4	4
	Causeway, (no)			
	Requiring Repair and Rehabilitation	1	6	7
	Pipe Culverts, (no)	0	0	0
3	Retaining Structures			
	Retaining Structures (all types), (m)	0	0	0
	Requiring Repair and Rehabilitation (all types), (m)	0	0	0
Proposed Works for Road Upgrading				
1	Side Drains	0	5,263	5,263
	Lined Side Drains, (m)			
2	Cross Drainage Structures	10	8	18
	Pipe Culvert, (no)	3	1	4
	Causeway, (no)	1	3	4
3	Retaining Structures			
	Retaining Structures (all types), (m)	50	846	896

m = meter, no = number
Source: Consultant Survey, 2012

71. **Existing and projected traffic.** The annual average daily traffic (AADT) for 2015 is 1,070 for Koshi Barrage open case and 3,693 for Koshi Barrage closed case. The traffic forecasts including motorcycle, indicates traffic volume of 9,319, 17,480, 50,606, and 83,084 for the years 2017, 2020, 2025, and 2035, respectively. Similarly for Koshi Barrage closed case,

traffic forecast indicates 14,454, 26,372, 78,616, and 133,285 for the years 2017, 2020 2025, and 2035, respectively.

C. Key Upgrading Activities

72. The key upgrading activities include geometry improvement, pavement upgrade, drainage improvement, retaining structures, slope protection/stabilization, other off-road works, and works on traffic management and road safety. The typical cross-sections of the Terai Roads are shown in **Figure 2**.

73. The upgrading involves widening of existing road width to 12 m to meet the design standards. Considerations have been made in preliminary design to widen the road to full width along selected major built-up areas and market fronts to enhance serviceability, provision for hard stand to parking/stopping vehicles, and allow better drainage management. These proposed location and length of widening are shown in Table III-6.

74. Realignment for Patnali Khola-Kharkhola Gaun (ch 16+116 to 18+056) and Kharkhola Gaun-Chatara (ch 18+056 to 20+000) for East Road, and realignments for bridge crossings at Sisuwa Khola and Gideri Khola, Kali Khola (ch 38+708 to 48+108), Kanchanpur (EWH) Bypass (ch 68+100 to 70+864) for West Road of EWH-Koshi Bridge (Chatara)-EWH will require new road construction.

Table 8: List of Road Widening at Markets and Built-up Area

No.	Chainage		Location	Remarks
	From	To		
1	11+840	11+850	Nadaha	Pavement widening to 12m
2	21+000	21+400	Bhandaritar	Pavement widening to 11m
3	26+500	26+600	Sombare	Pavement widening to 11m
4	27+300	27+400	Dumri Bote	Pavement widening to 11m
5	32+000	32+200	Seti Khola Gaun	Pavement widening to 11m
6	35+550	35+875	Rampur	Pavement widening to 11m
7	37+000	37+150	Budhha Chowk	Pavement widening to 11m
8	39+000	39+200	Gurung Chauri	Pavement widening to 11m
9	41+300	41+500	Lalbazar	Pavement widening to 11m
10	43+600	43+700	Ghumne Chauri	Pavement widening to 11m
11	46+200	46+400	Supade Gaun	Pavement widening to 11m
12	48+725	48+825	Basaha Gaun	Pavement widening to 11m
13	51+700	51+900	Sanibare Chowk	Pavement widening to 11m
14	52+400	52+500	Charan Chamling Chowk	Pavement widening to 12m
15	57+200	57+400	Ambasi Chowk	Pavement widening to 12m
16	62+400	62+500	Bollard Naya Bazaar	Pavement widening to 12m
17	64+200	64+400	Bhagani Maleth Chowk	Pavement widening to 12m
18	65+800	65+900	Maleth Quarter Chowk	Pavement widening to 12m
19	68+400	68+500	Baluwa Chowk	Pavement widening to 12m
20	71+100	71+200	Chandani Chowk	Pavement widening to 12m (in Alt 2, Kanchanpur Bypass)

Source: Consultant Survey, 2012

75. The road pavement work will involve strengthening, resurfacing, and partial reconstruction of existing sections, new construction on re-aligned sections, shoulder

improvement, and sealing of shoulder on hill roads. Drainage improvement comprises lining of side drains, improvement of existing natural drainage systems, culverts and causeways (including new construction), and side drains along main market fronts.

76. Road safety measures include provision of signs, delineators, barriers and pavement markings, minor realignment at identified black spots including pedestrian foot paths in market areas. The project has proposed for installation of 71 posts, 213 traffic signs and 1,775 delineators for this road section.

77. Bypasses were made to avoid massive tree cutting along forestland, major community areas, flood-prone zones, and connect to new bridge sites. Geometric realignments were also employed to minimize tree cutting and avoidance shifting of community property resources. In this sub-project, the realignment has been proposed for Patnali Khola-Kharkhola Gaun (ch 15+930 to18+056) and Kharkhola Gaun-Chatara (ch 18+056 to 20+700) for East Road, and at Sisuwa Khola and Gideri Khola, Kali Khola (ch 48+825 to 51+675), Phattepur Bypass (ch 57+800 to 59+375), Rupnagar Bypass (ch 69+480 to 70+865) for West Road. More detailed discussions on these realignments are provided in Analysis of alternatives chapter.

78. Construction of 18 new bridges and 7 upgrading of new bridges will be completed in this project road section and details are presented below. Upgrading of existing bridges involves clearing and rodding of drainage, replacement of bearing and expansion joints, and repair of river training and scouring protection.

Table 9: Proposed Bridges to be Constructed and Upgraded

No.	Name of Bridge	Length (m)	No.	Name of Bridge	Length (m)
New Bridges			**Existing Bridges**		
East Side			**West Side**		
1	Patnali	127.96	1	Trijuga Bridge (Existing)	325
2	Karam	25.56	2	Balai	30
3	Gauri	22.56	3	Ganga	50
West Side			4	Bhagini	30
4	Bagundre	16.56	5	Canal	20
5	Bairawa	22.56	6	Pauda	70
6	Seti Khola-1	47.18	7	Existing Bridge(Banara Khola)	50
7	Seti Khola-2	47.18			
8	Jarayo	22.56			
9	Khar	25.56			
10	Yasodha	25.56			
11	Murti	25.56			
12	Jogini	16.56			
13	Katari	40.8			
14	Sisuwa Khola-1	47.18			
15	Sisuwa Khola-2	102.36			
16	Gideri	76.76			
17	Kali	40.8			

No.	Name of Bridge	Length (m)	No.	Name of Bridge	Length (m)
New Bridges			Existing Bridges		
East Side			West Side		
18	Chandra Canal	18.12			

Source: TPPF Detailed Engineering Design, 2012

D. Materials Required and Sourcing

79. Engineering survey has identified the following sources of construction materials:

- Gravel - Kali Khola, Gideri Khola, and around Seti Khola, Gachhiya khola (approx. 4 Km east of Itahari), Khutti khola (approx. 4 km north of Lahan) along the EWH and Seuti khola (approx. 6Km south of Dharan) also
- Sand - from 2 to 5 Km up-steam of Pauda Khola, Gangajali Khola and Triyuga River off from the existing road, Koshi riverbank
- Stones - for gabion and masonry works are unlimited in quantity from north–western part of the proposed Koshi Bridge

Table 10: Construction Materials Sources

S.N	Area, Location/ Chainage and Details	Natural Deposit Details	Gravel & Boulder For Surface Dressing Chips and Base-Course (m^3)	Material for Sub-Base & Concrete Aggregate, Stones (m^3)	Sand Approx.Qty & Composition (m^3)	~~Adequacy Remarks~~
1	Pauda Khola, & Gangajali Khola (In between Kanchanpur to Phettepur)	Alluvial deposits comprising of Quartzitic and Gneiss Sand. Total Qty= 100,000 m^3	N.A.	Limited	2,0000	Major sand sources used for DOR projects , moderately adequate for sub-base mix in small amount
2	Kali Khola (Approx. Ch 49+Km)	Alluvial deposits comprising of cobbles , pebbles and sand of quartzite, Silt stone and Gneiss Total Qty= 20000m^3	10,000	5,000.	N.A.	Major source of base- course & Stone. Crusher plant with selection technique and double cone crushing required to get base-course material and limited S.D. Chips
3	Gideri Khola (Approx. Ch. 42+ Km) and Seti Khola (Approx. Ch 30+Km)	Alluvial deposits comprising of cobbles , pebbles and little sand of quartzite, Silt stone and Gneiss Total Qty= 20000 m^3 each	10,000	5,000	N.A.	Major source of base- course & Stone. Crusher plant with selection technique and double cone crushing required to get base-course material and limited S.D. Chips
4	Koshi River Deposit (Approx. 3 Km off south of Bairawa Khola around Ch 28+Km)	Alluvial deposits comprising of cobbles , pebbles and little sand of quartzite, Silt stone and Gneiss Total Qty= Unlimited	20,000	10,000	10,000	Major source of natural S.D. chips & base-course, concrete aggr. material and coarse sand if selective technique is used

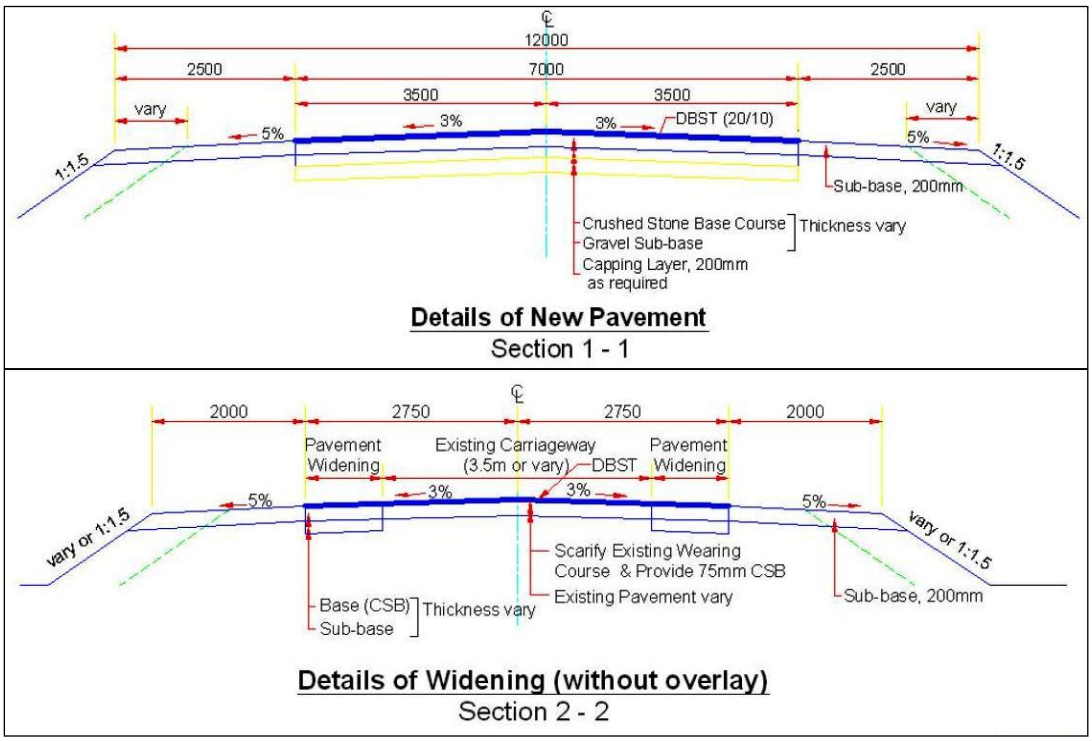
S.N	Area, Location/ Chainage and Details	Natural Deposit Details	Gravel & Boulder For Surface Dressing Chips and Base-Course (m^3)	Material for Sub-Base & Concrete Aggregate, Stones (m^3)	Sand Approx.Qty & Composition (m^3)	~~Adequacy Remarks~~
5	Ratomate (Approx. Ch 46+Km at Red hill part of Chure Range)	Colluvial and residual deposit comprising of Quartzitic sand stone and Phyllite Total Qty= 10000 m^3	1,000.	N.A.	N.A.	Moderate source of base-course , concrete aggr. material and stones for gabion and masonry works and major source for mix for sub-base material

Note: G= Gravel and Cobbles, S= Sand, C= Silt & Clay
Source: TPPF Detailed Engineering Design, 2012

E. Project Implementation Schedule and Cost

80. The construction work is expected to begin by mid-2013 and will last for 30 calendar months. The total estimated cost for whole road section and bridge works of the project including EMP is estimated to be NRs. 2,969,561,134 (including VAT, provisional sum and contingencies).

Figure 2: Typical Cross-sections of the Terai Roads



Source: TPPF Detailed Design Report, 2010

F. Need for the Project Road

81. The Koshi Bridge and road connections are part of a long-term plan by the GON to ensure access by the eastern regions to the rest of the country in the event of another breach in the Koshi Barrage system which damaged the EWH and severed access on both sides of the Koshi River through the barrage. Following the 2008 breach of the Koshi River embankment, the Koshi Bridge (Chatara) is being constructed as part of the ADB Emergency Flood Damage Rehabilitation Project (EFDRP) and this road will provide an alternative connect both sides of the Koshi River.

IV. DESCRIPTION OF THE ENVIRONMENT

A. Physical Resources

1. Meteorology and Climate

82. The project area has a tropical climate where the rainy season starts from June and ends in September. About 80% of the rainfall occurs in this season. In the dry season, the dry and cold northwest wind bears little moisture and accounts for the remaining 20% of the annual rainfall. The average rainfall of the project area is 1,863.37 mm per annum. The average monthly precipitation for the five different meteorological stations (2004-2008) in the project area and its vicinity are presented below.

Table 11: Average Monthly Rainfall

(mm)

Month	Metrological Station Sites					Monthly Average Rainfall
	Phattepur	Udaypur Gadhi	Rajbiraj	Dharan	Chatara	
Jan	12.64	5.44	9.04	13.76	6.12	9.4
Feb	19.24	17.4	9.1	22.8	24.04	18.516
Mar	31.5	32.62	8.78	37.12	38.56	29.716
Apr	62.4	89.78	56.225	101.42	102.24	82.413
May	131	166.84	119	161.62	194.2	154.532
Jun	295.94	275.9	243.32	300.52	278.88	278.912
Jul	637	518.34	459.02	517.28	499.4	526.208
August	324.64	321.22	199.46	424.18	361.12	326.124
Sep	323.72	316.18	223.56	392.24	431.38	337.416
Oct	75.38	72.04	28.92	134.24	157.36	93.588
Nov	4	12	0	1.98	0.44	3.684
Dec	2.2	6.76	0.96	3.14	1.26	2.864
Average Annual Rainfall (2004-2008)						**1,863.37**

Source: DoHM (2004-2008)

83. The project area lies in the tropical region; April, May, June and July are the hottest months, whereas November, December, January and February are the colder months. The average temperature in the project area ranges from 19^0C to 31^0C.

Table 12: Monthly Average Temperature
(°C)

Month	Phattepur		Udaypur Gadhi		Rajbiraj	
	Min Avg	Max Avg	Min Avg	Max Avg	Min Avg	Max Avg
Jan	9.95	24.78	10.58	22.96	10.42	23.18
Feb	12.88	27.46	12.58	25.4	13.5	26.64
Mar	16.48	32.16	16.5	30.13	17.62	32.02
Apr	20.78	33.8	20.14	33.26	21.24	34.86
May	23.26	34.3	22.3	33.32	23.95	35.2
Jun	25.48	34.38	24.04	33.06	25.04	34.14
Jul	25.76	33.34	23.78	31.25	25.26	32.68
Aug	25.84	34.12	24.13	31.28	25.65	33.54
Sep	24.76	33.74	23	32	23.33	33.14
Oct	21.5	33.56	21.18	31.96	21	32.42
Nov	15.275	31.46	16.65	29.88	15.38	29.48
Dec	11.675	28.3	11.07	26.4	11.48	25.15
Average	19.47	31.78333	18.82917	30.075	19.48917	31.04

Avg = average, max = maximum, min = minimum.
Source: DoHM (2004-2008)

84. Though there is lack of secondary information on the air quality for the project site, the ambient air quality is expected to be within the National Ambient Air Quality Standards (NAAQS) of Nepal as there are no major industries and significant traffic volumes. Most commercial and limited industrial activities are concentrated in the Kanchanpur and Phattepur and for most of the road length the land use is dominantly agricultural and associated residential areas. The quality of noise levels in the project area is expected to be within permissible standards prescribed by the Ministry of Environment, Science and Technology (MoEST) of the GON. However, a privately owned crusher plant is found operating on the bank of the Triyuga River, Tapeshwari VDC-9, at ch. 58+600 inside the KTWR Buffer Zone with a capacity of 2,200 tons per day. Ambient air quality near this plant is expected to exceed NAAQS.

2. Topography and Soils

85. The road alignment passes through the Siwaliks and Terai regions. Elevations of the Terai region range from 60 to 330 meters, with general slope gradients of 2 to 10 meters per kilometer. Whereas the Siwaliks region has undulating to steep slopes, and weakly consolidated layered bedrock, tend to invite severe surface erosion in spite of the generally thick vegetative cover. A wide range of colors of soils is found in the Siwaliks, reflecting parent material mineralogy. As a whole, the Terai region has flat terrain and hence there is a gentle slope from Siwaliks in the north to Terai in the south. The altitude variation of the project ranges from 125 to 109 m amsl.

86. The Land Resources Mapping Project (LRMP, 1987) indicated the Terai Region consists of recent and post–Pleistocene alluvial deposits. The land is generally flat with minor relief caused by ongoing river action and some tectonic movements especially in the southern partnism. The soils of project area can be categorized under three land type viz. (i) high terraces, (ii) middle terraces, and (iii) low terraces.

- High terraces: Soils under high terraces are characterized by undulating/ ridge topography, moderately deep, well drained, sub-angular blocky and granular structures, loamy/stony and boulder textures. These soils have no risk of flooding and ponding during monsoon season. But erosion problems are common. Soils under high terraces are extended from Kothu to Dumri.

- Middle terraces: Soils under middle terraces are characterized by gentle and uniform topography, deep, moderately well drained, blocky to sub-angular blocky structures, silty and loamy/gravely textures. These soils have less risk of flooding and ponding during monsoon season. But streams bank cutting is common. Soils under middle terraces are extended from Dumri to Rampur.
- Low terraces: Soils under low terraces are characterized by flat and uniform topography, deep to very deep, poorly drained, high water table, massive structures and silt to silt loam textures. They suffer frequently by severe flooding and ponding, and bank cutting. They cover extensive area of the project especially in the southern part.

B. Land Use Patterns

87. Land use pattern on the direct corridor of impacts (CoI), defined as 50 meters from either side of the road centerline, and was noted during alignment walkthrough. The major land use patterns include forests, cultivated land (lowland) settlements/bazaar including river, stream and rivulet channels. The corridor is rich in lowland ecological resources as illustrated below.

Table 13: Land Use Pattern along the Road Corridor

Chainage		Land Use Type	Remarks
From	To		
11+840	15+425	Forest Area	Nadaha, Kalindra, Janjagriti and Agaha CF
15+425	18+056	Forest Area + Agricultural Land	New Alignment
18+056	18+100	Settlement Area	Kharkhola Gaun
18+100	19+275	Agricultural Land	Bari land (Maize+pulses -millet)
19+275	21+000	Forest Area	Bhandaritar CF
21+000	21+400	Settlement Area	Bhandaritar Gaun
21+400	23+950	Forest Area	Ramailo CF
24+250	24+400	Agricultural Land	New Alignment
26+500	26+600	Settlement Area	Sombare Gaun
27+300	27+400	Settlement Area	Dumribote Gaun
28+600	28+700	Settlement Area	Rangmahal Gaun
28+700	29+570	Agricultural Land	Bari land (Maize+pulses -millet)
29+570	31+500	Forest Area	Hattisar CF
31+500	32+525	Agricultural Land	Khet land (Paddy-wheat/pulses)
32+525	34+575	Forest Area	Machhapuchhre CF
34+575	36+600	Agricultural Land	Khet land (Paddy-wheat/pulses)
36+600	36+700	Settlement Area	Rampur
36+700	37+525	Agricultural Land	Khet land (Paddy-wheat/pulses)
37+525	38+720	Forest Area	Gaurishankar CF
38+720	39+000	Agricultural Land	Khet land (Paddy-wheat/pulses)
39+000	40+175	Settlement Area	Gurung Chauri Gaun
40+175	40+600	Agricultural Land	New Alignment
40+600	41+300	Agricultural Land	Khet land (Paddy-wheat/pulses)

Chainage		Land Use Type	Remarks
From	To		
41+300	41+400	Settlement Area	Lal Bazar
41+400	42+500	Agricultural Land	Khet land (Paddy-wheat/pulses)
42+500	43+000	Agricultural Land + Barren Land	New Alignment
46+200	46+405	Settlement Area	Supade
46+405	47+000	Forest Area	Ranipandhera Deurali CF
47+000	48+580	Forest Area	Hattisar CF
48+580	48+825	Agricultural Land	Khet land (Paddy-wheat/pulses)
48+825	51+675	Agricultural Land	New Alignment
51+675	51+775	Settlement Area	Sanibare Chowk
51+775	52+300	Agricultural Land	Khet land (Paddy-wheat/pulses)
52+300	52+500	Settlement Area	Charan Chamling Chowk
52+500	57+140	Agricultural Land	Khet land (Paddy-wheat/pulses)
57+140	57+240	Settlement Area	Ambasi Chowk
57+240	57+800	Agricultural Land	Khet land (Paddy-wheat/pulses)
57+800	59+375	Agricultural Land	New Alignment
59+375	64+100	Agricultural Land	Fattepur Transformer Pole
64+100	64+200	Settlement Area	Bhagani Maleth
64+200	68+325	Agricultural Land	Khet land (Paddy-wheat/pulses)
68+325	68+525	Settlement Area	Baluwa Chowk
68+525	69+775	Agricultural Land	Khet land (Paddy-wheat/pulses)
69+775	70+865	Agricultural Land + Canal Road	New Alignment

Source: Field survey, 2012

C. Hydrology and Drainage

1. Surface Water

88. The entire project falls within the watershed of the Koshi River basin. The Koshi River is the largest trans-Himalayan river passing through Nepal and has the greatest snow and ice-covered areas of any Nepalese river basin. It has seven major tributaries viz. i) Sun Koshi, ii) Tama Koshi, or Tamba Koshi iii) Dudh Koshi, iv) Indravati, v) Likhu, vi) Arun and vii) Tamore or Tamar. Along with its tributaries, the river drains 30,700 km^2 in Nepal. Sun Koshi meets with Arun and Tamor at Triveni and then the name of river is called Sapta Koshi. Further down the Triveni, the river cuts a deep gorge across the lesser Himalayan range of Mahabharat Lekh in a length of 10 km and flows into the plains near Chatara. The river still flows for about 60 km in Nepal before entering the north Bihar plains in India.

89. Apart from the Koshi River, a large number of rivers and rivulets or Kholas and Kholsis, flow within the project area and finally drain into the Koshi River. Among them, Baklauri Khola, Sunsari Khola, Patnali Khola, Karam Khola, Gauri Khola, Chhinamastak Khola, Bagundre Khola, Bairowa Khola, Seti Khola, Jarayo Khola, Yasodha Khola, Murti Khola, Jogini Khola, Katari Khola, and Sisuwa Kholaare the major rivers. A list of major rivers and rivulets (Kholas and Kholsies) crossed by the road alignment enumerated below.

Table 14: Major Rivers and Streams along the Road Alignment

River/Stream	Chainage	Remarks
Patnali Khola	15+930	Rain-fed/chure origin/ephemeral
Karam Khola	18+975	Rain-fed/chure origin/ephemeral
Gauri Khola	19+336	Rain-fed/chure origin/ephemeral
Chhinamastak Khola	20+533	Rain-fed/chure origin/ephemeral
Koshi River	23+950	Major River (Perennial)
Bagundre Khola	25+646	Rain-fed/chure origin/ephemeral
Bairawa Khola	29+489	Rain-fed/chure origin/ephemeral
Seti Khola	31+672 and 32+565	Rain-fed/chure origin/perennial
Jarayo Khola	33+270	Rain-fed/chure origin/ephemeral
Yasodha Khola	35+898	Rain-fed/chure origin/perennial
Murti Khola	36+612	Rain-fed/chure origin/Perennial
Jogini Khola	37+524	Rain-fed/chure origin/ephemeral
Katari Khola	38+798	Rain-fed/chure origin/perennial
Sisuwa Khola	40+330	Rain-fed/chure origin/Perennial
Gideri Khola	42+687	Rain-fed/chure origin/Perennial
Kali Khola	49+335	Rain-fed/chure origin/Perennial
Triyuga River	58+580	Rain-fed/hills origin/Perennial
Gangajali Khola	63+425	Rain-fed/hills origin/Perennial
Pauda Khola	66+540	Rain-fed/hills origin/Perennial
Banara Khola	69+335	Rain-fed/hills origin/Perennial

Source: Field survey, 2012

90. In spite of the numerous rivers draining the road, localized flooding occurs during monsoon particularly along the Indo-Gangetic Plain. The project area is frequently inundated and embankments eroded during monsoon by Triyuga River, Gideri Khola, and Kali Khola.

91. Although the secondary information on water qualities of these rivers and rivulets are not available, it is assumed that the quality of these water resources is up to the prescribed standards as there are no any industry and other sources of pollutions along the river courses. The various water quality parameters of Koshi River at Chatara tested by Department of Hydrology and Meteorology (DoHM) in the month of May is presented below. The project area contains plenty of water resources and is used for both drinking and irrigation purposes. Gideri Khola, Sisuwa Khola, Seti Khola, Bagundre Khola, Rangamahal and Triyuga rivers are the major source of irrigation in the project area.

Table 15: Water Quality Parameters in the Koshi River at Chatara (16 May 2009)

Parameters	Unit	Average Value	Standard
pH		8.00	6.5-8.5
Conductivity	µS/cm	99	1,500
Dissolved Oxygen	mg/l	8.5	80-120% of saturation value (9.17) at 20°C (7.336-11)
PO_4-P	mg/l	0.21	8.75 ug/l (USEPA)
NO_3-N	mg/l	1.75	0.1 mg/l (USEPA)
COD	mg/l	11.58	10 mg/l (USEPA)
Chloride	mg/l	3.25	1.9 mg/l (USEPA)
NH_4-N	mg/l	0.20	<7
Alkalinity ($CaCO_3$)	mg/l	46.9	20 mg/l (USEPA)
Hardness ($CaCO_3$)	mg/l	34.75	No guideline (drinking)
Magnesium	mg/l	1.76	None (drinking)

Parameters	Unit	Average Value	Standard
Calcium	mg/l	11.03	None (drinking)
TSS	mg/l	594.75	None (drinking)

Note: CaCO3 = calcium carbonate, COD = chemical oxygen demand, mg/l = milligrams/liter, NO_2-N = nitrogen as nitrates, NO_3-N = nitrogen as nitrites, NH_4-N = nitrogen as ammonia, PO_4-P = total phosphorus, TSS = total suspended solids, µS/cm = millimho/centimeter
Source: DoHM, 2009

2. Flooding in the Koshi River Basin[7]

92. The Koshi River has a long history of breaching as presented in the succeeding Figure. After the embankments construction was completed in the 1950s, the first breached occurred in 1963 and followed in 1968 with failures believed to be caused by rats and foxes digging holes causing seepage and weakening sections. Breaches also occurred in 1971 in Bhimnagar, 1980 near Bahurawa, 1984 in Navhatta block, and in 1991 near Joginia. The most recent and one of the most devastating occurred in August 18, 2008, when the Terrai eastern embankment, 10 kms north of the EWH, breached and flood water flowed on one of its old eastern course. The 2008 breach killed 3 in Nepal and 6,190 in Bihar, India and displaced about 3 million people The EWH was broken in three points, disconnecting the Koshi and Menchi zones from the rest of the country. The alternative route to connect Sunsari and Saptari districts are through the Bathanaha-Birpur-Bahantabari in Bihar was also not passable due to flood waters. Only after 8 months were the repairs in the EWH completed and made passable to motor vehicles.

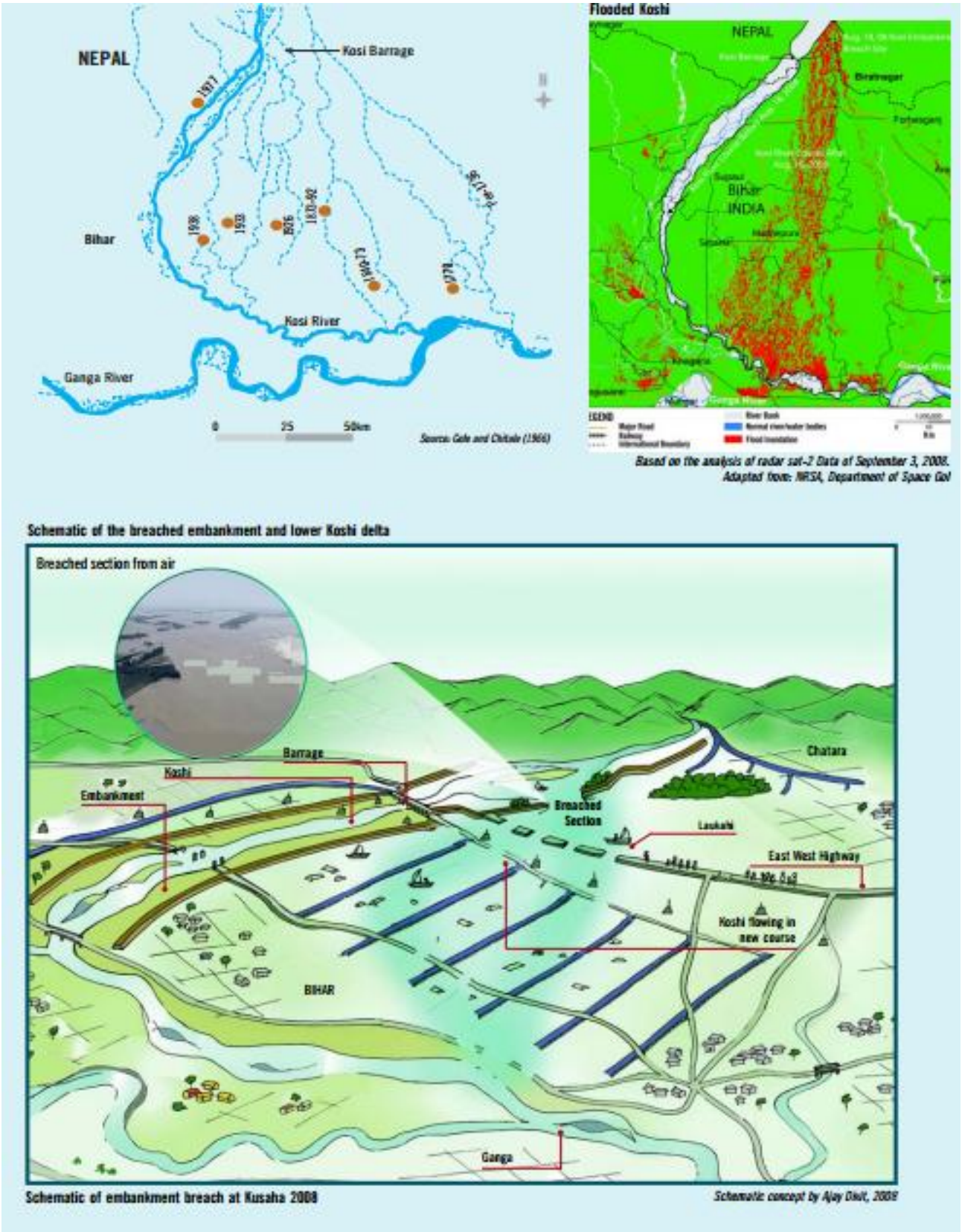
93. The Koshi River drains 60,000 square kilometers in Tibet, Nepal, and North Bihar and its water carry about 95 million cubic meters if silt and depositing in the large alluvial plain starting in Chatara immediately north of the KTWR is located. The Koshi River is dynamically active and has shifted its course 115 kms west for the past 220 years. This movement was contained in the early 1960s by constructing embankments and a barrage. This structure retarded the flow of silt-laden water, increase sedimentation in the flood storage area of the barrage resulting to shallower river bed compared to downstream of the barrage. Surveys show that the area circumscribed by the embankments and barrage is shallower by 3-4 meters.

94. The frequency embankment breaching is expected to increase as the river bed upstream of the barrage continues it aggradation, river morphological changes by constricting its flow between the embankments, and poor embankment maintenance. Added to this is the projection of more frequent and intense rainfall predictions from climate change.

95. The upgrading of the project road is GoN adaptation to climate change as the Koshi Barrage is subjected to increase risk of overtopping as the flooding flows from the Koshi River is increasing in frequency and scale. Even without the climatological extremes attributed to global climate change, the Koshi River has breached its embankments numerous times. The Koshi River is one of the most dynamic rivers and the last 250 years saw its course shifting 250m kilometers westward. With its headwaters located in the geologically active Himalayas, plate tectonics push the Himalayas upwards, blocking summer monsoon resulting to huge rainfall and increase in erosion. With the global climate change altering the snow and ice covers of the Himalayas, the risk of glacial lake outburst floods and and landslide dam outburst also increases.

[7] Nepal Climate Vulnerability Study Team. 2009. *Vulnerability Through the Eyes of the Vulnerable: Climate Change Induced Uncertainties and Nepals Development Predicament.* Institute for Social and Environmental Transition-Nepal. Boulder,Colorado, USA.

