Initial Environmental Examination: Pre-Investigative Works for Feasibility Study

March 2013

NEP: Bagmati River Basin Improvement Project

Prepared by DHI Group for the Asian Development Bank.

CURRENCY EQUIVALENTS
as of 21 March 2013

Currency unit	–	Nepalese Rupee (NRe)
NRe1.00	=	$ 0.01149
$1.00	=	NRs87.01

Abbreviations

ADB	–	Asian Development Bank
BRBIP	–	Bagmati River Basin Improvement Project
DNPWC	–	Department of National Park and Wildlife Conservation
DSC	–	Design and Supervision Consultant
EA	–	Executing Agency
EARF	–	Environmental Assessment and Review Framework
EIA	–	Environmental Impact Assessment
EMP	–	Environmental Management Plan
EPA	–	Environment Protection Act
EPR	–	Environment Protection Rules
GoN	–	Government of Nepal
GFP	–	Grievance Focal Points
GRC	–	Grievance Redress Commission
HPCIDBC	–	High Powered Commission Integrated Development for Bagmati Civilization
IEE	–	Initial Environmental Examination
MOEST	–	Ministry of Environment, Science and Technology
MOFSC	–	Ministry of Forest and Soil Conservation
PES	–	Payment of Environment Services
PPTA	–	Project Preparatory Technical Assistance
REA	–	Rapid Environmental Assessment
SEA	–	Strategic Environmental Assessment
SNNP	–	Shivapuri Nagarjun National Park
SPS	–	Safeguard Policy Statement
TA	–	Technical Assistance
VDCs	–	Village Development Committees
WECS	–	Water and Energy Commission Secretariat
WUAs	–	Water User Associations

Notes

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

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

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Archiving: All standard project files (documents, etc.) are archived in DHI project site. Any other project files (set-up files, forcing data, model output, etc.) are archived on an external hard drive located in the DHI project archive under Project No <11803440>.

EXECUTIVE SUMMARY

1. This section summarizes the findings and results of the Initial Environmental Examination (IEE) associated with the investigative work (topographic surveys, drilling and geotechnical investigations) required for the preparation of the feasibility study for the Nagmati Dam under the ADB assisted Bagmati River Basin Improvement Project (BRBIP) for improvement of river environment in Upper Bagmati river basin.

2. The purpose of this IEE is to assess potential environmental, health, safety and social impacts of the proposed investigative work at Nagmati to ensure compliance with ADB's Safeguard Policy Statement. A separate comprehensive EIA is being prepared for the entire proposed Nagmati Dam component. The assessments have been carried out based on primary data from field surveys (including consultations) carried out under the PPTA and secondary information collected from various sources.

3. There are no specific national regulations requiring an environmental impact assessment (EIA or IEE) for investigative work. However, since the work will be undertaken within the protected area on Shivapuri Nagarjun National Park, the Water and Energy Commission Secretariat (WECS, as project executing agency) will seek clearance from the Ministry of Forestry and Soil Conservation under the National Park and Wildlife Conservation Act, 1997. The investigative works will begin only when this clearance has been received.

4. The pre-feasibility investigative works include topographic surveys and geotechnical investigations involving drilling. The work will be carried out at and within the proposed area to be inundated behind the proposed Nagmati Dam. The Government of Nepal, with the financial support from ADB, has envisaged carrying out project preparation and feasibility study for the improvement of the Bagmati River to address water security issues in the Bagmati River Basin. As part of the project preparation, the PPTA consultant has carried out initial assessments and identified a potential favourable dam site on the Nagmati River. To establish the engineering feasibility (geotechnical and profile), there is need to carry out additional investigations to determine the geology and sub-surface rock conditions at the proposed site and to improve the topographic definition of the dam site and reservoir areas to bring the study and design of the dam to the required feasibility level.

5. The pre-feasibility investigative works involve two components: a) Topographic Surveys using Total Stations surveying at an interval of 250 m from dam site to the upstream reservoir areas, and b) Geotechnical investigation involving drilling for collecting the rock samples at six locations (5 drill holes at dam site, one drill hole at 70m upstream and 2 drill holes at quarry site proposed within reservoir area.

6. The investigative activities will includes: a) cutting of vegetation down to 1.2 m for the Total Station survey lines, and b) clearing of access tracks for drill machines, mobilization of two rigs by road to Nagmati site, construction of drilling platforms, moving rigs to the drill sites requiring disassembly and reassembly of the rigs prior to drilling each hole, drilling operation, moving of drilling machines from one place to another place, testing of rock samples etc.

7. The proposed Nagmati Dam site is located at $27^0$46'84.31" North latitude and $84^0$26'32.12" East Longitude in the Kathmandu District of the Central Development Region, Nepal. The topography in the Nagmati catchment is mountainous with steep slopes >30% covering

more than half of the catchment. The proposed dam site is located at an elevation of approximately 1825 m above mean sea level.

8. Geologically the proposed site falls in the Inner Himalayan region. The dominant rocks are gneiss and magnatite with mica schist and pegmatic granite. The soils of the area range from loamy sand on the northern side to sandy loam on the southern slope. Because of the steep topography and the nature of soil, soil erosion is very common. The land use pattern in and around the proposed site in mostly forest followed by grassland with shrubs and riverine features.

9. The project area has a subtropical to warm temperate type of climate. There is a high variation in annual temperature and precipitation. The recorded maximum average temperature is 22.7^0C in mid-May/June and the minimum average temperature of 0.30^0C is recorded in December/January. The mean annual precipitation is 2727mm mostly occurring during the monsoon period.

10. The region is the origin of some of the important river systems including Bagmati, Bishnumati, Nagmati, Syalmati, Rudramati, and Yashomati, which are major watersheds. The project area is in Sundarijal catchment and drained by the Nagmati River and its tributaries. The Nagmati merges into the Bagmati River about 2 km downstream of the proposed dam site. Reservoirs and ponds are mainly manmade for specific purposes such as drinking water, hydropower, and irrigation. Rivers, streams and reservoirs provide sources of drinking water for wildlife, livestock, people, irrigation and hydropower.

11. The proposed project site is located within the Shivapuri Nagarjun National Park (SNNP). The vegetation of the park represents midhill flora, fauna, and ecosystems in the transition zone between sub-tropical and temperate climate, where the variations is primarily a function of the altitude. SNNP supports rich floral and faunal diversity with a number of protected species of mammals, birds, and plants.

12. The SNNP supports a large number of wildlife species. There are registered 21 species of mammals living in the SNNP out of which nine are threatened[1]. They include Pangolin (Manis spp.), leopard cat (Prionailurus bengalensis), and clouded leopard (Pardofelis nebulosa), common leopard (Penthera pardus), Langur (Semnopithecus entellus), Rhesus monkey (Macaca mulatta), Jungle cat (Felis chaus), Goral (Naemorhedus goral), and Himalayan black bear (Ursus thibetanus).

13. The SNNP is also a popular area for watching birds and butterflies. It harbours 177 species of birds of which 12 of them are considered threatened as listed in Appendix A. Herpetofauna of SNNP has not been explored. Only one species (i.e. Oligodon arnensis) of reptilia has been reported in the Park. There are more than 102 species of butterflies. SNNP is the only habitat for the relict Himalayan DraGoNfly (Epiophlebia laidlawi) in Nepal.

14. The Park area experienced problems of soil erosion owing to deforestation, overgrazing, and cultivation on steep slopes in the past. The quality and quantity of water supplied from the area was also reduced. To overcome these problems, a program was initiated to protect Shivapuri as a watershed and wildlife reserve in 1975. It was declared as Nepal's 9th National Park in 2002.

[1] Shivapuri National Park Plan, 2004 (Draft)

15. The office of SNNP prepared a Management Plan to guide its operation in 2004 with the support from Nepal Trust for Nature Conservation and forwarded it to the Ministry of Forest and Soil Conservation for approval. However, the plan is not yet approved[2]. The Plan and other documents set the objectives of the initiative to maintain a proper balance between the natural environment and the basic needs of local people. The vision is to develop Shivapuri and Nagarjun areas as demonstration sites for multiple uses by restoring and maintaining the ecological integrity.

16. Field sampling was undertaken at proposed dam site to establish the presence of flora and fauna. Regarding vegetation *Symplocos pyrifolia* (*Kharane/Kholme*), *Quercus glauca* (Phalant) and *Rhododendron arboreum* (Guras/Lali guras) were the dominant tree species found in the proposed Nagmati dam area with an average density of 152, 102 and 91 trees per hectare, respectively. *Pinus roxburghii* (Khote salla), *Lyonia ovalifolia* (Bakal pate, Phalame) and *Camellia kissi* (Chiapate, Hingua) are other species found in relative large numbers. Among the listed plant species, *Symplocos pyrifolia* is the most common and uniformly distributed plant species.

17. Different species of terrestrial and epiphytic orchids were recorded. Orchids are considered threatened by IUCN[3] and falls under CITES Appendix II. They are protected mainly because of the excessive collection for trade. Most common among them are *Coelogyne critsata, C. ovalifolia, Calanthe tricarinata, Spiranthes sinensis, Satyrium nepalense* etc.

18. The Nagmati Dam site supports a relatively high diversity of birds with 16 species recorded during the bird survey. Warblers and Barbets were the most commonly observed at the Nagmati Dam site. However, only one vulnerable species listed as a nationally threatened bird, the White-tailed Stonechat was recorded. Of the other 11 threatened bird species found in the SNNP, the Saker Falcon, the Grey-sided Laughingthrush and Blue-winged Laughingthrush are possibly found at the dam site, while the remaining 8 threatened species are not likely to be found here.

