HARIYO BAN PROGRAM

Beyond Investment

Developing Sustainable Green Infrastructure in Nepal

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ABBREVIATIONS/ACRONYMS

ACA	Annapurna Conservation Area
ACAP	Annapurna Conservation Area Project
ADB	Asian Development Bank
ARP	Airport Reference Point
BNP	Bardia National Park
BZ	Buffer Zone
CAAN	Civil Aviation Authority of Nepal
CBD	Convention on Biological Diversity
CDO	Chief District Officer
CHAL	Chitwan-Annapurna Landscape
CITES	Convention on International Trade in Endangered Species of Wild Flora and Fauna
CNP	Chitwan National Park
DDC	District Development Committee
DFO	District Forest Office/Officer
DFRS	Department of Forest Research and Survey
DMG	Department of Mines and Geology
DNPWC	Department of National Parks and Wildlife Conservation
DoLIDAR	Department of Local Infrastructure Development and Agricultural Roads
DoR	Department of Roads
DTO	District Technical Office
EB	Equipment Based
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environment Protection Act, 1997
EPR	Environment Protection Rules, 1997
GBA	Gautam Buddha Airport
GLOF	Glacial Lake Outburst Flood
GoN	Government of Nepal
HEP	Hydroelectric Project
HH	Household
IBA	Important Bird Area
ICIMOD	International Centre for Integrated Mountain Development
IEE	Initial Environmental Examination
INGO	International Non-government Organization
ICAO	International Civil Aviation Organization
Km	Kilometer
LAPA	Local Adaptation Plan of Action
LEP	Labor-based, Environment Friendly and Participatory
LSGA	Local Self Governance Act
MCA	Manaslu Conversation Area
MoFALD	Ministry of Federal Affairs and Local Development
MoFSC	Ministry of Forests and Soil Conservation
MoFALD	Ministry of Federal Affairs and Local Development
MoSTE	Ministry of Science, Technology and Environment
MW	Megawatt
NAPA	National Adaptation Program of Action
NEA	Nepal Electricity Authority
NGO	Non-government Organization

NPC	National Planning Commission
NRs	Nepali Rupees
NTFP	Non-timber Forest Product
PPTA	Project Preparatory Technical Assistance
REDD	Reducing Emissions from Deforestation and Forest Degradation
RoR	Run-of-the-River
SEA	Strategic Environmental Assessment
SIA	Social Impact Assessment
SWR	Suklaphanta Wildlife Reserve
TAL	Terai Arc Landscape
TIA	Tribhuvan International Airport
ToR	Terms of Reference
UNCED	United Nations Conference on Environment and Development
USAID	United States Agency for International Development
VDC	Village Development Committee
WWF	World Wildlife Fund

FOREWORD

With economic development, planning and development of large scale infrastructure projects has increased rapidly across Nepal. The planning and development of infrastructure reflects the changing needs and demands of the people of Nepal, as well as the aspirations of the government to move the country forward and stimulate economic growth. Many of these infrastructure projects are planned in protected areas, forests and critical biological corridors. However, the increase in the level and scale of infrastructure development, and the associated activities invariably put pressure on the natural and human environment. Infrastructure development is currently one of the greatest threats to biodiversity and drivers of deforestation in the two landscapes where the Hariyo Ban Program is working, after overuse of forest resources and encroachment of forests.

Considering the potential impacts of inadequately planned large infrastructure projects, this study was commissioned to undertake a broad review of existing and proposed infrastructure affecting the landscapes, outline major environmental and social impacts, and identify major measures to mitigate negative effects and opportunities these offer to the Hariyo Ban Program for intervention. The study was conducted in the two Hariyo Ban landscapes, the Terai Arc Landscape (TAL) and the Chitwan-Annapurna Landscape (CHAL). Concurrently, the study has also analyzed impacts of climate change on such infrastructures. The study was carried out through rigorous consultations with key stakeholders, review of existing project related documents and field visits to sampled sites. I hope that this document will help conservationists better comprehend the issues and opportunities to enhance their understanding on infrastructure development, its impacts on conservation and possible mitigation measures to plan and increase the effectiveness of our investments.

I would like to thank the Government of Nepal for its support and contribution throughout this study. I would also like to thank United States Agency for International Development (USAID) for funding this study under the Hariyo Ban Program, and the consortium partners for their participation.

Anil Manandhar
Country Representative
WWF Nepal

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Many organizations and individuals made significant contributions to the study, including government employees, donor agencies, private stakeholders, International Non-government Organizations (INGOs), Non-government Organizations (NGOs) and freelancers working outside the government. This work would not have been possible without the support of the Government of Nepal. We would like to thank Barna B Thapa, Chief of the Management and Planning Section, Department of National Parks and Wildlife Conservation (DNPWC); Surendra Pant, Ecologist, Environment Impact Assessment (EIA) Section, Ministry of Science, Technology and Environment (MoSTE); Narendra Bd. Chand, Department of Forest Research and Survey (DFRS); Naresh Pradhan, Project Officer, Transport, Asian Development Bank (ADB); Rama Shrestha, Department of Roads (DoR); Mahesh Acharya, Nepal Electricity Authority (NEA); Bishal Bhardwaj, Environment Section, Ministry of Federal Affairs and Local Development (MoFALD); Yogendra Rai, Division Chief and Rajendra Singh, Chief Divisional Engineer, Department of Rail; Dr Mohan Pd Wagley and Santosh Bhattarai, ADB, MoSTE; Dr. Shesh Kant Bhatta, Environmentalist and Rajendra Khanal, Project Chief, Petroleum Exploration Promotion Project, Department of Mines and Geology (DMG); Hifzor Rehman, Deputy Director General; Jayaraj Ghimire, DMG; and Nabin Singh, Department of Electricity Development, Ministry of Energy.

Several developers and donors provided valuable information about individual infrastructure developments. During field visits to individual projects, officials from Tanahun Hydropower Project, Sikta Irrigation Project and Rani Jamara Kulariya Irrigation Project provided valuable insights into the projects.

We are very grateful to all those who attended the national level consultation workshop on 27th August 2013. The frank and encouraging discussion with developers and donors from several different infrastructure sectors helped shape the recommendations of this report, and forged introductions for future collaboration.

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Jonathan Hobbs, International Network Coordinator for the Extractives Sector in WWF International's Science and Policy Unit, kindly peer-reviewed the report.

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Judy Oglethorpe
Chief of Party
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EXECUTIVE SUMMARY

Infrastructure development is crucial for economic development of the country. But equally important are some of the key species and their habitats which form the part of a wider ecosystem on which the livelihoods of local communities depend. Considering the potential impacts of inadequately planned large infrastructure projects such as hydropower, irrigation, postal roads and railways on biodiversity and livelihoods, it is pertinent to understand ecological and socio-economic changes arising from such interventions. On this premise, the overall goal of this study was to provide an overview of existing and proposed infrastructures affecting the Terai Arc Landscape (TAL) and Chitwan-Annapurna Landscape (CHAL) in order to outline major environmental and social impacts, and opportunities these offer to the Hariyo Ban Program for intervention.

There is a range of robust and comprehensive social, environmental and climate change related policies, legislation and guidelines covering different types of infrastructure including hydropower, irrigation, roads, mining and minerals, and forest industry. These cover environmental and social assessments and studies, design and implementation of mitigation measures and monitoring. These are broadly consistent with and reflect international treaties and conventions that Nepal has signed with international agencies.

The findings of this study show that despite the wealth of policies and guidelines, at implementation level there are significant knowledge and capacity gaps. Some areas of more recent developments, such as oil and gas exploration (and eventual extraction) are being carried out in the absence of policy guidelines. The current knowledge base on interrelationships between climate change and infrastructure is still evolving (through a number of on-going study projects), and the measures required to support policies are understandably basic. Most important, however, is the glaring gap in execution of the policies where main issues are: weak and delayed communication between implementing and enforcement agencies, perfunctory preparation of Environment Impact Assessment (EIA)/ Social Impact Assessment (SIA)/ Initial Environmental Examination (IEE) documents, lack of clarity on the type of environmental assessments, and low priority in allocating resources to mitigation measures.

The landscapes where Hariyo Ban works are important from environmental, socio-cultural and development perspectives. The TAL and CHAL, characterized by rich biodiversity and indigenous ethnic culture, are undergoing significant growth in infrastructure development. The roads and hydropower developments within the Annapurna Conservation Area (ACA), Kali Gandaki Corridor Road, postal roads, irrigation schemes in TAL, and airport expansion are some examples. Infrastructure such as the East-West Highway, Bhurigaon-Telpani-Surkhet Road, Babai Barrage, Sikta and Rani Jamara Irrigation Projects, and postal roads across Khata, Gerewa and Karnali corridors are very sensitive areas from a biodiversity conservation point of view. However, these projects are yet to implement mitigation measures in an effective manner. Similarly, Kamdi corridor and existing highways in Banke National Park, Daiji/Bani-Jogbudha Road and transmission lines adjoining Suklaphanta Wildlife Reserve and Churia Range are associated with potential threats to conservation in TAL.

The transmission lines and highway extensions in the Barandabhar forest corridor and Chitwan National Park (CNP) could significantly and permanently compromise the quality of these areas. In particular, extension of Kasara-Madi road/proposed Dhurbaghat road within CNP poses notable threats to the protection of natural heritage. The level of infrastructure growth in TAL and CHAL is significant. A total of 38 major hydropower projects (14 over 50 Megawatt (MW) capacity and 24 less than 50 MW, total capacity 2,877.6 MW) are operational, under construction or proposed in these areas with potential of moderate to severe impacts on biodiversity.

Major infrastructure in CHAL such as the Tanahun Hydroelectric Project (140 MW), Besishahar-Chame-Manang Road (approximately 68 kilometers (km), Beni-Jomsom Road, Syafru Besi-Timure Road and the Hetauda-Bharatpur-Bardaghat (220 KV) transmission line pose visible threats to the local environment. The implementation of the majority of these infrastructure projects (e.g. Besisahar-Chame Road, Beni-Jomsom Road) without due environmental consideration poses long-term environmental threats to the region.

The study concludes that the numerous infrastructure projects being developed in the two landscapes have significant potential to adversely impact the natural and social environment, and there are considerable opportunities for the Hariyo Ban Program to work together with these projects to reduce negative impacts. More specifically EIA and SIA are in the preliminary stages of preparation for most of the new large-scale infrastructures of interest to Hariyo Ban (e.g. East-West Railway, Marsyangdi Hydropower). Infrastructure projects, even those supported by international development partners, are often reluctant to share their environmental and social impact studies, and discuss them openly. This is particularly so at earlier stages to avoid possible highlighting of negative impacts. The infrastructure projects largely sideline or delay implementation of environmental and social mitigation measures primarily due to resource considerations.

There is considerable scope for Hariyo Ban to truly contribute to improving the environmental performance of the infrastructures developed in its program areas.The process of engagement with the infrastructure projects is a long and continuous one given the planning and development timeframe and sensitivities of the projects. Any meaningful/productive partnership for engagement between Hariyo Ban and a particular infrastructure project will require Hariyo Ban to extend technical support to the project in conserving the environment that the project is likely to adversely impact. Hariyo Ban influence on infrastructure projects is likely to be stronger if the program approaches engagement in closer partnership with government agencies.

The study proposes that the Hariyo Ban Program establish an Infrastructure Unit within the Program for regular coordination, documentation and communication with new and emerging sensitive projects. This Unit will contribute to knowledge sharing and increase awareness in project implementation personnel (at executive levels).The engagement that Hariyo Ban Program should prioritize will need additional resources. These will be used to strengthen the capacities of the executing and implementing agencies to better understand anticipated impacts and design/organize mitigation measures. In view of the widespread application of environmentally unfriendly design and construction practices in the rural road sector, it is important that Hariyo Ban engages to encourage more environmental practices with those agencies working closely with Village Development Committees (VDCs) and District Development Committees (DDCs), while coordinating with Department of Local Infrastructure Development and Agricultural Roads (DoLIDAR)/ Ministry of Federal Affairs and Local Development (MoFALD) and the National Planning Commission (NPC).

The Government has a central and important role to play in ensuring that environmental considerations are taken into consideration while designing and implementing large infrastructures. The government should increase funding levels to improve its capacity to monitor and regulate the performance of key projects. There should be proactive initiation to assess and communicate with emerging infrastructure projects. It should further update and develop, as appropriate, policies and guidelines for environmental and social protection. This should include non-traditional projects (such as oil and gas exploration and extraction) as well as emerging projects such as railways, metros and possibly river based transport.The government should consider removing existing confusion on the levels of environmental assessments applied to a range of infrastructure.There should be wider practice to adopt Strategic Environmental Assessment (SEA) at central and implementation levels to bring further effectiveness in applying environmental mitigation measures.

1 INTRODUCTION

1.1 Background

In Nepal, planning and development of large scale infrastructure such as hydropower schemes, irrigation facilities, mineral based industries, highways and expressways, as well as smaller and rural community based infrastructures such as rural roads, are increasing rapidly and extensively. This reflects the changing needs and demands of the people and the aspirations of the government to move forward with economic growth of the nation, supported by essential infrastructure. The rapidly expanding infrastructure development and associated activities invariably puts pressure on the natural and human environment, often with serious and irreversible consequences in the absence of proper planning and mitigation measures.

The ideal way forward is to achieve an inclusive and sustainable "green growth" that leads to sustainable poverty reduction, better social equity, mitigation of natural resource scarcities and decreased environmental impacts including carbon footprint[1]. What this means in simple terms is that the development process, including development of infrastructure, needs to follow a sustainable and environmentally friendly approach where there is genuine sensitivity towards human/social considerations, natural ecosystems and the broader landscape.

This study reviewed the impacts and opportunities of existing and proposed key and environmentally sensitive infrastructures in the Terai Arc Landscape (TAL) and Chitwan-Annapurna Landscape (CHAL) areas, taking into account not just impacts of single developments, but also possible combined effects of multiple infrastructure developments. Some small and local infrastructures, including rural road networks, lead to significant environmental impacts mainly due to their location (e.g. fragile hill slopes), their magnitude and methods of construction (e.g. unsupervised use of heavy equipment). The construction and operation of large scale infrastructures, on the other hand, can pose significant impacts due to their scale, location, method of construction, and workforce management (leading to social and environmental impacts e.g. hunting, extraction of forest products while on the job), movement and use of construction materials, nature of operation and eventual decommissioning.

1.2 Hariyo Ban Program

The overall goal of Hariyo Ban is to reduce threats to biodiversity and vulnerability to climate change in Nepal in two priority and high-value biodiversity landscapes: TAL and CHAL. TAL covers the low-lying central and western Terai, running east to west; CHAL comprises all of the Gandaki river basin in Nepal, with a vast altitudinal gradient and running from the Trans Himalayan region north of the Annapurna range to Chitwan in the Terai. The main objectives of the program are:

1. Reduce threats to biodiversity in target landscapes;
2. Build the structures, capacity and operations necessary for effective sustainable landscape management, with a focus on reducing emissions from deforestation and forest degradation (REDD+) readiness; and,
3. Increase the ability of targeted human and ecological communities to adapt to the adverse impacts of climate change.

1 Dr. Karki, M., Climate Himalaya (chimalaya.org)

The program has three thematic components (biodiversity conservation, sustainable landscapes and climate adaptation) based on the three objectives, and three cross-cutting themes: livelihoods, governance, and gender equality and social inclusion.

1.3 Objectives of the Study

The overall goal of this study was to provide an overview of existing and proposed infrastructures affecting CHAL and TAL in order to outline major environmental and social impacts, and opportunities these offer to the Hariyo Ban Program for intervention, and explore approaches and areas with the infrastructure projects for combined initiatives to mitigate negative effects. The specific objectives of the study were to:

- review the existing and proposed large-scale infrastructure developments in CHAL and TAL and scope key sensitive infrastructures
- identify major positive and negative environmental and social impacts of existing and proposed developments
- prioritize likely opportunities of these infrastructures with respect to the Hariyo Ban objectives
- recommend practical engagement to reduce negative impacts.

1.4 Study Areas

1.4.1 Chitwan-Annapurna Landscape

CHAL in central Nepal is known for its biodiversity. The landscape is drained by eight major rivers (Kali Gandaki, Seti, Madi, Marsyangdi, Daraundi, Budi Gandaki, Trishuli, and Rapti) and their tributaries of the broader Gandaki river system. They cover all or part of 19 districts, namely, Mustang, Manang, Gorkha, Rasuwa, Nuwakot, Dhading, Lamjung, Tanahun, Chitwan, Nawalparasi, Syangja, Kaski, Parbat, Baglung, Myagdi, Gulmi, Arghakhanchi, Makwanpur and Palpa. The protected areas are Chitwan National Park (CNP) and its Buffer Zone (BZ), a portion of Parsa Wildlife Reserve and its BZ, Shivapuri Nagarjun National Park, Annapurna Conservation Area (ACA), Manaslu Conservation Area (MCA), and a portion of Langtang National Park and its BZ. The Siwaliks harbor several economically valuable tree species, including *Shorea robusta, Acacia catechu* and *Dalbergia sissoo*. The tropical grasslands and riverine forest ecosystem found in the Chitwan valley host one of the last remaining populations of rhinoceros and tiger; have high ungulate density, and high number of carnivore species. Fifty-six species of mammals are recorded in the Chitwan National Park alone. The Barandabhar forest and wetlands of Chitwan National Park and its BZ are Important Bird Areas (IBAs) that harbor around 540 bird species.

The Schima-Castanopsis forests found in the eastern part of the Middle Mountains sustain high number of flowering plants, as well as many important species of wild animals including pangolin, monkeys, leopard, and several other small mammals, birds and reptiles. The broadleaf and conifer forests found in the eastern part of the High Mountains harbor very high floral and faunal diversities, including several endemic plant species. Red panda *(Ailurus fulgens)*, clouded leopard *(Neofelis nebulosa)*, Himalayan black bear *(Ursus thibetanus)* are some flagship mammals found in this region. The sub-alpine and alpine meadows support one of the world's richest alpine floral diversities (Mittermeier et al., 2004 in KAFCOL 2013b). The meadows are also very rich in faunal diversity. The endangered snow leopard, Himalayan goral *(Naemorhedus baileyi)*, serow *(Capricornis sumatraensis)* and Himalayan tahr *(Hemitragus jemlahicus)* are some of the important mammals found in this ecoregion. The wetlands and diverse agro-ecosystems are other repositories of biodiversity.

1.4.2 Terai Arc Landscape

TAL encompasses 23,199 sq km in Nepal and stretches between Bagmati in the east and

Mahakali Rivers in the west, and is located to the south of the Churia range in 14 districts (Rautahat, Bara, Parsa, Makwanpur, Chitwan, Nawalparasi, Rupandehi, Palpa, Kapilbastu, Dang, Banke, Bardia, Kailali, and Kanchanpur).The landscape includes core areas (three national parks, two wildlife reserves, one conservation area, and their BZs), corridors (Brahmadev, Laljhadi, Karnali, Khata, Kamdi, Barandabhar, Parsa-Bagmati) and bottlenecks (Dobhan and Lamahi). TAL was created to provide east-west linkages between protected areas to maintain genetic flow among wildlife species, including globally significant rhino, tiger and elephant. Forest corridors also stretch north-south to connect protected areas to transborder areas in India.

It supports 85 species of mammals, 550 species of birds, 47 species of known reptiles and amphibians, and over 125 species of fishes. The highly productive alluvial grasslands and subtropics forests support highest densities of Royal Bengal Tigers in the world and the second largest population of the Greater One-horned Rhinoceros, largest herd of Swamp Deer and other endangered and protected species like Asian Elephants, Gangetic Dolphin, Gharial, Great Hornbills, Sarus Crane and Bengal Floricans. Thus management of the landscape can conserve the rich biological diversity of the Terai and provide opportunities for long-term survival of a large number of threatened species (HMGN/MoFSC, 2004). The area is also rich in cultural diversity with 45 different ethnic groups including indigenous Tharu, Bote, Sonaha, Mushar and Chepang groups with a wide range of cultural and religious practice.

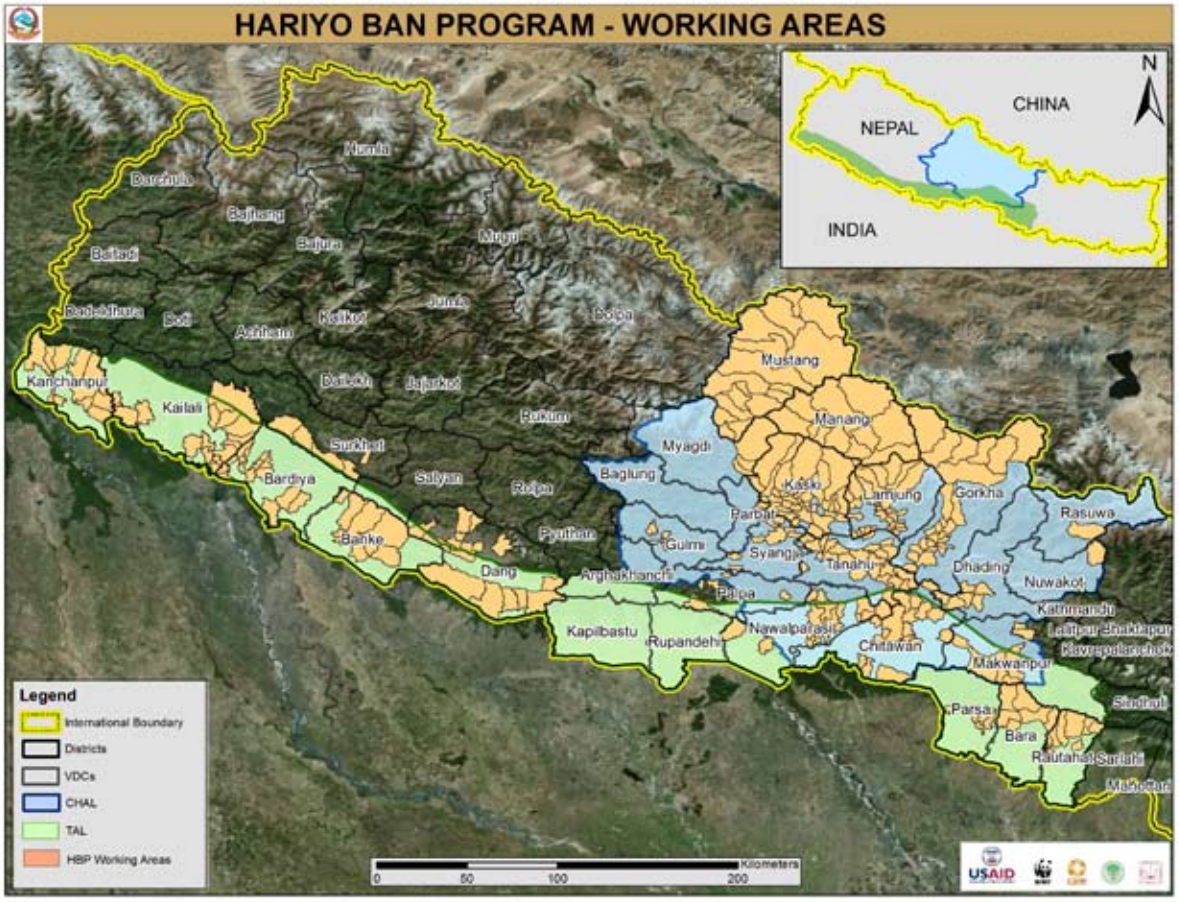

Figure 1: Study areas (TAL and CHAL)

1.4.3 Biodiversity and Infrastructure Growth

Biodiversity conversation has a strong relationship with the infrastructure growth taking place in the country. For example, the threats that biodiversity faces include the following that directly relate to infrastructure development:

Table 1: Summary of threats to biodiversity from infrastructure

S.N.	Threats (direct and indirect)	How Infrastructure Interacts	Remarks
1	Encroachment/fragmentation and degradation of habitat	Roads, railways, irrigation canals and transmission lines fragment habitats. Greater access from new roads enables new settlement to encroach forests (frequently along roads, but also inside forest), and also extraction of timber (legal and illegal) and other products which fragments/degrades habitats.	
2	Unsustainable use of natural resources	Excessive quarrying of river and hills leads to destruction of habitats and erosion. Forest and freshwater resources are often depleted quickly with opening of new road access. Increased road access near international borders is likely to accelerate international trade in endangered species such as tiger parts, rhino horn and elephant ivory. Extraction of construction materials (timber, sand, gravel etc.) for infrastructure development can have detrimental effects on the source environment.	Pro-poor design of infrastructure can lead to economic prosperity of local communities
3	Climate change (direct impacts)	Cost of infrastructure and risk of its failure increase with climate change. New infrastructure can place additional non-climatic stress on wildlife and the environment, and render them more vulnerable to climate change.	How they contribute to climate change is being explored.
4	Human-wildlife conflict	Infrastructure brings people closer to forests and may increase interaction with wildlife, thus increasing the instances of conflict; also infrastructure may confine wild animals from part of their range and force them into closer contact with people.	

S.N.	Threats (direct and indirect)	How Infrastructure Interacts	Remarks
5	Flood, landslide and soil erosion	Soil erosion and landslide events could increase from poorly designed/constructed district roads; scouring downstream from dams; mining; overgrazing from increased road access, etc. Upstream mining, extraction and river redirection structures (quarries, dams, tunnels etc) can change river flow regimes and cause floods.	Infrastructure can help to contain floods.
6	Fire	With increased road access to forest areas, human-caused fires may increase; infrastructure construction workers may cause accidental forest fires. As infrastructure expands, human encroachment into the forests for resources or land increases, thus increasing fire events.	
7	Pollution of aquatic environments and changes in river flows	Hydropower schemes change river flows, impacting aquatic biodiversity, wetlands and grasslands. Roads and sand/gravel extraction can cause increased sediment loads.	
8	Shifting cultivation	Could increase in remote forest areas as access is opened up, resulting in forest destruction/ fragmentation; soil erosion, human wildlife conflict, increased fire risk, etc.	
9	Overgrazing	Increased access to remote areas may result in opening up of new areas for unsustainable grazing by livestock (forest and high altitude grassland).	
10	Poaching	Increased access to interior areas of forests during construction, influx of labor around sensitive areas, constant risk during operation.	

1.5 Scope of the Study

The scope of the study was to undertake the following:

- To prepare a database of existing and proposed key infrastructures and projects in TAL and CHAL through secondary sources, stakeholder consultations, and site visits;
- To identify significant adverse environmental and social impacts of the infrastructures;
- To identify significant opportunities created by infrastructure developments;
- To identify possible consequences of climate change on the infrastructure developments and vice versa, and
- To identify and review mitigation measures and make recommendations.

The study noted that not all large infrastructures have negative impacts; and at the same time, small rural infrastructure such as rural roads can have very significant negative impacts. A general classification of infrastructures in Nepal is provided in Annex 1. As a result, the study considered the following parameters for inclusion as key infrastructure:

a. ***Sensitive infrastructure:*** the selection of infrastructure is largely carried out from the perspective of its sensitivity. The study defined this as existing and planned infrastructure that is particularly noted for its social and environmental impacts, especially those of interest to Hariyo Ban.

b. ***Types of infrastructure:*** both large as well as community based small and rural infrastructure.

c. ***Active or passive:*** existing infrastructure whose social and environmental impacts are still 'active' and not yet diffused or neutralized over time.

1.6 Study Approach and Methodology

The study included the following activities:

- Field observations and database verification of a number of representative large-scale infrastructure developments in TAL and CHAL; community consultations, key informant interviews and focus group discussions were carried out for selected projects. Questionnaires and checklists used in field visits are given (Annexes 2-6).
- Consultations and interviews with relevant government employees, donor agencies, private stakeholders, INGOs, NGOs and freelancers working outside the government. A list of stakeholders consulted is given in Annex 7.
- A national consultation workshop was organized among key stakeholders in the infrastructure and environment sector; see Annex 8 for list of participants.
- Review of published/unpublished EIA/SIA reports, research work, data, and literature available on selected infrastructures.
- Detailed analysis of the findings from secondary sources and field visits; compilation of reports, and sharing of findings through reports and presentations.

In Central and Western Regions (Manang, Kaski, Tanahun, Chitwan and Makwanpur) the following project sites were visited:

a. Besishahar-Chame Road
b. Tanahun Hydropower Project
c. Sand and gravel extraction in Seti River, Kotre, Tanahun
d. Bharatpur-Bardaghat 220 kv Transmission Line
e. Infrastructure developments within Chitwan National Park
f. Sand and gravel extraction along the Churia Range in Makwanpur

The following irrigation projects were visited in the western TAL:

a. Sikta Irrigation Project
b. Rani Jamara Kulariya Irrigation Project

1.7 Limitations of the Study

The objective of this study was to prepare an overview of environmental and social impacts of large infrastructure of interest to the Hariyo Ban Program. The study did not carry out initial environmental examinations (IEEs), EIAs or SIAs, but depended on the availability of these documents for the respective projects. However, during the course of the study, it became increasingly clear that many of the projects of interest to Hariyo Ban did not readily have the required level of information. In a number of cases it was difficult to access the information while in some cases, the information did not exist, or was currently being collected.

This resulted in a number of limitations of the study:

a. The study team was constrained by restricted access to information; in some cases this was very severe. A range of relevant offices/ officers were reluctant to share documents/ databases/information on projects.

b. The study covered many proposed and under-development projects. EIA/SIA or other relevant studies for many of those projects have not been carried out so far. Concrete information was lacking for a majority of ongoing and upcoming projects.

c. The study team perceived a general concern among the agencies consulted (e.g. developers) about the intended use of the information and this was a contributory factor to the non-availability of some data.

d. The interrelationship between climate change and infrastructure remains a speculative field, with so much unknown in the sector. The key long-term programs working in this area were still in their primary phases, including the project 'Mainstreaming climate change risk management in development', a long-term program of the Ministry of Science, Technology and Environment (MoSTE).

e. The study is based on secondary information as provided by EIAs, SIAs and other relevant documents. The lack of project-specific primary information limited the impact and mitigation analysis.

f. An important aspect of the study was to explore potential Hariyo Ban collaboration with individual projects. Limited exposure to project specific information and personnel for the reasons above resulted in extremely vague and informal collaboration strategies.

g. The study sought to explore, using secondary sources, a river basin wide analysis of impacts from a combination of infrastructure developments rather than from individual developments alone. However, the study team realized the absence of any base studies or information to feed into such analysis. Consequently assessment of cumulative impacts was deemed beyond the scope of this study.

h. The study found that it was important to explore areas of collaboration and realistic areas of support by Hariyo Ban to development projects in order to generate interest among the projects. However, the team took care to avoid raising unrealistic expectations that Hariyo Ban would not be able to fulfill given its limited resources.

2 OVERVIEW OF POLICY, LEGISLATION AND GUIDELINES AND THEIR APPLICATION

2.1 Introduction

The environmental and social assessments and studies, and implementation of agreed mitigation measures by infrastructure developers are guided by the policies, guidelines and framework agreements of the Government of Nepal (GoN). This in turn reflects international treaties and conventions that the GoN signs with international agencies. It is therefore important to understand the structure of these legal and sectoral frameworks as Hariyo Ban seeks to interact with the infrastructure sector. This section therefore provides an overview of the relevant plans, legislation and guidelines of the GoN, with special reference to environmental and social responsibilities of developers.

2.2 Policies

There are a number of existing environmental and climate change related policies, legislation and guidelines in different infrastructure sectors such as hydropower, irrigation, road, mine and minerals, and the forest industry. Important polices and legislation are briefly described below.

2.2.1 Three-Year Plan (2010/11-2012/13)

The main objective of the Three-Year Plan was to "enable people to feel change in their livelihood and quality of life by supporting poverty alleviation and establishment of sustainable peace through employment centric, inclusive and equitable economic growth". The Plan emphasized promotion of green development, making development activities climate-friendly, mitigating the adverse impacts of climate change, and promoting adaptation. The plan made MoSTE responsible for coordinating all activities related to environment, conservation and climate change, including the National Adaptation Program of Action (NAPA) implementation.

2.2.2 Climate Change Policy 2011

The climate change policy was endorsed by Government of Nepal on 17 January 2011. The main goal of this policy is to improve livelihoods by mitigating and adapting to the adverse impacts of climate change, adopting a low-carbon emissions socio-economic development path, and supporting and collaborating in the spirit of country's commitments to national and international agreements related to climate change. Climate change policy emphasizes technology development, transfer and utilization through adopting necessary research for constructing climate-resilient structures and infrastructure, while focusing on climate friendly natural resource management. The Climate Change Strategy and working policy prohibit the development of human settlements in climate-vulnerable areas (landslide-prone areas, flood-prone river banks, etc.).

2.2.3 National Adaptation Program of Action

The National Adaptation Program of Action (NAPA) process in Nepal began in May 2009 and was endorsed by the Government on 28 September 2010. It assessed the country's vulnerability to impacts of climate change on socio-economic conditions, built environment, and ecosystems. It further identifies priority activities and immediate needs to adapt to climate

change and improve capacity for adaptation. The NAPA provides a process for Local Development Commitees to identify, communicate and respond to their most "urgent and immediate" adaptation needs, and prioritise those needs. While these needs do not directly relate to infrastructure, it refers to improved access to agricultural services (through rural roads, for example), improved water supply and sanitation, irrigation facilities and electrification. However, the reference is not strong and clear in the document.

2.2.4 Local Adaptation Plans of Action

Local Adaptation Plans of Action (LAPAs) are community-based approaches that take a 'vulnerability first' approach to climate change adaptation. The LAPA framework was designed and piloted in nine districts across Nepal during 2010 by the Climate Adaptation Design and Piloting-Nepal Project and detailed in 14 districts in 2011 and 2012. The LAPA is considered as a tool to synergize top-down and bottom-up approaches of climate change initiatives for Nepal. GoN endorsed the LAPA framework in November 2011. The main feature of this framework is to provide opportunities to implement NAPA priorities with the participation of local communities. The LAPA framework ensures that the process of integrating climate change resilience into local to national planning is bottom up, inclusive, responsive and flexible (MoE, 2011).

2.2.5 Forestry Sector Policy 2000

The Forestry Sector Policy 2000 is an updated version of the Forestry Master Plan Policy. The Forestry Sector Policy 2000 contains development imperatives, outlines, strategies, and programs, and summarizes the investment required to develop the forestry sector.

2.2.6 National Land Use Policy 2012

National Land Use Policy 2012 has been formulated as a roadmap to utilize and better manage the limited land resources. The policy calls for land to be classified into six categories —agricultural area, residential area, commercial area, industrial area, forest area and public and other areas of necessity, with provision to preserve at least 40 percent of the total land area for forestry. The policy allows the government to acquire any land, even within protected areas, if necessary, for infrastructure development. The policy states that land can only be used in accordance with the classification, and any developmental activities must be in accordance with the Land Use Plan. The policy also aims to identify and preserve environmentally sensitive land, and discourage people from residing in areas prone to natural disasters.

2.2.7 Hydropower Development Policy 2001

The policy requires developers to implement the mitigation measures identified in EIA reports where implementation of infrastructures such as power-houses, dam sites, tunnels, canals, reservoirs, transmission lines, distribution lines and access roads of the hydropower generation project have direct adverse impacts. Provision will be made to release water from dams directly into rivers, based on the greater of: at least ten per cent of the minimum monthly average discharge of the river/stream, or the minimum required amount as identified in the EIA study report.

2.2.8 Government Policies on Extraction of Construction Materials

The Local Self Governance Act (LSGA), 1999 confers exclusive ownership of several district based resources including sand, gravel, and stones to the District Development Commitees (DDCs) while the Forest Act 1995 provides the same authority to the MoFSC for the same resources lying within forest areas.

The LSGA, 1999 has given authority to DDC and District Forest Officers (DFOs) (if the area falls within the forest boundary) to award licenses for extraction of riverbed materials. The Environment Protection Rules (EPR) criterion requires an IEE/EIA of such an activity, and approval from the relevant Ministry. The Mines

and Mineral Act, 1985 requires that the extractable quantity of materials should be estimated, before tendering. There are no legal documents stating the specific conditions for protecting riverbeds and surrounding environment; Clause 33 of Mines and Mineral Regulation 1996 merely states measures are to be taken to protect the environment. The Environmental Management Guideline, 1999 (DoR) mentions that quarry sites should be away from population centers, drinking water tanks/supplies, cultivated land, and bridge sites. For extraction of material from other areas including hill slopes, licenses should be obtained from Department of Mines and Geology, after meeting EPR criteria. The Forest Regulation, 1995 and National Parks and Wildlife Conservation Act, 1972 also prohibit operation of quarry sites inside protected areas and require regulatory provisions to be fulfilled for those in forested areas, including community forests.

The EPR (1997) has defined the quantity of extraction material per day and year under the provision of IEE/EIA. According to EPR, any extraction of sand gravels amounting greater than 300 cubic meters per day will need to go through the EIA process. Clause 206 of the Local Self Governance Regulations, 1999 requires DDCs to assess environmental impacts of the project.

2.3 Acts and Regulations

2.3.1 Environment Protection Act, 1997 and Environment Protection Rules, 1997

The Government of Nepal enacted the Environment Protection Act (EPA) 1997 and the Environment Protection Rules (EPR) 1997, which make IEE and EIA legally binding to projects.

Table 2: Highlights of the Environment Protection Rules, 1997

Rule 3	The proponent is required to prepare IEE and/or EIA reports as per Schedules 1 and 2 respectively.
Rule 4	Before preparing an EIA report, the proponent should publish a 15-day public notice so that stakeholders can provide their opinions and concerns in writing on the proposal. The proponent should prepare and submit the scoping report to the concerned agency and forward to relevant Ministry for approval, and the Ministry should determine the scope of the EIA study as submitted or amended.
Rules 8-9	These have been repealed by the First Amendment (April 1999).
Rule 5	In case of an IEE report, the proponent should prepare and submit the ToR and get approval from the concerned agency if there is deemed to be no significant adverse impact, while for an EIA report, the proponent should prepare and submit the ToR to the concerned agency, which should forward to the relevant Ministry for necessary consideration and approval if there is deemed to be no significant impact.
Rule 6	In case the approving agency of an IEE report finds it appropriate to carry out an EIA, the proponent should fulfill all the formalities of the EIA process.
Rule 7	The proponent should prepare IEE and/or EIA reports in the format specified in Schedule 5 of the EPR, 1997. In case of IEE report, the proponent should notify the concerned VDC, municipality, DDC, school, health post and hospital to offer their opinions and suggestions in writing before finalization of the IEE report. For EIAs, the proponent should conduct a public hearing at the project site on the EIA report.
Rule 10	The proponent should submit 15 copies of the IEE/EIA report along with the recommendation of the concerned VDC or municipality to the concerned agency for approval.

Rule 11	The concerned agency, after investigation, should make a decision on the IEE report within 21 days from the date of receipt. For EIA, it should submit 10 copies of the EIA report with its recommendations to the relevant Ministry within 21 days of receipt. Upon receipt of the EIA report, the Ministry should issue a 30-day public notice in the daily newspaper to request written comments from stakeholders. The Ministry may also seek the suggestions of the committee, if formed for this purpose, and should make a decision on the EIA report within 60 days from the date of receipt or within 90 days in case of special reason.
Rule 12	The proponent should implement EIA and other conditions given during the approval process.
Rule 13	The concerned agency (relevant Ministry) is made responsible for environmental monitoring and evaluation activities, and issues necessary directives to the proponent to implement environmental protection measures.
Rule 14	MoSTE is responsible to prepare the environmental auditing report after two years of the commencement of the service in the proposal.
Rules 45-47	Anyone wishing to receive compensation may file an application to the Chief District Officer (CDO) and should forward the file to the concerned agency in case of evaluation of effects/loss. Once the loss is evaluated, the CDO should determine the amount of compensation within 60 days of receipt of application. The proponent should pay the compensation amount within 30 days of the decision. If the proponent (individual, institution or proponent) fails to pay within the time limit, the victim may submit an application, and the CDO shall auction the property of the proponent and pay the amount of compensation as determined.

The Government sets guidelines to determine the thresholds for applying IEE or EIA for a given project. For example, the government has brought, through budget speech for 2008/09, an amendment to Rule 3 of EPR 1997 which assigns the threshold for EIA in hydropower projects as those above 50 MW. Earlier, this threshold was 5 MW. Similarly, the EPR 1997, Schedule 2 provision for EIA includes construction of transmission lines of more than 66 kV; any water resource development activity which displaces more than 100 people; and construction of multipurpose reservoirs.

2.3.2 Aquatic Animal Protection Act, 1961 (First Amendment, 1998)

The guideline was promulgated for protecting aquatic animals in water bodies like rivers, reservoirs and lakes and has remained virtually defunct due to lack of related bylaws/regulations. Its first amendment in 1998, Sections 4a, 4b and 5, empowers the government to prohibit catching, killing and harming certain kinds of aquatic animals in different scenarios. The Act requires infrastructure developers to build appropriate provisions for allowing fish movement wherever possible to do so, and maintain hatcheries/ nurseries for artificial breeding if fish ladders are not feasible.

2.3.3 National Parks and Wildlife Conservation Act, 1973

This Act provides for the conservation of natural areas and wildlife and regulates the consumptive and non-consumptive uses of biodiversity to sustain the welfare of the people. The Act provides special and complete protection to 38 endangered species (26 species of mammals, nine species of birds and three species of reptiles). The Act has been further amended to incorporate the concept of BZs and to facilitate public participation in the conservation, design and management of these zones.This Act is supplemented by several other Acts for further strengthening biodiversity conservation and protection efforts in Nepal. List of Department of National Parks and Wildlife

Conservation (DNPWC) approved infrastructure development projects within protected areas within CHAL and TAL is provided in Annex 9.

2.3.4 Forest Act, 1993 and Forest Regulation, 1995

The provisions of this Act relating to protected forests, community forests and leasehold forests have short-term as well as long-term impacts on the conservation, sustainable management and use of forest resources. The Act empowers the government to delineate any part of a national forest that has special environmental, scientific or cultural importance as a protected forest.

2.3.5 The Electricity Act, 1993

The Act has provisions to minimize soil erosion, floods, air pollution and damage to the environment while producing and transmitting electricity (Section 24). The Electricity Rules, 1993 stress environmental analysis, which should include environmental mitigation measures to minimize adverse impacts likely to occur while developing hydro-electricity (Rule 12 and 13).

2.3.6 Mines and Minerals Rules, 2000

This Rule obliges the proponent to adopt environmental protection measures and ensure environmental conservation (Rule 19). Furthermore, rules 32 and 33 elaborate provisions to minimize significant environmental impacts. Mines and Minerals Rules, 2000 provide an opportunity to identify potential environmental impacts and implement mitigation measures, as part of the EIA process.

2.3.7 Petroleum Act, 1983

The Act declares that all petroleum under the subsurface of Nepalese territory is the property of the government. The government has the exclusive right to carry out petroleum exploration, development, and production either by itself or through contractors. The Act has no provisions for environmental protection covering possible impacts during exploration and extraction.