Figure 3: Historical Embankment Breaches of the Koshi River



Source: Nepal Climate Vulnerability Study Team, 2009

3. Ground Water

96. The project road lies in the Siwaliks and Terai regions. The Siwaliks region is known to have limited groundwater availability. However, the Terai region has bountiful ground water resources to supply drinking and other domestic purposes. The seasonal range of depth to water table in the Terai varies from 0 to 10 meter below ground surface. The quality of ground water in this area should be monitored closely as presence of arsenic and other minerals have been detected in several cases.

4. Geology/Seismology

97. Nepal is a seismically active country lying between collisions of Indian to the Eurasian plate and moving continuously resulting frequent and often devastating earthquakes within this region. Nepal experienced catastrophic earthquake damages in 1934 and 1988. The epicentre of the earthquake that occurred in 1988 was in the Udaypur district (project district) that killed thousands of lives and damaged infrastructure in the Eastern Development Region. The GON has issued specific guidelines in constructing earthquake resistant buildings[8], however, there are no such guidelines for earthquake resistant roads and bridges. In lieu, the Indian Code IRC:6 1966 was applied on the assumption that the project area is under Indian Seismic Zone V, denoting the highest risks zone that suffers earthquakes of intensity MSK IX or greater and referred to as the Very High Damage Risk Zone.

Table 16: Catastrophic Earthquakes in Nepal

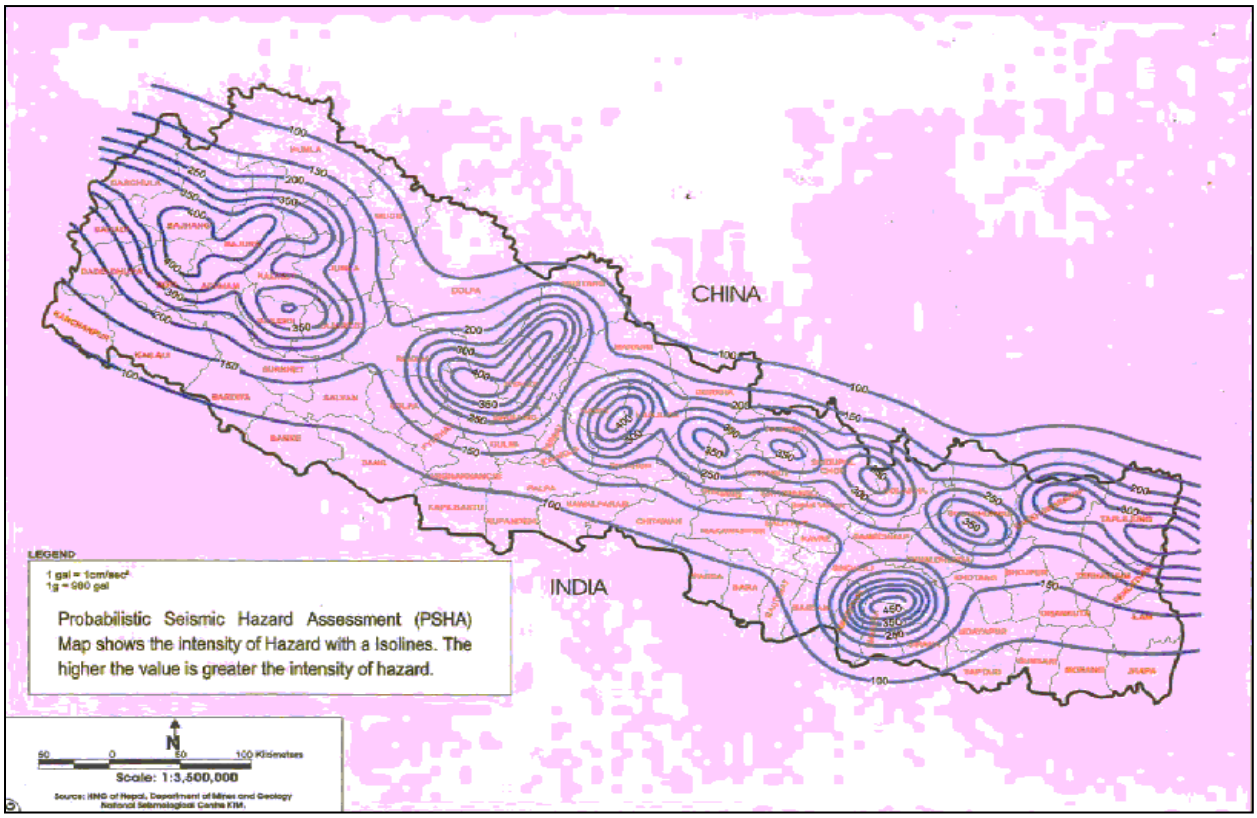
Date	Damage
1310 BS/ 1255 AD	One third of the total population of Kathmandu were killed, numerous buildings and temples of the valley were entirely destroyed while many of them were severely damaged, the magnitude of the earthquake is said to be around 7.7 in Richter scale
1316BS/ 1260 AD, 1463BS/ 1408AD, and 1737BS/ 1681 AD	Many buildings and temples collapsed, many more were severely damaged, heavy loss lives. No written or verbal records survive to indicate any human loss or the magnitude of sufferings and damages caused.
1890 BS/ 1833 AD	On the months of August or September, two major strikes were experienced in the Kathmandu valley. The first one was felt in around 6 pm and the second one was around 11 pm at night when most of the valley people were already in their beds. Houses, temples, public shelters collapsed. The tower of Dharahara was also severely damaged. The towns of Thimi and Bhaktapur took the brunt of the disaster severely damaging the housing facilities, roads network and various temples. Many building and temples were utterly destroyed. 4,214 houses were said to have collapsed within Kathmandu Valley and in totality over 18,000 houses collapsed all over the country.
1891 BS/ 1834 AD	Four major earthquakes were felt in the months of June and July. These earthquakes destroyed or damaged many buildings and temples. Since there was a lot of rain which commenced and ended with the earthquakes the search and rescue operations were severely hampered. The Bagmati River was over flooded and a bridge over the river also swept away. The crops planted near the banks of the rivers were also swept away. There are no records of human or livestock casualties.
1990 BS/ 1934 AD	Magh (January- February) Earthquake, Known as Great Nepal Bihar Earthquake struck Nepal and its surrounding areas around 2 pm on the 16th of January. The

[8] Department of Urban Development and Building Construction (DUDBC), Ministry of Physical Planning and Works(MPPW) (Reprinted 2007) Guidelines for Earthquake Resistant Building Construction : Earthen Building

Date	Damage
	magnitude of the earthquake was 8.4 on the Richter scale. Casualty figures were highest, a total 8,519 people lost their lives, 126,355 houses were severely damaged, and around 80,893 buildings were completely destroyed.
2037 BS/ 1980 AD	6.5 Richter scale, far western region mostly affected – Baitadi, Bajhang, Darchula, 125 people dead, 248 seriously injured, 11,604 buildings destroyed, 13,414 buildings damaged, heavy loss of livestock
2045 BS/ 1988 AD	Udayapur Earthquake, Eastern Development Region mostly affected and some parts of Central Development region affected, 721 deaths, 6553 people injured, 64174 private buildings, 468 public houses, 790 government buildings damaged, 1566 live stocks, 22 districts of eastern Nepal affected, Total direct loss of 5 billion rupees.

Source: National Society for Earthquake Technology-Nepal (2012)

Map 4: Probabilistic Seismic Hazard Map



Source: Nepal Department of Mines and Geology National Seismological Centre, KTM

98. According to geological survey, the road alignment passes through sediments of Indo-Gangetic Plain and rocks of the Siwaliks Group. The Lower Siwaliks Formation is represented by mudstone embedded with sandstone. The Indo-Gangetic Plain contains thick boulder-gravel beds as well as gravel to thick sand beds. The road alignment crosses the Himalayan Frontal Thrust (HFT) and also passes through Dun valley sediments. The drift geology includes the interbedding of sandstone and mudstone (ch 20+700-23+600 and 24+400-29+500), and alluvial deposits (ch 0+000-20+700 and 23+600-24+400) including mix of alluvial and residual soil deposits (ch 20+600-21+000 and 29+500-71+645). Major length of the road alignment is considered as low-hazard because of flat topography, land use patterns, and geo-tectonics.

D. Ecological Resources

1. Forests

99. The project road traversed several community managed forests in Kalindra, Janjagriti, Agaha, Bhandaritar, Ramailo, Hattisar, Machhapuchhre, Gaurishankar, and Ranipandhera Deurali. A total of 9.45 kms of the proposed road section passes through these community forests, representing 15.43% of the total road length. Community Forest User Groups (CFUGs) have been organized under the present forestry sector policy responsible for the protecting, harvesting, and regenerating community forest. CFUG in turn can use 75% of the income from community forest for the community development activities and rest 25% for the community forestry development activities. Forest types existing along the road is mainly Sal (*Shorea robusta*) with smaller portions of moist evergreen forest, dry deciduous forest and Khair - Sisoo (*Acacia catechu-Dalbergia sisoo*) forest.

100. Three species namely, *Shorea robusta, Acacia catechu* and *Bombax ceiba* are protected plant species and they are banned for felling, transportation and export under the Forest Regulations, 1995 (amended in 2001). Further, *Acacia catechu* falls under the threatened category of IUCN status. The major tree species found along the road corridor are as follows:

Table 17: List of Major Tree Species Found Along the Project Road Corridor

Local name	Scientific Name	Family
Aanp	*Mangifera indica* L.	Anacardiaceae
Badahar	*Artocarpus lakoocha* Wall	Moraceae
Bakenu	*Melia azederach* L.	Meliaceae
Bamboo	*Bambus spp*	Poaceae
Banjh	*Quercus lanata* Sm.	Fagaceae
Bar	*Ficus bengalensis* L.	Moraceae
Barro	*Terminalia bellirica*	Combretaceae
Bel	*Aegle marmelos*(L) Corr.	Rutaceae
Bhalayo	*Rhus javanica* L.	Anacardiaceae
Bot Dhayaro	*Lagerstroemia parviflora* Roxb.	Lythraceae
Narival	*Cocos nucifera* L.	Palmae
Dabdabe	*Garuga Pinanata* Roxb.	Burseraceae
Dhaiyaro	*Woodfordia fruticosa* (L) Kurz.	Lythraceae
Gidari	*Premna integrifolia* L.	Verbenaceae
Haade	Lagerstroemia parviflora Roxb.	Lythraceae
Hallunde	*Lannea coromandelica* (Houtt.)Merr	Anacardiaceae
Harro	*Terminalia chebula*	Combretaceae
Katahar	*Artocarpus heterophyllus* Lam	Moraceae
Jamun	*Syzigium cumini*	Myrtaceae
Karma	*Adina cordifolia*	Rubiaceae
Kabro	*Ficus lacor*	Moraceae
Kadam	*Anthocephalus chinensis*	Rubiaceae
Kumbi	*Cochlospermum religiosum*	Cochlospermaceae
Kusum	*Carthamus tinctorius*	Compositae
Kyamun	*Hedychium ellipticum*	Zingiberaceae
Oghal	*Abelmoschus pungens*	Malvaceae
Pipal	*Ficus religiousa*	Moraceae
Pithari	*Trewia nudiflora*	Euphorbiaceous
Sal	*Shorea robusta* Gaerth	Dipterocarpaceae
Saj	*Terminalia alata* Heyne ex. Roth	Combretaceae
Simal	*Bombax ceiba* L.	Bombacaceae

Local name	Scientific Name	Family
Sakhuva	*Shorea robusta* Gaerth	Dipterocarpaceae
Siris	*Albizia lebbeck*	Mimosaceae
Sissau	*Dalbergia sissoo*	Leguminosae
Sami	*Ficus benjamina* L.	Moraceae
Tatari	*Dillenia pentagyna* Roxb.	Dilleniaceae
Sagvan	*Tectona grandis* L.f	Verbenaceae
Thakal	*Argemone maxicana* L.	Papaveraceae
Tuna Tuni	*Toona ciliate*	Meliaceae

Source: RCP Final Report, 2010

2. Wildlife

101. Most of the significant wildlife encountered along the entire Project road is found within 9.525 kms project road stretches within the KTWR Buffer zone. Koshi Tappu is formed as a result of braiding and meandering of the Sapta Koshi River. This river is a convergence of seven perennial river systems namely Arun, Tamor, Likhu, Sunkosi, Dudhkosi, Tamakosi, and Indrawati. This is the largest perennial river system in Nepal with a catchment area of 60,000 sq. km. and major tributary of River Ganges in India. The Sapta Koshi River after flowing about 60 kms from Tribeni at Chatara enters to Birpur at Indian border of Bihar State.

3. Koshi Tappu Wldlife Reserve and its Buffer Zone

102. KTWR is the smallest protected area in the Nepal Terai spread over 175 sq. km. However, it is one of the best sites for the conservation of many rare and endangered species of plants, fish, herpetofauna, resident and migratory birds and mammals. The NPWC Act, 1973, defines a Reserve as an area set aside for the conservation and management of wildlife including bird, vegetation, and landscape together with the natural environment.

103. KTWR was gazette as a wildlife reserve under the NPWC Act in 1976 and declared as the first Ramsar Site in Nepal in 1987. The site was included in the Ramsar list because this wetland regularly supports more than 20,000 waterfowl population. KTWR's wetland is composed of riverine that includes both perennial and flood plain; oxbows and ponds; marshes and swamps; and manmade structures like Koshi barrage, canals, and ricefields. As of 1992, the total river, sand, and boulder areas inside the KTWR cover 3,668 hectares. Similar areas in the buffer zone were estimated at 2,496 hectares, and additional 318 hectares of swamp land. These wetlands provide feeding, breeding, and nesting for more than 20,000 residential and migratory birds.

104. KTWR is a hotspot for supporting 200 species of fish and is of special value for maintaining the genetic and ecological diversity of a region (Scott 1989). The Ramsar designation is meant to promote wise use and conservation of ecological characters of KTWR through a planned approach. Further details on the background and history of KTWR and its buffer zone are provided in **Appendix 2**.

105. The KTWR is confirmed to support 514 species of plants, 77 species of butterfly, 200 species of fish, 45 species of herpetofauna, 461 species of bird and 31 species of mammals and remnant population of critically endangered wild water buffalo (*Bubalus arnee*)[9]. It is an important site for waterfowl conservation, acting as a staging and wintering area for a variety of trans-Himalayan migrants, notably ducks and shorebirds (IUCN 1998). The Ramsar designation

[9] The wild water buffalo is one of 26 mammal species protected by the NPWC Act, 1973.

is meant to promote wise use and conservation of ecological characters of KTWR through a planned approach. (DNPWC, 2009).

106. In spite of being a Ramsar Site, KTWR faces a multitude of conservation challenges to protect its wildlife and natural resources. One of the major problems is crop damage and human injuries by wild animals including wild water buffalo coming out of the Reserve. Some domestic cattle and buffaloes are still grazing inside the Reserve exerting intense competition for food and space with the wildlife. These feral livestock also damage crop in the peripheral agricultural fields. Photographs 8 to 10 of Appendix 2 shows pictures of damages and injuries caused by wildlife. The domestic buffaloes are also cross breeding with wild water buffalo, which may have caused genetic pollution in the pure wild breed.

107. Dependency of the local people on natural resources abundantly found inside the Reserve like thatch, grass and other resources persist. Frequent flooding, sedimentation due to river braiding and wildlife mortality from floods are other serious problems. Also of equal concern is the intentional fire and poaching of wild animals from the Reserve's northern and southern boundaries. These scenarios pose formidable challenges to balance wildlife and human needs and the mitigation of conflicts between the Reserve management and people living around the Reserve (DNPWC/PPP, 1999).

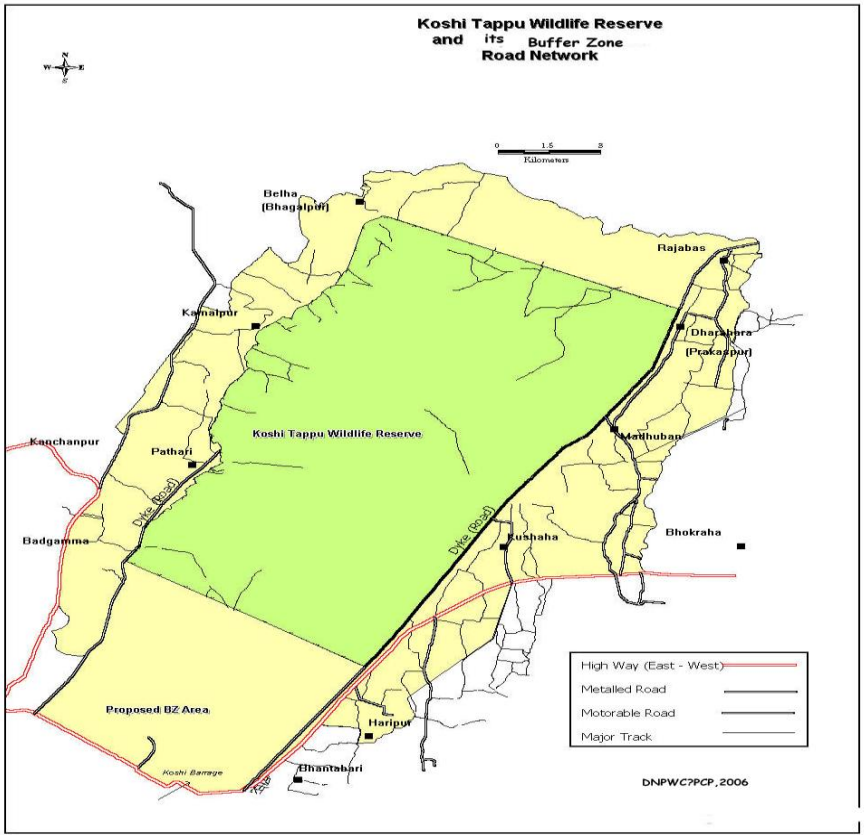
108. As a strategy to resolve these conflicts, DNPWC proposed a delineation of a Buffer Zone condistent with the 4th amendment in the NPWC Act, 1973, in 1992. A Buffer Zone is defined as "the peripheral area of national park or Reserve refering to the villages, settlements or hamlets set aside as Buffer Zone lying within the national park or Reserve" (KTWR Management Plan, 1999)."

109. The Buffer Zone of KTWR is 173 sq. km distributed across 16 Village Development Committees of Sunsari, Saptari and Udayapur Districts and 49.6 sq km submerged government land between the Koshi barrage and southern boundary of the Reserve. Several User Groups (UGs) and Committees (UCs) were organized and the Buffer Zone Management Committee (BZMC) is the apex local body responsible for full ownership of the Buffer Zone development and management programme. The Buffer Zone Regulation 1996 empowered the UGs, UCs and BZMC to carry out community development activities, especially those that maintain a sustainable use of forest products without disturbing the wildlife habitat of the protected areas.

110. Agriculture is the dominant land use (86.5%) in the Buffer Zone followed by river/sand/boulders (6.0 %), grassland (5.6 %), swamp (1.3 %) and orchard (0.6 %). Of the total Buffer Zone, the eastern sector covers 57 % and the western sector, where the Project road encroached, covers 43 %. About 55.7 % of the total population in the Buffer Zone resides on the wester sector. On an average each household has land area of 1.52 ha on the eastern sector and only 0.87 ha on the western sector.

111. There are no permanent motorable roads inside the Reserve and acces is provided thorugh dykes along the eastern and western boundary of the Reserve. Most of the VDCs in the Buffer Zone are connected by motor roads. Out of the 16 VDCs in Buffer Zone, East-West Highway passes through 8 VDCs. Six VDCs are connected with Kanchanpur-Phattehpur road and 2 VDCs are connected with gravel road. However, lack of bridges, culverts and internal roads are constraints, especially during monsoons in all VDCs.

Map 12: KTWR's and Buffer Zone Road Network and Settlement Distribution



Source: KTWR Management Plan, 2009

4. Faunal Diversity

112. KTWR supports about 45 % of total vertebrate species of Nepal (IUCN, 1998). The wild water buffalo population is increasing from 63 in 1976 (Dahmer, 1976), 145 in 2000 (Heinen and Singh, 2000) and 219 in 2009 (DNPWC, 2009). Other mammals, the wild boar (*Sus scrofa*) and hog deer (*Axis porcinus*), spotted deer (*Axis axis*), smooth coated otter (*Lutrogale perspicillata*), fishing cat (*Felis viverrina*), jungle cat (*F. chaus*), Indian fox (*Vulpes bengalensis*) and the jackal (*Canis aureus*) are common (IUCN, 1998). The wetlands harbor several aquatic fauna like insects, fish, amphibians, reptiles, birds and mammals described below.

Table 18: Mammals of Koshi Tappu Wildlife Reserve

Family	Scientific Name	*Common Name*	Status			
			NPWCA (1923)	NRDB(1995)	IUCN	CITES
Bovidae	1. Bos gaurus *2. Bubalus arnee* *3. Boselaphus*	Indian Bison Wild Water Buffalo(Arna) Blue	P P	E C V	V E	I III(NP)
Canidae	*4. Canis aureus* *5. Vulpes benghalensis*	Golden Jackal Bengal Fox		S	I	III(IN)
Cercopithecidae	6. *Macaca mulatta* *7. Semnopithecus en*	Rheus Macaque Hanuman Langur		S S		II I
Cervidae	*8. Axis axis* *9. Axis porcinus* *10. Muntiacus muntjak*	Spotted Deer Hog Deer Barking Deer		S		I
Elephantidae	*11. Elephas maximus*	Asiatic Elephant	P	E	E	I
Felidae	*12. Felis chaus* *13. Prionailurus viverrinus*	Jungle cat Fishing Cat Spotted Leopard		S V S	K	II II I
Hystricidae	*15. Hystrix indica*	Indian Crested				

Family	Scientific Name	*Common Name*	Status			
			NPWCA (1923)	NRDB(1995)	IUCN	CITES
Herpestedae	*16. Herpestes edwardsii* *17. Herpestes javanicus*	Indian Grey Mongoose Small Asian Mongoose				
Leporidae	*18. Lepus nigricollis*	Indian Hare				
Lutranae	*19. Lutra lutra* *20. Lutrgale perspicillata*	Common Otter Smooth Coated Otter		S S	 K	I II
Mustilidae	*21. Martes flavigula*	Yellow- Throated				
Platanistidae	*22. Platanista gangetica*	Gangetic Dolphin	P	C	V	I
Pteromyidae	*23. Petaurista petaurista*	Red flying Squirrel				
Pteropodidae	*24. Pteropus giganteus*	Indian Flying Fox				
Sciuridae	*26. Ratufa bicolar* *27. Funambulus palmarum*	Black Giant Squirrel Three Striped Squirrel				
Suidae	*29. Sus scrofa*	Wild boar				
Vespertilionidae	*30. Pipistrellus cor*	Indian Pipistrelle				
Viverridae	*31. Viverra zibetha* *32. Viverricula indica*	Large Indian Civet Small Indian				

C= critically endangered, E = endangered, I = indeterminate, K = insufficiently known, IN = India, IUCN = International Union for the Conservation of Nature, NPWCA= National Parks and Wildlife and Conservation Act,NP = Nepal, NRDB = National Red Data Book, P= GON protected, S= Susceptible, I, II, III = Convention on International Trade in Endangered Species (CITES) Appendices, V=vulnerable

Sources: KTWR, Management Plan Preparation team's field survey, 2000; IUCN, 1998

113. IUCN (1998) reported 77 species of butterfly, 200 species of fish, 45 species of herpetofauna (amphibians and reptiles), 461 species of bird and 31 species of mammal (BPP, 1995; IUCN, 1998 and Baral, 2000). Out of 91 fish species, 21 are local migratory and 5 species are migratory (IUCN, 1998). Of the e 45 species of herpetofauna; 11 are amphibians (2 toads and 9 frogs), 34 reptiles (2 crocodiles, 11 turtles, 6 lizards and 15 snakes). Among the 461 species of birds that represent 58 families (Baral, 2000) the most numerous are Accipitridae (42 spp.), Muscicapidae (40 spp.), Sylviidae (36 spp.), Corvidae (31 spp.), Passeridae (29 spp.), Anatidae (27 spp.) and Scolopacidae (20 spp.). At least 176 species breed in the Reserve and 180 species are passage migrants or winter visitors (IUCN, 1998). KTWR is the only area in Nepal where water cock, *Gallicrex cinerea* and Abbot's babbler, *Trichastoma abbotti* are known to occur (Inskipp, 1989). Bird species in the Reserve also include 114 species of water birds, representing almost all the species known to occur in Nepal. (DNPWC, 2009).

5. Endangered and Endemic Species

114. Six species of plant, *Rauwolfia serpentina, Alstonia scholaris, Oroxylum indicum, Acacia catechu, Butea monosperma and Dalbergia latifolia* listed in different threat categories and Appendices of IUCN and CITES respectively occur in the Reserve. A total of 9 species are listed in the threatened categories of NRDB (1995), 8 and 1 species as vulnerable and endangered respectively. Seventeen species of herpetofauna are nationally threatened out of which six species are globally threatened (IUCN, 1998).

115. Out of 493 species of birds, 101 species are nationally threatened and 12 species are globally threatened (NRDB, 1995; IUCN, 1998). Of the nationally threatened, 4 species are critically endangered, 20 species are endangered, 55 species are susceptible and 22 vulnerable. Forty- one species are CITES listed of which 6 species are in Appendix I, and 35 are in Appendix II. The species such as greylag goose (*Anser anser*), darter (*Anhinga melanogaster*), swamp partridge (*Francolinus gularis*), Bengal florican (*Houbaropsis bengalensis*), Eurasian tree sparrow (*Passer montanus*) and little cormorant (*Phalacrocorax Niger*) have become endangered, scarce or uncommon in the area (Heinen, 1987). Other noteworthy species, which have been recorded in small number, include black stork (*Ciconia*

nigra), black-necked stork (*Ephippiorhynchus asiaticus*), greater adjutant stork (*Leptoptilos dubius*), lesser adjutant stork (*L. javanicus*), painted stork (*Mycteria leucocephala*), spoonbill (*Platalia leucorodia*), white tailed stonechat (*Saxicola leucura*) and striated marsh warbler (*Megalurus palustris*) (Scott, 1989, Inskipp, 1989).

116. Out of 31 species of mammal, 14 species are threatened nationally and 7 species globally (NRDB, 1995). Thirteen species are listed in CITES. Of this 7 are listed under Appendix I, 4 under Appendix II and 2 under Appendix III. The blue bull, spotted deer, gaur, wild elephant, and Gangetic dolphin has noticeably declined from KTWR.

117. One species of fish *Colisa sota* recorded from Kamal Daha, two species of bird *Gallicrex cinerea*, and *Trichastoma abbotti,* and one species of mammal, *Bubalus bubalis* are the endemic/localized species of the Reserve as so far they have not been reported from any other part of the country (Inskipp, 1989; WMI/ IUCN Nepal, 1994; Suwal and Verheugst, 1995).

6. Aquatic Biology and Fisheries

118. Koshi River is one of the major river systems of Nepal and the important fishes found are big catfish (*Gangata cenia, Bagarius bagarius* and *Rita rita*), catla (*Catla catla*), rohu (*Labeo rohita*), freshwater eel (*Anguilla bengalensis*), puffer fish or Pokcha (*Tetradon cutcutia*), Gainchi (*Macrognathus aculeatum*), Giant Snake Head or Saur (*Channa maurilus*), Pabata (*Ompok bimaculantus*), Buhari (*Wallago attu*), and Kanti (*Mystus seenghala, Rita rita*)[10]. During focus group discussions, local people commonly found fish species along the project road are Asla (*Schizothorax progastus*), Bam (*Anguilla bengalensis*), and Buduna (*Gerra aunandalei*).

E. Economic Development

1. Industrial

119. Based on the 2001 census the percentage of the population that is economically active in the three project districts is about 56.56% for Sunsari, 65.41% for Udayapur and 55.54% for Saptari. The large scale industries in the project districts include agro-based and distilleries, pipe and steel, textile, tobacco and, soap and detergent. These industries are mainly located near the start and end point of the road which is closer to the EWH. The dominant small-scale industries include cereal processing mills and wood related factories, herbal medicinal, paper, stone and brick related industries.

2. Agricultural

120. Agriculture is the major source of economic activity in the Siwaliks, Bhabar zone (between Siwaliks and Terai) and Terai regions of the project area. Soils of the Terai region is comparatively fertile than the Siwaliks and Bhabar. Most of land in the Terai region has irrigation facility most notable are the Chandra canal-the oldest canal of Nepal, and Chatara Canal. The source of irrigation for Chandra canal is Triyuga River and the Koshi River for Chatara canal that supply irrigation water to the western and eastern parts of the project area, respectively. Small-scale irrigation facilities are also available in the project area, mainly confined to the Terai region. In contrast, the Siwaliks and Bhabar regions are heavily dependent on rain-fed agricultural system. The major crops and cropping patterns practiced in the project area are paddy-wheat-maize, paddy-maize/vegetables in irrigated condition, and maize+pulses-oilseeds/spices (ginger, garlic), fruits (citrus, jackfruit, banana, mango, pineapple, guava, coconut), in the rain-fed condition. Animal husbandry especially buffalo and goat farming are important components, providing additional income.

[10] Shreshta, 2003.

3. Mineral Resources

121. There are no metallic minerals extraction reported in the project districts. However, perennial and seasonal rivers provide ample supply of sand, boulders, and stones for construction purposes and are even exported to neighboring districts and Indian cities close to the border.

4. Tourism

122. The Koshi Tappu Wildlife Reserve (KTWR), a Ramsar Site lies close to the project area. This Ramsar Site is famous for wild buffalo (*Bubalus arnee*) and different species of migratory birds. The project area also lies close to the famous historical and Hindu religious site-Barahakshetra temple, believed to be built more than two thousand years ago. Many Hindu pilgrimages from India and neighboring districts of the project districts visit this temple. The other interesting sites for domestic tourism development are:

1. **Bhulke** and **Ranipokhari** (pond of spring water): This is a religious and historical place located at Baklauri VDC. People celebrate here as a festival nearly one month during monsoon season.
2. **Mahatgaina**: This is a Hindu religious site that is located at Odraha VDC. People celebrate here Nepali New Year (BS) every year.
3. **Belka Raja-Rani:** This is a historical and archaeological site that is located at Mahabharatdanda at Chaudandi VDC.
4. **Mahakali Devi:** This is a famous temple for Hindu a pilgrim that is located at Thoksila VDC.
5. **Chatara Haridwar:** This is a famous Hindu temple that is located at Maina Maini VDC. The Hindu and Buddhists celebrate here during Baisakhe purnima and Mangsir purnima.

Along the road corridor are potential spots for rafting, and canoeing.

5. Infrastructure Facilities

a. Water Supply

123. District level access to improved source of drinking water for Sunsari, Udaypur and Saptari districts account for 95.7%, 69.7% and 96.0%, respectively. Improved source of drinking water includes water from piped line or tube-well/borehole.[11]

b. Market Centers

124. Large market centers for the project area are Biratnagar, Itahari, Jhumka, Dharan and Kathmandu. While local market/ bazaar areas are Pakali, Nadaha, Chatara, Rampur, Lalbazar, Sanibare, Phattepur, Bhagani Maleth, Baluwa Chowk and Kanchanpur. Buying and selling of daily needed commodities are the major transactions in these markets. These markets are also the centers for the collection of vegetables and cash crops for marketing in the large market centers. These are the local Hat Bazaar (market centers) and operate for two or three days in a week where people carry their farm products to sell and buy household commodities also people bring large volume of local products for trading business in the large markets.

[11] CBS, 2001

c. Communication:

125. Telephone lines per thousand populations for the three districts namely, Sunsari, Udayapur and Saptari are 17.54, 3.24 and 1.15 respectively[12]. However, the communication facility has increased significantly in the last five years and the project area has the facility of Pre-paid, Post-paid Mobile Phones and CDMA phones throughout the road corridor with the facility of national and international calls. Landline phones are basically concentrated to the southern part of the project area close to the national highway. In addition, the project districts have FM Radio stations, television towers including cable networks and local newspaper (daily and weekly).

d. Transportation

126. Road is the dominant mode of transportation in the project area. The total length of road in Sunsari district is 813 km including about 112.33 km of bituminous, 68.7km gravel and 10km of earth surfaced roads. 89.03 km of National Highway passes through this district. The road density and population influenced per km road in the district is 15/100 km^2 and 3275 respectively[13]. This district is linked with various headquarters of other districts through road transport. There is no airport in this district.

127. The total length of road in Udaypur district is 179.86 km including 77.36km of bituminous, 32.5km gravel and 70km of earthen surfaced roads. 89.03 km of National Highway passes through this district. The road density and population influenced per km road in the district is 9/100 km^2 and 1600 respectively[14]. This district is linked with various headquarters of other districts through road transport. There is no airport in this district.

128. The total length of road in Saptari district is 239.5 km including 135km of bituminous, 45.5km, gravel and 59km of earthen roads. 71.15km of National Highway passes through this district. The road density and population influenced per km road in the district is 18/100 km^2 and 2381 respectively[15]. This district is linked with various headquarters of other districts through road transport. There is no airport in this district.

e. Energy

129. Percentage of households having electricity facility for the three districts namely, Sunsari, Udayapur and Saptari districts are 42.7%, 41.3% and 32.2%, respectively. They are getting electricity from various sources (e.g Nepal Electricity Authority or Micro-hydropower or Solar System). Electricity facility for Sunsari and Udaypur districts is slightly higher than the national average (39.8%) whereas Udayapur district has slightly lower value than the national average[16].