19. Concerning wildlife, scats of *Felis bengalensis* and *Felis chaus* and scent of *Viverra zibetha* were recorded in the area confirming the presence of these three carnivores. However, none of the animals were sighted directly in the area. The Nagmati dam area is part of the important SNNP wildlife habitat and the area hosts corridors for wildlife movement. None of the three animals recorded during the wildlife survey are listed in the IUCN List of Threatened species for Nepal.

20. The total population of Sundarijal VDC is 2,631 in 2011 with males constituting 53.8% and female 46.2%. The average household size is 4.2 persons and the total household number is 621. Most of the people are Tamangs, and Buddhists predominate in the region. Sundarijal is a tourism area. Here foreigners as well as internal tourists are attracted due to its pristine natural beauty with rivers, streams and small waterfalls. The presence of Shivapuri Nagarjun National Park also attracts the visitors to this place. The economic condition of the Sundarijal VDC is not strong. The agricultural land is present only in ward number 8. No major industry is present in the area. Agriculture accounts for 35% of Nepal's Gross Domestic Product (GDP), industry 15% and services (including tourism) the remaining 50%.

21. The environmental impacts anticipated from the clearing of vegetation for the access tracks, drilling platforms and survey topographic lines in the reservoir area are considered to be

[2] Personal communication with Mr Gopal Prakash Bhattarai, Chief Warden,Shivapuri - Nagarjuna National Park,
[3] http://biodiversityofnepal.icimod.org/ProtectedAreas/Redbook.asp

relatively modest and temporary. It is envisaged that only clearing of secondary growth forest, shrubs and bushes is required as the alignments of access tracks and survey lines are selected to avoid cutting of trees with a 10cm diameter at breast height, or more.

22. A temporary camp for drilling workers will be located in one of the open areas in the vicinity of the dam site. During site visit with a representative for the Village Development Committee 3 possible sites were identified. No cutting or clearing of vegetation is necessary for the establishment of the camp. The duration of the mobilisation, drilling works, demobilisation and cutting surveys are foreseen completed within 3 months. It is expected that 10 to 14 workers will occupy the camp. To avoid cutting / trimming of big trees, Total Station surveying has been adopted instead of GPS surveying, because more clearing would be needed to clear the overhead canopy to access the GPS satellites.

23. For topographic survey lines, it is estimated that about 3000 m^2. (3000 m long and 1 m wide strip) will require cutting of vegetation to a height of 1.2 m or less at the dam site and in the reservoir area.

24. The site-preparation activities include clearing of 550 m long and 2 to 3 m wide strip (on average 2.5 m) from access point on existing Sundarijal-Chisapani road to drilling points at the site of the dam and in the quarry area. This will require clearing of approximately 1375 m^2 of land. Similarly at each drillhole, about 15 m^2 will be cleared for drilling platform, drilling equipment, drilling consumables, and storage of drillcores. In total this will require clearing of an area of 120 m^2 for eight drillholes (15 x 8nos). Another 750 m^2 area (300 m long and on average 2.5 m wide strip) will be cleared for moving drillrigs from one point to another. The total area to be cleared for access and drilling points is approximately 2245 m^2. None of the clearing will require felling of trees with a diameter of 10cm, or more. During site visit inspection suitable access track routes free of trees have been identified.

25. Clearing of 2245 m^2 of forest area and cutting of 3000 m^2 down to 1.2 m may cause some temporary and local impacts on the ecosystem. However the degree of impairment will be low since only shrub / bushes will be cleared, and in the survey lines all vegetation below 1.2 m will be left untouched. Necessary replanting for restoring the vegetative cover in the 2245 m^2 to be cleared will be identified in consultation with DNPWC as part of the Environmental Management Plan.

26. The delineation of the access tracks and drill sites will be identified and marked under the supervision of officials from the National Park. Further, the clearing of shrubs and bushes will be carried out in the presence of officials from the National Park and cut shrubs and bushes will be disposed off as recommended by National Park officials.

27. Since the scope of the proposed investigative work is limited to site clearing and drilling activities, no impacts are anticipated on topography, climate or soils

28. The PPTA consultants on behalf of the project proponent (HPCIDCB) will ensure that the Contractor has a contractual obligation to adhere to an environmental management plan following GON and ADB regulations and guidelines.

29. A number of officials from various agencies, i.e., the Ministry of Forests and Soil Conservation, Department of National Parks and Wildlife Conservation, Ministry of Environment, Science and Technology, Village Development Committee members etc., were consulted during the fact finding visit. The consultations included both discussions with stakeholders and dis-

cussions with village level authorities. Field visits were jointly undertaken with a range officer from the Shivapuri Nagarjun National Park to identify the extent of physical activities and likely impacts to forest/vegetation, if any.

30. The environmental impacts associated with the proposed survey and drilling works have been assessed and described in the previous sections of this document. The findings establish that the Investigative Works will be carried out within a confined area and there will no cutting of mature trees. Clearing of bushes and grass for the access tracks for the drillrigs will be carried out in consultation with SNNP officials to avoid any adverse impacts.

31. Impacts during drilling operations such as noise, workers health and safety, waste management etc. will be taken care of by adopting mitigation measures as listed in the EMP. The EMP will be included in the drilling contractors' specifications and contract and the PPTA consultant will ensure its implementation by continuous supervision and monitoring.

32. Upon completion of the works all cleared areas will be re-planted with native species and re-growth is expected to be relatively fast, and the areas will return to their present, natural condition within few years.

33. It is therefore concluded that the Investigative Works have no significant environmental impacts, and when implemented, the EMP will fully comply with ADB's SPS 2009 and Government requirements.

I. INTRODUCTION

A. Project Background

1. Rapid increase in Kathmandu's population and related city expansion has put great pressure on the water resources of the Upper Bagmati Basin. During the dry season, around 80% of the Bagmati river flow is diverted for drinking water purposes leaving very little flow to carry waste effluents. Thus there is an urgent need to address the principal concerns of river improvement and water augmentation, watershed management and flood risk management.

B. Objective and Scope of the PPTA

2. The Asian Development Bank (ADB) is supporting the Government of Nepal (GoN) to address these critical water security issues in the Bagmati River Basin by financing the preparation of the Bagmati River Basin Improvement Project (BRBIP) under a present PPTA. The Water and Energy Commission Secretariat (WECS) is the Executing Agency with the High Powered Commission for Integrated Development for Bagmati Civilization (HPCIDCB). The BRBIP has been envisioned to improve water security and resilience to potential climate change impacts in the Bagmati River Basin. It aims to build on the general public's desire to restore the river environment in the Kathmandu Valley and the Government's efforts to improve irrigation development and mitigate the impact of water-induced disasters in the middle and lower reaches of the Basin. The project adopts the principles of integrated water resources management (IWRM) and provides Nepal with its first opportunity to apply this key policy element since it has been adopted under the National Water Plan in 2005.

3. The key outputs of PPTA include: (i) subproject prioritization further refined to ensure maximum relevance to the project outcome and ownership; (ii) feasibility studies including, technical, economic and safeguards due diligences on the above mentioned priority subprojects.

4. Together with the Project implementation, the Project will include the following components:

- **Component 1**: Towards Integrated and Participatory River Basin Management aimed at supporting the GON to establish the RBO including addressing necessary regulatory changes and capacity strengthening.

- **Component 2**: Improving Upper Bagmati River Environment: This component includes two sub-projects:

  a. **Sub-project 2(a)**: Storage Dam sub-component - to provide adequate environmental flow Potential dams under investigation are: i) Dhap Dam (in Nagmati headwaters), a 19 m high dam, storing 800,000 m^3 of water, sufficient to provide a dry season environmental flow of 40 l/s. ii) Nagmati Dam (located 2 km north-east of the confluence with Bagmati River), a 60 to 70 m high dam storing up to 8 million m^3 of water, sufficient to provide a dry season environmental flow of 400 l/s.

  b. **Subproject 2(b)**: River Environment Improvement sub-component.

c. **Component 3**: Integrated River Training and Irrigation for Marin Khola (Stage 1): to improve water security and resilience against water-induced disasters.

C. Objective and Scope of the IEE Study

5. The objective of this Initial Environmental Examination (IEE) is to identify the impacts associated with the investigative work (topographic surveys, drilling and geotechnical investigations) required for the preparation of the feasibility study for the Nagmati Dam under Component 2(a).

6. The proposed site for the Nagmati Dam is located in the area administered by the Sundarijal Village Development Committee (VDC) within Kathmandu Valley, Nepal. The proposed site is located within the protected area of Shivapuri Nagarjun National Park. The scope of this IEE is limited to the sites of the proposed drilling and topographic surveys at the proposed dam site. The IEE assesses the potential environmental, health, safety and social impacts of the proposed investigative work and identifies adequate remediation actions to ensure compliance with ADB's Safeguard Policy Statement (SPS)[4].

7. A separate comprehensive EIA is being prepared for the entire Component 2 which involves both proposed dams and other proposed environmental improvement interventions in the Upper Bagmati from Sundarijal to a position approximately 1 km below Tilganga Bridge.

D. Methodology

8. The IEE has been prepared during the project preparation work in the month of October 2012. The assessments have been carried out based on primary data from field surveys conducted during the month of September, 2012. (including consultations) and secondary information collected from various sources. During the site visits, the Specialists had discussions with various stakeholders including Shivapuri Nagarjun National Park (SNNP), VDC members and local executive powers for their opinions on the proposed investigative activities. The results of the consultations as well as an evaluation of the institutional framework have been incorporated into this assessment.