2.3.8 Public Road Act, 1974

This Act has provisions for road construction, maintenance, and extension which defines public road, road limit (right of way) and classifies the road into four categories and prohibits any type of structures to be constructed within the boundary (right of way) of the road.

2.3.9 Land Acquisition Act, 1977 and its Guidelines

The Land Acquisition Rules, 1969 and The Land Acquisition Act, 1977 (amendment, 1992) empower government to acquire any land by paying compensation for public use. This Act is the core legal document to guide tasks related to land acquisition and resettlement activities in Nepal. There is provision in Clause 3 of the Act to acquire land for any public purpose, subject to the award of compensation. Besides, any institutions seeking land acquisition may also request GoN to acquire the land under the regulatory provisions provided that they have resources to compensate. As per the prevailing government rule, the compensation to be provided for land acquisition should generally be in cash and reflect market value. This is determined by an acquisition and rehabilitation committee which is also known as the Compensation Determination Committee.

2.3.10 Local Self-Governance Act, 1999

The Act empowers local bodies to formulate and implement periodic and annual plans within their respective jurisdictions. It also envisages devolving sectoral development functions to be planned and implemented by these local bodies in their areas. The Act empowers municipalities to control and manage different types of pollution, forest and other natural resources. This Act emphasizes and makes provisions for communities to work closely in coordination with local DDCs and VDCs in implementing projects.

2.4 International Conventions and Treaties

2.4.1 Convention on Biological Diversity

The Convention on Biological Diversity (CBD) was signed on 5 June 1992 at the Earth Summit in Rio de Janeiro and entered into force on 29 December 1993. In Nepal, this binding Convention was ratified on 23 November 1993 and came into force on 21 February, 1994. The main goals of CBD are: conservation of biodiversity; sustainable use of biodiversity; and the fair and equitable sharing of the benefits arising from the use of genetic resources. Article 14 of CBD requires the introduction of appropriate procedures for environmental impact assessment during development of infrastructure posing significant adverse effects on biological diversity.

Similarly, Agenda 21, a non-binding international statement of goals and principles has been implemented by Nepal. It urges countries to promote activities that are well supported in Nepal, such as alleviation of poverty, improved land use, conservation of biodiversity, public participation, empowerment of women, respect of indigenous cultures, working with NGOs, development of human resources, etc.

2.4.2 Convention on International Trade in Endangered Species of Wild Flora and Fauna

This multilateral treaty was opened for signature in 1973, and entered into force on 1 July 1975. Since 1975, Nepal has been a signatory to this legally binding convention. The main objective of this convention is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. The goal of CITES is to control, reduce or eliminate international trade in species whose numbers or condition suggests that further removal from their natural habitat would be detrimental to survival of the species.

2.4.3 Forest Principles

The non-binding United Nations Conference on Environment and Development (UNCED) principles on forest regulation and management have been accepted by Nepal to increase public participation, respect of indigenous cultures and rights, empowerment of women, comprehensive valuation of forests, sustainable management of natural forests, extension of forest cover, conservation of biodiversity and pre-project environmental assessment.

2.4.4 ILO Convention 169

The Convention is a legally binding international instrument open to ratification which specifically deals with the rights of indigenous and tribal peoples. Twenty countries have ratified the convention and are subject to compliance supervision. The Convention recognizes that indigenous and tribal peoples' cultures and identities form an integral part of their lives—and that their way of life often differs from that of the dominant population. These differences are to be respected through the recognition of, among other things, their own customs and institutions, languages and beliefs.

2.4.5 UNCED and UNFCCC

UNCED held in Rio de Janeiro in 1992 produced international environmental treaty named United Nations Framework Convention on Climate Change (UNFCCC). Kyoto Protocol under the treaty sets mandatory emission limits for industrialized countries as specified under Annex one countries of the Protocol. Developing countries like Nepal are not expected to implement their commitments under the Convention unless developed countries supply enough funding and technology. For such countries, reduction in Green House Gas emissions has lower priority than economic and social development and poverty alleviation.

2.5 Policy and Guidelines of Multilateral Donor Agencies

A range of development partners are supporting the development processes in Nepal. The support

inevitably has included significant level of investment in infrastructures, some of them large, and of a sensitive nature.

The following policy and guidelines of multilateral agencies are specifically applied in the development of infrastructures in Nepal:

- USAID Climate Change and Development Strategy 2012-2016
- USAID Environmental Procedures 2012
- Asian Development Bank (ADB) Environment Policy, 2002
- ADB Environmental Assessment Guidelines, 2003
- ADB Safeguard Policy Statement, 2009
- World Bank Environment and Social Policy and Procedural Guidelines for Project and IDA Countries, 2012
- Japan International Cooperation Agency Guidelines for Environment and Social Consideration, 2010

While it would be useful to review the above policies, strategies, guidelines etc. in detail, it is outside the scope of this study.

2.6 Challenges in Policy Application

The Government has accorded high priority to resolving environmental consequences of development activities through the application of these comprehensive sets of policies, acts and legislation. One of the objectives of the policy overview is to assess how these policies are adhered to or flouted by the implementing agencies to the detriment of the environment, biodiversity and the wellbeing of local communities.

The key environmental and social concerns associated with infrastructure development arise at the implementation level. In general, experience shows that the following types of limitations are often observed during the course of construction and operational phases of infrastructures:

2.6.1 Resource Allocations and Institutional Weaknesses

- Lack of inter-agency coordination.
- The inability of national regulatory bodies to regulate and monitor policy implementation.
- Lack of adequate resources to undertake regulatory functions.
- Low resource allocation priority to environmental measures.
- Corrupt and weak governance structures assigned to implement projects.
- Political instability leading to frequent changes in government staffing.
- Lack of rigorous EIA/IEE/SIA verification and implementation appraisals.
- Capture of social benefits by elite groups.
- Lack of good quality IEE/EIAs; these documents being prepared superficially merely to meet legal requirements.

2.6.2 Social Dimensions

There has been significant improvement in the application of social safeguards in recent years in applying measures that support poor and local communities, particularly those that are disadvantaged and are adversely impacted by development projects. There is a good level of compensation for lost property and livelihoods; opportunities for local employment; and support to pick up new livelihood approaches through skill enhancing trainings. Nonetheless, these improvements are not widespread across all projects, and the following limitations are often noted:

- Consultative processes on project design and resource allocation are mostly dominated by the rural elites while the voices of women and disadvantaged groups are still weak and often ignored.
- Poor and inequitable access to job opportunities for local communities and limited local employment despite availability of skills locally.
- Women, particularly from vulnerable groups, are often exposed to risky and hard tasks without support measures such as child care provision.
- Inadequate or no accident insurance provision, or safety measures for working groups, often adds to poverty among workers when accidents occur.

- Changed livelihood patterns of those traditionally using natural resources are often not suitable and lead to increased poverty in the long run for the poor and more marginalized members of affected communities.

2.6.3 Environmental Dimensions

The following challenges and limitations are common:

- Environmental safeguards are often disregarded or paid only lip service by project developers, often as a result of poor governance/corrupt practices inherent in project development process.
- Engineering design, cost effectiveness, political sensitivity and other aspects of infrastructure development are given priority over environmental and climate change considerations in planning as well as in operational phase.
- Environmental measures are regarded by project developers as additional hurdles.
- There is an absence of skill and knowledge base among development agencies.
- There is lack of coordination between the government and developers.
- Random exploitation of natural resources (e.g. quarry, river control, slope excavation, deforestation etc) often occurs by the business community with collusion from local elites.
- Policies and guidelines are often not updated to reflect the most recent findings and knowledge in the scientific world, such as emerging knowledge base in climate change, associated vulnerability assessments and interrelationship between infrastructure and climate change.
- Cumulative impact of different infrastructure developments are not assessed jointly or managed collaboratively to reduce adverse environmental and social impacts (e.g. series of dams on the same river).
- There is weak monitoring, reporting and sharing of EIA/IEE experiences from development of completed infrastructures. As a result, there are missed opportunities to learn and improve environmental regulatory functions.
- Delays in implementing projects mean that some impacts and mitigating measures suggested in IEE/EIA/SIA become irrelevant, out of date or ineffective.

2.7 Limitations of EIA Applications

The IEE/EIA process in Nepal is based on EPA/EPR 1997. Although the legal process has clear and systematic provisions to conduct an IEE/EIA study throughout the project cycle from pre-planning to implementation, EIA practices, where carried out in Nepal, are generally limited to fulfilling the legal requirements.

As is often the case, the proponent is focused in getting approval from relevant agencies. There are no serious exercises in exploring available technical options using a reasonably high level of expertise. The tendency to undertake superficial impact analysis and documentation is predominant for rural infrastructures in general and rural roads in particular. For example, almost all of the IEEs or EMPs prepared for rural roads are 'look-alikes' with disregard to changes in local landscape, flora and fauna, slope stabilities arising from factors associated with geology, and methods of construction.

Similarly, there is an increasing tendency to award infrastructure development works, particularly the feeder roads, to institutions which are not traditionally road building agencies and lack specialized knowledge in the area. This is often done in order to expedite the construction process and to accomplish generally difficult excavation tasks e.g. cutting in hard rock cliff areas. Construction of some key road links such as Besishahar-Chame road by the Nepal Army is one example. In assigning environmentally sensitive tasks to these institutions, important consultative processes and remedial measures in safeguarding the environment are often missed. The EIA processes are either unapplied, or when prepared, the application is very likely poor. As we shall note later, implementation of infrastructures by the Nepal Army, where it offers technical and management advantages, could be made environmentally responsive through incorporation of provisions to safeguard environment and build capacities within the body to better integrate environment related skills.

3 OVERVIEW OF ENVIRONMENTAL IMPACTS OF INFRASTRUCTURE DEVELOPMENT IN TAL AND CHAL

3.1 Introduction

This section provides a general overview of how various types of infrastructure impact the natural environment. Some generic impacts are applicable in nearly all contexts, including in TAL and CHAL areas, but many impacts are very site specific as they are influenced by project design as well as environmental sensitivity of the area.

The study relies on the project EIA/IEE and SIA documents, where available, for site specific environmental and social impacts. However, in many cases where infrastructure projects have not yet carried out EIAs, IEEs or SIAs, the overview provided in this section is based on generic knowledge available from consultative meetings.

3.2 Overview of Interactions between Infrastructure and Natural Environment in TAL and CHAL

A number of key and sensitive infrastructures exist or are planned in the Hariyo Ban Program areas. The proposed East West Railway; Fast Tracks; roads and hydropower developments in the Annapurna Conservation Area Project (ACAP) region; Kali Gandaki Corridor Road; postal roads[2]; irrigation schemes in TAL areas; and airport expansion are some examples. Irrigation schemes, roads, airport, railway, hydropower infrastructures, mining, petroleum exploration activities, and sand and gravel extraction are often associated with adverse environmental impacts. These generally include landscape disturbance, landslides, slope instability, soil erosion, siltation, and loss of habitat and biodiversity (details of which are discussed in the section 3.3 below). Deforestation, overgrazing, inappropriate use of agro-chemicals, production intensification, shifting cultivation with a shortened cycle, development work, mal-distribution of landholdings, industrial waste, and others are all important causes of land degradation (ADB/ ICIMOD, 2006).These negative environmental impacts are often consequences of incompatible design and tools used in naturally dynamic and fragile landscapes.

All infrastructure developments are interlinked with wide ranging environmental systems and processes.The locations of infrastructures such as East-West Highway, Bhurigaon-Telpani-Surkhet Road, Babai Barrage, Sikta and Rani Jamara Irrigation Projects, and Postal Roads along Khata, Gerewa and Karnali corridors coincide with biodiversity important areas that are often very sensitive. Similarly, the Kamdi corridor and existing highways in Banke National Park, Daiji/ Bani-Jogbudha Road and transmission lines adjoining SWR and Churia Range pose potential threats to conservation in TAL.

The quality of the Barandabhar forest corridor and CNP could be significantly and permanently compromised by proposed transmission lines and highway extensions. Extension of the Kasara-Madi road and the proposed Dhurbaghat road within the CNP poses notable threats to the protection of natural heritage[3].

Altogether, 38 major hydropower projects (14 HEPs over 50 MW capacities and 24 HEPs less than 50 MW, total capacity 2,877.6 MW) are operational, under construction or proposed in TAL and CHAL with moderate to severe impacts on biodiversity conservation. For ACAP alone, DNPWC shows that

2 Postal roads are road links close to and parallel with the Indian Border in Terai that were used for postal services during the Rana Regime.

3 See section 3.3.5 for impacts of roads on biodiversity

a total of 29 hydropower projects with a combined capacity of 590.59 MW and five transmission lines (including Upper Marsyangdi-II HEP with transmission line of 400KV) have been approved for implementation (Annex 9).

Major infrastructure in CHAL such as the Tanahun HEP (140MW), Besishahar-Chame-Manang Road (approximately 68 km), Beni-Jomsom Road, Syafru Besi-Timure Road, and the Hetauda-Bharatpur-Bardaghat transmission line (220KV) pose visible threats to the local environment. The development of well-designed, sustainable and adaptable infrastructure with consideration to diverse elements like institutional, technological, and financial aspects needs to be promoted to avoid potential environmental threats during design, construction and operation.

For further details and precise assessment of specific impacts and possible mitigation measures, it is important to review and consider project specific impacts that are derived from EIA and SIA documents for each project. The overviews of general environmental and social impacts of key infrastructures are given in section 3.3 and Chapter 5 respectively, while overviews of specific projects that are sensitive in nature are given in the Supplementary document with Project Sheets (See Annex 11).

3.3 Overview of Impacts and Opportunities of Selected Infrastructure Types

The shortlist of key and sensitive infrastructures of major concern in TAL and CHAL fall into the following categories:

- Hydropower projects
- Electricity transmission lines
- Irrigation projects
- Sand and gravel extractions
- Road projects
- Airports
- Mine and minerals
- Oil and gas exploration
- Railways

A comprehensive database of infrastructures is provided in Annex 10. The major likely impacts of different types of sectoral projects, except for railways, are summarized in the following sections.

3.3.1 Hydropower Projects

Hydropower potential is a major natural asset for Nepal but its development has been extremely challenging, especially posing serious threats to freshwater biodiversity.

Hydropower projects cause disturbances in the main river channels, and in the case of Nepal with small-scale reservoirs, the changes caused in river hydrology are significant especially when combined with irrigation projects (Bhatt and Khanal, 2011a). Other possible impacts such as changes in microclimatic conditions arising from temperature alterations are less prominent.

The major river basins in CHAL and TAL such as the Kali Gandaki, Seti, Madi, Marsyangdi, Daraudi, Budhigandaki, Trishuli, Karnali and Mahakali all have potential for significant hydropower development. Hydropower development is usually accompanied by the opening of access roads, canals and tunnels, river diversions, settlement expansion, resettlement and market development. The reservoir of the plant generates major ecological changes in terrestrial, river and lentic environments. The construction activities involved in building the dam, embankments and power plant are associated with various adverse impacts like alteration of river hydrology, aquatic and terrestrial ecosystem loss/degradation, wildlife disturbance, agriculture and forestland take, and resettlement/relocation of affected people. In the operational phase, sedimentation is considered as a major challenge for hydropower development in Nepal.

Hydropower plants and their processes affect fish biodiversity and local fishing communities by disrupting the feeding and breeding habitats which can eventually lead to loss of fish species. Hydropower development also affects the

movement of migratory fish up and down river (Bhatt and Khanal, 2011b).

The major upstream, onsite and downstream impacts due to large dams or hydropower developments are briefly described below:

Landscape disturbance and instability:
Hydropower developments are associated with landscape changes which can lead to slope instability, soil erosion, landslide, rock fall, etc. Landslides both affect and may be caused by hydropower developments, particularly across CHAL areas with unstable geology combined with torrential monsoon downpours. Hydropower developments require access roads which further augment the risk of landslides by rock/slope fragmentation and vegetation removal. There is high risk of damage to infrastructure from landslides, which may not only damage the project infrastructures but also sweep away settlements and properties downstream. Landslides also cause loss of habitat and agricultural land.

HEPs also increase the risk of damage from seismic activity. While dams and associated structures are often designed to withstand an acceptable level of earthquake tremors, this is often weakly implemented. The quality of workmanship and possible threat of a higher scale of earthquake mean that a major dam failure could wipe out whole downstream communities, natural assets and infrastructure.

Inundation and loss of land:
Storage dams take up significant amount of land in river valleys, some very rich in biodiversity and productive for local communities. This sometimes necessitates resettlement of local communities, causing massive disturbance and uprooting of traditional livelihood patterns. A study carried out in India (Pandit and Grumbine, 2012) in similar terrain to the mid hills of Nepal showed average land flooding by 113 dams to be around 0.78 ha/MW generated.

Habitat destruction and loss of access:
The area that is covered by a reservoir is destroyed, killing the habitats that existed there beforehand. Reservoirs also obstruct access to habitats due to the presence of dam. Drawdowns associated with dams affect the value of habitat for wild animals (e.g. rapid and irregular drawdowns make shoreline habitats less attractive for water fowl). Migratory fish can no longer travel upstream past large dams in order to reach their spawning grounds. For example, in case of Tanahun HEP, movement of endangered fish such as Sahar and Asala, which need to travel upstream to breed, will be obstructed by the dam construction[4]. Similarly, in Triveni Dam, the dolphin population is almost nonexistent and 200-300 gharials which are released in Nepal every year get washed down and are unable to migrate upstream due to the dam[5]. Likewise, terrestrial species may lose access to essential parts of their range if the new reservoir blocks their access to areas across the valley.

Habitats are also severely affected downstream. For example, if wet season flows are reduced and flooding becomes less extensive, downstream wetlands may be reduced or disappear, and grasslands may become forested (i.e. trees start encroaching grassland due to cessation of flooding and/or fall in the water table, causing loss of habitat for key species such as tiger prey). Fires may become more frequent as areas become drier. Falling water tables may result in less water points for wildlife during the dry season, causing wildlife to move out of dry areas. In some cases they may move into closer proximity to people, increasing human-wildlife conflict.

Forest cover and species richness may also be seriously impacted by dam building. A study in India (Pandit and Grumbine, 2012) noted that dam building would likely reduce tree species richness by 35% and tree density by 42%. The study further noted that while forest loss and fragmentation negatively affect species diversity, creation of dams and reservoirs alters the ecosystem which can lead to sudden species losses.

Change in standing water characteristics:
Water from man-made reservoirs seeps down into the water table. This excess water can overload the natural water table, slowing down its flow, and ultimately turning it stale; this can

4 Meeting with Mr Mahesh P Acharya, MD, Tanahun Hydropower Limited on 1 February 2013

5 Meeting with WWF Nepal on 27 January 2013

be damaging to aquatic flora and fauna. Stagnant water provides a better medium than running water for many kinds of bacteria, disease vectors and parasites which can be dangerous for drinking and potentially harmful to livestock, humans and sometimes wildlife.

In storage type HEPs, large reservoirs of standing water heat up as a large surface area of stagnant water is exposed to the sun for long periods of time. Aquatic lives that are sensitive to temperature may not adjust to this change in water quality. The river's salinity can rise in the reservoir due to increased evaporation rates. Natural nutrients build up in reservoirs causing eutrophication and resulting in low dissolved oxygen which harms aquatic life, particularly when an area is first flooded and submerged vegetation rots. Invasive aquatic plants such as water hyacinth and water lettuce can cover the surface of reservoirs, causing problems for navigation, fishing, and operation of turbines.

Industrial and residential pollutants, as well as agricultural runoff (including high nitrate loads, fertilizers and pesticides) can increase toxic levels in reservoirs, especially during the dry season.

The changes in water characteristics in reservoirs that are mentioned above continue downstream when discharged. Although downstream the effects are diluted, the cumulative effect of many dams on a single river can magnify each of these factors to harmful levels. For example, the downstream flow from Kulekhani III storage scheme on the Rapti River, including a 4 km river section from the tailrace to the bridge on the highway, is considered to be affected by this phenomenon.

Flow reduction:
The downstream impacts of the net flow reduction due to extraction upstream can be extensive. They include habitat alteration or destruction far downstream at the mouth of the river, and drop in the water table. For example, the proposed reservoir of Tanahun HEP will block fish migration and spawning, and restrict submerged riverine habitat 2 km downstream on the Seti River. In the Middle Marsyangdi HEP, water diversion by the dam (55 m height) at Phalia Sangu is envisaged to bring substantial physical changes in the river hydrology and riverbed morphology in the operational phase. The implications are most acute in the 4.5 km stretch immediately below the dam and before the confluence with Dordi Khola.

RoR hydropower projects also disrupt flow between the dam and downstream discharge site, with potential impacts due to reduced stream flow and the barrier to movement of freshwater organisms. If RoR dams store water for power generation during peak times (e.g. early morning and evening), discharges may undergo large diurnal fluctuations with potential adverse impacts on biodiversity and people downstream. Impacts will depend on how rapidly the flow increases and decreases, and may affect channel morphology, fish (e.g. stranding), invertebrates (e.g. flushing downstream), and safety for people and property downstream.

However, flow control during the high monsoon season can contribute to decreasing downstream flood risk for settlements, infrastructure and agriculture.

Change in natural flood patterns and sedimentation:
Natural floods inundate downstream regions with nutrient rich sediments. Traditional farming systems in CHAL/TAL areas are dependent upon seasonal floods to deposit nutrient rich sediments on the downstream shores and floodplains of the river. They also seasonally clear out blocked waterways which prevent larger floods from causing massive damage.

The major rivers in Nepal are laden with sediment, a large part of which occurs naturally and a significant part of which comprises riverbed load, embankment erosion, and similar components (ADB/ICIMOD, 2006). However,

HEP alters this pattern. For example, the sediment build up on the upstream of the diversion dam of the Marsyangdi Hydropower Station 5 is a good example where a permanent loss of upper pool storage volume has occurred. Studies showed the rise in the river bed was only about 14 m out of a total depth of 21 m at the dam. This situation is responsible for producing, at times, extremely high sediment concentration in the flow entering the settling basin (up to 80,000 ppm or 80 kg/m3), reducing its trap efficiency and causing severe equipment abrasion. This is often the case with reservoirs full of sediment; at the onset of flood the saturation sediment concentration is attained for which no de-sanding structure can be designed.

Risk of glacial lake outburst floods[6]:
Most hydropower schemes in Nepal are RoR types and snow fed. There is a risk of glacial lake outburst floods (GLOFs) which is accelerated by climate change. These may affect downstream infrastructure, settlements and economic activities, resulting in casualties, inundating farmland, destroying hydropower schemes, damaging bridges and affecting habitats. Regulation of flow by hydropower reservoirs could contribute to minimizing the adverse impacts of GLOF events, if they have the capacity to absorb the flood water.

Hunting and poaching:
Labor in construction camps may be involved in harassing and poaching, illegal hunting and/or trapping of wildlife, as well as unmanaged firewood collection for cooking purposes. Increased access to forests and species-rich areas via access roads could encourage illegal hunting, poaching or fishing by locals and outsiders, once the roads are open. It may become increasingly difficult for community groups to control illegal activities in their forests.

Impacts on tourism:
Hydropower projects also impact the tourism industry. Some rivers of CHAL and TAL areas are used for commercial rafting. For example, the Seti River in Tanahun district is seasonally used for commercial rafting from Damauli (3 km downstream from the dam site) to Gaighat at the Seti-Trisuli confluence and further down to Devghat. Similarly, the Trisuli and Narayani Rivers are used for rafting with the section from the Seti River-Trisuli River confluence downstream to Narayanghat forming the lower part of the Trisuli River rafting route. Proposed dams in CHAL will seriously affect this activity.

On the positive side, dams can attract visitors and augment tourism if their design and management provide aesthetic and leisure opportunities for the visitors. However, if dams have unfavorably rapid and significant drawdown, then this potential is diminished.

Hydropower projects of major concern:

1. Budhi Gandaki Hydropower Project, Gorkha/Dhading (in development[7])
2. Kulekhani III Hydroelectric Project, Makwanpur (in development)
3. Lower Manang Marsyangdi Power Plant, Manang (in development)
4. Upper Trishuli 3A HEP, Rasuwa/Nuwakot (in development)
5. Tanahun Hydropower Project, Tanahun (in development)
6. Kali Gandaki A Hydropower Station, Syangja (in operation)
7. Chilime Hydropower, Rasuwa (in operation)

The project sheets for Budhi Gandaki, Tanahun, Lower Manang and Marsyandi, and Kulekhani III hydropower projects are given as Supplementary Document-Project Sheets. The project sheets include salient features of these projects, associated environmental and social impacts and proposed action plans (See Annex 11).

The location map and development status for these hydropower projects of major concern is given in Figure 2.

6 More details on this is given in the Chapter 6, Climate Change and Infrastructure
7 In development means either it is under construction or it has been approved for construction

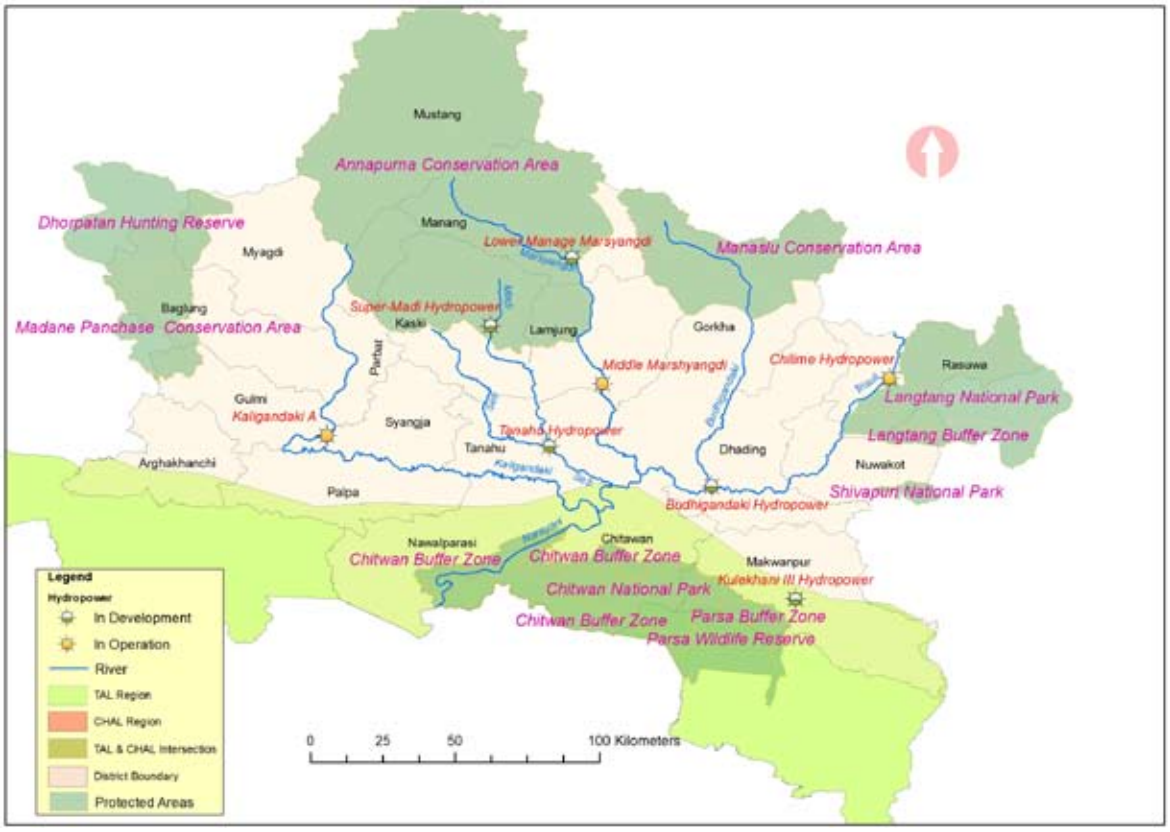

Figure 2: Hydropower projects of major concern in TAL and CHAL

Opportunities offered by HEP:

The construction and operation of hydropower projects can provide opportunities for local communities for employment, increased economic activities and infrastructure benefits from access roads. Electricity generation from the projects can supply the national grid to fulfill the demand of power, and promote local industries. Dam construction has the potential to regulate river flow and reduce flooding disasters in downstream areas. While studies have not been carried out to compare the extent of social and economic benefits with respect to environmental costs, the economic contribution from dam construction could be beneficially used by the government to lift the people above poverty line and promote environmentally friendly practices (such as reduction in firewood for cooking, irrigated agriculture, and improved access to markets and social services).

3.3.2 Electricity Transmission Lines

Transmission of electricity on a large scale involves the construction of large circuit towers and associated infrastructures in CHAL and TAL areas. The transmission line projects which are under execution in CHAL include Hetauda-Bharatpur with 73 km of 220kV double circuit transmission line, Bharatpur-Bardghat with 75 km 220kV double circuit transmission line, and Hetauda-Dhalkebar-Duhabi which includes the construction of a 400kV double circuit transmission line of 290 km. Other transmission line projects in the CHAL area with completed surveys are: Marsyangdi-Kathmandu 220kV, 85 km; Lekhnath-Damauli 220kV, 45km, Kali Gandaki (Dana-Kusma and New Modi-New Butwal-Bardghat) 220/132kV,150 km. Likewise, the transmission line projects within the Hariyo Ban landscapes with completed feasibility studies include: Chilime-Trishuli 220kV, 40 km; Marsyangdi-Bharatpur 220kV, 25 km; Damauli-Bharatpur 220kV, 40 km; Duhabi-Anarmani 400kV, 100 km; Hetauda-Butwal 400kV, 168 km; Butwal-Lamki 400kV, 300 km; and Lamki-Mahendranagar 400kV, 102 km.

Nepal Electricity Authority (NEA) forecasts that there will be an additional 3,272 km of transmission lines in ten years. This includes 78 km of 33 kV, 1409 km of 132 kV, 755 km of 200 kV and 1030 km of 400 kV. The following are the corridors of transmission line projects in CHAL and TAL:

Table 3: Proposed transmission lines in CHAL and TAL

SN	Transmission Line Projects	Capacity (kV)
1	Kabeli Damak	132
2	Kosi corridor (Basantapur-Kusha)	220
3	Middle Marsyangdi-Manang	132
4	Kali Gandaki	220
5	Karnali Corridor (Lamki-Upper Karnali)	132
6	Thankot-Chapagaun-Bhaktapur	132
7	Syangja substation	132
8	Kushum-Hapure	132
9	Butwal-Kohalpur	132
10	Hetauda-Butwal	400
11	Kali Gandaki-Gulmi (Jhimruk)	132
12	Butwal-Lamki	400
13	Lamki-Mahendranagar	400

Construction of these large and medium sized transmission lines across hill slopes and forested areas are noted to have negative impacts on the environment and ecosystems. Some of the major environmental consequences of transmission line installation are: strips of deforestation leading to accelerated degradation of forests; increased access to forest and wildlife, making it easier for illegal extraction of forest resources and poaching; increase in human wildlife conflict; impact on bird species; and aesthetic impacts on tourism. The key areas of impact are briefly described below:

Land degradation and stability:
The construction activities of site clearance, foundation excavation, transportation of materials and stringing cause ground disturbance, creating an erosion hazard and potentially destabilizing slopes.The construction of tower foundations can alter natural drainage patterns, causing localized erosion. The removal of vegetation and excavation for tower foundations poses the greatest hazard.

Loss of forest and vegetation:
The regulations for Right of Way (RoW) of transmission lines require mandatory clearance of forest land. Sometimes the area of tree felling for transmission lines can be alarmingly high. For example, the Hetauda-Bharatpur (220kV) transmission line project will clear 168 ha forest land, felling 52,547 standing trees of various species. Similarly, the Environment Management Action Plan of Bharatpur-Bardghat 220 kV transmission line project will result in the loss of 193 ha forest land including 16,557 standing trees of various species. A continuous section of riverine forest near and around Diyalo Bungalow in Chitwan will be disturbed by the Bharatpur-Bardaghat transmission line construction.

Figure 3: Deforestation from transmission line development in Chitwan

Disturbance and fragmentation of wildlife habitat:
The removal of vegetation will fragment wildlife available in transmission line alignment area. For example, Hetauda-Bharatpur 220 kV

transmission line construction will lead to felling of trees and poles in 127.5 ha of forest land. The removal of vegetation fragments the core forest habitat available to mammals and birds. The loss of tall trees will adversely impact monkeys and langurs as they prefer continuous forest canopy for easy movement.

Similarly, the Upper Seti-Chitwan[8] transmission lines passing through Barandabhar Corridor is likely to have a big impact on wildlife movements. Earthing wires create a significant hazard as they are located on the crests of towers and are thin, and therefore more difficult to detect. Likewise, transmission lines may cause serious injuries to birds due to both collision and electrocution. The construction of access roads and other structures for transmission line development can fragment forest areas, and cause irreversible loss of primary forest sections, as is observed in the station and housing construction area for the Bharatpur-Bardaghat transmission line.

Transmission lines of major concern:

1. Bharatpur-Bardaghat 220 kV (under construction)
2. Hetauda-Bharatpur 220 kV (under construction)
3. Hetauda-Dhalkebar-Duhabi 400 kV (under construction)
4. Lamki-Upper Karnali 132 kV (in development)
5. New Butwal-Gorakhpur Cross Border Line, 400 kV (in development)
6. Samundratar-Trishuli 3B, 132 kV (in development)

The project sheets for Hetauda-Bharatpur 220 kV Transmission Line, Bharatpur-Bardaghat 220 kV Transmission Line, Talkot-Mahendranagar 400 kV Transmission Line and Hetauda-Dhalkebar-Duhabi 400 kV Transmission Line are given as Supplementary Document-Project Sheets. The project sheets include salient features of these projects, associated environmental and social impacts and proposed action plans (See Annex 11).

The location map for the transmission lines of major concern is given below.

Figure 4: Transmission lines of major concern in TAL

8 Meeting with WWF/Hariyo Ban on 24 January 2013

Opportunities offered by transmission lines:
Transmission lines contribute to accelerating economic growth and improving the standard of living associated with the use of electricity. Significantly, they also help conserve the environment through reduced use of firewood. Crossing international borders allows for electricity trade, incoming when electricity generation is deficient in Nepal, and outgoing, when it is in excess of national demand. Economic implications of exporting electricity are huge for a water resource rich nation like Nepal, where the electricity generation potential is cited to be more than 83,000 MW.

3.3.3 Irrigation Projects

Irrigation schemes are important for agricultural production and support the economic growth of the country. Irrigation projects can also result in undesirable adverse environmental impacts. In the absence of adequate watershed conservation, the use of dynamite in constructing contour canals along hill slopes causes slope instability, rock falls, landmass movements, and canal damage, disturbing the natural state of the habitat. With the increased network of canal systems in the hills and mountains, water leakage and drainage problems may damage the physiography of the terrain and cause soil erosion and slope instability. In Terai, larger scale irrigation projects, such as widespread sub-surface irrigation systems (e.g. shallow and deep tubewells) as well as large surface irrigation systems (e.g. Sikta, Rani Jamara, Bheri Babai Diversion Multipurpose Project) are in development. These are known to have key environmental impacts associated mainly with underground water depletion, wildlife movement, aquatic species and siltation.

The main adverse impacts associated with irrigation projects are summarized below.

Loss of vegetation:
As part of site clearance in the project area, forest land is lost during the construction of the project. Direct and indirect involvement of the workers and growth of business enterprises and agricultural activities from improved irrigation facilities may lead to encroachment of forestland and excessive harvesting of Non-timber Forest Products (NTFPs).

Disturbance to wildlife habitat:
Disturbance resulting from mining of construction materials, operation of crushers, construction activities, vehicle movement and other related activities can interrupt movement, feeding and other activities of wildlife. There may be loss of rare flora due to human activities. Construction activities may continue at night for the timely completion of project, thus affecting the nocturnal movements of nearby species in the area.

Impact on wildlife movement:
Some of the important surface irrigation schemes currently in construction are located in wildlife sensitive areas. These systems have canals with an average width of more than 20 m. These are enough to obstruct movement of wild animals in the absence of structures that enable crossings. This impact is emerging as one of the most important and far-reaching impacts from large irrigation projects as these irrigation systems are increasingly built in flat areas adjoining major forest pockets.

For example, the Environmental Management Plan for Rani Jamara Kulariya Irrigation Scheme (DoI, 2011) envisages that construction of feeder canal and activities in the intake area, including annual improvement of the Jharahi Nala, will affect occasional wildlife movement in Chetana, Kalika, Shiva Shankar, Jagatpur and Kaileshwor community forests. It will particularly be difficult for the young, pregnant and sick wild and small terrestrial animals to cross over a feeder canal of depth of around 1.8 m to 2.4 m and a width between 18 m to 23 m (water width would vary between 15 m to 21 m). Similarly, Abahi West Rapti Irrigation Project (part of Sikta irrigation scheme) passes through Banke NP with deep irrigation canals and no corridor provisions, thus restricting wildlife movement and creating relatively isolated habitat segments within and outside the national park. The EIA for Sikta (DoI, 2006) states that the irrigation project foresees an impact to 38 identified species of mammals, including Bengal tiger, and their movement through their corridors. However, the EIA does not elaborate on the nature of the

impact and movement routes, while suggesting general forms of mitigation measures such as canal crossings which are not yet implemented.

Illegal logging and poaching:
The labor in the construction camps may be involved in poaching, illegal hunting and/or trapping of wildlife, as well as unmanaged firewood collection for cooking purposes. Increased access to forests and species rich areas via access roads could also encourage illegal hunting, poaching or fishing by locals and outsiders. This is likely to augment as populations and settlements increase following better irrigation facilities that attract people to settle around their fields.

Figure 5: Section of Sikta Irrigation Project

Impact on aquatic species:
Irrigation projects may have several impacts on fish and other aquatic species. These include:

- Leaching or misuse of chemical pesticides and fertilizers. For example, the increased use of both chemical fertilizers and pesticides adversely impact larger aquatic animals such as dolphins in the Karnali, Mohana and Pathraiya rivers (DoI, 2011). Similarly, sewage drained through the Seti Irrigation Outlet to Phewa Lake increases nitrate and phosphorus content, thereby creating an unfavorable environment for aquatic species[9];
- Fishing or poaching activities by project staff/workforce;
- Destruction or disturbance to movement and habitats. For example, Rapti Laxmanpur Dam and Girijapuri Barrage south of the border have adversely impacted upstream migration of aquatic biodiversity in Nepal[10]. Similarly, the Babai barrage is noted to have critically obstructed the movement of endangered gharial and sahar fish species, and their numbers have reduced after construction of the barrage. The population of gharial has been reported to have declined from 700 to 107 after the construction of Babai irrigation[11].

Aquatic species are also impacted if too much water is drawn from the river. For example, the Head of BNP considered that if Rani Jamara Kulariya Irrigation scheme takes more than 80 cum of water from Karnali, *'loss of wetlands in the downstream area and loss of over 120 species of fish will be imminent if more than the stipulated quantity is diverted. Crocodiles and dolphins will not be exceptions, either.'*

In designing irrigation schemes it is important to consider the likely impact on species and habitats in conjunction with the hydropower schemes as these often go together in major river basins. The dams associated with larger irrigation projects are noted to alter vegetation types and impact habitats, while smaller irrigation projects cause reduced stream flows and changes in livelihoods patterns of local communities, sometimes driving them to increased dependency on fragile natural resources.

Irrigation Projects of Major Concern:

1. Bheri-Babai Irrigation Project, Banke/Bardia (under construction)
2. Sikta Irrigation Project, Banke (under construction)
3. Rani Jamara Kulariya Irrigation Scheme
4. Kaligandaki-Tinau Irrigation Project, Rupandehi/Nawalparasi (planned)
5. Sunkoshi-Kamala Irrigation Project, Saptari/Siraha/Dhanusha/Mahottari (planned)

The project sheets for Sikta Irrigation Project and Rani Jamara Irrigation Project are given as Supplementary Document-Project Sheets. The project sheets include salient features of these projects, associated environmental and social impacts and proposed action plans (See Annex 11).

9 National consultation, 27 August 2013
10 Meeting with WWF Nepal on 27 January 2013
11 National consultation, 27 August 2013

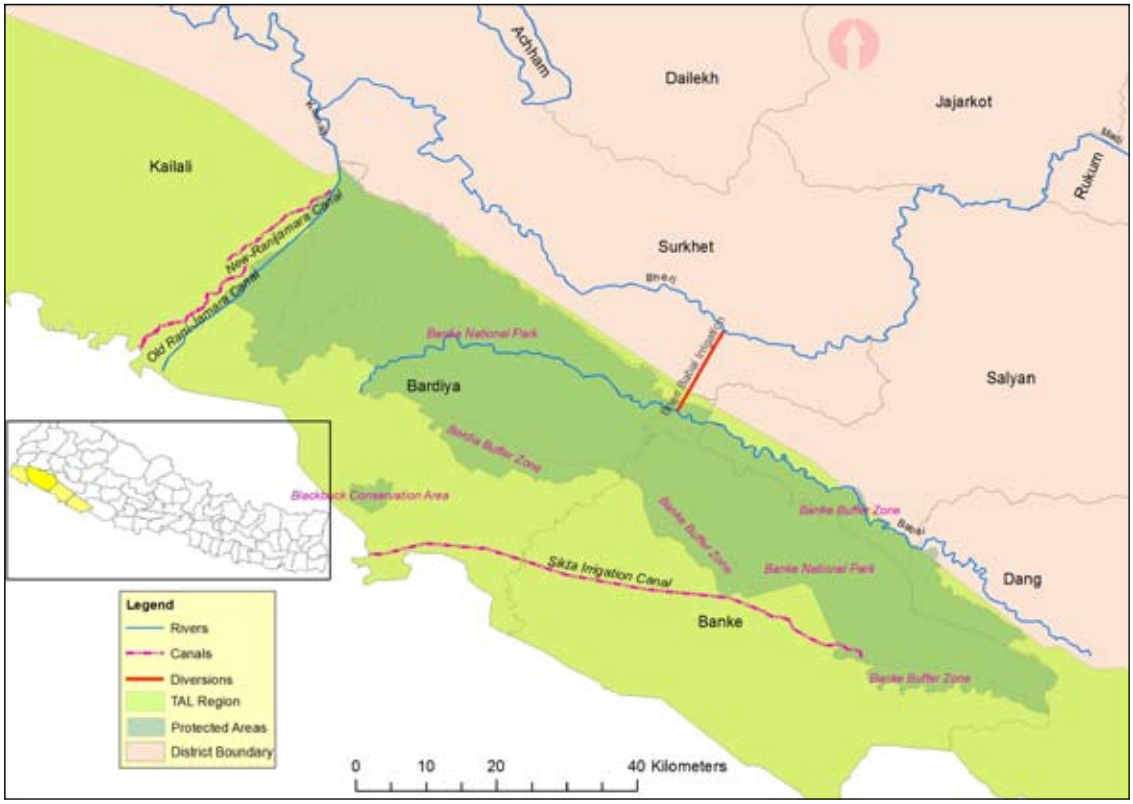

Figure 6: Irrigation projects of major concern in TAL

Opportunities from irrigation projects:

The construction of irrigation canals has the potential to improve the lives of farmers in the irrigated area by improving agricultural productivity, which has a positive influence on the economy of the country and locality, and may relieve pressure on forests for local livelihoods. The opening up of access roads can introduce previously unconnected communities to facilities like electricity, communication etc. while providing opportunities for economic activities.