130. Majority of the households in the project areas are dependent on firewood for cooking food. Percentage of households using solid fuels for cooking for Sunsari, Udayapur and Saptari districts are 72.9%, 92.7% and 85%, respectively. Use of LPG and bio-gas are gradually increasing especially in the urban areas.

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[12] CBS, 2001

[13] ISRC, 2008

[14] ISRC, 2008

[15] ISRC, 2008

[16] CBS, 2001

F. Social and Cultural Resources

1. Population and Communities

131. The road alignment passes through fourteen (14) VDCs in Sunsari, Udaypur and Saptari districts. The total population of the project area is 109,229 and is female dominated (50.22%) with the average household size of 5.52. The population density of the project districts namely, Sunsari, Udayapur and Saptari is 368.7/ km^2, 107/km^2 and 341/km^2, respectively. The population densities for Sunsari and Saptari are higher than the population density of the country (157/km^2). The demographic characteristics of the project are presented below.

Table 19: Demographic characteristics of the project area

District	VDCs	Population				Total	Total HHs	Average HH Size
		Male		Female				
		Number	Percent	Number	Percent			
Sunsari	Bharaul	8,136	48.19	8,746	51.81	16,882	3,046	5.54
	Barahchhetra	5,551	49.40	5,685	50.60	11,236	2,434	4.62
V. Udaypur	Mainamaini	2,392	48.06	2,585	51.94	4,977	846	5.88
	Thoksila	9,667	50.23	9,579	49.77	19,246	3,454	5.57
	Katunje Babla	2,473	51.52	2,327	48.48	4,800	782	6.14
	Basaha	1,629	50.50	1,597	49.50	3,226	515	6.26
	Tapeswari	4,784	49.30	4,920	50.70	9,704	1,759	5.52
Saptari	Phattepur	5,150	50.53	5,042	49.47	10,192	1,746	5.84
	Kamalpur	2,476	51.37	2,344	48.63	4,820	824	5.85
	Ghoghanpur	2,388	48.94	2,491	51.06	4,879	923	5.29
	Pipra (Purba)	1,720	49.83	1,732	50.17	3,452	622	5.55
	Dharampur	2,391	50.46	2,347	49.54	4,738	1,089	4.35
	Kanchanpur	3,154	52.51	2,853	47.49	6,007	1,068	5.62
	Rupnagar	2,467	48.66	2,603	51.34	5,070	957	5.30
Total		**54,378**	**49.78**	**54,851**	**50.22**	**109,229**	**18,997**	**5.52**

HH= household, VDC = village development committee
Source: CBS, 2001

132. The project road section inside the KTWR-Buffer Zone crosses Tapeshwori VDC in Udayapur District, and Kamalpur, Ghoghanpur, Pipra, Dharampur, and Kanchanpur VDCs in Saptari District. In the entire Buffer Zone, 70% of the land is privately onwned while 40% of the households are landless or near landless with landholding less than 0.05 hectares.

1. Religion and Ethnicity

133. The main religions adopted by the people in the project area include Hinduism and Buddhism with diverse ethnic groups. The major ethnic groups in the project area consist of Tharu, Newar, Limbu, Rai, Magar, Tamang, Brahmin, Chhetri and Dalit (so called low caste ethnic group).

2. Literacy Rate and Education Level

134. According to Census of 2001, the literacy rate of Sunsari, Udayapur and Saptari district is 43.6%, 37.8% and 33.9%, respectively.

3. Occupational status

135. Majority of the population is employed in agriculture, fisheries, and forestry. In urban centers, people are engaged in professional employment, services, industrial and other craft and trade sectors.

4. Health and Sanitation

136. All the VDCs of project area have facility of sub-health post. The health posts/sub-health posts provide basic health facilities including immunization programs and minor healthcare. Apart from this, the district headquarters- Sunsari, Udayapur and Saptari have District Public Health Offices including District Hospitals. The district Public Health Offices are primarily focused on public health and District Hospitals on curative cure. The B.P. Koirala Medical College is located in Dharan within the project area of Sunsari district. The large and complex cases are generally referred to the B.P. Koirala Medical College or Biratnagar or Kathmandu.

137. Although access of use of toilet in urban area is increasing, outside defecation practice is still common. The major diseases that prevailed in the districts include intestinal worms, gastritis, presumed non-infectious diarrhea (persistent), and amoebic dysentery indicating an urgent need to improve water sanitation facilities.

5. Educational Facilities

138. The project area has primary, lower secondary, higher secondary, and campus level educational institutions.

6. Physical or Cultural Heritage

139. The most famous religious place in the Project area is the Barahakshetra temple, Chatara, about 3 km away from the road alignment. It is believed that the temple was built more than two thousand years ago and a sacred place for Hindu devotees from different parts of the country and India.

VI. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

A. Assessment of Impacts and Risk

140. The potential impacts and risks were analyzed in the confines of the road influence area, which is defined in this study in two layers, the core zone of impact defined a 100 meters on both sides of the road center line were all direct impacts occurs, and 7 kilometers on both sides of the road to capture potential induced and cumulative impacts.

141. The ADB Rapid Environmental Assessment Checklist for Roads facilitated the screening and identification of likely impacts attributable to the upgrading of the EWH-Koshi Bridge-EWH. The project road section is classified as Category A mainly due to project siting and its proximity to the special area for protecting biodiversity. Significant adverse impacts may occur along the project road since 9.5 kilometers of the entire road section is located inside the Koshi Tappu Wildlife Reserve Buffer zone, with its nearest point 2 kilometers away from the KTWR Core Area boundary. Adverse impacts include disturbance to wildlife migration during construction phase, and induced migration of people to the buffer zone as a result of improved access which will heighten the wildlife-human conflict already being experienced in the buffer zone.

142. In detail, the REA checklist identified the following impacts:

- Disfiguration of landscape by road embankments on road realignments 13.660 kms new alignment at Patnali Khola-Kharhola Gaun, Kharkhola Gaun-Chatara, Sisuwa Khola, Gideri Khola, Phattepur bypass, Rupnagar bypass, and Kanchanpur bypass
- Encroachment on precious ecology such as sensitive or protected areas.
- Alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction sites. The Siwalik region where the project road is located is prone to erosion due to weakly consolidated layered bedrock.
- Creation of temporary breeding habitats for mosquito vectors of diseases.
- Dislocation or involuntary resettlement of people.
- Accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials and loss of life.
- Increased noise and air pollution resulting from traffic, leading from traffic volume.
- Increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road.
- Social conflicts between locals and migrant workers.
- Risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation.
- Community safety risks due to both accidental and natural causes, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning.

143. The completed REA checklist for this subproject is provided in **Appendix 1**. Appropriate qualitative methods were applied for determining the likely direct and indirect impacts. The impacts have been predicted in terms of their magnitude (i.e. minor, moderate and major), extent (i.e. local, regional, national and trans-boundary) and duration (i.e. short-term, medium-term and long-term) along with their nature (i.e., direct and indirect, reversible and irreversible).

144. Mitigation measures are actions to be taken by DoR in collaboration with important stakeholders such as the contractors, Wildlife reserve officials, local forestry officials and local communities. These measures are aimed at augmenting beneficial impacts and avoiding, reducing or compensating for potential adverse environmental consequences of the project activities. The proposed road improvement activities and mitigation measures also incorporate the outcomes arrived through consultations and discussions with affected people and stakeholders. The anticipated impacts through the proposed improvement activities have been discussed along with the mitigation measures in the sections below.

B. Beneficial Impacts

145. While beneficial impacts expected from the proposed road upgrading are mostly socio-economic in nature there will be some environmental benefits in terms of improved monitoring and stewardship for the KTWR. The key benefits expected are listed below:

- Employment generation, 16,700 unskilled and 5,600[17] skilled laborers throughout the construction period.
- Opportunity for new income generating activities to support the demand of the construction camp in terms of food and services
- Upgrading local labor skills in road construction
- Better access to markets for local products such as paddy, wheat, maize, vegetables, pulses, oilseeds/spices (ginger, garlic), fruits (citrus, jackfruit, banana, mango, pineapple, guava, coconut).
- Improved access to social services
- Better opportunity for tourism development of the KTWR; Bhulke and Ranipokhari (pond of spring water), Baklauri VDC; Mahatgaina, Odraha VDC; Belka Raja-Rani, Mahabharatdanda Chaudandi VDC; Mahakali Devi, Thoksila VDC; and Chatara Haridwar, Maina Maini VDC.
- Capacity building of the local community people on better understanding and awareness on the importance of the wildlife sanctuary, hence better stewardship for KTWR and the wildlife in the project area
- Environmental benefits also include improve management of the KTWR. Through the road upgrading project, key activities proposed in the protected area management plan will be implemented as part of the environmental management plan (EMP), these are: i) establishment of two check posts, forage development inside the core area, and capacity building to select members of the affected communities to become eco-guardians and promote

[17] Data from BOQ for subproject

C. Environmental Impacts during the Pre-Construction Stage

1. Loss of Land and Resettlement

a. Impact

146. During the pre-construction stage all land required for road widening will be acquired. Details of land acquisition requirements and impacts on properties and individual is given in **Table 20** below. The resettlement will result to fragmentation of communities and loss of livelihood opportunity.

Table 20: Summary of EWH-Koshi Bridge-EWH Road Section Resettlement Impacts

Impact	Number
Total land acquisition requirements (hectares)	188.70
Total number of private land units/plots affected	1,837
Total number of private structures affected	1,245
Total number of households affected	1,964
Total number of vulnerable households affected	260
Total number of displaced persons	7,062
Total number of CPR (Religious Structures) affected	6
Total number of Government structures affected	none
Total number of trees affected	1,095

CPR = community property resource
Source: Resettlement Plan, 2012

b. Mitigation

147. All project affected person identified in the census survey, which encompasses all individuals having formal legal rights to the land lost and occupants, regardless of ownership of the land lost are entitled to compensation, assistance and rehabilitation as provided in the approved Entitlement Matrix of the Resettlement Plan (RP). All project affected persons will be given sufficient advance notice and requested to vacate premises and dismantle affected structures prior to project implementation. Details on the affected people and procedures on compensation are provided in the RP prepared for this sub project.

2. Loss of agricultural production

a. Impact

148. A total of 28.59 hectares of agricultural land planted with rice, wheat, maize, and pulse will be permanently converted to support the need for road and embankment widening. The annual loss in production is estimated at 94,742.03 kgs and valued at NRs 2,500,751 in 2011 prices.

b. Mitigation

149. These losses will be compensated for in accordance with the Entitlement Matrix prepared in the RP based on the requirements of the Government of Nepal as well as the ADB SPS 2009.

D. Environmental Impacts during the Construction Stage

1. Ecological Impacts

a. Loss of trees

i. Impact

150. The project road crosses many forested areas. However all these areas are Community Forests and not National Forests or Protected Forests. The community forests that the road passes are the Kalindra, Janjagriti, Agaha, Bhandaritar, Ramailo, Hattisar, Machhapuchhre, Gaurishankar, Ranipandhera Deurali, and Hattisar community forests with an aggregate length of 9.45 kilometers representing 15.43% of the total project length. Based on the field surveys it has been found that approximately 1,095 trees will need to be cleared along the proposed carriage width and shoulders.

ii. Mitigation

151. All trees to be felled will be compensated at a rate of 1:25 and cared for the next 5 years as required by the Ministry of Forest's Working Guideline for the Utilization of Forest Area to Other Use (2006). Before the felling of any trees, prior approval from the jurisdictional CFUG and clearance from the respective District Forestry Officer (DFO) must be obtained. Efforts will be made to further reduce the number of trees required for felling through geometric realignment, during construction survey when ground staking is performed by the Contactor and Engineer. **Table 21** provides an overview of the number of trees and budget required for compensatory afforestation for the entire project including this sub-project. The rates are based on information provided by the Department of Forest. An additional 10% of trees have been included to address issues of low survival rate or plant mortality. Identification of plantation location and types of trees will be carried out by the respective local forestry office or community forestry user group (CFUG) following the payment of the budget for compensatory plantation is made by the DoR. A separate programme will be prepared by the the local forestry department/CFUG to implement the compensatory plantation.

Table 21: Compensatory Plantation Program for SRIP

Project Road	Trees to be Felled	Compensatory Plantation (1:25 + 10%)	Cost (NRs)
Manthali-Ramechhap	400	11,000	990,000
Halesi-Diktel	200	5,500	495,000
Leguwaghat – Bhojpur	25	6,888	61,920
Menchipul – Birtamod	8	220	19,800
EWH-Koshi Bridge-EWH	1,095	30,113	2,701,170
Total	1,728	47,521	4,276,890

EWH = East-West Highway
Source: TPPF, 2012 in consultation with Forester Officials, Department of Forest
Notes:
1. Cost of sampling = NRs30
2. Cost of planting = NRs10
3. Cost of caring for 5 years = NRs50
4. Additional 10% to address plant mortality is common practice by DoF but supported by any regulation or guideline

152. The budget required for felling the trees as well as compensatory afforestation will be borne by DOR. 25% of the afforestation requirement will be met by plantation of fodder trees for

elephants. Hence 25% of the budget be utilized for fodder plantation activities. Further details of fodder plantation is provided in Table 22.

b. Impacts on KTWR and wildlife

153. Approximately 10 to 12 elephants are known to pass through the project area. Conflicting information were gathered on the origin of these wild elephants. Discussions with the KTWR Warden indicated that these elephants, are part of the great migration coming from West Bengal,[18] India or elephants subsisting in the terai forest in and around the KTWR.

154. There are two distinct elephant foraging movement periods, during which the elephants cross the project road under the Gangajali Khola bridge at 62+150 km (appendix 2, photograph 11 & 12). The first is from June to July in time for maize and wheat harvestings, and second from September to November in time for harvesting paddy. During these foraging seasons, 10-12 elephants regularly cross the road from Kamalpur to Odraha to forage outside the KTWR as given in figure 5. These elephants have developed a taste for this type of food, and are regularly raiding the crop fields of the villages in the KTWR Buffer Zone which have resulted to man-elephant conflicts. It has been observed that the elephants have become a regular visitor of these agro-fields of the farmers in the same season every year for eating the same variety of crops.

155. Elephant behavior studies (Singh and Ramesh, 2001) have indicated that any disturbance like road construction and traffic near the feeding ground will distract their movement. Most of the herd will avoid such spots, even at the cost of traveling longer distances to forage elsewhere. Except for the bull who will dare to go to that spot and can cause havoc to road users as depicted in Figure 5-1 which captures an incident that took place on the Haridwar – Dehardun national highway in India. Since the project road lies in between the northwester section of the KTWR and known foraging area, disturbances attributable to the project will be unavoidable.

Figure 4: A Bull Elephant Behavior About to Charge a Vehicle at Haridwar - Dehradun National Highway in India

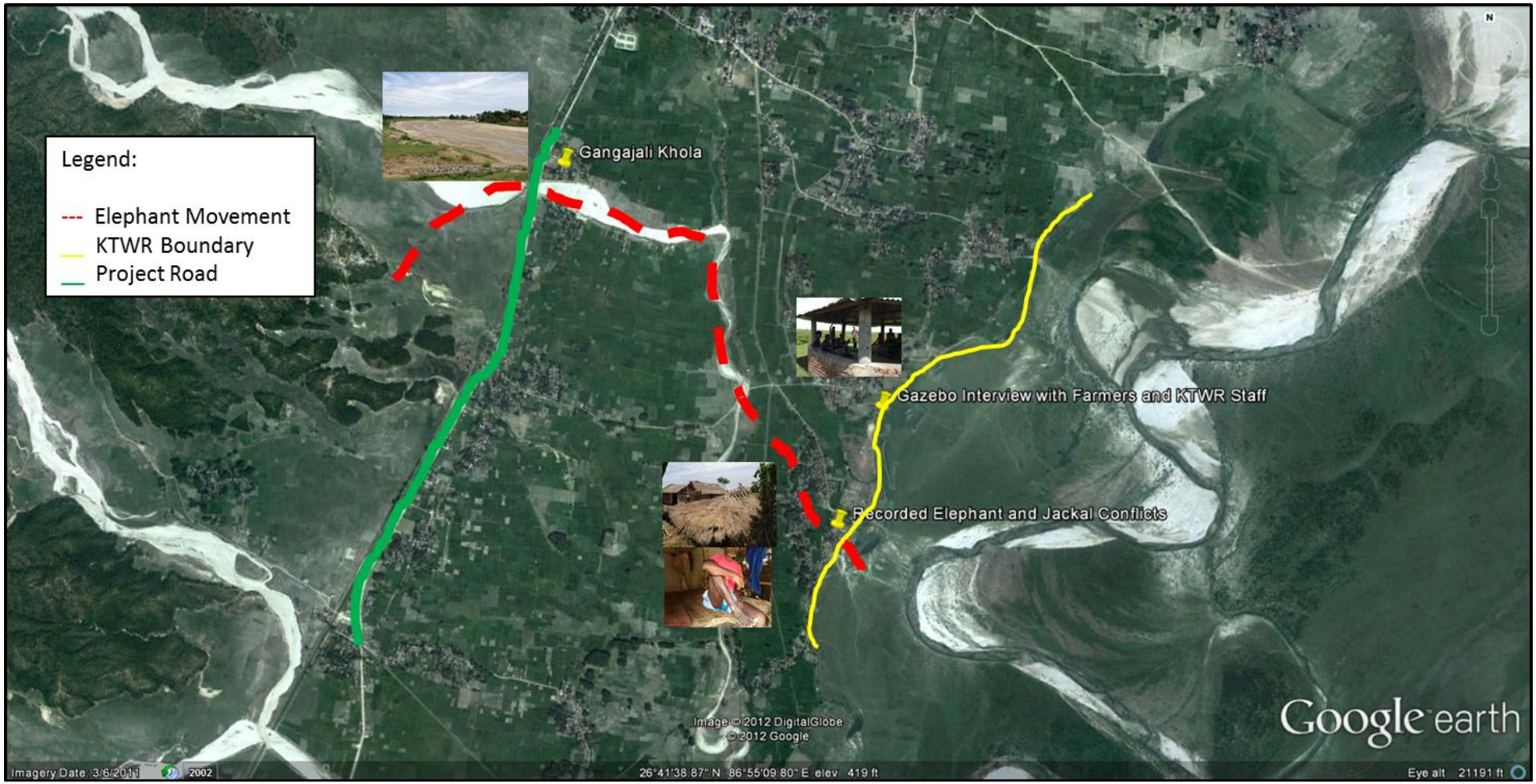
Source: R.Joshi, et.al. 2010

[18] Migration route traces as far as Kalimpong division and Apalchand RF, Baikunthpur, Mahananda Wildlife Reserve, and passing to several reserve forests (Baman Pokhari, Lamagopa, Dhalkajbar, and Tukriajar), eventually entering Nepal in Jhapa.

i. Impact

156. In light of the existence of important wildlife habitat and wildlife species in the project area particularly elephant and wild water buffalo, the project construction activities may impact the wildlife in a number of ways. Noise and vibration from operation of equipments and other construction activities will directly affect the wildlife through disturbances which may cause the animals to shy away from the project construction area. The construction workers may get tempted hunt or poach and extract other resources from the forested areas unlawfully. All these kind of activities and disturbances may prevent the wildlife from following their normal feeding and migrating activities in and around the project area particularly in the section that passes through the buffer zone of KTWR.

Figure 5: Wild Asian Elephant Movement Across the KTWR Buffer Zone and Project Road



Source: TPPF, 2012

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157. Since the project only entails uprading of an existing road inside the buffer zone, there are no foreseabe impacts on the waterfowls that takes refuge inside the KTWR. The land use within 100-meter strip along the the project road inside the buffer zone is dominantly residential and agricultural. No conversion of wetland will be required in the road upgrading within the buffer zone.

ii. Mitigation

158. To minimize disturbances to the wildlife and at the same time ensure timely progress of construction activities a number of measures as given below will be taken by the contractor.

- No construction camps or staging camps including temporary storage will be allowed inside the KTWR-Buffer Zone which is located from km 53+025 to 56+500 and km 62+150 to 68+200.
- No materials will be sourced inside the KTWR Zone. This includes earth borrowing, quarrying, and 3rd party supplier.
- All works will be suspended between sunset and sunrise throughout the length of the project road
- Works will also be suspended 500m on either side of the Gangajali khola bridge (km 62+150) which is a known elephant crossing area during migration season of Asian Elephants. The migration seasons being June to July and September to November.
- Harvesting of flora and fauna in the project area will be strictly prohibited and included as a condition in the agreement with the contractor
- Speed brakes in terms of temporary barriers and sign boards will be installed to advice motorist of incoming hazards and to reduce vehicle speed at most 40km/hr
- Installation and operation of the wildlife checkposts to be located at both ends of project road and KTWR Buffer Zone intersections to monitor wildlife movement and strictly enforce the EMP provisions
- Blowing of vehicle horn in the buffer zone will be restricted. This will be enforced through installation of appropriate sign boards.

159. Starting September to November 2012 harvest season, the DOR has deployed District staff coordinate with the KTWR Warden and Buffer Zone Management Council in monitoring elephant and other wildlife movements until project completion. This will allow the gathering of up-to-date information which will guide the CSC and contractor site adapt the engineering designs.

2. Impact on Physical Environment

a. Air Emissions

i. Impacts

160. The potential sources of air pollution during the construction phase include: dust from earth works; emissions from the operation of construction equipment and machines; unpaved road travel, materials storage hauling, fuel combustion, and cooking and waste incineration inside labor camps.

ii. Mitigation

161. Short-term direct impacts of fugitive dust emissions from materials storage, hauling and unpaved road travel will be mitigated through: i) vehicle restriction in terms of speed, weight,

haul cover, and number; ii) surface improvement by adding gravel or slag on dirt road; and iii) surface treatment like watering to suppress dust. Emissions from storage and quarry areas[19] will be controlled through wind speed reduction by installing wind breaks or covering, and water suppression will be implemented.

162. Emissions from construction equipment such as hot mix plants, stone crushers, diesel generators, haul trucks, pavers, graders, and rollers will be managed through regulatory compliance to emission standards and proper operation and maintenance. All hot mix and stone crushers will be located at least 1 kilometer from the nearest community and necessary permits and clearance secured prior to operation. All diesel generation sets will be fitted with stacks observing good engineering practice where height of stack = height of the nearest building + 0.2 √ KVA (Kilo-Volt-Ampere)[20].

163. No firewood for cooking and heating bitumen, and incineration of wastes will be allowed by the Contractor.

164. Air quality monitoring will be implemented by the Contractor and Engineer to ensure compliance to ambient air emission standards are maintained. The Contractors will monitor air quality within the construction camps and active road construction fronts, while the Engineer will monitor in settlement areas, as provided in the Monitoring Plan.

b. Noise Level

i. Impacts

165. During the construction stage, ambient noise will increase temporarily and intermittently in the close vicinity of active construction fronts and camps. These 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.

ii. Mitigation

166. Noise during construction phase will be mitigated through the following: i) siting noise sources away from the communities and sensitive ecosystems, the construction camp including all plants will be located at least 1 kilometer away from the communities; ii) timing of construction activities only between 7 am to 6 pm to avoid disturbance to nearby communities at night; iii) installation of acoustic barriers[21] to confine equipment near sensitive sites like schools, hospitals, government offices, and inside the KTWR buffer zone along active construction fronts. All construction workers exposed to elevated noise will be provided ear plugs and muffs exposure limited to no more than 8 hours at greater than 85 dB.

167. Similarly air quality monitoring will be implemented by the Contractor and Engineer to ensure compliance to noise standards. The Contractors will conduct monitoring within the construction camps and active road construction fronts, while the Engineer will do the monitoring in settlement areas, as provided in the Monitoring Plan.

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[19] Construction materials will be sourced from the rivers and Kholas namely, Patnali Khola, Seti Khola, Gideri Khola

[20] In the absence of a specific regulation in Nepal, this requirement is taken from the requirement of the Government of India, Central Pollution Control Board (CPCB) New Delhi, Emission Regulations, Part IV, Comprehensive Industry Document Series (COINDS)/26/1986-87.

[21] Without gap of material having surface density of at least 10 kg/m2 (World Bank, 2007)

c. Vibration

i. Impacts

168. Blasting is not necessary for the construction of the road. However, there is likelihood human discomfort and damage to infrastructures (crack formation) due to the vibration caused by concrete breaking excavators and asphalt rotomills used to lift the existing road surface, rollers and compactors used to resurface the existing road, and truck movements.

ii. Mitigation

169. Mitigation measure to avoid discomfort is the timing of activities to avoid sensitive periods. If structural damage is observed, the Contractor will modify construction equipment or the construction method.

d. Loss of Productive Soil and Agricultural Lands

i. Impact

170. The conversion of agricultural land to allow the proposed road widening and soil borrowing for embankment formation will lead to loss in productive agricultural soil during the construction.

ii. Mitigation

171. To minimize this impact, top soil (0-25 cm) from the productive land will be collected and stored for reuse as final dressing of embankment turfing or given back to the farmers upon request.

e. Landslide and Soil Erosion

i. Impact

172. With a portion of the road located in erosion-prone Siwaliks, minor slides and slope failures were noted at the following locations: ch 25+500-25+550, 26+730-26+750, 27+220-27+250 and 28+400-28+440.

ii. Mitigation

173. Slope protection through road undercutting at the basal part, trimming/scaling of loose materials, surface water management, including protection and management of upper catchments will be made during construction phase. Only required vegetation will be cleared and eroded bare slopes will be re-vegetated. Disposal of spoils and debris on the valley side will be strictly prohibited.

f. Borrow Pits and Quarry Sites

i. Impact

174. Patnali Khola, Koshi River, Seti Khola, Gideri Khola, and Kali Khola along the road alignment contain abundant soils, stones, sand and gravels can be quarried from several location in rivers beds without developing large size, borrow pits and quarry sites. Soil erosion may arise if borrow area are not stabilized/restored properly.

ii. Mitigation

175. The development of borrow pits and quarry sites will be governed by the following:

- Only wastelands will be used for borrowing and outside protected and forest areas, settlements, and water sources.
- Approval from authorities of government and landowners will be taken.
- Suitable size of borrow pits and quarry sites will be operated as per required volume of materials.
- Top soil will be stockpiled and preserved for the re-instatement of the site or used in the road embankment turfing.

Monitoring of borrow pits and quarry sites is given in **Appendix 5**.

g. Soil Contamination and Compaction

i. Impacts

176. During construction phase, several project activities pose risk of loss or impairment of productive agricultural lands. Soil may get contaminated from handling of construction materials such as stones, sand, gravels, bitumen, fuel, lubricants, paints, and disposal of solid and sewage. Soil compaction may take place in haulage roads, labor camps and workshop areas due to movement of construction vehicles, machineries and equipment.

ii. Mitigation

177. To avoid this impact, an Environmental Management Action Plan (EMAP) that further details the EMP will be prepared and submitted by the Contractor no later than 30 days after the Notice to Proceed (NTP) for review and approval of the Engineer. The location, layout, and operation guidelines of construction camps, haulage roads, workshop and storage area for different materials will provide in the EMAP. Detailed guidelines on materials handling will include:

- The storage area will be paved with gentle slope to a corner and connected with a chamber to collect or recover any oil spills.
- All efforts will be made to avoid and minimize the solid and liquid wastes generation. Unavoidable solid and liquid wastes will be stored at designated places prior to disposal.
- To avoid soil contamination at the wash-down and re-fuelling areas, “oil interceptors” will be provided.
- Oil and grease spill and oil soaked materials will be collected and stored in labeled containers (Labeled: WASTE OIL and hazardous sign be displayed).
- Restrict movement of construction vehicles, machinery and equipment in the designated haulage route.
- Efforts will be made to design approach roads through the waste/barren land and rocky area to reduce the compaction induced impact on soil.
- Farm land will be restored after the completion of road improvement activity.
- Temporary latrine pits will be provided in the construction camps and will be restored after the completion of activity.

- Solid waste generated from construction camp will be segregated into biodegradable and non-biodegradable wastes. The non-biodegradable and recyclable waste will be sold off. Efforts will be made to compost biodegradable wastes in small size compost pits by the Contractor.

h. Siltation and Contamination of Rivers

i. Impacts

178. Particularly during bridge construction, siltation from construction spoils and water contamination from oil spills may occur which could impair the beneficial use of the receiving rivers. Water bodies near construction camp are at risk of contamination from the disposal of sewage, solid waste, and construction material spills.

ii. Mitigations

179. Mitigation measures to be implemented by the Contractor are:

- Prohibit disposal of excavated spoils and debris into river water.
- Bridge construction activities including pile driving will not be undertaken during monsoon season (June- September).
- All chemicals and oil will be stored away from water and concreted platform with catchments pits for spills collection.
- Arrange training program to all equipment operators, drivers, and warehouse personnel on immediate response for spill contamination and eventual cleanup. Further, emergency procedures and reports preferably written in easy to understand local dialect will be distributed to the equipment operators, drivers and warehouse personnel.
- Silt fencing and/or brush barrier will be installed for collecting sediments. Collected silt/sediment will be stockpiled for possible reuse.
- All wastes arising from the construction sites will be disposed in an environmentally accepted manner. Wastes will be collected, treated (e.g. sewage through septic tank) or stored (e.g. waste oil, lubricants, and paints) prior to disposal or transported to the approved disposal sites.
- No vehicle or equipment will be washed, parked or refueled near river water
    - All labor camps will be located at least 500 meters from rivers and to the extent possible laborers will be locally recruited to avoid large camps.
- Sewage from labor camps will be treated through septic tanks. No untreated sanitary wastewater will be discharged into the river water.

180. All impacted rivers will be monitored monthly during the active construction activity occurring in its reach. Upstream and downstream water quality parameters will be collected to determine the effectiveness of mitigation measures.

i. Hydrology and Drainage

i. Impact

181. Potential impacts hydrology and drainage are attributed to the risk of increasing sedimentation and siltation of waterways during construction phase.

ii. Mitigation

182. Existing natural drainage system, including irrigation channels will not be disturbed. Causeways will be provided in each perennial and seasonal streams as well as rivulets. In addition, adequate cross drainage structures will be provided to facilitate natural flow of water across road embankment. New bridge sites are selected because of the geologically stability and elevation to minimize risk of slope failure and bank cutting problem.

j. Construction Spoils/Waste

i. Impacts

183. Road construction generates substantial amount of waste which includes demolition debris, earth spoils, municipal waste and sewage from camps, fuels and lubricants, and rejected construction materials like bitumen, sand, gravel, and cement. These wastes post hazard to human health and safety.

ii. Mitigation

184. As a component of the Environmental Management Action Plan, the contractor will provide details of monthly estimated amounts of waste by type, type of collection, treatment, and disposal.

3. Socio Economic Impacts

a. Occupational Health and Safety

i. Impacts

185. Road construction exposes workers to various physical hazards that may result to minor, disabling, catastrophic, or fatal injuries. Working close to rotating and moving equipment like hot mix plant operation, materials handling, motor pool repairs/machining and the like create trap hazards putting extremities at risk. Exposure to loud noise can cause temporary or permanent hearing impairment. Hand-arm vibration, electrical, welding/works, and working close to moving vehicles also expose workers to injuries.

ii. Mitigation

186. Employers are required to implement precautions to protect the health and safety of workers. **Appendix 6** presents the “Work Safety in Common Operation and Construction” to be implemented by the Contactor.

b. Hygiene in the Construction Camp

i. Impact

187. With the bias towards locally sourced labor, the construction camp required by the project is expected to be small, with less than 150 individuals staying at any single time. However, experience has shown that a poorly managed construction camp becomes hazardous to its tenants. Poor hygiene in waste handling, food preparation, and sleeping quarters expose workers to vector-borne diseases.

ii. Mitigation Measure

188. Consistent with the FIDIC requirements, the Contractor is responsible for: i) providing electricity, gas and water to the construction camp, ii) health and safety of personnel, in collaboration with local health officials, will ensure that medical staff, first aid facilities, sick bay and ambulance service are available at all times, iii) conduct STI, STD and HIV-AIDS awareness program, iv) providing sufficient supply of suitable food and water, and iv) take necessary precautions to protect personnel from insect and pest nuisance to reduce their danger to health.

189. The contractor will appoint in writing a safety officer no later than 30 calendar days after the issuance of Notice to Proceed. The safety officer will maintain records concerning health, safety and welfare, and damage to properties on monthly basis to form part of the semi-annual environmental monitoring report to ADB.

c. Impacts on Community Health and Safety

i. Impacts

190. These impacts pertain to those that take place outside the project boundaries, in this case the ROW and campsite, but are related to road construction and operation. Impacts on water quantity, and air and water qualities were discussed in other sections. Other impact on community health and safety related to road construction pertains to road crashes, structural safety, transport of hazardous materials, communicable and vector borne diseases, and emergency preparedness in case or road failures such as slides and flooding rendering villages inaccessible. Accident risks associated with increase in vehicular traffic, leading to accidental spills of toxic materials is magnified during construction.

ii. Mitigations

191. Risk of road crashes will increase during construction when a construction related and transport vehicles, and workers are co-located along restricted construction fronts. During construction phase, the projected increase in the number of motorized road users traveling at higher speeds also increases the chances of injuries and fatalities from road crashes. To mitigate these risks, the contactor needs to adopt safety measures for workers and road users particularly those that are more vulnerable to crashes. Contractors need to emphasize safety among drivers; ensuring drivers have adequate skills, avoiding dangerous routes and times of day to reduce chances of crashes, speed control devices, and regular maintenance of vehicles to avoid premature failure. The address the risk cause by increase in traffic, the Contractor will: i) minimize pedestrian interaction with construction vehicles, ii) install signage, visibility and overall road safety particularly near schools or where children are present, iii) coordinate with local emergency groups on location of active construction fronts to facilitate appropriate first aide, iv) use of local materials to the extent possible to reduce hauling distance, v) employ flag person to warn dangerous conditions.