E. Structure of the Report

9. This IEE report is structured (below) in compliance with the outline prescribed in Annexure 1 (Safeguard Requirements 1: Environment) of ADB's Safeguard Policy Statement.

Section 1: Introduction
Section 2: Policy, Legal, and Administrative Framework
Section 3: Description of the Project
Section 4: Description of the Environment
Section 5: Anticipated Environmental Impacts and Mitigation Measures
Section 6: Information Disclosure, Consultation, and Participation
Section 7: Grievance Redress Mechanism
Section 8: Environmental Management Plan, and
Section 9: Conclusion and Recommendations

[4] ADB Safeguard Policy Statement, June 2009

II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

A. Government of Nepal Environmental Laws and Regulations

10. The Government of Nepal (GON) has a well-established legal framework for environmental assessment of infrastructure development projects. A number of laws have been passed, dating from the Aquatic Life Protection Act of 1961 to the present. Foremost of these which are relevant to the proposed BRBIP project are the Environment Protection Act (EPA) of 1997 and the Environment Protection Rules (EPR) also of 1997 and with Amendments in 2007.

11. The EPA and EPR are the key legal provisions governing the environmental safeguards in Nepal. Section 3 of the EPA mandates project developers to carry out environmental assessment of projects at the level of IEE or EIA. It prohibits the implementation of any project without receiving environmental clearance from the GON in the form of approved EIA or an IEE reports. Rules 2 and 3 of the EPR requires a project developer to carry out IEE or EIA for the type and size of projects as listed in the Schedule 1 or 2, respectively.

12. The most relevant national policies, acts and guidelines of the GON concerning environmental safeguards, which are relevant to the proposed investigative work, are discussed in subsequent paragraphs.

13. **National Park and Wildlife Conservation Act, 1973, GON:** It addresses the conservation of ecologically valuable areas and indigenous wildlife. The Act prohibits trespassing in park areas, prohibits wildlife hunting, construction works in the park area, damage to plant and animal, construction of huts and houses in park area without permission of authorized persons. It lists 26 species of mammals, 9 species of birds, and 3 species of reptile as protected wildlife. Since the proposed investigative work will be carried our within SNNP, **clearance from Department of National Park and Wildlife Conservation within the Ministry of Forests and Soil Conservation is required**.

14. **Environmental Protection Act, 1997, GON :** It stipulates that any development project, before implementation, shall pass through an environmental assessment, which may be either Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA). Approval of the reports and environment clearance will be provided by a competent government agency as identified by the Act. The Act restricts polluting activities and authorizes government for monitoring and enforcement. The Act has provision of compensation to affected parties from environmental impacts and punishment to polluters. **Environmental Protection Rule (EPR) 1997 (amendment, 2007), GON** : It provides various step-wise requirements to be followed while conducting EIA and IEE studies. The rules also oblige the Proponent to timely consult and inform the public on the contents of the proposal and EIA and IEE studies.

15. **Forest Act, 1993 (amendment, 2007), GON:** This Act requires decision makers to take account of all forest values, including environmental services and biodiversity, not just the production of timber and other commodities. It includes several provisions to ensure development, conservation, management, and sustainable use of forest resources based on appropriate planning.

16. **Forest Rules, 1995, GON:** These rules elaborate legal measures for the conservation of forests and wildlife. Tree cutting clearance is required from Department of Forest. Expenses incurred for cutting trees and transportation is to be borne by the infrastructure developer. As per the Section 5 of the Working Guidelines for Use of Forest Land for Other Purposes, 2006, if a

commercial project requires cutting of trees having girth size of more than 10 cm, then the project proponent is required to plant **25 trees for each tree cut including the provision of 5 year maintenance as compensatory afforestation**.

17. **National Environmental Impact Assessment Guidelines, 1993, GON:** These guidelines provides guidance to project proponent on integrating environmental mitigation measures, particularly on the management of quarries, borrow pits, stockpiling of materials and spoil disposal, operation of the work camps, earthworks and slope stabilization, location of stone crushing plants, etc.

18. Manual for Preparing Initial Environmental Examination (IEE) Report for Hydropower Projects. Department of Electricity Development, HMG Nepal, in collaboration with United States Agency for International Development and International Resources Group, has prepared a series of manuals to help a proponent to prepare EIA documents within the framework of existing rules and regulations. These guidelines are recommendations rather than mandates.

B. ADB's Environmental Safeguard Requirements and Policies

19. This IEE is carried out in compliance with ADB's SPS to ensure that potential adverse environmental impacts are identified, avoided where possible and managed or addressed.

20. ADB categorizes projects into categories A, B, C, and FI according to the significance of likely impacts. Based on the ADB's SPS, the activities proposed for the investigative work is categorized as category B, based on the most sensitive component. Category B projects are judged to have some adverse impacts, but to a lesser degree and/or significance than category A projects.

21. An initial environmental examination (IEE) is required to determine whether or not significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report. Accordingly this IEE is prepared to meet the requirements of the ADB's SPS. A separate detailed EIA is being prepared for the proposed dams and associated infrastructure.

C. Institutions

22. The principal national agency charged with environmental protection is the Ministry of Environment, Science and Technology (MOEST). The role of MOEST is to protect the environment and promote sustainable development. It is also the agency required to respond to any complaints from the public about environmental issues.

23. The Department of National Park and Wildlife Conservation (DNPWC) within Ministry of Forests and Soil Conservation (MOFSC) is responsible for conservation and management of protected areas including National Parks in the country. The Chief Warden of the Shivapuri National Park has wide powers to give permission for activities to be carried out in the national park. In the event that the drilling and surveys do not require cutting of trees having girth size of more than 10 cm, the Chief Warden can give the permission directly.

III. DESCRIPTION OF THE PROPOSED INVESTIGATIVE WORK

A. Type of Investigative Work

24. The pre-feasibility investigative works include topographic surveys and geotechnical investigations involving drilling. The work will be carried out within the proposed area to be inundated behind the proposed Nagmati Dam.

B. Need for the Investigative Work

25. The Government of Nepal, with the financial support from ADB, has envisaged carrying out project preparation and feasibility study for the improvement of the Bagmati River to address water security issues in the Bagmati River Basin. As part of project preparation, the PPTA consultant has carried out initial assessments and identified a potential favourable dam site on the Nagmati River. To establish the engineering feasibility (geotechnical and profile), there is need to carry out additional investigations to determine the geology and sub-surface rock conditions at the proposed site and to improve the topographic definition of the dam site and reservoir areas. Therefore, the topographic survey and geotechnical investigation (drilling) have to be carried out to bring the study and design of the dam to the required feasibility level.

C. Investigative Work Components

26. The feasibility investigative work involves two components:

a. Topographic Surveys using Total Station surveying at the dam site and at intervals of 250 m from dam site to the upstream reservoir area, and

b. Geotechnical investigation involving drilling for collecting the rock samples at eight locations (5 drill holes at dam site, one drill hole at 70m upstream and 2 drill holes at the proposed quarry site proposed within the reservoir area.

D. Proposed Dam Site Location and Features

27. The proposed site for Nagmati Dam is 2 km north-east of the confluence with the Bagmati river, in Sundarijal Village Development Committee (VDC) of Kathmandu District, Nepal at an elevation of approximately1825 m. The site is located in the protected forests of the Shivapuri Nagarjun National Park, Sundarijal range. Figure 3-1 shows the location map on the proposed dam site on the topographic sheet and Google Earth map.

28. The Nagmati dam site is accessible from the existing Sundarijal – Chisapani road (unsurfaced track, usable only in dry season) that runs within 150 m of the dam site on the right-west) bank of the Nagmati River, see Figure 3-2.

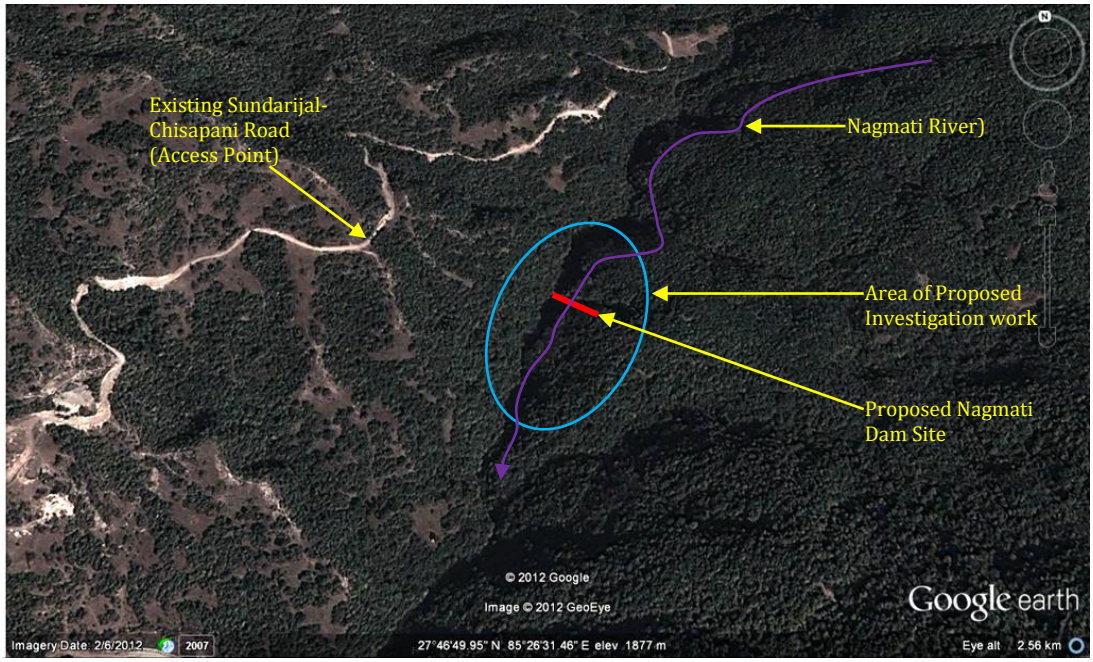

Figure 3-1: Location Map of the Proposed Nagmati Dam Site on Google Earth Image[5]