Developers of irrigation projects in Nepal do not seem to have utilized the opportunities to mitigate environmental impacts associated with canal construction, especially in corridors and protected areas. Development of irrigation systems with due consideration for environmental safeguards can bring enormous economic and health benefits to the local population who would be more than willing to conserve the natural environment for long term development of the area.

3.3.4 Sand and Gravel Extraction

While sand and gravel extraction are not projects in themselves, these are essential sub-activities of any major infrastructure works. The section is added to reflect in a more detailed manner on how this in itself impacts the natural environment.

Extraction activities are intense in TAL and CHAL areas due to the high extraction potential in the rivers and their tributaries. The collection and extraction of boulders, sand and gravel from the riverbed has serious direct and indirect effects on landscape pattern and aquatic biodiversity. The direct and indirect impacts of the crusher industries can lead to changes in river morphology and affect other infrastructure such as dams, spurs, revetment walls, culverts, roads and bridges. The visible impacts on riparian infrastructure include scouring of bridge foundations, retaining structures and embankments of road sections.

Some key impacts from extraction activities are the following:

Landscape impact:
Concentrated mining activities at large scale leads to an upstream progression of channel degradation and erosion referred to as headcutting. Headcuts induced by sand and gravel mining are often responsible for dramatic changes in a stream-bank and channel impacting the instream flow, water chemistry and temperature, bank stability, available cover, and siltation. Channel scouring and erosion occur as a result of increased water velocity and decreased sediment load associated with mined areas.

Examples of these processes are eroding cliffs and banks that are characteristic of intensive extraction sties. Consequently, over the years the cliff recedes hundreds of meters, taking away forest or agricultural lands valuable to the community and putting settlements at risk.

The adverse impacts from extraction activities are very acute in the Seti River (Kaski and Tanahun districts) and Manohara River in Makwanpur. The sand and gravel extraction at Kotre, Tanahun and crusher industries located downstream in the Seti River were seen to have contributed to the loss of agricultural land upstream and downstream of the mining areas.

Impacts on biodiversity:
Engagement of workers during excavation and expansion of settlement creates long-term pressure on forest resources from illegal collection of fuel wood, timber and other forest products. There will also be possible adverse impacts on local wildlife populations during extraction activities, including threatened mammals, birds and other endangered species. Noise and vibration produced by extraction activities and vehicular movement during night operations and hunting/poaching by project labor force may affect wildlife. Also, access to scarce dry season water supplies may be restricted. For example, around three dozen crusher plants are located in the Chure hill area of Bara and Makwanpur districts, many of which are in the BZ of the Parsa Wildlife Reserve.

As cited during local level stakeholder consultation, 10 registered sand mines exist in Chitwan district. Heavy extraction of riverbed material in the district is leading to increased debris flow and debris deposits. Debris deposits were cited to have led to river bed aggradations, breaching of embankments, flooding of riparian communities and river cutting. Similarly, the stone crushing industries along the Rapti, Manahari, Kukhureni khola and Lothar River have degraded river morphology and increased downstream sedimentation. Use of heavy equipment caused both noise and dust pollution in the area (Source: local consultations).

Impacts on aquatic habitat:
Extensive gravel and sand mining inevitably leads to the destruction of aquatic and riparian habitat due to bed degradation, bed coarsening, lowered water tables near the streambed, and channel instability. These physical impacts cause degradation of riparian and aquatic species. The degraded river, rampant excavation and decrease in the sediment in the river will cause changes in the habitat of fish, insects, amphibians and small creatures which adversely affect the river ecosystem. Along with these, destructive methods of fishing like explosion, electrification, and use of chemicals by the work force and locals may lead to local extinction of aquatic life.

Figure 7: River cutting observed in Seti River in Kotre, Tanahun across the river from a crusher plant

13 Focus group discussion at Khairenitar, Tanahun.

Fishing initiated by developments, and community changes in the area brought on by extraction industries, was pointed out as the cause of declining fish numbers in the Seti River around Kotre, Tanahun[13]. Local people and fishermen collect fingerlings to meet soaring demands during diversion of the river and extraction of riverbed materials, thus limiting breeding opportunities and chances of species survival.

Impact on infrastructure and groundwater:

The combined processes of channel incision and headcutting also can undermine bridge piers and other structures such as valley aligned highways. Numerous bridges in Nepal, for example those in the East West Highway, have either collapsed or are endangered due to intensive river mining.

Apart from threatening bridges, sand mining transforms the riverbeds into large and deep pits. As a result the groundwater table drops, causing drinking water wells on the embankments of these rivers to go dry. Bed degradation from in-stream mining lowers the elevation of streamflow and the floodplain water table which in turn can eliminate water table-dependent woody vegetation in riparian areas, and decrease flooding periods in riparian wetlands. This is also noted to have affected grasslands in the floodplain as they increasingly turn into woody vegetation.

Sand and gravel extraction activities of major concern:

1. Extraction activities on Seti River, Kaski/ Tanahun
2. Extraction activities around Parsa Wildlife Reserve, Bara/Makwanpur

The project sheet for sand and gravel extraction activities in Seti River, Kaski/Tanahun is given as Supplementary Document-Project Sheets. The project sheets include salient features of these activities, associated environmental and social impacts and proposed action plans (See Annex 11).

Opportunities from sand and gravel mining:
Mining of rivers for sand and gravel that are much needed to maintain the infrastructure growth can be an abundant source of income for VDCs and DDCs. These funds can then be used for much needed mitigation and rehabilitation works (which are often ignored by the developers), overall development of the area, and improving the livelihoods of the poorer communities who may be harvesting natural resources unsustainably to manage their daily lives.

The key consideration with river mining is not the avoidance of such mining which brings in materials for infrastructure development, but regulating it under professional supervision. Studies could be carried out to estimate the annual bedload sand and gravel supply from upstream, consider the replenishment rate, and limit annual mining to some fraction of the replenishment rate considered to be a "safe yield" (Kondolf, 1997). Following a good study, application of legal tools with due monitoring mechanisms would be necessary. Current legislation prohibits collection of river sediments within 500 m of built structures and within protected areas. The Supreme Court has ruled that crusher factories in Chure forest areas must be relocated by 2013.

Figure 8: Sand and gravel extraction in Seti River, Kaski

3.3.5 Road Projects

National and rural road network development and construction in Nepal has increased very rapidly in the past few decades for the promotion of economic growth in all parts of the country. Rural roads, their construction mechanisms and associated impacts are covered in a separate section. The environmental impacts arising from new construction as well as rehabilitation/ upgrading of national level roads are discussed below.

Change in land use:

Road projects immensely and irreversibly contribute to notable changes in land use. While the road itself consumes much forestland, shrub land and agriculture land, with its passage, much larger scale impacts often arise from indirect impacts of increased vehicular access. Settlements start to spring up in otherwise isolated areas and pressure on the natural resources buildup.These impacts are long-term and irreversible. The land use changes may enhance the risk of landslides and soil erosion on either side of the road.

Landscape disturbance:

Many parts of the Hariyo Ban landscapes are fragile. Cutting of hill slopes, stock piling of construction material, and earth spoils can be seen from afar, causing visual impact. There are landslide- and erosion-prone areas along the proposed routes of many large scale road projects in the landscapes. Roads through forest areas may accelerate erosion and cause landslides after the clearance of forest cover. Similarly, roads along streams may cause soil erosion and sediment transport/flooding problems. Steep slopes, landslides and erosion zones may impact downhill settlements, forests and agriculture land through the road construction activity.

Figure 9: Unstable slopes and fissured landscape along Besishahar-Chame Road

Figure 10: Massive pieces of rock deposited in the river channel along the Besishahar-Chame Road. Similar deposits consisting of large stones and/or smaller pebbles and rock fractions were observed at multiple points along the road

Road works require a large amount of sand and aggregates that are collected from rivers near the road alignment. The extraction process, when carried out haphazardly, may cause instability in the surrounding area. For example, the extensive use of explosives in the construction of Besishahar-Chame Road has caused numerous fissures in the existing roadside rock beds. These vertical and unprotected cliffs pose severe safety risks for travelers and for the river below. They are very likely to slide and fall, triggered by traffic generated vibrations and rain-induced moisture, over a short period of use of this road alignment.

Pollution:

The road construction and operational activities may cause noise, and air and water pollution,

which is harmful for wildlife and local people. Roads in the mountainous areas generate high noise levels due to steep gradients and use of worn out and overloaded vehicles. Earthen roads built along the river valleys add sediment load to the rivers and impact aquatic life. In the plain areas, the intensity of traffic results in high dust levels, and noise including indiscriminate use of horns. Trash thrown away along roads accumulates or washes into rivers if not collected, with adverse effects for tourism and aquatic life.

Risk of accelerated sedimentation in water bodies:

The debris generated from road construction and operation may increase sediment loads in rivers if not managed properly. For example, in multiple sections of the Chame-Besishahar road it was observed that debris from the road construction activities was disposed of in the river, thereby increasing sedimentation load and changes in river morphology.

This road, linking the headquarters of Lamjung to Manang, passes through extremely difficult river valley terrain characterized by an abundance of steep, hard rock cliff sections. Technical design and construction methods should be accordingly sensitive. During the field visit while driving along this road, it was possible to observe large stones, pebbles and aggregates haphazardly disposed of in the Marshyangdi River. This has the potential to change the river morphology, increasing flood risk for downstream settlements and hydropower stations as well as other infrastructure. What is very striking, and certainly indicative of widespread and haphazard use of explosives, was the presence of a large boulder on the river bed at one point in the alignment. The explosion for track clearance had obviously dislodged a massive rock from the cliff into the river and the resulting vibrations had even caused a landslide on the opposite bank of the river (see Figure 10).

An impact of road development with resulting siltation of water bodies was also notable for Phewa Lake in Pokhara. Encroachment for agriculture, settlements and road construction in Baidam, and areas along Phirke Khola, has intensified sedimentation in the Lake, thus transforming completely submerged areas into exposed alluvial plains. As a result, the lake surface area has significantly reduced from 5.8 sq km in 1981 to 4.4 sq km in 2001 (more recent figures are not available). Phewa Lake constantly receives sediment consisting of silt, sand and gravel that is deposited in the lake from Harpan Khola, as well as from urban sewage/garbage disposal, Seti Canal, Bulandi and Phirke Khola. Seti Canal in particular is designed to dispose of excess irrigation water in the lake. The canal carries water from Seti laden with sediments and is further aggravated by household (HH) and municipal waste that communities dump in the canal (see Figure 11 for details).

Figure 11: Phewa Lake in 1996 and 2013

Impacts on biodiversity:
Road development may dissect and/or fragment the natural habitat and biodiversity corridors. Wildlife can be affected by increased noise level, hunting, human pressure and fragmentation of habitat. Aquatic biodiversity may be affected by the disposal of the construction wastes and increased level of sedimentation in the water bodies. Roads passing through sensitive areas may cause loss of important natural habitats. The existing and proposed roads in TAL and CHAL areas are very sensitive for biodiversity conservation. This includes the Bhurigaon-Telpani Road and other postal roads within the Bardia National Park and BZ.

The East-West Highway of the country traverses Chitwan and Nawalparasi districts. The roads between Hetauda-Ratnanagar-Bharatpur, Narayangarh-Gaindakot to Kawasoti and Narayanghat-Mugling to Kathmandu have different connecting links within Chitwan National Park including postal roads.The Kasara-Madi road crosses a 10 km stretch of core area of CNP and is sensitive for possible poaching/ hunting activities. The extension work of the same road between Madi-Nirmal Thori-Birgunj passes through Parsa Wildlife Reserve and its BZ and poses a formidable challenge for protection of wildlife.

The proposed Jagatpur-Meghauli-Golaghat-Lamichaur-Triveni postal road will also have negative impacts on biodiversity due to habitat destruction. For instance, Lamichaur forest is important for rhino and tiger habitat. The proposed alignment will fragment wildlife habitat of rhino, tiger, elephant and other species. The proposed bridge construction in Golaghat is very likely to affect a key area for gharial. Enabling easy access within the CNP/BZ may encourage poaching of rhinoceros and other animals by shooting, electrocution, and poisoning.

There is also a risk of accidents on the road involving wild animals, particularly on long straight stretches where vehicles will travel fast, and near traditional wildlife routes.

Loss of forest and other vegetation:
The existing and planned construction road work requires site clearance leading to loss of forest and other vegetation. IEE/EIA reports mention generic compensatory plantation to offset the loss of trees in the ratio of 1:25 though this is not practiced in the spirit of the legislation. The forest and other vegetation may also be degraded during the operation phase due to new roadside settlement as additional pressure is placed upon nearby forests to fulfill daily needs for fire wood for cooking and heating, and timber for construction work. Improved vehicular access further leads to increase in legal and illegal extraction of timber and other forest products for commercial purposes.

The construction of the Besisahar-Chame Road has opened up access to previously vehicle-inaccessible alpine forest areas, thus elevating the risk of illegal harvest.

In addition there is a risk that if drainage beneath roads is inadequate, vegetation may change due to changing water table and/or stream flow. For example, if roads built across streams and wetlands or areas with high water table impede drainage, wetland may increase on the upper side and/or decline on the lower side. This could also affect the forest-grassland balance by changing the water table, and could affect habitat for tiger prey.

National road sections of major concern:

1. East-West Postal Highway
2. Kathmandu-Terai Fast Track
3. Daldale Bhimad Road, Nawalparasi/ Tanahun
4. Daiji/Bani-Jogbudha Road, Kanchanpur
5. Besishahar-Chame Feeder Road, Lamjung/ Manang
6. Beni-Jomsom-Pokhara Feeder Road, Myagdi/ Mustang/ Kaski
7. Syabrubesi-Timure Road, Rasuwa
8. Kasara-Madi-Birgunj Road, Chitwan/ Parsa

The project sheets of East-West Postal Highway, Kathmandu-Terai Fast Track and Thoche-Larke Road are given as Supplementary Document-

Project Sheets (See Annex 11). The project sheets include salient features of these projects, associated environmental and social impacts and proposed action plans.

The location map of national roads in development in CHAL is given in Figure 12.

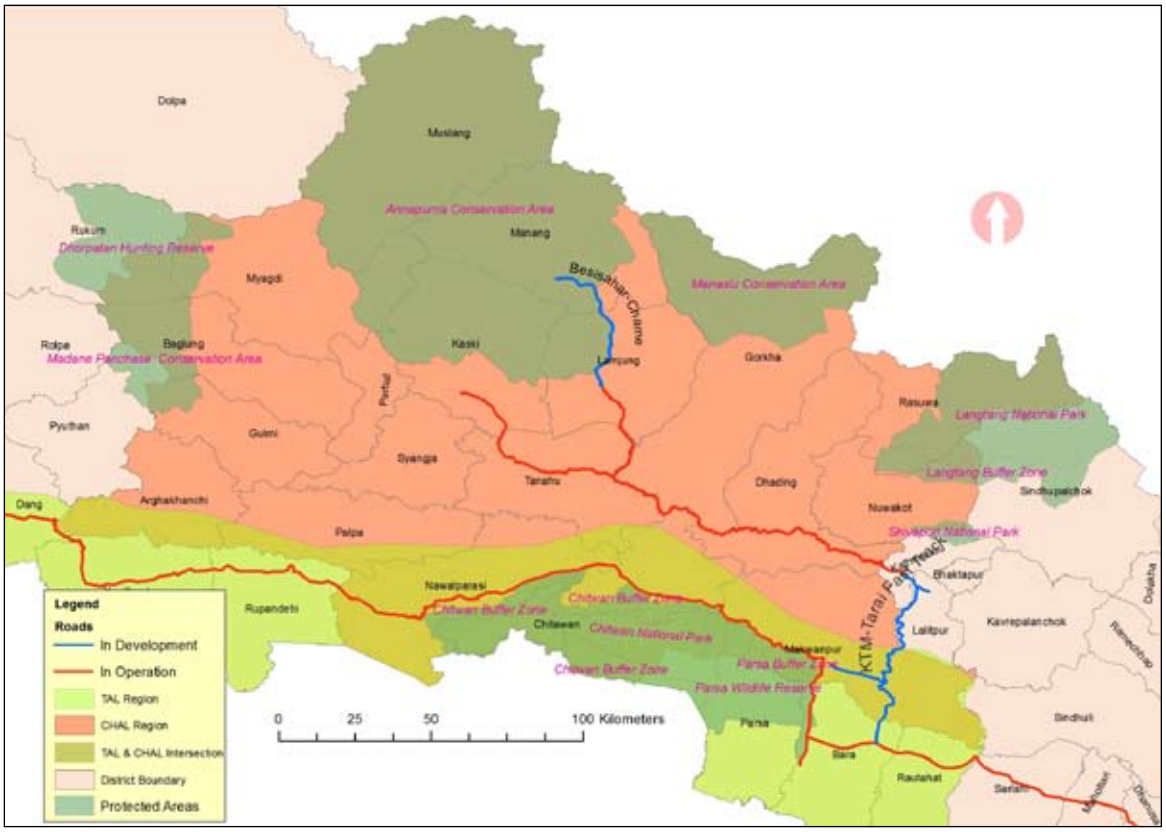

Figure 12: National roads under development in CHAL

Opportunities from road construction:
The opening up of access has the potential to introduce a multitude of facilities to the affected areas, including electricity, communication, increased opportunities for better health facilities, education, commercial activities, etc. The increase in economic activities and tourism from increased access can contribute to upgrading of the livelihoods and economic standards of the local communities. This can, with support of appropriate initiatives, result in lowered pressure on the natural environment through reduced dependency on firewood for cooking, heating, etc. and improved livelihoods through better marketing of agricultural products and sustainably harvested NTFPs.

3.3.6 Airports

During new construction and extension of existing airports, all earthworks, civil works for installation of runway centerline lights, pavement markings and runway edge and threshold lights, shoulders, perimeter road diversion etc. may change existing land uses of forest, agricultural and private land.

The environmental impacts of infrastructure related to airport development activities are summarized in the table below:

Table 4: Environmental impacts of airport related infrastructure

Preparatory Phase	Construction Phase	Operational Phase
• Land acquisition • Displacement of community people/ residential houses	• Site clearance resulting in loss of wildlife habitat and disruption of biodiversity corridors • Earthwork excavation • Stockpiling the excavated earth for reusing in the runway shoulder • Fill material excavation from the selected borrow pit sites • Stockpiling of construction materials • Air, noise and water pollution • Traffic congestion • Associated impacts of construction related structures like access roads • Increased pressure on resources and natural environment due to increased settlements arising from employment opportunities • Increased hunting/ poaching, extraction of timber	Aircraft emissions from takeoff and landing of aircraft Bird hazard Effluents from terminal building, administrative office/ control tower discharges Impacts from rehabilitation and landscaping Increased pressure on the natural environment due to expansion of settlements, attracted by employment and business opportunities Increased demand for water, forest products and other resources, corresponding to the increase in population and human activities

More specifically, the EIA[14] carried out for proposed Gautam Buddha Airport extension is summarized as follows:

- Diversion of Ghagra Khola along the airport boundary and merging with the existing Ghagra Khola in south west side will have notable adverse impact on aquatic life.
- Earth filling the existing Ghagra Khola will have an impact on aquatic life.
- Effect on air quality due to aircraft emissions from aircraft during take off and landing.
- Noise effect due to aircraft during take off and landing.
- Impact on air quality (vehicular movement),
- Water quality deterioration during construction activities, spillage from ground support equipment and vehicle movement. This is drained into the Ghagra Khola.

Airport projects of major concern:

1. Nijgadh Second International Airport, Bara (in development)
2. Gautam Buddha Regional International Airport, Rupandehi (in development)
3. New Pokhara Airport at Chinne Dada, Kaski (proposed)

The project sheets for Gautam Buddha Airport, Nijgadh Airport and Pokhara Airport are given as Supplementary Document-Project Sheets (See Annex 11). The project sheets include salient features of these projects, associated environmental and social impacts and proposed action plans.

The location map of airport projects of major concern is given in Figure 13.

14 Information from EIA was available only for the Gautam Buddha Airport extension. EIA for Nijgadh Airport, although conducted, was not available for this study.

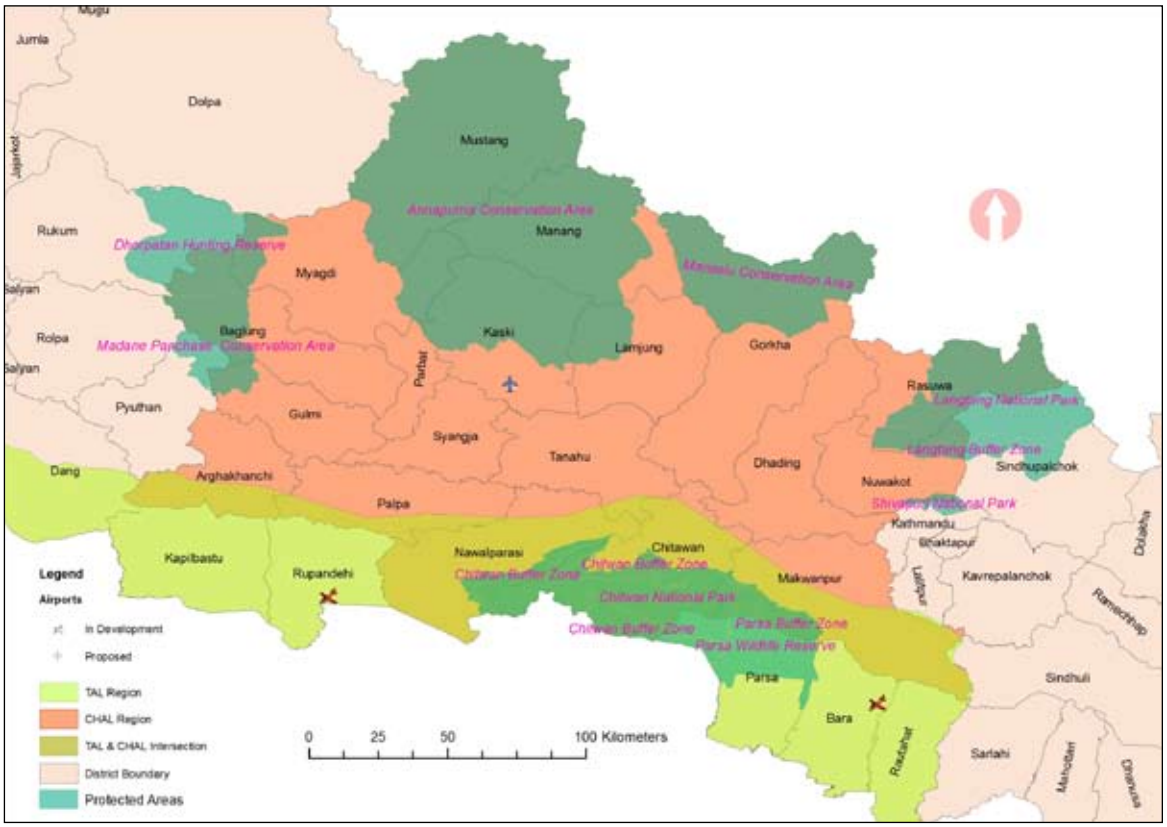

Figure 13: Airport projects of major concern in TAL and CHAL

Opportunities from airport development:
The construction of new airports and upgrading of existing ones can address the increasing demand for air travel in the country and promote tourism and business activities especially in areas unserved or underserved by ground transport. Inadequate air services currently severely limit tourism development in Nepal; with the development/upgrading of airports there will be greater flexibility for tourism circuits. Economic activities in and around airport regions can provide employment and improve the living standards of communities. With appropriate awareness and support programs, increased income can reduce community dependence on natural resources and help conserve the natural environment.

3.3.7 Mining and Minerals

The Department of Minerals and Geology (DMG) recognizes that the southernmost Terai Plain offers significant potential for mineral resources including gravel, sand, ground water, petroleum and natural gas. The sub Himalaya (Churia/Siwalik foothills) has a wealth of construction materials, radioactive minerals, petroleum, natural gas and a limited amount of coal. Similarly, lesser Himalaya (the Mahabharat Range including midlands) is promising for metallic minerals such as iron, copper, gold and uranium; industrial minerals such as magnesite, phosphorite, limestone; gemstones; fuel minerals particularly methane gas, petroleum and natural gas; and radioactive minerals. Moreover, voluminous construction materials like crushed gravel as well as river boulders, gravel and sand are widely available. Some Higher Himalaya areas have potential for precious and semi precious stones, marble and metallic minerals. However, because of rugged topography, difficult mountain terrain, complex geology, lack of infrastructure and financial constraints, exploration and exploitation of these

mineral resources in Nepal is still challenging (Kaphle, 2011).

The exploration and extraction of mined minerals in geologically sensitive areas may degrade landscapes and cause landslides, erosion, mass shifting, additional runoff, increased sedimentation and flooding. Similarly, sensitive areas of forest biodiversity in exploration areas may be disturbed, degraded, or fragmented; overfishing may occur; and wildlife may be disturbed and hunted. This will be worse if there is extensive settlement associated with the mining activity. Limited experience of mining in Nepal, such as that of marble in Godavari, Lalitpur and Magnesite in Dolakha; offer poor examples of mining operations in the country. In both cases, the mining has left visible scars in the landscape and unproductive land in the absence of rehabilitation of the area.

Any large scale extraction resulting in eventual use of oil and gas will contribute to climate change from burning of these fossil fuels. However, this could also result in reduced dependency on other natural resources such as firewood used for cooking.

Opportunities from mining:
Mining activities can generate income for communities by providing employment, and increase national income through taxes. Local government bodies receive additional revenues. Previously untapped minerals can be opened up for extraction within the country and imports can be reduced, with significant economic implications.

3.3.8 Oil and Gas Exploration and Extraction
There are 10 designated blocks for oil and gas exploration within the Terai plains and hill areas. The possible impacts of oil and gas exploration are:

- Areas of natural habitat outside of protected areas may be affected during construction activities, camps establishment and general survey activities.
- Some survey areas are located within protected areas, BZs, wildlife corridors and other sensitive area identified by the project. Most of these areas lie in Churia and TAL areas where there are sensitive wildlife habitats, endangered and threatened species, and forests.
- Water resources of surveyed locality and downstream may be contaminated through waste disposal, storage and handling of fuel and similar activities during exploration.
- Similar impacts may occur in private agricultural land and local settlements.
- The exploration works may disturb communities e.g. from noise, traffic and workforce interactions.
- There will be impacts if spillage occurs during exploration processes.

The impacts arising from extraction of petroleum in assigned blocks in Nepal are not covered in this report. The government has not undertaken any study nor prepared any guidelines for this activity; and it is not likely to take place for at least 3-4 years.

The project sheets of petroleum exploration activities in Nepal are given as Supplementary Document-Project Sheets (See Annex 11). The project sheets include salient features of these projects, associated environmental and social impacts and proposed action plans.

Opportunities from oil and gas extraction:
Extraction of petroleum products within the country will provide opportunities of employment for people as well as decrease the dependence on imported petroleum products. If indeed the extraction is of a high magnitude, this can significantly support in offsetting the import-export imbalance that the country currently faces.

4 OVERVIEW OF RURAL ROAD CONSTRUCTION METHODS

4.1 Introduction

Rural road construction activities have increased dramatically in Nepal in the last decade. Existing and ongoing rural road networks in Nepal cover an extensive area of forest land. Access is improved to remote parts of the country, facilitating economic and social development, but the environmental impacts caused by rural road construction are massive, and in several cases, irreversible.The associated impacts can be direct from poor construction practices conducted without regard for the environment, or indirect from increased vehicular or other access to large areas of forest and sensitive areas. Due to their massive cumulative environmental impacts, rural roads have been identified subjectively by Hariyo Ban and WWF as a major driver of deforestation and a major threat to forest biodiversity (KAFCOL, 2013a). Hence, a chapter has been dedicated to analyzing the mechanisms of construction, impacts of rural roads, and possible mitigating measures.

Opening up road access to rural areas is essential for the improvement of physical, economic and social livelihoods of the resident population. It has been widely indicated that one of the key reasons for rural poverty is physical isolation of areas resulting in poor access to markets, services and economic opportunities. Construction of rural roads in Nepal is taking place at an unprecedented scale. However, it is occurring without strategic consideration of required road networks. This has resulted in disuse and rapid deterioration of road quality beyond maintainability conditions of as much as one third of the network (Source: consultation with DoLIDAR).

Notable rural road programs in Nepal started in the mid-1990s at community, local and central levels with a focus on fulfilling access needs of the people while promoting labor based, environment friendly and participatory (LEP) approaches.The level of investment in development of rural roads has significantly increased over the past 10 years. A number of rural road based projects and programs are currently being implemented with a total budget of more than US$ 400 million spent in nearly four years (ToR, Study on Economic Analysis of Local Government Investments in Rural Roads, April 2010, Local Governance and Community Development Programme, MoFALD). Similarly, each DDC spends on average more than Nepali Rupees (NRs) 40 million per year on roads, while each VDC spends on average NRs One million per year on rural roads. The DDCs and VDCs are undertaking the construction, rehabilitation and maintenance of these rural roads with support of DoLIDAR and MoFALD.

4.2 Policy, Mechanism of Implementation and Current Situation

MoFALD is responsible for the development and management of the rural transport infrastructure. Following the prevailing government policies, responsibility for implementing the work of rural roads lies with DoLIDAR. Key policies and acts related to rural transport infrastructure are as follows:

- Local Self-Governance Act (LSGA) (1999)
- Local Body Financial Administration Regulations (LBFAR) (2007)
- The National Transport Policy (2001)
- The Local Infrastructure Development Policy (2004)
- National Plan for Rural Road Maintenance (1999)

- Local Infrastructure Development Strategic Action Plan (2007)
- Rural Roads Maintenance Directive (2008)
- Roads Board Act (2002)

Through the LSGA and the Local Self-Governance Regulation, issued in 1999/2000, local bodies are responsible for planning, implementation and maintenance of the rural transport infrastructure. MoFALD and DoLIDAR are responsible for providing policy directives and technical support to the local bodies for managing the rural transport infrastructure. At the local level DoLIDAR is represented by the District Technical Office (DTO). The DTO provides technical support for all local infrastructure works to the DDCs and VDCs. Assistance in the management of their rural roads network is of prime importance for most DTOs. A team of Engineers, Sub-engineers and Assistant Sub-engineers of the DTOs implement local road construction and maintenance in the districts.

4.3 Current Approaches to Rural Road Construction

The current practices in road construction involve labor-based, environment friendly and participatory (LEP) and equipment-based (EB) approach. Both of these approaches have advantages and constraints.

4.3.1 Labor-Based, Environment Friendly and Participatory (LEP) Approach

Labor-intensive construction is a traditional practice in Nepal and is an area where awareness of gender issues and benefits for the poor is expanding. This approach is widely acclaimed worldwide and in Nepal, as practiced in donor funded rural road programs, for its contribution to poverty alleviation through employment generation in often poor or food deficit areas.

The labor-based LEP approach, as defined in policy documents (HMGN/MoLD 1999, 2004), predominantly uses human labor, but also allows the use of machines to a small extent. In Nepal, until recently labor-intensive and labor based methods of construction were taken as synonymous. Now, with the presence of a large number of machines in the rural areas, the definition of LEP is revised in project documents to include appropriate use of heavy equipment. However, this is yet to be reflected in key policy or technical documents of the GoN.

The very backbone of the pro-poor, gender sensitive and socially inclusive rural infrastructure development process, particularly in the rural roads sector, is the correct and sincere application of LEP approach using labor-intensive and participatory tools. This practice is slowly dying in Nepal, particularly in the DDC/VDC funded road programs. While specific and official data do not exist, it is estimated that more than 80% of the rural roads, both district and village roads included, are now being built using large machines such as excavators and bulldozers. The DDCs and VDCs are fuelling the process by handing over the construction to heavy machinery, with very minimal use of labor, using the funds they receive as block grants from the central government.

The LEP approach has not yet internalized the emerging climate change sensitivity. So far, the focus has been on conserving the natural terrain through the softer approach to ground excavation, slope stability and erosion control. There is little understanding on how climate change and roads and highways relate. However, there is now increased research on climate change and road development processes. An important study[15] is currently in an initial stage of implementation which seeks to understand and integrate climate change risks into Nepal's development implementation with a focus on infrastructure and urban and rural service provision (especially water supplies and sanitation, roads, and irrigation).

15 Mainstreaming Climate Change Risk Management in Development, Asian Development Bank, Nepal

4.3.2 Equipment-Based (EB) Approach

The factors contributing to favoring heavy equipment use over labor based approaches for rural road construction in Nepal are[16] :

- Budgetary grants/funds are disbursed to local authorities in Nepal usually in May-June when the local population is busy in agricultural operations and a limited time (less than 2 months) exists to utilize the funding before it is frozen, thus prompting the use of this supposedly rapid construction method that requires a smaller workforce.

- Unskilled labor wages have increased three fold in the past 15 years while heavy equipment rental costs have decreased to less than half. The purchase cost of heavy equipment has decreased substantially as well, resulting in a higher number of plant available, more competitive market, and reduced rental costs. Financial constraints of projects at local level favor EB approaches over labor based construction.

- Heavy EB road construction is perceived as more rapid compared to labor based approaches. However, careful analysis of both approaches reveals that the time frame required for construction with the EB approach is comparable to the labor based approach with proper planning and execution (Section 5.5).

- Misappropriation of allocated funds by relevant authority personnel or construction contractors has been a common practice in rural road construction. Preparation of fake documents and invoices demonstrating the use of high-cost labor forces, while employing lower cost heavy equipment in non-environmentally friendly ways for the actual construction, has proved profitable for some actors, leading to the promotion of EB approaches.

The rapid abandoning of the labor based approach is both the reason for and consequence of corruption now widely acknowledged around rural roads at the local level. The impact of poor governance has resulted in a gradual move away from the LEP, extensive use of heavy equipment, and the increasing use of contractors either directly and officially or in the disguise of User Committees. All forms of corrupt practices are emerging in association with the use of heavy equipment. Most districts make cost estimates on the basis of construction being carried out using labor groups. At the implementation level, the work, however, is carried out by heavy equipment often at a fraction of the cost.

Figure 14: Ongoing equipment-based rural road construction

This practice is helping the proliferation of heavy equipment. Currently, it is estimated that there are more than 8,000 of these machines in the country, most of which are used in rural road construction. Even a remote district on average has more than 25 heavy equipment units, exacerbating environmental damage with each day of road building without technical and environmental considerations.

The machine constructed rural roads have the following common features:

- Most non-engineered roads are not designed
- Most non-engineered roads are not included in the District Transport Master Plan
- Most non-engineered roads are not yet complete and are not motorable
- Most non-engineered roads are left as very narrow tracks with steep side slopes and no

16 Dr Govinda P Koirala, 2011

retaining structures
- Most non-engineered roads do not have any drainage or cross-slope
- Most non-engineered roads have very high maximum gradients, up to 30% in some cases
- The cost per km for non-engineered roads is often perceived to be lower than a properly designed and built road, but is comparable to earthwork excavation by hand.

Table 5: A comparison between LEP and EB rural road construction approaches in Nepal

S. No.	Parameters	LEP	EB
1	Engineered/Non- Engineered	Engineered	Non Engineered
2	Local Employment/ Involvement	Extensive	Limited
3	Road Standards	Standards met	Standard generally not maintained
4	Implementation Modality	User Committees engage labor	User Committees hire heavy equipment and limited labor
5	GoN Policy	Implementation regulations in place	The new policies and approaches allow use of heavy equipment in rock cutting and other difficult sections. However, no norms developed for rural roads.
6	Practiced by	DDC projects supported by donor agencies	Independent DDC and VDC projects
7	Structural Works	Generally included	Generally not included
8	Sustainability	Naturally stabilized roads, bioengineering and water management, high sustainability	Focused on track opening, extensive cut and fill; soil stabilization and water management structures absent, low sustainability.

4.4 Some Dimensions of Labor-Based Technology

From experience in building rural roads in Nepal, by far the most effective and environmentally friendly method of road construction in hilly areas is to use a labor-based approach. However, at the same time, using bulldozers is a politically popular method for district road construction works though it comes with serious concerns, especially in hilly areas, on social, economic, technical and environmental grounds. The increasing use of heavy equipment (often called bulldozers irrespective of the type of machine used) takes place amidst a number of popular misconceptions that they are faster, better and cheaper.

The problem with bulldozers is not as such with the use of machines, but with the fact that they are being used for a task that they were not designed for. Bulldozers can be effective when used in conjunction with other machinery, such as excavators, loaders, tippers, etc. when the road is designed, planned and supervised in a proper manner. If only one machine were to be used, an excavator would be a much

more appropriate machine to use for district road construction. A JCB type machine with a backhoe has similar advantages, as well as being able to drive to the site.

The essential element of earthwork in road building, with or without the use of heavy equipment, is to achieve cut and fill balance in earthwork management. Ideally, all the excavated earth (or stones) should be used in filling the dips and valleys along the road, thereby minimizing the slope disposal down the valley. This is where labor-based approaches have advantages in controlled disposal while machines are used for haphazard dumping down the slopes, mainly to save machine time and associated costs.

4.4.1 Social and Economic Benefits

The most powerful argument for labor-based road construction is the benefits it brings to the local population in terms of employment and subsequent economic benefits. In comparison, the economic benefits during construction of a bulldozer road are unlikely to remain within the local economy. With labor-based construction there is a chance to have a direct impact upon poverty by ensuring that the benefits go directly to the local community. If the local community is involved in the construction, and also has to make some form of contribution to the work, then the ownership is likely to be high. This will also benefit the maintenance of the road in the longer term as the local community living within the road corridor and involved in the construction of the road will be more likely to feel ownership of the road and therefore take more responsibility for its maintenance.

To make a comparison, for the purchase price of one bulldozer it would be possible to use 120,000 person days in labor-based road construction (equivalent to approximately '200' km of 1.5 m wide trail, or '4-5' km of full-width earthen road). With labor-based construction, income-generating opportunities can also be incorporated into the road construction process. With training people can use the money they earn on the road to set up a more sustainable future for themselves. Equipment-based road means a missed opportunity in poverty alleviation and results in a lack of local ownership of the road.

4.4.2 Environmental Benefits

Labor-based road construction has proven to be environmentally friendly, put into the context of road construction in general. In Nepal especially, a lot of effort has been put into ensuring that this is the case, for example the development of the 'green roads' approach. When phased construction is used it gives the road a chance to integrate into the landscape gradually over 3 to 4 years, allowing water management to be progressively developed. This minimizes the environmental impact of the road in terms of slope instability, drainage and effect upon agriculture. If the environmental impact is found to be too severe after the first or second years, it is relatively cheap and easy to realign.

Using labor-based methods the cut material can be utilized most efficiently. Cut spoil can be used to fill areas, whereas useful materials such as boulders and topsoil can be separated, stored and used at a later date. Bulldozers cannot effectively cut and fill material, so slopes are not cut to the correct angle, leading to higher and less stable slopes, with the consequent increase in costs of retaining structures for these slopes. Also bulldozers cannot separate useful and non-useful material; even boulders and topsoil that could be used later on in the construction process are pushed over the side of the excavation.

Drainage and structures are not often planned or implemented with bulldozer roads, at least initially, leading to wash-outs and subsequent failure of the road during the monsoon months. This is due to a lack of proper planning and unrealistic expectations from the communities, politicians and civil servants. Unless the drainage is properly planned and installed at an appropriate time, then the road is vulnerable to suffer serious damage during the monsoon.

Environmental problems can arise through soil erosion. Whereas the labor-based method allows for appropriate management of cut material, with a bulldozed road the cut material cannot be relocated, and has to be pushed over the side of the excavation.

The consequence of this is often that it washes out and can block irrigation or drainage systems, increase sedimentation of lakes and reservoirs and deposits on fields downstream, as well as causing serious safety hazards to any settlements in the immediate area. International Centre for Integrated Mountain Development (ICIMOD) is currently carrying out research on siltation of waterways, which seems to indicate that unpaved roads that are not constructed appropriately can have a serious hydrological effect. Landslides tend to be more frequent on bulldozed roads and have been known to block adjacent roads.

4.5 Some Common Misconceptions

4.5.1 Cost – Are labor-based roads really more expensive?

Bulldozed roads can be cheaper to construct in terms of excavation only on a cost per kilometer basis, by up to 50%, based on market hire rates for bulldozers. However this is misleading, because a trail cut by bulldozer cannot be considered as a proper road. When additional activities such as structures and bio-engineering are added to the equation and then compared to a comparable labor-based road, the difference in cost is minimal. In some cases the bulldozed road can even be more expensive. It should be realized that capital and running costs of a bulldozer generally result in a mass outflow of funds, not only from the district but also out of the country, with little or no benefit to the local or national economy.

With the present low level of awareness of the comparable merits of labor-based roads versus bulldozed roads, it is easy to persuade local people that they need a bulldozer to build their roads. DDCs are also often able to persuade all VDCs to contribute towards a bulldozer for a particular district, making the purchase (but not the maintenance) affordable.

When a bulldozer breaks down it is often beyond the financial capacity of the district to repair it. Also skilled operators and mechanics are not available in the district leading to premature and frequent breakdowns of the equipment. These factors combine to make repairs expensive and impractical, leading to lengthy down times and funds being redirected from other district sources. Ultimately some vehicles are even abandoned. If foreign exchange is scarce, the purchase of bulldozers will use scarce funds that could otherwise be used in local currency through labor-based technologies.

4.5.2 Speed – Are labor-based 'green' roads really slower to build?

In terms of opening the alignment, with a crudely cut trail of 5 m width with no camber, spoil disposal, drainage, etc, bulldozed roads are quick to construct. A 5 m trail can be opened for between approximately 50 m and 250 m per day. However, a similar result could be achieved using labor, which can be arranged in several gangs at intervals along the alignment. Considering the time it takes to make a road fully motorable, the time is comparable to labor-based methods.

4.5.3 Which roads are built to a higher standard?

Using labor is a much more flexible and quality oriented way to build rural roads. For example, material can be managed, cambers can be made accurately, slopes can be cut to the appropriate angle, drainage can be made as the road progresses, etc. The primary test is how long a road lasts. In the experience of most rural roads programs in the districts of Nepal, labor-based roads are much more likely to withstand the rigors of the monsoon and still be motorable, due to both the construction standards applied and the ownership of the local community who are more likely to maintain the road if they have been integrally involved in building it. There are several instances of bulldozed roads being washed out or sustaining serious damage when subjected to even average rainfall (RRF, 2003).