192. Contractor's or its third party suppliers of fuel, lubricants, and bitumen will be required to demonstrate proofs of capability to handle spills to include: i) proper labeling of container content, hazards, and operator's contact details; ii) ensure the integrity of the packaging/containers and transport vehicle are commensurate to the hazardous material; iv) drivers and assistants are trained on transport and emergency procedures; v) operator has the means to respond to emergencies on a 24 hour basis.

193. The construction camps pose risk of communicable and vector-borne diseases not only among its workers but to the host communities through poor camp sanitation and living

conditions, migrant workers might carry sexually-transmitted diseases such as HIV/AIDS. The Contractor will undertake health awareness and education through information and promoting individual protection. The Contractor will link with existing state and national health programs on STDs, HIV/AIDS, and immunization. Contractors will cause the provision of treatment of communicable diseases in community health care facilities, access to medical treatment, confidentiality particularly with respect to migrant workers. The Contractor, will implement mosquito, rodent, and arthropod-borne diseases control that will have the following components: i) prevention of propagation by eliminating all breeding habitats close to the camps, ii) elimination of all unusable impounded water; iii) increase water velocity in channels near camps; iv) judicious use of insecticides on building walls; v) promoting the use of mosquito nets; vi) monitoring and treatment of diseases and collaboration with health officials, vii) distribute educational materials among workers and host communities, and viii) proper handling and use of insecticides to minimize human exposure and spills.

194. Roads and bridges failures due to inadequate designs may cause injuries to community and other road users. This risk is mitigated through the compliance with appropriate engineering design standards by the design engineers and review and approval of engineering plans by the PWD. All new bridge constructions were designed to cope with a 100 year return period and withstand earthquakes usually experience I Seismic Zone 5.

E. Environmental Impacts during Operation Stage

1. Ecological Impacts

i. Impacts

195. Adverse impacts on wildlife and KTWR is expected mainly during operation of the project road. More than the short term impacts during construction, it is the long term impacts that are a bigger concern and the main reason that warranted this subproject to be categorized as A. As discussed in earlier sections the project has been identified to potentially threaten continued existence and movement of the Asian Elephant in the project area by contributing to enhanced emigration of private land owners to the project area through improved access brought about by the project. Improved access and potentially increased emigration to the buffer zone will magnify the already existing human-wildlife conflict involving other protected species such as wild water buffalo, deer, wild pig, monkey, common leopard, bear, jackal, hare, and common mongoose.

ii. Mitigation

196. In the light of the adverse impacts anticipated and threats to KTWR which also holds the last population of wild water buffalo in the terai of Nepal, several consultations were carried out with the local communities, KTWR management, KTWR-BZ management as well as DOR to develop mitigation measures that will contribute to protection of the KTWR as well as benefit the local communities. While the anticipated impacts are long term and will potentially take place during the operation stage, measures for mitigating and minimizing the impacts will need to be taken during the project construction stage.

197. A fourfold approach will be adopted to avoid degradation of the KTWR and further reduction in the number of endangered species. The approach strives to facilitate elephant movement across the project road, enhance monitoring in the project area through establishment of checkposts, improve wildlife habitat through fodder plantation and build the capacity of the local community people to make them better stewards of the KTWR and the wildlife in the project area. Details of each approach and respective measures are provided in the sections below.

1) Facilitate movement of elephants across the Gangajali Khola Bridge area

198. To confine the movement under the bridge and not pose hazard to both road user and wildlife, the following measures were integrated in the bridge design:

- Establishment elephant fodder[22] should be planted along establish elephant path ways/corridors to attract and confine their movement
- Ensure riverbed will have flatbed along torrent
- warning signs at 300m, 200m, 100m, and 50m of impending elephant crossing and to slow down

2) Establishment of Check posts

199. In coordination with the KTWR Management, two check posts will be established inside the project road stretch running inside the KTWR buffer zone at chainage 56+500 km and 68+200 km. The main purposed of the checkposts will be to enforce traffic controls, monitor wildlife movement, deter poaching, and respond to emergency situations like road crashes particularly involving wildlife. Land, measuring at least 500 square meters for each check posts will be donated by the KTWR while the cost of construction and initial operation during construction phase is borne by DOR under the project. These checkposts will be manned and operated by eco-guardians as discussed below under section iv). Each post will have the following features and amenities:

- Single-storey structure to act as command post and inspection room to accommodate five persons with solar panels, flood/search lights, overhead tanks, and road barriers
- Mobile phones to allow communication with the KTWR
- Two units motorbike
- Two computers and 1 printer

3) KTWR Habitat Enhancement

200. To serve as a social fence and facilitate movement of wild animals, particularly Asian Elephant, the DOR will coordinate with the KTWR and community to establish fodder areas at strategic locations within the KTWR. As discussed under section D.1.b, through the project, 25% of the total compensatory plantation required under the Forest Act equivalent to 11,880 trees will be diverted for this purpose. The DOR will coordinate with the Departments of Forest and National Parks and Wildlife and User Groups to craft a memorandum of agreement to establish and maintain these forage areas for a period of 5 years. The plant varieties, number, and locations will be determine with the KTWR to conform to the KTWR Management Plan. Details of the budget plan for implementing this are given in **Table 22** below.

[22] *Mallotus philippensis*, *Ehretia laevis*, *Bridelia retusa*, *Ziziphus xylopirus*, *Acacia catechu*, *Ougeinia oojenensis*, and *Lannea coromandelica*

Table 22: Cost of Establishing Fodder Inside the KTWR

Cost Item (for 11,880 nos)	Unit Cost (NR)	Total Cost (NR)
Cost of sapling	30	356,400
Cost of planting	10	118,800
Care for 5 years	50	594,000
Total		1,069,200

Source: TPPF Metings with DOF, 2012
Notes: 1. Cost of sampling = NRs30
2. Cost of planting = NRs10
3. Cost of caring for 5 years = NRs50
4. Additional 10% to address plant mortality is common practice by DoF but supported by any regulation or guideline

4) Capacity building of local communities

201. As part of the Gender Action Plan and consistent with the KTWR Management Plan,[23] 25 individuals from Dharampur, East Pipra, Ghoghanpur, Kamalpur, and Tapeshwari will be trained to become eco-guardians and become partners in the protection of KTWR. The DOR, through an NGO will partner with the KTWR to launch this capability program. Training modules will include, but not be limited to the following core subjects: cultural history, environmental advocacy, leave no trace awareness, nature conservation, the art and science of guiding, and modules on habitats of the KTWR. The course will be administered for 3 months using lecture and field exercises. Certificates of completion will be issued to participants successfully completing the program. In turn, the KTWR will issue a circular that no tourist will be allowed inside the park without being accompanied by a certified eco-guardians and fees to be paid for their services. As counterpart, the eco-guardians will invest time and effort to help operate the check points and join routine boundary surveillance of KTWR. Currently tourists either move around freely in the KTWR and buffer zone area or at the most are escorted by a guide from nearby cities such as Kathmandu. **Table 23** provides the budget overview for the capacity building activities which will be borne by the project.

Table 23: Estimated Cost of Implementing Eco-Tourism Capacity Building

Cost Item	Unit Cost	Total Cost
Capability building NGO to prepare training materials and administer program (3 individual x 6 months)	US$2,000/man-month	36,000.00
Training cost (25 individuals x 45 days spread in 3 months)	US$10/day-person	11,250.00
Training materials and brochures	Lumpsum	12,750.00
Total		**60,000.00**

NGO = nongovernment organization.
Source: TPPF, 2012

[23] Such kind of training program for the local community people is already included in the KTWR Management Plan but has not been implemented so far due to budget constraints.

2. Impacts on Physical Environment

i. Impacts

202. Impacts during the operation phase decreases dramatically in number and scale, and shift towards road safety. However, after construction the DoR's control over activities occurring on the road is also limited. Impacts expected to occur are deterioration of air quality from increase emissions from increase in traffic, risk of structural damage from increase in vibration, improve accessibility will increase the need to convert lands into built-area resulting loss in agricultural lands and congestion, deterioration of receiving water quality from oil laden runoff, and increase in road crashes.

ii. Mitigations

203. During the project operation phase, the DoR has limited control over the road users and can only implement activities that will influence vehicle owners in controlling emissions. These activities include coordination with relevant agencies on the implementation of the Nepal Vehicle Mass Emission Standard, 2056 (2000)[24], provision of informatory road signs reminding the motorist to properly maintain their vehicles to economize on fuel consumption and protect the environment; and support development organizations (NGO, INGO and CBOs) to motivate the local communities to maintain greenery in the project area.

204. The principal noise sources are motor vehicle engines, exhaust, and tire to pavement contact particularly at speeds greater than 90 kph. This will be mitigated through: i) vegetation noise barriers as a component of compensatory afforestation; and ii) speed brakes near community areas and inside the KTWR Buffer Zone.

205. Increase in vibration due to the plying of heavy buses and trucks may damage the infrastructure. The DOR will coordinate with the MoPPW to monitor truck loads as per Nepal Road Standard, 2027 B.S. (First Revision 2045 B.S.) and drivers will be made aware about the capacity of the road and bridges, and their consequences through signage.

206. To address this uncontrolled ribbon development along the project road, the DOR will encourage VDCs to prepare and implement their respective development plans[25]. Also, the DOR will strictly implement its policy of 25 m ROW protection in the Highway[26].

207. The DOR will implement its Length-Persons system wherein identified staff are made responsible for routine and recurrent maintenance of roads like cleaning up drains, soil deposited on the roads due to slope failure and erosion to maintain and sustain access.

208. During project operation phase, water quality deterioration may occur from oil-contaminated runoff however this is considered minimal owing to the low expected traffic volume.

209. The risk cause by increase in traffic to communities will be addressed early in the when road safety furniture have been integrate in the overall road design.

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[24] This standard is similar to the European Standard, popularly known as the EURO-1 standard.

[25] Item 64, Chapter 7 of the Local Self Governance Regulation, 2056 (1999)

[26] According to the MPPW, Environment and Social Management Framework (ESMF), the standard ROW of highway in Nepal is 25 m on either side from the centreline of the road.

F. Induced and Cumulative Impacts

210. The main purpose of the proposed subproject is to provide an alternate route and ensure proper and continued connectivity between the eastern and western side of the Koshi river to facilitate development on the western side. The Koshi barrage has a history of breaching ever since it was established in 1950. The most recent breach event occurred in 2008. This caused catastrophic damage to the river basin area including the EWH and it took up to eight months to repair the EWH.

211. Existing conditions on the proposed road are poor making travel difficult and time consuming. Therefore in the quest to enhance connectivity between the eastern and western side of the Koshi river, communities along the proposed road will also benefit.

212. In the 9.5 km section falling inside the KTWR buffer zone serious issues of human – wildlife conflict exist as elaborated in Chapter IV and Appendix 2. With the onset of development in the project area initiated with the construction of the Koshi barrage in 1950, there has been a rapid degradation of habitat and wildlife species.

213. There are no other significant development projects or activities going on or planned for in the near future within the project area which is largely agriculture based. The ongoing construction of the Chatara bridge (also with ADB financing) which is located at km 23+250 at the middle of the proposed road will have short term and long term impacts similar to that of the road. Given this situation cumulative impacts of the project together with other activities or development projects in the project area is non-existent or insignificant.

214. However, improvement of the road will certainly induce development in the project area. Better road conditions, easier travel and continuous connectivity between the eastern and western side of the Koshi river will improve access and connectivity throughout the project area. This could enhance more trade of agricultural products and bring in new development projects on agriculture, industries, health, education, tourism etc. There is huge potential for further growth of tourism in the project area due to the existence of a number of important religious sites and the KTWR. One of immediate impacts of improved access is an increase in land prices. All these changes and development can encourage people from urban centers or other areas to migrate or move back into the project area.

215. While these developments induced by the project road will bring great socio-economic benefits for the road users and local communities, there can be many negative impacts on the environment. More vehicles travelling on the road can bring about more problems of noise and air pollution. Road safety will become a bigger concern. Mitigation measures to address these problems will be implemented through improvement in design, coordination with regulatory authorities, raising awareness on road safety and better vehicle management etc. as given in section 5.E.2.

216. The most environmentally sensitive area on the project road is undoubtedly the 9.5 km stretch that passes through the KTWR buffer zone. It is this zone that is most vulnerable to further degradation in biodiversity as a result of the induced developments from the improved road. Improved access to the buffer zone can bring uncontrolled extraction of natural resources, poaching and overall more disturbances to the wildlife in the area. As discussed in section 5.E.1, a variety of activities targeted at facilitating wildlife existence as well as capacity building of the local communities are proposed to avoid potential induced long term impacts. As a result while the project will potentially bring about negative impacts on the biodiversity, it also serves as an opportunity to improve management and monitoring activities targeted at conserving the critical habitat in the buffer zone as well as the core zones of KTWR. It must also be noted that without the project it would not be possible to take these conservation related initiatives and problems of human-wildlife conflict and degrading habitat would continue unchecked.

VII. ANALYSIS OF ALTERNATIVES

217. Two levels of alternatives were explored in this section, the first level involves the "with" and "without" project alternatives examination and the second level evaluates further alignment options within the "with" project alternative.

A. "With" and "Without Project Analysis

Table 24: Financial, Technical, Economic, Social, and Environmental Implications

Alternative	Financial	Technical	Economic	Social	Environmental
Without Project	No investment cost but higher maintenance and repair costs particularly after flood events. Benefits from the on-ongoing ADB-assisted Emergency Flood Damage Rehabilitation Project – Koshi Bridge (Chatara) construction will not be realized.	Technical complexity of maintaining the existing EWH is much easier and the existing institutions are already in place.	The cost of inaccessibility to Saptari and Sunsari districts immediately after flooding is tremendous in terms of delays in mobilizing relief and transporting injured. Cost of longer route to transport products to markets in case EWH inundation.	No displacement in terms of road development but communities are more vulnerable to flood and less capable to cope up due to inaccessibility of the EWH	Ongoing situation of human-wildlife conflict and poor understanding and ownership of the KTWR and important wildlife will continue. Potential for long term emigration of people to the project area will be negligible without the improved road.
With Project	Large investment cost.	Most of the road alignment exists except areas prone to flooding and flood prone areas were bypassed and new roads leading to new bridges. Technical experts, not necessarily available in the DOR, must be engage to design and construct the road and bridges.	Continuous and reliable connectivity with eastern region ensures economic activities are not displaced during and after flood event. However, the transportation cost is higher as the project route is 25 kms longer than existing routes.	Resettlement of people and structures falling within the ROW.	There maybe short term increased disturbance to wildlife during construction. Measures on fodder plantation, local capacity building, enhanced monitoring and improvement in local stewardship for KTWR and wildlife that will be introduced through the project will help to address the current human – wildlife conflict and perhaps improve the situation.

DOR = Department of Road, EWH = East-West Highway, ROW = right-of-way.
Source: Final Report, RCP (2010)

B. Alignment Options Considered During Feasibility Stage of EWH

218. During the project feasibility stage, several alternative routes were evaluated to connect both sides of the Koshi River through the Koshi Bridge in Chatara which is being constructed with ADB assistance. **Figures 6 and 7** depict the alternatives considered for the eastern and western sections of the project road that bears environmental significance while **Table 25:** describes these alternatives and preferred options.

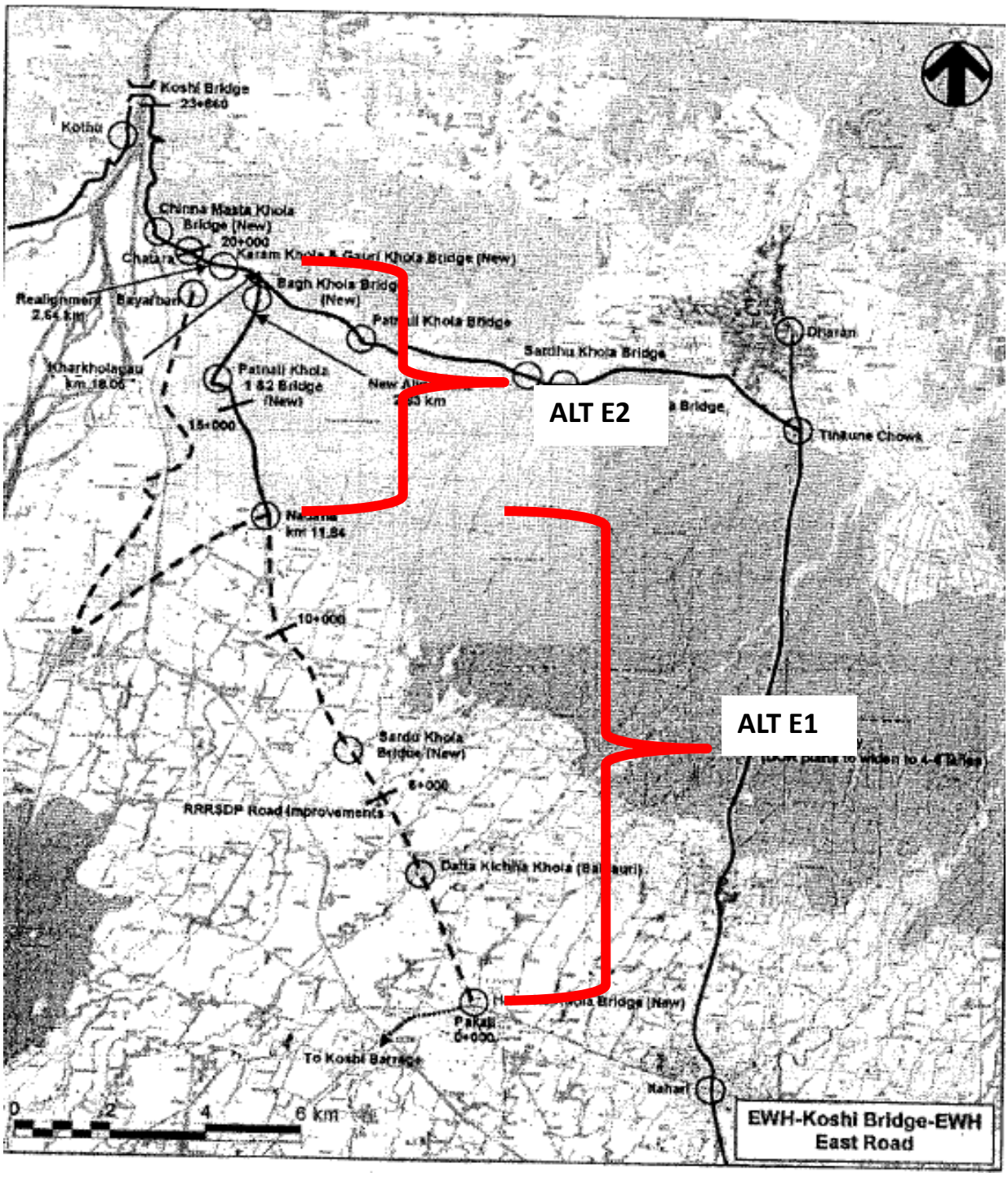
Table 25: Alignment Alternatives with Environmental Implications Considered in the Project Road

Code	Alternative	Issues	Preferred Alternative
	Alternative Alignments Considered in the East Road		
ALT E1	Widening of the Pakali-Nadaha Road	Road section already upgraded under the ADB Rural Rehabilitation and Reconstruction Sector Development Project (RRRSDP) to a single lane sealed standard.	Project starting point shifted from chainage 0+000km in Pakali to Nadaha at 11+840 kms
ALT E2	Construction of new alignment between Nadaha and Kharkholagaun through forest area to avoid Puarbas and Bayarban settlements.	Resettlement cost outweighs the environmental cost of constructing new road through forestland.	New road alignment from Patnali Khols to Gauri Khola Bridge passing through Kharkholagaun dense mixed forest.
	Alternative Alignments Considered in the West Road		
ALT W1	New alignment between Kothu and Ambasi offers a shorter route but will pass through forest and flood prone areas.	The existing alignment between Koshi Bridge-Phattepur-Kanchanpur was adopted with minor realignments on areas where new bridges will be constructed that includes Sisuwa Khola and Gideri Khola, and Kali Khola (ch 48+103 to 51+000). More specifically, realignment of the road is proposed on high terrace from the left side of Kali Khola, which will require a single bridge crossing with a span about 25 m. The length of proposed realignment will be about 2.85 km. A minor realignment is also proposed below Belkha and before entering into Kali Khola valley to avoid crisscrossing of one of its tributaries.	New alignment was not pursued. Minor alignments to connect to new bridges and locate roads on more stable grounds were preferred.
ALT W2	Ambasi Chowk to Siddhipur (Phattepur) (Ch. 56+000 to 58+657).	From Ambasi Chowk, two alternatives to approach to the proposed new bridge crossing of Trijuga River were explored. Alternative 1 will follow about 0.6 km of existing road from Ambasi to Bhalmanti/Purandaha and then take a new alignment towards the bridge which is about 2.1 kms away. Alternative 2 also takes the existing alignment but further towards the Trijuga Bridge and then take a shorter new alignment of about 1.57 km. In both cases the alignment will pass through cultivated land, river valley and settlements for new bridge crossing of Trijuga River and bypass for Phattepur	Building of the new Trijuga bridge was not taken under this Project. Improvement of existing alignment was adopted.
ALT W3	Kanchanpur bypass	Alternatives where the proposed road will intersect the existing EWH in Kanchanpur were investigated to minimize impacts to Kanchapur area which is heavily settled. Alternative 1: Banara Bridge –Rupnagar (EWH), (Ch. 68+000 to 70+864) new alignment takes-off from the right side of Phattepur-Kanchanpur, about 100 m after Banara Bridge. The proposed route will pass through cultivated lands, Chandra Canal, having flat to gentle rolling terrain, encompass about 0.275	Alternative 1 was selected with less resettlement requirement.

Code	Alternative	Issues	Preferred Alternative
		km of existing unsealed road before ending at EWH and some 2.6 km west of Kanchanpur junction at EWH. The 2nd alternative: Kanchanpur –EWH, (Ch. 69+775 to 70+864) is a 1.85km new alignment which will by-pass Kanchanpur Bazaar, avoiding the narrow and crowded section which will minimize resettlement and environment costs. This route will cross cultivated lands, some settlements and barren lands. About 75% of the alignment runs parallel to the Chandra main canal. The proposed alignment will meet EWH, about 0.7 km west of existing Kanchanpur junction	

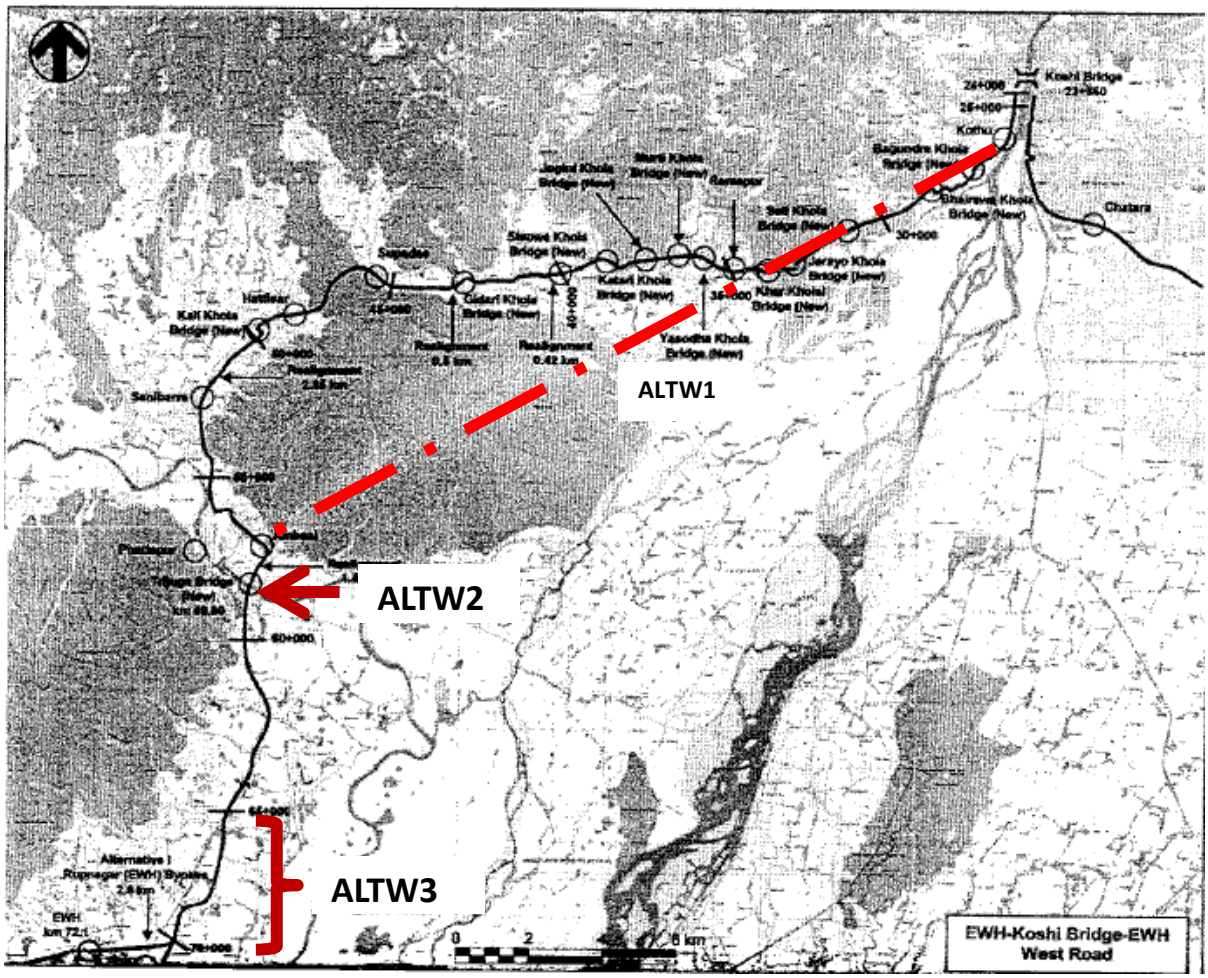
ALT = alternative, ch = chainage, EWH = East-West Highway.
Source: TPPF, 2012

Figure 6: Alignment Alteratives Considered for the East Section of the EWH (Nadaha) - Koshi Bridge (Chatara) –EWH Road Upgrading



ALT = alternative, ch = chainage, EWH = East-West Highway.
Source: TPPF, 2012

Figure 7: Alignment Alteratives Considered for theWest Section of the EWH (Nadaha) - Koshi Bridge (Chatara)–EWH Road Upgrading



ALT = alternative, ch = chainage, EWH = East-West Highway.
Source: TPPF, 2012

VIII. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Consultation Method and Information Disclosed

219. As required for Category A projects, consultations were conducted at the early stage of EIA preparation (July, 2010), mostly involving local communities and organizations. Successive consultations are being conducted by the DoR after the initial drafting of this report which included representatives of local communities and national entities tasked with the regulation of the road development and environmental protection. These consultations were also undertaken in compliance with the GoN environmental policies and rules and in coordination with relevant institutions described in Chapter 3.

B. Consultations Highlights

220. The table below depicts the type, methods and general outcome of the consultations made early in the project development. A total of 76 individuals participated in organized workshops from the project districts of Kamalpur, Sunsari, and Udayapur.

Table 26: Distribution of Participants in the Consultations

Sector	Project District		
	Saptari	**Sunsari**	**Udayapur**
Villagers	5	18	19
Community Leaders	6	17	2
NGO	2	3	4
Total	**13**	**38**	**25**

NGO = nongovernment organization.
Source: Final Report, RCP (2010)

221. Representatives from community, VDCs, NGOs, and village leaders were consulted and expressed their support for the road upgrading (**Appendix 11**, photograph 1 – 5, 7). The participants related the difficulties they are facing due to bad condition of road like high risk of accidents, dust pollution, and uncomfortable travel for pregnant women and sick persons. Expectations are high on the potential benefits of better roads like easier to retain doctors in the hospitals, qualified teachers in the schools, and better access medical facility for pregnant women and other sick persons. Increase livelihood from opportunities for internal tourism development, exploitation of hydropower potentialities, agro-based industries, NTFP based industries, and other industries related with infrastructure development, was also expressed. Improved access by tourist to the KTWR also offers potential for increase in livelihood.

222. Stakeholders from BZMC and KTWR opined that since the road was built several years ago, limited impacts will be generated. However, during construction and operation stages, there may be disturbance to wildlife, increase in illegal hunting and poaching activities. Still, in spite of these adverse impacts, beneficial impacts such as development of eco-tourism and maintenance of roads will improve drainage and thereby will improve hygienic condition and other sources of income.

223. The community representative suggested proper maintenance of natural drainage systems, protection of religious and cultural sites, water supply systems, irrigation canals, and their reinstatement during project implementation and proper compensation of land and houses including standing crops, fruits, and fodder trees.

224. The locations, name of participants and issues consulted in the meetings and discussions are presented in **Appendix 7.**

Table 27: Purposes and Methods of the Public Consultations Conducted by DOR

Stakeholders	Purpose	Method
District level	To brief the project and project and objectives Request for the relevancy of the project To asses protected areas, wildlife reserves, forest situation, community managed forests, and other projects and programs on-going in the district Request for relevant secondary information	Official letter Formal and informal meeting with district level stakeholders. viz. officials of Chief District Development Office, District Development Committee, District Forest Office, District Soil Conservation Office, and other relevant district level agencies
VDC Level	Disseminate all five principles of ADB Safeguard Policy including information dissemination, information solicitation, integration, co-ordination and engagement into dialogue Information dissemination about the project, project approach, likely environmental impacts and enhancement measures for beneficial and mitigation measures for adverse impacts and sharing on ideas, suggestions and perception	Earlier requests were made to stakeholders (affected people, NGOs, vulnerable groups of people, including the poor and Indigenous people) through VDC to attend meeting. Group meetings/consultations, individual meeting/sharing including focus group discussions Informed and discussed with the Buffer Zone Management Committee (BZMC) and KTWR regarding improvement/upgrading of the road passes through the VDCs that are declared Buffer Zone

KTWR = Koshi Tappu Wildlife Reserve, NGO = nongovernment organization, VDC = village development committee.
Source: Final Report, RCP (2010)

225. A second level consultation workshop involving representatives of national agencies, was conducted on 5 September 2012 in Kathmandu to solicit inputs on the draft EMP prepared during the final stages of the detailed engineering design (**Appendix 11**, **photograph 6**). Issues discussed during this consultation are: rationalize the cost of resettlement, inclusion of environmental cost in the BOQ, engineering design should adapt the flood-prone characteristics of the Koshi River, integrate elephant crossing area mitigation measures, consider habitat Management of the wildlife along the roadside, protect medicinal and endangered species along the road corridor, enhance the eco-tourism potential of the area through capacity building activities; and highlight the enhancement activities in the EIA report.

C. Information Disclosure

226. Information was initially disclosed during the public consultations. The DoR continues to consult and disclose information in line with the requirements of the EIA Act in which it seeks to secure approval for the project. The ADB and DOR will disclose all environmental documents in their respective websites. The full EIA report and subsequent semi-annual monitoring reports will be disclosed in the websites and hard copies made available to the interested parties upon request.

227. The Implementing Agency (DOR) will extend and expand the consultation and disclosure process during the implementation (construction) of the project. The feedback of the affected people, stakeholders and the public will be incorporated in the detailed project design for implementation during construction.

IX. ENVIRONMENTAL MANAGEMENT PLAN AND GRIEVANCE REDRESS MECHANISM

A. Environmental Management Plan

228. The Environmental Management Plan (EMP) contains the agreement between DOR and ADB detailing the implementation of mitigation measures, monitoring program, cost estimates, and institutional arrangement to ensure that no significant adverse impacts results from the investment.

229. The basic objectives of the EMP are to:

- establish the roles and responsibilities of all parties involved in the project's environmental management;
- ensure implementation of recommended actions aimed at environmental management and its enhancement; and
- ensure that the environment and its surrounding areas are protected and developed to meet the needs of the local communities including other stakeholders and safeguard and the interests of the common people.

230. A detailed EMP is prepared and presented in **Appendix 3** and will form part of the biding documents.

231. The total budget for implementing the EMP is NRs. 29,752,318. The costs for the mitigation measures other than the compensatory plantation are dealt under the engineering (civil works) and resettlement (compensation) estimate.

B. Environmental Monitoring Plan (EMoP)

232. A companion document of the EMP, the Environmental Monitoring Plan (EMoP) contain parameters, location, sampling and analysis methods, frequency, and compared to standards or agreed actions that will indicate non-compliances and trigger necessary corrective actions. More specifically, the objectives of the EMoP are :

- ensure that impacts do not exceed the established legal standards
- check the implementation of mitigation measures in the manner described in the EIA report
- monitor implementation of the EMP.
- provide an early warning of potential environmental damage
- check whether the proposed mitigation measures have been achieved the intended results, and or/ other environmental impacts occurred

233. The monitoring plan will be used for performance monitoring of the project. A monitoring plan defining all parameters to be monitored, with tentative location, project stages for measurements, implementation and institutional responsibility for different environmental components is prepared for all stages of project and presented in **Appendix 4.**

234. As a guiding principle in designing the EMoP, ambient monitoring to assess impacts on sensitive receptors like community areas and rivers will be conducted by the Supervsion Consutant while point-of-source emissions and discharges are to be monitored by the contractor which is usually part of permit/clearance application and renewals.