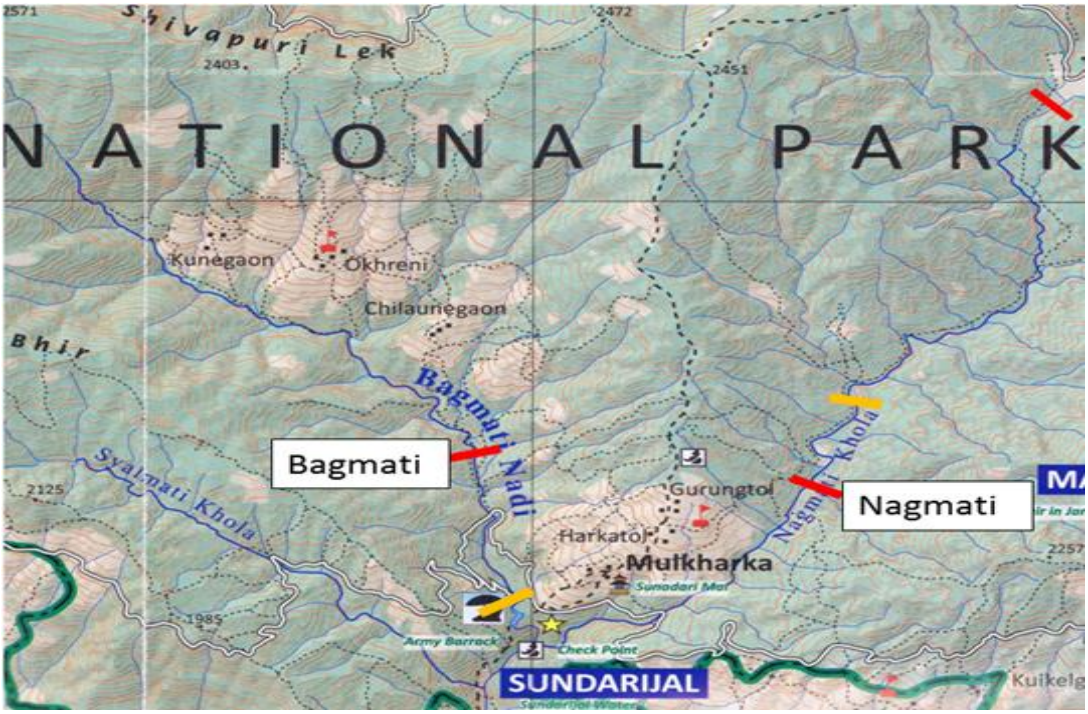

Figure 3-2 Location Map of the Proposed Nagmati Dam Site on Topographic Map (in Red)[6]

[5] Note: circled area should go from 100 m downstream of the dam centreline to the head of the reservoir. Several areas with no forest cover can be used for worker's camp. Specific site to be decided together with contractors, VDC's representative and National Parks.

[6] A second dam site is indicated in the Bagmati River. This site has been considered as less preferred than the site at Nagmati for technical and economic reasons.

E. Project Activities and Details

29. Various activities to be undertaken within the scope of investigative work include: Clearing of access tracks for Total Station surveys and drill machines, mobilization of two rigs by road to Nagmati site, preparation of drilling platforms, moving rigs to the drill sites requiring disassembly and reassembly of the rigs prior to drilling each hole, drilling operation, moving of drilling machines from one place to another place, obtaining of rock samples etc. The various activities are described herewith.

1. Access to the Area

30. The existing road from Sundarijal to Chisapani running within 150 m of the proposed site of the dam will be used by the surveyors and drill rig operators to access the areas where they are set to work (i.e. as defined in Sections 3.5.2 and 3.5.3).

2. Clearing for Topographic Survey

31. In order to improve the topographic definition of the dam site and reservoir area, lines will be cut to provide a line of sight for electronic 'Total Station' surveying (note that GPS surveying is not appropriate, because more clearing would be needed to clear the overhead canopy to access the GPS satellites). The requirements for this survey line cutting is as follows:

(i) Lines to be approximately 1 m wide. These lines need not be in exact straight lines (e.g. can deviate to avoid cutting mature trees), and
(ii) Vegetation up to approximately 1.2 m in height can be left untouched (i.e. because it is below the line-of-sight)

32. The quantum of the survey lines to be cut is as follows:

a. At Dam site:
(i) Dam centreline: On average a 2.5 m line to be cut for the drill rig access (refer Section 3.5.3)
(ii) At 20 m upstream and downstream of dam centreline: 100 m long line (approx.) x 2 No.
(iii) At 40 m upstream and downstream of dam centreline: 75 m long line (approx.) x 2 No.
(iv) At 60 m upstream and downstream of dam centreline: 50 m long line (approx.) x 2 No.
(v) At 80 m upstream and downstream of dam centreline: 25 m long line (approx.) x 2 No.
(vi) 180 m long line joining (i) – (v) [i.e. to link surveys to a consistent datum].

b. In the Reservoir Area:
(i) Lines perpendicular to the river at 250 m intervals up the reservoir (i.e. approximately 12 No)
(ii) Lines to run from the road on the right bank to elevation 1900 m on the left bank.
(iii) The total line length to meet the conditions in (i) and (ii) above is approximately 3,000 m.

3. Clearing for Drill rig Access and Drilling

33. Drilling is to be undertaken at the following locations:

(i) On dam centreline: 5 drillholes, namely on left and right abutments[7] and at the river (depths approximately 40 m and 30 m, respectively): track length approximately 220 m.
(ii) At upstream toe of dam (i.e. approximately 70 m upstream from centreline): 1 drillhole to 30 m depth – assuming that the drillrig can be moved 70 m up river, so no clearing is required.
(iii) Upstream of dam, in area where rock for the rockfill dam is to be quarried: 4 drillholes to 50 m depth. Total track length approximately 300 m (estimate only – depends on quarry site and proximity to existing road).

34. Drillrigs (2 No) will be moved into position by a combination of pulling and winching (on a sledge), and hand carrying rig components, for re-assembly at the drilling site. The following clearing will be required:

(i) Clearing track on average 2.5 m in width from the existing road down to the locations referred to above.
(ii) At each drillhole location, a clearing of approximately 10 – 15 m^2 is needed , to accommodate:
  - Drillrig platform (needs to be horizontal – where the location is on a rock face, a temporary platform will be constructed from timber brought to the site.
  - Drilling equipment (e.g. drill pipe)
  - Drilling consumables (e.g. diesel)
  - Storage for drillcores.

35. Workers camp will be established in one of the 3 suitable, open areas above and in the vicinity of the dam site. While workers for clearing vegetation, transporting equipment, assisting in drilling are expected to be hired from the nearby villages, the camp will be used by drilling personnel, from 10 to 14 staff. The duration of clearing of vegetation, mobilisation, drilling and demobilisation is expected to be carried out over a 3 month period.

F. Implementation Schedule

36. Drilling at each site will occupy a period of approx. 5 – 10 days. From the start of drilling to final reporting of the drilling and testing work is likely to take about 3 months The expected start of mobilisation is by end November 2012.

IV. DESCRIPTION OF THE ENVIRONMENT

A. Physical Resources

37. **Topography, Geology and Soil:** The proposed Nagmati Dam site is located at $27^0$46’84.31” North latitude and $84^0$26’32.12” East Longitude in the Kathmandu District of the

[7] It should be noted that the left and right abutment slopes are approx. 50 and 60 degrees respectively

Central Development Region, Nepal. The topography in the Nagmati catchment is mountainous with steep slopes >30% covering more than half of the catchment. The proposed dam site is located at an elevation of approximately 1825 m above mean sea level.

38. Geologically the proposed site falls in the Inner Himalayan region. The dominant rocks are gneiss and magnatite with mica schist and pegmatic granite. The soils of the area range from loamy sand on the northern side to sandy loam on the southern slope. Because of the steep topography and the nature of soil, soil erosion is very common. The land use pattern in and around the proposed site in mostly forest followed by grassland with shrubs and riverine features.

39. **Climate:** The project area has a subtropical to warm temperate type of climate. There is a high variation in annual temperature and precipitation. The recorded maximum average temperature is 22.7^0C in mid-May/June and the minimum average temperature of 0.30^0C is recorded in December/January. The mean annual precipitation is 2727mm mostly occurring during the monsoon period.

40. **Water Resources:** The region is the origin of some of the important river systems including Bagmati, Bishnumati, Nagmati, Syalmati, Rudramati, and Yashomati, which are major watersheds. The project area is in Sundarijal catchment and drained by the Nagmati River and its tributaries. The Nagmati merges into the Bagmati River about 2 km downstream of the proposed dam site. Reservoirs and ponds are mainly manmade for specific purposes such as drinking water, hydropower, and irrigation. Rivers, streams and reservoirs provide sources of drinking water for wildlife, livestock, people, irrigation and hydropower.

B. Ecological Resources

41. **Flora and Forests:** The proposed project site is located within the Shivapuri Nagarjun National Park (SNNP). The vegetation of the park represents midhill flora, fauna, and ecosystems in the transition zone between sub-tropical and temperate climate, where the variations is primarily a function of the altitude. SNNP supports rich floral and faunal diversity with a number of protected species of mammals, birds, and plants.