The proposed recommendations/action plan for the rural road sector are included in 7.1.4.

5 OVERVIEW OF SOCIAL IMPACTS OF INFRASTRUCTURE

5.1 Introduction

Social impacts from infrastructure are of significance as they not only determine how the communities behave towards the projects, but also how they will perceive and support conservation initiatives. In most of the cases, communities happy with a project are those who have productive engagement leading to employment and economic benefits arising from the infrastructure development.

This chapter broadly outlines the important social elements associated with infrastructure development. For example, this section emphasizes that it is important to know whether or not the communities displaced by a hydropower reservoir, if any, have been supported in restoration of livelihoods as well, or if the women, particularly if pregnant or lactating mothers, working in the rural road project have been made to carry heavy stones leading to health complications, or whether an increase in stagnant water is causing an increase in disease incidence.

5.2 Background

The development of infrastructure projects has both adverse and beneficial socio-economic impacts. Benefits are often associated with employment opportunities, economic upliftment of local people, easy access, and opportunity to reach resources. On the other hand, infrastructure projects can also have potential negative social and health impacts. These include hazardous child labor, breaches of indigenous rights and property, social discrimination, increased spread of diseases, adverse impacts on livelihoods and agriculture, and loss of traditional and cultural practices. A well designed and executed project ensures that negative impacts are minimized and benefits from project development also reach the disadvantaged and poor segments of the community.

5.3 Overview of Social Impacts from Selected Infrastructure Types

The following negative social impacts are generally associated with development of the following infrastructures:

5.3.1 Hydropower Projects

Hydropower development often has the following negative social impacts:

Displacement of settlements:

Hydropower projects, particularly the reservoir type, are very likely to displace local people from the project areas, and they require relocation. Long established communities may be dispersed and their property destroyed. For example, the Tanahun HEP will affect about 758 HHs in the reservoir area; 86 HHs will be physically displaced while the remaining 672 HHs will lose their agricultural land.

Table 6: Number of households displaced by hydropower projects in CHAL

SN	Name of the project	Total number of HHs displaced	Total number of population affected	Loss of Agricultural Land (ha)
1	Tanahun HEP	86	900	151.22
2	Middle Marsyangdi	49	NA	20.07

(Source: Project documents of Tanahun HEP and Middle Marsyangdi)

ILO 169 (Articles 6, 7 and 15), to which Nepal is a signatory, aims at ensuring that indigenous populations are fully consulted in matters relating to development, land and resources (Tamang, 2005). This aspect is often not fully taken into consideration. A field visit by this study team to Tanahun HEP site noted that the HHs in the submergible area remained to be assured of their future livelihood security and possible priorities in employment in the HEP construction. They did know that they would be very well compensated for their land and property by the project.

Rapid increase in economic activities leading to increased consumption of imported food and drink items:
Experience has shown in neighborhoods of the new hydropower schemes developments suddenly surge and there are heightened economic activities with opening of shops, bars, restaurants and hotels. This often leads to a high level of imported goods, often plastic wrapped, and bottles. This poses threats to the local social and natural environments.

Change in the availability of river resources for downstream communities:
When rivers are diverted for hydropower projects, or their flow is reduced for storage, the amount of water received by the area downstream can reduce dramatically which can have detrimental impacts on the community's water use and livelihoods. The reduction in fish species and numbers can limit livelihood options for fishery based communities, while limited water for irrigation and HH use can result in diminishing income and quality of life of downstream communities. It is therefore important that the HEP are designed to allow minimum water requirements of the communities downstream so that they are able to maintain their livelihoods to the maximum possible even after dam construction. The standard of at least 10 per cent of the minimum monthly average discharge from hydropower projects may not be enough, and minimum needs should be assessed on a case by case basis for individual projects. In addition, rapid increase in streamflow (for example, to meet peak demand for electricity generation) can be a danger to people and property downstream, as can sudden decreases, which can cause collapse of river banks.

However, it should also be noted that river regulation by dams can potentially reduce flood events and unpredictable river behavior, thus elevating the safety and satisfaction of such communities. It is important that HEPs have good discharge planning and management to enable this to happen.

Loss of access routes for local people:
HEPs also lead to alteration of traditional and most comfortable routes traditionally used by the communities. For example, in Tanahun HEP, the upstream settlements are using an existing short trail to visit the district headquarters along the Seti River that goes through the locations of the proposed powerhouse, reservoir and intake area. The trail will be inundated once Tanahun HEP comes into operation. Local people expressed concern over the loss of their traditional route and the lack of a convenient alternative.

Figure 15: A popular trail, used by upstream communities to access Damauli, the district headquarters

Training, awareness, and local people's participation:
The HEP usually carries out, as a routine measure, some awareness programs on social safeguards applied by the project. However, these are often perfunctory and ineffective. In the case of Tanahun HEP, the site visit showed that the project affected families met by the team were unaware of any training, awareness, and participatory activities and did not have access to the brochures that the project had reported as

being distributed weeks before the site visit. As a result project affected families are not fully aware of the project activities or types and nature of compensation, though the construction period was imminent.

5.3.2 Sand and Gravel Extraction

Sand and gravel extraction, though often associated as a localized activity, has notable social impacts that can be summarized as follows:

Loss of agricultural land:
Extraction activities are associated with significant movement of sediments resulting in loss of agricultural land from deposition of sediments, and river cutting downstream as well as upstream.

Increase in squatter settlements along the river:
Most of the sand gravel extraction areas have a social issue of squatter settlements developing along the river leading to encroachment of nearby forest and public land.

Pressure on local resources:
The increased settlements along the river site require huge amount of fuel wood which creates pressure on the local forest. Similarly, settlers might illegally collect NTFPs and timber from the forest area, and hunt wildlife.This activates deforestation and over extraction of forest products. Pressure on resources and habitats might also compel wildlife to enter human settlements. Instances of human-wildlife conflict are likely to increase under such circumstances.

5.3.3 Electricity Transmission Lines

Land and property acquisition:
Due to the implementation of transmission line project, forest areas and private and cultivated land may be acquired permanently for the construction of the angle towers and substation. For example, the proposed Bharatpur-Bardghat 220 kV Transmission Line Project has proposed the acquisition of 0.763 ha cultivated land from 43 HHs for construction of 43 towers. The acquisition of this cultivated land will permanently reduce the production of 3.92 Mt of food grain annually. It is also envisaged that this will incur the loss of 62 private houses, 41 cowsheds, 30 toilets and 15 kitchens owned by 62 HHs, which will be demolished. The Hetauda-Bharatpur transmission line has proposed removal of 115 houses and 56 cowsheds owned by 114 HHs.

Health impacts and property devaluation:
High tension transmission lines produce electromagnetic fields; while there is no conclusive evidence that these are harmful to human health, the possibility has not been disproved. In Nepal these health aspects have led to statutory restrictions imposed on land uses, which subsequently drives down the price of such holdings. Social dissatisfaction and issues of inequity may be raised under such circumstances.

5.3.4 Irrigation Projects

Land acquisition:
Construction of large scale irrigation may impact private, public, agricultural and forest land which may be an issue with proponent and the affected families. In some cases, involuntary acquisition of lands and properties may create conflicts and disputes between project and people.

Impact on community infrastructures:
Demolition of community facilities and infrastructures during construction works may hamper drinking water sources, transportation and other social service facilities.

Impact on fisheries-based livelihoods:
There is likely reduction of fish catch during intake structure construction, and reduced fish populations due to fish entering into the main canal.

Gender impacts:
Irrigation systems have often encouraged women's participation in system management and subsequent farming activities. While this

empowers women to take responsibilities, in recent years it is becoming more of an unmanageable burden for women especially in the absence of male members in the family (husband, son etc) due to overseas employment. Coupled with absence of proper education and awareness, difficulties juggling multiple responsibilities, and male-led information and communication channels, women may find the chores too difficult to handle alone.

5.3.5 Airports

The main socioeconomic impacts associated with airport construction and extensions are summarized below:

- Acquisition of agriculture, forest, residential and commercial land,
- Displacement of affected HHs and loss of agricultural income from farming,
- Loss of nearby forest and its products and services,
- Displacement of social infrastructures such as schools, boreholes, cowsheds, pump sheds and health posts,
- Disturbance due to demolition and transportation of construction materials, and aircraft noise once operational,
- Increase in social disputes, sexual abuse, prostitution, and spread of HIV etc.

5.3.6 Road Projects

Major socio-economic impacts associated with the construction of Besishahar-Chame Road were:

Encroachment of land and private property:

Except for highways and donor funded road projects, most of the land and properties taken up by rural roads are not compensated. Many of the poorer and disadvantaged families losing their properties are not adequately compensated, leaving them more destitute.

Decreased numbers of trekkers and business:

Opening of roads to previously popular trekking destinations has resulted in a decreasing trend in the number of trekkers. Roads destroy the sense of wilderness and trekkers no longer want to walk along previously remote trails that are now close to roads. Some now drive along that portion of the route rather than walk to get to more remote parts. As a consequence the settlements near to the road have a deserted look with significantly lower numbers of visitors or residents in intermediate bazaars. The trekking sector is looking for new routes in wilderness areas.

Road safety:

The roads in Nepal are often constructed meeting only rudimentary requirements i.e. without meeting proper drainage, slope protection and safety elements of a road. Consequently, roads under development are highly dangerous. The recently opened route to Manang is unsafe for travelers due to unstable slopes, insufficient width, unmanaged slope protection measures and lack of proper drainage. Besides that, there are inadequate provisions for road safety measures like signals and road standards, so that even small negligence while driving may result in tragic accidents.

Reduced aesthetic value:

Poorly designed and implemented roads reduce the beauty offered by natural landscapes. Ideally, roads should blend into the backdrop, and not be visible as scars. The poorly constructed roads in Nepal sadly damage the aesthetics of the scenery. This is the case with most rural road networks and feeder roads.

Figure 16: Dangerous driving conditions observed on Besishahar-Chame Road

6 CLIMATE CHANGE AND INFRASTRUCTURE

6.1 Introduction

Variations in temperature and precipitation have been observed in Nepal in the past decades, although studies are limited. It has been observed that Trans Himalayas, Himalayas and Middle Mountains have undergone the most rapid increase in temperature in the 1977-1994 periods, averaging at 0.09, 0.06 and 0.08 oC/ annum respectively (Table7).

Table 7: Average annual change in temperature in Nepal (1977-94)

Region	Seasonal				Annual
	Winter (Dec-Feb)	Pre-monsoon (Mar-May)	Monsoon (Jun-Sep)	Post-monsoon (Oct-Nov)	
Trans-Himalayas	0.12	0.01	0.11	0.1	0.09
Himalayas	0.09	0.05	0.08	0.08	0.06
Middle Mountains	0.06	0.05	0.06	0.09	0.08
Siwaliks	0.02	0.01	0.02	0.08	0.04
Terai	0.01	0	0.01	0.07	0.04
All Nepal	0.06	0.03	0.05	0.08	0.06

(Source: Shrestha et al. 1999)

Future projections for Nepal undertaken by the Organization for Economic Co-operation and Development (OECD) using the best seven out of 12 General Circulation Models and the SRES B1 scenario group (which is one of the best-case scenario groups on emission reduction) show a rise of 3.0° C in temperature and a 12.6% rise in precipitation by 2100 (Table 8) (IPCC, 2000). Although the rise will be gradual, and possibly non-uniform, the cumulative effect of such changes on ecosystems and water regimes is likely to be massive.

Table 8: Temperature and precipitation change projections for Nepal

Year	Mean Temperature Change (°C)	Mean Precipitation Change (%)
Baseline Average		1433 mm
2030	1.2	5.0
2050	1.7	7.3
2100	3.0	12.6

(Source: Agrawal et al. 2003)

In addition, climate variability is expected to increase, with greater fluctuations in temperature and precipitation, and greater frequency of extreme weather events. These are likely to cause more frequent and severe incidences of drought and flood, irregularity in precipitation, and increase in frequent forest fires and landslides.

Climate change understanding and design of appropriate awareness building and adaptation measures are of crucial significance in development of infrastructures. Since rivers and their systems in Nepal are replenished by snowmelt and precipitation, they are highly susceptible to impacts arising from changes in temperature and rainfall (Table 9). Infrastructures, especially hydropower, irrigation schemes and others related to water like roads and bridges face greater risks from unpredictable glacial and riverine fluctuations; storm surge; prolonged rainfall; drought; flood; change in wind direction; and scour patterns.

Table 9: Ranking of climate change impacts in Nepal by sector

Sector/ Ranking	Certainty of Impact	Timing of Impact (urgency)	Severity of Impact	Importance of Resource
Water Resources and Hydropower	**High**	**High**	**High**	**High**
Agriculture	Medium-low	Medium-low	Medium	High
Human Health	Low	Medium	Uncertain	High
Ecosystems/ Biodiversity	Low	Uncertain	Uncertain	Medium-high

(Source: Agrawal et al. 2003)

Increase in temperature, especially in the high mountains, is contributing to glacial retreat and snow melt. As a result of increased glacier melt, several glacier lakes are at risk of bursting (MoE 2010). GLOFs threaten downstream infrastructure, ecosystems, agriculture and livelihoods at higher altitudes.

Increase in temperature, especially in alpine regions, will cause the snow line to retreat due to increased snow melt, thus shifting the tree line northward in places where soil conditions are suitable for tree growth. Terai ecosystems may shift north as species seek cooler climates during the summer months. Parts of the CHAL could serve as climate change refugia for the biodiversity in TAL areas, which necessitates the protection of N-S corridors to facilitate the northward migration of species. Four such corridors have been identified (KAFCOL, 2013b):

1. Barandabhar Forest-Gaighat-Seti River Valley-Panchase -Annapurna Conservation Area (ACA)
2. Barandabhar Forest-Gaighat-Seti River Valley-Madi River Valley-ACA
3. BZ Forest of CNP in Nawalparasi-Churia Range-Mahabharat Range-Panchase -ACA
4. Manhari, Parsa Wildlife Reserve-Namtar-Simbhanjyang-Shivapuri Nagarjun NP-Langtang NP

These identified corridors are relatively infrastructure and fragmentation free to date but numerous infrastructures specially hydropower/hydroelectricity, transmission lines and roads have been planned and proposed in these corridors (See Annex 11). It is therefore imperative to preserve the ecological integrity of these corridors so the climate change refugia for CHAL and TAL biodiversity are maintained.

Malaria, kalazaar and Japanese encephalitis are likely to become more widespread with increase in temperature and precipitation. The potential impacts of climate change on livelihoods are not certain. It is estimated that the pressure

will be higher on economically, or otherwise disadvantaged groups, from issues such as exposure to low crop yields, flood and landslide events, disease outbreaks, and community displacements (MoE 2010).

6.2 Climate Change and Infrastructure

This section briefly reviews possible climate change impacts on infrastructure, and how climate change is impacted by infrastructure development processes. It also considers how infrastructure and climate change can interact synergistically in their impacts on the environment and people. However, since very little is known to date about climate change and infrastructure co-relationships in Nepal, the section is limited in scope.

The infrastructure sector comprises many different systems, and each is vulnerable to a range of climate change hazards and direct and indirect climate impacts, which may be exacerbated by socio-economic factors. Climate factors that can affect infrastructure include more intense rainfall; flood; longer drought; snow; extreme wind; frost; fog; and soil shrinkage. Embankments may be affected by water table rise; increases in storm surge; prolonged rainfall; and floods of increased frequency and higher levels. Bridges may be affected by increased storm surge; prolonged rainfall; flood; change in wind direction and scour patterns. Several types of infrastructure may be affected by increased frequency and severity of landslides, e.g. due to more intense rainfall, as well as changing land use. At the same time, use of land and natural resources is changing rapidly in Nepal: e.g. due to increased urban living and labor migration, which may influence how infrastructure is affected by climate change. There are a growing number of researches and studies being undertaken to better understand the dynamics between infrastructure and climate, but few results are available to date.

6.3 Hariyo Ban and Climate Change Priorities

Climate Change component of Hariyo Ban Program aims to increase the ability of targeted human and ecological communities to adapt to the adverse impacts of climate change. The major focus of the program is to raise awareness in government and civil society about climate change vulnerability and gender-equitable and socially inclusive adaptation planning. Hariyo Ban is focusing its climate vulnerability assessments to enhance knowledge on climate impacts on local communities including water, food security, disaster risk, natural resources, energy, and infrastructure; on biodiversity; and on ecosystem, river basin and landscape vulnerability.

The Hariyo Ban priority areas such as Bardia, Banke, Kailali and Kanchanpur districts in the west, Chitwan in central Nepal, and Bara and Rautahat districts in the east are widely sensitive to climate change and climate variability. These are frequently prone to floods and drought. Some parts of these districts lie within Churia and the lower river basin ecosystems, the Brahmadev, Karnali and Kamdi corridors, the Churia part of Barandabhar, and the Parsa-Bagmati corridor areas. These areas are additionally sensitive to soil erosion. Consequently, any variations in rainfall arising from climate change are likely to have significant impacts in these areas.

6.4 Climate Change, GLOFs and River Systems

Climate change is likely to intensify the frequency and magnitude of Glacial Lake Outburst Flood (GLOF) events. Increased glacial melt due to increase in temperature, change in precipitation patterns, and variability in climate can impact downstream natural environments, as well as physical structures by elevating flow volume and velocity. Damage to existing hydropower structures caused by unpredicted and intense rise in flow can be severe.

The Gandaki and Narayani river system in CHAL area has seven Himalayan tributaries namely Daraudi, Seti, Madi, Kali Gandaki, Marsyandi, Budhi Gandaki, and Trisuli (also called Sapta Gandaki). The Kali Gandaki flows between the 8,000 meter Dhaulagiri and Annapurna ranges in the world's deepest valley. After the seven upper tributaries have joined, the river becomes

the Narayani inside Nepal. The total 31,100 km basin area covered by the Gandaki river system contains 338 lakes, and 1,025 glaciers covering an area of 2,030.15 km (Mool et al. 2001).

A study conducted by ICIMOD (2011) showed that the total of 338 glaciers recorded in 2001 in the Gandaki river basin was found to have reduced to 116 in 2009. Less than 24% area of the glacial lakes remained while the number of glaciers was reduced by over 65% in the seven year period (Table 10). A similar trend was observed in the Karnali River Basin.

Table 10: Changes in glacial lakes in CHAL river basins

Sub Basin	Glacial Lakes 2001		Glacial Lakes 2009		Change 2001 to 2009	
	Number	Area (Km^2)	Number	Area (Km^2)	Number (%)	Area (%)
Gandaki River Basin	338	12.50	116	9.53	-65.68	23.73
Trisuli	117	2.03	50	1.68	-57.26	-17.40
BudhiGandaki	37	0.64	12	0.71	-67.57	-10.78
Marsyangdi	78	6.28	22	5.16	-71.79	-17.90
Seti	10	0.26	6	0.11	-40.00	-56.54
Kali Gandaki	96	3.29	26	1.88	-72.92	-42.86
Karnali River Basin	907	37.67	742	29.16	18.19	-22.59

(Source: ICIMOD, 2011)

In a similar study conducted by ICIMOD, the moraine-dammed lake (Gbu_gl 9) in Budhi Gandaki River Sub-basin, Gmar_gl 70 (Thulagi) in Marshyangdi River Sub-basin, and the lakes Gka_gl 38, Gka_gl 41, Gka_gl 42, and Gka_gl 67 in Kali Gandaki River were found to be potentially dangerous (Mool et al., 2001).

6.5 Climate Change Impact and Risk Levels for Hydropower Projects

All hydropower projects in CHAL are RoR types except two storage type projects: Kulekhani I (in operation) and Tanahun Hydropower Project (construction to begin in near future). Most of the rivers in the Gandaki basin are snow fed rivers. The Seti River is glacial in origin and comes from the Annapurna Range. Hydropower projects in the basins may be directly affected due to increasing temperature and shifting rainfall patterns.

Hydroelectric plants, particularly RoR types, are highly dependent on predictable runoff patterns. Unreliability of dry season flows poses potentially serious risks to water supplies at that time. Therefore, hydropower generation in TAL and CHAL could be severely affected by increased climate variability that can affect frequency and intensity of flooding and droughts.

6.6 Climate Change Impacts on and from Hydropower Schemes

While little is known about infrastructure and climate change interrelationships, some studies have been undertaken by hydropower projects as to how climate change impacts hydropower projects, or vice versa. Some conclusions drawn on how hydropower relates to climate change are summarized below:

- Hydroelectricity might not contribute to global warming by manner of its production, but the construction of dams and power stations requires considerable energy investment, including use of fossil fuels.
- Design of hydropower plants may not allow for climate related changes in streamflow from glacier and snow melt, though they may be directly affected by them.
- Hydropower plants and associated structures are exposed to higher physical risk from flooding due to GLOFs or intense flow due to rapid snowmelt or more intense rainfall as a result of climate change.
- Increased turbidity and sediment load in rivers due to increased soil erosion from more intense rainfall, and increased and turbulent streamflow, is likely to cause mechanical damage to hydropower generation components including turbines. Increased sedimentation in reservoirs will also require more frequent cleanup, or reduced electricity generation, which has further economic and social implications.
- Reduction in streamflow below dams may occur during more intense drought periods, and create many biophysical changes in downstream areas.
- Similarly, reduced flooding of downstream floodplains can lead to major ecological and hydrological changes including salinization of the downstream plains. This salinization then reduces agricultural productivity, or necessitates a change in crop type, which brings economic and/or cultural changes. Climate change may compound this problem, when temperature rise elevates eva transpiration rates, and streamflow is reduced due to glacier and snow retreat, or increased periods of drought. Reduced stream flow and increased water stress is likely to alter vegetation types downstream in some places: for example, shrinking or loss of wetlands; conversion of grassland to woody vegetation; and conversion of riparian forest to non-riparian forest. This will have major implications for wildlife.
- Special vulnerability of certain groups or communities may affect indigenous peoples or ethnic minorities. Psychological and social impact on these people including impacts on culture and traditional practices may have greater implications for them. Communities displaced from hydropower development may need to be relocated to safer locations to reduce exposure to risk of flood and landslide events due to climate change. Relocation to higher altitudes might require more intense social impact mitigation measures.

6.7 Climate Change and Road Network Development

The road sector is very vulnerable to the impacts of climate change. This includes direct impacts due to changes in temperature and precipitation, and indirect impacts due to the effects of climate change on the location of population and human activity, altering the demand for roads. Roads typically have design lives of 20 to 40 years and bridges of 100 years. An understanding of the expected impacts of future climate change by road planners, designers and asset managers, and incorporating these into design now, could engender considerable cost savings in the long term.

With increased climate variability, it is likely that one response in infrastructure design is to have a higher level of flexibility in structural design, e.g. road designers allow for greater intensity of rain storms than they are currently experiencing. This could mean that design of culverts and bridges cater to what used to be a 100 year flood event as a 10 year event. Similarly, the bitumen used in sealing roads is designed to withstand wider temperature variations than previously specified.

However, this also makes the infrastructure development process more expensive, and possibly unaffordable for poor countries. More investment needs to be made to improve understanding of the complexities of climate change and possible relationships with infrastructure.

7 CONCLUSIONS AND RECOMMENDATIONS

The numerous infrastructures being developed in the study areas have significant potential to adversely impact the natural and social environment, and there are considerable opportunities for WWF/Hariyo Ban Program to work together with these projects to reduce negative impacts. However, challenges include:

- Infrastructure projects, even those supported by international development partners, are often reluctant to communicate or share their environmental and social impacts studies, and discuss them openly. This is particularly so at early stages to avoid possible highlighting of negative impacts.
- Infrastructure projects largely sideline or delay implementation of environmental and social mitigation measures primarily due to resource considerations.
- A long and continuous process is needed to work successfully with projects, given the planning and development timeframe and sensitivities of the projects.
- Projects are looking for something in return for collaboration, for example technical support on conserving the environment that the project is likely to adversely impact.
- The need for approaching engagement with projects in closer partnership with government agencies.
- The fact that EIAs and SIAs are only in the preliminary stages of preparation for most of the large scale new infrastructures of interest to Hariyo Ban (e.g. East-West Railway, Marsyangdi Hydropower).

In view of these challenges the following recommendations are made as a way forward.

7.1 Recommendations to WWF Nepal/ Hariyo Ban Program

7.1.1 Establishment of an Infrastructure Unit within Hariyo Ban

- The Hariyo Ban Program should establish an Infrastructure Unit within the Program. The Unit should work exclusively with those infrastructure projects that are identified to have the highest level of environmental and social impact in Hariyo Ban areas.
- The Unit should maintain a detailed database of infrastructure projects through a continuous process of engagement, and update information on projects as implementation progresses.
- A system should be designed to assign Impact Ranking based on the existing/ predicted impacts of a project, and specify a threshold for project inclusion/exclusion in the Infrastructure Unit, with a shortlist based on expert analysis and/or consultations, and Hariyo Ban's comparative advantage in becoming involved.
- The Hariyo Ban Infrastructure Unit should coordinate with the selected projects wherever it is viable to do so, and provide necessary information/expertise/assistance when in the common interests of the project and Hariyo Ban.
- The Hariyo Ban Infrastructure Unit will contribute to knowledge sharing and increase awareness in project implementation personnel (at executive levels) about the impacts their projects are having on the environment/climate change. This could result in a Guidance Note owned by the Government and infrastructure projects.

- The Infrastructure Unit should work to build capacity to continue this role as appropriate after Hariyo Ban closes.

7.1.2 Closer Coordination and Collaboration with Government Agencies

To undertake this work, Hariyo Ban will need strong government involvement as it reaches out to infrastructure projects.

7.1.3 Coordination and Collaboration with Specific Projects to Influence Design, Operation and Impact Mitigation

Table 11 contains recommendations to promote sound practices, including activities for the Hariyo Ban Program. Note that for all infrastructure types, regulations, guidelines and standards should be prepared or revised taking climate change impacts into consideration.

Table 11: Recommended action plan for Hariyo Ban for collaboration with central and local level stakeholders

S.No.	Infrastructure Type	Recommendations	Hariyo Ban Collaboration
1	Hydropower/ Dams	• Identify and mitigate cumulative effects of hydropower projects/ dams on a single river/ecological unit including environmental flows analysis[17] • Promote aquatic animal movement through suitable provisions in dam construction (e.g. Fish ladders, bypass streams etc) • Promote sustainable use of local resources in construction and maintenance, including human resources, with priority given to disadvantaged communities and women. Benefit sharing with the affected community, monetary or otherwise (improved infrastructure and social services, subsidized power etc) • Collaborate with south of border dams for facilitating fish movements • Promote hatcheries of key aquatic species maintained to replenish the upstream areas to preserve biodiversity • In areas deforested by HEP construction, reforestation can be done to maintain wildlife habitat and corridors for animal movement. These activities should be carried out in co-ordination with DFO and community users, preferably with DFO acting as a regulating agency rather than an executing body.	• **Coordinate and facilitate communication between multiple projects that have impacts on/adding to each other** • **Training and capacity** building events designed to impart specialized knowledge and skills. • **Collaborate with** government agencies responsible for monitoring to obtain comprehensive assessment of impacts on environment and society during operation • **Collaborate with** government/non-government agencies to initiate communication with Indian authorities for possible joint measures in protecting biodiversity in both countries • **Support further development and** refinement of existing guidelines and manuals, and associated training events.

17 An environmental flow is the water regime provided within a river, wetland or coastal zone to maintain ecosystems and their benefits where there are competing water uses and where flows are regulated. Environmental flows provide critical contributions to river health, economic development and poverty alleviation. They ensure the continued availability of the many benefits that healthy river and groundwater systems bring to society (Dyson et. al, 2008).

		• **Promote climate smart planning. For example, sediment reduction before** reservoir, sediment resistant turbines **etc. can help reduce mechanical failure in plants from increased sediment load.** Dams designed to withstand floods **are necessary as flow regimes may be** unpredictable due to climate change. Avoid N-S corridors during project **development so as to leave routes for climate change induced migration of species undisturbed (northbound** towards CHAL areas).	
2	Transmission Lines	• **Promote prioritization of tree canopy,** forest cover and old growth forests in the design phase (e.g. avoid clearfelling of primary forests for transmission line right of way, increase transmission tower height to minimize impact, avoid biodiversity hotspots and corridors, avoid sensitive land use areas, including important religious/ cultural sites) • **Promote alternative right of way** clearing measures (e.g. half tree left intact in forests capable of lateral growth, so as to preserve carbon value and habitat) • **Promote sustainable use of local** resources in construction and maintenance, including human resources, with priority given to disadvantaged communities and women • **Repurpose forest products or use** revenue from sales for impact mitigation • **Avoid N-S corridors during project** development so as to leave routes for climate change induced migration of species undisturbed (northbound towards CHAL areas).	• **Provide concept,** information and expertise to developers • **Monitor mitigation efficiency** • **Collaborate with** government agencies responsible for monitoring to obtain comprehensive assessment of impacts on environment and society during operation

3	Irrigation	• **Include provisions for animal movement** in design (e.g. tunnels, flyovers in known migration corridors) • **Promote sustainable use of local** resources in construction and maintenance, including human resources, with priority given to **disadvantaged communities and** women. • **Focus on planning and designing** irrigation schemes that are climate resilient as well as reducing **sedimentation (e.g. through proper** watershed management measures in **addition to engineering structures).**	• **Provide concept,** information and expertise to developers • **Monitor mitigation efficiency** • **Collaborate with** government agencies responsible for monitoring to obtain comprehensive **assessment of impacts on environment and society during operation**
4	**Sand and** Gravel Extraction	• **Undertake rigorous monitoring of compliance on part of extractors (e.g.** volume extracted, manner of extraction, terms of agreement compliance, legal **standards)** • **Supreme Court ruling requires all** crushers in Chure forest area to be relocated by 2070 BS; monitor to **ensure compliance** • **Undertake pollution monitoring and** mitigation • **Since legal provisions and requirements** are ignored by operators in multiple cases, ensure stricter enforcement • **Illegal and poor performing crusher** operations, in many cases, are under DDC protection. Authority to revoke licenses granted by DDCs should be awarded to a central agency, should complaints arise. • **Promote sustainable use of local** resources in operation, including human resources, with priority given to disadvantaged communities and women	• **Monitor Parsa Wildlife** Reserve buffer zones and **other sensitive Chure forests for extraction activities**

5	Oil and Gas Exploration	• **Develop detailed guidelines and** regulations (no environmental guidelines/norms exist for petroleum exploration, other than generalized international guidelines/standards) • **Extraction likely to be nomadic. Avoid** biodiversity hotspots and corridors, fragile areas and areas of religious/ cultural importance • **Promote sustainable use of local** resources in construction and maintenance, including human resources, with priority given to disadvantaged communities and women • **Promote monetary or other benefit sharing with affected communities (improved infrastructure and social services, subsidized petroleum etc)**	• **Collaborate with** Department of Mines and Geology in developing guidelines based on international best practices • **Monitor potential** extraction sites, when conceivable, to determine their sensitivity, and collaborate with DMG for mitigation Note: Petroleum exploration in Nepal is practically inactive as of now. Need to keep monitoring this status for developments.
6	Rural Infrastructures (general)	• **Incorporate environmental** considerations from relevant experts, in addition to community opinions, in design of rural infrastructure projects (e.g. infrastructure placement, technical specifications, additional structures/ features necessary) • **Avoid protected areas, forests and** environmentally, socially or culturally sensitive spots, to avoid conflict with nature or communities • **Involve disadvantaged groups and** women in project development in all stages (planning, construction, operation, maintenance) • **Avoid N-S corridors during project** development so as to leave routes for climate change induced migration of species undisturbed (northbound towards CHAL areas) • **Impacts of climate change such as** increasing floods, droughts, landslides etc. should be taken into consideration during planning and design of rural infrastructure. These often include design of drainage and retaining structures.	• **Provide knowledge,** concept and expertise to community user groups on the environmental and social implications of the projects during planning, as well as operation; and mitigation of potential impacts • **Coordinate knowledge** and experience sharing at the inter-community level and/or inter-infrastructure level (e.g. environmentally and socially sound rural infrastructure developers, promoters, or users can be facilitated to share their knowledge and expertise to communities planning, constructing or operating such infrastructures).

7.1.4 Recommendations/Action Plan: Rural Roads

In light of widespread environmentally inappropriate design and construction practices in the rural road sector, it is important that Hariyo Ban engages with the following Government organizations to encourage more environmentally appropriate practices. A way forward for this is outlined in Table 12. As has been evident from experience of consultations with various government and non-government organizations in the course of executing this study, collaboration with projects and developers will require a very cautious and informed approach, so as to make the intentions of Hariyo Ban clear and secure cooperation.

Table 12: Recommended action plan for Hariyo Ban for collaboration with central and local level stakeholders of rural roads

S. No	Institution/ program	Partnership role	Hariyo Ban Responsibilities
1	NPC	Key partner at the national level	• Work with NPC to influence better road building practices in periodic plan and MCPM ranking criteria. • Support NPC in reviewing and adapting key directives and guidelines. • Provide feedback to NPC on findings of planning and joint monitoring processes.
2	MoFALD	Partner Ministry for local level policy and implementation support	• Develop willingness in MoFALD to incorporate agreed best practices in periodic plan. • Support MoFALD through engagement in development of key directives and guidelines. • Engage DDC and DTO teams in joint monitoring of sensitive rural roads. • Work with MoFALD to review and analyze findings of joint planning and monitoring activities.
3	DoLIDAR	Ruralinfrastructure policy and practice support	• Support in reviewing and adapting best practice guidelines and incentive packages for DDCs. • Develop attractive norms and packages for labor based road building contractors.
4	DDC	Key local-level partner and institutional home for rural road construction	• Develop willingness in DDCs to incorporate agreed best practices in road building in local planning process. • Support DDCs through engagement in use of key directives and guidelines. • Engage DDCs and DTO team in joint monitoring of sensitive rural roads.
5	VDC	Local beneficiary and implementing agency for village roads	• Develop willingness in VDCs to incorporate agreed best practices in road building in local planning process. • Support VDCs through engagement in use of key directives and guidelines.

7.2 Recommendations to the Government of Nepal

The Government of Nepal, particularly the Ministry of Science, Technology and Environment and the Ministry of Forests and Soil Conservation, has a central and important role to play in ensuring that environmental aspects are truly taken into consideration while designing and implementing large infrastructures. It has to spearhead the process while working together with other governmental as well as non-governmental agencies, including development partners. If brief, we suggest that the GoN considers the following for implementation:

- As monitoring mechanisms are weak due to low level of budget allocated for monitoring of activities, resources (funding level and capacity) should be increased within all ministries, departments and units working in relevant areas to mitigate environmental impacts of infrastructure projects.
- More recent and new projects, such as oil and gas exploration and eventual extraction, are being carried out without a comprehensive environmental mitigation framework. It is therefore very important to develop necessary guidelines in conjunction with improved planning and coordination.
- Lower priority to environmental concerns often results in the forestry sector being consulted at the very end of the process when infrastructure construction is set to start, just short of consent or approval. MoFSC is only given a short time to respond when significant commitments are required, such as forest land to build the infrastructure on. This communication process needs to be initiated at an early stage, with proper orientation among infrastructure developers and related government ministries.
- The current practice of using a default requirement of at least 10% of the minimum monthly average discharge from hydropower projects can be very damaging to the environment, and should be replaced with a regulation that ensures assessment of minimum discharge for each individual project through sound EIA/IEE/strategic environmental assessment (SEA) practice, based on environmental science and needs of downstream users.
- There is an urgent need to consider green infrastructure in future developments. This should be carried out with emphasis on rigorous and detailed monitoring of environmental management plans of large infrastructures by government institutions. Given the challenges of hydropower, Nepal should place greater emphasis on other forms of alternative energy including solar and wind, and develop a blended approach towards low carbon energy development.

7.2.1 Recommendations: IEE/EIA Policy and Procedures

The regulation governing IEE/EIA should indicate as clearly as possible which projects are subjected to EIA procedure and which are not, so as to avoid bureaucratic constraints on minor activities. If it is considered that the requirement for IEE/EIA may change with time, it may be appropriate to make a general statement in the body of the legislation and keep the specifics for supplementary guidelines or regulations. Rules governing IEE/EIA should always be documented.

On the contents of an EIA, the law requires the submission of a written document to a designated agency or decision-making body describing the environmental impact of the proposed project and/or alternatives as well as mitigating measures(and their assessments). At a minimum, the EIA document should contain the following:

- A description of the proposed activity;
- A description of the potentially affected environment, including specific information necessary for identifying and assessing the environmental and social effects of the proposed activity;
- A description of practical alternatives as appropriate;

- An assessment of the likely or potential environmental impacts of the proposed activity and alternatives, including the direct, indirect, cumulative, short-term and long-term effects;
- Identification and description of measures available to mitigate adverse environmental impacts of the proposed activity and alternatives, and an assessment of those measures. This should include the option of not doing the development at all if its impacts are unacceptable and cannot be mitigated through better design;
- An indication of gaps in knowledge and uncertainties which may be encountered in compiling the required information, including more recent knowledge in climate change;
- An indication of whether the environment of any other areas beyond national jurisdiction are likely to be affected by the proposed activity, and possible alternatives; and
- A brief non-technical summary of the information provided under the above headings.

In addition, to make the EIA process more effective:

- The EIA legislation or provision should establish effective review and dispute settlement procedures to avoid unnecessary delays in decision-making.
- Technical review may be undertaken by an independent agency of environmental experts on the proposal project or in exceptional circumstances the decision maker.
- There is need for a tribunal or arbitrator for dispute settlement, since the ordinary courts may be too busy to act on EIA cases promptly. An independent arbitrator or a special body could be appointed to hear objections and make decisions with reasonable dispatch. Such an arrangement would help ensure that EIA in Nepal is a tool to aid development rather than impeding it.

Although the policy requires developers to undertake EIA, the achievements are generally not satisfactory due to the lack of coordination amongst the related sectors, inadequate trained manpower as well as poor budget allocation for the environment activities.

After the approval of EIA by the concerned government authority, little or no government involvement is observed in monitoring and evaluating the application and efficiency of mitigation measures. The government should be actively involved in, at least for a specified amount of time by infrastructure type, in assessing the extent of environmental impacts and the efficiency of the mitigation measures. If the proposed mitigation measures are not applied, or are applied poorly, provision should be made for enforcement by legal action.

7.2.2 Adoption of Strategic Environmental Assessment (SEA)

In view of the limitations widely observed in developing and applying EIA/SIA documents across the development sector, there is an increasing realization that 'the need and scope of many individual project EIAs can be streamlined and EIAs made muchmore cost-effective by introducing SEA – strategic environmental assessment at the level of policies, plans and programmes' (Khadka et al., 2012).

A move towards SEA would enable more effective integration of development, environment and poverty reduction, both at the center (in policy areas) and implementation levels, while addressingthekeyissuesassociatedwithlivelihoods and environment by the project developers. It would be a particularly valuable tool for integrated river basin planning, enabling assessment of the combined effects of several hydropower projects in the same basin, as well as combined impacts of different types of infrastructure, with analysis of environmental flows. However, the adoption of SEA in Nepal is limited so far; there is a need for its wider application along with improved clarity and understanding among key stakeholders on this systematic decision support tool.

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ANNEX 1: CLASSIFICATION OF INFRASTRUCTURES IN NEPAL

S.N.	Infrastructure Type	Category I			Category II			Category III		
		Class/Type	Characteristics	Executing Agency	Class/Type	Characteristics	Executing Agency	Class/Type	Characteristics	Executing Agency
1	Motorable Road	Village Road	• IEE or EMP required • 15m right of way (RoW) • 4m carriageway • Mainly through User Committees	VDC	District Road	District Roads	DDC	Strategic Road (feeder road and highway)	• IEE or EIA required • 50m right of way (RoW) • 4m carriageway • Uses heavy equipment and explosives extensively	DoR
2	Irrigation	Small Project/ System	• Command area up to 25 ha in Hills and up to 200 ha in Terai	VDC/ DDC	Medium Project/ System Large Project/ System	• Command area 25-500 ha in Hills and 200- 2000 ha in Terai • Command area 500- 1000 ha in Hills and 2000-5000 ha in Terai	DoI Operation transferrable to user committees in smaller blocks of up to 500 ha irrigation area	Major Project/ Systems	• Command area 25-500 ha in Hills and 200-2000 ha in Terai • Command area 500-1000 ha in Hills and 2000-5000 ha in Terai	DoI Operation transferrable to user committees in smaller blocks of up to 500 ha irrigation area
3	Hydropower	Micro	• Upton 100 kW. Plans to designate up to 500 kW projects as Micro (AEPC) • No License Required • Income Tax Exempt • No royalty payable to NEA	User Committees Private Party	Small- 100 kW to 25 MW Medium- 25 MW to 100 MW	• IEE Required for 10- 50 MW projects • EIA required for projects over 50 MW • License required for projects over 1000 kW, 50 years maximum validity • Royalty payable to NEA for projects over 1000 kW	NEA Private Party	Large	• Feasibility Study, EIA Required • License Required, 50 years maximum validity • Royalty payable to NEA	NEA Private Party

4	Bridge	Culvert	• Length up to 6 m • IEE Exempt	DoR	Minor	• Length up to 50 m (with span up to 25 m)	DoR	Major Special	• Length more than 50 m or span more than 25 m • Nonstandard bridges (e.g. Suspension bridge, cable-stayed bridge, etc.) • Require special design considerations	DoR
5	Metallic Mine Sand and Gravel Quarry	Very Small Small Very Small Small	• Underground: Upton 10 tons • Surface: Upton 25 tons • Underground: Upton 100 tons • Surface: Upton 250 tons • Upton 50 cubic meters • Upton 200 cubic meters	DMG	Medium Medium	• Underground: Upton 500 tons • Surface: Upton 1000 tons • Upton 800 cubic meters	DoMG	Large Large	• Underground: Over 500 tons • Surface: Over 1000 tons • Over 800 cubic meters	DoMG
6	Drinking Water and Sanitation	Rural	• Within a district • Serves up to 1000 beneficiaries for Government Projects • Can serve more than 1000 beneficiaries for project built without government aid	• Department of Water Supply and Sewerage						

7	Airport	STOL / Domestic	• Provides domestic air services • Paved and unpaved runway with length less than 1200 m • Operating aircrafts Twin Otter DHC 6, Dornair type aircraft • Beechcraft aircraft operational in paved domestic airports with length more than 1200 m • Operational under VFR • Operational during day	CAAN	Regional Hub	• Provides domestic air services • Paved runways with length more than 1500 meter, which are categorized as 3C and above • Operating aircrafts ATR 42 / 72, Jetstream J41, Beechcraft B 1900, DHC 6, Dornair • Shuttle air services to various STOL / domestic airports. • Operational under VFR and IFR • Operational during day and evening flights (equipped with runway lights)	CAAN	International	• Provides international and domestic air services • Paved runway of 4D and 4E code airports as per ICAO • Operational under IFR and VFR • Operational during day and night (equipped with runway, taxiway lights and airport approach lighting system)	CAAN

ANNEX 2: TABLE SENT TO STAKEHOLDERS SEEKING INFORMATION REQUIRED BY THE STUDY
Details of Large Scale Infrastructure in CHAL/TAL Districts (Hariyo Ban Program)*

S.N	Type of Infrastructure (Road, Hydropower, Irrigation, Airport etc)	District/ Location	Current Status (As of Jan 2013) : Proposed(P) Under Construction (UC) Completed (C)	Start Date- Date of Completion (if applicable)	Salient Features Size (Length, Capacity, Quantity) Type (e.g. District Road, ROR, Storage) Total Budget	Funding/ Implementing/ Executing Agencies	EIA/SIA Status: Yes (Y) No (N)	Major Environmental and Social Concerns
					Size:			
					Type:			
					Total Budget:			
					Size:			
					Type:			
					Total Budget:			
					Size:			
					Type:			
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					Total Budget:			

ANNEX 3: MATRIX FOR ENVIRONMENTAL AND SOCIAL IMPACTS

A	Landscape Impact			Sensitivity (as per EIA/SIA)	Significance (analysis of EIA/SIA)
	• Visible, physical, objective, tangible components, e.g. landform, land use and landscape, buildings.	• Visible, spatial (rather than physical), subjective, intangible components, e.g. scale, pattern, color, texture etc	• Non-visible components that cannot be seen, e.g. sound and cultural associations		
	Land Use and Land Cover: • Water; • Forest, Woodland and Trees; • Agriculture, Fields and Boundaries; • Settlements; • Other Land Uses	Slope stability • Flood • Erosion			
B	**Ecological Impact**				
	Noise, particularly its effect on bird populations; Air pollution	• Hydrological effects e.g. effects on the water table, • Changes in flood patterns, downstream effects; • Fisheries	• Forest and biodiversity; • Effects on endangered species and other large mammals		
C	**Climate change impact**				
D	**Social Impact**				
	• Health, sanitation and safety • Recreation or aesthetic value • Demands on transportation or other infrastructure • Demographic effects	• Potential loss of managed resources (e.g., fish, farmland, water) • Impact on crop production	• Impact on irrigation • Transport, Demands on public resources		

ANNEX 4: CHECKLIST FOR FOCUS GROUP DISCUSSION (FGD)

Name of Project:
Location:
1. What are the major impacts of the project?