Table 29: Cost Summary of EMoP During Construction Phase

Monitoring Activity	Part of BoQ Civil Works	Part of Supervision Consultant's Terms of Reference
Wildlife Movement Near the Project Road within the Buffer Zone	None	NRs 600,000 (SC-Wildlife Specialist)
Air Quality	Stack and vehicle emissions monitoring part of Civil Works Contract and permit application/renewal	NRs980,000
Water Quality	NRs135,750	Nrs540,750
Noise Monitoring	NRs558,600	
Sub-Total	694,350	2,120,750
Total	2,815,100	

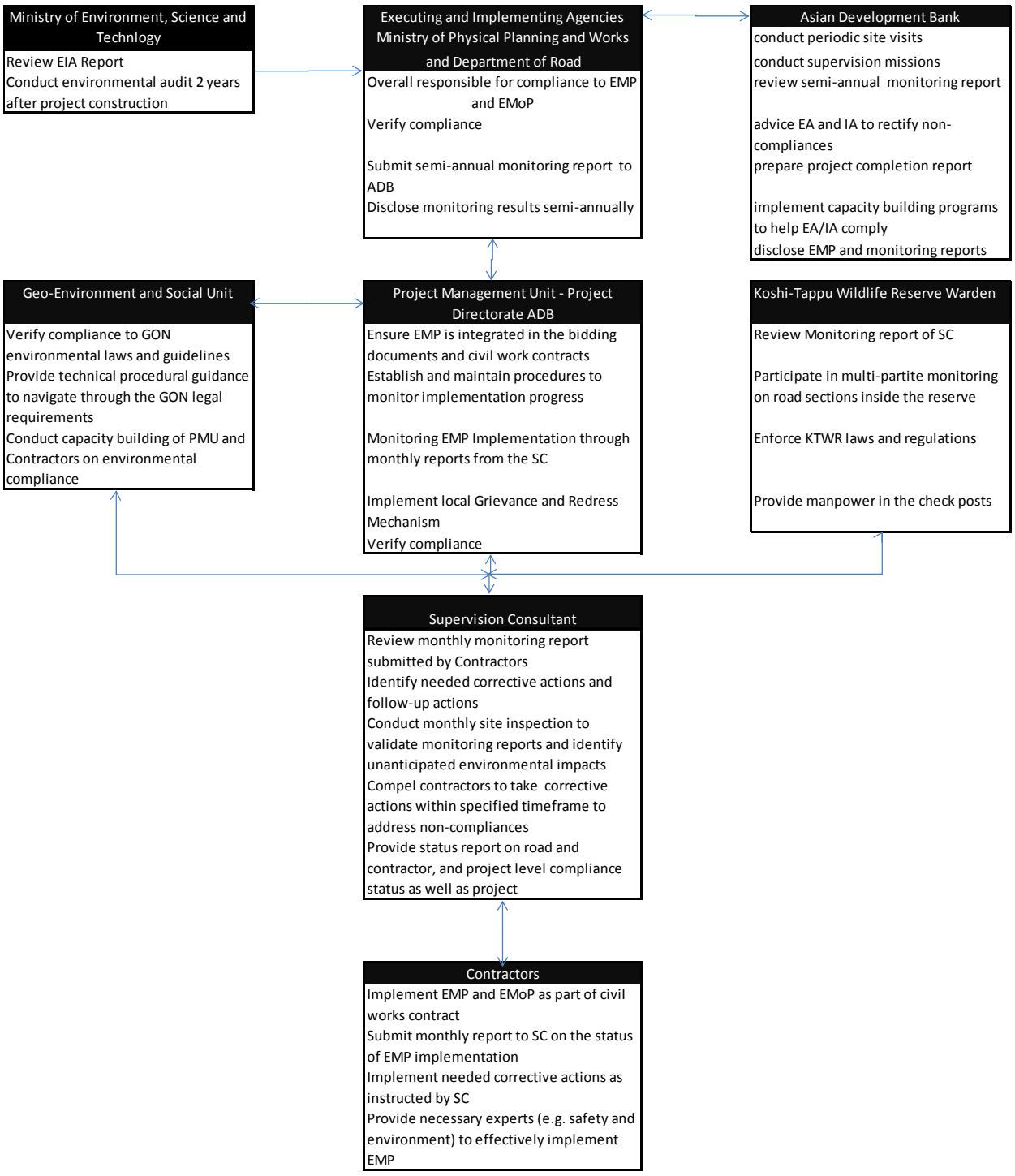
BoQ = Bill of Quantities, SC = supervision consultant.
Source: TPPF

C. Institutional Arrangement to Implement the EMP

235. The succeeding Figure illustrates the functional relationship between the principal agents in implementing the EMP and EMoP.

236. Two special features of the institution arrangement in the implementation of the EMP are the involvement of the KTWR Warden in the monitoring construction along the stretches inside the KTWR Buffer Zone and the mobilization of a wildlife expert as member of the Supervision Consultant.

Figure 8: Institutional Arrangement to Implement the EMP



Source: TPPF, 2012

D. Grievance Redress Mechanism

237. The concern/grievances from local/affected people may come up related to inappropriate implementation of various components of EMP or the overall road upgrading itself. These issues will be addressed through acknowledgement, evaluation and corrective action and response approach.

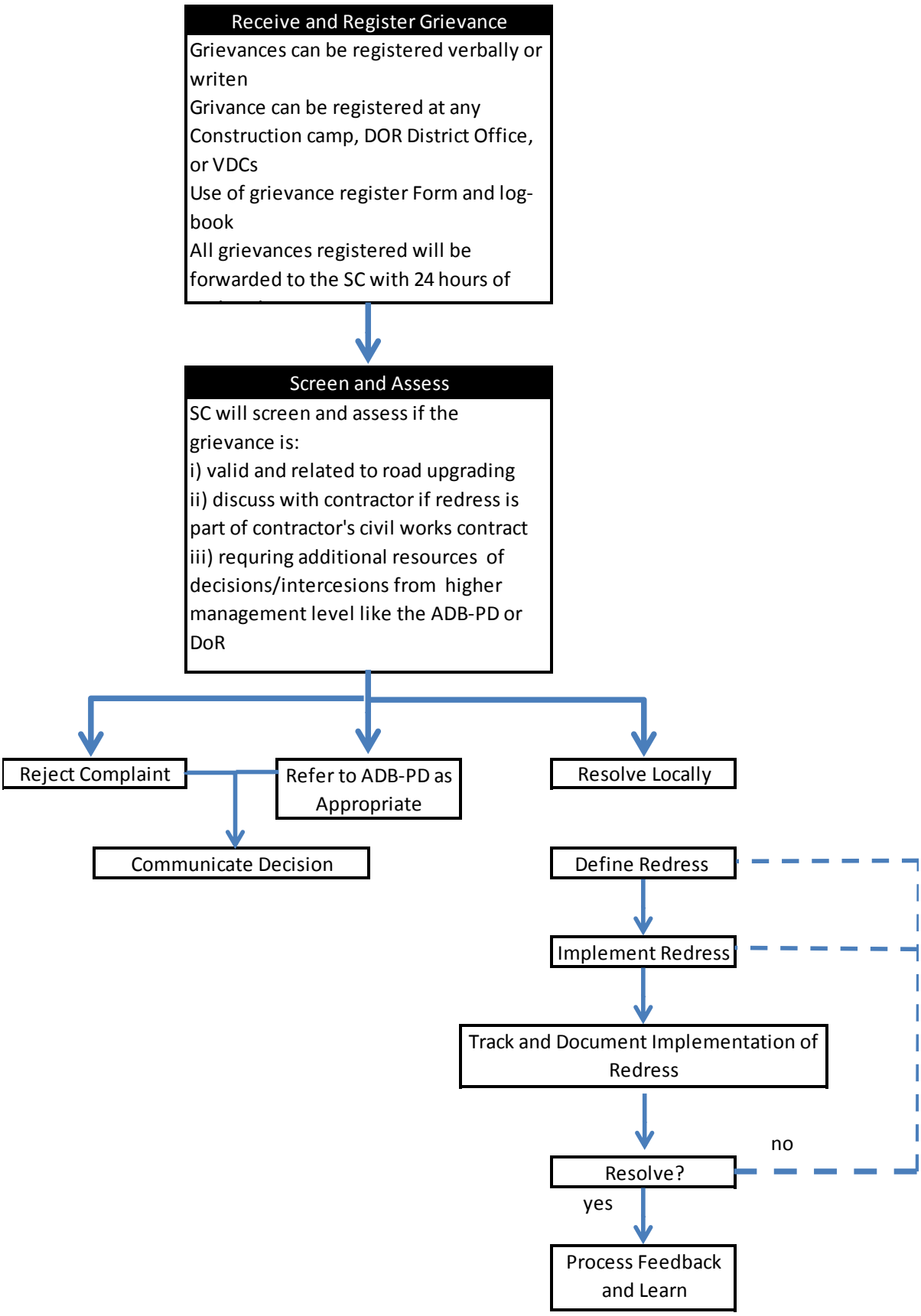
238. The Supervision Consultant, in behalf of the DoR will take lead in administering the mechanism. Grievances maybe lodge verbally or in writing to construction camp, VDCs, or the District DoR Office. Each grievance will be properly documented regarding its nature and identfication details of the complainant taken. The register book will delineate: (i) date of grievance registered, (ii) name/address of grievance lodger (stakeholder), (iii) nature of grievance being lodged, and (iv) location/site of fault works requiring corrections.

239. Within 24 hours of grievance lodging, the SC will be informed by the receiving unit on the nature of the grievance. Within 15 days from receipt, the SC will have screen and assess the complaints. Whimsical and frivolous complaints, or those that are beyond the influence and control of the Project will be rejected in writing. Corrective measures will be prepared by the SC to address valid complaints. Details of the corrective measures like description, estimated date of implementation and completion will be communicated to the complainant also with the 15-day period.

240. During the implementation of the corrective measure, the SC will conduct regular monitoring to ensure its effective and timely implementation. Status of implementation will be reported to the complaint will be made by the SC until its resolution. In cases were the corrective measures were found inadequate, the SC will design additional remedies.

241. In case where the grievance require decisions from a higher management level like Project Directorate or DoR, the supervision consultant 10 days upon receipt of the complaint will elevate the matter accordingly and inform the complaint of such action. In no case will a compliant remain un-acted after 30 working days from registry.

Figure 9 : Grievance and Redress Mechanism



Source: Adapted from ADB *Draft Sourcebook for Safeguard Requirement 1: Enviroment*, 2010

X. CONCLUSION AND RECOMMENDATION

242. The proposed EWH (Nadaha)-Koshi Bridge (Chatara)-EWH is an existing alignment that will offer continued access east of the Koshi River even during extreme flooding by the Koshi River. This road section will allow the access to the on-going construction of the Koshi Bridge (Chatara) also funded by the ADB under the Nepal Emergency Flood Damage Rehabilitation Project. The proposed road project is classified as environment category "A" due to potential direct and induced adverse impacts to wildlife movement inside the Koshi Tappu Wildlife Reserve Buffer Zone. About 9.525 km of the existing road passes through the KTWR buffer zone, and the nearest point from the road to the KTWR Core Zone is 2 km away. The KTWR is a Ramsar site established in 1987 for the habitat protection of the last remaining wild Asian buffaloes.

243. The KTWR is habitat with high biodiversity critical for the survival of endangered species. The KTWR integrity as habitat for endangered species is being threatened by cow grazing, human encroachment, poaching, human and wildlife conflict, breaches of the Koshi embankments, and lack of human and financial resources available to the wildlife managers.

244. Although the project road does not pass through the KTWR Core Zone, it provides hindrance to the movement of wildlife particularly foraging wild Asian Elephants and may induce emigration and settlement within the buffer zone, which is in between the road and the KTWR Core Zone, aggravating the human-wildlife conflict. Hindrance could result to habitat isolation and increased elephant-motor vehicle accidents while human-wildlife conflict will result to further habitat loss and population depletion.

245. To ensure no net loss of the affected biodiversity, through exhaustive consultations with and advise from DOR the KTWR management and the BZMC engineering, habitat management, improved enforcement, and community participation were incorporated in the EMP. Specific measures have been included in the project to: i) improve wildlife habitat through compensatory afforestation, ii) improve monitoring for wildlife conservation through establishment of check posts, iii) improve awareness and stewardship amongst the local people for the KTWR through capacity building programs and by involving them in eco-tourism and monitoring activities and iv) enhance road design to make road users aware on the existence of important wildlife species. Given this situation, the project offers an opportunity to bring improvements to wildlife conservation in the project area.

246. Community-based participation is mobilized to strengthen biodiversity protection of the KTWR. Through the project, 25 citizen eco guardians will be trained to monitor and enforce wildlife laws and become eco-tourist guides. Also through community participation, fodders and wetlands will be rehabilitated within the KTWR to minimize wildlife foray beyond its boundary.

247. Other impacts of the project outside the KTWR Buffer Zone are unlikely to cause any significant environmental impacts and are localized and temporary in nature and easy to mitigate. Several community forests were traversed and 1,095 trees will be cleared and compensated at the mandatory rate of 1:25. Significant impacts during construction are air quality deterioration due to increase in fugitive dust emissions from materials hauling and unloading, ground shaping, hot mix plant operation, quarry operation, and unpaved road travel. Nuisance to nearby residents due to increase in noise from heavy equipment operation, hindrance in accessibility to common property resources, and increase in traffic on road sections where construction is on-going. Minor change in land use from agricultural or residential to road due to expansion of road right-of-way adequate for a 2-lane carriageway. Health and safety risk due to increase in heavy equipment traffic particularly to children and near pedestrian crossing points. During operation stage, the main impact may be accident risk to pedestrians and livestock, hindrance in accessibility, increased noise due to increase in traffic.

248. Other than the permanent change in land use, all identified impacts are short-duration and co-terminus with the construction phase, and are easy to mitigate. All private lands that will

be converted, including structures that will be relocated will be justly compensated in compliance to existing laws.

249. In general, the project was supported by the local people. The local people appreciated that besides providing an all-weather continuous and efficient connectivity to large rural populations and improving the traffic scenario in the region, it will bear out several other socio-economic positive benefits.

250. The environmental assessment of the project indicated that the significant adverse impacts can be mitigated and is unlikely to cause any significant residual environmental impacts. The Executing Agency shall ensure that EMP and EMoP is included in Bill of Quantity (BOQ) and forms part of bid document and civil works contract. The same shall be revised if necessary during project implementation or if there is any change in the project design and with approval of ADB.

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RAPID ENVIRONMENTAL ASSESSMENT CHECKLISTS

Country/Project Title : Nepal Strategic Road Improvement Project
EWH-Koshi Bridge-EWH Road Upgrading
Sector Division : Department of Road (DoR/ADB)
Category of Road : Asian Highway II
Project District : Sunsari, Udayapur and Saptari

SCREENING QUESITIONS	YES	NO	REMARKS
A. Project Siting Is the Project area adjacent to or within any of the following environmentally sensitive areas?			
▪ Cultural heritage site		√	The famous Baraha Kshetra hindu temple is located about 3 km north of the road project and will not be affected.
▪ Protected area		√	The road section nearest to the KTWR Core Area boundary is 2 kilometers away, in Odraha village.
▪ Wetland	√		KTWR is a 175 km^2 wetland terai in Udayapur district, Nepal and listed as a Ramsar site in 1987.
▪ Mangrove		√	
▪ Estuarine		√	
▪ Buffer zone of protected area	√		An estimated 9.525 kilometers of the proposed road is inside the KTWR buffer zone. Chainage 62+150 to 62+200 in Kamalpur and Odraha and chainage 53+025 to 56+500 in Tapeshwari. The proposed road passes through 5 village district committees (VDCs) inside the buffer zone. The buffer zone is dominantly agricultural land with human settlements.
▪ Special area for protecting biodiversity	√		KTWR is a Ramsar site being the last remaining habitat for wild water buffaloes. The wetland supports more than 20,000 waterfowl, and hotspot for 200 species of fish. Asian elephant, jackals, and migratory birds actively crosses the buffer zone. Improvement in road condition will induce higher in-migration in the buffer zone area escalating human-wildlife conflict. The buffer zone was established in 2004 with an area of 173 km2 covering 16 village development committees (VDCs), 215 settlements and 108 wards, and 78,000 population.
B. Potential Environment Impacts Will the Project cause:			
▪ Encroachment on historical/cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?	√		Permanent disfiguration in 13.660 kms new alignment (Patnali Khola-Kharhola Gaun, Kharkhola Gaun-Chatara, Sisuwa Khola, Gideri Khola, Phattepur Bypass, Rupnagar Bypass, and Kanchanpur Bypass. Construction materials will be drawn from government permitted quarries only.

SCREENING QUESITIONS	YES	NO	REMARKS
			However, no materials shall be sourced from quarries and crushers inside the KTWR buffer area. Existing temples, graveyards, religious trees, monuments and resting places along the ROW will be avoided through geometric realignment, or shifted following consultation and consent.
▪ Encroachment on precious ecology (e.g. sensitive or protected areas)?	√		The existing road alignment is part of an active Asian elephant migration corridor. Along the road project, the KTWR warden has identified sightings of several endangered species like the Long Billed Vulture, White Eyed Buzzard, Jackal, and Fishing Cat. The road alignment traverses through 9.45 km of community forests, and estimated 1,117 trees will be cleared and compensated at 1:25.
▪ Alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site?	√		The Siwalik region where the project road is located is prone to erosion due to weakly consolidated layered bedrock. In contrast, the low terraces suffer frequently from seasonal flooding. Mitigation measures include: - Installation of breastwalls, retaining walls, and bioengineering on identified high risk of slides and erosion - Provision of sufficient number of drains for good drainage - Minimize extraction of construction materials from the Siwalik region and river bed
▪ Deterioration of surface water quality due to silt runoff and sanitary wastes from work-based camps and chemicals used in construction?		√	Impacts will be minor, short- term and site specific. Mitigation measures include: - Proper waste management facilities to be provided in labor camps - Disallow storage of chemicals within 100 m periphery of permanent water course or spring - Contaminated run off from storage areas need to be captured in ditches or ponds - Apply sealing or binding materials in the case of major spills of hazardous materials (liquids)
▪ Increased local air pollution due to rock crushing, cutting, and filling works, and chemicals from asphalt processing?		√	Impacts will be minor, site specific, and short-term. Mitigation measures include: - Locate static plants at least 100 m from occupied buildings and 800 m sites deemed by the Engineer - Locate asphalt plants 1 km away from residential areas, schools, hospitals. - Stone crushing plants should be fitted with approved dust control devices and operate in accordance with manufactures specifications and should be operated in day time only - Sprinkle water on sites with ongoing construction activities in order to control dust nuisance - Control vehicle speed
▪ Risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?		√	Occupational health and safety plan, training, implementation and monitoring will form part of the EMP. Informational and regulatory traffic signs is part of road design, based on road safety audit.
▪ Noise and vibration due to blasting and other		√	No blasting will be employed. Work scheduling

SCREENING QUESITIONS	YES	NO	REMARKS
civil works?			of work and provision of noise barriers during construction will be implemented by contactor. All equipment to be used will have compliance certificates to noise standards. Location of compensatory forestation will include noise attenuation during project operation.
▪ Dislocation or involuntary resettlement of people	√		The road section will affect more than 200 persons. Please refer to the approved resettlement plan for the compensation measures.
▪ Dislocation and compulsory resettlement of people living in right -of -way?	√		A substantial number of structures resulting to resettlement will occur in the project road. Please refer to the approved resettlement plan for the compensation measures.
- Disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		√	Improvement of the road is likely to increase several beneficial impacts such as girls' enrollment in schools, regular health check up facility for pregnant women including delivery in the health facilities. Similarly, are expected to increase employment and income opportunities.
▪ Other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress?		√	Impacts will be minor, site specific, and short-term. Mitigation measures include: - Locating hot mix and batching plants at least 1 km away from residential areas, schools, hospitals. - All hot mix, crusher, and batching plants will have compliance certificates to emissions standards. - Control dust by the periodic sprinkling of water
▪ Hazardous driving conditions where construction interference		√	Arrangement for traffic during construction is part of the EMP illustrating diversion of traffic layout; location types and colors of signs; lighting; and flagmen deployment.
▪ Poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases (such as STI's, HIV/AIDS) from workers to local population?		√	Impacts will be minor, site specific, and short-term. Mitigation measures include: - Contactor will link with on-going national and local health protection campaigns. - Contractor will make available at all times medical staff, first aide facilities, sickbay and ambulance services - Contractor to take precaution to protect health from insects and pests. - Adequate, suitable and safe food stuff will be provided by the Contractor. - Avoid construction camps near settlement areas, near water sources - Ensure cleanliness and appropriate management of construction camp sites - Provision of waste disposal at designated sites - Provide awareness raising training to workers on transmission of communicable diseases
▪ Creation of temporary breeding habitats for mosquito vectors of diseases?	√		Road passes through the areas that is prone to mosquito diseases vectors. Mitigation measures include: - Restore borrow pits and quarry sites for preventing breeding sites of disease vectors - Use of - Educate local people for avoiding water logging condition
▪ Accident risks associated with increased	√		Impacts will be minor. Mitigation measures

SCREENING QUESITIONS	YES	NO	REMARKS
vehicular traffic, leading to accidental spills of toxic materials and loss of life?			include: - Enforcing of speed limits, and imposing penalties on the traffic violators - Provide provision of rest places - Provide traffic signs for speed limits and rest areas. - Displayed "Warning Messages" such as better late than never" - Possibility of significant increase in traffic if EWH is not accessible (e.g. overtopping of Koshi Barrage)
▪ Increased noise and air pollution resulting from traffic, leading from traffic volume?	√		No construction will be allowed inside the buffer zone during animal migration periods. Within he buffer zone, trees and shrubs will be planted along the corridor to control noise. DoR will coordinate with the Department of Transport Management on the implementation of emission control for vehicles.
▪ Increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road?	√		Impacts will be moderate. Mitigation measures include: - Restrict washing of vehicles in water bodies - Awareness raising of vehicle drivers on negative impacts of washing vehicles in streams and river - All 3rd party materials suppliers, particularly petroleum, will be required by the Engineer to submit proofs of capability and capacity to contain and clean-up spills.
▪ Social conflicts if workers from other regions or countries are hired?	√		Impacts will be minor and temporary as most of the workers will be locally recruited.
▪ Large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		√	- The workers camp sites will be located outside residential and market areas. - Water extraction permits will be secured by the contractor ensuring that no conflict with existing water users.
▪ Risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?	√		The project design incorporated warnings and cautionary measures to road users of incoming hazards to avoid road crashes. Impacts will be minor and temporary in nature. Mitigation measures include: - Raise awareness among drivers and store keepers for safe handling and disposal of the hazardous materials and their containers. - Educate communities on risk to health due to explosives, fuel and other chemicals during construction and thereby precautions should be taken during construction and operation of the road.
▪ Community safety risks due to both accidental and natural causes, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning.	√		- Restriction of the local people from the construction areas, - Use of traffic and warning signs at and near the construction site - Educate the contractors and the local people on traffic safety - Enforcement of speed limits, traffic rules and regulations - Installation of warning signs, speed breakers, pedestrian crossings and

SCREENING QUESITIONS	YES	NO	REMARKS
			specific areas for bus stops due to increased number of vehicles and increased speeds.

The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.

Climate Change and Disaster Risk Questions	Yes	No	Remarks
Is the project area subject to hazards such as earthquake, flood, landslide, tropical cyclone, wind, storm surges, tsunami or volcanic eruptions and climate changes?	√		The project road passes through the siwalik region and plain terrain. Therefore, there are chances of flood, but no tsunami or volcanic eruptions. There is possibility of landslide in the siwalik region during rainy season and earthquake due to the fragile nature of the Hindukush Himalaya.
Could changes in temperature, precipitation, or extreme events patterns over the project lifespan affect technical or financial sustainability (e.g. increased erosion or landslide could increase maintenance costs, permafrost melting or soil moisture content could affect sub-grade)		√	No. The proposed road takes advantage of the existing route which is not prone to flooding. The proposed road section can be viewed as a climate change adaptation as its principal objective if the provide n alternative connection of the EWH during periods of flood over-topping of the Koshi Barrage.
Are there any demographic or socio-economic aspects of the project area that are already vulnerable (e.g. high incidence of marginalized populations, rural-urban migrants, illegal settlements ethnic minorities, women or children)?		√	None
Could the project potentially increase the climate or disaster vulnerability of the surrounding area (e.g. by encouraging settlement in areas that will be more affected by floods in the future or encouraging settlement in earthquake zone)?		√	The proposed EWH-CB-EWH is an adaptation to overtopping of the Koshi Barrage in August 2008 due to extreme rainfall. The overtopping severed access to both sides of the Koshi River for 6 months through the EWH. The proposed road provides and alternate crossing north of the barrage.

The Koshi Tappu Wildlife Sanctuary and its Buffer zone

A. Background

1. Biodiversity conservation took momentum in Nepal only after the establishment of the Wildlife Conservation Office in 1972 and the subsequent promulgation of the National Parks and Wildlife Conservation Act (NPWCA), 1973. The history of the Koshi Tappu Wildlife Reserve (KTWR) can be ascribed to the establishment of the Koshi barrage in 1950. Soon after the establishment of the barrage, the Government of Nepal (GoN) established six Royal Hunting Reserves in the Terai, including Koshi Tappu in 1969. The Koshi Tappu was covered with dense riverine forest and tall grasses that harboured diversity of animal species, including the Bengal tiger (*Panthera tigris*), leopard (*Panthera pardus*), Asiatic wild elephant (*Elephas maximus*), Wild Water Buffalo (*Bubalus arnee*), Nilgai (*Boselaphus tragocamelus*), dolphin (*Platinista gangetica*), and swamp partridge (*Houbaropsis bengalensis*). The construction of Koshi dam, Koshi bridge and access road coupled with other anthropogenic activities and natural calamities have cleared the forest and eventually destroyed habitat of big wild mammals. As a result, it has lost 80 % carnivores and 58 % ungulates over the last 40 years (*Heinen, 1993a*).The diminishing faunal and floral diversity drew attention of GoN to establish a protected area on the land already acquired by the Koshi Embankment Project. The area was gazetted as Koshi Tappu Wildlife Reserve in 1976 under the NPWC Act, 1973. To strengthen protection efforts, a Nepal Army (NA) protection unit was deployed in 1977 for strict law enforcement and the Wildlife Reserve Rules enforcement. Dahmer (1978) conducted first study on the status of wild water buffalo and consequently about 12,000 people were resettled out of the Reserve in 1979.

2. The year 1980 marked greater commitment of GoN towards wildlife conservation by the establishment of a separate Department of National Parks and Wildlife Conservation. Since then, many studies on wildlife were initiated such as fishes, waterfowls, wild water buffalo, elephant, etc. The KTWR was declared as a wetland of international importance or Ramsar Site) on December 17, 1987 with greater commitment for conservation when Nepal joined the “Convention on Wetland of International Importance especially as Waterfowl Habitat” (IUCN 1990).

3. Tourism sprouted in the early 1990s on a very small scale with the establishment of a resort named Koshi Tappu Wildlife Camp just outside the eastern dyke of the Reserve in Prakashpur village. In the year 1994, DNPWC prepared biodiversity database of KTWR and its adjacent area with the joint support of Woodlands Mountain Institute/IUCN Nepal and also initiated Park People Programme for Buffer Zone development with the support of UNDP. Interventions in the Buffer Zone were strengthened with the passage of the Buffer Zone management regulations in 1992 and guidelines in 1996. The DNPWC initiated formulation of conservation strategy and integrated management planning of KTWR and its vicinity in 1998. The buffer zone of KTWR was declared in August 2004 incorporating 77,950 people, 10,693 households, 215 settlements and 108 wards of 16 Village Development Ccommittees.

4. The KTWR buffer zone is in the forefront of conflict between protecting biodiversity and promoting economic development. Degradation of the KTWR which threatens survival of endangered species is caused by increasing encroachment of human activities and settlements. These activities include illegal grazing polluting the genetic integrity and transformation of diseases to wild water buffaloes, over-fishing and poisoning, poaching, and collection of resources. On the other hand, crop and property damages, and injuries and death of residents results from numerous skirmishes with wildlife.

5. The human-wildlife conflict inside the KTWR Buffer Zone is taking a heavy toll on both parties. Yadav (2002) indicates that a total of 31 persons were killed by rampaging elephants, and in retaliation 5 elephants were killed by humans from 1986 to 2001 in Sansari, Saptari and

Udaypur villages. File review from KTWR revealed that from 2010-2012 at least 15 persons were injured and 3 were killed resulting in compensatory expenses of NRs 732,824,000 for the government. During the same period, NRs 6,464,940 was spent on compensation for crop damage. Details of these are provided in table 1 and 2. Foraging elephants and wild water buffaloes cause the most damage to human lives and properties in the Buffer Zone. Crop damages due to foraging wild animals have been documented to extend to more than 2.5 kilometers from the KTWR boundary, well beyond the narrowest distance between the park and project road at 2 kilometers. Discussions with local residents[27], KTWR-BZ Management President[28], KTWR Warden[29], recent victims of wildlife attacks[30], and former KTWR Warden[31], have confirmed that jackals and wild water buffaloes raids occur immediately at the boundary of the KTWR[32] while the wild elephants regularly cross the project road passing under the Gangajali Khola Bridge at chainage 62+175 km, in between Kamalpur and Odraha.

Table A2.1: Details of Loss of Human Life from Wild Animals and Compensation (2010-2012)

S. No.	Location	Fiscal Year	Type of Animal				Type of Damage		Compensation Amount Paid (NRs.)
			Wild Buffalo	Elephant	Wild Boar	Bear	Injury	Death	
1	Madhuvan VDC, Sunsari	2066/67 (2009/2010)	✓				4		85,000.00
2	West Kusaha, Sunsari				✓		1		4,500.00
3	Tapeshwory, Udayapur			✓				1	150,000.00
4	Bairawa, Saptari		✓				1		10,500.00
5	West Kusaha, Sunsari	2010/2011	✓				2	1	200,000.00
6	Jagatpur, Saptari	2011/2012	✓				2		32,376.00
7	Haripur, Sunsari	2011/2012	✓				1		11,622.00
8	West Kusaha, Sunsari	2011/2012	✓	✓			1	1	168,241.00
9	Phattepur, Saptari	2011/2012				✓	2		70,585.00
10	Madhuvan VDC, Sunsari	2011/2012	✓				1		Not paid yet

Source: KTWR, 2012

[27] July and August 2012

[28] Birendra Kumar Yadav

[29] Ashok Kumar Ram

[30] July 2012 Consultation Mission field interviews

[31] Barna Bahadur Thapa

[32] Locally called “aracha shimana” or edge of boundary

Table A2.2: Detail of Loss of crops and properties from Wild Animals and Compensation (From 2010-2012)

S. No.	Fiscal Year	District wise Damage	Type of Damage	Compensation Amount (NRs.)	Remarks
1	2009-2010	Sunsari	Crops/Cattle Shed including crop storage facility	18,36,775.00	
2		Saptari		67,820.00	
3		Udayapur		10,100.00	
4	2010-2011	Sunsari		10,37,230.00	
5	2011-2012	Sunsari		34,36,995.00	
6		Sunsari		76,020.00	
Total Amount (NRs.)				6,464,940.00	

Source: KTWR, 2012

Table A2.3: Human-Elephant Conflict in KTWR, 2002

Population of Elephants in KTWR and immediate Terrai area	No. of Persons Killed by Elephants [1/]	Elephants Killed by Humans [2/]
10	31	5

Source: Yadav, B.R. (2002)
Notes: 1/ Distribution of mortality: Sunsari=15 (1990-99), Saptari=4 (1989-01), and Udayapur=12 (1986-99)
2/ Distribution of mortality; Sunsari = 4+1 calf. Udayapur = 1

B. Conservation significance of Koshi Tappu Wildlife Reserve

6. KTWR is the smallest protected area in the Nepal Terai spread over 175 sq. km. However, it is one of the best sites for the conservation of many rare and endangered species of plants, fish, herpetofauna, resident and migratory birds and mammals. The NPWC Act, 1973, defines a Reserve as an area set aside for the conservation and management of wildlife including bird, vegetation, and landscape together with the natural environment.

7. The KTWR is the first Ramsar Site in Nepal. The site was included in the Ramsar list because this wetland regularly supports more than 20,000 waterfowl population. It is a hotspot for supporting 200 species of fish and is of special value for maintaining the genetic and ecological diversity of a region (Scott 1989). The Ramsar designation is meant to promote wise use and conservation of ecological characters of KTWR through a planned approach.

8. KTWR is the last stronghold in Nepal for the conservation of the last remnant population of critically endangered wild water buffalo (*Bubalus arnee*). The wild water buffalo is one of 26 mammal species protected by the NPWC Act, 1973. The forest in the KTWR and its vicinity are the remnants of the representative tropical rain forest of the eastern Nepal Terai. It is also an important site for waterfowl conservation, acting as a staging and wintering area for a variety of trans-Himalayan migrants, notably ducks and shorebirds (IUCN 1998). The floral and faunal diversity of this small Reserve is unique in the world as it has been confirmed that 514 species of plants, 77 species of butterfly, 200 species of fish, 45 species of herpetofauna, 461 species of bird and 31 species of mammals are present here (Baral 2000, IUCN 1998, Bauer 1987). Besides, 21 species of invertebrates have also been identified here. However, no scientific study of invertebrates has been carried out in the reserve.