42. The floral diversity is quite high in the park due to its location, altitude, and climatic variations. There are more than 2,122 species of flora and 16 of them are endemic flowering plants. About 129 species of mushroom including Lactarius pleusitides have been identified in the park. Table 4-1 presents the Forest Habitats and Altitudinal distribution of Flora and Fauna in the park area.

Table 4-1: Forest Habitats and Latitudinal distribution of Flora and Fauna

Forest type or Habitat	Altitude (m)	Flora	Fauna
Ever green mixed broad-leaved forest	1000-1500	Schima wallichii Castonopsis indica Alnus nepalensis Anthosaphalus cadamba Prunus cerasoides	Wild boar (Sus scrofa) Barking deer (Muntiacus muntijak) Rhesus monkey (Macaca mulatta) Langur (Semnopithecus entellus) Indian hare (Lepus nigricollis)
Chir pine forest	1000-1600	Pinus roxburghii Castonopsis indica	Same as above.

		Myrica esculenta Pyrus pashia	
Upper mixed hardwood forest	1500-2700	Acer. Aesculus Juglans regia. Betula, Fraxinus sp. Alnus nepalensis Salix sp. Quercus sp. Celtis sp.	Himalayan goral (Nemorhaedus goral) Himalayan black bear (Ursus thibetanus) Yello-throated marten (Martes flavigula) Wild boar (Sus scrofa)
Oak-Rhododendron forest	2300-2700	Quescus semacarpifolia Eurya acuminata Ilex dipyrens Michelia champaca Rhododendron arboreum Symplocos sp.	Wild boar (Sus scrofa) Barking deer (Muntiacus muntijak) Porpucine (Hystrix indica)

Source: Shivapuri National Park Management Plan, 2004 (draft).

43. Forests are one of the major natural resources of the National Park covering more than 70% of the park area. As detailed in the table, the Park has four types of forests which are distributed along the altitudinal gradients.

44. **Fauna and Wildlife:** The SNNP supports a large number of wildlife species (Table 4.2). There are registered 21 species of mammals living in the SNNP out of which nine are threatened[8]. They include Pangolin (Manis spp.), leopard cat (Prionailurus bengalensis), and clouded leopard (Pardofelis nebulosa), common leopard (Penthera pardus), Langur (Semnopithecus entellus), Rhesus monkey (Macaca mulatta), Jungle cat (Felis chaus), Goral (Naemorhedus goral), and Himalayan black bear (Ursus thibetanus).

45. The SNNP is also one of the most popular areas for watching birds and butterflies. It harbours 177 species of birds of which 12 of them are considered as listed in Appendix A. Herpetofauna of SNNP has not been explored. Only one species (i.e. Oligodon arnensis) of reptilia has been reported in the Park. There are more than 102 species of butterflies. SNNP is the only habitat for the relict Himalayan DraGoNfly (Epiophlebia laidlawi) in Nepal. The overall status of various flora and faunal species found in the SNNP is presented in Table 4-2 below.

Table 4-2: Status of Species in SNNP

Group	Total Number of Species	Status
Mammals	21	Protected, Threatened (9)[1]
Birds	177	Threatened (12)[2]
Herpentofauna	1	DNA
Butterflies	102	Endemic, susceptible species[1]
Plants	2122	Endemic (16) flowering[1]
Mushrooms	129	One species new to science[1]

Source: [1]Shivapuri National Park Management Plan, 2004 (Draft). [2]IUCN

[8] Shivapuri National Park Plan, 2004 (Draft)

46. The Park area experienced problems of soil erosion owing to deforestation, overgrazing, and cultivation on steep slopes in the past. The quality and quantity of water supplied from this area was also reduced. To overcome these problems, a program was initiated to protect Shivapuri as a watershed and wildlife reserve in 1975. It was declared as Nepal's 9th National Park in 2002.

47. The office of SNNP forwarded a draft of a Management Plan in 2004 with the support from Nepal Trust for Nature Conservation and forwarded this to the Ministry of Forest and Soil Conservation for approval. However, the plan is not yet approved. The Plan and other documents set the objectives of the initiative to maintain a proper balance between the natural environment and the basic needs of local people. The vision is to develop Shivapuri and Nagarjun areas as demonstration sites for multiple uses by restoring and maintaining the ecological integrity.

48. **Flora and Fauna at the proposed Dam Site:** In general, most of the forest in the survey area is in secondary stage of succession. Cutting of trees for fire wood happens regularly. As a result there are very few large/mature size trees in the area. Field sampling was undertaken at proposed dam site to establish the presence of flora and fauna, see Figure 4-1.

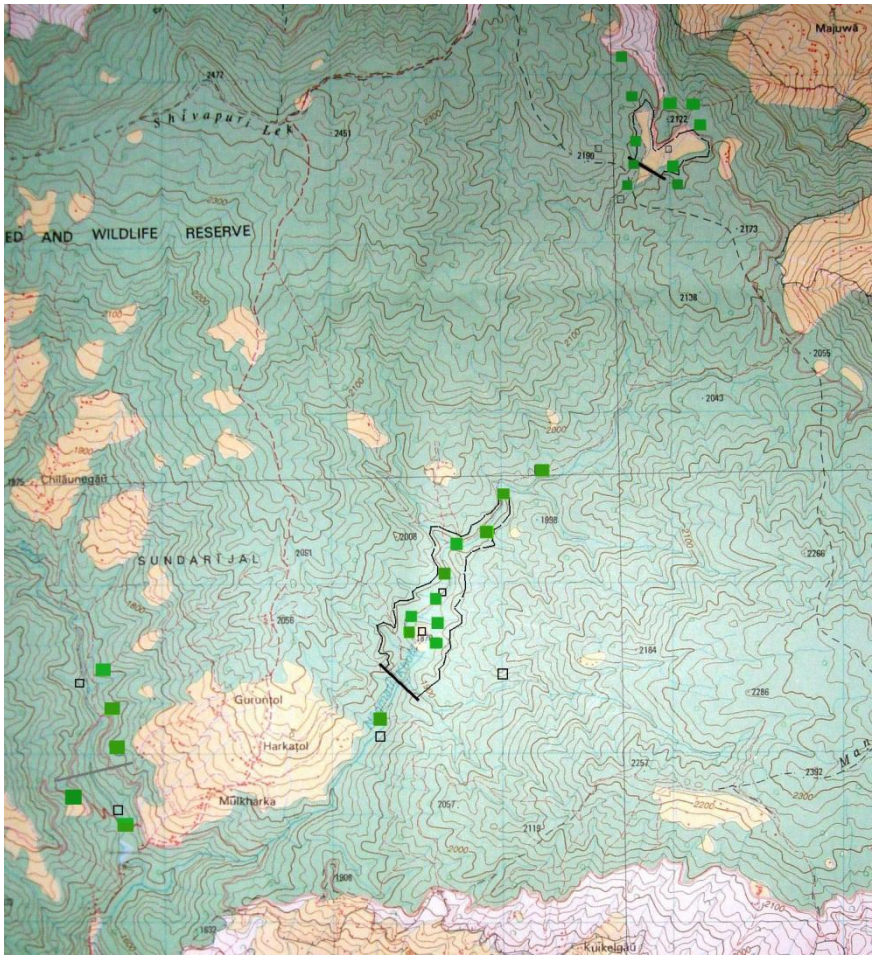

Figure 4-1: Sites (in green) for vegetation surveys.

49. Regarding **vegetation** *Symplocos pyrifolia* (*Kharane/Kholme*), *Quercus glauca* (Phalant) and *Rhododendron arboreum* (Guras/Lali guras) were the dominant tree species found in the proposed Nagmati dam area with an average density of 152, 102 and 91 trees per hectare, respectively. *Pinus roxburghii* (Khote salla), *Lyonia ovalifolia* (Bakal pate, Phalame) and *Camellia kissi* (Chiapate, Hingua) are other species found in relative large numbers. Among the listed plant species, *Symplocos pyrifolia* is the most common and uniformly distributed plant species (Table 4-3).

Table 4-3: Population parameters of major trees in proposed Nagmati dam site

SN	Scientific name	Density. No trees per ha
1	*Symplocos pyrifolia*	152.27
2	*Quercus glauca*	102.27
3	*Rhododendron arboreum*	90.91
4	*Pinus roxburghii*	84.09
5	*Lyonia ovalifolia*	70.45
6	*Camellia kissi*	56.82
7	*Cleyera japonica*	45.45
8	*Quercus lamellose*	25.00
9	*Persea odoratissima*	22.73
10	*Pyrus pashia*	20.45

50. A few scattered saplings of Taxus wallichiana (Lauth salla) were recorded along the Nagmati River about 2 km upstream of the dam site. This species falls under CITES appendix II and the Government of Nepal protected list[9]. When tracks for topographic surveys and for drilling rig moving have been identified, the tracks will be inspected by a vegetation specialist under the EMP. to map any occurrence of Taxus wallichiana under the EMP. If re-alignment of the tracks identified is not possible, replanting of any recorded Taxus wallichiana plants will be carried out at the same locations and 3 times the number, to ensure re-growth, where Taxus wallichiana were identified. Different species of terrestrial and epiphytic orchids were recorded. Orchids are considered threatened by IUCN[10] and falls under CITES Appendix II. They are protected mainly because of the excessive collection for trade. Most common among them are *Coelogyne critsata, C. ovalifolia, Calanthe tricarinata, Spiranthes sinensis, Satyrium nepalense* etc.

51. The Nagmati Dam site supports a relatively high diversity of **birds** with 16 species recorded during the bird survey (Figure 4-2(Table 4-4). Warblers and Barbets were the most commonly observed at the Nagmati Dam site.