Positive environmental Impact	Negative Environmental Impacts		
	Impacts due to project location	Impacts due to construction works	Impacts due to project operation
Traffic congestion reduction	Changes in Land use	Soil erosion and health risk at construction site	Pollution
Quick service and safety	Loss of Trees	Traffic diversions and risk to existing buildings	Visual impact
Less fuel consumption	Loss of historical and cultural sites and monuments	Impact on water quality	Impacts on livestock and fisheries
Reduction in air/ water pollution,		Disposal of construction materials/stockpiling	Impacts of Forest and biodiversity
Better roads/ transportation facility		Impacts on wildlife and biodiversity	Cropping pattern
Employment opportunities			Downstream/upstream Impact/regional impacts

2. What are the mitigation measures been proposed?
   i. Compensation for loss of land,
   ii. Compensation for loss of trees
   iii. Compensatory afforestation and fencing
   iv. Water Supply and Sanitation
   v. Water Pollution Control
   vi. Noise Control
   vii. Vibration Control

3. Are the mitigation measures implemented as proposed?

4. What are the main opportunities/benefits from the Project?

5. Suggestions and Recommendations

ANNEX 5: CHECKLIST FOR KEY INFORMANTS INTERVIEW (KII)

Name of the interviewee:
Organization/Agency:
Location:
Project Code:

1. How many large scale projects are implemented or planned in your district/area?
2. What are the major benefits and opportunities from the project for you?
3. Do you feel that project cause any serious environmental and social impacts (as follows)?
4. Are the proposed mitigation measures implemented properly as planned?

	Parameter	Negative Impact	Positive Impact	No Impact
	Impacts due to project location			
i. ii.	Change of land use and ecology Impacts on historical/cultural monuments		Traffic congestion reduction	
	Impacts due to construction works		Quick service and safety	
i. ii iii iv	Soil erosion, pollution and health risk at construction site Traffic diversions and risk to existing buildings Disposal of construction materials/stockpiling Impacts on water quality Impacts on wildlife and biodiversity		Less fuel consumption	
	Impacts due to project operation		Reduction in air pollution	
i ii iii iv v vi vii viii	Air pollution Noise and vibration Accidental hazards Impacts on water supply Visual impacts Impacts on wildlife and biodiversity Impacts on cropping pattern Downstream/upstream impacts		Better roads, and Employment opportunities	

ANNEX 6: CHECKLIST FOR INTERVIEW WITH STAKEHOLDERS (PROJECT IMPLEMENTERS OR DEVELOPERS)

Organization:
District:
Infrastructure:

1. Overview of Existing/Proposed Infrastructure

Major Infrastructures	Salient Features	Current Status (As of Jan 2013)	Funding Agencies	Implementing/ Executing Agencies	EIA/SIA Status	Remarks

2. Major Opportunities and Threats

Name of the Project	Opportunity	Threats	Remarks

3. Environmental and Social Impacts

Name of the Project	**Environmental Impacts**		**Social Impacts**	**Major Landscape Impacts**
	Physical	**Biological**		
	Water Resource	Forest	Agriculture	
	Land stability	Wildlife Biodiversity	Employment	
	Pollution (Air, Water, Noise)	Fisheries	Social Service Sector	
			Health and Safety	

4. Mitigation Strategy

Name of the Project	Proposed Mitigation Measures	Implementation as proposed	Implications

5. Alternative Analysis

- Design Working process or schedule
- Project Site or Location
- Raw material to be used
- Others

6. Recommendations/Suggestions

ANNEX 7: LIST OF KEY STAKEHOLDERS CONSULTED

Organization	Personnel
Department of National Parks and Wildlife Conservation	Acting DG Barna B Thapa and Chief, Management and Planning Section
National Trust for Nature Conservation	Ambika Khatiwada
Ministry of Science, Technology and Environment	Surendra Pant (Ecologist) - EIA Section
MoE- DoED	Nabin Singh
Ministry of Forests and Soil Conservation- DFRS/REDD+	Narendra Bd. Chand (Climate Change Officer)
MoI- Department of Mines and Geology	Dr. Shesh Kant Bhatta (Environmentalist) and Rajendra Khanal (Project chief, petroleum section), Hifzor Rehman (DDG), Mr Jayaraj Ghimire
ADB	Naresh Pradhan (Project Officer-Transport)
GESU, DoR	Rama Shrestha
NEA, Dept of Electricity, Tanahun Hydro	Mahesh Acharya
Environment Section, Ministry of Federal affairs and Local Development	Bishal Bhardwaj
Railway Division, Department of Rail, Battisputali	Mr Yogendra Rai, Division Chief and Mr Rajendra Singh, Chief Divisional Engineer
NESS, Thapathali	Dr Toran Sharma and MS Akiko Urago
ADB-TA, MoSTE, Singh Durbar	Dr Mohan Pd Wagley and Mr Santosh Bhattarai

ANNEX 8
PARTICIPANTS OF NATIONAL CONSULTATION MEETING ON 'ENVIRONMENTAL AND SOCIAL IMPACTS OF LARGE INFRASTRUCTURES IN NEPAL'
AUGUST 27, 2013 IN KATHMANDU

S.N.	Name	Designation	Organisation
1	Krishna Prasad Acharya	Joint Secretary	Ministry of Forests and Soil Conservation
2	Yam Bahadur Thapa	Deputy Director General	Department of Forests, Babarmahal
3	Maheshwar Dhakal	Ecologist	Department of National Parks and Wildlife Conservation
4	Santosh M. Nepal	Director-Policy and Support	WWF Nepal
5	Judy Oglethorpe	Chief of Party	Hariyo Ban
6	Sandesh S. Hamal	Deputy Chief of Party	Hariyo Ban
7	Browyn Llewellyn	Environment Team Leader	USAID/Nepal
8	Netra Sharma Sapkota	AOR-Hariyo Ban	USAID/Nepal
9	Colin Holmes	Program Officer	USAID
10	Shiv Raj Bhatta	Deputy Director	WWF Nepal
11	Prakash Upadhyaya	Senior Divisional Engineer	Department of Railways
12	Juddha Bahadur Gurung	Member Secretary	National Trust for Nature Conservation
13	Surendra Raj Pant	Ecologist	Ministry of Science, Technology and Environment
14	Maheshwor Narsingh	Project Manager	Babai Irrigation Project
15	Tirtha Bahadur Joshi	Consultant (Infrastructure Expert)	Scott Wilson Nepal
16	Sharad Lal Shrestha	Colonel (Engineer)	Nepal Army
17	Rajendra Khanal	Chief	Petroleum Exploration Project
18	Shree Krishna Gautam	Research Officer	Department of Forest Research and Survey
19	Shanta R. Jnawali	Biodiversity Conservation Coordinator	Hariyo Ban/WWF Nepal
20	Keshav Khanal	Sustainable Landscapes Coordinator	Hariyo Ban/WWF Nepal
21	Sunil Kumar Regmi	Climate Change Adaptation Coordinator	Hariyo Ban/CARE Nepal
22	Rajendra Lamichhane	Monitoring and Evaluation Specialist	Hariyo Ban/WWF Nepal
23	Jagadish Chandra Kuikel	Livelihood Specialist	Hariyo Ban/WWF Nepal
24	Pallavi Dhakal	Communications Officer	Hariyo Ban/WWF Nepal
25	Kabita Gautam	Program Assistant	The Small Earth Nepal
26	Shuva Kantha Sharma	Team Leader	Scott Wilson Nepal
27	Krishna Bahadur Khadka	Team Leader/Hariyo Ban	FECOFUN
28	Prakash Nidhi Tiwari	Senior Engineer	Butwal Power Co. Ltd.
29	Thakur Bhandari	Member	FECOFUN
30	Bachu Shah Karu	Member	FECOFUN
31	Nirmal Kumar Acharya	Project Development Manager	Butwal Power Co. Ltd.

32	Shyam Kumar Thapa	Conservation Officer	Hariyo Ban/NTNC
33	Jeewan Guragain	Senior Divisional Engineer	Department of Local Infrastructure Development and Agriculture Roads
34	Dr. Bijay Kumar Singh	Independent Researcher	-
35	Prem Kumar Srivastav	Senior Divisional Engineer	Rani Jamara Kulariya Irrigation Project
36	Narendra Pradhan	Development, Research and Monitoring Coordinator	WWF Nepal
37	Naresh Pradhan	Project Officer	ADB
38	B. K. Karki	Colonel	Nepal Army
39	Aarati Gurung Malla	Program Development Officer	WWF Nepal
40	Prakash Rai	Database Manager	Scott Wilson Nepal
41	Toran Sharma	Director	Nepal Environmental & Scientific Services (P) Ltd
42	Salina Shrestha	Administrative Assistant	WWF Nepal/Hariyo Ban
43	Dipesh Joshi	Program Officer	WWF Nepal/ Hariyo Ban

ANNEX 9: LIST OF DNPWC APPROVED INFRASTRUCTURE DEVELOPMENTS IN PROTECTED AREAS WITHIN CHAL AND TAL

S.N.	District	Location	Protected Area	Project	Salient Features	Provisions of the Approval
1	Mustang	Kowang VDC	Annapurna Conservation Area	Tangchahara Khola Micro Hydroelectricity Project	2.4 mW	Feasibility and EIA Study
2	Myagdi	Narchyang VDC	Annapurna Conservation Area	Ghalendi Khola Hydroelectricity Project	4 mW	EIA Study
3	Mustang	Kagbeni VDC	Annapurna Conservation Area	Ghilumpa Khola Hydroelectricity Project	7 mW	Feasibility Study
4	Manang	Chame, Tachebagar and Dharapani VDCs	Annapurna Conservation Area	Lower Manang Marsyangdi Hydroelectricity Project	93 mW	Electricity Generation Survey and EIA Approval
5	Myagdi	Narchyang VDC	Annapurna Conservation Area	Mistridana 132 kV Transmission Line		Transmission Line Survey Approval
6	Kaski	Langhalen VDC	Annapurna Conservation Area	Upper Mardi Khola Hydroelectricity Project	10 mW	Feasibility and EIA Study
7	Manang	Thoche VDC	Annapurna Conservation Area	Dudhkhola Hydroelectricity Project	25 mW	Feasibility and EIA Study
8	Myagdi	Narchyang VDC	Annapurna Conservation Area	Raylay Hydroelectricity Project	3 mW	Feasibility Study
9	Kaski	Machhapuchhre VDC	Annapurna Conservation Area	Karuwa Hydroelectricity Project	30 mW	Feasibility Study Approval
10	Mustang	Kagbeni VDC	Annapurna Conservation Area	Jhong Khola Hydroelectricity Project	2.2 mW	Feasibility Study Approval
11	Lamjung	Pasgaun VDC	Annapurna Conservation Area	Togo Rudi Khola Micro Hydroelectricity Project	660 kW	
12	Kaski		Annapurna Conservation Area	Tilicho Pump Storage Hydroelectricity Project		
13	Myagdi		Annapurna Conservation Area	Lower Kaligandaki Hydroelectricity Project	90.46 mW	Feasibility Study
14	Lamjung	Taghing VDC	Annapurna Conservation Area	Upper Sangekhola Micro Hydroelectricity Project	183 kW	Feasibility Study
15	Lamjung	Ghanpokhara and Khudi VDCs	Annapurna Conservation Area	Upper Khudi Hydroelectricity Project	19.5 mW	Feasibility and EIA Approval
16	Myagdi	Narchyang VDC	Annapurna Conservation Area	Liping Khola Hydroelectricity Project	30 mW	Feasibility and EIA Study

17	Myagdi	Narchyang VDC	Annapurna Conservation Area	Ghalemdi Khola Hydroelectricity Project	10 mW	Feasibility and EIA Study
18	Mustang	Ghanpokhara and Khudi VDCs	Annapurna Conservation Area	Upper Khudi A Hydroelectricity Project	4.98 mW	Feasibility and EIA Study
19	Lamjung	Bhoje, Bhujung, Uttarkanya and Maling VDCs	Annapurna Conservation Area	Midim Khola Hydroelectricity Project	3.4 mW	Feasibility and EIA Study
20	Myagdi	Narchyang VDC	Annapurna Conservation Area	Nilgiri Khola Hydroelectricity Project	38 mW	Feasibility and EIA Study
21	Lamjung, Gorkha, Nawalparasi, Myagdi		Annapurna Conservation Area	Upper Marsyangdi Hydroelectricity Transmission Line	400 kV	Feasibility and EIA Study
22	Mustang	Tukuche, Kowang, Lete and Kunjo VDCs	Annapurna Conservation Area	Kaligandaki Kowang Hydroelectricity Project	100 mW	Feasibility and EIA Study
23	Kaski	Ghandruk VDC	Annapurna Conservation Area	Ghandruk Modi Hydroelectricity Project	64 mW	Feasibility and EIA Study
24	Kaski, Lamjung	Majure and Pasgaun VDCs	Annapurna Conservation Area	Rudikhola A Hydroelectricity Project	6.8 mW	Feasibility and EIA Study
25	Lamjung	Bahundada VDC	Annapurna Conservation Area	Nyadi Hydroelectricity Transmission Line	132 kV	Feasibility and EIA Study
26	Manang	Tachebagar and Dharapani VDCs	Annapurna Conservation Area	Lower Manang Marsyangdi Hydroelectricity Transmission Line	220 kV	Feasibility and EIA Study
27	Lamjung	Taghring VDC	Annapurna Conservation Area	Upper Marsyangdi Micro Hydroelectricity Project	2.4 mW	Feasibility Study
28	Kaski	Sardikhola, Taghring, Ghachowk and Lachowk VDCs	Annapurna Conservation Area	Sardikhola Hydroelectricity Transmission Line	33 kV	Feasibility and EIA Study
29	Kaski	Narmajung VDC	Annapurna Conservation Area	Garchyangkhola Micro Hydroelectricity Project	4 mW	Feasibility Study
30	Manang, Lamjung	Dharapani, Ghermu and Taghring VDCs	Annapurna Conservation Area	Upper Marsyangdi 2 Hydroelectricity Project	600 mW	EIA Study
31	Kaski, Lamjung		Annapurna Conservation Area	Rudikhola B Hydroelectricity Project	7.6 mW	EIA Study
32	Myagdi	Narchyang VDC	Annapurna Conservation Area	Nilgirikhola 2 Cascade Hydroelectricity Project	63 mW	Feasibility and EIA Study
33	Kaski, Parbat		Annapurna Conservation Area	New Modi- Lekhnath Transmission Line	132 kV	Feasibility and EIA Study
34	Rasuwa	Samarthali and Bhorle VDC	Langtang National Park	Falangu Khola Hydroelectricity Project	3 mW	Feasibility and EIA Study
35	Rasuwa, Nuwakot	Hakubesi and Narkot VDCs	Langtang National Park	Upper Trishuli 2 Hydroelectricity Project	102 mW	Feasibility and EIA Study
36	Rasuwa	Thuman, Goljung and Bridim VDCs	Langtang National Park	Rasuwa Bhotekoshi Hydroelectricity Project	22.6 mW	Feasibility and EIA Study
37	Rasuwa	Samarthali and Yarsa VDCs	Langtang National Park	Falangu Khola Hydroelectricity Project	5 mW	EIA Approval

38	Rasuwa	Samarthali and Bhorle VDCs	Langtang National Park	Falakhu Khola Hydroelectricity Project	2.4 mW	EIA Study
39	Rasuwa, Nuwakot		Langtang National Park	Upper Trishuli A Hydroelectricity Project		EIA Study
40	Nuwakot	Ghayangfedi VDC	Langtang National Park	Upper Tadikhola Hydroelectricity Project	3 mW	Feasibility and EIA Study
41	Nuwakot	Shikharbesi and Samundratar VDCs	Langtang National Park	Tadikhola Hydroelectricity Project	2.8 mW	EIA Approval
42	Rasuwa	Bridim VDC	Langtang National Park	Fenlun Bridimkhola Micro Hydroelectricity Project	1.8 mW	Feasibility Study
43	Nuwakot	Shikharbesi and Ghyanfedi VDCs	Langtang National Park	Middle Tadikhola Hydroelectricity Project	5.5 mW	Feasibility and EIA Study
44	Rasuwa	Dhunche VDC	Langtang National Park	Trishuli Khola Hydroelectricity Project	5 mW	Feasibility Study Approval
45	Rasuwa	Timure	Langtang National Park	Ghatte Khola Micro Hydroelectricity Project	4.4 mW	Feasibility Study
46	Rasuwa	Syafrubesi, Bridim and Timure VDCs	Langtang National Park	Syafrubesi- Rasuwagadhi Road	11.1 km	In operation
47	Rasuwa	Syafrubesi VDC	Langtang National Park	Thulobharkhu- Brabal-Thulosyafru Agriculture Road	9 km	Temporary permission for construction
48	Rasuwa	Dhunche VDC	Langtang National Park	Sole- Bhimli- Bhotekoshi Road	3.51 km	EIA Approval
49	Rasuwa	Dhunche VDC	Langtang National Park	Himalayan Spring Water Processing Center		
50	Rasuwa	Dhunche and Haku VDCs	Langtang National Park	Upper Trishuli 1 Hydroelectricity Project	216 mW	EIA Study
51	Rasuwa, Nuwakot	Tupche, Manakamana, Gorkhu and Laharepauwa VDCs	Langtang National Park	Middle Trishuliganga River Hydroelectricity Project		Feasibility and EIA Approval
52	Rasuwa	Thuman, Timure, Bidim, Chilime, Goljung and Syafru VDCs	Langtang National Park	Rasuwa Bhotekoshi Hydroelectricity Project		EIA Approval
53	Nuwakot	Sikre VDC	Shivapuri Nagarjun National Park	Poudhkhola Dodhan Micro Hydroelectricity Project	8 kW	Construction and Operation Approval
54	Bardia	Belawa VDC	Bardia National Park	Bheri Babai Diversion Project	16.5 km	EIA Approval
55	Bardia, Surkhet		Bardia National Park	Bhurigaun- Telpani- Surkhet Road	27 km	EIA Approval
56	Bardia, Surkhet		Bardia National Park	Kehalpur- Surkhet Transmission Line	132 kV, 17 km	Operation Approval
57	Kailali, Banke, Bardia, Surkhet		Bardia National Park	Karnali – 7 Hydroelectricity Transmission Line	400 kV, 130 km	Feasibility and EIA Study
58	Gorkha		Manaslu Conservation Area	Bhalu Khola Hydroelectricity Project		Feasibility Study
59	Gorkha	Lho VDC	Manaslu Conservation Area	Super Budhigandaki Khola Hydroelectricity Project		Feasibility Approval
60	Gorkha	Sirdibas, Keroja, Uiya VDCs	Manaslu Conservation Area	Budhigandaki Khola Hydroelectricity Project	254 mW	Feasibility and EIA Study
61	Chitwan	Gardi, Baghauda, Kalyanpur and Aayoudhyapuri VDCs	Chitwan National Park	Transmission Line	33 kV	EIA Approval

ANNEX 10: DATABASE OF INFRASTRUCTURES

A) HYDROPOWER

S. N.	District/Location	Major Infrastructures	Salient Features	Current Status (As of Jan 2013)	Funding Agencies	Implementing/Executing Agencies	Remarks
1	Gorkha/ Dhading	Budhi Gandaki Hydropower Project	600 mW installed capacity and annual energy generation of 2495 GWh, 5370 km2 area catchment	In development, EIA and detail design to start shortly			
2	Kaski	Madi- 1 Khola	Installed capacity of 10 mW	PPA concluded, In development		Annapurna Group Pvt Ltd	
3	Kaski	Upper Madi	Installed capacity of 19 mW	PPA concluded, In development		Madi Power Pvt Ltd	
4	Kaski	Namarjun Madi	Installed capacity of 11.8 mW	PPA concluded, In development		Himalayan Hydropower Pvt Ltd	
5	Kaski	Madkyu Khola	Installed capacity of 9.9 mW	PPA concluded, In development		Sikles Hydropower (P) Ltd	
6	Lamjung	Middle Marsyangdi Hydropower Station, Bhoteodar, Siundibar, Lamjung	Installed capacity of 70 mW and annual design generation of 398 GWh, Cost NRS 30 billion	In operation			Large Power Plant
7	Lamjung	Upper Marsyangdi A	Installed capacity of 50 mW	PPA concluded, In development		Sinihydro- Sagarmatha Power Company Pvt Ltd	
8	Lamjung	Dordi Khola	Installed capacity of 27 mW	PPA concluded, In development		Himalayan Power Partner Pvt Ltd	
9	Lamjung	Upper Dordi A	Installed capacity of 22 mW	PPA concluded, In development		Liberty Hydropower Pvt Ltd	
10	Makwanpur	Kulekhani-I Hydropower Station	60 mW, annual design generation of 211 GWh	In operation			
11	Makwanpur	Kulekhani-II Hydropower Station	32 mW, annual design generation of 104.6 GWh	In operation			

S. N.	District/Location	Major Infrastructures	Salient Features	Current Status (As of Jan 2013)	Funding Agencies	Implementing/Executing Agencies	Remarks
12	Makwanpur	Kulekhani III Hydroelectric Project	14 mW installed capacity and 40.85 GWh annual energy generation, estimated cost of NRS 2.43 billion,143 km2 catchment area	In development	GoN, NEA	NEA	
13	Makwanpur	Hetauda Diesel Power Plant	Installed capacity of 14.41 mW	In operation			Medium Power Plant, Costlier than hydropower due to soaring fuel prices, first and second phased commissioned in 1963 and 1980 AD respectively
14	Manang	Lower Manang Marsyangdi Power Plant	Installed capacity of 141 mW, 735 GWh annual energy generation	In development		Butwal Power Company Ltd	
15	Myagdi	Rahughat Hydroelectric Project	Installed capacity of 32 mW with average annual energy generation 187.66 GWh, Estimated cost USD 67 million, 305 km2 catchment area	In development, scheduled to be completed in 2016	Government of India	IVRCL Limited, India	
16	Myagdi	Thapa Khola	Installed capacity of 11.2 mW	PPA concluded, In development		Mount Kailash Energy Pvt Ltd	
17	Myagdi	Mistri Khola	Installed capacity of 42 mW	PPA concluded, In development		Robust Energy Pvt Ltd	

S. N.	District/Location	Major Infrastructures	Salient Features	Current Status (As of Jan 2013)	Funding Agencies	Implementing/Executing Agencies	Remarks
18	Nawalparasi	Gandak Hydropower Station, Surajpura, Nawalparasi	Installed capacity of 15 mW and annual design generation of 106.38 GWh	Two out of three units are down, rehabilitation of non-operational units proposed			Medium Power Plant, commissioned in 1979 AD
19	Nuwakot	Trishuli Hydropower Station, Trishuli, Nuwakot	Installed capacity of 21 mW and annual design generation of 163 GWh	In operation			Medium Power Plant, commissioned in 1967 AD and rehabilitated in 1995 AD
20	Nuwakot	Devighat Hydropower Station, Devighat, Nuwakot	Installed capacity of 14.1 mW and annual design generation of 144 GWh	Rehabilitated and operational since 2011			Medium Power Plant
21	Nuwakot	Upper Tadi	Installed capacity of 11 mW	PPA concluded, In development		Suryakunda Hydroelectric Pvt Ltd	
22	Parbat	Modi khola Hydropower Station, Dimuwa, Parbat	Installed capacity of 14.8 mW and annual design generation of 92.5 GWh, Cost USD 30 million	In operation			Medium Power Plant
23	Parbat	Lower Modi I	Installed capacity of 9.9 mW	PPA concluded, In operation		United Modi Hydropower Pvt Ltd	
24	Parbat	Lower Modi	Installed capacity of 20 mW	PPA concluded, In development		Manang Trade Link Pvt Ltd	
25	Parbat	Madhya Modi	Installed capacity of 15.1 mW	PPA concluded, In development		Middle Modi Hydropower Ltd	
26	Rasuwa	Chilime	Installed capacity of 22 mW	PPA concluded, In operation		Chilime Hydro Power Company Ltd.	
27	Rasuwa	Upper Milung	Installed capacity of 14.3 mW	PPA concluded, In development		Molina Power Ltd	

S. N.	District/Location	Major Infrastructures	Salient Features	Current Status (As of Jan 2013)	Funding Agencies	Implementing/Executing Agencies	Remarks
28	Rasuwa	Upper Sanjen	Installed capacity of 14.8 mW	PPA concluded, In development		Sanjen Hydropower Co Ltd	
29	Rasuwa	Rasuwa Gadi	Installed capacity of 111 mW	PPA concluded, In development		Chilime Hydro Power Company Ltd.	
30	Rasuwa	Sanjen	Installed capacity of 42.5 mW	PPA concluded, In development		Sanjen Hydropower Co Ltd	
31	Rasuwa and Nuwakot	Upper Trishuli 3A Hydroelectric Project	90 mW run- of-river (ROR) Hydropower Project with annual energy generation of 460 GWh, Estimated cost USD 125.775 million, 4542 km2 catchment area	In development, scheduled to be completed in 2014	GoN, China Exim Bank	China Gezhouba Group Co. Ltd. (CGGC)	
32	Syangja	Kaligandaki 'A' Hydropower Station, Beltari, Syangja	Installed capacity of 144 mW and annual design generation of 842 GWh	In operation			Large Power Plant, commissioned in 2002 AD
33	Tanahun	Marsyangdi Hydropower Station, Anbukhaireni, Tanahu	Installed capacity of 69 mW and annual design generation of 462.5 GWh, Cost USD 22 million	In operation			Large Power Plant, commissioned in 1989 AD
34	Tanahun	Tanahun Hydropower Project	Installed capacity 140 mW	In development, Construction to start shortly			

B) IRRIGATION

S.N	District/Location	Major Infrastructures	Salient Features	Current Status (As of Jan 2013)	Funding Agencies	Implementing/Executing Agencies
1	Bara, Parsa, Rautahat	Narayani Irrigation Network	31,400 Ha land in southern Parsa, Bara and Rautahat irrigated, 81 km long primary canal	Ongoing rehabilitation and maintenance, Rehabilitation cost NRS 1.5 billion	GoN	Department of Irrigation (DoI)
2	Sarlahi, Rautahat	Bagmati Irrigation Project	45,600 Ha land irrigated, 282 km long primary canal, estimated cost at NRS 6.2 billion	Ongoing rehabilitation and expansion, target irrigation area of 122,000 Ha	GoN, Saudi Development Fund	Department of Irrigation (DoI)
3	Bardia	Babai Irrigation Project	Dam constructed in Babai river, 28 km primary canal operational to irrigate 9600 Ha , total expenses estimated at NRS 2.87 billion	Work ongoing, target irrigation area of 13,240 Ha	GoN	Department of Irrigation (DoI)
4	Kanchanpur	Mahakali Irrigation Project	135 km of primary and secondary canals irrigate 6800 Ha, expected expenses NRS 8 billion	Third phase work ongoing, target irrigation are of 32,000 Ha	GoN	Department of Irrigation (DoI)
5	Banke	Sikta Irrigation Project	14 km primary canal being constructed in stages in Banke district, , estimated expenses NRS 12 billion	Target irrigation area of 36,000 Ha in Banke district, headwork construction in final stages	GoN	Department of Irrigation (DoI)

C) AIRPORTS

CHAL AIRPORTS

S.N	District/ Location	Name of Airport	Type of Airport	Salient Features			Current Status (As of Jan 2013)	Funding Agencies	Implementing/ Executing Agencies	EIA/SIA Status	Remarks
				Pavement Surface	Runway Dimensions	Elevation (AMSL)					
1	Chitwan	Bharatpur Airport	STOL	Bitumen	1200 x 30 m	207 m	In operation	ADB/ CAAN	CAAN	Not performed	Operational since 5 March 1961
2	Chitwan	Meghauli Airport	STOL	Grass	1067 x 30 m	152 m	Chartered Flights	CAAN	CAAN	Not performed	Operational since 1966
3	Rasuwa	Langtang Airport	STOL	Grass	420 x 30 m	3,658 m	Chartered Flights		CAAN	Not performed	
4	Kaski	Pokhara Airport	Regional Hub	Bitumen	1444 x 30 m	809 m	In operation	ADB/ CAAN	CAAN	Not performed	Operational since 4 July 1958
5	Kaski	New Pokhara Airport at Chhine Danda	Regional International	Bitumen	2500 x 45 m	809 m	Proposed new airport		CAAN	EIA completed	
6	Gorkha	Palungtar Airport	STOL	Grass	1067x 45 m	445 m	Not in operation	CAAN	CAAN	Not performed	Operational since 1960
7	Manang	Manang Airport	STOL	Bitumen	900 x 30 m	3,381 m	In operation	CAAN	CAAN	Not performed	Operational since 28 Feb. 1978
8	Mustang	Jomsom Airport	STOL	Bitumen	739 x 20 m	2,736 m	In operation	ADB/CAAN	CAAN	Not performed	Operational since March 1976
9	Baglung	Balewa Airport	STOL	Grass	608 x 30 m	990 m	Not in operation		CAAN	Not performed	Operational since 24 Sep. 1973
10	Baglung	Dhorpatan Airport	STOL	Grass	365 x 30 m	2,728 m	Chartered Flights	CAAN	CAAN	Not performed	
11	Lamjung	Lamjung (Sitaleswanra) Airport	STOL	Grass		1,650 m	Under construction	CAAN	CAAN	EIA scoping completed	
12	Gulmi	Gulmi Airport	STOL				Under construction	CAAN	CAAN	EIA scoping completed	

TAL AIRPORTS

S.N.	District/ Location	Name of Airport	Type of Airport	Salient Features			Current Status (As of Jan 2013)	Funding Agencies	Implementing/ Executing Agencies	EIA/SIA Status	Remarks
				Pavement Surface	Runway Dimensions	Elevation (AMSL)					
1	Kanchanpur	Mahendranagar Airport	STOL	Grass	884 x 30 m	216 m	Not operational	CAAN	CAAN	Not performed	Operational since 30 Dec. 1973
2	Kailali	Dhangadhi Airport	Regional Hub Airport	Bitumen	1800 x 30 m	176 m	In operation	CAAN	CAAN	Not performed	Operational since 16 Dec. 1964
3	Kailali	Tikapur Airport	STOL	Grass	548 x 30 m	157 m	Chartered Flights	CAAN	CAAN	Not performed	Operational since 11 Oct. 1984
4	Banke	Nepalgunj Airport	Regional Hub Airport	Bitumen	1524 x 30 m	158 m	In operation,	CAAN	CAAN	Not performed	Operational since 15 March 1961
5	Rupandehi	Bhairahawa Airport	Regional Hub Airport	Bitumen	1524 x 30 m	109 m	In operation, Regional International upgrade planned (3000 x 45 m runway)	CAAN	CAAN	EIA performed for upgrading to Regional International	Operational since 8 July 1958
6	Chitwan	Bharatpur Airport	STOL	Bitumen	1200 x 30 m	207 m	In operation	ADB / CAAN	CAAN	Not performed	Operational since 5 March 1961
7	Chitwan	Meghauli Airport	STOL	Grass	1067 x30 m	152 m	Chartered Flights	CAAN	CAAN	Not performed	Operational since 1966
8	Bara	Simara Airport		Bitumen	1195 x 30 m	139 m	In operation	CAAN	CAAN	Not performed	Operational since 4 July 1958
9	Bara	Nijgadh Airport	Second International Airport (SIA)	Bitumen	3600 x 45 m		Proposed			EIA scoping completed	
10	Dang	Dang Airport		Gravel	1158 x 46 m	634 m	Chartered flights	CAAN	CAAN	Not performed	Operational since 15 March 1961

D) ROADS

TAL DISTRICTS ROADS

S.N	District/Location	Salient Features								
		Type of Road				Road Category				Total (km)
		BT	GR	ER	NH	FRN	FRO	MH	PR	
1	Kanchanpur	44.32	89.00	22.10	44.32	52.60	0.00	0.00	58.50	155.42
2	Kailai	157.83	63.77	48.00	150.78	83.12	0.00	0.00	35.70	269.60
3	Bardia	116.34	65.98	7.00	87.89	89.43	0.00	0.00	12.00	189.32
4	Banke	149.80	42.50	34.10	128.41	65.00	0.00	0.00	33.00	226.41
5	Dang	128.25	184.53	43.00	119.16	151.62	36.00	0.00	49.00	355.78
6	Kapilbastu	139.97	554.00	29.00	60.84	106.79	18.84	0.00	36.50	222.97
7	Arghakhanchi	58.91	2.00	42.00	4.12	56.79	42.00	0.00	0.00	102.91
8	Rupandehi	106.44	37.00	9.00	70.35	55.78	26.31	0.00	0.00	152.44
9	Palpa	94.59	4.00	30.00	58.93	69.66	0.00	0.00	0.00	110.54
10	Nawalparasi	127.28	41.05	24.00	98.33	69.00	11.00	0.00	14.00	192.33
11	Chitwan	130.39	50.00	10.00	88.90	40.49	0.00	0.00	61.00	190.39
12	Parsa	22.62	13.00	2.00	10.84	2.78	0.00	0.00	24.00	37.62
13	Makwanpur	157.97	59.57	61.00	139.97	117.57	21.00	0.00	0.00	278.54
14	Bara	81.13	68.00	16.00	64.25	78.88	0.00	0.00	22.00	165.13
15	Rautahat	71.83	9.00	7.00	26.39	45.44	0.00	0.00	16.00	87.83

Note: BT= Black Topped, GR= Gravel, ER= Earthen, NH= National Highway, FRN= Feeder Road, MH= Mid Hill Road, PR= Postal **Road**

CHAL DISTRICTS ROADS

S.N.	District/Location	Salient Features								
		Type of Road				Road Category				Total (km)
		BT	GR	ER	NH	FRN	FRO	MH	PR	
1	Lamjung	19.17	0.00	38.70	0.00	57.87	0.00	0.00	0.00	57.87
2	Dhading	112.88	22.00	11.00	94.38	51.50	0.00	0.00	0.00	145.88
3	Gorkha	23.84	0.40	64.10	0.00	63.84	24.50	0.00	0.00	88.34
4	Chitwan	130.39	50.00	10.00	88.90	40.49	0.00	0.00	61.00	190.39
5	Manang	0.00	0.00	18.00	0.00	18.00	0.00	0.00	0.00	18.00
6	Myagdi	0.00	10.00	16.00	0.00	26.00	0.00	0.00	0.00	26.00
7	Baglung	6.34	5.79	90.00	0.00	12.13	0.00	90.00	0.00	102.13
8	Mustang	0.00	0.00	43.00	0.00	43.00	0.00	0.00	0.00	43.00
9	Parbat	24.11	0.00	13.00	0.00	24.11	13.00	0.00	0.00	37.11
10	Tanahu	105.16	14.25	13.00	71.25	61.16	0.00	0.00	0.00	132.41
11	Makwanpur	157.97	59.57	61.00	139.97	117.57	21.00	0.00	0.00	278.54
12	Nuwakot	77.81	19.70	38.20	0.00	106.51	29.20	0.00	0.00	135.71
13	Rasuwa	0.00	40.50	10.00	0.00	50.50	0.00	0.00	0.00	50.50
14	Nawalparasi	127.28	41.05	24.00	98.33	69.00	11.00	0.00	14.00	192.33
15	Kaski	87.46	5.00	20.50	35.40	54.06	23.50	0.00	0.00	112.96
16	Gulmi	40.34	4.20	66.00	0.00	101.54	9.00	0.00	0.00	110.54
17	Arghakhanchi	58.91	2.00	42.00	4.12	56.79	42.00	0.00	0.00	102.91
18	Syangja	97.94	3.00	37.00	78.94	59.00	0.00	0.00	0.00	137.94
19	Palpa	94.59	4.00	30.00	58.93	69.66	0.00	0.00	0.00	110.54

Note: BT=Black Topped,G R=Gravel, ER=Earthen, NH=National Highway, FRN=Feeder Road, MH=Mid Hill Road, PR=Postal Road

POSTAL ROADS

S.N	District/Location	Infrastructure	Length (km)	Type
PHASE I				
1	Bara	MRM (Tamagadhi)- Simraungadh	39.3	Feeder
2	Bara	MRM (Manmat)-Kalaiya-Matiyarwa	27.0	Feeder
3	Banke	Nepalgunj- Baghauda	44.5	Feeder
4	Bardia	MRM (Bhurigau)-Guleria-Murtia	36.0	Feeder
5	Kailali	MRM (Lamki)-Tikapur-Khakraula	27.7	Feeder
6	Dang	MRM (Lamahi)-Koilabas	34.0	Feeder
7	Kailali	Sati-Bhajania-Dhangadhi	61.0	Postal
8	Parsa	TRP (Birgunj)-Thori	52.8	Postal
Total in TAL Districts			**322.3**	

PHASE II				
1	Rautahat, Bara	Hardi-Malangwa-Badarhawa-Gaur-Kalaiya	89.0	Postal
2	Chitwan, Nawalparasi	Jagatpur-Meghauli-Kolhuwa-Bahaman	38.0	Postal
3	Nawalparasi	Narayanchowk-Parasi	14.0	Postal
4	Kapilbastu	Taulihawa-Bahadurgunj-Ramnagar-Charainaka-Dhankhola	56.0	Postal
5	Dang	Kalakati-Gadhawa-Rajpur-Hardawa	50.0	Postal
6	Banke	MRM(Sikta)-Kamdi	37.0	Postal
7	Bardia, Kailali	Dhodari-Rajapur-Sati	27.0	Postal
8	Kailali, Kanchanpur	Dhangadhi-Bellauna-Beladandi-Dangra Daiji	58.0	Postal
9	Rautahat	Badharwa-Phatwa Maheshpur/Gandak Canal Alignment	5.0	Feeder
10	Bara	Gadhimai-Bariyarpur-Kawahi	10.0	Feeder
11	Parsa, Chitwan	Thori-Bharatpur	66.0	Feeder
12	Nawalparasi	MRM(Dumkibas)-Triveni	20.0	Feeder
13	Nawalparasi	Kathawa-Triveni	19.0	Feeder
14	Kapilbastu	MRM (Kharindapur)-Shitalapur-Vilmi	18.0	Feeder
15	Bardia	Rajapur-Daulatpur	7.0	Feeder
16	Kanchanpur	MRM(Kaluwapur)-Belauri	30.0	Feeder
Total in TAL Districts			**544.0**	

E) MINES AND QUARRYING

i) Exploration of Minerals 2068/69

S.N	Mineral	Annual		Total
		New Certificate Granted	Certificate Renewal	
1	Limestone	53	133	186
2	Coal	16	14	30
3	Copper	4	25	29
4	Gold	15	61	76
5	Iron	20	16	36
6	*Khari*	18	30	48
7	Quartzite	9	4	13
8	*Kinite*	2	21	23
9	Dolomite	6	5	11
10	Tourmaline	1	47	48
11	*Abhrakh*	1	2	3
12	Glass	4	7	11
13	Aquamarine	2	1	3
14	*Ratomato*	6	1	7
15	Magnesite		3	3
16	Ruby, Granite	1,0	1,0	2,0
17	Quartz	7	9	16
18	Calcite, Graphite	1,2	4,2	5,4
19	Marble	1	1	2
	Total	173	389	562

ii) Extraction of Minerals 2068/69

S.N.	Mineral	Annual		Total
		New Certificate Granted	Certificate Renewal	
1	Limestone	2	32	34
2	*Ratomato*	0	7	7
3	*Khari*	1	7	8
4	Magnesite	0	1	1
5	Coal	0	17	17
6	*Kinite*	3	3	6
7	Marble	0	3	3
8	Tourmaline	1	2	3
9	Quartzite	0	2	2
10	Quartz	0	1	1
11	Steel, Iron	0	1,1	2
	Total	7	77	84