9. There are also ox-bow lakes and riverine swamps within KTWR and fresh water marshes and ponds formed due to seepage from Koshi River in borrow pits between eastern embankment and the cultivated area. Moreover, there is a submerged land of 49.6 sq km between the Koshi barrage and southern boundary of the Reserve. These wetlands provide feeding, breeding, and nesting sites for resident & migratory birds and are important places for biodiversity conservation. The endangered species such as swamp partridge, Bengal florican, gharial crocodile and Gangetic dolphin have been sited in KTWR and its surrounding wetlands.

10. Moreover, many of the birds and aquatic life that use the Koshi Tappu also move to and from other wetlands. Thus, Koshi Tappu, especially for migratory birds, is regarded as an open ecosystem with connection to other ecosystems, some as far as Siberia and other sites in between where many migratory birds rest and breed. Due to this unique feature, Koshi Tappu Wildlife Reserve was designated as Ramsar site.

11. In spite of being a Ramsar Site, as mentioned earlier KTWR faces a mosaic of conservation challenges to safeguard the wildlife and natural resources contained within it. One of the major problems is crop damage and human injuries by wild water buffalo coming out of the Reserve. Some domestic cattle and buffaloes are still grazing inside the Reserve exerting intense competition for food and space with the wildlife. These feral livestock also damage crop in the peripheral agricultural fields. The domestic buffaloes are also cross breeding with wild water buffalo, which may have caused genetic pollution in the pure wild breed. Dependency of the local people on the thatch, grass and other resources of the Reserve are still very heavy and boundary encroachment has remained persistent. Frequent flooding, sedimentation due to river braiding and wildlife mortality from floods are other serious problems. Also of equal concern is the intentional fire and poaching of wild animals from the Reserve's northern and southern boundaries. These scenarios pose formidable challenges to balance wildlife and human needs and the mitigation of conflicts between the Reserve management and people living around the Reserve (DNPWC/PPP, 1999).

C. Buffer Zone of Koshi Tappu Wildlife Reserve

12. Nepal is one of the pioneers in combining conservation goals with the needs of the local people. The DNPWC gradually shifted its management paradigm to pro-people by introducing the Buffer Zone concept in the protected area that allow up to 50 % revenue sharing by GoN for integrated conservation and development programmes in the Buffer Zone. Hence, in order to translate this concept into practice, DNPWC initiated Park People Programme with the support of UNDP as a planned pilot initiative since 1995. The Programme intends to develop alternative natural resources base in the Buffer Zone of the protected areas to minimize dependency of people in the Reserve resources, and socio-economic development of the people living in the Buffer Zone. The thrust is on a gender balanced, equitable and bottom-up planning approach to sustainable resource management and use. Similarly, UNDP funded Conservation and Sustainable Use of Wetlands in Nepal (CSUWN) is initiated since 2008. The program intends to minimize pressure of the local people in KTWR by providing alternative livelihood options.

13. As a strategy to resolve Reserve Authority and people conflicts, DNPWC proposed the Buffer Zone concept for the protected areas of Nepal. Accordingly, GoN has declared Buffer Zone surrounding the national parks and Reserves through the 4th amendment in the NPWC Act, 1973, in 1992. The Act defines Buffer Zone as "the peripheral area of national park or Reserve declared under section 3a of the Act and this section refers to the villages, settlements or hamlets set aside as Buffer Zone lying within the national park or Reserve" (GoN, 1999). The factors such as geographical location & area affected from the Reserve, status of settlements and appropriateness from the point of management, are also considered for the declaration of a Buffer Zone. The extent and area of the Buffer Zone in the context of Nepal has been determined on the basis of an impact zone concept (Sharma and Shaw, 1992) and with thorough consultation with the local communities involved.

14. The Buffer Zone of KTWR is 173 sq. km distributed partially or totally over 16 Village Development Committees (VDC, as smallest political administrative unit in Nepal) of Sunsari, Saptari and Udayapur Districts and 49.6 sq km submerged government land between the Koshi barrage and southern boundary of the Reserve. In the Buffer Zone, settlement level, male and female user groups have been formed, and the process of formation of User Committees and Buffer Zone Management Committee (BZMC) is taking place. The council is an apex local body responsible for full ownership of the Buffer Zone development and management programme. In this endeavour, the Buffer Zone Regulation 1996 has empowered the User Groups (UG), User Committee's (UC) and BZMC to carry out community development activities, especially those that maintain a sustainable use of forest products without disturbing the wildlife habitat of the protected areas.

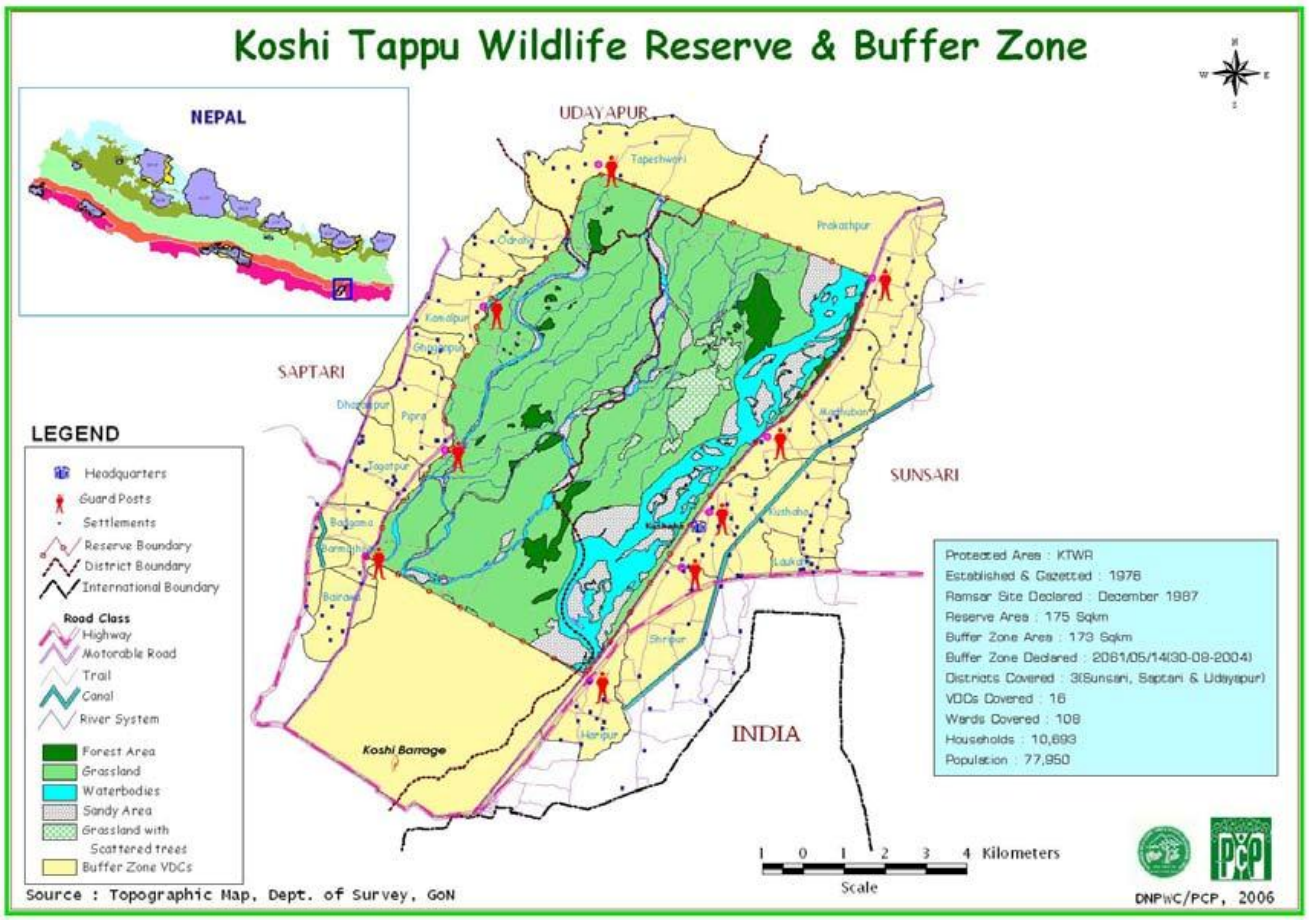
D. Physical Attributes

1. Location

15. Koshi Tappu Wildlife Reserve lies within 86°55'15"-87°05'02" E longitude and 26°33'57"-26°43'40''N latitude while the Buffer Zone extends further at 86°53'41"-87°06'32"E longitude and 26°33'58"-26°43'42''N latitude (Map 1.1). The Reserve during establishment in 1976 was 65 sq km. It was extended to about 175 sq km in 1980 to include the Koshi alluvial floodplain lying in Saptari, Udayapur and Sunsari districts with new boundary description. The Buffer Zone is 173 sq km. As given in figure 1, the Reserve is roughly rectangular in shape running 16.3 km north south and 9.3 km east west. The core zone is the area in green while the buffer zone is the yellow area surrounding the core zone. The Reserve's headquarter is in Kushaha, Sunsari district, 2.6 km north-west from the East West Highway and approximately 57 km west of Biratnagar by road, the second largest city of Nepal.

16. The southern boundary of the Reserve runs parallel to the Koshi Barrage, 6.5 km to the south. The land between the barrage and the southern boundary of the wildlife Reserve is called 'duban' (submerged land) and is leased to Indian Government for 199 years. The northern boundary of the Reserve is demarcated along the floodplain of the eastern embankment near Prakashpur to the village of Tapeshwori north of Trijuga River. The eastern and western boundaries of the Reserve run along the 5-7 m high eastern and western earthen embankments that bound the river floodplain and prevent water from flooding agricultural fields during the rainy season.

Figure A2.1: Koshi Tappu Wildlife Reserve and Buffer Zone Location



Source: Topographic Map, Department of Survey, Government of Nepal

2. Topography

17. The Reserve is roughly a flat and rectangular area and elevation ranges from 80m-95m from the mean sea level with a gradual aspect from south to north. In order to control Sapta Koshi River's monsoon floods, dykes/embankments 5-7 metre high were constructed on both western and eastern side parallel to the river. Crated stone spurs of various lengths and heights have supplemented the embankments. The eastern embankment extends 35 km from the barrage to Chakarghatti (settlement further north from Reserve's boundary) but the western embankment is shorter extending only 8.5 km up to Pathari. Both embankments on either side of the river effectively contain the river to a maximum spread of 10 km width.

3. Climate

18. The climate of Koshi Tappu is subtropical monsoonal and experiences four distinct seasons. Spring commences on February and continues to April with pleasant warm temperate and strong silt laden wind. Summer/monsoon starts from May and is intensely hot with minimal precipitation and maximum temperature up to 400C. Monsoon commences on late May or early June with frequent and violent thunderstorm. Rainfall is greatest during July. Autumn commences on August and continues till October. Due to moisture-laden winds from the Bay of Bengal, 80-85 % of the total rainfall occurs from June to September. Winter lasts from November through January with clear skies, cold mornings and warm days. January is the coldest month with lowest temperature reaching 3.30C. The area receives a small amount of winter rain brought by the south-westerly winds from the Arabian Sea.

19. The average annual rainfall is 2019 mm and average daily maximum temperature ranges from 23.5^0C-33.4^0C, the minimum from 7.8^0C-25.3^0C and the mean monthly temperature between 15.7^0C and 29.2^0C. Humidity remains high all year round with the monthly average varying from 76 % to 94 % (GoN, Department of Meteorology, Phattehpur Station).

4. Biological Attributes

a. Habitat Diversity

20. The habitats of the Reserve and its Buffer Zone can be differentiated into two broad categories i.e. aquatic and terrestrial. These two habitats consist of several wetland and vegetation types respectively. The aquatic and terrestrial habitats were reported to occupy 12.9 % and 87.1 %total available habitat of the Reserve respectively (WMI/IUCN Nepal, 1994). However, the Management Plan Preparation Team estimated 25.9 % aquatic and 74.1 % terrestrial habitat according to the 1:25,000 Topographical Survey Maps of 1996 based on aerial photos of 1991/1992.

b. Faunal Diversity

21. KTWR supports about 45 % of total vertebrate species of the country (IUCN, 1998). Large mammals like gaur (Bos gaurus) and blue bull (Boselaphus tragocamelus) seem to be scarce or vanished. The wild water buffalo, prominent species of KTWR, has increased from 63 in 1976 (Dahmer, 1976), 145 in 2000 (Heinen and Singh, 2000) and 219 in 2009 (DNPWC, 2009). Among other mammals, the wild boar (Sus scrofa) and hog deer (*Axis porcinus*), spotted deer (*Axis axis*), smooth coated otter (*Lutrogale perspicillata*), fishing cat (Felis viverrina), jungle cat (*F. chaus*), indian fox (*Vulpes bengalensis*) and the jackal (*Canis aureus*) are common (IUCN, 1998). The wetlands harbour several aquatic fauna like insects, fish, amphibians, reptiles, birds and mammals described below.

Table A2.4: Mammals of Koshi Tappu Wildlife Reserve

Family	Scientic Name	*Common Name*	Status			
			NDWCA (1923)	NRDB(1995)	IUCN	CITES
Bovidae	1.Bos gaurus *2.Bubalus arnee*	Indian Bison Wild Water	P P	E C	V E	I III(NP)
Canidae	*4.Canis aureus*	Golden Jackel		S	L	III(N)
Cercopithecida	6.*Macaca mulatta*	Rheus Macaque		S		II
Cervidae	*8.Axis axis* *9.Axis porcinus*	Spotted Deer Hog Deer		S		I
Elephantidae	*11.Elephas maximus*	Asiatic Elephant	P	E	E	I
Felidae	*12.Felis chaus* *13.Prionailurus viverrinus*	Jungle cat Fishing Cat		S V	K	II II
Hystricidae	*15.Hystrix indica*	Indian Crested Porcupine				

Herpestedae	*16.Herpestes edwardsii* *17.Herpestes javanicus*	Indian Grey Mongoose Small Asian Mongoose				
Leporidae	*18.Lepus nigricollis*	Indian Hare				
Lutranae	*19.Lutra lutra*	Common Otter		S		I
Mustilidae	*21.Martes flavigula*	Yellow- Throated				
Platanistidae	*22.Platanista gangetica*	Gangetic Dolphin	P	C	V	I
Pteromyidae	*23.Petaurista petaurista*	Red flying Squirrel				
Pteropodidae	*24.Pteropus giganteus*	Indian Flying Fox				
Sciuridae	*26.Ratufa bicolar* *27.Funambulus*	Black Giant Squirrel Three Striped Squirrel				
Suidae	*29.Sus scrofa*	Wild boar				
Vespertilionida	*30.Pipistrellus*	Indian Pipistrelle				
Viverridae	*31.Viverra zibetha*	Large Indian Civet				

C= critically endangered, E = endangered, I = indeterminate, K = insufficiently known, IN = India, IUCN = International Union for the Conservation of Nature, NPWCA= National Parks and Wildlife and Conservation Act,NP = Nepal, NRDB = National Red Data Book, P= GON protected, S= Susceptible, I, II, III = Convention on International Trade in Endangered Species (CITES) Appendices
Sources: KTWR, Management Plan Preparation team's field survey, 2000; IUCN, 1998

22. IUCN (1998) reported the presence of 77 species of butterfly in the Reserve. The vertebrate fauna of the Reserve includes 200 species of fish, 45 species of herpetofauna (amphibians and reptiles), 461 species of bird and 31 species of mammal (BPP, 1995; IUCN, 1998 and Baral, 2000).

23. Out of total species of fish, 91 species are resident, 21 species are local migratory and 5 species are migratory (IUCN, 1998). The most common species in the Koshi River are *Puntius conchonius*, *P. ticto,* and *Barilius barna*. Similarly, *Badis badis*, *Chanda nama* and *Esomus danricus* are common in marshes and swamps.

24. Among the 45 species of herpetofauna; 11 are amphibians (2 toads and 9 frogs), 34 reptiles (2 crocodiles, 11 turtles, 6 lizards and 15 snakes). Among the 461 species of birds that represent 58 families (Baral, 2000) the most numerous are Accipitridae (42 spp.), Muscicapidae (40 spp.), Sylviidae (36 spp.), Corvidae (31 spp.), Passeridae (29 spp.), Anatidae (27 spp.) and Scolopacidae (20 spp.). At least 176 species breed in the Reserve and 180 species are passage migrants or winter visitors (IUCN, 1998). KTWR is the only area in Nepal where water cock, *Gallicrex cinerea* and Abbot's babbler, *Trichastoma abbotti* are known to occur (Inskipp,1989). Bird species in the Reserve also include 114 species of water birds, representing almost all the species known to occur in Nepal.

ENVIRONMENTAL MANAGEMENT PLAN

Stage/ Environmental Impact	Mitigation Measure	Location	Time Frame	Mitigation Cost	Institution Responsible	
					Implementation	Supervision
Pre-Construction Stage						
1.Loss of Land and Resettlement	compensation, assistance and rehabilitation of all affected persons as provided in the approved Entitlement Matrix. Sufficient advance notice and requested to vacate premises and dismantle affected structures prior to project implementation.	Sections of the road where land acquisition and resettlement will occur	Before construction		DOR	ADB
2. 1,095 trees will be cleared	trees felled will be compensated at a rate of 1:25 and cared for the next 5 years consistent with the provisions of the Ministry of Forest's Working Guideline for the Utilization of Forest Area to Other Use (2006) EIA Report approved by Ministry of Environment and Scence and Technology Secure Forestry Clearance for felling trees from Ministry of Forest and Soil Conservation Permission from the KTWR Warden for tree cutting inside the Buffer Zone	Kalindra, Janjagriti, Agaha, Bhandaritar, Ramailo, Hattisar, Machhapuchhre, Gaurishankar, Ranipandhera Deurali, and Hattisar Community Forests	Forest clearances secured before tree felling	**Rs2,701,170**	CFUG	DOF, DOR
3. 28.59 hectares of agricultural land will be permanently converted with annual loss in production	Compensation for the lost in land and income		Compensated before start of construction		**DOR**	**ADB**

Stage/ Environmental Impact	Mitigation Measure	Location	Time Frame	Mitigation Cost	Institution Responsible	
					Implementation	Supervision
estimated at 94,742.03 kgs. annually and valued at NRs2,500,751 in 2011 prices.	Land acquisition and compensation approved by Ministry of Physical Planning and Works					
Construction Stage						
4. Air quality deterioration from fugitive dust; emissions from the operation of construction equipment and machines; unpaved road travel, materials storage hauling, fuel combustion, and cooking and waste incineration inside labor camps	i) vehicle restriction in terms of speed, weight, haul cover, and number; ii) surface improvement by adding gravel or slag on dirt road; and iii) watering to suppress dust. iv) Wind breaks or covers and watering to control emissions from storage and quarry areas v) All hot mix plants, stone crushers, diesel generators, haul trucks, pavers, graders, and rollers required comply to regulations prior to use vi) Proper operation and maintenance of equipment vii) All hot mix and stone crushers will be located at least 1 kilometer from the nearest community and necessary permits and clearance secured prior to operation. viii) All diesel generation sets will be fitted with stacks observing good engineering practice of height of stack = height of the building + 0.2 □ KVA (Kilo-Volt-Ampere). ix) No construction material will be source inside the KTWR Buffer Zone x) No firewood for cooking and	Construction camp, active construction front, haul road	Construction phase	Part of construction cost	Contractors will monitor air quality within the construction camps and active road construction fronts	Engineer will monitor in settlement areas, as provided in the Monitoring Plan.

Stage/ Environmental Impact	Mitigation Measure	Location	Time Frame	Mitigation Cost	Institution Responsible	
					Implementation	Supervision
	heating bitumen, and incineration of wastes will be allowed by the Contractor xi) Air quality monitoring					
5. ambient noise will increase temporarily and intermittently causing nuisance and health hazard	i) construction camp, maintenance, and plants will be located at least 1 kilometer away from sensitive locations; ii) Select equipment and machinery with lower sound power levels for the use iii) timing of construction activities only between 7 am to 6 pm to minimize disturbance; iv) integrate in the compensatory plantation design multilayered plantation during construction near built up areas close to the road alignment v) installation of acoustic barriers to confine noisy equipment near sensitive sites like schools, hospitals, government offices, and inside the KTWR buffer zone vi) All construction workers exposed to elevated noise will be provided ear plugs and muffs exposure limited to no more than 8 hours at greater than 85 dB. vii) noise monitoring to ensure compliance to noise standards. viii) Develop a Grievance Re-dress Mechanism to record and respond to complaints on noise by the local communities.	in the close vicinity of active construction fronts and camps	Construction phase	Part of construction cost	Contractors will monitor air quality within the construction camps and active road construction fronts	Engineer will monitor in settlement areas, as provided in the Monitoring Plan.
6. Loss of Productive Soil	Top soil (0-25 cm) from the	All agricultural lands	Construction	Part of	Contractor	Engineer,

Stage/ Environmental Impact	Mitigation Measure	Location	Time Frame	Mitigation Cost	Institution Responsible	
					Implementation	Supervision
and Agricultural Lands	productive land will be collected and stored for reuse as final dressing of embankment turfing or given back to the farmers upon request Restore back to any land taken on lease or used community or/ government land for access roads and construction/labour camps to its original land use before handing it over back to land owners.	converted	phase	construction cost		Supervision Consultant (SC)
7. Landslide and Soil Erosion	Slope protection through road undercutting at the basal part, trimming/scaling of loose materials, surface water management, including protection and management of upper catchments Only required vegetation will be cleared and eroded bare slopes will be re-vegetated. Disposal of spoils and debris on the valley side will be strictly prohibited.	portion of the road located in erosion-prone Siwaliks, minor slides and slope failures were noted at the following locations: ch 25+500-25+550, 26+730-26+750, 27+220-27+250 and 28+400-28+440	Construction phase	**NRs 13,364,830.33** (This cost of bio engineering works is based on Engineers' Estimate)	Contractor	Engineer, Supervision Consultant (SC)
8. Borrow Pit and Quarry Site - Likelihood of slope failure, sedimentation, water logging, change in the aesthetic values of the landscape, damage to sensitive areas due to improper selection and management of borrow pit and quarry sites for the construction materials	i) Only wastelands will be used for borrowing and outside protected and forest areas, settlements, and water sources. ii) Approval from authorities of government and landowners will be taken. iii) Suitable size of borrow pits and quarry sites will be operated as per required volume of materials. iv) Top soil will be stockpiled and preserved for the re-instatement	All borrow pits and quarry areas	Construction phase	Part of construction cost	Contractor	Engineer, Supervision Consultant (SC)

Stage/ Environmental Impact	Mitigation Measure	Location	Time Frame	Mitigation Cost	Institution Responsible	
					Implementation	Supervision
	of the site or used in the road embankment turfing. v) Monitoring of borrow pits and quarry sites is given in Appendix 5.					
9. Soil Contamination and Compaction	Environmental Management Action Plan (EMAP) that further details the EMP will be prepared and submitted by the Contractor no later than 30 days after the Notice to Proceed (NTP) for review and approval of the Engineer. The location, layout, and operation guidelines of construction camps, haulage roads, workshop and storage area for different materials will provide in the EMAP. Detailed guidelines on materials handling will include: i) paved storage area with hamber to collect or recover any oil spills. ii) avoid and minimize the solid and liquid wastes generation. iii) wash-down and re-fuelling areas will have oil interceptors iv) Oil and grease spill and oil soaked materials will be collected and stored in labeled containers (Labeled: WASTE OIL and hazardous sign be displayed). v) Restrict movement of construction vehicles, machinery and equipment in the designated haulage route. vi) Design approach roads through the waste/barren land and rocky	Construction camp, haul roads, project road	Construction phase	Part of construction cost	Contractor	Engineer, Supervision Consultant (SC)

Stage/ Environmental Impact	Mitigation Measure	Location	Time Frame	Mitigation Cost	Institution Responsible	
					Implementation	Supervision
	area to reduce the soil compaction vii) Farm land will be restored after the completion of road improvement activity. viii) Temporary latrine pits provided in the construction camps. ix) Solid waste generated from construction camp will be segregated, and composted or recycled.					
10. Siltation and Contamination of Rivers	i) Prohibit disposal of excavated spoils and debris into river water. ii) Bridge construction activities including pile driving will not be undertaken during monsoon season (June- September). iii) All chemicals and oil will be stored away from water and concreted platform with catchments pits for spills collection. iv) training program to all equipment operators, drivers, and warehouse personnel on immediate response for spill contamination and eventual cleanup. v) emergency procedures and reports distributed to the equipment operators, drivers and warehouse personnel. vi) Silt fencing and/or brush barrier vii) No vehicle or equipment will be washed, parked or refueled near river water	All water bodies	During construction near waterbodies	Part of construction cost	Contractor	CSC

Stage/ Environmental Impact	Mitigation Measure	Location	Time Frame	Mitigation Cost	Institution Responsible	
					Implementation	Supervision
	viii) Provide chute drains to drain surface runoff and prevent erosion from slopes. ix) All labor camps will be located at least 500 meters from rivers and to the extent possible laborers will be locally recruited to avoid large camps. x) Sewage from labor camps will be treated through septic tanks prior to disposal xi) Water quality monitoring upstream and downstream water quality parameters will be collected to determine the effectiveness of mitigation measures					
11. Hydrology and drainage - risk of increasing sedimentation and siltation of waterways during construction phase	Existing natural drainage system, including irrigation channels will not be disturbed. Causeways will be provided in each perennial and seasonal streams as well as rivulets. Adequate cross drainage structures will be provided to facilitate natural flow of water across road embankment. New bridge sites are selected because of the geologically stability and elevation to minimize risk of slope failure and bank cutting problem.	All water bodies crossed by the Project road	During construction near waterbodies	Part of construction cost	Contractor	CSC
12. Construction Spoils/Waste	As a component of the Environmental Management Action Plan, the contractor will provide	Construction camp and project road alignment	30 days before start of construction	Part of construction cost	Contractor	CSC

Stage/ Environmental Impact	Mitigation Measure	Location	Time Frame	Mitigation Cost	Institution Responsible	
					Implementation	Supervision
	details of monthly estimated amounts of waste by type, type of collection, treatment, and disposal.		submission of EMAP, implementation during construction phase			
13. Reduction of forest land and removal of trees - 9.45 km of the proposed road section passes through community forest around 1,095 trees will be felled during the construction period including the clearing of bushes and shrubs.	Clearance will be secured from the CFUGs prior to clearing including management of recovered timber. The DOR will provide necessary resources to implement a 1:25 compensatory plantation and 5 years care in coordination with the CFUGs. Cleared areas will be re-vegetated with suitable local species.	Community forestland	Construction phase	Rs2,701,170	DOF, CFUG	CSC, DOR
14. induce wildlife-human conflict, reduction of endangered species, and degradation of the KTWR	i) Facilitate elephant movement under Gangajali Khola bridge by installation of speed breakers and sign boards and planting fodder trees along the river side. ii) provide support to the KTWR habitat enhancement program by developing fodder plantation within the reserve and minimize movements of mammals outside the reserve, iii) install checkpoints at both ends of the project road within the Buffer Zone to enhance environmental enforcement of KTWR, iv) Launch a capacity building program that will foster greater government and community partnership in protecting KTWR	KTWR Buffer Zone	Construction phase		DoR design and Bid Document Preparation	ADB
15. Fauna	i) No construction camps or	KTWR Buffer Zone	Construction		Contractor	CSC

Stage/ Environmental Impact	Mitigation Measure	Location	Time Frame	Mitigation Cost	Institution Responsible	
					Implementation	Supervision
movement of Asian Elephant, and induce impacts of increasing settlements inside the Buffer Zone which will KTWR magnify wildlife-human conflict involving other protected species like wild buffalo, deer, wild pig, monkey, common leopard, bear, jackal, hare, and common mongoose	staging camps including temporary storage will be allowed inside the KTWR-Buffer Zone. ii) No materials will be sourced inside the KTWR Zone. This includes earth borrowing, quarrying, and 3rd party supplier. iii) All works will be suspended between sunset and sunrise, and during migration season of Asian Elephants. iv) Harvesting of flora and fauna are prohibited v) coordinate with the KTWR Warden Office and will seek necessary instructions need to be followed. vi) make aware workforce regarding the importance of KTWR and Buffer Zone Area, and disciplines and precautions that need to be followed while performing construction activities. vii) I follow strictly all conditions that are mentioned in the mitigation plan. viii) provide precautionary mechanism to avoid accidental spills of oils/grease/chemicals, and also spread of wastes/spoils, controlling of open filled defecation by work staff to protect aquatic resources. ix) Speed brakes in terms of		phase			

Stage/ Environmental Impact	Mitigation Measure	Location	Time Frame	Mitigation Cost	Institution Responsible	
					Implementation	Supervision
	temporary barriers and sign boards will be installed to advice motorist of incoming hazards and to reduce vehicle speed at most 40kph Installation and operation of the wildlife checkposts to be located at both ends of project road and KTWR Buffer Zone intersections to monitor wildlife movement and strictly enforce the EMP provisions x) Blowing vehicle horn is restricted.					
16. Occupational Health and Safety	Appendix 6 presents the "Work Safety in Common Operation and Construction" to be implemented by the Contactor.					
17. Hygiene in the Construction Camp	i) provide electricity, gas and water to the construction camp, ii) health and safety of personnel, in collaboration with local health officials, will ensure that medical staff, first aid facilities, sick bay and ambulance service are available at all times, iii) conduct STI, STD and HIV-AIDS awareness program, iv) providing sufficient supply of suitable food and water, and v) take necessary precautions to protect personnel from insect and pest nuisance to reduce their danger to health, and vi) appoint in writing a safety officer no later than 30 calendar days after the issuance of Notice to					

Stage/ Environmental Impact	Mitigation Measure	Location	Time Frame	Mitigation Cost	Institution Responsible	
					Implementation	Supervision
	Proceed					
18. Impacts on Community Health and Safety	i) minimize pedestrian interaction with construction vehicles, ii) install signage, visibility and overall road safety particularly near schools or where children are present, x) coordinate with local emergency groups on location of active construction fronts to facilitate appropriate first aide, xi) use of local materials to the extent possible to reduce hauling distance, xii) employ flag person to warn dangerous conditions. xiii) proper labeling of container content, hazards, and operator's contact details; xiv) ensure the integrity of the packaging/containers and transport vehicle are commensurate to the hazardous material; iv) drivers and assistants are trained on transport and emergency procedures; xv) operator has the means to respond to emergencies on a 24 hour basis. xvi) undertake health awareness and education through information and promoting individual protection. xvii) link with existing state and national health programs on STDs, HIV/AIDS, and immunization.	In and around construction camp	Construction phase	Part of construction cost	Contractor	CSC

Stage/ Environmental Impact	Mitigation Measure	Location	Time Frame	Mitigation Cost	Institution Responsible	
					Implementation	Supervision
	xviii) Provide treatment of communicable diseases in community health care facilities, access to medical treatment, confidentiality particularly with respect to migrant workers. xix) implement mosquito, rodent, and arthropod-borne diseases control					
19. Transportation and Storage of Materials Likely impact due to transportation and storage of materials such as oils, fuel, bitumen, blasting materials, construction materials, etc	i) Store materials nearby the construction sites without damaging farm lands. ii) Store oils, fuels, bitumen and other chemicals on concreted platform with spill collection pits and cement covering by water proof tarpaulin, and locate at least 150 m away from habitat. iii) Avoid use of haulage trucks higher than the carrying capacity of the haulage roads and existing roads. iv) The contractor will be responsible for repair and maintenance of damaged existing road by the haulage trucks.	Throughout the road corridor	During Construction	Included in Engineers' Estimate	Contractor	SC, DOR/PD
20. Natural Hazard Possibility of damage to road due to natural hazard such as flooding and siltation, and earthquake	i) Design the road embankment level to be higher than the highest flow level and/or flood level of the rivers, streams and rivulets. ii) Design the sub-project structures with the consideration of probability of earthquakes.	As required at road alignment	During Construction	Included in Engineers' Estimate	Contractor	SC, DOR/PD
Environmental Impacts during Operation Stage						

Stage/ Environmental Impact	Mitigation Measure	Location	Time Frame	Mitigation Cost	Institution Responsible	
					Implementation	Supervision
21. Impacts expected to occur are deterioration of air quality from increase emissions from increase in traffic, risk of structural damage from increase in vibration, improve accessibility will increase the need to convert lands into built-area resulting loss in agricultural lands and congestion, deterioration of receiving water quality from oil laden runoff, and increase in road crashes.	During the project operation phase, the DoR has limited control over the road users and can only implement activities that will influence vehicle owners in controlling emissions. These activities include: i) coordination with relevant agencies on the implementation of the Nepal Vehicle Mass Emission Standard, 2056 (2000) , ii) informatory road signs reminding the motorist to properly maintain their vehicles to economize on fuel consumption and protect the environment; iii) support development organizations (NGO, INGO and CBOs) to motivate the local communities to maintain greenery in the project area. iv) vegetation noise barriers as a component of compensatory afforestation; v) ii) speed brakes near community areas and inside the KTWR Buffer Zone. vi) coordinate with the MoPPW to monitor truck loads as per Nepal Road Standard, 2027 B.S. (First Revision 2045 B.S.) and drivers will be made aware about the capacity of the road and bridges, and their consequences through signage vii) encourage VDCs to prepare and implement their respective	Entire project road	Operation phase	Agency budget	DOR	

Stage/ Environmental Impact	Mitigation Measure	Location	Time Frame	Mitigation Cost	Institution Responsible	
					Implementation	Supervision
	development plans . Also, the DOR will strictly implement its policy of 25 m ROW protection in the Highway . viii) DOR will implement its Length-Persons system for recurrent maintenance of roads like cleaning up drains, soil deposited on the roads due to slope failure and erosion to maintain and sustain access. ix) The risk cause by increase in traffic to communities will be addressed early in the when road safety furniture have been integrate in the overall road design.					