[9] Protected Species under the National parks and Wildlife Conservation Act, 1973.
[10] http://biodiversityofnepal.icimod.org/ProtectedAreas/Redbook.asp

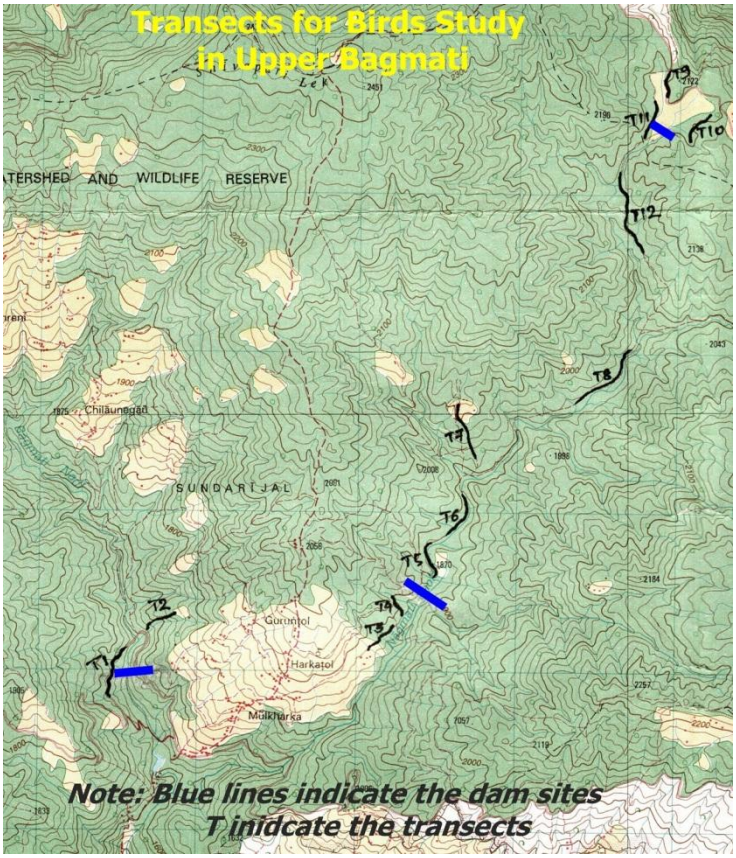

Figure 4-2 Transects for bird surveys.

Table 4-4 List of Birds Recorded at the Nagmati Dam Site

V. S.N.	VI. Common Name	VII. Scientific Name
1	Black Bulbul	*Hypsipetes leucocephalus*
2	Chestnut-bellied Nuthatch	*Sitta castanea*
3	Common Hoopoe	*Upupa epops*
4	Grey Treepie	*Dendrocitta formosae*
5	Grey-hooded Warbler	*Seicercus xanthoschistos*
6	Himalayan Bulbul	*Pycnonotus leucogenys*
7	Hoary-throated Barwing	*Actinodura nipalensis*
8	Mountain Bulbul	*Hypsipetes mcclellandii*
9	Oriental Turtle Dove	*Streptopilia orientalis*
10	Rufous-bellied Niltava	*Niltava sundara*
11	Shikra	*Accipter badius*
12	Striated Laughingthrush	*Garrulax striatus*

13	White Wagtail	*Motacilla alba*
14	White-tailed Nuthatch	*Sitta himalayensis*
15	White-tailed Stonechat	*Saxicola leucura*
16	Yellow-breasted Greenfinch	*Carduelis spinoides*

52. The SNNP is a possible habitat for 12 threatened bird species, see Appendix A, of which four are globally threatened (Hodgson's Bush Chat, Lesser Kestrel, Saker Falcon and White rumped Vulture) and four vulnerable nationally threatened (Grey sided Laughingthrush, Blue-winged Laughingthrush, White-tailed Stonechat and Brown Wood Owl) and one nationally endangered (Spot-bellied Eagle Owl).

53. However, only one vulnerable species listed as a nationally threatened bird, the White-tailed Stonechat was recorded at the Nagmati Dam site (Table 4-4). Of the other 11 threatened bird species listed in Appendix A, the Saker Falcon, the Grey-sided Laughingthrush and Blue-winged Laughingthrush are possibly found at the dam site, while the remaining 8 threatened species are not likely to be found here.

54. The survey results for the **wildlife** are given in Table 4-5. Scats of *Felis bengalensis* and *Felis chaus* and scent of *Viverra zibetha* were recorded in the area confirming the presence of these three carnivores. However, none of the animals were sighted directly in the area. The Nagmati dam area is part of the important SNNP wildlife habitat and the area hosts corridors for wildlife movement.

Table 4-5: Wildlife of Nagmati Area

Mammal	Sign	Crown Cover	Dominant Trees	Distance from Water
Felis chaus	Scat	Open	*Pinus roxburghii, Rhododendron arboreum, Myrica esculenta*, etc.	100 m from Nagmati
Felis bengalensis	Scat	4%	*Pinus roxburghii, Pyrus pashia, Quercus sp., Gultheria fragrantissima,* etc.	20 m
	Scat	28%	*Rhododendron arboreum, Quercus sps, Thea sps, Myrica esculenta,* etc.	20 m
	Scat with worms	64%	*Rhododendron arboreum, Lyonia ovalifolia, Daphniphyllum himalayensis*	20 m
Viverra zibetha	Scent	85%	*Pyrus pashia, Thea sps, Myrica esculenta,* etc.	50 m

55. None of the three animals recorded during the wildlife survey are listed in the IUCN List of Threatened species for Nepal[11].

[11] http://biodiversityofnepal.icimod.org/ProtectedAreas/Redbook.asp

C. Socio-economic Resources

56. Agriculture accounts for 35% of Nepal's national Gross Domestic Product (GDP), industry 15% and services (including tourism) the remaining 50%. GDP growth was 3.5% in 2011 and the economy grew by an annual average of 3.4% during the past five years which was led by growth in the service sector by 6% annually, whilst growth in the agriculture sector was only 2.6%. Per capita income was $642 in 2011 and has grown annually by 10.5% during the past five years. In 2011 the Human Development Index (HDI) of Nepal was 0.458, placing it at 157th position in the world.

57. According to the 2011 population census, in Kathmandu district (noting that the project is located in Sundarijal VCD of Kathmandu district), 9 VDCs and Kathmandu metropolitan together have a total population of 1,163,785. Females constitute 47.4% and males constitute 52.6%. The average household size is 3.7 persons. Of the total population 86.5% is urban (Kathmandu metropolitan) and 13.5% rural. The household size in the urban area is slightly lower (3.6 persons).

58. The total population of the Sundarijal VDC where the dam site is situated is 2,631 in 2011. The settlement closest to the dam site is about 1000 meters down the road passing the dam site. There are 621 households in the Sundarijal VDC with males constituting 53.8% and females 46.2%. The average household size is 4.2 persons. A majority of the people are Tamangs, and Buddhists. Local villagers are regularly cutting trees for firewood and for the production of local liquors everywhere around and inside the dam site area. No other activities or use of the dam site area have been identified.

59. Almost 90% of the Sundarijal VDC comes under the upstream areas where the Tamang communities predominate. They grow millet and maize in the upstream areas. However, some vegetables and barley are also cultivated. Most of them are engaged in hoarding livestock while some are seen to be involved in small business like shops and hotels. In the downstream areas, wheat, barley, maze, potato, vegetables and millet are grown. The majority of the people are Chhetriyas, Brahmins, and Newars. Some of them are involved in governmental and non-governmental services while most of them are involved in agriculture and business.

60. 'Sundarimai Mandir (Temple)', Ganesh Mandir and Krishna Mandir are the main cultural sites in the Sundarijal VCD. People from Kathmandu and other places go to Sundarijal for visiting these temples. All the Hindu and Buddhist festivals are celebrated. Additionally, during the month of July, 'Dashahara' fate/festival is celebrated at the spots near waterfalls and rivers near the temples.

61. Sundarijal is a tourism area. Here foreigners as well as internal tourists are attracted due to its pristine natural beauty with rivers, streams and small waterfalls. The presence of Shivapuri Nagarjun National Park also attracts visitors. It is also the starting point for the tourists who go for trekking towards Helambu (Langtang Range). The people of Kathmandu Valley are attracted to the place because it can be accessed by only about a one hour-drive. There are also some picnic spots set up in the area.

62. The economic condition of the VDC is not strong. The agricultural land is present only in Ward Number 8. No major industry is present in the area. Animal hoarding is also not done on a large farming scale. The people are using traditional means of farming l and there is no evidence of modern technology of farming yet being introduced. Only 50% of the inhabitants can read or write, and not all of these are fully literate.

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

A. Impacts and Mitigation Measures Due to Location and Design Site Preparation

63. The impacts of the proposed investigative work will not be very significant as it would be carried out in a confined area and paying close attention to minimising impacts. Selection of alignment of access track would be done to avoid cutting of trees. A temporary camp for drilling workers should be located in an open area away from any dense forests.

64. To avoid cutting of big trees, Total Station surveying has been adopted instead of GPS surveying, because more clearing would be needed to clear the overhead canopy to access the GPS satellites.

65. The PPTA will ensure that the Contractor has a contractual obligation to adhere to an environmental management plan following GON and ADB regulations and guidelines. PPTA staff along with The Natural Parks staff will oversee that the Contractors implement and follows the EMP.