F) OIL AND GAS EXPLORATION

S.No.	District/Location	Major Infrastructures	Salient Features	Current Status (As of Jan 2013)	Implementing/Executing Agencies
1	Kanchanpur, Kailali	Block 1 (Dhangadhi)	4941 sq km	Exploration bid awarded to Cairn Energy in 2004, work ceased citing political reasons	Department of Mines and Geology
2	Kailali, Bardia	Block 2 (Karnali)	4838 sq km	Exploration bid awarded to Cairn Energy in 2004, work ceased citing political reasons	Department of Mines and Geology
3	Banke, Dang	Block 3 (Nepalgunj)	4908 sq km	Exploration bid awarded to Texana in 1998, work ceased citing political reasons	Department of Mines and Geology
4	Dang, Kapilbastu, Rupandehi	Block 4 (Lumbini)	4965 sq km	Exploration bid awarded to Cairn Energy in 2004, work ceased citing political reasons	Department of Mines and Geology
5	Rupandehi, Nawalparasi, Chitwan	Block 5 (Chitwan)	494945 sq km	Exploration bid awarded to Texana in 1998, work ceased citing political reasons	Department of Mines and Geology
6	Chitwan, Parsa, Bara	Block 6 (Birgunj)	4880 sq km	Exploration bid awarded to Cairn Energy in 2004, work ceased citing political reasons	Department of Mines and Geology
7	Bara, Rautahat	Block 7 (Malangawa)	4920 sq km	Exploration bid awarded to Cairn Energy in 2004, work ceased citing political reasons	Department of Mines and Geology

G) TRANSMISSION LINES

S.N.	Major Infrastructures	District/Location	Salient Features	Current Status (As of Jan 2013)	Funding Agency	Implementing/ Executing Agencies
1	Anarmani-Duhabi	Sunsari	132 kV, 85 km, Single Ckt	Existing, Operational		NEA
2	Kusha-Katiya (India)		132 kV, 19 km, Single Ckt	Existing, Operational		NEA
3	Duhabi-Hetauda	Sunsari, Makawanpur	132 kV, 282 km, Double Ckt	Existing, Operational		NEA
4	Hetauda-Kulekhani 2 P/S	Makawanpur	132 kV, 8 km, Single Ckt	Existing, Operational		NEA
5	Bharatpur-Marsyangdi P/S	Chitwan, Tanahun	132 kV, 25 km, Single Ckt	Existing, Operational		NEA
6	Marsyangdi P/S - Suichatar	Kathmandu	132 kV, 84 km, Single Ckt	Existing, Operational		NEA
7	Suichatar-Kulekhani 2 P/S	Makawanpur, Kathmandu	132 kV, 34 km, Single Ckt	Existing, Operational		NEA
8	Suichatar- New Bhaktapur	Kathmandu, Bhaktapur	132 kV, 26.9 km, Single Ckt	Existing, Operational		NEA
9	New Bhaktapur - Lamosangu	Bhaktapur, Sindhupalchowk	132 kV, 48 km, Double Ckt	Existing, Operational		NEA
10	Lamosangu - Khimti P/S	Sindhupalchowk, Rammechhap	132 kV, 46 km, Single Ckt	Existing, Operational		NEA
11	Hetauda-Gandak P/S	Makawanpur	132 kV, 154 km, Single Ckt	Existing, Operational		NEA
12	Bharatpur- Pokhara	Chitwan, Tanahun, Kaski	132 kV, 97 km, Single Ckt	Existing, Operational		NEA
13	Bardaghat-Butwal	Rupandehi, Nawalparasi	132 kV, 43 km, Double Ckt	Existing, Operational		NEA
14	Butwal - Kali Gandaki A P/S	Rupandehi, Syangja, Palpa	132 kV, 58 km, Double Ckt	Existing, Operational		NEA
15	Kali Gandaki A P/S - Lekhnath	Kaski, Syanja	132 kV, 48 km, Single Ckt	Existing, Operational		NEA
16	Pokhara-Modikhola P/S	Kaski, Parbat	132 kV, 37 km, Single Ckt	Existing, Operational		NEA
17	Butwal-Tanakpur P/S	Rupandehi, Kapilvastu, Dang, banke, Bardia, Kailali, Kanchanpur	132 kV, 407 km, Single Ckt	Existing, Operational		NEA
18	Pathalaiya-New Parwanipur	Bara, Parsa	132 kV, 17 km, Double Ckt	Existing, Operational		NEA
19	Marsyangdi-M. Marsyangdi	Tanahun	132 kV, 44 km, Single Ckt	Existing, Operational		NEA
20	Chilime P/S-Devighat P/S	Rasuwa, Nuwakot	66 kV, 43.56 km, Single Ckt	Existing, Operational		

21	Trisuli P/S -Balaju	Kathmandu	66 kV, 29 km, Double Ckt	Existing, Operational		
22	Debighat P/S-Balaju	Nuwakot, Kathmandu	66 kV, 30 km, Single Ckt	Existing, Operational		
23	Debighat P/S-New Chabel	Nuwakot, Kathmandu	66 kV, 33 km, Single Ckt	Existing, Operational		
24	Balaju-Lainchaur	Kathmandu	66 kV, 2.3 km, Single Ckt	Existing, Operational		
25	Balaju-KL1 P/S	Kathmandu	66 kV, 36 km, Double Ckt	Existing, Operational		
26	KL 1 P/S Birgunj	Parsa	66 kV, 72 km, Double Ckt	Existing, Operational		
27	Suichatar-Teku	Kathmandu	66 kV, 4.1 km, Single Ckt	Existing, Operational		
28	Suichatar-New Patan	Kathmandu, Lalitpur	66 kV, 4 km, Double Ckt	Existing, Operational		
29	Teku-K3 (Underground	Kathmandu	66 kV, 3.5 km, Single core Ckt	Existing, Operational		
30	Suichatar-K3	Kathmandu	66 kV, 6.9 km, Single Ckt	Existing, Operational		
31	New Patan-New Baneshwor	Lalitpur, Kathmandu	66 kV, 2.8 km, Single Ckt	Existing, Operational		
32	Bhaktapur-New Chabel	Bhaktapur, Kathmandu	66 kV, 12 km, Single Ckt	Existing, Operational		
33	New Baneshwor-Sunkoshi P/S	Kathmandu	66 kV, 61 km, Single Ckt	Existing, Operational		
34	Debighat Trisuli	Nuwakot	66 kV, 4.56 km, Single Ckt	Existing, Operational		
35	Indrawati-Panchkhal	Kavrepalanchok	66 kV, 10 km, Single Ckt	Existing, Operational		
36	Khimti-Dhalkebar	Dhanusha, Rammechhap	220 kV, 75 km, Single Ckt	Under construction		
37	Hetauda Bharatpur	Makwanpur, Chitwan	220 kV, Double Ckt, 73 km long, Estimated cost USD 19 million	Under construction		
38	Thankot-Chapagaon	Kathmandu, Lalitpur	220 kV, 28.5 km, Double Ckt	Under construction		
39	Chameliya-Attariya	Kailali, Darchula	220 kV, 129 km, Single Ckt	Under construction		
40	Dhalkebar Muzzaffarpur Cross Border Line	Dhanusha, India	400 kV, 45 km, Double Ckt	Under construction	NEA Joint Venture under PPP	
41	New Marsyangdi-Matatirtha	Kathmandu	220 kV, 85 km, Double Ckt	Planned/Proposed		
42	Sangati-Lamosangu	Sindhupalchowk	132 kV, 40 km, Double Ckt	Planned/Proposed		
43	Kabeli-Damak	Jhapa	132 kV, 90 km, Double Ckt	Planned/Proposed		
44	Middle Marsyangdi-Dumre-Marsyangdi	Tanahun	132 kV, 44 km, Double Ckt	Planned/Proposed		
45	Dumre-Damauli	Tanahun	132 kV, 18 km, Single Ckt	Planned/Proposed		

46	Butwal-Kohalpur Second Circuit	Rupandehi, Banke	132, kV, 208 km, D/C Tower	Planned/Proposed		
47	Bharatpur-Bardaghat	Chitwan, Nawalparasi	220 kV, Double Ckt, 73.5 km transmission line, Estimated cost USD 20 million	Planned/Proposed		
48	Hetauda-Kulekhani II0 Siuchatar Second Circuit	Makawanpur, Kathmandu	132 kV, 44 km, D/Ck Tower	Planned/Proposed		
49	New Hetauda-Dhalkebar-Duhabi	Makawanpur, Dhanusha, Sunsari	220 kV, 283 km, Double	Planned/Proposed		
50	New Hetauda-Mathatirtha	Makawanpur, Kathmandu	220 kV, 45 km, Double Ckt	Planned/Proposed		
51	Bardaghat-New Butwal	Rupandehi, Nawalparasi	220 kV, 30 km, Double Ckt	Planned/Proposed		
52	Trishuli-Thankot	Kathmandu	220 kV, 54 km, Double Ckt	Planned/Proposed		
53	Kohalpur-Attariya Second Circuit	Banke, Kailali	132 kV, 200 km, D/C Tower	Planned/Proposed		
54	Duhabi-Purnia Cross Border Line	Sunsari, India	400 kV, 22 km, Double Ckt	Planned/Proposed	NEA Joint Venture under PPP	
55	New Butwal-Gorakhpur Cross Border Line	Rupandehi, India	400 kV, 25 km, Double Ckt	Planned/Proposed	NEA Joint Venture under PPP	
56	Sanjen Chilime	Rasuwa	66 kV, 12 km, Double Ckt	Planned/Proposed	NEA Joint Venture under PPP	
57	Madi-Lekhnath	Tanahu, Kaski	132 kV, 22 km	IEE Completed		
58	Gulmi- Arghakhanchi-Chanauta	Gulmi, Arghakhanchi	132 kV, 110 km	IEE Completed		
59	Tadi Corridor (Samundratar-Trishuli 3B)		132 kV, 20 km	IEE Completed		
60	Hapure-Tulsipur	Dang	132 kV, 18 km	IEE Completed		
61	Dordi Corridor (Kirtipur-Udaipur/ Marsyangdi)	Kathmandu	16 km	IEE Completed		
62	Karnali Corridor (Lamki-Upper Karnali)	Kailali	132 kV, 60 km	Feasibility Study Completed		
63	Bajhang- Deepayal-Attariya	Bajhang, Doti, Kailali	132 kV, 130 km	Feasibility Study Completed		
64	Surkhet- Dailekh-Jumla	Surkhet, Dailekh, Jumla	132 kV, 107 km	Feasibility Study Completed		
65	Kaligandaki-Gulmi (Jhimruk)	Syanja, Gulmi	132 kV, 43 km	Feasibility Study Completed		

66	Dhalkebar-Loharpatti	Dhanusha	132 kV, 20 km	Feasibility Study Completed		
67	Butwal-Lumbini	Rupandehi	132 kV, 22 km	Feasibility Study Completed		
68	Baneshwor-Bhaktapur	Kathmandu, Bhaktapur	132 kV DC, 12 km, Underground	Feasibility Study Ongoing		
69	Budhganga-Umedi-Pahalwanpur	Kailali	132 kV, 75 km	Feasibility Study Ongoing		
70	Balefi-Barhabise	Sindhupalchowk	132 kV, 25 km	Feasibility Study Ongoing		
71	Dumre-Damauli-Marsyangdi	Tanahun	18km of double circuit transmission line from Dumre to Damauli, 1km four circuit loop-in loop-out transmission line at Middle Marshyangdi power plant, stringing of 39km 132kV second circuit transmission line from Middle Marshyangdi to Dumre, Estimated cost USD 16.6 million	Ongoing (as of 2012)		
72	Hetauda-Dhalkebar-Duhabi 400kV Transmission Line	Makwanpur	400kV double circuit transmission line of 290 km, Estimated cost USD 144 million	Ongoing (as of 2012)		

ANNEX 11: PROJECT INFORMATION SHEET FOR SENSITIVE PROJECTS WITHIN CHAL AND TAL

1. Gautam Buddha Regional International Airport
2. Nijgadh Second International Airport Project
3. Pokhara Regional International Airport Project
4. Budhi Gandaki Storage Hydropower Project
5. Kulekhani III Hydroelectric Project
6. Lower Manang Marsyangdi Hydroelectric Project
7. Marsyangdi Hydropower Project
8. Middle Marsyangdi Hydroelectric Project
9. Super Madi Hydroelectricity Project
10. Tanahun Hydropower Project
11. Rani Jamara Kularia Irrigation Project
12. Sikta Irrigation Project
13. Petroleum Exploration
14. Besisahar-Chame Road
15. East West Postal Highway Project
16. North South Fast Track Project
17. Thoche-Larke District Road Project
18. Mechi-Mahakali and Kathmandu-Pokhara Railway Project
19. Bharatpur-Bardghat 220 kV Transmission Line Project
20. Hetauda-Bharatpur 220kV Transmission Line
21. Hetauda-Dhalkebar-Duhabi 400kV Transmission Line
22. Talkot-Mahendranagar 400 kV Transmission

PROJECT SHEET

1. Gautam Buddha Regional International Airport

1. Location

Location			Coordinates of Project Area
District	Municipality	VDC	
Rupandehi	Siddhartha Nagar	Hatibangai, Kachiriwa, Bhujawli, Dharmapur	Airport Reference Point (ARP) 273026N 0832505E

2. Schedule of Implementation

PPTA Study / ADB	Detail Design	IEE/EIA/EMP/SIA	Construction	Operation	Maintenance / Rehabilitation
Project Preparatory Technical Assistant (PPTA) Study completed in May 2010	Detail Engineering completed in September 2012	EIA and EMP completed by PPTA / ADB in May 2010. SIA not performed Resettlement plan completed by PPTA / ADB in May 2010. EIA assessment, land acquisition and resettlement, Detail Engineering Design Sep.2012.	Construction scheduled to start by the end of2013	Planned to operate international flights by the end of 2016	

3. Funding/Implementing Agencies

Funding Agency	
Name	Address
CAAN	Babar Mahal, Kathmandu, Nepal
ADB	Asian Development Bank Nepal Resident Mission Srikunj Kamaladi, Ward No. 31 P.O. Box 5017, Kathmandu, Nepal
OFID	OFID Parking 8 A – 1010, Vienna, Austria
Implementing Agency	
Name	Address
CAAN	Babar Mahal, Kathmandu, Nepal

4. Salient features

New Runway with flexible pavement	3000 meter length x 45 meter width
Parallel taxiway (existing 1500 meter extension 400 meter length)	1900 meter length x 23 meter width
Exit Taxiway	(2 new and 1 existing)
New International Aircraft parking Apron with rigid pavement	388 meter length x 160 meter width
Existing Domestic Aircraft parking with flexible pavement	130 meter x 63 meter
Diversion of Ghagra Khola around the periphery of airport boundary	2500 meter
New International Terminal building	15,169 Sq. meter
New Operation / Control Tower / Administrative Building	2,141 Sq. meter
New Crash Fire Rescue Building	1,608 Sq.m
Air Cargo and Maintenance Building	2,395 Sq.m
Total project cost is estimated to be US$ 90.68 million (civil works cost US$ 83.75 million and equipment cost US$ 6.93 million). Project will be funded by ADB/OFID/GON/CAAN. Approved fund is US$ 50 million (ADB Loan US$ 12.03 million, ADB Grant US$ 5.42 million, OFID Loan US$ 15 million, GoN US$ 6 million, CAAN US$ 11 million).	
GoN will allocate fund for implementation of mitigation measures under Environmental Management Plan (EMP) NRs. 12.496 million. EMP cost includes environment protection measures cost, environment monitoring unit, impact monitoring evaluation study cost and environment auditing cost.	
Review of Design by ADB appointed consultant is underway for additional funding of US$ 42 million (ADB/OFID Loan US $ 30 million, GON/CAAN US$ 12 million). Construction work activities are scheduled to commence after ADB finalises the additional loan.	

5. Brief description of the Project

Gautam Buddha Airport (GBA) is located in Bhairawa in the mid-western region of Nepal, which is twenty four kilometers from district headquarters Butwal and 3 Kms west from Bhairawa. The airport is situated at an altitude of 109 m above mean sea level. This airport started to operate air services from July 04, 1958 and is now operating as a regional hub domestic airport. This airport is categorized as ICAO 2C code. Aircrafts such as ATR 42, ATR 72, Jet Stream J41, Beechcraft B 1900 and DHC 6 are operating domestic air flights in the existing airport.

Distance between GBA and Lumbini, the birthplace of Lord Buddha, is about 20 Kms. Lumbini was declared as a World Heritage Site by UNESCO in 1997. The majority of visitors to Lumbini either travel from Kathmandu to Bhairawa by air and then by bus/car to Lumbini or travel by bus/ private cars from India to Lumbini. Taking into consideration the importance of Lumbini and as per objectives of the Civil Aviation Authority of Nepal (CAAN), the Government of Nepal has decided to upgrade this airport to a Regional International Airport. Under the initiative of ADB, South Asia Sub regional Co-operation (SASEC) proposed various infrastructures development within the SASEC countries for development of "Footsteps of Buddhist Circuit" including the upgrade of Gautam Buddha Airport to an international standard airport. After the completion of the proposed upgrading works, this airport will operate as a Regional International Airport. Then, direct international flights from various countries will operate and this airport will also operate as an alternative international airport to Tribhuvan International Airport (TIA).

6. Summary of EIA

Updated EIA study for upgrading of GBA to Regional International Airport standard of Code 4E was prepared by ADB financed PPTA study TA 6504 Reg. "Improving Connectivity and Destination Management of cultural and natural resources in the South Asia Sub-region" in May 2010. The updated EIA study was approved by MOE in March 2011. EIA was prepared as per the EPR 1997. There are no major impacts due to the upgrading of this airport. Few associated impacts of the project development are summarized as following:

- Diversion of Ghagra Khola along the airport boundary and merging with the existing Ghagra Khola in south west side will have an impact on aquatic life.
- Earth filling the existing Ghagra Khola will have an impact on aquatic life.
- Impact on air (vehicular movement) and water quality during construction activities due to spillage of fuel to Ghagra Khola.
- Impact of spillage from GSE, vehicle movement to drain and ultimately to Ghagra Khola.

7. Summary of SIA

Resettlement plan was prepared during PPTA study undertaken through ADB in May 2010. This resettlement plan needs to be updated. SIA has not been prepared. Main socio economic impacts are summarized as following:

- Land acquisition of 94.80 ha will affect 590 plots. Out of which 93.80 ha comprises of agriculture land, 0.34 ha of residential land and 0.63 ha of commercial land.
- 292 households and 1752 persons are affected by the project and lose agricultural income from farming their own land. 17 residential houses are displaced and 102 persons are affected by the project.
- One private school with 306 students and one public school with 500 students are affected by the project. (Private school has already bought land nearby and public school is shifting to a new site).
- Private assets including 55 bore holes, 6 cowsheds, 4 pumpsheds, temporary structures and others.
- 98 laborers will be deprived of working in agricultural works.

8. Areas of common opportunities and concern for Hariyo Ban

- After the implementation of the project, direct international flights from Thailand, Bhutan, Sri Lanka, Japan, India and other countries will be operated and this will have direct economic benefit to GoN through revenues and direct benefit for local people with employment and business opportunities.
- After the airport is operational as an international airport, there will be an increase in tourism traffic and international visitors to Lumbini will fly directly to this airport.
- The concern to Hariyo Ban about the impacts of 292 households and 1752 persons, displacement of 17 residential houses and 102 persons.

9. Proposed areas for Hariyo Ban engagement with the Project

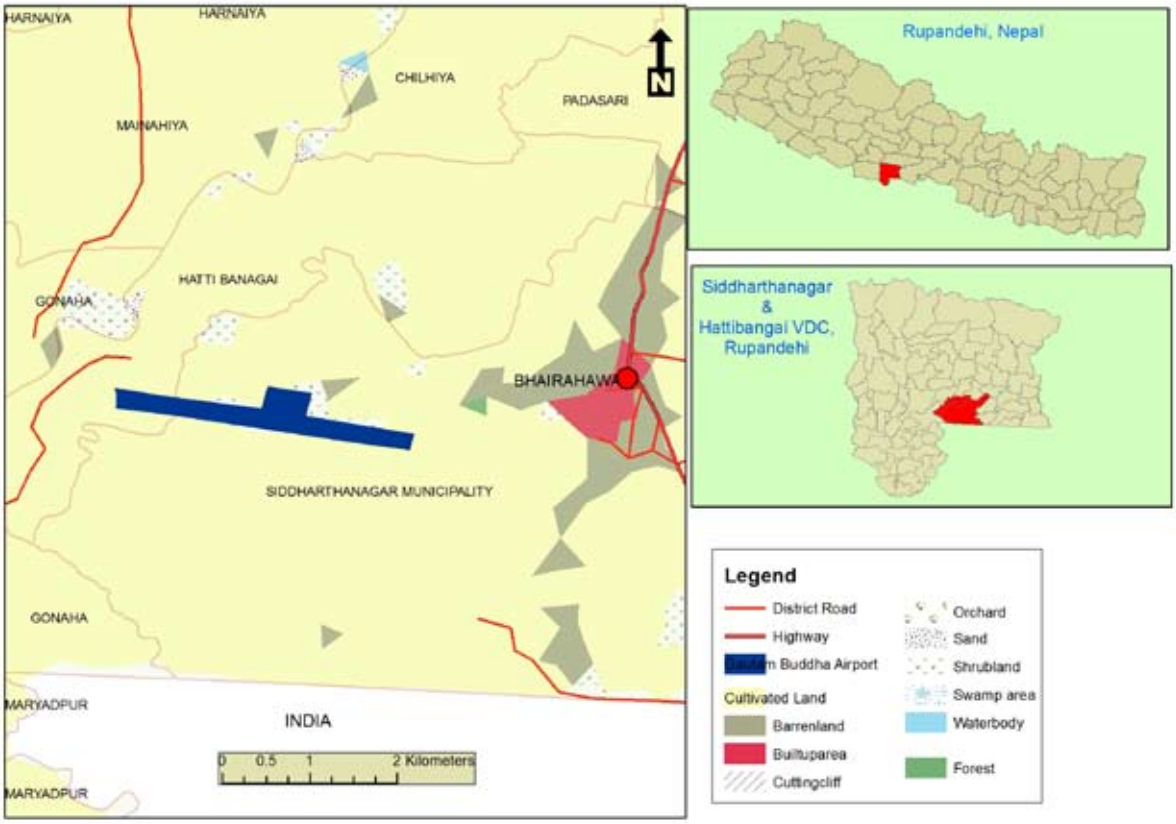
The proposed engagement activities of Hariyo Ban with GBA upgrading are as following:

- To reduce bird hazard due to the dumping of solid waste within and around the airport,
- To improve livelihood and agriculture practices of local people,
- To engage vulnerable groups during construction period,
- To properly manage the solid waste, sewerage and drainage management.

10. Action Plan

Project Implementation Stage	Approx. time frame	Proposed Engagement/Action	Expected Result
• Preparatory Phase • Land acquisition • Detail Engineering design already completed • Displacement of 17 residential houses and 2 schools • One private school and one public school • One shrine and private assets		Land acquisition completed. As per EMP residential houses, school buildings are demolished, material carried away. Contractor will acquire temporary land for labor camp, site for stockpiling of constructional materials, toilets and washing rooms.	
• Construction Phase Activities • Site clearance • Earthwork excavation from Ghagra Khola and within airport • Stockpiling the excavated earth for reusing in the runway shoulder • Fill material excavation from the selected borrow pit sites of Tinau, Dano and Rohini rivers. • Stockpiling of construction materials • Air, noise and water pollution control • Occupation health and safety • Community health and safety • Traffic congestion	3 (three) years from the construction start date.	Permit and Approval from DDC and VDC for excavating materials from Tinau, Dano and Rohini Khola. Monitoring implementation of EMP including environmental protection measures. Monitoring RP including employment opportunities for AP in airport construction works. Monitoring of construction works without any disturbances and security for the regular aircraft movement operation of this airport.	

• Operational Phase Activities • Air emissions from takeoff and landing of aircrafts • Bird Hazard • Effluents from Terminal building, administrative office / control tower discharges direct to Ghagra Khola may deteriorate water quality and may affect aquatic life. • Rehabilitation and Landscaping • Rehabilitation of temporary occupied buildings • River bank protection of the borrow pit site	Throughout the year Within one to two months after construction	Noise and air pollution control. Monitoring of the waste disposal to prevent bird hazards. Effluents to be treated in treatment plant prior to discharging to Ghagra Khola. Monitoring implementation of EMP and RP Demolition of all the temporary structures and land rehabilitation Bamboo afforestation all along borrowed pit site embankments and construction of civil structures for river diversion if needed.	



2. Nijgadh Second International Airport Project

1. Location

Location			Coordinate of Project Area (ARP)
VDC	Municipality	District	
Nijgadh		Bara	North Runway 3003822.5N 61300E South Runway 3002645N 612100E

2. Schedule of Implementation

Feasibility Study	Detail Design	IEE/EIA/EMP/SIA	Construction	Operation	Maintenance /Rehabilitation
Pre-feasibility study completed in 1995 by NEPECON,Nepal. Feasibility study completed in July 1997 by NEPECON Nepal. Detail feasibility study by Land Mark Worldwide (LMW) of South Korea in 2010		Scoping and ToR has been approved by MoE. EIA not available			

3. Implementing Agencies

Implementing Agency	
Name	Address
Civil Aviation Authority of Nepal (CAAN)	Babar Mahal, Kathmandu, Nepal

4. Salient features

Particulars	Year			Ultimate capacity
	2020 (Phase 1)	2025 (Phase 2)	2030 (Phase 3)	
Forecasted passengers	4.8 Million	6.7 Million	9.2 Million	60.0 Million
Airport Facilities				
Runway	3600 meter x 45 meter	3600 meter x 45 meter	3600 meter x 45 meter	3600 meter x 45 meter (2 Nos. of parallel)
Parallel Taxiway	3600 meter x 23 meter (2 Nos. of parallel)	3600 meter x 23 meter (2 Nos. of parallel)	3600 meter x 23 meter (2 Nos. of parallel)	3600 meter x 23 meter (4 Nos. of parallel)
Aircraft parking apron	15 (4) Spots	20 (3) Spots	27(3) Spots	172 Spots
Cargo apron	2 spaces	2 Spots	3 Spots	15 Spots
Passenger Terminal Building	58,000 Sq.m	81,000 Sq.m	111,000 Sq.m	720,000 Sq.m
Cargo Terminal Building	34,000 Sq.m	50,000 Sq.m	67,000 Sq.m	400,000 Sq.m
Fire Training Station	10,000 Sq.m	10,000 Sq.m	10,000 Sq.m	10,000 Sq.m
Airport & Aircraft Maintenance Complex	2,900 Sq.m	29,100 Sq.m	59,700 Sq.m	311,000 Sq.m
Engine Run-up pad		10,000 Sq.m	10,000 Sq.m	10,000 Sq.m
GSE Storage Area	5,640 Sq.m	7,410 Sq.m	10,140 Sq.m	55,380 Sq.m
GSE Maintenance Area	2,000 Sq.m	2,600 Sq.m	3,600 Sq.m	19,400 Sq.m
Flight Catering Facilities	5,000 Sq.m	7,000 Sq.m	10,000 Sq.m	60,000 Sq.m
Car Parks	30,500 Sq.m	43,800 Sq.m	59,100 Sq.m	381,000 Sq.m
Utilities				
Power Plant	15,000 Sq.m	15,000 Sq.m	15,000 Sq.m	60,000 Sq.m
Airfield Lighting Substation	400 Sq.m	400 Sq.m	400 Sq.m	400 Sq.m
Heating and CoolingPlant	20,000 Sq.m	20,000 Sq.m	20,000 Sq.m	40,000 Sq.m
Pumping Station and Water Treatment Plant	20,000 Sq.m	20,000 Sq.m	20,000 Sq.m	40,000 Sq.m
Sewage Treatment Plant	10,000 Sq.m	14,000 Sq.m	19,000 Sq.m	120,000 Sq.m
Solid and Hazardous Facilities	4,760 Sq.m	6,721 Sq.m	9,225 Sq.m	60,000 Sq.m
Aircraft Fueling Facilities	15,000 Sq.m	21,000 Sq.m	28,000 Sq.m	180,000 Sq.m
Preliminary estimated project cost	US$ 668 million			

5. Brief description of the Project

It is estimated that given the future demand and constraints, TIA can operate albeit with decreasing levels of safety and service, until approximately 2025 although saturation may well occur before this time if there are insufficient aircraft stands, maintenance areas etc. (a distinct possibility). Hence, CAAN has performed a pre-feasibility study of various probable sites within Nepal and selected Nijgadh as the prominent site for Second International Airport (SIA) construction and GoN also has approved the Nijgadh site. Feasibility Study of SIA in Nijgadh was performed. GoN has decided to construct this airport under the BOOT concept. Accordingly, LMW of South Korea was awarded the contract for detailed Feasibility Study. LMW has completed the Detailed Feasibility Study for construction of a Second International Airport at Nijgadh with its own financial resources of US$ 3.6 million. The study Report has been submitted to GoN and decisions are not yet made for the detailed design, construction and operation of SIA under the BOOT concept. Based on the projected passenger movements, airside / landside infrastructure facilities and utilities have been proposed for 2020, 2025, 2030 and the Ultimate Capacity by LMW in the detailed Feasibility Study. Preliminary project cost for 2020 has been estimated to be US$ 668 million for Phase 1. Two parallel runways are planned in the ultimate capacity. A single runway airport is proposed for the initial phase on the northern side of the proposed site and is aligned along east to west with a magnetic bearing of 09 /27. The proposed airport boundaries are as following:

- Mahendra Rajmarga on north.
- Lal Bakaiya Nadi (river) on east.
- VDC boundaries of Sihorwa, Haraiya, Kakdi and Sapahi on south.
- Pasaha Khola on west.

As per the conceptual Master Plan of SIA, which has been prepared by LMW, an airport city with commercial and residential activities has been planned along north of the airside and south of the Mahendra Rajmarga. Planning has been prepared to meet the International Civil Aviation Organization (ICAO) requirements for Code 4 F airport.

6. Summary of EIA

Scoping and TOR for EIA has been completed and has been approved by MoE. Detailed EIA has to be performed. Preliminary field investigations reveal the following impacts:

- Proposed airport as per Phase 1 will displace 81 hectares (9 hectare x 9 hectare) of dense forest owned by the government.
- Two nurseries of less value are within the proposed airport boundary.
- Forest has to be cleared and no cost for land acquisition is required.
- 1316 houses have to be displaced and resettlement required.

7. Summary of SIA

Not yet performed.

8. Areas of common opportunities and concern for Hariyo Ban

- After the implementation of the project, direct international flights from all countries will be operated and there will be no penalty on the load to be carried by the aircraft.
- After the airport is operational as an international airport, there will be increased tourism traffic and international visitors to the country.
- After the implementation of the project, this will have direct economic benefit to GoN through revenues and direct benefit for local people with employment and business opportunities.
- Development of airport city towards north of the proposed airport will provide employment and business opportunities to many people.
- This airport after the implementation can serve as a hub international airport for South Asia and transfer connection to other countries will be possible.
- Diversion to other airports in India due to the climatic condition will not be required. Nijgadh airport has no problem of fog.
- All categories of 4E aircrafts as per ICAO classification will operate air service without any load penalty.
- The concern to Hariyo Ban about the impacts of 1316 households.

9. Proposed areas for Hariyo Ban engagement with the Project

The proposed engagement activities of Hariyo Ban with construction of SIA are as following:

- To reduce bird hazard due to the dumping of solid waste within and around the airport;
- To improve livelihood of local people;
- To engage vulnerable groups during construction period;
- To properly manage the solid waste, sewerage and drainage management.

3. Pokhara Regional International Airport Project

1. Location:

Location			Coordinate of Project Area	Date of project approval
VDC	Municipality	District		
	Pokhara Sub Metropolitan City	Kaski	NW: 281210.32 N 84009.99E SE: 281029.77 N 849226.64E	

2. Schedule of Implementation

Feasibility Study	Detail design	IEE/EIA/EMP/SIA	Construction	Operation	Maintenance / Rehabilitation
Conceptual Paper for developing New Pokhara Regional International Airport 2008.	Engineering survey, Layout Plan Preparation and Earthwork Estimation June 2010.	EIA prepared in August 2006. Needs updating. EIA not yet approved.			

3. Funding/Implementing Agencies

Implementing Agency	
Name	Address
CAAN	Babar Mahal, Kathmandu, Nepal

4. Salient features

Airside and Landside Infrastructure development	CNS / Air Traffic Management / Meteorological and other equipment
Runway 2500m X 60m (including 7.5m shoulder on either side)	Navigational Aids
Taxiway 2Nos. 290 m X 38 m (including 7.5m shoulder on either side)	Airport lighting
Parallel Taxiway 1200 m x 38 m (including 7.5m shoulder on either side)	RFFS vehicles –CAT VIII
Airport periphery road 10 m wide (2 lane	Three-men console
Airport approach road 20 m wide (4 lane)	VSAT terminal and associated equipment
Apron: International 300m x 152.5m, Future apron 150m x 152.5 m, Domestic 150m X 100m	AMHS Terminal
International Terminal Building (approx. 8500 square meter)	EPABX- 500 lines with accessories
Domestic Terminal Building (approx. 5000 square meter)	X-ray machines for screening baggage
Control Tower/Operation Building (approx. 1500 square meter	Security equipment (Detectors)
Rescue & Fire Fighting Facilities CAT VIII	Meteorological equipment
Cargo Terminal Building (approx. 1000 square meter)	DVOR/DME
International hangar (250m length), Domestic Hangar (150m. length)	Monopulse Secondary Surveillance Radar (MSSR)
Fuel Farm facilities, Car park facilities	
CAAN estimated project cost is US $ 170 million.	
Cost for implementation of EMP is estimated to be NRs. 38.17000 million. EMP cost includes environment protection measures cost, Pre-construction, Construction and Operation cost, environmental management unit cost, impact monitoring evaluation cost and environment auditing cost.	

5. Brief description of the Project

The existing Pokhara Airport is located in the Pokhara Sub-Metropolis of Kaski District in Gandaki Zone of the Western Development Region of Nepal. This is a regional hub airport located in the heart of Pokhara city. Pokhara is the second most popular tourist destination of the country and lays only 200 km north-west of Kathmandu. The demand for air traffic is rapidly rising due to the increase in tourism and other economic activities in the western parts of the country. Considering the needs for regional air transport development and demand potential of air transport in Pokhara as a hub airport for the northern and western parts of the country, CAAN (then Department of Civil Aviation) had acquired 155 ha of land at Chinne Danda village during the 1970s to build a new airport in Pokhara. The land is located about 3 km south of the present Pokhara airport. A number of preliminary studies have also been subsequently undertaken for the development of a New Pokhara Airport by CAAN. The Master Plan for New Pokhara Airport developed proposes a 2500m x 45m runway suitable for operation of Code 4D aircraft to cater the future needs.

Presently, due to limitations of the existing Pokhara airport in serving the increasing number of passengers and their service demand, proximity to the city, the adverse impact of runway layout and approach limitations of extension of the airport, construction of a new Pokhara Airport as a regional airport has become a necessity. In order to accommodate the future demand, CAAN is planning to

develop this airport as a Regional International Airport.

The Government of Nepal is in the process of receiving concessional loan to finance the project from China Exim Bank. It is envisaged that portion of the loan will be used for eligible payments under the Contract. Accordingly, in February 2012 CAAN had invited EPC Contract for execution of Pokhara Regional International Airport Project by the Chinese Contractors. Technical and financial evaluation has already been completed and due to technical reasons the EPC contract has not been awarded. CAAN has not yet decided how the project will be implemented. From 2012, CAAN with its own funding started earthwork in filling of Runway and has been continuing this year as well.

6. Summary of EIA

EIA has been performed by CAAN and submitted to MoE for approval on August 2006. Land acquisition was performed earlier and compensation has been paid to all the land owners except four Karki brothers.These four land owners had not received the compensation of the land till August 2006. Now they have received the land acquisition cost and MOEST has requested CAAN for updating the EIA and submission. There are no major impacts that need to be mitigated. Few associated impacts due to the project development are summarized as following.

Environmental Impacts

- Effect on air quality due to aircraft emissions from aircraft during takeoff and landing and bitumen mixing.
- Change in land use from agriculture to airfield.
- Noise effect due to aircraft during takeoff and landing.
- Impact on air (vehicular movement) and water quality during construction activities due to spillage of fuel to Khahare and Bijayapur Khola.
- Impact of spillover of chemicals, noxious elements and vehicular emission during construction will lead to ground and surface water contamination.
- Filling material being excavated from Borrow Pit located at Bacchebudha site near to Bijayapur Khola will have impacts in land erosion and protection of landside after the project completion.
- Severely project affected family (SPAF) include four Karki families who had not received land compensation of 2.79 ha during EIA preparation. Now they have received cost for land acquisition.
- Impact on agro based livelihood due to the need to convert earning from agriculture to other business like trade and tourism.
- Possibility of air accidents due to Nepal Army's firing located just across the rivers. This has to be managed.

Environment Management Plan (EMP)

Various work activities within the EMP as indicated in EIA study are summarized as following:

- Cost Estimation for environment protection measures which include plantation, watering, skill development, and support for improving infrastructure facility and others during construction.
- Environment Management Unit (EMU) will be created under PMU at site for monitoring the pre-construction, construction and implementation phase. Consultants with various expertises will be recruited by EMU and budget has been estimated.
- Consultants will be recruited for Impact monitoring evaluation study of the project at the end of

project period or within the two years of project completion. Cost has been estimated.
- An indicative cost has been estimated for environmental auditing of the project, which will be conducted by MOEST after the completion of the project.

7. Summary of SIA

Not yet performed.

8. Areas of common opportunities and concern for Hariyo Ban

- After the implementation of the project, direct international flights from various countries will be operated and this will have direct economic benefit to GON through revenues and direct benefit for local people with employment and business opportunities.
- There will be an enhancement in local trade and skilled and unskilled manpower will get employment in the airport construction.
- After completion of New Pokhara and Gautam Buddha Regional International Airport, international aircrafts that get diverted from Tribhuvan International Airport due to climate problem has two options either to divert to New Pokhara Airport or Gautam Buddha airport. This will have an economic benefit to GoN.
- After the airport is operational as an international airport, there will be an increased tourism traffic, increase in adventure tourism like hiking etc. and increase in local economic activities near the airport sites.

9. Proposed areas for Hariyo Ban engagement with the Project

The proposed engagement activities of Hariyo Ban with New Pokhara Airport construction are as following:
- To reduce bird hazard due to the dumping of solid waste within and around the airport,
- To improve livelihood and agriculture practices of local people,
- To engage vulnerable groups during construction period,
- To properly manage the solid waste, sewerage and drainage management,
- Greenhouse gas emissions effects,
- Carbon pricing.

10. Action Plan

S.No	Project Implementation Stage	Approx. time frame	Proposed Engagement/Action	Expected Result
	Preparatory Phase • Preparatory work prior to construction activity		Contractor will acquire temporary land for labour camp, site for stockpiling of constructional materials, toilets and washing rooms.	
	Construction Phase Activities • Site clearance • Earthwork excavation from within airport • Stockpiling the excavated earth for reusing in the runway shoulder • Fill material excavation from the selected borrow pit sites of Bacchedanda near Bijayapur Khola • Stockpiling of construction materials • Air, noise and water pollution control • Occupation health and safety • Community health and safety • Traffic congestion		Permit and Approval from DDC and VDC for excavating materials from Bachhedanda near Bijayapur Khola. Monitoring implementation of EMP including environmental protection measures. Monitoring of construction works without any disturbances and security for the regular aircraft movement operation of this airport.	
	Operational Phase Activities • Air emissions from take-off and landing of aircrafts. • Bird Hazard • Effluents from Terminal building, administrative office / control tower discharges direct to Khahare and Bijayapur Khola may deteoriate water quality and may affect aquatic life. • Rehabilitation and Landscaping of land acquired for camp setup • Rehabilitation of temporary occupied buildings • River bank protection of the borrow pit site.	Throughout the year Within one to two months after construction.	Noise and air pollution control. Monitoring of the waste disposal to prevent bird hazardness. Effluents to be treated in treatment plant prior to discharging to Khahare and Bijayapur Khola. Monitoring implementation of EMP. Bamboo afforestation all along burrow pit site embankments and construction of civil structures for river diversion if needed. Landscaping of the airside and landside.	.

	Maintenance / Rehabilitation Activities • Regular maintenance of airside and landside infrastructure. • Cleaning of debris from trapezoidal outer drains. • Periodic maintenance and rehabilitation as and when required.	Throughout the year	Concerned Civil Maintenance Section of Airport will be responsible for monitoring these activities.	

4. Budhi Gandaki Storage Hydropower Project

1. Location:

Location			Coordinate of Project Area
District	Municipality	VDC	
Dhading		Budhathum,Chainpur,Khari, Maidi,Salyantar,Salang	Latitude: 27° 48′ 30″ - 28° 07′ 30″
Gorkha		Namjung,Dhawa,Darbhung, Borlang,Ghyalchok,Tandrang	Latitude: 84° 42′ 30″ - 84° 56′ 00″

2. Schedule of Implementation:

Prefeasibility Study	Detail Design	IEE/EIA/EMP/SIA	Construction	Operation	Maintenance /Rehabilitation
Prepared in 1984	start March 2013	Preliminary EIA- 2010/11 Detail EIA- start March 2013			

3. Salient Features

Installed Capacity: 600 MW	Average Annual Energy: 2495 GWh
Effective Storage Capacity: 2755 Million m3	Surface Area: 50 km2
Catchment Area 106 km	Long Term Average Flow 195 m3/s
Probable Maximum Flood 15 126 m3/s	Dam Type: Zoned rock fill with inclined core. Crest Level: El.525 m Maximum Height: 225 m
Diversion Tunnel : Design flood-1170m2/s, 10 m diameter	Tailrace Tunnel: D Shape, 13m x 13m, 1.1 km Length
Powerhouse: Underground 24m x 120m x 43.5 m	Access Tunnel: D Shape, 8m x 10m, 976 m Length
Turbine Type: 4 Francis Turbines, Vertical axis	Estimated Cost: USD 774 Million

4. Brief history of the Project

Budhi Gandaki Hydropower Project is a storage type project with a capacity of 600 MW located on the Budhi Gandaki River in Dhading and Gorkha Districts. The prefeasibility study, completed in 1984 had recommended this project to be implemented immediately. However, the project remained in hibernation for about 26 years. The pre-feasibility study of this project has recommended a 225m high rockfill dam on Budhigandaki River about 2 km upstream of the confluence of Trishuli and Budhigandaki Rivers. The dam will create a reservoir from where the stored water will be diverted to the underground powerhouse through a 276 m long headrace tunnel with a diameter of 12 m and a penstock of 4 m diameter and 240 m length to feed four Francis turbines each having a capacity of 150 MW. The project will be able to generate approximately 2500 GWh of energy annually. The ability to generate electricity during the dry months and the proximity of the project to Kathmandu (About 79 Km) make this project an attractive prospect.

The PDD completed the preliminary environmental impact study, counting of household in the reservoir area, establishment of survey monuments around the reservoir area, topographical survey of the project area establishment of gauging station in the tailrace area and up gradation of gauging station on at the dam site, Ankhu Khola and Arughat in the fiscal year 2010/11 The department initiated the process to hire an international consultant for the feasibility study and to carry out the detailed design of the project in the fiscal year 2011/12.

5. EIA Summary

Detailed EIA and design scheduled to start in March 2013.