ENVIRONMENTAL MONITORING PLAN

Environmental Indicators	Project Stage	Parameters	Methods/Guidelines	Tentative Location	Frequency and duration	Standards	Cost	Implem' nt.	Super vision
1. Asian elephant and other wildlife movement	Construction	Population (by gender and age) Location, time, and date of sighting Track taken Location, time, and cost of damage caused during conflict	Visual	Triyuga River Kamalpur, Odraha, and Kanchanpur	During peak human-elephant conflict: June-July (Maize & Wheat) and Sept-Nov (Paddy)	None	NRs100,000 per season x 2 seasons x 3 years = Rs600,000 per	SC-Wildlife expert	KTWR Warden and DOR
2. Air Quality	Construction	TSPM, PM_{10}, NOx, SOx, COx	Stack emission testing Emission testing for all vehicles Ambient air quality sampling and analysis at selected sites/sensitive spots using through High Volume Sampler 24-hour	Crusher, hot mix plants, diesel generator Construction camp Major settlements: Nadaha, Bhandaritar, Sombare, Dumri Bote, Seti Khola Gaun, Rampur, Budhha Chowk, Gurung Chauri Lalbazar, Ghumne Chauri, Supade Gaun, Basaha Gaun, Sanibare Chowk, Charan, Chamling Chowk, Ambasi Chowk, Bollard Naya Bazaar, Bhagani	Annual in line with permit renewal Annual as part of permit renewal Baseline: 1 sampling each before construction Monthly when construction is on-going along settled area	National Ambient Air Quality Standards (NAAQS)	Part of permit renewal 22 sites x 10,000/sampling = NRs 220,000 22 sites x 3 months x 10,000 = NRs 660,000	Contractor Contractor SC	SC, DOR SC, DOR DOR

Environmental Indicators	Project Stage	Parameters	Methods/Guidelines	Tentative Location	Frequency and duration	Standards	Cost	Implem' nt.	Super vision
				Maleth Chowk, Maleth, Quarter Chowk, Baluwa Chowk, Chandani Chowk Sensitive site: KTWR Buffer Zone (1 km interval)	6 months		10 sites x 10,000/sampling = Nrs 100,000		
	Operation			Major settlements				DOR	
3. Water Quality	Construction	BOD, Turbidity, E.Coli, TSS, Oil and Grease	•Collect and analyze sample from source • Observation of blockage of waterways - extent and secondary impacts • Water pollution incidents due to unsafe disposal of waste and spoil, analyzing effects on local fisheries • Observations on vehicle and equipment washing practices in rivers	All 27 bridges along the road Upstream and downstream of the bridge	Once a month for 2 months	Nepal Water Quality Guidelines for the Protection of Aquatic Ecosystems	27 rivers x 2 months x 2 points (up- and downstream) x NRs3,750 =NRs.405,000	SC	PD/ DOR
				Construction camp final discharge effluent	Monthly for 3 years		36 months xNRs3,750 = NRs135,750	SC	PD/ DOR
		Drinking water quality parameters		Contractor's camp	Monthy for 3 years	National Drinking Water Quality Standards (NDWQS) and	Rs135,750	Contractor	SC, DOR
		Clogging of drains from silt with oil	Groundwater well sampling						

Environmental Indicators	Project Stage	Parameters	Methods/Guidelines	Tentative Location	Frequency and duration	Standards	Cost	Implem' nt.	Super vision
	Operation		Visual	All drains	Annually before the on-set of rainy season		Agency budget	DOR	
4. Soil Quality	Construction Stage	Check for contamination from material spills and compaction due to heavy equipment	Visual	Agricultural Land, oil spillage locations and other probable hazardous materials contamination location or as suggested by SC	Continuing during construction	Should be the same as baseline before start of construction	Part of construction cost and Grievance redress mechanism	Contractor	S
	Operation Stage			Agricultural Land, oil spillage locations and other probable hazardous materials contamination location or as suggested by SC (5 Locations)	Continuing		Clean up of spills is responsibility of polluter	DOR	
5. Noise Levels	Construction	(1 hr L_{eq} dB(A)) WHO Standards	• Point source measurements in dB (A) at settlement sites/sensitive spots for noise level at 2, 5 and 15 m from road shoulder • Traffic volume	Construction sites, major road intersections, residential, commercial and sensitive receivers along the road alignment or suggested by SC	1 site for each 22 settlement sites monthy for 3 months 10 points	Nepal Ambient Noise Level as per NHRC	22 x 1 x 3 x NR2,450 =NRs.,161, 700 10 x 3 x NRs2,450 = NRs=73,50	Contract or	SC, PD/DO R

Environmental Indicators	Project Stage	Parameters	Methods/Guidelines	Tentative Location	Frequency and duration	Standards	Cost	Implem' nt.	Super vision
			measurements		inside KTWR Buffer Zone for 3 months		0		
	Operation			Major road intersections, residential, commercial and sensitive receivers along the road alignment or suggested by SC	Once during the first year of operation		Part of agency budget	DOR	
6. Landslide and Soil Erosion	Construction	Magnitude, extent and location	Visual	portion of the road located in erosion-prone Siwaliks, minor slides and slope failures were noted at the following locations: ch 25+500-25+550, 26+730-26+750, 27+220-27+250 and 28+400-28+440	Annually for 3 years	No landslide and erosion that will block access or endanger road users	Constructio n Contract	Contract or	SC, PD/DO R
	Operation	Magnitude, extent and location		Throughout the road alignment,				DOR	SC, PD/DO R
7. Siltation by rivers and drainage congestion	Construction	• Siltation and presence of construction spoils and wastes • Blockage of waterways - extent and secondary impacts	Direct Observation	Throughout the road alignment, especially at the drainage congestion areas as mentioned in the EIA report or as suggested by SC	Continuing during construction phase	Visual Observation	Constructio n contract	Contract or	SC, PD/DO R
	Operation	• Siltation • Blockage of			Annual		DOR Length	DOR	

Environmental Indicators	Project Stage	Parameters	Methods/Guidelines	Tentative Location	Frequency and duration	Standards	Cost	Implem' nt.	Super vision
		waterways - extent and secondary impacts					Person System		
8. Borrow Areas and Quarry Sites	Construction	Location, drainage condition, siltation, erosion, spoil management, etc	Site observation, discussion with workers and local people	Borrow areas quarry sites location	Quarterly during construction period	Visual Observation	Construction Contract	Contractor	SC, PD DOR
	Operation	Restoration as recommended in the EMP	Site observation, discussion with workers and local people		Once immediately after the completion of construction		DOR	DOR	
9. Labour Camps	Construction	Proper sitting of food stalls, camp sanitation facilities	Site observation, discussion with workers and local people	Construction and camp sites	Quarterly during construction period	Visual Observation	Construction Contract	Contractor	SC, PD/DOR
	Operation	Restoration of construction camp as recommended in the EMP	Site observation and discussion with local people	Construction sites and camps	Once immediately after the completion of construction		DOR	DOR	
10. Tree Plantation	Construction	Maintenance of saplings planted as compensation for trees felled	Direct Observation, discussion with workers and local people	Throughout the road alignment	Once a month for one year immediately after plantation	Visual Observation	Included in environmental mitigation cost	CFUGs	DFO DOR
	Operation	Maintenance of saplings planted during construction Survival rate of trees	Direct Observation and discussion with local people		Once a month for one year for saplings that are less			CFUGs	DFO DOR

Environmental Indicators	Project Stage	Parameters	Methods/Guidelines	Tentative Location	Frequency and duration	Standards	Cost	Implem' nt.	Super vision
		Growth and development of saplings			than a year old Once in a year for 5 years				
11. Road Safety and Accidents	Construction	Accidents (Major and minor) Safety	• Record numbers and types of road accidents recorded by the traffic police and the local health service centres • Suitability of signs at construction sites • Direct observation and discussion with workers and local people	Throughout the road alignment	Once after the construction begins	Visual Observation , Verification and discussion with workers and local people	Construction contract	Contractor	S DOR
	Operation		• Record numbers and types of road accidents recorded by the traffic police and the local health service centres • Suitability of local road signs • Records on public road safety awareness campaigns • Direct observation and discussion with local people • Speed measurements at selected spots	Throughout the road alignment	Once a year		DOR	DOR	

GUIDELINES FOR BORROW AND QUARRY AREAS MANAGEMENT

Datasheet for Quarry Management and Restoration Plan

(i) Datasheet

Name of Subproject:

Contract No:

Locations of Civil Works:

Type of Structure: Slab culvert / Pipe culvert / RRM wall / Gabion wall (Chainage wise).

Required Type of Material from Local Sources: Stone / Gravel / Sand / Soil.

Required quantity of material from local quarry (in cum):

(Write qty. from different sources in serial order)

Parameter for quarry site selection: (e.g. unsuitable land for cultivation, stable slope, minimum environmental hazard etc.).

Sources of Material: Within RoW / Private land / Public land / Forest (community/ private/government/religious/leasehold)/Surplus material extracted by workers / River / Stream / Borrow pit / Roadway.

Available quantity in Selected Source (in cum**)**:

Approval for Quarry site: GON Organizations/ Private Party/ Community / Land Owner (Attach agreement herewith).

Method of extraction and transportation: Depth of cut / Height of cut / and Tractor / Tipper / Manually or any means.

Precaution measures during excavation:

Likely negative environmental impacts:

(ii) Restoration Plan

Restoration Plan: Trimming of slope / Filling of quarry / Need of check wall / Toe wall / Plantation / Benching etc.,

Any special safety arrangement required:

Mitigation measures for negative environmental impacts:

Verification of Restoration Work as Planned by the Supervision Consultant Engineer/ES:

Certification of the Restoration Plan at the end of work at each location

Annex:

Quarry plan:

X-section @ of 5-10m intervals (where appropriate)

Quantity estimation sheets

Restoration design on X-section and plan

Submitted by: Checked by: Approved by:

Note: The payment of each structure will be made only after filling of the data by the contractor for Quarry Management and Restoration Plan. Final payment will be dependent on verification and approval by SC at the end construction of each respective structure.

Guideline for Quarries and Borrows Management and Restoration Plan Preparation

Introduction

1. The guideline makes effort to highlight points to be considered in preparing quarry management and restoration plan. The purpose of this document is to provide reference to select quarry and borrow sits and check the quarry management and restoration plan submitted by the Contractor. The guideline has been prepared taking into consideration to the works mentioned in contract and EIA/EMP.

Quarry Site

2. Quarry is a place from which construction materials (soil, stone, sand, gravel, etc.,) are extracted. Quarry site potential depends upon availability of sources (quantity) and suitability of materials.

Parameter to be Considered for Quarry Site Selection

3. Quarry site should be located 1 km away from the villages/settlement area, drinking water supply sources, community infrastructure such as school, health post, bridge, etc., religious sites, cultivated land, protected forests, natural drainage systems. Quarry will not be located at wildlife conservation area. River gravel will not be extracted from flowing water due the disturbance of raising sediment and danger of resulting oil/fuel leaks.

4. Quarry sites should be selected in stable area, in agriculturally unsuitable land and away from the above mentioned sites. In addition to this, local communities will be consulted and take approval from respective owner before selecting the place for quarry operation.

Likely Negative Environmental Impacts

5. The potential negative impacts are disruption of natural landscape and vegetation, accelerated erosion and landslides, slope stability, disturbance in natural drainage patterns, siltation due to surface water, water pollution and dust pollution. In case of riverbeds, scouring of riverbeds resulting endangerment of bridges and continuous degradation of river regime and detrimental effects on aquatic lives and their habitats.

Quarry Operation

6. Prohibition to work during the night time

7. Barricade to site to control free movement of local people

Points to be Considered in Restoration Plan

8. In order to prepare quarry management and restoration plan the following points should be taken into consideration:

9. The plan must contain site restoration measures such as spoil management, slope stabilisation, drainage pattern, etc.

10. Suitability of proposed mitigation measures for negative environmental impacts is needed to be conformed and verified.

11. Provision of drainage system during operation and no risk of likelihood of depositions of debris from quarry to lower catchments are important.

12. The plan must contain provision of spoil collection and appropriate management during operation, if necessary.

13. The plan should mention use of safety gears during working hours in the quarry site, and appropriate means of safeguarding for passer-by and nearby households.

14. The plan should include suitable bioengineering techniques where appropriate.

15. **Acceptance of Restoration Work:** The Supervision Consultant should satisfy himself and accept the restoration works carried out by the Contractor. The mentioned teams` engineer/ES will make sure that quarries are operated and closed according to the submitted plan.

16. The payment of each works structure should only be made after filling of the data by the Contractor for quarry management and restoration plan and acceptance by the Supervision Consultant. Final payment will be dependent on verification and approval by SC at the end construction of each respective structure.

17. **Site Supervision:** The Supervision Consultant engineer/ES shall supervise the following parameters and indicators:

- Implementation of mitigation measures as per design plan;
- No evidence of water ponding or presence of fresh gullies;
- Proper site closure;
- Natural contours and vegetation restoration;
- Engineer’s report testifying to completion of restoration work.

18. Other details will be submitted in **Appendices**.

WORKERS' SAFETY IN COMMON OPERATION AND DURING CONSTRUCTION

HOUSEKEEPING PRACTICES

- Maintain washrooms and canteens clean
- Keep all walkways clear and unobstructed at all times
- Ensure that no spillages of oil and grease occurs in the construction camp
- Stack raw materials and finished products clear of walkways or out of roads
- Do not leave tools on the floor or in any location where they can be easily dislodged
- Keep windows and light fittings clean
- Maintain the workplace floors dry and in a non-slippery condition
- Provide and maintain proper drainage system to prevent stagnant water.
- Use metal bins for oily and greasy rags and store all flammable materials in appropriate bins, racks or cabinets. Ensure that the meal bins for storing oily and grease rags should be covered with lids.
- Ensure that protruding nails in boards or walls are removed or bent over so that they do not constitute an hazard to people
- Make sure that hazardous/dangerous chemicals are kept in the stores with the appropriate labeling, display of the material-safety-data-sheet (MSDS) and other precautionary measures
- Display 'no smoking' signs in areas with high fire risks such as paint stores, wood working areas, etc.

SAFE LAYOUT IN THE CONSTRUCTION PLANT, CAMP AND QUARRY AREAS

- Arrange perimeter fencing for construction plant
- Ensure good visibility and safe access at site entrances
- Provide adequate warning signs at the entrance and exit and where ever necessary
- Provide adequate space/area for loading, unloading and storage of materials, plant and machinery
- Display emergency procedure and statutory notices at conspicuous locations
- Consider provision of welfare facilities required
- Provide areas for dumping garbage and other waste materials, and also arrange their regular clearance and safe disposal
- Arrange storage, transport and use of fuel, other flammable materials and explosives in lines with the license requirements to be obtained from appropriate authorities
- Plan emergency assembly points, fire escape routes and location of fire-fighting equipment
- Provide access roads and plant movement areas within the site.
- Ensure the availability of first aid facilities and display notices to show the location of these facilities
- Provide proper drainage and sewage facilities

TREE FELLING

- Use hard hats during tree felling works
- Ensure that tools such as axes are in good condition
- Determine proper foot and body position while using the axe
- Wear appropriate foot protection while felling trees
- Carry a first aid kit to the site
- Determine possible hazards in the area, with reference to electrical or telephone or other utility lines
- Determine the safest direction for the tree fall prior to felling
- Determine the proper hinge size before directing the tree fall.

NOISE HAZARDS AND ITS CONTROL

- Observe the indications of noise levels
- Use sound level meters to measure. If the sound level exceeds 85 dB(A), then preventive and protective measures should be taken
- Make personnel aware of noisy areas by using suitable warning signs and insisting that ear protective devices should necessarily be worn.
- Reduce noise at source by improved maintenance, replacing noisy machines, screening with noise absorbing material, making changes to the process/equipment, controlling machine speeds, ensuring that two noise-generating machines are not running at the same time, using cutting oils and hydraulic breakers.
- Appoint a competent person to carry out a detailed noise assessment in the site, designate ear protection zone, and give instructions on the necessary precautionary measures to be observed by site personnel, including the use of suitable type of ear protections.
- Wear and maintain ear muffs and ear plugs as required
- In construction or repair works, noise should be kept to a low-level bearing in mind the disturbance to local residents.

ROAD WORKS

- The use of signage is most important to caution the road users of possible unsafe conditions due to the road works.
- Use appropriate signage devices as required by the site conditions/situation. The devices include regulatory signs, delineators, barricades, cones, pavement markings, lanterns and traffic control lights.
- While using signs, make sure that they are (i) simple, easy-to-understand and convey only one message, (ii) luminescent and with reflective properties and (iii) prominent and of appropriate size.
- While using barricades, make sure that you keep traffic away from work areas and you guide the drivers to keep along a safe and alternative path.
- Ensure that proper personal protective equipment (PPE) is provided to all the workers.
- Cover existing road signs and install new ones at appropriate locations taking into account the distances that would be required and reaction times.

- Plan layout and traffic management so that hazards do not occur.
- Deploy flagmen to control traffic at the work areas. The flag should be 600mm x 600mm fastened to a 1m length staff.
- Flagmen should wear reflective safety vests along with hard hats.
- If required, use wireless devices for flagmen to co-ordinate form either ends of the road, where works are being carried out.

ELECTRICAL HAZARDS IN CONSTRUCTION AREAS

- Treat all wires as live wires
- Never touch dangling wires but report them to the manager
- Unless you are a qualified electrician do not attempt electrical repairs
- Never use electrical equipments if your hands are wet or you are standing in water
- If electrical equipment is sparking or smoking, turn the power off and report the condition to the supervisor
- Never use electrical wires having physical damage
- Never allow equipment or traffic to run over the electrical wires.

USE AND STORAGE OF GAS/LPG

- Store filled gas/LPG cylinder in an open area or outside the building
- Transport, store, use and secure cylinders in upright position
- Ensure proper ventilation at the ground level where the gas/LPG is in use
- Avoid physical damage to the cylinder
- Never weld or cut on or near the cylinder
- Store empty cylinders secured and in upright position.
- Make sure that the cylinder is closed immediately after use.
- Investigate immediately if there is the smell of LPG or gas.
- Never use destenched gas/LPG on site.
- Make sure that there is no fire in the vicinity of the cylinder.

OPERATION OF EXCAVATORS

- Ensure that excavators are operated by authorized persons who have adequately trained.
- Prevent unauthorized movement or use of excavators
- Check regularly and maintain the machine thoroughly
- Ensure that all relevant information, including those related to instruction, training, supervision and safe system of work are provided to the operators.
- Ensure that the operation and maintenance manuals, manufacturer’s specifications, inspection and maintenance log books are provided for the use of machines to service engineers or other safety personnel during periodic maintenance, inspection and examination.

- During tipping or running along the trenches, excavators must be provided with stop blocks.
- Excavators must be rested on firm ground during operation.
- Avoid operating the machine too close to an overhand, deep ditch or slope.
- Locate and identify underground utility services by checking with all utility companies before the excavations.
- Ensure that all excavations are supervised by experienced and competent persons.
- When reversing or in case the operator's view is restricted, adequate supervision and signaling should be provided.
- Ensure that the type and capacity of the excavator are properly chosen for the intended purposes and site conditions. Never use a machine for any purposes other than it is designed for.
- Check and report for excessive wear and any breakage of the bucket, blade, edge, tooth and other working tools of the excavator.
- Check that all linkages/hinges are properly lubricated and ensure that the linkage pins are secured. Never use the improper linkage pins.
- Never get down or climb a moving machine
- Ensure adequate ventilation and lighting in the working place.
- Ensure that the protective front screen of the driving cabin is fixed in position during excavations to avoid eye injury to the operator.
- Ensure to switch-off the unattended vehicle.

OPERATION OF TRUCKS AND DUMPERS

- Ensure that only trained, authorized and licensed drivers operate the vehicles.
- Provide the help of another worker before reversing the vehicle.
- Switch-off the engine of an unattended vehicle.
- Lower the tipping bodies when the machine is unattended, but if it is necessary to leave them in the raised position they should be blocked to prevent their fall.
- Wear safety boots or shoes to avoid injuries during loading and unloading.
- Carryout periodic servicing to the manufacturer's requirements. All records of maintenance and repairs should be in writing and kept in the site.
- Keep the vehicle tidy and its cabin free from tools and materials which might obstruct the controls.
- Do not exceed speed limits.
- No passenger should be carried on a dumper except the driver
- Never drive the vehicle across a slope
- Provide stop blocks when the vehicle is tipping into or running towards excavations
- Do not overload the vehicle.
- Carry only well secured loads.
- Park only on level ground, in neutral with the parking brake applied.

- Never climb or get down from a moving vehicle.

GAS WELDING

- Use the following personal protective equipment during welding
    a. Face or hand shield fitted with filters,
    b. Goggles, particularly while chipping slag,
    c. Gloves long enough to protect wrists and forearms against heats, molten metal and radiation,
    d. High-top boots to prevent sparks from burning foot.
- Screen the work area with sturdy opaque or translucent materials as glare can cause eye injury.
- Key for opening the acetylene cylinder valve must be kept ready while the cylinder is in use so that the cylinder valve may be immediately shut-off in an emergency.
- Ventilate the workplace using air blowers and exhaust fans to remove poisonous fumes and gases that are being used during welding
- Take precautions against flying spark and hot slag where welding is being done near flammable materials and check the area before leaving.
- Do not weld the material degreased with solvents until it is completely dry.
- Do not use gas cylinders for supporting work or as rollers.
- Do not use oil/grease on oxygen cylinder fittings.
- Do not use cylinders with damaged valves.
- Do not use too much force if valves are stuck.
- Replace valve caps after use
- Search for leaks in equipment by using a solution of soap water.
- Shut the cylinder valve if acetylene from a cylinder catches fire at the valve or regulator due to leakage at a connection.
- Treat all gas cylinders as “full” unless you are sure otherwise.
- Never attempt to transfer acetylene from one cylinder to another or attempt to refill an acetylene cylinder.
- Keep portable fire extinguishers near the welding area
- Secure all cylinders against accidental displacement.
- Always lift gas cylinders. Do not slide them along the ground or drop them from trucks.
- Keep gas cylinders in vertical position both in store and when it is in use.
- Keep the work place dry, secure, free from combustible materials and obstruction.
- Store the acetylene and oxygen cylinders separately and in a proper store.
- Keep the gas cylinders away from source of heat, flammable materials, corrosive chemicals and fumes.

MANUAL HANDLING AND LIFTING

- Use mechanical equipment in place of manual handling as far as possible.

- Assess the manpower required to handle or lift the load safely and arrange the manpower accordingly.
- While handling hazardous materials, the workers shall be informed of the hazards and safety precautions.
- All relevant persons shall be trained on proper methods of lifting and carrying.
- Where team work is required, select the persons whose ages and physical builds are compatible for teaming up. Coordinate the actions of the team members by giving necessary instructions.
- Always lighten or suitably shape the load for manual handling. As far as possible keep a look for splinters, sharp edges, loose banding and nails.
- Clear path or obstruction and tripping hazards.
- Stack and secure goods safely on trucks, otherwise they fall off and injure passers-by.
- Use personal protective equipment such as gloves, safety shoes, etc.
- Adopt the following procedure when you lift a load.
    a. Stand close to the object, have a firm footing with feet spread on either side of the road.
    b. Bend the knees and keep your back as straight as you can.
    c. Grasp object firmly & be sure grip will not slip
    d. Breathe in and throw the shoulder backwards.
    e. Straighten the legs, continuing to keep the back as straight as you can.
    f. Hold the object firmly & close to the body
    g. Always lift smoothly, avoid jerky motions and turn with feet instead of twisting the back.

FIRST AID

- Provide first aid boxes at every site.
- Ensure that training on the use of first aid box is provided to a handful of staff working in the site.
- Display the list of persons who are trained on providing first aid.
- Ensure that every first aid box is marked plainly “First Aid” in English and local language.
- The responsible person or first aider should replenish the contents of the first aid box as necessary.

PERSONAL PROTECTIVE EQUIPMENT

List of personal protective equipment (PPE)

Sl. No.	Part of the body	Personal protective Equipment
1	Eye	Safety glasses, Goggles
2	Face	Face shields
3	Nose	Nose masks
4	Head	Helmets
5	Feet	Safety shoes
6	Hands and Arms	Gloves
7	Body	Vests
8	Hearing	Earplugs, Earmuffs

Cost of Personal Protective Equipment (PPE):

Cost of Personal Protective Equipment per person per project has been considered based on the assumption that one person/labour requires two set of PPE till the completion of the project. Cost per set of PPE is taken as Rs. 750 on an average for EMP BoQ estimate. So cost/ person/ project will be NRs. 1500.00

General:

- Ensure that sufficient personal protective equipments are provided and that they are readily available for every person who may need to use them.
- The management should ensure that all persons make full and proper use of the personal protective equipment provided.
- Provide instruction and training on the proper use and care of protective equipment.
- Do not willfully misuse, interfere with or ill-treat any protective clothing and equipment provided.
- Ensure that the personal protective equipments are in good condition. Report immediately any damage to the management for replacement. Always keep the personal protective equipment as clean as possible.

Eye Protection

- Issue eye protection equipment where there is a foreseeable risk of eye injury.
- Ensure an adequate supply of goggles/shields is available.
- Keep the goggles clean and make sure they fit well.
- Do not watch welding operations unless your eyes are protected.

Head Protection

- No person shall enter a construction site unless he is wearing a suitable safety helmet
- Wear a safety helmet:
    - When there is the risk of being hit by falling objects
    - While on or near a construction site
    - During adverse weather conditions
    - When in any area designated as a “hard hat” area.
- Provide identification labels to all helmets in some way to prevent random exchange among wearers, with one helmet exclusive to each person.

- Inspect helmets for cracks, sign of impact or rough treatment before each usage and replace defective or damaged helmets.

Hearing Protection

- Provide ear plugs or ear muffs as required. Use re-usable ear plugs when the reduction required (15-25 dB (A) is not excessive. Use ear muffs where a large attenuation of up to 40 dB (A) is demanded.
- Do not use dry cotton wool for hearing protection because it cannot provide protection.
- Provide disposable ear plugs for infrequent visitors and ensure that they are never re-used.
- Provide re-usable ear plugs for those who need to work continuously for a long period in a high noise area.
- Use ear muffs with replaceable ear cushions because they deteriorate with age or may be damaged in use.
- Avoid wearing spectacles with ear muffs.
- Use soap and water or the recommended solvent for cleaning ear muffs.
- Provide ear muffs for those who may need to get in and out of a high noise area frequently.

RESPIRATORY PROTECTIVE EQUIPMENT

- Wear suitable respirable mask for protection against small particles entering the lungs, e.g. while emptying of cement bags.
- Provide training to all persons using the respirators for their correct fitting, use, limitations and symptoms of exposure.
- Clean and inspect all respirators before and after use.
- Store respirators properly when it is not in use.

Safety Footwear

- Wear suitable footwear while working.
- Use safety footwear on site or in dangerous areas.
- 3) Wear suitable safety shoes or ankle boots when working where there is a high risk of foot injuries from slippery or uneven ground, etc.
- All Safety footwear including safety shoes, ankle boots and rubber boots should be fitted with steel toecaps.
- Avoid wearing flip flops, high heeled shoes, slippers, light sport shoes in situations where there is a risk of foot injury.
- Keep shoe lace knots tight.

Hand Protection

- Wear suitable gloves for activities such as welding & cutting and manual handling of materials & equipment.
- Do not wear gloves where there is a risk of them becoming entangled in moving parts of machinery.

- Wash hands properly with disinfectant soap before eating & drinking. Wash hands immediately after each operation on site & when the situation warrants.

FIRE PREVENTION, FIGHTING AND EQUIPMENT

Before fire breaks out

- Store flammable material in proper areas having adequate fire protection systems.
- Display sufficient warning signs.
- Train selected personnel to use these fire extinguishers.
- Inspect fire extinguishers regularly and replace as necessary.
- Fire escape route should be kept clear at all times and clearly indicated.
- Know the escape route and assembly point.
- Display escape route maps prominently at prominent places.
- Carryout fire drill regularly. Designate fire Officers.
- Install fire alarm wherever required and test regularly.
- Provide sufficient exit signs at prominent locations for directing people to the escape route.

When fire breaks out

- Alert all persons.
- Put off the fire with appropriate fire extinguishers when you are sure that you are safe to do so.
- Escape if you are in danger through the fire escape route to assembly point.
- Fire officers should carryout head count at the assembly point.

GUIDELINES FOR WORKERS SAFETY DURING CONSTRUCTION

Sl. no.	Stage and Nature of construction Hazard	Safety measures expected to be taken by the contractors and site Engineers
1	Excavation in soft, loose & slushy soil above 2m depths sliding of earth or collapsing of sides.	The Excavation beyond 1.5m to 2m to be done in steps of minimum 500mm offsets and also planking and strutting should be done.
2	Excavation in slippery area (water logged) -the labour may fall or machinery on site may slip.	Try to dewater the area and spread minimum 150mm thick sand layer to avoid slipping
3	Excavation in rock where chiseling involved – The fall of hammer may injure the hand, small rock pieces may injure the eyes and legs.	For hammer work, only experienced and skilled labour should be employed. Chisel should not be allowed to be held by hand, while hammering but chisel holding clamp should be provided. The labour should be provided with goggles and leg cover to protect eyes and legs, from injuries due to small rock pieces.
4	Excavation in Rock where blasting is involved – careless handling may lead to injury to worker or a passerby.	The work of blasting should be entrusted to only experienced persons. Provide sufficient length of fuse to give ample margin of time from the time of lighting to the time of explosion. A danger zone at least 180m diameter is to be flagged off 10 minutes before

Sl. no.	Stage and Nature of construction Hazard	Safety measures expected to be taken by the contractors and site Engineers
		actual firing. All workmen should be sent way from danger zone except the firing man, who should be provided with a whistle.
5	Excavation for drain across road or manhole adjacent to a road – chances of a passer by falling into the excavated portion.	The area should be well barricaded & a red lamp provided at night. A watchman should be deputed to prevent any movement of persons or vehicles.
6	Centering and scaffolding – formwork collapse while concreting or just before concreting or just before concreting especially when wooden ballies are used.	Many a times ballies joined together give way due to weak joint. Hence the use of joined ballies should be restricted. Only 2 joined ballies out of 8 ballies should be allowed. In case of double staging for a slab at a height, utmost care should be taken to see that the top balli rests on the bottom balli. Particular care that should be taken during each concreting, operating of slabs and beams is that one carpenter and two helpers with spare ballies, nails etc. should be deputed below the slab/beam that is being concreted to watch any disturbance in the supports of the form-work below, during concreting and in case of any doubt concreting should be stopped immediately and the form work to be strengthened. Never allow bricks below a balli to make up the required height. This is most dangerous.
7	Form- work for beams and slabs – opening the form – work accident due to fall of materials during removing the forms.	In fact, this is a most dangerous work. One should be very careful while formwork is removed. Only trained carpenters should be deputed for the work. A safe resting place outside the area of slab as a temporary measure should be constructed from where the slab can be removed safely. Removal of form-work during night should not be permitted under any circumstances.
8	Scaffolding – Fall of work–man, supervision staff, standing on challis not tied properly or toed only at one end. (Challis mainly made of Bamboos)	This is a very common negligence on the part of labour who does scaffolding work. The Challis on which they work either span over its complete length or is tied loosely and many a times at one end only. Hence, care must be taken that the challis do not span over the full length but some middle support should be provided and also the same is tied properly on both ends.
9	Ladders - Balli or bamboo ladders – The horizontal member breaks and the person falls. Sometimes the top face just rests on wall and the whole ladder tilts causing an accident.	The ladders should be strong enough to bear the weight of a labour with materials on head. As for as possible a hand rail should be provided at one end. The horizontal member should be preferably fixed with bolt & nuts or strong nails. When the ladder is placed across a wall the top portion should be tied firmly to a strong support so that the ladder does not

Sl. no.	Stage and Nature of construction Hazard	Safety measures expected to be taken by the contractors and site Engineers
		move laterally.
10	Dismantling – Dismantled materials may fall on passerby or the person engaged in dismantling work may fall due to slipping. The dismantled materials may fall on persons working below.	When work of demolition is to be taken up the area should be closed for all outsiders. No one should be allowed up to 50m from the place of demolition. The workers engaged in demolition should be asked to wear safety belts. Helmets must be worn by all the workers engaged in dismantling work. The place should be strictly guarded at night with red lights at prominent places, and watchman should be posted.
11	Electrical connections/ cables etc., - HT / LT electric wire passing near the slab structure – while bending, lifting or tying reinforcements the bar benders may sustain the electric shock, causing fatal injury.	The work in such places should not be allowed to the workers themselves, but in such position the work must be executed under the strict supervision of a responsible Foreman or a Supervisor.
12	Electric- connections/cables, etc., - cables below ground may get punctured during excavation & thus electrocute the labour working. Similarly when connecting is in progress the punctured cable may prove to be fatal to the labour.	Before taking up the work all available drawings should be studied, local enquiry to be made to know the position of cables and work in such area should be got executed under strict supervision of an experienced Foreman or a supervisor.
13	Electric connections/cables etc.,- Temporary Electric lines near damp walls, near joinery stretched on a considerable length – There is every chance that the wire may get cut due to usage and may develop short circuits/leakages etc., and may electrocute the person touching the wire accidentally.	The Electric wires should be maintained by an electrician who should regularly check up the insulation of wires especially placed near steel items & damp areas. The temporary wiring should be supported properly. As far as possible a good quality wire should be used which may not get damaged easily.
14	Electric and gas welding work – Drilling, polishing work – Done by temporary cables used on a number of works – Due to the fact that the wires are old & when they come in contact with water even in the process of curing the surrounding area may get affected due to leakage in the electric current thus causing damage to the workers & supervision staff.	All wiring works to be inspected by experienced electrician. All wires to be properly insulated and fixed at height on temporary poles. No welding work should be permitted near damp area. The welders to be provided with welder's goggles & gloves. As far as possible machine in good condition should be used.
15	Construction machinery – Concrete mixers – Safety precautions. A mixer with hopper tried to be operated by an helper could not release brake in time thus causing injury to the person near hopper – sometimes fatal one.	The Mixers with hopper should be operated by an experienced mixer operator and such mixers should not be allowed to be handled by a helper or a labour.
16	Water storage Tank for general use and curing - chances of children of	The water tanks constructed on site should be protected by at least 1.0m high walls on four

Sl. no.	Stage and Nature of construction Hazard	Safety measures expected to be taken by the contractors and site Engineers
	workers falling in the tank with fatal accident.	sides, so that the children do not fall.
17	Site cleaning – Cleaning top floors of buildings – Upper portion of any structure – throwing waste materials broken concrete pieces, brick bats, sand etc., straightway from top to ground injuring person below or even a passerby.	This dangerous practice should not be allowed at all. The materials should be brought to the ground with the help of lift or the use of rope over pulley with a bucket, thus bringing down materials safely.
18	Bar bending work – Helpers of bar benders to follow short cut method, throw surplus steel pieces from top floors to ground and may cause fatal injuries.	This is a very bad practice. The helpers should bring the rods to ground with help of lift or rope and pulley.