B. Impacts and Mitigation Measures Due to Site-Preparation activities

66. The environmental impacts anticipated from the clearing of vegetation for the access tracks, drilling platforms and survey topographic lines in the reservoir area are considered to be relatively modest and temporary. It is envisaged that only clearing of secondary growth forest, shrubs and bushes is required as the alignments of access tracks and survey lines are selected to avoid cutting of tree of a 10cm diameter at breast height.

67. The site-preparation activities include clearing of 550 m long and 2 to 3 m wide strip (on average 2.5 m) from access point on existing Sundarijal-Chisapani road to drilling points at the site of the dam and in the quarry area. This will require clearing of approximately 1375 m^2 of land. Similarly at each drillhole, about 15 m^2 will be cleared for drilling platform, drilling equipments, drilling consumables, and storage of drillcores. In total this will require clearing of an area of 120 m^2 for eight drillholes (15 x 8nos). Another 750 m^2 area (300 m long and on average 2.5 m wide strip) will be cleared for moving drillrigs from one point to another. The total area to be cleared for access and drilling points is approximately 2245 m^2.

68. For topographic survey lines, it is estimated that about 3000 m^2. (3000 m long and 1 m wide strip) will be cut down to a height of 1.2 m at the dam site and in the reservoir area.

69. Clearing of 2245 m^2 of forest area and cutting of 3000 m^2 down to 1.2 m may cause some temporary and local impacts on the ecosystem. However the degree of impairment will be low since only shrub / bushes will be cleared, and in the survey lines all vegetation below 1.2 m will be left untouched, wherever possible. Any tree species of special importance to birds will be identified when tracks are identified, before any cutting, under the EMP. As part of this, any nesting in vegetation to be cut will be identified, and cutting avoided of this vegetation as part of the EMP. Necessary replanting for restoring the vegetative cover in the 2245 m^2 to be cleared, will be identified in consultation with DNPWC as part of the Environmental Management Plan.

70. The delineation of the access tracks and drill sites will be identified and marked under the supervision of officials from the National Park and oversight by the PPTA under the EMP. Further, the clearing of shrubs and bushes will be carried out in the presence of officials from

the National Park and cut shrubs and bushes will be disposed off as recommended by National Park officials.

71. Since the scope of the proposed investigative work is limited to site clearing and drilling activities, no impacts are anticipated on topography, climate or soils

C. Impacts and Mitigation Measures Due to Surveying and Drilling Activities

72. **Flora:** Care must be exercised during topographic surveys to avoid any significant damage or loss to flora and fauna. To achieve this, the contractor will be required to implement following mitigating measures:

(i) Existing vegetation including shrubs and grasses along the survey lines (except within the strip directly under line-of-sight) should not be disturbed.
(ii) The surveying team must strictly follow the cleared survey lines, and not encroach into the Park Forest.
(iii) Any cutting of trees and vegetation is strictly forbidden outside the sites and track designated for clearance. The sites and tracks designated for clearance will be identified by the National Park staff that will oversee the clearance works in cooperation with the PPTA.

73. **Fauna:** Some disturbance to the wildlife is expected during the works. In order to minimise the impact, any movement outside the designated sites, tracks etc. is strictly forbidden. Any poaching and hunting are forbidden as well. Noise from the drilling operations to be reduced to the lowest possible level. Noise level measurements will be carried out under the EMP. Corrective measures such as implementation of noise screens will be provided, if necessary.

74. **Waste and wastewater:** Short-term adverse impacts from waste and wastewater on soil and water anticipated from the drilling works, if not addressed by the Environmental Management Plan, may originate from: spillage of oils, handling and storage of drilling mud, wastewater from workers camps etc. The anticipated impacts and mitigation measures are discussed in subsequent sections.

75. **Workers Camps:** Establishment and operation of workers camps in the vicinity of the proposed sites could cause temporary adverse impacts on flora and fauna as well as on the health of the workers. The following measures will be adopted and applied for construction and removal of the camps.

(i) Permission for camp areas must be obtained in writing from the National Park authorities.
(ii) Suitable latrines and other sanitary arrangements at the camps and sites where work is in progress should be availed to the personnel.
(iii) Access tracks and the camp area as well as drilling sites should be sited to cause minimum disturbance. Kerosene should be used for cooking.
(iv) Movement of personnel should be restricted within workers camps, access tracks, drilling sites.
(v) Poaching and hunting of wild animals should be strictly prohibited. Contract agreements should specify heavy penalties for illegal hunting, trapping and wildlife

trading. No permanent structures should be built at the camp, and the camp site to be cleared and cleaned free of all debris, waste and hydrocarbons at end of the works under inspection by the National Park authorities.

(vi) All rubbish (except for oils and other mechanical or chemical waste) should be buried or removed. Organic waste shall be buried. Non-organic waste shall be removed.

(vii) Waste oils, chemicals and mechanical waste should be stored and removed by a registered waste handling company.

76. **Drilling Sites:** Some impacts from drilling waste and other wastes generated during the drilling activities are anticipated. The contractor will be required to implement the following measures to control drilling sites:

(i) Each drilling site should be completely cleared of all waste after use. Drilling waste (chippings and mud) will be buried. Rubbish, waste oil and chemicals should be returned for disposal as outlined in the Workers Camp section (viii) above.

(ii) Waste and drilled material should not be disposed in the river water.

(iii) No spillage of oils or fuels should occur. In order to reduce and control any spillage, stocks of sawdust should be placed at strategic points in the working areas, to be poured immediately onto any spill. In the event, the sawdust will have to be removed and deposited by a registered waste handling company.

(iv) On completion of each drillhole the site must be left clean and free from all debris, hydrocarbons and waste, and the drillhole capped to the satisfaction of the PPTA Consultant and Shivapuri national park authorities.

77. **Drilling Operation:** Potential adverse impacts are anticipated due to noise generated from operations of drills. The following measures will be implemented to control adverse impacts from drilling operations.

(i) Drilling operations shall be carried out only during the day time to minimize adverse impacts on wildlife in the forest area.

(ii) The Contractor should have certificates from the manufacturer for type approval and conformity of production for Diesel Generator (DG) set/s.

(iii) For DG sets of capacity up to 1000 kVA, the noise level at 1 m from the enclosure surface shall not exceed 75 dB (A).

(iv) Workers shall be provided with personnel protective equipments (i.e. helmet, safety shoes, ear muffler and air mask) and their use should be strictly enforced.

78. **Human Relations**: The following activities must be taken care of to avoid any unexpected impacts during the project activities:

(i) Wildlife, people, water, land and livestock must be respected.

(ii) Necessary permission to enter the Park must be sought from the National Park authorities. Work should be done with minimal damage to trees.

(iii) All conflicts / disagreements and any agreements, no matter how trivial, must be logged and dated, with details of persons involved and subject matter, in a book for this purpose at the workers camp, as part of the Grievance Redress Mechanism to be implemented under the EMP.

VI. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

79. As part of the IEE, stakeholder and community consultations were carried out during field visits. The consultations included discussions with stakeholders and village level authorities. The details of such consultations carried out during field visits are presented in Table 6.1.

80. Field visits were jointly undertaken with a Range Officer from the Shivapuri Nagarjun National Park to identify the extent of physical activities and likely impacts to forest/vegetation, if any.

81. Also, a number of officials from various agencies, i.e., the Ministry of Forests and Soil Conservation, Department of National Parks and Wildlife Conservation, Ministry of Environment, Science and Technology, Village Development Committee members etc., have been consulted during the ADB visit.

82. Consultations will continue at next stages i.e. during preparation of the detailed environmental impact assessment (EIA), for the final feasibility study for the environmental interventions in the Upper Bagmati. Some of the issues raised by the villagers are relevant to the feasibility study and not on investigative works and will be dealt with in the EIA.

Table 6VI-1: List of Stakeholders / Communities Consulted

Name and Designation	Organization and Date	Issues Discussed	Comments on the issue
Mr.Gopal Prakash Shivakoti, Warden	Shivapuri and Nagarjun National Park (SNNP), August 09, 2012.	• Survey permission and procedure essential to carry out activities in the park • Secondary Information regarding the park	• As per the Rules, necessary actions are included in EMP • The information collected will be included in EIA reports
Mr. Ram Chandra Khatiwada, Asst. Conservation Officer Mr.Nawa Raj Baral, Engineer	Shivapuri and Nagarjun National Park (SNNP), September 13, 2012	• Is the Dams construction activity a national priority project? • Chances of habitat fragmentation • Procedure to be followed while clearing trees in the park • Compensatory plantation at the ratio of 1:25	• The issue of national priority project is forwarded to the technical and institutional experts • Environmental issues falling under the scope of the drilling are covered in EMP • The issues of PES and EIA of the road will be covered in

		• Large scale infrastructure is not a priority of the National Park • Mitigation measures may take a big share of the project • Payment of Environmental Services (PES) • EIA of road passing through the Park	EIA study
Ms. Madhu Devi Ghimire, Head	EIA Section, Ministry of Forest and Soil Conservation, Sept 14, 2012	• Mandatory Provision of getting approval from MOFSC for EIA study for any intervention in the Park • Govt. of Nepal (Minister or Cabinet level) approval essential for cutting the trees in the park • In the past, the Govt. has permitted to cut the trees in the park for national priority projects only after EIA approval • Is the Dam construction activity a national priority project?	• Request for EIA study as per the Government rules has been sent to MOFSC • The issue of national priority project is forwarded to the technical and institutional experts
Mr. Shiva Lal Gaire, Ranger	Shivapuri Nagarjun National Park, September 15, 2012	• Possibilities of lowering the rig in the river without cutting the trees • Possibilities of carrying out the topographic survey without cutting the trees.	• The issues have been addressed in EMP of this study
Mr.Nima Sherpa, Ex. Chairperson	Sundarijal VDC, September 15, 2012	• Employment of the locals during survey, construction and operation of the dams • Upgrading of the existing road for the purpose of serving the project as an	• The issues raised will be covered in EIA study

		access road • Benefits to the local communities as of the construction of the project	
About 60 participants	Mulkharka Village, Sundarijal VDC, Sept 22, 2012	• Resettlement of the Households currently living inside the Park • Employment to the locals if Govt. decides to not relocate them • Contamination of drinking water supplied to Kathmandu due to the settlements in the park • Open defecation in the Park • Household wastewater treatment of the communities in the park • Employment to the locals during project construction and operation • Consideration of alternatives (several low height dams vs. a single tall dam) • Disclosure of risk mitigation plan in case of dam failure • Rehabilitation and upgrading of the local road • Technical team must discuss the alternatives and technical details with the public prior finalising the design • On what basis the projects components particularly in the Sundarijal-Tilganga stretch were selected?	• Issues such as resettlement of Households and contamination of drinking fall beyond the scope of BRBIP. However, they will be forwarded to the Government authority in appropriate meetings. • Non-environmental issues such as employment, project component selection etc. have been forwarded to the Team Leader, other technical resource persons and institutional experts of the PPTA Team • Environmental issues falling beyond the scope of the drilling work will be addressed thoroughly in the EIA study.