5. Kulekhani III Hydroelectric Project

1. Location

Location			Coordinates of Project Area
District	Municipality	VDC	
Makwanpur	NA	Tikapur, Bhaise	Latitude: 27° 28.123′ N -27° 30.615′ N Longitude :85° 02.459′ E -85° 02.946′ E

2. Schedule of Implementation

Feasibility Study	Detail design	IEE/EIA/EMP/ SIA	Construction	Operation
1994 A.D.	NA	EIA Study for 42 MW started in 2000. EIA Report approved: March 2000	Construction Started: April 27, 2008 As of early 2013, only half the construction is complete	Initially scheduled to be in operation since July 2012. Current status: Not complete.

3. Funding/Implementing Agency

Funding Agency	
Name	Address
Nepal Electricity Authority	Central Office, Durbarmarg Kathmandu Nepal
Implementing Agency	
Name	Address
Nepal Electricity Authority	Central Office, Durbarmarg Kathmandu Nepal

4. Salient Features

Project Type	Cascade project of Kulekhani Storage Project
Average Annual Generation	40.85 GWh
Design Discharge	16.0m^3/s
Conveyance length	302 m
Headworks	Khani Khola Intake Conventional Side Intake of stilling basin downstream of the consolidation check dam, 370m Diameter steel/tunnel 2.3m/3.8m
Connection Tunnel	Horse shoe shaped; Length 651.2m; Diameter 3.5m
Turbine	2 Vertical Axis Francis Turbines
Transmission Line	132 KV; 0.5 Km
Installed Capacity	14 MW
Generator	Two 3 phase, Synchronous AC
Catchment Area	143 Km^2
Powerhouse	Subsurface; Dimension 13.10m×21.8m×31.1m
Contractor	Sino Hydro

5. Brief Description of the Project

Kulekhani III hydroelectric project with an installed capacity of 14 MW (annual energy generation of 40.85 GWh) is a cascade scheme of Kulekhani storage project (Kulekhani I and Kulekhani II hydroelectric projects) It is designed to utilize the regulated flow of Kulekhani II hydroelectric project and natural flow of Khani Khola for the generation of electricity.

Kulekhani III project utilizes a combined design discharge of 16m3/s for electricity generation. A portion of this discharge is provided by Khani Khola (2.5 m3/s) while the remaining portion of the discharge is provided by the tailrace of Kulekhani II power station at Bhaisedobhan (13.5 m3/s). A check-dam is constructed few meters downstream from the confluence of Kali Khola and Khani Khola (after the confluence it is called Khani Khola which joins Rapti River 150m further downstream) to tap the water from both the streams before being combined with Kulekhani II tailrace water. The Rs 1.08 billion contract was awarded to Sino Hydro in 2008. The company has already received Rs 300 million and has only completed 45 percent of the civil work so far. NEA failed to receive government approval to cut down 150 trees in the area for the construction of a tunnel in January, 2011, which further delayed the progress of the project.

6. EIA Summary

Physical Impacts

- The impact of downstream flow from Kulekhani III storage scheme on the Rapti River including a 4 km river section form Tailrace to bridge on the Highway is considered significant.
- The major impact on the river due to operation will be the change in width and depth of the river: likely degradation of the Rapti river due to fluctuations in water flow: and likely disturbances from human activities in the river.

Biological Impacts

- 429 numbers of trees in 1.68ha area were felled at Bokedaha CF. (250 trees from access road, 143 from dam and reservoir site, 6 from intake site, 20 from Audit A and B, 10 from Tailrace site)
- Increased demand for fuel wood and timber: Pressure will increase on Naugauli forest and Kesadi Khola forests
- Impact on Aquatic and wildlife habitat: Slash burn practices may increase and fish and wildlife species likely to decline.

7. Areas of Common Opportunities and concern for Hariyo Ban

The project area is rich in biodiversity with mixed deciduous riverine subtropical forests. The entire project area is highly disturbed due to project activities as well as mining/quarrying sites, nearby cement factory and regular traffic on the Tribhuvan Highway. Kulekhani III project construction will have significant impacts on natural landscape and its biodiversity in the area and will need active measures for conservation.

- Declining rate of fish species due the project activities, sedimentation increment and disturbances in 200m section of Khani khola
- Compensatory water flow 0.05m3/s release from Yangrang Khola during dry period for the protection of aquatic biodiversity. No downstream flow for Khani khola only for 200m section. The provision of water flow is in the range of 10% of the average flow which is not applicable for this project.

8. Proposed areas for Hariyo Ban engagement with the Project

The Kulekhani III project is situated in the Rapti River Basin. Khani Khola, a sub watershed of Rapti, and Kulekhani River are associated with the project. Rapti is a sub watershed of Narayani River Basin whereas Kulekhani is the sub watershed of Bagmati River Basin. The cumulative impact of the project activities on these river basins could be severely detrimental.
The major concerns of HBP relate with the conservation and preservation of resources existing in Kulekhani/Narayani River Watersheds and to minimize possible project impacts on livelihood in the local community.

9. Action Plan

Project Implementation Stage	Approx. time frame	Proposed Engagement/Action	Expected Result
Preparatory Phase Activities		• Elimination of water pollutant • Stop faecal substances from being dumped in the river • Monitoring of water quality • Inform, aware implementation agency. • Consultation /Discussion	Protection of fish biodiversity
Construction Phase Activities		• Minimize forest clearance • Stop illegal felling. • Monitoring of deforestation • Consultation and meeting with CFUGs/DFOa	Protection of floral biodiversity
Operational Phase Activities			
Maintenance / Rehabilitation Activities			

6. Lower Manang Marsyangdi Hydroelectric Project

1. Location

Location			Coordinates of Project Area
District	Municipality	VDC	
Manang		Tachibagar, Dharapani, Bagarchhap	Latitude: 28° 30′ 00″ - 28° 32′ 30″ Latitude: 84° 20′ 00″ - 84° 21′ 55″

2. Schedule of Implementation

Feasibility Study	Detail Design	IEE/EIA/EMP/ SIA	Construction	Operation	Maintenance/ Rehabilitation
Completed			Start: end of 2012 Projected Date of Commission: 2017		

3. Funding/Implementing Agency

Funding/Implementing Agency	
Name	Address
Butwal Power Company	Ganga Devi Marga - 313, Buddha Nagar, Kathmandu, Nepal

4. Salient Features

Type	Run of River (RoR)
Installed Capacity	141 MW
Average Annual Energy Output	735 GWh
Design discharge	52 m^3/s
Gross head	320 m
Headrace tunnel	4670 m
Power Evacuation	Inter-connection will be made to the Marsyangdi Corridor Transmission line planned by NEA at Dharapani/Manang Hub.
Access to site	Power house Site is 90 km away from Dumre a point at Prithvi Highway which is about 129 Km away from Kathmandu. Headwork site is at about 6 Km away from Power house

5. Brief description of the Project

The survey license of the project was obtained on May 25, 2009 and expired on May 24, 2011. An application for the renewal of the survey license with further power optimization has been submitted to Department of Electricity Development) on March 23, 2011. Feasibility study of the project has been carried out by Hydro Consult Pvt. Ltd (HCPL) and reviewed by Bernard Ingenieure ZT GmbH, Hall in Tirol, Austria. The Feasibility Study Report was submitted to GoN on February 25, 2011. Electrical Resistivity Tomography (ERT) survey for geotechnical investigation has been completed while core drilling investigation is ongoing and 70% is completed. Low flow measurement, sediment sampling and river-stage staff gauge reading are ongoing at the site. Contract agreement has been made with Bernard Ingenieure for Computational Fluid Dynamics (CFD) Study of Headworks on March 8, 2011 and the analyses work is ongoing. Study on Marketing and Evacuation of Power for LMMHEP has been completed. Draft Report of Land Acquisition also has been completed.

The catchments area of the project is 1694 km^2 and the elevation of catchment is from about 2100 amsl to 7800 amsl. The powerhouse of the project will be at 1770 amsl. Besisahar-Chame Feeder Road is under construction and expected to be accessible before the beginning of the construction work in the project. The powerhouse and the headwork's areas are directly connected to the feeder road. LMM HEP is a RoR project with installed capacity of 140.51 MW. The design discharge is 52 cumecs and the gross head is 320 m. Energy generated is estimated to be 734.92 GWh consisting of dry season energy of 95.87 GWh and wet season energy of 639.05 GWh. Total net sellable annual energy is 698.22 GWh.

6. Summary of EIA

Not Available

7. Areas of common opportunities and concern for Hariyo Ban

A dam construction project displaces people from their homes and land to other areas, which destroys their production systems and causes them to lose the opportunity to sustain their livelihood. If water-related development projects and programs are not able to contribute to the livelihood security of people, such projects will not get public support and they will fail simply on the grounds of public resistance, mistrust or lack of ownership (Upreti, 2007).

Proposed areas for Hariyo Ban engagement with the Project
The Lower Manang Marsyangdii Hydroelectric Project is located in the high Himalayan area of Gandaki zone in western Nepal. The Project area lies in Annapurna Conservation Area (ACA).

7. Marsyangdi Hydropower Project

1. Location

Location			Coordinates of Project Area
District	Municipality	VDC	
Tanahun			

2. Schedule of Implementation

Feasibility Study	Detail Design	IEE/EIA/EMP/ SIA	Construction	Operation	Maintenance /Rehabilitation
		EIA not available	Civil Construction Started: February, 1986 Commercial Operation Started: 5 November, 1989	In operation	

3. Funding/Implementing Agency

Funding Agency	
Name	Address
GoN	
ADB	Asian Development Bank Nepal Resident Mission Srikunj Kamaladi, Ward No. 31 P.O. Box 5017, Kathmandu, Nepal
IDA	
KFW	
SFD	

Implementing Agency	
Name	Address
Nepal Electricity Authority	Central Office, Durbarmarg Kathmandu Nepal

4. Salient Features

Project Type:	Peak-run-of-the-river
Installed Capacity :	69 MW
Average Annual Generation:	462.5 GWh
Average Annual Discharge :	210 m^3/s
Rated Turbine Discharge :	30.5 m3/s
Catchment Area :	3850 sq. km
Rated net head :	90.5 meter
Head race tunnel	7199m, 6.4m dia., concrete lined
Pressure Shaft :	75m long, 5m dia., steel lined
Surge Tank :	20.5m dia., 56m high concrete throttle shaft
Turbine Generator Set :	3 sets
Type of Turbine :	Francis
Rated Output :	26 MW x 3
Rated Speed :	300 rpm
Type of Generator :	Vertical shaft synchronous
Capacity :	30 MVA
Voltage Ratio :	11/132 KV
Power Transformer :	11/132 KV single phase, 3x 10 kva, 9 Nos.
Construction Cost :	USD 221.57 million

5. Brief description of the Project

Marsyangdi Hydropower station is a peaking-run-of-the-river type with an installed capacity of 69 MW located on the Marsyangdi River. The powerhouse was commissioned in the year 1989. Marsyangdi Hydropower Station generated 336.9 GWh of energy in this fiscal year, an increase of 40.65% compared to the last years' generation. The generation from this power station has contributed 13.92% of the total energy in the INPS. The Marsyangdi Hydropower Project successfully completed in July, 1990 with excellent construction quality on time, winning praise from senior officials and local residents of Nepal.

Major project components include diversion works and diversion weir, headrace and tailrace tunnels, powerhouse, transmission lines, substations and equipment. The project also provides for consulting engineers, technical assistance and training. A primary benefit will be derived from the generation of additional electricity for industrial, commercial and domestic consumption, and for irrigation purposes. Benefits will also be received through improvement of the distribution system, enhancement of maintenance capacity and the training of manpower. Some risk relates to possible deficient design and construction, poor management and cost overruns. Appointment of a panel of experts to review design and construction, adequate provision for supervision in close cooperation with the consulting engineer, and assignment of a claims advisor should help minimize these risks.

6. Summary of EIA

EIA not available.

7. Area of Interest/Opportunity between project and Hariyo Ban

Nepal Electricity Authority (NEA) seeks bids for equipment to modernize the 69-MW Marsyangdi and 15-MW Gandaki hydroelectric projects as part of a program to upgrade hydropower, transmission, distribution, and other renewable energy in the mountain nation. Bids are due January 20, 2010.

The Asian Development Bank (ADB) approved a US$ 65 million loan to Nepal in November for an Energy Access and Efficiency Improvement Project. The loan covers 69 percent of the project's US$ 93.7 million cost. The ADB-administered Climate Change Fund and Multi-donor Clean Energy Fund will provide another US$ 4.5 million in grants.

8. Proposed areas for Hariyo Ban engagement with the Project

For RoR projects with small reservoir it is necessary to equip the diversion dam with adequate gate size and number which will allow establishment of pre-dam stage discharge conditions at the dam site. This will allow efficient flushing of the sediment accumulated at the upstream end of the upper pool under normal operating conditions. Such flushing is necessary otherwise permanent aggradation of the river bed upstream of the diversion dam will occur. The sediment build up on the upstream of the diversion dam of the Marsyangdi Hydropower Station 5 is a good example where a permanent loss of upper pool storage volume has occurred. Studies showed the rise in the river bed by about 14 m out of a total depth of 21 m at the dam. This situation is responsible for producing at times extremely high sediment concentration in the flow entering the settling basin (up to 80,000 PPM or 80 kg/m3) reducing its trap efficiency and causing severe equipment abrasion. This is often the case with reservoirs full of sediment, at the onset of flood the saturation sediment concentration is attained for which no de-sanding structure can be designed.

8. Middle Marsyangdi Hydroelectric Project

1. Location

Location			Coordinates of Project Area
District	Municipality	VDC	
Lamjung		Bhoteodar	Latitude: 28° 08′ 20″ - 28° 11′ 50″ Latitude: 84° 24′ 18″ - 84° 26′ 51″

2. Schedule of Implementation

Feasibility Study	Detail design	IEE/EIA/EMP/ SIA	Construction	Operation	Maintenance /Rehabilitation
			Construction Started: 25 June 2001	In operation	

Description of Works	Period of Construction
Borehole Drilling at Headwork	November 19, 2002 – October 9, 2003
Excavation and Support Work of the Ventilation Tunnel	April 8, 2006 – August 16, 2003
Surge Tank Excavation and Support	March 1, 2005 – February 2006
Penstock Tunnel Excavation and Support Work	July 19, 2005 – April 2006
Excavation and Support of Power Tunnel and Surge Tank bypass Tunnel	July 19, 2005 – April 2006

3. Funding/Implementing Agency

Funding Agency	
Name	Address
KFW	
NEA	Central Office, Durbarmarg Kathmandu Nepal

Implementing Agency	
Name	Address
Nepal Electricity Authority	Central Office, Durbarmarg Kathmandu Nepal

4. Salient Features:

Installed Capacity	76 MW
Average Annual Energy Output	470 GWh
Intake Weir	4.700 m³/s
Design discharge	80 m³/s
Gross head	120 m
Headrace tunnel	5500 m
Steel penstock	470 m
Total project costs	USD 173 million
Contract value	USD 84.93 million

5. Brief description of the Project

Middle Marsyangdi Hydroelectric Project is located on the middle reach of the Marsyangdi River, some 40 km upstream of the existing Lower Marsyangdi Hydropower Plant. The project is the second largest hydro-electric project of Nepal. It is a RoR project with a reservoir for 5 hour daily peaking and has an installed capacity of 72MW with an average annual energy generation of 398 GWh. The key components of the project are: 74 m high concrete dam, reservoir area of 4.7 hectares, underground desanding basin, and 5.3 km long headrace tunnel of 5.2m diameter, a surge shaft, and a semi-underground powerhouse. Upgrading study and detailed design of pondage-run-of-river scheme with an installed capacity of 71 MW, 30 m high concrete gravity dam, surface desander, 5 km tunnel conveyance system, surge tank and underground powerhouse. The main features of the scheme comprise an intake weir including the gated spillway and a lateral rockfill dam, an underground de-sander, a headrace tunnel of 5.5 km length, a 470 m long steel penstock, a shaft powerhouse and a short tailrace tunnel.

The consultant (Engineer) Fichtner JV (FJV) was selected in the year 1999 after concluding financial and project agreements between Government of Germany, the Government of Nepal (GoN) and Nepal Electricity Authority (NEA) for the grant of Euro 178.26 million through Kreditanstalt fur Wiederaufb au (KfW). The procurement of Consulting service, Civil Works and Electromechanical Equipment was carried out through Limited Bidding system. The initial estimated Project cost in year 2000 was US$ 181.27 million equivalent to Euro 212 million at exchange rate US$1=Euro 1.17. But due to various circumstances project could not be completed within the original completion period of 43 months and accordingly the project cost and time has increased. As per the Engineer's updated project cost of February 2010 (Magh 2066), the revised cost is Euro 274.72 million which 2 million less than earlier estimate 276.5 million euro. These costs do not include Interest During Construction (IDC). Civil construction works of Middle Marsyangdi Hydroelectric Project started from June 25, 2001 (Ashad 11, 2058) with the completion target of 39 months September 24, 2004 (Ashoj 8, 2061).

6. Summary of EIA

NEA has conducted IEE study of the project during its feasibility stage in 1994. The detail EIA study was conducted in 1997 during upgrading phase of the feasibility study. These studies conclude that the project was environmentally feasible and needed stringent mitigation plan implementation and effective monitoring of the project during its construction and operational periods. This EIA study

was conducted during the tender design stage of project development that differed with the previous one due to change in project sitting and its features. Besides EIA study of this project NESS is also currently undertaking the environmental monitoring of the project.

The NEA, as it is concerned to the financial arrangement and execution of construction works of MMHEP components and subsequent management and operation, is the project proponent. As stipulated in EPR, chapter-2, Rule-4 NEA thus bears the responsibility and has prepared this EIA report of the MMHEP in accordance with Rule- 7 and schedule-6 of the EPR for its approval from Electricity Development Department, Ministry of Water Resources, and MoSTE. This EIA study was limited to explore environmental consequences of the implementation of different components of MMHEP in the prevailing biophysical and social environment. Environmental mitigations works were carried out by NEA as per Environment Mitigation Action Plan (EMAP). These works were audited by TAEC/NESS JV-Environment Consultant of MMHEP and have been accepted for its compliance. The main impacts of the project outlined in the EIA study are:

- It is estimated that the project will bring permanent land-use changes in 64.176 ha of land of which 31.28% is agricultural land. Riverine Zone including flood plain comprises 46.48% and the remaining consists of grassland and shrub land areas.
- It is estimated that 3,475 numbers of trees will be cut down during construction from the occupied agricultural, grass land and shrub land areas.
- It is estimated that 306 households will be affected by the project due to permanent and temporary land and property acquisition. Out of the total 68 households will be affected by temporary acquisition and 238 households by the permanent acquisition. Of the 238 households 122 households will be affected seriously whereas 116 will be impacted marginally. Of the 122 seriously project-affected households, 49 families will need relocation because of the acquisition of their residential premises or business establishments.
- Water diversion by the dam (55 m height) at Phalia Sangu is envisaged to bring substantial physical changes in the river hydrology and riverbed morphology in the operational phase. Nearly 3.2 km stretch of the river above dam will be converted into a reservoir and will be the site for main sediment receptor. The dam and before the confluence of Dordi Khola, the implications are more acute in the stretch of 4.5 km.

9. Super Madi Hydroelectricity Project

1. Location

Location			Coordinates of Project Area
District	Municipality	VDC	
Kaski		Namarjun, Parche	28° 19′ 02″ - 27° 21′ 39″ N 84° 04′ 45″ - 84° 08′ 34″ E

The head works is located at the foothill of Sikles village and the powerhouse is located just opposite of Sodha village about 23 km north-east of Pokhara.

2. Schedule of Implementation

Feasibility Study	Detail Design	IEE/EIA/EMP/ SIA	Construction	Operation	Maintenance /Rehabilitation
Survey and feasibility study ongoing		EIA Not Available	Period: 4 years		

3. Funding/Implementing Agency

Funding/ Implementing Agency	
Name	Address
Himal Hydro and General Constructi on Ltd	Chhauni Housing Complex Bahiti (Near Sitapaila Chowk) Kathmandu Nepal

4. Salient Features:

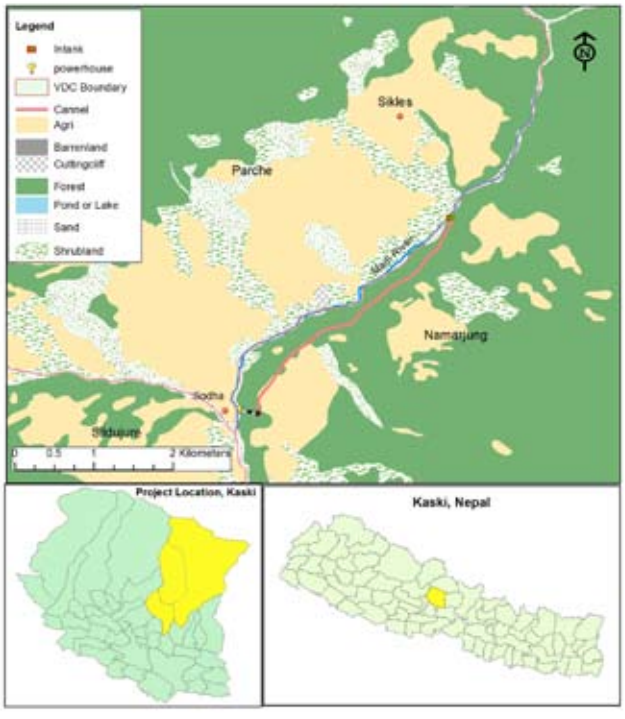
Installed Capacity: 44 MW	Headrace Tunnel Length: 5905 m
Catchment Area: 284.1 sq km	Penstock Tunnel Length: 38 m
Average Annual Generation: 243 GWh	Penstock: Exposed Steel, Length 1381 m, Average Diameter 2.6 m
Mean Annual Discharge: 30.29 cubic m per second	Surge Tank: Circular Underground, Height 37 m, Diameter 9 m
Design Flood Discharge: 1288 cubic m per second	Turbines: Three Pelton Turbines, 89.5% Rated Effeciency
Type of Weir: Free Overflow with Spillway	Powerhouse: Semi Surface, 52 m (L) x 14 m (B) x 28 m (H)
Funding: Private Company Project	

5. Brief Description of the Project

This project is a simple RoR scheme that utilizes the flow in Madi River. Madi River is one of the major tributaries of the Narayani River of the Gandaki basin after mixing with the Seti River. The proposed project has installed capacity of 44MW, design discharge of 18m3/sec and net head of 295m. The head works is located at the foothill of Sikles village and the powerhouse is located just opposite of Sodha village. The project lies about 23 km north-east of Pokhara. At present there is about 16km long earthen road access towards the project from Pokhara City.

6. EIA Summary

Not Available



Super Madi Project

10. Tanahun Hydropower Project

1. Location

Location			Coordinates of Project Area
District	Municipality	VDC	
Tanahun	Vyas Municipality	Kahun Shivpur	27°45'00"N to 28°30'00" N 84°00' E to 85°00" E

2. Schedule of Implementation

Feasibility Study	Detail Design	IEE/EIA/ EMP/SIA	Construction	Operation	Maintenance /Rehabilitation
July 2001 (as Upper Seti HEP) Upgrading feasibility study: 2006/07 (NEA)	Detail Engineering Design: completed in 2012 15 Months	PAF Study: 2003 (NEA) 2006 (JICA) EIA Study: 09/03/2010 - 17/09/2011	Construction of access road bridge, upgrading of existing road and camp facilities: 12 months Total construction period from commencement of detail engineering design: 72 months Scheduled to commence in 2014	Scheduled to be in operation by 2020	

3. Funding/Implementing Agency

Funding Agency	
Name	Address
NEA	Central Office, Durbarmarg Kathmandu Nepal
ADB	Asian Development Bank Nepal Resident Mission Srikunj Kamaladi, Ward No. 31 P.O. Box 5017, Kathmandu, Nepal

JICA	JICA Nepal Office Block B, Karmachari Sanchaya Kosh Building, Hariharbhavan, Lalitpur, Nepal (P.O.Box 450, Kathmandu, Nepal)
European Investment Bank (EIB)	
GoN	
Implementing Agency	
Name	Address
Nepal Electricity Authority	Tanahun Hydro Department of Electricity NEA Training Center Kharipati, Bhaktapur

4. Salient Features

Installed Capacity: 140 MW	Annual average energy: 607GWh
Reservoir : 7.26km^2 , 18 km long along the Seti river	Intake: Sloping type single surface with invert elevation 371masl.
Dam: 140m high roller concrete gravity dam, crest width 6.6.m, length of 170. At the dam crest, elevation of 420masl.	Headrace Tunnel: 927m in length, 7.8m in diameter
Diversion Tunnel : Design flood-994.6m2/s, 2 tunnels length of 712cm, 881m diameter	Penstock: Underground Tunnel type, single, inner diameter 5m to 3.1m, total length 195m
Powerhouse:Underground 90m (L) x 22m (W) x 42 m (H) size in rock comprising of 140MW vertical axis turbines	Tailrace Tunnel: Tail water level 289.2m, length 320m, diameter 8.2m
Turbine Type: Maximum discharge 127.4, vertical axis 2 Francis Turbine	Switch yard: Type: GIS Single BUS Voltage 220kv
Transmission Line: A 40 km double circuit, 220kv	Design Discharge: 127.4m3/s
Access Road and Project Road:3km access road from village Patan to the dam site, and 3.8km project road in the project area	Expected Approximate Expenses: USD 450 Million
Funding: USD 150 Million soft loan from ADB, USD 184 Million soft loan from JICA, USD 100 Million soft loan from European Investment Bank and Abu Dhabi Trust	

5. Brief description of the Project

The project dam is located near Damauli Bazar at Vyas Municipility and Kahun Shivapur VDC on the left and right banks of Seti River respectively. The powerhouse is located in Vyas Municipality and Kahun Shivapur VDC. The project impact area covers 387.53km^2 of 8 VDCs (Bhimad, Chhan, Jamune, Kotdarbar, Kahun, Shivpur, Rising Ranipokhari, Majhkot, Pokhari Bhanjyan) and Vyas municipality. The detail survey of the project was carried out by JICA. This project is of high importance for power consumption and system management. It is a reservoir based project, which is good for peak hour demand of electricity. This storage type of project has been identified as a national priority project by the government and recommended for further implementation by national budget. The project loan expected to be approved in February to mid March 2013.

6. EIA Summary

The feasibility study of the project was conducted by NEA in July 2001. Scoping and ToR of the project was approved in January 2003. The Environmental and Social Studies Department (ESSD) of NEA is responsible for EIA studies but initially one of the departments, Soil, Rock and Concrete Laboratory (SRCL) of NEA has completed EIA study in July 2004. For reviewing and upgrading EIA study, ESSD has been assigned. The EIA report was prepared as per the EPR 1997. The main impacts associated with the project are following:

Biophysical Environmental Impacts

- The expansion of river on 726 ha area over an approximate 18 km stretch along the Seti River has assumed changed on microclimatic condition.
- Loss of 422 ha forest area has been considered major impact of the projects. A total of 296.05 ha of Mixed Hardwood Forest of the project area will be affected particularly 73.92 ha of Sal forest and 52.62 ha of Khair Sisso forest.
- Destruction of large area of forest, natural habitat of wildlife species have been considered as a major impact.
- The 2 km section of the rivers will be blocked for fish migration, spawning and submerged riverine habitat.

Socioeconomic and Cultural impacts

- The project will affect 151.22ha agriculture land and loss of 660 metric ton of annual agricultural production.
- The livelihood of the local people in the project impact areas will be affected since majority of people are engaged in agriculture.
- Total 86 HHs will be affected from the project implementation. Approximately 900 persons will be displaced from the project.

7. Areas of common opportunities and concern for Hariyo Ban

The implementation of project will reduce power demand supply, direct economic benefit to GoN through royalties and revenues, direct benefit for local people with employment and business

opportunity, rural electrification and reliable power supply during peak demand and infrastructure improvement in the area. The concern for Hariyo Ban is the impact on 460 ha forest area of nine government, community and private forests. Similarly, 422ha forest area at project site and reservoir area will be lost. The direct impact of project construction on 36 fish species (6 long distant migrant, 7 midrange migrant and 23 resident species) is the major conservation issue. The project site and surrounding area is habitat to 11 floral species and 15 mammals listed under the conservation category of GoN, CITES and IUCN Red Book. Six species of fish existing in the Seti River are listed in the IUCN Red Book out of which *Tor putitora* is endangered and *Schizothorax richardsonii* is listed as vulnerable. The project's impacts are identified as changes to microclimatic conditions, degradation of vegetation and forest, disturbance and loss of natural habitat of wildlife biodiversity and impact on fish species.

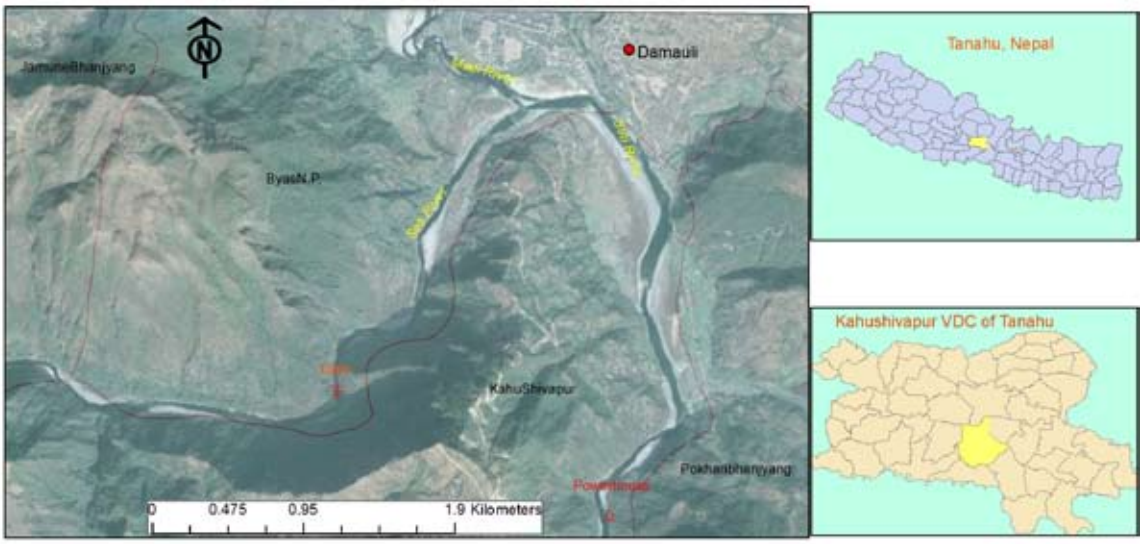
8. Proposed areas for Hariyo Ban engagement with the Project

The proposed engagement activities of Hariyo Ban within the Tanahun Hydroelectric project are:

- To reduce encroachment/fragmentation and degradation of wildlife habitat
- To minimize pollution of aquatic environments, loss of aquatic habitat and changes in river flows
- To reduce effects of changing patterns of microclimatic condition
- To improve livelihood and agriculture practices of local people
- To engage vulnerable groups during the project construction

9. Action Plan

Project Implementation Stage	Approx time frame	Proposed Engagement/Action	Expected Result
Preparatory Phase Activities			
Construction Phase Activities • Site clearance • Removal of river boulder, diversion of river • Displacement of 86 families from the project area • Dam construction • Loss of land and property		• Avail Biodiversity/Forest Expert during site clearance • Monitoring of water quality and fish species • Community meetings • Monitoring downstream riverine habitat • Community meetings	
Operational Phase Activities • Expansion of reservoir in 7.26km^2, 18 km stretch along Seti river		• Conduct research study on livelihood and cropping pattern of the local communities.	
Maintenance / Rehabilitation Activities			



11. Rani Jamara Kulariya Irrigation Project

1. Location

Location			Coordinates of Project Area
District	Municipality	VDC	
Kailali	Tikapur	Pathraiya, Durgauli, Janakinagar, Pratap-pur, Baliya, Munuwa, Dhansinghpur, Narayanpur, Chuha VDCs	Latitude 81°03′ 00″ to 81° 15′ 00″ Longitude 28° 25′ 00″ to 28° 42′ 00″

2. Schedule of Implementation

Feasibility Study	Detail Design	IEE/EIA/EMP/SIA	Construction	Operation	Maintenance /Rehabilitation
1994		Initial Environmental Examination (IEE) conducted by ERMC Ltd.		Scheduled to be completed in 6 years of commencement	
		IEE approved by the Ministry of Irrigation (MoI) in October 2010			

3. Funding/Implementing Agency

Funding Agency	
Name	Address
Department of Irrigation	Jawalakhel, Lalitpur
Implementing Agency	
Name	Address
Rani Jamara Kulariya Irrigation Project Department of Irrigation	Unit Office Room No. 427 DoI Building Jawalakhel, Lalitpur

4. Salient Features

Name of the River: Karnali		Type of Source: Snow fed perennial	
Gross Command Area:	24000 ha	Cultivable Command Area:	20400 ha
De- silting basin: of intake (size 800 m * 50 m)	5100m d/s	Total Project Cost:	NRs 12.78 billion
Population in Command Area:	157092 (in 2006)		

5. Brief Description of the Project

Rani, Jamara and Kulariya Kulo Irrigation Project is a cluster of three independent systems (Rani, Jamara and Kulariya) and were constructed by local farmers (mostly Tharus). This project is to provide assured year round irrigation to 24,000 ha agricultural land in the right bank of Karnali River and also protect the command area from erosion and siltation by Karnali River. This project will rehabilitate and modernize the existing canals; Rani (20 km), Jamara (16 km), and Kulariya (16 km) branch canals, by providing necessary control and regulating structures. It is a cluster of three independent Kulos each with separate inundation-type intakes from a sub-course of Karnali River - locally called as Kaudiya Nallah and an extensive canal infrastructure with 41 branch and sub-branch canals. There are three Water Users Associations (WUA) and one Central Committee (Federation) that links the three systems together.

6. IEE Summary

The direct project impact area is bound by Karnali River in the east, Kandra River in the west, East-West Highway in the north and India-Nepal boarder in the south. The major impacts of the project are summarized below:

- The command area (24000 ha) lies within the settlement area with public roads, foot trails and domestic animal trails in several places. The construction of irrigation canal may disrupt accessibility of local people and domestic animals across canal.
- Loss or degradation of farmland and productivity
- The construction activities such as site clearance, earthwork excavation, spoil disposal, quarrying and burrowing might disturb natural slope stability.
- Consequent removal of riverbed materials accelerates soil erosion, landslide, mass wasting, slope failure and disturbance in natural drainage patterns, water logging and water pollution, change in river morphology, and/or further deepening of riverbed.
- Forest degradation and loss of vegetation for timber and fuel wood, and encroachment of forest.
- Disturbance and threat on rare, endemic, endangered, protected and threatened species of flora and fauna due to construction activities

7. Areas of common opportunities and concern for Hariyo Ban

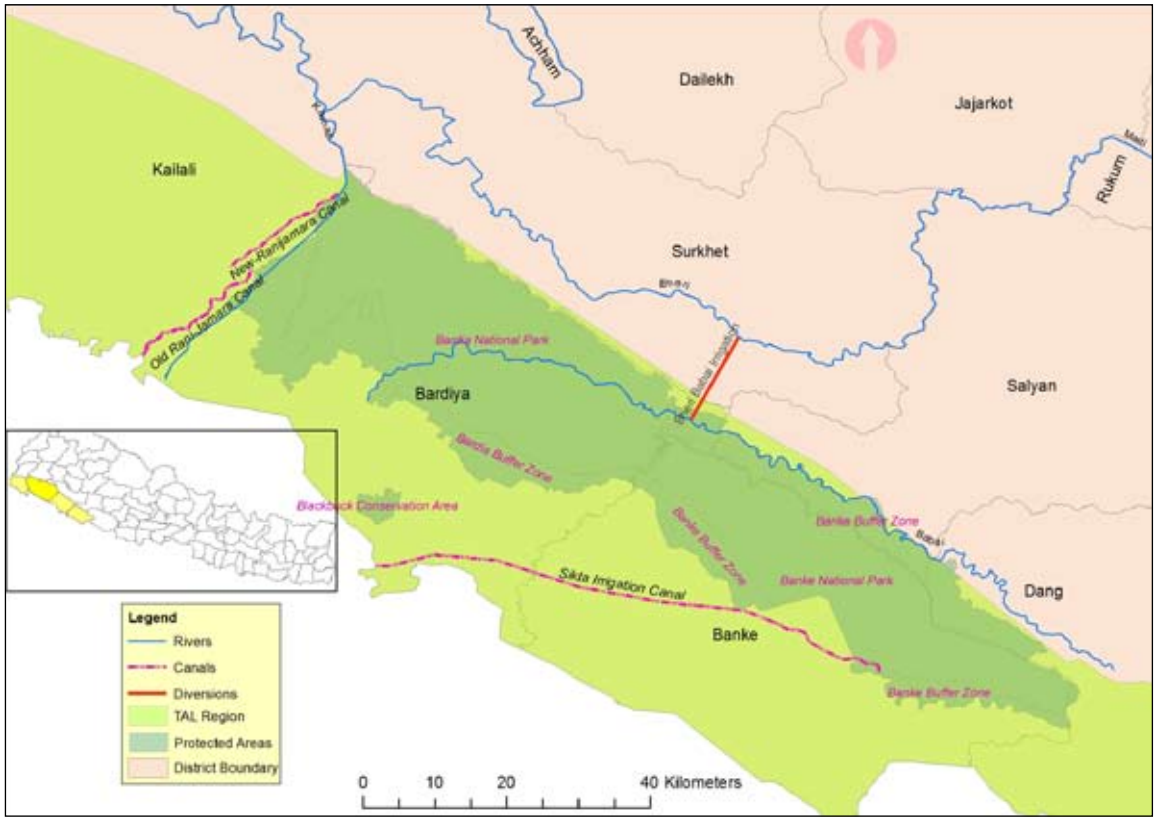
- This project benefits the local people who are deprived of irrigation facilities and this project will enhance the livelihood options of the local people since agriculture related investment will increase.
- The project area is surrounded by Patharaiya River on the west, Mohana on the South, Kaudiyanala (Karnali West Branch) on the East and forest boundary on the north. This area is rich in terrestrial and aquatic biodiversity and natural ecosystems which is the major concern for the Hariyo Ban.
- The project disturbs the habitat of local fish, mainly the movement of dolphins (endangered species) in the intake of main canal.
- Wildlife habitat and the movement will be severely restricted due to the canal.
- Other potential impacts leading to biodiversity loss can be illegal poaching and over-exploitation of plants, and potential conversion of forestland (existing community forests) to agricultural land.
- Disturbance and change in landscape, land-use, drainage etc. will be caused by disposal of materials obtained from excavation during construction activities Heavy sedimentation may occur in the canal stream which inundates the total agricultural land creating pressure on agricultural system.

8. Proposed areas for Hariyo Ban engagement with the Project

- Conservation of endangered species like dolphin, and forest products.
- Focus on the movement of wild animals of Bardia National Park (BNP) as canals may restrict their movements.
- Safe means of movement (seasonal/annual) for wildlife for passage across canals and dams, such as fish ladders and flyover bridges where appropriate.
- Control of illegal poaching and over-exploitation of plants.
- Assurance of year round drinking water facilities for wild animals
- Monitor and discourage encroachment, deforestation and degradation of forest resources
- Landscape management at local level throughout the project period.

9. Action Plan

Project Implementation Stage	Approx time frame	Proposed Engagement/Action	Expected Result
Preparatory Phase Activities			
Construction Phase Activities • Extraction of river bed materials • Changes in landscape • Loss of forest resources • Illegal hunting and poaching of wild animals		• Preservation of aquatic habitat (mainly endangered species) • Afforestation in the affected areas. • Perpetuation of habitat of wild species	• Aquatic species will be preserved. • Increase in greenery and protection of water resources.
Operational Phase Activities • Diversion of water changes the route of fish movement • Inundation of agricultural land and effect on livelihood due to overflow of water (summer season). • Disturbance in the movement of wild and domestic animals			
Maintenance / Rehabilitation Activities			



12. Sikta Irrigation Project

1. Location

Location			Coordinates of Project Area
District	Municipality	VDC	
Banke	Nepalgunj Municipality	34 VDCs	Latitude: 28° 00' to 81° 14′ Longitude: 81°30′ to 81° 57′

2. Schedule of Implementation

Feasibility Study	Detail Design	IEE/EIA/ EMP/ SIA	Construction	Operation	Maintenance/ Rehabilitation
	Year I		Year I: Detailed construction surveys and construction designs, tender procedures, land acquisition process started	Scheduled to be completed in 7 years of commence ment	
			Year II- IV: Irrigation infrastructure construction completed Year V: Secondary canal system completed Year VI- VII: Iinstitutional development processes completed, agricultural support programme implemented		

3. Funding/Implementing Agency

Funding Agency	
Name	Address
Department of Irrigation	Jawalakhel, Lalitpur
Implementing Agency	
Name	Address
Department of Irrigation	Unit Office Room No. 427 DoI Building Jawalakhel, Lalitpur

4. Salient Features

Name of the River:	West Rapti
Type of Source:	Perennial
Gross Command Area:	36000 ha
Cultivable Command Area:	33766 ha
Population in Command Area:	157092 (in 2006)
Pond Level:	173 m
Diversion Structure:	Weir cum Bridge
Height of Weir:	5 m
Total Width of the Diversion Weir:	372 m
Idle Canal Length:	32 km
Main Canal Length:	46 km
Number of Households in Command Area:	46715
Total Project Cost:	NRs. 7.3 billion

13. Petroleum Exploration

1. Location

Location		
District	**Municipality**	**VDC**
Kanchanpur, Kailali, Bardia, Banke, Dang, Kapilvastu, Rupandehi, Nawalparasi, Chitwan, Bara, Parsa, Rautahat		

2. Schedule of Implementation

Feasibility Study	Detail Design	IEE/EIA/EMP/ SIA	Construction	Operation	Maintenance /Rehabilitation
Petroleum Exploration Promotion Project (PEPP)-1982		Not Available			

3. Funding/Implementing Agency

Implementing Agency	
Name	Address
Department of Mines and Geology	Lainchaur, Kathmandu, Nepal

4. Salient Features

Block 1 (Dhangadhi): 4941 sq km block in Kanchanpur and Kailali Districts, leased to Cairn Energy for exploration.	Block 2 (Karnali): 4838 sq km block in Kailali and Bardiya Districts, leased to Cairn Energy for exploration
Block 3 (Nepalgunj): 4908 sq km block in Banke and Dang Districts, leased to Texana Resources Company for exploration.	Block 4 (Lumbini): 4965 sq km block in Dang, Kapilvastu and Rupandehi Districts, leased to Cairn Energy for exploration.
Block 5 (Chitwan): 4945 sq km block in Chitwan, Nawalparasi and Rupandehi Districts, leased to Texana Resources Company for exploration.	Block 6 (Birgunj): 4880 sq km block in Bara, Parsa, and Chitwan Districts, leased to Cairn Energy for exploration.
Block 7 (Malangawa): 4920 sq km block in Bara and Rautahat Districts, leased to Cairn Energy for exploration.	