PUBLIC CONSULTATION

Government of Nepal

Ministry of Physical Planning and Works

Department of Roads

Project Directorate (ADB)

TA 7411 (NEP): Road Connectivity Project

Subject: Meaningful Consultation with the affected people and stakeholders (including development organization, NGOS/INGOs) for their ideas, opinions, concerns, suggestions regarding improvement of Western section of the EWH-(Koshi Bridge)-EWH Road.

Place: Kamalpur, Ward no. 6; Saptari

Date: 11 July, 2010

Main Agendas for Discussions:

- Likely impact through the proposed road improvement on environment (beneficial and adverse)
- Major concerns/attention need to be paid during subproject implementation
- Ideas, opinions, concerns, suggestions
- Group discussions for primary information

List of persons consulted for discussion

S.N.	Name	Institution and address	Position
1.	Badri Sharma	Kamalpur VDC	Farmer
2.	Chandrika Chaudhary	Kamalpur VDC	Mukhiya
3.	Manoj Kumar Chaudhary	Kamalpur VDC	Farmer
4.	Kaushal Khadka	Pharmacy Owner	Seller
5.	Shambhu Prasad Chaudhary	Triyuga Sahakari Sanstha	Member
6.	Rajendra Khadka	Forum-Loktantrik	Village Committee President
7.	Durga Khadka	Madhesi Jana Adhikar	President
8.	Lalit Kumar Khadka	Chandra Nahar Jana Upabhokta Sanstha	Member
9.	Nathu Chaudhary	Kamalpur VDC	Farmer
10.	SitaRam Yadav	CPN UML	V.D.C Secretary
11.	Suresh Mandal	Kamalpur VDC	Carpenter
12.	Amar Kumar Singh	Janta Secondary School	Teacher
13.	Bishnu Bahardar	Sadbhawana Party	V.D.C Representative

**Signatures are in original document.*

Highlights

- Welcomed the project;

- Shared experiences on difficulties faced due to bad condition of road especially risk of accidents, increased dust pollution, and uncomfortable travelling for pregnant women and sick persons;
- Added benefits were mentioned through better roads including: easy to retain doctors in the hospitals, qualified teachers in the schools, easy medical facility for pregnant women and other sick persons;
- Further added other benefits include: opportunities for internal tourism development; exploitation of hydropower potentialities, agro-based industries, NTFP based industries, and other industries related with infrastructure development; easier access to larger markets for agriculture production marketing;
- Expressed concern on the improvement of the sub-project will promote internal and external tourism development through the better access to the Koshi Tappu Wildlife Reserve (KTWR) and thereby the socio-economic condition of the people in the area;
- Suggested proper maintenance of natural drainage systems, protection of religious and cultural sites, water supply systems, irrigation canals, and their reinstatement;
- Compensation of land and houses including other private properties (standing crops, fruits and fodder trees)

Government of Nepal

Ministry of Physical Planning and Works

Department of Roads

Project Directorate (ADB)

TA 7411 (NEP): Road Connectivity Project

Subject: Meaningful Consultation with the affected people and stakeholders (including development organization, NGOS/INGOs) for their ideas, opinions, concerns, suggestions regarding improvement of Pakali-Chautara section of EWH-(Koshi Bridge)-EWH Road.

Date: 8 July, 2010

Place: Bharaul VDC Ward no. 3; Sunsari

Main Agendas for Discussions:

- Likely impact through the proposed road improvement on environment (beneficial and adverse)
- Major concerns/attention need to be paid during subproject implementation
- Ideas, opinions, concerns, suggestions
- Group discussions for primary information

List of persons consulted for discussion

S.N.	Name	Involved Institution and Address	Position
1.	Padam. B. Shrestha	UML Village Committee; Bharaul	President/Representative
2.	Puspa B. Basnet	Maoist; Bharaul	D.C.M/VDC Representative
3.	Amit Gautam	Computer Institute; Bharaul	Propriter
4.	Khem Pradhan	Maoist; Bharaul	D.C.M/VDC Representative
5.	Prem Limbu	Limbuwan Samaj	Member
6.	Surendra Shakya	Maoist; Bharaul	Regional Member/VDC Representative
7.	Govinda Karki	Bharaul no. 3	Businessman
8.	Tilak Baraili	Dalit Sewa Sangh	Member
9.	Shraman Kumar Rajdhami	Bharaul no. 4; Forum	Representative
10.	Dipak Nayayan Rajdhami	Bharaul no. 4; Forum	Representative
11.	Rameshwor Tamang	Bharaul no. 3;	Social Worker
12.	Gopal Rai	Bharaul no. 3; CFUG	Member
13.	Madan Budhathoki	Bharaul no. 3; CFUG	Member
14.	Indra B. Rai	Bharaul no. 3; CFUG	President
15.	Chandra Idhunge	UML	Member
16.	Ramesh Khadka	Star F. M Radio	Journalist/Representativ

			e
17.	Ratna P. Rai	Representative of Barah Chetra Development Committee	Member
18.	Dipak Subedi	Bharaul no.3	Chairperson/Secretary
19.	Nar B. Adhikari	Bharaul no. 3	Farmer
20.	Ghoti Lal Chaudhary	Nepali Congress Party	VDC Representative
21.	Jagat B. Karki	Nepali Congress Party	VDC Representative
22.	Kul Bahadur Khadka	Bharaul no. 3	Farmer
23.	Kaji Man Limbu	Bharaul no. 3	Farmer
24.	Mukti Rai	Bharaul no. 3	Nagarik Samaj
25.	Ramesh Rai	Bharaul no. 3	Nagarik Samaj

* Signatures are in original document

Highlights

- Welcomed the project;
- Shared experiences on difficulties faced due to bad condition of road especially risk of accidents, increased dust pollution, drainage problem and uncomfortable travelling for pregnant women and sick persons;
- Added benefits were through better roads including: easy to retain doctors in the hospitals, qualified teachers in the schools, easy medical facility for pregnant women and other sick persons;
- Further added other benefits include: opportunities for internal tourism development; exploitation of hydropower potentialities, agro-based industries, NTFP based industries, and other industries related with infrastructure development; easier access to larger markets for agriculture production marketing;
- Suggested proper maintenance of natural drainage systems, protection of religious and cultural sites, water supply systems, irrigation canals, and their reinstatement;
- Compensation of land and houses including other private properties (standing crops, fruits and fodder trees).

Government of Nepal

Ministry of Physical Planning and Works

Department of Roads

Project Directorate (ADB)

TA 7411 (NEP): Road Connectivity Project

Subject: Meaningful Consultation with the affected people and stakeholders (including development organization, NGOS/INGOs) for their ideas, opinions, concerns, suggestions regarding improvement of Pakali-Chautara section of EWH-(Koshi Bridge)-EWH Road.

Date: *12 July 2010*

Place: Border of Baklauri Ward no. 6 and 3; Sunsari

Main Agendas for Discussions:

- Likely impact through the proposed road improvement on environment (beneficial and adverse)
- Major concerns/attention need to be paid during subproject implementation
- Ideas, opinions, concerns, suggestions
- Group discussions for primary information

List of persons consuted for discussion

S.N.	Name	Involved institution and address	Position/Occupation
1.	Puspa Raj Pyakurel	Swotantra Kishan Morcha; Baklauri	Central Vice President
2.	Dinesh Bhattarai	Baklauri	Farmer
3.	Hari Prasad Acharya	Baklauri	Pandit (priest)
4.	Saroj Raj Dhami	Cycle Maintenance Shop; Baklauri	Technician
5.	Dipak Chaudhary	Baklauri	Carpenter
6.	Punya Prasad Bhattarai	Baklauri	Farmer
7.	Pachu chaudhary	Baklauri	Rajmistri (Chief technician)
8.	Kumar Rai	Maoist	Y.C.L Vice President
9.	Bhanu Nepal	Baklauri	Social Worker
10.	Tanka Poudel	Baklauri	Social Worker
11.	Anjani Raj Dhami	Maoist	Member Secretary
12.	Hem Raj Dhami	Maoist	District Member-YCL
13.	Raj Kumar Dhami	Maoist	Sikarmi/Rajmistri (Carpentar)

*Signatures are in original document.

Highlights

- Welcomed the project;

- Shared experiences on difficulties faced due to bad condition of road especially risk of accidents, increased dust pollution, drainage problem and uncomfortable travelling for pregnant women and sick persons;
- Added benefits were through better roads including: easy to retain doctors in the hospitals, qualified teachers in the schools, easy medical facility for pregnant women and other sick persons;
- Further added other benefits include: opportunities for internal tourism development; exploitation of hydropower potentialities, agro-based industries, NTFP based industries, and other industries related with infrastructure development; easier access to larger markets for agriculture production marketing;
- Suggested for proper maintenance of natural drainage systems, protection of religious and cultural sites, water supply systems, irrigation canals, and their reinstatement;
- Compensation of land and houses including other private properties (standing crops, fruits and fodder trees).

Government of Nepal

Ministry of Physical Planning and Works

Department of Roads

Project Directorate (ADB)

TA 7411 (NEP): Road Connectivity Project

Subject: Meaningful Consultation with the affected people and stakeholders (including development organization, NGOS/INGOs) for their ideas, opinions, concerns, suggestions regarding improvement of Kothu-Kanchanpur section of EWH-(Koshi Bridge)-EWH Road.

Date: 11July 2010

Place: Ambasi Tapeshowari; Udayapur

List of persons consulted for discussion

S.N.	Name	Involved institution and address	Position
1.	Ishwori. P.Nepal	Fattepur Multipurpose Co-operative Ltd	Manager
2.	Krishna B. Karki	Ambasi	Farmer
3.	Narendra B. Karki	Ambasi	Farmer
4.	Babu Ram Bist	Ambasi Madhyamik Vidhyala	Chair person
5.	Jiba Dhoj Karki	Ambasi	Farmer
6.	Karna B. Karki	Ambasi	Farmer
7.	Gopal Rai	Ambasi	Farmer/Merchant
8.	Kedar Bista	Ambasi	Retired Principal
9.	Kumar Karki	Ambasi	Farmer
10.	Hast Bahadur Rana	Ambasi	Farmer
11.	Dil Bahadur Basnet	Ambasi	Farmer

**Signatures are in original document.*

Highlights

- Welcomed the project;
- Shared experiences on difficulties faced due to bad condition of road especially risk of accidents, increased dust pollution, drainage problem and uncomfortable travelling for pregnant women and sick persons;
- Added benefits were through better roads including easy to retain doctors in the hospitals, qualified teachers in the schools and colleges, easy medical facility for pregnant women and other sick persons;
- Expressed concern on the improvement of the sub-project will promote internal and external tourism development through the better access to the Koshi Tappu Wildlife Reserve (KTWR) and thereby the socio-economic condition of the people in the area;
- Further added other benefits include: opportunities for internal tourism development; exploitation of hydropower potentialities, agro-based industries, NTFP based industries, and other industries related with infrastructure development; easier access to larger markets for agriculture production marketing;
- Suggested for proper maintenance of natural drainage systems, protection of religious and cultural sites, water supply systems, irrigation canals, their reinstatement, better foot

path for pedestrians at bazaar and market areas, and plantation of trees on both sides of the roads; and

- Compensation of land and houses including other private properties (standing crops, fruits and fodder trees)

Government of Nepal

Ministry of Physical Planning and Works

Department of Roads

Project Directorate (ADB)

TA 7411 (NEP): Road Connectivity Project

Subject: Meaningful Consultation with the affected people and stakeholders (including development organization, NGOS/INGOs) for their ideas, opinions, concerns, suggestions regarding improvement of Kothu-Kanchanpur section of EWH-(Koshi Bridge)-EWH Road.

Date: *10 July 2010*

Place: Rampur bazaar, Thokshila VDC Ward no. 2; Udayapur

List of persons consulted for discussion

S.N.	Name	Involved institution and address	Position
1.	Nar Bahadur Bi. ka	Samyukta Dalit Ekta Samaj Thokshil	Vice president
2.	Pushpa Raj Subedi	UML, Thoksila no. 6	Ilika Committee Secretary
3.	Angam Sing Niraula	UML, Thoksila no. 6	President
4.	Bal Ram Pokhrel	FNCCI	Businessman
5.	Badri Raj Giri	Lower Secondary School, Champakot	Teacher
6.	Shaligram Khadka	River Control Committee	Chairperson
7.	Tej Kumar Khadka	Thoksila-2	Farmer
8.	Bhim Bahadur Basnet	Janapad Prahari	Hawaldar
9.	Jagnarayan Shah	Janapad Prahari	Sipahi (Police)
10.	Santosh Rai	Janapad Prahari	Jawan
11.	Surya Narayan Shah	Higher Secondary School , Rampur	Principal
12.	Dik Bahadur Thapa	Kalika Lower Secondary School	Head Master
13.	Umesh Bishwakarma	UCPN (Maoist)	District Member
14.	Karna Kumar Shrestha	Newa Mankha Khala	President

**Signatures are in original document.*

Highlights

- Welcomed the project;
- Shared experiences on difficulties faced due to bad condition of road especially risk of accidents, increased dust pollution, drainage problem and uncomfortable travelling for pregnant women and sick persons, and lack of bridges over the rivers, and access to neighboring villages;
- Added benefits were through better roads including: easy to retain doctors in the hospitals, qualified teachers in the schools, easy medical facility for pregnant women and other sick persons;

- Further added other benefits include: opportunities for internal tourism development; exploitation of hydropower potentialities, agro-based industries, NTFP based industries, and other industries related with infrastructure development; easier access to larger markets for agriculture production marketing;
- Suggested for proper maintenance of natural drainage systems, protection of religious and cultural sites, water supply systems, irrigation canals, and their reinstatement;
- Compensation of land and houses including other private properties (standing crops, fruits and fodder trees).

Government of Nepal

Ministry of Physical Planning and Works

Department of Roads

Project Directorate (ADB)

TA 7411 (NEP): Road Connectivity Project

Subject: Meaningful Consultation with the affected people and stakeholders (including development organization, NGOS/INGOs) for their ideas, opinions, concerns, suggestions regarding improvement of Kothu-Kanchanpur section of EWH-(Koshi Bridge)-EWH Road.

Date: 11July 2010

Place: Lal Bazar, Thokshila ward no. 7; Saptari

List of persons consulted for discussion

S.N.	Name	Involved institution and address	Position
1.	Dilip Kumar Rai	Rakshani Lower Secondary School; Thokshila	Teacher
2.	Raj Kumar Magar	Thokshila	Farmer
3.	Shyam Kumar Rai	Solar Technology; Thokshila	Technician
4.	Nirmal Adhikari	Thokshila	Business
5.	Krishna Magar	Transport Association	In charge
6.	Mukta Bahadur Karki	Thokshila	Farmer
7.	Khagendra Rai	Thokshila	Shopkeeper
8.	Deepak Dangal	CPN UML Youth Association Nepal; Thokshila	Vice president
9.	Bhim Bahadur Khadka	Thokshila	Farmer
10.	Netra Bahadur Thapa	Janta Higher Secondary School	Teacher
11.	Min Bahadur Uparkoti	Thokshila	Businessman
12.	Samsher Bahadur Nepali	Thokshila	Farmer
13.	Khadak Bahadur Katuwal	Thokshila	Farmer
14.	Mughadhan Tamang	District Forest Office	Jamdaar
15.	Sagar Rana	CPN UML	V.D.C Member
16	Netra Karki	Thokshila	Businessman
17	Min Bahadur Danuwar	Nepal Police; Thokshila	Hawaldar
18	Shyam Magar	Thokshila	Businessman
19	Jay Prasad Adhikari	Thokshila	Farmer
20	Ganga Rana	Thokshila	Farmer
21	Chitra Karki	Thokshila	Farmer
22	Gyan Bahadur Khadka	Thokshila	Farmer
23	Tanka Adhikari	Thokshila	Businessman
24	Ram Bahadur Tamang	Thokshila	Farmer
25	Chandra Magar	Thokshila	Farmer

**Signatures are in original document.*

Highlights

- Welcomed the project;
- Shared experiences on difficulties faced due to bad condition of road especially risk of accidents, increased dust pollution, drainage problem and uncomfortable travelling for pregnant women and sick persons, and lack of bridges over the rivers;
- Added benefits were through better roads including: easy to retain doctors in the hospitals, qualified teachers in the schools, easy medical facility for pregnant women and other sick persons;
- Further added other benefits include: opportunities for internal tourism development; exploitation of hydropower potentialities, agro-based industries, NTFP based industries, and other industries related with infrastructure development; easier access to larger markets for agriculture production marketing;
- Suggested for proper maintenance of natural drainage systems, protection of religious and cultural sites, water supply systems, irrigation canals, and their reinstatement;
- Compensation of land and houses including other private properties (standing crops, fruits and fodder trees).

Government of Nepal

Ministry of Physical Planning and Works

Department of Roads

Project Directorate (ADB)
Transport Project Preparatory Facility (TPPF)
ADB Grant 0227-NEP

Second Level Consulation on the Draft Environmental Management Plan

Objectives

- Inform national-level stakeholders on the proposed EWH-Koshi Bridge-EWH road upgrading
- Solicit comments and suggestions to refine the draft environmental management plan
- Build consensus and support towards successful project implementation

Second Level Consultation on the Draft EMP

S.No	NAME, POSITION	ADDRESS	OFFICE	PHONE NO.	EMAIL ADDRESS
1	Bharat Bdr. Khadka	Lalitpur	ADDCN	9841484036	
2	Barna Bdr. Thapa	Babarmahal, KTM	DNPWC	9741061964	barnathapa@gmail.com
3	Dhundi Pd. Niraula	Bishalnagar	PDADB	9841726449	nirauladp@yahoo.com
4	Keshav Kumar Sharma	KTM	DoR/PDCA	9841294884	kebsharma@gmail.com
5	Shova Giri	KTM	DoR/PDCA	9841696383	shovagiree@gmail.com
6	Purna SL Shrestha	DoR	DoR/GE	9851009339	purnasiddhilal@hotmail.com
7	Shiva Shankar Karki	TPPF	TPPF	9841060890	
8	Carlito Bing Rufo	ADB	ADB		crufo.consultant@adb.org
9	Gambhir Shrestha	DOR, ADB	DoR/ADB		gamvir@yahoo.com
10	Pradeep Raj Shakeya	KTM	DoR/PDCA	9841954518	sobys_pr@yahoo.com
11	Dr. P. Shrivastava	KTM	TPPF		
12	Jamuna Bdr. Shrestha	KTM	TPPF	9841469627	jamuna.bahadur@hotmail.com
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14	Rama Shrestha	Ratopul, KTM	DoR	9841293143	rama.shrestha@gmail.com
15	Rajendra Kr.Pandit	KTM	TPPF	9851069910	rajankpandit@gmail.com
16	Hari Bhakta Shrestha	KTM	MoPPWTM	9841272784	hbshrestha@gmail.com
17	Dinkar Sharma	KTM	DoR	9851100475	
18	Tulsi Pd. Sitaula	KTM	MoPPWTM	9851091938	tpsitaula@moppw.gov.np
19	Ajaya Nepal	KTM	SILT	9851044591	
20	K.P Wagley	KTM	SILT	9841462522	kpwagley@hotmail.com
21	Sanat	KTM	SILT	01-4109634	sanatup@hotmail.com

	Pd.Uppadhya				
22	Navaraj Pokharel	KTM	SILT	9851117882	navarajp@gmail.com
23	Sudarshan Pandey, OM	KTM	TPPF	9841245131	s.pandey@silt.com.np
24	Shiva Pd. Ghimire, Asst.	KTM	TPPF	9841310684	
25	Rajkumari Gurung	KTM	ADB	9841707719	rajkthapa@hotmail.com

Highlights

- The workshop was started at 8.30 AM and completed at 2 PM on 5th of September, 2012.
- Dr. Prabhat Shrivastav (Team Leader TPPF): Highlighted the background and introduction about the TPPF and current status of the consulting process.
- Mr. Keshab Prasad Sharma (Deputy Project Director): Welcome all the participants of the workshop. introduced the project and highlighted some of the features of the proposed project.
- Mr. Carlito Rufo (Consultant ADB): Highlighted the current safeguard policy statement of the Development projects including the road project. He also highlighted the environmental criteria's for the proposed EWH-Koshi Bridge-EWH Road project.
- Mr. Shiva Shanker Karki (Environmental Specialist, TPPF): He presented the draft report of Environmental Impact Assessment (EIA). He also highlighted the various impacts and proposed mitigation measures as well as monitoring mechanism.

Discussion Session

On this session the following Participants ctively participated and Consultant team has answered issues raised on the EIA of the report: Bharat Bdr. Khadka Representative of District Development Committee , Association; Mr. Borna Bahadur Karki (Representative from Department of National parks and Wildlife Reserve and ex- Warden of the Koshi Tappu Wildlife Reserve); Mrs. Meera Joshi (Environmental Consultant, GESU); Mrs. Rama Shrestha (Socialogist, GESU), and Dinkar Sharma (Director General of Department of Roads)

- The cost of the Resettlement should be as per the prevailing market price so that both parties become satisfied.
- Separate out the bioengineering cost during the Contract from Environmental cost
- Engineering design should consider the issue of flooding area of Koshi River
- Elephant crossing area should be designated in the road alignment
- Habitat management and capacity development programme should be planned
- Enhancement activities should be incorporate in EIA report.

- Mr. Tulsi Prasd Sitaula (Secretary of Ministry of Physical Planning Works and Transport Management): He has given the concluding remarks of the Workshop on behalf of the Government of Nepal.
- Dr. Prabhat Shrivastav: He has given the vote of Thanks to all the participants.

NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS) FOR NEPAL

Parameters	Units	Averaging Time	WHO Guideline	Concentration in Ambient Air, maximum	Test Method
TSP (Total Suspended Particulates)	$\mu g/m^3$	Annual	120-230	-	HVS 24 hour sampling(one weak sample on 2 road side station
		24-hours*		230	
PM10	$\mu g/m^3$	Annual	70	-	Light Volume Sampling
		24-hours*		120	
Sulphur Dioxide	$\mu g/m^3$	Annual	125	50	Diffusive sampling based on weekly average
		24-hours**		70	
Nitrogen Dioxide	$\mu g/m^3$	Annual	150	40	Diffusive sampling based on weekly average
		24-hours**		80	
Carbon Monoxide	$\mu g/m^3$	8 hours**	100000	10,000	To be determined before 2005
		15 minute		100,000	Indicative sampler
Lead	$\mu g/m^3$	Annual	0.5-1.0*	0.5	Atomic absorption spectrometry analysis of PM 10 samples
		24-hours		-	
Benzene	$\mu g/m^3$	Annual	-	20****	Diffusive sampling based on weekly average
		24-hours		-	

Notes:

*24 hourly values shall be met 95% of the time in a year. 18 days per calendar year the standard may be exceeded but not on two consecutive days,

**24 hourly standards for NO2 and SO2 and 8 hours standard for CO are not to be controlled before MOPE has recommended appropriate test methodologies. This will be done before 2005,

***If representativeness can be proven, yearly averages can be calculated from PM10 samples from selected weekdays from each month of the Year,

****To be re-evaluated by 2005.

Source: Nepal Gazette B.S. 2060/4/19 (4 August, 2003)

AMBIENT NOISE LEVEL LIMITS FOR NEPAL

(Leg dB (A))

Environmental Setting	**Typical Range of Ldn, dBA**	**Average Ldn, dBA**
High Traffic Area	64-86	74.36
Old Residential Area	59-73	66.28
New Residential Area	48-69	62.00
Commercial Cum Residential Area	69-75	72.75
Commercial Cum Tourist Area	59-76	69.25

Source: Nepal Health Research Council, 2003

Guideline values for community noise in specific environments

Specific environment	**Critical health effect(s)**	**LAeq [dB]**	**Time base [hours]**	**LAmax fast [dB]**
Outdoor living area	Serious annoyance, daytime and evening Moderate annoyance, daytime and evening	55 50	16 16	- -
Dwelling, indoors Inside bedrooms	Speech intelligibility and moderate annoyance, daytime and evening Sleep disturbance, night-time	35 30	16 8	 45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60
School class rooms and pre-schools, indoors	Speech intelligibility, disturbance of information extraction, message communication	35	during class	-
Pre-school Bedrooms, indoors	Sleep disturbance	30	sleeping -time	45
School, playground outdoor	Annoyance (external source)	55	during play	-
Hospital, ward rooms, indoors	Sleep disturbance, night-time Sleep disturbance, daytime and evenings	30 30	8 16	40 -
Hospitals, treatment rooms, indoors	Interference with rest and recovery	#1		
Industrial, commercial, shopping and traffic areas, indoors and Outdoors	Hearing impairment	70	24	110
Ceremonies, festivals and entertainment	Hearing impairment (patrons:<5 times/year)	100	4	110

Specific environment	Critical health effect(s)	LAeq [dB]	Time base [hours]	LAmax fast [dB]
events				
Public addresses, indoors and outdoors	Hearing impairment	85	1	110
Music through headphones/ Earphones	Hearing impairment (free-field value)	85 #4	1	110
Impulse sounds from toys, fireworks and firearms	Hearing impairment (adults) Hearing impairment (children)	- -	- -	140 #2 120 #2
Outdoors in parkland and conservation areas	Disruption of tranquility	#3		

Source: WHO, 1999

NEPAL'S DRINKING WATER QUALITY STANDARDS

Group	Parameter	Unit	Maximum Concentration Limits
Physical	Turbidity	NTU	5 (10)**
	pH		6.5-8.5*
	Color	TCU	5 (15)**
	Taste & Odor		Would not be objectionable
	Total Dissolved Solids	mg/l	1000
	Electrical Conductivity	µc/cm	1500
	Iron	mg/l	0.3 (3)**
	Manganese	mg/l	0.2
	Arsenic	mg/l	0.05
	Cadmium	mg/l	0.003
	Chromium	mg/l	0.05
	Cyanide	mg/l	0.07
	Fluoride	mg/l	0.5-1.5*
	Lead	mg/l	0.01
	Ammonia	mg/l	1.5
Chemical	Chloride	mg/l	250
	Sulphate	mg/l	250
	Nitrate	mg/l	50
	Copper	mg/l	1
	Total Hardness	mg/l	500
	Calcium	mg/l	200
	Zinc	mg/l	3
	Mercury	mg/l	0.001
	Aluminum	mg/l	0.2
	Residual Chlorine	mg/l	0.1-0.2*
Micro Germs	E-Coli	MPN/100ml	0
	Total Coli form	MPN/100ml	95 % in sample

Notes:

* These standards indicate the maximum and minimum limits.

** Figures in parenthesis are upper range of the standards recommended.

Source: Ministry of Physical Planning and Works (Nepal Gazette (B.S. 2063/03/12)

Nepal Water Quality Guidelines for the Protection of Aquatic Ecosystem

S.N.	Parameter name		Target Water Quality Range	Chronic Effect Value	Acute Effect Value
1.	Aluminium (mg/l)		At pH <6.5: 5	10	100
			At pH >6.5:10	20	150
2.	Ammonia (µg/L)		< 7	< 15	< 100
3.	Arsenic (µg/L)		< 10	< 20	< 130
4.	Atrazine (µg/L)		< 10	< 19	< 100
5.	Cadmium				
	Soft water	(60 mg/l $CaCO_3$)	< 0.15	0.3	3
	Medium	(60 – 119 mg/l)	< 0.25	0.5	6
	Hard water	120 – 180 mg/l	< 0.35	0.7	10
	Very Hard	> 180 mg/l	< 0.40	0.8	13
6.	Chlorine (Residual) µg/L		< 0.2	0.35	5
7.	Chromium (VI) µg/L		7	10	200
8.	Chromium (III) µg/L		< 12	24	340
9.	Copper µg/L				
	Soft water	(60 mg/l $CaCO_3$)	< 0.3	0.53	1.6
	Medium	(60 – 119 mg/l)	< 0.8	1.5	4.6
	Hard water	120 – 180 mg/l	< 1.2	2.4	7.5
	Very Hard	> 180 mg/l	< 1.40	2.8	12
10.	Cyanide µg/L		1	4	110
11.	Dissolved Oxygen (%		80 – 120	> 60	> 40
12.	Endosulphan (µg/L)		< 0.01	0.02	0.2
13.	Fluoride (µg/L)		< 750	1500	2540
14.	Iron		The iron concentration should not be allowed to vary by more than 10 % of the background dissolved iron concentration for a particular site or case, at a specific time.		
15.	Lead µg/L				
	Soft water	(60 mg/l)	< 0.2	0.5	4
	Medium water	(60 – 119 mg/l)	< 0.5	1.0	7
	Hard water	120 – 180 mg/l	< 1.0	2.0	13
	Very Hard	> 180 mg/l	< 1.2	2.4	16
16.	Manganese (µg/L)		< 180	370	1300
17.	Mercury (µg/L)		< 0.04	0.08	1.7

S.N.	Parameter name	Target Water Quality Range	Chronic Effect Value	Acute Effect Value
18.	Nitrogen (inorganic)	Inorganic nitrogen concentrations should not be changed by more than 15 % from that of the water body under local unimpacted conditions at any time of the year; The trophic status of the water body should not increase above its present level, though a decrease in trophic status is permissible (see Effects);		
19.	pH			
	All aquatic ecosystems	pH values should not be allowed to vary from the range of the background pH values for a specific site and time of day, by > 0.5 of a pH unit, or by > 5 %, and should be assessed by whichever estimate is more conservative.		
20.	Phenols (µg/l)	<30	60	500
21.	Phosphorus (inorganic) All surface waters	Inorganic phosphorus concentrations should not be changed by > 15		
		The trophic status of the water body should not increase above its present level, though a decrease in trophic status is permissible (see Effects);		
		The amplitude and frequency of natural cycles in inorganic phosphorus concentrations should not be changed.		
22.	Selenium (µg/l)	< 2	5	30
23.	Temperature (All aquatic ecosystems)	Water temperature should not be allowed to vary from the background average daily water temperature considered to be normal for that specific site and time of day, by > 2ºC, or by > 10%, whichever estimate is the more conservative.		
24.	Total Dissolved Solids (TDS) (All inland waters)	• TDS concentrations should not be changed by > 15 % from the normal cycles of the water body under un impacted conditions at any time of the year; • The amplitude and frequency of natural cycles in TDS concentrations should not be changed.		
25.	Total Suspended Solids (All inland waters)	Any increase in TSS concentrations must be limited to < 10 % of the background TSS concentrations at a specific site and time.		
26.	Zinc (µg/l)	< 2	3.6	36

TDS = total dissolved solids, TSS = total suspended solids.
Source: Department of Irrigation, Ground Water Project (Nepal Gazette (Number 10, B.S., 2065-03-02))

PHOTOLOG

Photograph 1. Public Consultation in Nadaha

Photograph 2. Public Consultation in Kothu

Photograph 3. Public Consultation in Rampur on 10 July 2010

Photograph 4. Discussions with Local Residents in Phattepur

Photograph 5. Public Consultation in Kamalpur on 11 July 2010

Photograph 6. Second Level Consultations in Kathmandu, 5 September 2012

Photograph 7. Consultation with Farmers and KTWR Guards,

Photograph 8. KTWR Buffer Zone Chairman Birendra Kumar Yadav Showing the Recently Damaged Hut on the Left Background by Elephants, Kamalpur

Photograph 9. Man Bitten by a Jackal in His Leg, Kamalpur

Photograph 10. A Father Showing the Scars on His Son's Back After a Jackal Attack, Kamalpur

Photograph 11. The Road Used by Elephants Leaving the KTWR as Seen in the Foreground, Kamalpur

Photograph 12. View of Gangajali Khola flowing Towards KTWR