5. Brief description of the Project

Petroleum exploration in Nepal started in 1982 as a World Bank initiative, the Petroleum Exploration Promotion Project (PEPP), which was developed with the technical and financial assistance of World Bank, under the Department of Mines and Geology.

In Nepal, there are two sets of enabling legislations governing the negotiation, conduct of petroleum related operations and the fiscal treatment of these activities:

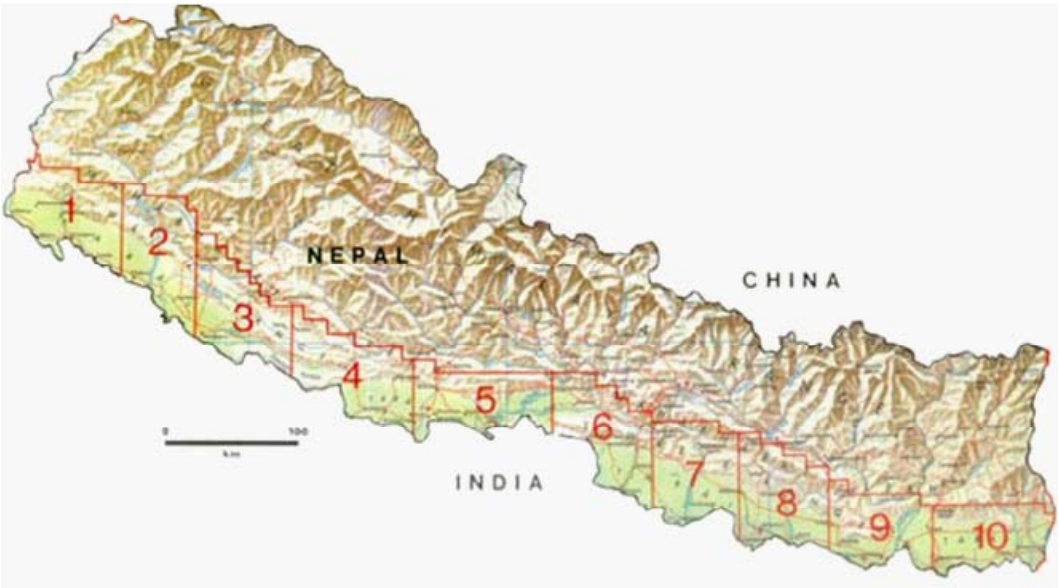
I. Nepal Petroleum Act, 2040 (1983), and
II. Petroleum Regulation, 2041 (1985), the Petroleum (First Amendment) Regulation, 2046 (1986), and Petroleum (Second Amendment) Regulation, 2051 (1994)

By 1985, southern Terai plains and the adjoining Siwalik Range had been divided into 10 different blocks, each of approximately 5000 sq km for petroleum exploration. In 1986, Shell Netherlands bored a single drill hole in Block 10 in Eastern Nepal but abandoned its project when the 3520 m borehole near Biratnagar recorded dry. In December 1998, Texana Resources Company (USA) was awarded the rights to carry out seismic and geological studies in Block 3 and 5. In 2004, Blocks 1,2,4,6, and 7 were awarded to Cairn Energy (UK). Texana postponed its exploration activities in 2000 citing political and security reasons. Similarly, Cairn Energy postponed its work for four years to resume in December 2009. Most recently, both companies have filed 'force majeure' in June, 2012 citing bureaucratic hurdles and lack of co-operation from the government. Currently, the work in all 7 exploration blocks has been suspended. Both companies have decided to abandon their exploration in Nepal, and Texana is reportedly considering international arbitration against Nepal Government for the noncompliance of agreed terms.

The remaining Blocks (8, 9 and 10) were awarded to BBB Champions Oil (USA) and its partner Emirates Associated Business Group (UAE) for exploration on July 5, 2012.

6. EIA Summary

EIA Not Available



Petroleum Exploration Lease Block Outline (Blocks 1-10). Source: Department of Mines and Geology

14. Besisahar-Chame Road

1. Location

Districts: Lamjung, Manang

2. Funding/ Implementing Agency

Government of Nepal through Nepal Army

3. Salient Features

Length:	approx 68 km
Construction:	Heavy equipment and widespread use of explosives
EIA/SIA:	Not available.

4. Brief description of the Project

This valley aligned road links the district Headquarters of Lamjung with the district HQ of Manang. This also coincides with the world famous trekking route across the Annapurna range connecting Lamjung with Muktinath and Jomson in Mustang. This is being constructed through the Nepal Army (NA), with vehicular traffic reaching Manang in early 2013. The road is still in the early stage of development with only limited single lane width excavated through highly rocky terrain. Environmental measures are not yet in place. Detailed information about this road is not available in the public domain.

5. Environmental Impacts/Issues

The major environmental impacts/issues observed during the field trip are as follows:

Disposal of Spoils: Inappropriate spoil disposal was observed as one of the biggest physical environmental problems in Besisahar-Chame road. Large boulder, pebbles, aggregates were found haphazardly disposed within the Marsyangdi River itself which has changed the river morphology creating the risk for downstream settlements, hydropower stations as well as other infrastructures through obstructed flow and possible floods.

Water and air pollution: Large volume of construction materials deposited on the bank of river and road site mass wasting was found increasing along the river leading to degradation of the water quality of the river. Similarly due to the movement of vehicle and new construction, dust pollution was notable in the vicinity, significantly impacting long standing tourist attraction of the area.

Long term slope instability and increased sedimentation: The rock excavation has been carried out using uncontrolled explosion approaches. This is highly detrimental to long term slope stability. The nature of slope cut show risk of long term and continuous slope failures (rock falls, slope failures etc) putting the terrain, road users and local communities at risk.

The fresh cut and filling in the road sites accelerated landslides and erosion which ultimately increases downstream sedimentation in the river. This could also impact the hydropower projects along and downstream of the heavy cutting areas of the road alignment.

Risk of GLOF: The local people's concern about the GLOF events in the Marsyangdi River showed that the impact of the road construction may enhance flooding due to change of river morphology. The large rocks excavated during road construction have been found blocking main river channel at different places. The riverside settlements, land holdings and infrastructures are exposed to enhanced risk from GLOF events.

Easier access to local forests: Construction of road has contributed to the development of market centers and road side settlements. This will exert pressure on forest resources. Forest degradation is observed due to increasing demands of forest products, illegal felling/cutting of poles and trees.

Possible increment of poaching and smuggling activities: The road is sensitive for ANCA and there is possibility of poaching and smuggling activities of wild animals and forest products due to increased demands from road users. It was reported during local interviews that hunting by locals is nonexistent at present due to strict gun control and awareness. However, with easier access, illegal poaching and hunting activities might be encouraged.

6. Social Impacts/Issues

Encroachment of land and private property: According to the local people, private land acquired by the road project has not been compensated. It is found that the road has not developed with proper consideration for project affected families.

Decrease numbers of trekkers: Operation of the road is noted to have resulted in decreasing trend

in number of travelers. Trekkers have difficulty to trek due to destruction of existing trekking route. Usually, travelers used alternative route to visit Manang and adjoining areas.

Road safety: The road is unsafe for vehicles, travelers, local people and livestock movement at the moment. During the construction, explosives were liberally used for breaking rocks. These activities have shaken and cracked the natural slope exposing the areas to prolonged slope instabilities.

Reduction in local markets and economy: Due to direct vehicular access from Besisahar to Chame, most of the tourist or travelers are using available transportation facilities. Presently, local markets are depending on occasional trekkers and local visitors. Thus, the local market and economy is found in decreasing trend.

Declining aesthetic value: The natural landscape along the Besishar to Chame road has changed local ecology including land use pattern, hydrology, trekking routes which are eventually declining the aesthetic and wilderness value of the area.

7. Areas of common opportunities and concern for Hariyo Ban

The road was constructed by the Nepal Army, and as per the community consultations carried out, this was done without serious consideration for social and environmental impacts or their mitigation. Reimbursement was not provided to affected families for the land acquired for the construction. Spoils were disposed directly into the Marsyangdi river valley, without any consideration for sedimentation issues, or the impacts on settlements and projects downstream. The road in its current state is incomplete and unsafe for public transport though public vehicles ply regularly. The exotic flora and fauna of the project area are extremely important for biodiversity, and need to be protected from increased risk due to easier access.

8. Proposed areas for Hariyo Ban engagement with the Project

The road development offers areas of significant interest for Hariyo Ban. The Program can engage with Nepal Army (who is also involved in other access opening projects throughout the country) to formulate a co-operation mechanism, where Hariyo Ban could work with Nepal Army in matters of environmental and social impact minimization and mitigation. The priority of HB could be to co-operate and assist as much as possible to achieve common environmentally friendly goals, and these objectives could be of interest to NA. The Ministry of Defence could be approached to achieve required coordination with Nepal Army.

If an collaborative arrangement is acceptable, Hariyo Ban could engage with Nepal Army in minimizing use of explosives in construction by application of suitable alternatives, proper disposal of spoils, factors to be considered during alignment design, arrangements for protection of wildlife and forests after project implementation, social impact mitigation and reimbursement for loss of land, road safety measures etc.

15. East West Postal Highway Project

1. Location

Location			Coordinates of Project Area
District	Municipality	VDC	
Kanchanpur, Kailali, Bardia, Banke, Dang, Kapilvastu, Rupandehi, Nawalparasi, Chitwan, Parsa, Bara, Rautahat			

2. Schedule of Implementation

Agreement	Detail Design	IEE/EIA/EMP/ SIA	Construction	Operation	Maintenance /Rehabilitation
15 January 2010		IEEs approved EIA not available	Phase I - ongoing Phase II Phase III		

3. Funding/Implementing Agency

Funding Agency	
Name	Address
Government of India	
Implementing Agency	
Name	Address
	Project site offices in Nepalgunj, Hetauda, Janakpur and Itahari

4. Salient Features

Total Length: 1450 km	Phase I: 19 roads, 605 km, 3.75 m width blacktopped
Features: Black Topped, All weather	Phase II: 835 km, two lanes
No. of Bridges: 63	
Estimated Cost: Rs 50 billion	

5. Brief description of the Project

Under the Nepal-India Cooperation Program, the Government of India pledged to fund the upgrade of E-W Postal Highway in Nepal parallel to the existing Mahendra Highway. The agreement was signed in New Delhi on January 15, 2010.

As per the agreement, the Government of India will fund the construction of the Highway, while the Government of Nepal will build bridges along the proposed alignment, develop infrastructures like water and electricity supply systems, and compensate for relocations/resettlements. The project will be implemented in three phases. The construction of 19 roads under phase I is currently ongoing.

6. EIA Summary

EIA is not available.

16. North South Fast Track Project

1. Location

Location		
District	Municipality	VDC
Kathmandu, Dhading Makwanpur, Bara		

2. Schedule of Implementation

Feasibility Study	IEE/EIA /EMP/ SIA	Pre- Construction	Construction	Operation
Feasibility Studies and Preliminary Design- May 2008		Land Acquisition and Resettlement: 12 Months	Proposed Civil Works Schedule • Earthworks: Month 1- 30 • Pavement: Month 28- 51 • Tunnel: Month 1- 46 • Bridge: Month 1- 46 • Culvert and Underpass: Month 1- 33 • Interchange: Month 1- 46 • Roadside and other facilities: Month 31-53 • E-W Highway: Month 1- 25 • Hetauda Connector: Month 1-25 Total Civil Works: 53 Months	

3. Funding/Implementing Agency

Funding Agency	
Name	Address
Implementing Agency	
Name	Address

4. Salient Features

Alignment

- Originates at the proposed Outer Ring Road in Kathmandu
- Sanokhokana-Mukhpanibasti (km 0-9)
    - 3 bridges along the way, through Kuipu, Naikhandi, Pakachown, Danuwargaun, Simpanibasti (elev 1240 m)
- Simpanibasti-Thingan (km 9- 29.8)
- Thingan-Nijgadh (km 29.8- 76)
    - Budne (km 48)- Grade separated intersection/ junction proposed for Hetauda Connector Road
    - Connect to East West Highway by an interchange in Nijgadh
- Hetauda Conector
    - 18 km
    - Single carriageway, two lanes
    - 50 m RoW to allow for possible future widening
    - Budune-Phurkechaur-Bhulbhula-Hatiya to join the Tribhuwan Rajpath
- Kathmandu-Nijgadh (main line)
    - Asian Highway Standard Class 1, two carriageways- each of two lanes
    - Shoulder width of 2.5 m and 2.0 m proposed for rolling/plain and mountain/steep terrain
    - Lane width: 3.5 m
    - 40 m RoW
- Estimated Cost for four lane track: NRs77430.5 millions/USD 1055.0 millions (current in 2008)

5. EIA Summary

EIA/SIA not available. Feasibility Studies and Preliminary Design (2008) available.

Selected Alignment Map: Kathmandu- Terai Fast Track with the Hetauda Connector

17. Thoche-Larke District Road Project

1. Location

			Coordinates of Project Area
District	Municipality	VDC	
Manang		Thoche	

2. Schedule of Implementation

Feasibility Study	Detail Design	IEE/EIA/EMP/ SIA	Construction	Operation	Maintenance /Rehabilitation
		EIA submitted			

3. Funding/Implementing Agency

Funding Agency	
Name	Address
Implementing Agency	
Name	Address
District Development Committee, Manang	Chame, Manang

4. Salient Features

Location	
Start Point	Thoche village of Thoche VDC, Manang District
End Point	Larkepass in Thoche VDC, Manang District
Geographical Features	
Terrain	Hilly
Alignment	River Bank
Climate	Temperate, Cool Temperate and Alpine
Soil	Alluvial, colluvial and residual
Classification of road	District "A" Road
Length of road	32 km (lies within the Annapurna Conservation Area)
Standard of Pavement	Earthen
Traffic Forecast	25 vehicles per day
Design Speed	20 km per hour
Major settlements	
Name of settlements	Thoche, Tiliche, Goa, Bhaisikharka, Bhimtang
VDCs along the road	Thoche
Cross-section	
Right of way	15.0 m on either side of the road
Formation width	5.0 m having 5% outward slope
Carriage way	3.0 m
Earthwork	
Cutting	1813121.54 m^3
Filling	99620.61 m^3
Project Cost	
Net Cost (NRs.)	Rs. 265600000.00
Cost per km. (NRs.)	Rs. 8300000.00
Employment generation (Total person days)	
Skilled	33762
Unskilled	513760
Total employment generation (no. of laborer) for 90 working days	
Skilled	375
Unskilled	5708

18. Mechi-Mahakali and Kathmandu-Pokhara Railway Project

1. Location

Recommended Alignments /Sections	Important Points in the Section
Mechi-Mahakali section Section-1 – From Gaddachoki to Mahadevpuri - 202.665 Km Section-2 – From Mahadevpuri to Mahuwa - 139.163 Km Section-3 – From Mahuwa to Tamsariya - 123.500 Km Section-4 – From Tamsariya to Chandranigahapur - 176.937 Km Section-5 – From Chandranigahapur to Lahan - 119.129 Km Section-6 - From Lahan to Kakarbitta - 183.850 Km	Gaddachowki Mahandranager Attariya Tikapur Ghorpatta Baidi Kohalpur Mahadevpuri Lamahi Bhalubang Shivapur Butwal Tilakpur Tamsariya Kalyanpur Simara Chandranigahapur Bardibas Lahan Rajbiraj Itahari Damak Birtamod Kakarbitta
Pokhara-Kathmandu section	Pokhara
Section-7 – Tamsariya to Abukhaireni (Connection between Mechi-Mahakali and Pokhara-Kathmandu Railway lines) - 71.729 Km Section-8 – From Pokhara to Kathmandu - 187.083 Km	Damauli Abukhaireni Belakhu Kathmandu

2. Schedule of Implementation

Feasibility Study	IEE/EIA/EMP/SIA	Construction	Operation	Maintenance /Rehabilitation
		Pokhara-Kathmandu & Tamsariya-Abukhaireni sections -9 years		
		Pokhara-Kathmandu & Tamsariya-Abukhaireni. Simara-Kakatvitta -7 years		

3. Salient Features:

Route Length	
From Mechi to Mahakali (Section-1 to Section-6)	945.244 Km
From Pokhara to Kathmandu (Section-8)	187.083Km
From Tamsariya to Abukhaireni (Connection between Mechi-Mahakali and Pokhara-Kathmandu Electrical Railway)	71.729 Km
Connection s with Indian Border Towns	113.419 Km
Total Length	1317.475 Km
Formation	
Formation Width for Embankment for Single Line	6.85m
Slope on Embankment	2.0 (H) : 1.0 (V)
Formation Width for Cutting for Single Line	6.25 m
Slope of Cutting	1.0 (H) : 1.0 (V)
Bridges	
Standard of Loading	MBG-1987 Loading
Total no. of Bridges	1870
No. of Major Bridges	401
No. of Minor Bridges	1469
Length of Longest Bridge and location	
i) Mechi-Mahakali, Tamsariya-Abukhaireni and Connections with Indian border town	1250.40m, over Kaligandaki Nadi
ii) Pokhara-Kathmandu	1295.4m, over Madi Nadi
Road Crossing	
Total No. of Road Crossings	686
No. of Manned Level Crossings	340
No. of Road Over Bridges	19
No. of Road Under Bridges	327
Project Cost	
Total Capital cost of Fixed Infrastructure	NPR 65414 Crores
Total Capital cost of Rolling Stock (2019-20)	NPR 4973 Crores

4. Brief description of the Project

Total length of the Recommended Alignment is 1317.475 Km. There are in total 4 Terminal Stations, 9 Junction Stations, 1 Custom Station and 122 Intermediate Stations on the network.The elevation ranges from 80m to 120m in Mechi- Mahakali alignment and 800m to 1300m Pokhara -Kathmandu alignment respectively. The rack structure in a Railway system consists of rails, sleepers, fastenings, ballast, turnouts etc. For axle load of 22.9 tonne, 60 Kg 90 UTS rail will be provided. Main line track will be provided with Long Welded Rails (LWR). Pre stressed concrete (PSC mono block) sleepers are recommended because they are environment friendly & economical in the long run. Sleepers @ 1660 Nos. per km on mainline and @ 1540 Nos. per km on loop lines will be provided.

5. Environmental Impacts

The major environmental impacts likely to occur by implementation of the proposed project are described below:

Based on one km. RoW of influence area, a total population of the settlements falling in Mechi-Mahakali alignment is 3, 40,113 and no. of households are 58,327. The most populated area is Kailali district and least populated area is Argakhanchi district. Likewise total population in Tamsaria-Abukhaireni Alignment is 24,380 in 4160 households.

The construction activities from Mechi to Mahakali, Tamsariya to Abukhaireni and Kathmandu to Pokhara will affect the forest area as a part of site clearance. In the Mechi-Mahakali alignment 2247.75 ha of forest will be lost. Similarly in Tamsaria-Abukhaireni and Pokhara-Kathmandu alignment, 187.02 and 151.73 ha of forest will be lost. In the Connection Alignment 75.15 ha of forest is expected to be lost.

6. Areas of common opportunities and concern for Hariyo Ban

The Mechi-Mahakali alignment traverses through forests (sal forest), settlements and cultivated land in addition to the Koshi Tappu Wildlife Reserve, Parsa Wildlife Reserve, Chitwan National Park, Corridors in Western Terai Landscape Complex (Khata Corridor, Basanta Corridor and Laljhadi Corridor) and Shuklaphanta Wildlife Reserve. Many of these areas are ecologically sensitive and rich in floral and faunal diversity. Similarly the Tamsaria-Abukhaireni Alignment consists of sal fores and a patch of Scima-Castenopsis forest also exists near Abukhaireni. A sal forest is recorded in Connections Alignment. Forest resources in the proposed Kathmandu- Pokhara alignment are hill Sal forests, subtropical deciduous hill forests and subtropical conifer forests. Majority of the people of the project area depend on forest resources to meet their daily requirements. The proposed alignment passes through many community forests. Protected species recorded in the project alignment area are sal, khayar, chanp, and okhar. Destruction of a massive area of forests will have adverse impacts on wildlife habitat and soil stability as well.

19. Bharatpur-Bardghat 220 kV Transmission Line Project

1. Location

Location		
District	**Municipality**	**VDC**
Chitwan Nawalparasi	Bharatpur	14 VDCs of Nawalparasi district (Amarapuri, Devchuli, Dhaubadi, Dibyapuri, Dumkibas, Gaindakot, Makar, Mukundapur, Nayabolan, Rajahar, Shiva Mandir, Tamsariya, Parsauni and Deurali)

2. Schedule of Implementation

Feasibility Study	Detail Design	IEE/EIA/EMP/SIA	Construction	Operation	Maintenance /Rehabilitation
NA	NA	EMP/SIA	Ongoing, Expected completion: December 2013	NA	NA

3. Funding/ Implementing Agency

Funding Agency	
Name	Address
GoN/NEA/World Bank	The World Bank 1st Floor, West Wing Lal Durbar Convention Center Yak and Yeti Hotel Complex Durbar Marg Kathmandu, Nepal
Implementing Agency	
Name	Address
Nepal Electricity Authority	Central Office Durbarmarg, Kathmandu, Nepal

4. Salient Features

Transmission Line Length:	73.5 kilometers
Span:	350 meters
No. of Tower:	256 (out of which 43 are located in cultivated land)
Private land to be acquired for Tower:	0.673 ha
Voltage level:	220 kV
RoW:	30 meters
Minimum ground clearance of wires:	7.5 meters
Tower type:	Steel Lattice Structure, self supported
Tower Height (typical):	42.45 meters
Circuit:	Double
Foundation Type:	Pad and Chimney
Foundation Area:	12.50 x 12.50 meters (Typical approximate per tower)
Project Cost:	USD $ 19 million
Foundation Area:	12.50 x 12.50 meters (Typical approximate per tower)
Project Cost:	USD $ 19 million

5. Brief History of the Project

Nepal Electricity Authority (NEA) is constructing a 220 kV transmission line between Bharatpur and Bardaghat to strengthen the power transmission network of Integrated Nepal Power System (INPS). Physiographically, the proposed transmission line falls under the Inner Terai (the Dun Valleys), the Sub-Himalaya (the Siwaliks or the Churiya Hills), and the Indo-Gangetic Plain (the actual Terai Plain) of the Central and the Western Development Region of Nepal. The Dun valley, which is bounded by the Siwalik range, includes the western Chitwan and the north-eastern part of Nawalparasi in the project area. East-West Highway is the main access to the project area. Some part of the alignment is accessible through existing feeder roads of concerned districts.

The major portion of the transmission line alignment crosses the forest area (79.19%) followed by cultivated land (18.38%) and rivers, roads & rocky areas (2.43%).

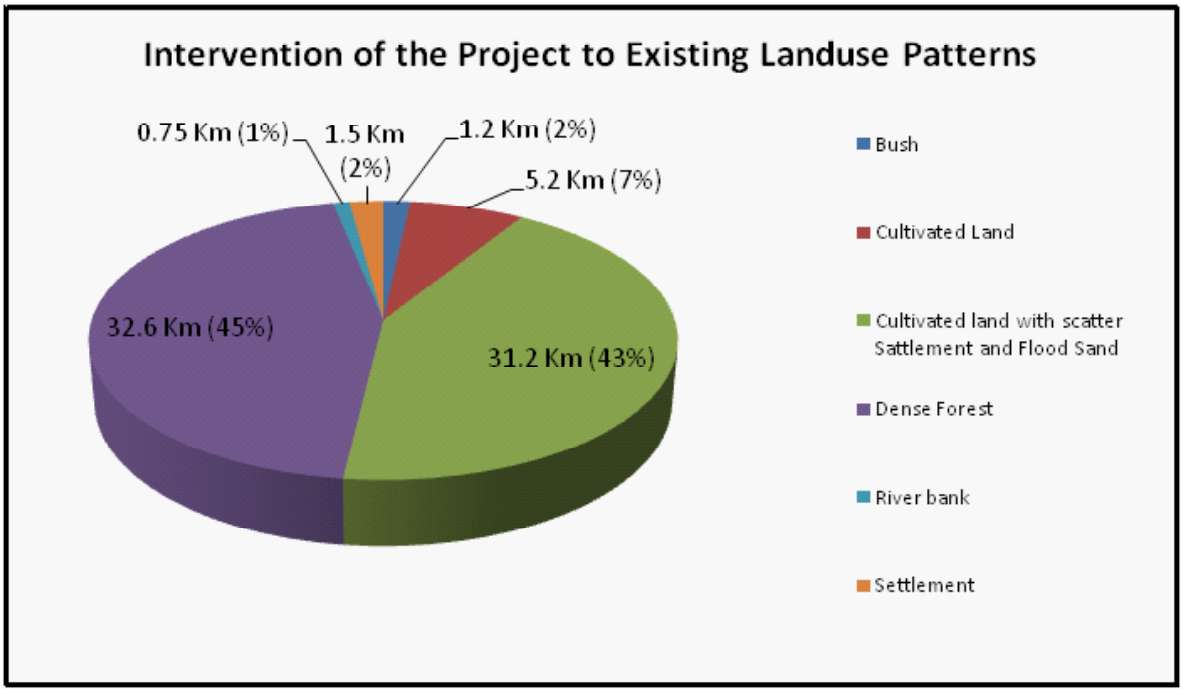
6. Summary of EMAP

The Environmental Management Action Plan of the project was prepared by NEA. The main impacts and mitigation measures of the proposed projects are summarized below:

- Loss of forest land of 193ha including 16,557 standing trees of various species and sizes will be felled down
- The major socioeconomic and cultural environmental impact includes, acquisition of 0.763 ha cultivated land of 43 HHs for construction of 43 towers. The acquisition of 0.773 ha of cultivated land will permanently reduce the production of 3.92 Mt food grain annually.
- Loss of 62 private houses, 41 cowsheds, 30 toilet and 15 kitchen owned by 62 households.
- Loss of NTFPs of two community forests, pressure on timber and fuel wood
- Effect on migratory birds of Chitwan National Park
- Loss of wildlife habitat in project impact area.

7. Areas of common opportunities and concern for Hariyo Ban

- Create employment opportunities to local people.
- Evacuation of the energy produced from Kaligandaki and other HEP planned in west to east where demand is high and provide reliable power supply.
- Expansion of distribution network.
- Deforestation of 187.5 ha forest land including 52547 trees. Among them 70 % species comprises Sal forest and management of logged trees.
- Exploitation of forest resources including timber, fuel wood and NTFPs
- Possible RoW encroachment by landless people during operation and invasion of new species such as weeds with implications on the existing floral diversity.
- Loss of habitat (birds and mammals) especially of monkeys, langurs, as their habitat on existing forest canopy if impact areas.
- Possible poaching and wild animals during construction.
- Displacement of 174 households and loss of cultivated land.



8. Proposed areas for Hariyo Ban engagement with the Project

- Protection of landscape of Siwaliks or the Churiya Hills which are highly fragile and prone to landslides and erosion
- Control of dissected gullies and steep escarpments exhibits abundant soil erosion (rill erosion, gulley erosion and sheet erosion) all along the Churiya range that contributes to the rivers originating from Siwaliks which increases the river bed and inundates the land during flooding.
- Afforestation in the deforested areas along the route of transmission line.
- The Narayani River and its major tributaries originating in the Siwaliks or beyond the Mahabharat Range is the best example of highly sediment laden Narayani River that encounters along the 220kV transmission line corridor.

9. Action Plan

Project Implementation Stage	Approx time frame	Proposed Engagement/Action	Expected Results
Preparatory Phase Activities		Wider consultation with policy level agencies	Protection of natural forest
Construction Phase Activities • Foundation works • Concrete foundation-excavation • Erection of transmission towers • Wire stringing • Testing and commissioning	2 years	• Follow proposed mitigation measures • Consultation with CFUGs • Implementation of protection measures • Monitoring	• Protection and rehabilitation of community forests. • Protection of fragile ecosystem of Churiya range
Operational Phase Activities		NA	
Maintenance / Rehabilitation Activities		NA	

20. Hetauda-Bharatpur 220kV Transmission Line

1. Location

Location		
District	**Municipality**	**VDC**
Chitwan, Makwanpur	Hetauda, Bharatpur	Basamadi, Manahari, Piple, Bhandara, Birendranagar, Chainpur, Pithuwa, Jutpani, Shaktikhor and Kabilas

2. Schedule of Implementation

Feasibility Study	Detail Design	IEE/EIA/EMP/SIA	Construction	Operation	Maintenance /Rehabilitation
		EMAP, SIA	Ongoing, Expected completion: June 2013		

3. Funding/ Implementing Agency

Funding Agency	
Name	**Address**
GoN World Bank	
Implementing Agency	
Name	**Address**
NEA, Central Office	Durbarmarg, Kathmandu, Nepal

4. Salient Features

Line Length:	72 kilometers
Span:	350 meters
No. of Tower:	226 (36 in cultivated land)
Private Land to be acquired for Tower:	0.88 ha
Voltage level:	220 kV
RoW:	30 meters
Minimum Ground Clearance of Wires:	7.5 meters
Tower Type:	Steel Lattice Structure, self supported
Tower Height (typical):	42.45 meters
Circuit:	Double
Foundation Type:	Pad and Chimney
Foundation Area:	approx12.50 x 12.50 meters/ tower
Project Cost:	US$ 62 Million

5. Brief history of the Project

The project will enhance the transmission capacity and reliability of the Integrated Nepal Power System (INPS), and will help to evacuate the power to be generated by other hydro power plants from western region of Nepal. The scope of the project includes the construction of 72 km of 220 kV transmission line and substations from Hetauda to Bharatpur. The TL starts from existing Hetauda substation located at Hetauda Municipality Ward no 1 Chaukitole of Makwanpur district and terminates at the proposed Bharatpur substation located at Jaladevi Community Forest land at Bharatpur Municpality of Chitwan district.

6. EIA/SIA Summary

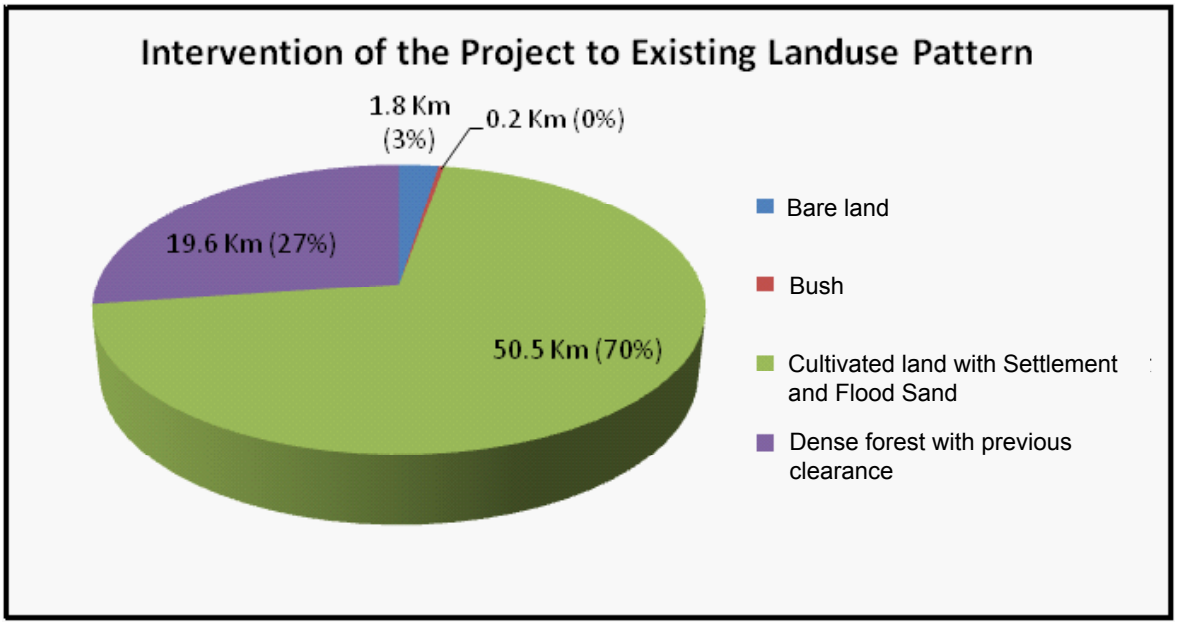
The main assessed impacts of the project are:

- A total of 6.90 ha private cultivated land will be acquired permanently for the construction of the angle towers (0.88ha) and Hetauda substation (6.02 ha).

- The acquisition of 6.90 ha of cultivated land will permanently reduce the production of 15.66 Mt food grain annually.
- Demolition of 115 houses and 56 cowsheds owned by 114 households.
- Loss of 230 trees (including 74 fruit trees, 38 fodder trees, and 44 timber size trees) owned by 87 households.
- Effects on 5 religious structures (2 temples, 2 Gumbas and 1 church)
- The implementation of the proposed project will affect 168 ha forest area of 2 project districts. Altogether 52547 standing trees of various species and sizes will be felled by the project.
- The sub contractors may hire non-local people due to cheap wage. They could also discriminate the local men, while hiring the wage labors women and vulnerable groups.

7. Areas of common opportunities and concern for Hariyo Ban

- Transmission line from substations of Hetauda, Makwanpur district and at Bharatpur, Chitwan district will help expand the coverage of rural electrification in Nepal
- Out of the total 72 km length of the transmission line, 56 km falls along forest and bushes including barren land, road, river etc and 16 km over the cultivated land. The proposed alignment passes through 8 VDCs and one municipality of Chitwan district and 2 VDCs and one municipality of Makwanpur district.
- The loss of forest land and large number of trees, change in existing landscape and disturbance of wildlife habitat is the major concern for Hariyo Ban.
- Plantation of 299520/ha saplings as proposed mitigation measures.
- Similarly, proposed 131367 saplings as compensatory plantation of 52547 felled trees.



8. Proposed areas for Hariyo Ban engagement with the Project

- Protection of natural forests through degradation and deforestation of large number of forest area and loss of tree species
- Government policy for approval of felled trees
- Conservation of wildlife species in the project impact area.
- Protection of fragile landscape of Churiya range
- Protection of NTFP of the project influence area
- Protection of cultural heritage
- Strengthening local livelihood and promotion of vulnerable groups

9. Action Plan

Project Implementation Stage	Approx time frame	Proposed Engagement/Action	Expected Result
Preparatory Phase Activities		Strengthen community people and backup support to the project implementation agency	Improvement in livelihood
Construction Phase Activities		Support to community people towards nursery establishment and plantation activities such as grass, fodder and other indigenous tree species	Maintenance of green cover, Slope stabilization
Operational Phase Activities		Policy dialogue, Alternative analysis	Protection of natural forest
Maintenance/ Rehabilitation Activities			

21. Hetauda-Dhalkebar-Duhabi 400kV Transmission Line

1. Location

Location			Proposed Alignment
VDC	Municipality	District	
Churiyamai, Hatiya, Hurnamdi, Shreepur, Chatiwan, Dhiyal Nijgadh, Bharatgang Chandranigahapur, Kakanpur, Rangapur, Judibela, Paurai	Hetauda	Makwanpur, Bara Rautahat, Sarlahi Mahottari, Dhanusha Siraha, Saptari, Udaypur, Sunsari	Hetauda-Hurnamdi, 18.6 km Hurnamdi-Nijgadh, 23.4 km Nijgadh-New Duhabi, 243.2 km, Terai plains parallel to E-W Highway

2. Schedule of Implementation

Feasibility Study	Detail Design	IEE/EIA/EMP/SIA	Construction	Operation	Maintenance /Rehabilitation
		IEE, Resettlement Action Plan, Social Impact Management Framework			

3. Funding/ Implementing Agency

Funding Agency	
Name	Address
GoN and World Bank	
Implementing Agency	
Name	Address
NEA, Central Office	Durbarmarg, Kathmandu, Nepal

4. Salient Features:

Line Length:	324.2 km
No. of Angle Points	136
No. of Tower:	585
Average Span between Towers	400 m
Voltage level:	400 kV
RoW:	46 meters (23 m on either side)
Clearance of Wires:	Roads: 9.0 m Distribution Lines: 5.5 m Ground negotiable by vehicle: 9.0 m Ground not negotiable by vehicle: 8.0 m Water surface at maximum flood: 7.5 m
Tower Type:	Steel Lattice Structure
Standard Tower Height:	45 meters
Circuit:	Double
Foundation Type:	Concrete pier and pad type
Foundation Area:	approx12.50 x 12.50 meters/ tower
No. of major river crossings:	4
Project Cost:	US$ 166.2 Million

5. Brief description of the Project

The overall objective of this project is to enhance cross boarder power exchange with India and augment the transfer capacity of the INPS. The cost of this project is estimated at US$ 144 million and jointly funded by WB and GoN. The project is scheduled to be completed in 2013/014. The project activities include the construction of 400kV double circuit transmission line, construction of 220kV bus bar at New Hetauda Substation, erection of 400 kV and 220kV bus bar at Dhalkebar substation, and construction of interconnection facility with existing 132kV in Inaruwa substation. The detail survey of the project been completed and land acquisition for Dhalkebar Substation is in the final stage. The procurement of the counseling services for this project is underway.

22. Talkot- Mahendranagar 400 kV Transmission Line Project

1. Location

Location		
District	Municipality	VDC
Doti Dadeldhura Kailali Kanchanpur	2 Municipalities	19 VDCs

2. Schedule of Implementation

This project is a part of the controversial West Seti 750 MW Hydropower Project. Below provided schedule reflects the proposed implementation of the West Seti Hydropower Project

Feasibility Study	Detail Design	IEE/EIA/EMP/SIA	Construction	Operation	Maintenance /Rehabilitation
March 2013- December 2014		EIA (conducted by West Seti Hydro Ltd in 2007)	2016- April 2021		

3. Funding/ Implementing Agency

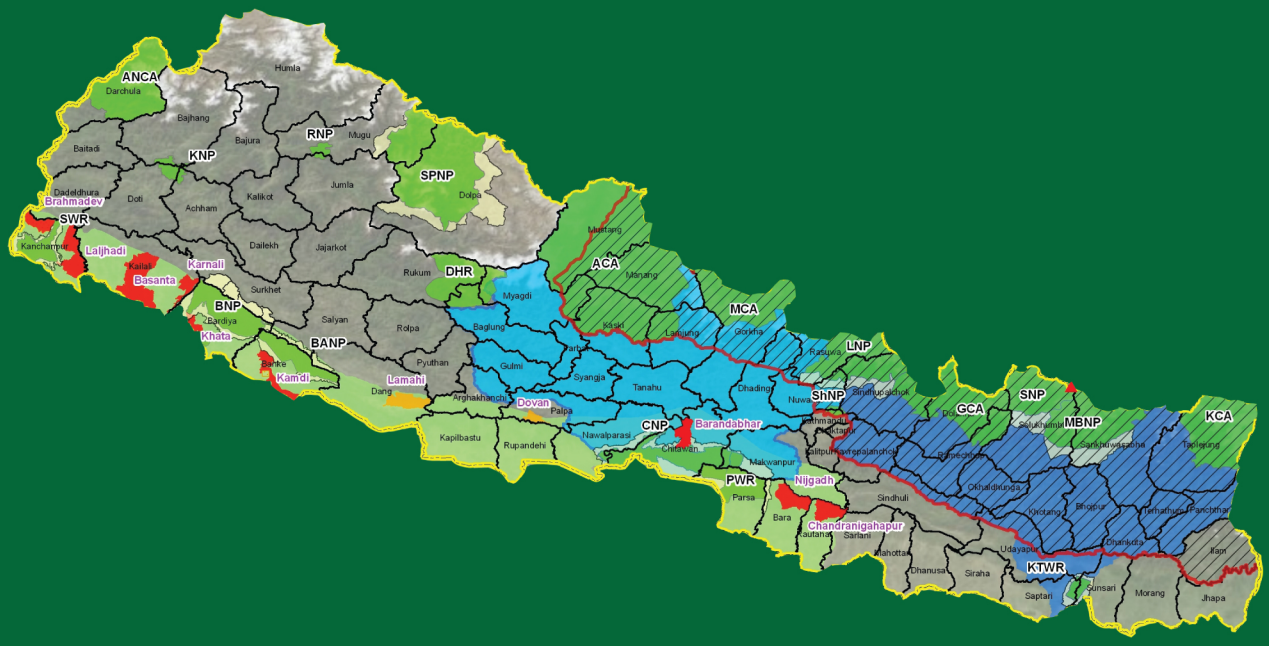
Implementing Agency	
Name	Address
CWE Investment Company (Subsidiary of China Three Gorges Corporation, China)	

4. Salient Features:

Length	132.5 km in Nepal (Total 230.5 km)
RoW	46 m (23 m on each side)
No of Towers	356
Tower Average Height	45 m (37-63 m)
Tower Base	12 m x 12 m
Average Distance Between Towers	Hill: 400 m, Terai: 350 m
Elevation	150 m- 2305 m
Conductor	Aluminium Conductor Steel Reinforcement (ACSR)
Height of Wires (Clearance)	Road (vehicle accessible): 9 m Road (not accessed by vehicles): 7.5 m Distribution Line: 5.5 m Forest Area 0-7 m: 30 cm 7.5- 15 m: 1.5- 3 m 15- 18m: 5 m 18- 23 m: 7 m

5. Brief description of the Project

The West Seti Hydroelectric Project will have installed capacity of 750 MW and annual generation is estimated to be 3636 GWh. The project was stalled for many years as its license holder, the West Seti Hydropower Company Limited failed to generate sufficient financial resources for its construction. However, the project is now to be implemented by CWE Investment Company (Subsidiary of China Three Gorges Corporation, China). The majority of electricity generated will be exported to India via the Talkot-Mahendranagar 400 kV Transmission Line to be fed into the Indian transmission system at Bareilly.



The Hariyo Ban Program is named after the famous Nepali saying 'Hariyo Ban Nepal ko Dhan' (Healthy green forests are the wealth of Nepal). It is a USAID funded initiative that aims to reduce the adverse impacts of climate change and threats to biodiversity in Nepal. This will be accomplished by working with the government, communities, civil society and private sector. In particular, the Hariyo Ban Program works to empower Nepal's local communities in safeguarding the country's living heritage and adapting to climate change through sound conservation and livelihood approaches. Thus the Program emphasizes the links between people and forests and is designed to benefit nature and people in Nepal. At the heart of Hariyo Ban lie three interwoven components – biodiversity conservation, payments for ecosystem services including REDD+ and climate change adaptation. These are supported by livelihoods, governance, and gender and social inclusion as cross-cutting themes. A consortium of four non-governmental organizations is implementing the Hariyo Ban Program with WWF Nepal leading the consortium alongside CARE Nepal, FECOFUN and NTNC.

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