		• Payment of environmental Services • Misleading information in the media regarding the project • Little or no communication to the public regarding the preparation of the project	

83. The IEE report will be disclosed in the English and local language in the office of HPCIDBC. The report will also be made available to interested parties on request from the office of HPCIDBC. The IEE report will also be placed on ADB's website.

VII. GRIEVANCE REDRESS MECHANISM

84. The process for resolving complaints that may arise in the project will be handled by a grievance redress mechanism. Any local stakeholder, feeling that adverse and material harm is caused by the Project, may contact village community development leaders from the Village Development Committee, that would then forward the complaint to HPCIDCB and National Parks, or the stakeholder may contact the social department of HPCIDBC or National parks, directly.

85. When obtaining the information from the complainant the social department of HPCIDCB and/or the National Parks will register the complaint with the assistance of the PPTA, and initially seek to identify the source of the problem and inform the HPCIDCB operation division and National Parks. When the operation division/PPTA receives the information, they will clarify if the complaint is caused by the investigative works.

86. Once verified that the problem/complaint is well founded and due to investigative works, HPCIDBC will together with the PPTA consultant and the Contractor take the necessary corrective actions. If necessary, the EMP will be updated in order to avoid similar problems, afterwards.

87. The HPCIDBC social department will inform and update the complainant about the progress of grievance mitigation within 24 hours for urgent issues and 7 days for non-urgent issues.

88. The HPCIDCB social department will provide monthly reports of any complaint registered, and how it has been dealt with to the Park Authorities, the PPTA and the HPCIDCB management.

VIII. ENVIRONMENTAL MANAGEMENT PLAN

A. General

89. The Contractor shall take all reasonable steps to protect the environment and to prevent environmental damage and public nuisance resulting from construction activities.

90. The Contractor shall comply with all statutory requirements, environmental regulations and environmental quality standards, as stated in the Government of Nepal Environmental Laws and Regulations, see Section 2.1.

91. Permission for drilling sites and camp areas must be obtained in writing from DNPWC.

92. Necessary permission for personnel to enter the Park must be sought from DNPWC.

93. The Contractor shall bear all costs associated with environmental pollution avoidance and environmental mitigation, including any clean-up operations if necessary.

B. Cutting of Vegetation

94. No cutting of vegetation, except for the clearance of access tracks for the drillrigs and clearance of drill sites (no trees with a diameter of more than 10cm to be cut) and the cutting of vegetation to 1.2 m for the surveys are allowed.

95. The Contractor shall under the supervision of the Shivapuri National Park staff and the PPTA consultant identify and mark the borders of the access tracks and drill sites (with no trees having a diameter of more than 10cm to be found within these borders. If any trees with a diameter larger than 10 cm they should be left un-touched.

96. When tracks for vegetative clearing are identified, a bird specialist will under the EMP check that no nesting habitats for any threatened species are affected.

97. No cutting of vegetation is allowed outside the marked borders of the access tracks and drill sites.

98. The use of firewood is strictly prohibited. Kerosene should be used for cooking.

C. Wildlife

99. Poaching and hunting of wildlife is strictly prohibited.

100. Movement of personnel should be restricted to a minimum to cause as little disturbance to wildlife as possible.

101. Access tracks should be sited to cause minimum disturbance.

D. Pollution from Wastes

102. The Contractor shall maintain all drilling sites in a clean and safe condition and provide and maintain appropriate facilities for temporary storage of all wastes before transportation and disposal.

103. The Contractor shall organise disposal of all rubbish, waste oils, chemicals and mechanical waste generated during drilling works in an environmentally acceptable manner. The waste produced will be managed by the private solid waste management companies based in Kathmandu City. Private companies registered with GON and who are permitted to undertake waste management work will be selected to pick up the waste from the park premises. Solid waste will be disposed it to the designated solid waste management landfill site i.e. Sisdol Landfill site. Necessary permission will be acquired from the park and Sundarijal VDC before under-

taking the task outside the National Park. This shall include consideration of the nature and location of disposal sites, so as to cause least environmental impact.

E. Health and safety

104. Provision of suitable latrines and other adequate sanitation facilities at the labour camp and on drilling site.

105. Disposal from all sanitary systems should be undertaken to avoid causing environmental pollution. Wastewater should be routed through suitable designed soak aways, without contaminating either ground or surface water or causing a health risk.

106. Provision of an adequate supply of water for drinking and washing purposes for all site personnel, including all workers, as appropriate. Drinking water quality should comply with GoN Standards and WHO guideline values.

107. Workers shall be provided with personnel protective equipment (e.g. helmet, safety shoe, ear muffs and air masks) and their use should be strictly enforced.

108. Cooking at site will be done using kerosene stoves. Adequate fire fighting equipment shall be available in the workers camp.

F. Noise

109. The Drilling Contractor should have certificates from manufacturer for type approval and conformity of production for Diesel Generator set(s).

110. For Diesel Generator sets up to 1000kVA, the noise level a 1 m from the enclosure surface shall not exceed 75 dB (A). As part of the EMP noise measurements will be carried out regularly. If and when necessary, corrective measures, such as noise screens shall be implemented.

111. Avoid any unnecessary noise during mobilisation, drilling and de-mobilisation.

112. Maintain of all transport vehicles and drillrigs to a high standard, in accordance with manufacturers maintenance procedures.

G. Air Quality and Dust

113. Minimisation of dust nuisance by regular watering of any access tracks, bare soil, sand and other areas, as appropriate and as determined by weather conditions.

H. Post Investigative Works Mitigation Measures

114. At the conclusion of the drilling and testing work on each drillhole, the drillhole shall be marked and capped with a lockable steel cover grouted into the top of the hole to prevent ingress of surface water

115. No permanent structures are to be built at camps and drilling sites.

116. At the end of the contract, drillrig sites and camp sites should be removed and the sites cleared and cleaned free of all debris, waste and hydrocarbons. National Park authorities should inspect the cleared site.

117. The major adverse effects of the investigative works are clearing of vegetative cover for access tracks and cutting down vegetation to 1.2 m height for survey lines.

118. While the vegetation in the survey lines is expected to recover quickly, the areas cleared for drilling will be rehabilitated through re-planting of the same type of vegetation and with three times the density found naturally at the site, to leave room for survival.

Summary of Mitigation and Enhancement Measures

Work activity /stage	Potential impact	Proposed mitigation measure	Responsible for implementation of mitigation measures	Responsible for supervision and oversight.
Work planning and conducting of works	Negligence of environmental mitigation measures	Ensure that EMP is included in the bidding documents	Contractor	PPTA
Debris and wastewater generated due to investigative works	Pollution of soil and water bodies due to disposal of waste material.	Provision of adequate drainage system including controlled collection and preliminary treatment of wastewater. Maintain all sites in a clean and safe condition. Safe disposal of all solid wastes outside the National Park	Contractor	PPTA
Movement and operation of drill rigs	Noise and disturbance of wildlife from operation and movement of drill rigs	Drilling techniques selection and drillrig maintenance to minimize noise levels from all operations - Diesel Generator noise level at 1 m from the enclosure surface not to exceed 75 dB(A). Noise measurements will be carried out regularly. If and when necessary, corrective measures, such as noise screens shall be implemented. Minimise dust by regular	Contractor	PPTA

Work activity /stage	Potential impact	Proposed mitigation measure	Responsible for implementation of mitigation measures	Responsible for supervision and oversight.
		watering of all stock-piles, access tracks, bare soil etc.		
Access tracks and movement of personnel	Noise and disturbance to wildlife	Access tracks to be sited to cause minimum disturbance Restriction of movement of personnel to a minimum Permission of each staff access to the site to be sought from the SNNP.	PPTA and Contractor	SNNP
Cutting of trees and clearing / trimming of trees and vegetative cover	Loss of trees and vegetative covers/loss of potential nesting habitats	- siting of tracks for movement of drill rigs to minimize disturbance to vegetation . Any tree having a diameter more than 10 cm is to be left undisturbed. A bird and vegetation specialist will inspect siting of tracks before any cutting of tracks, to ensure no trees of having a diameter of more than 10cm is cut, and no nesting of birds is affected. - No permanent structures to be constructed - Replanting of same type of vegetation and with three times the density as found naturally at the site - Prohibiting any felling of any vegetation and trees by workers Use of firewood prohibited. Kerosene to be used for cooking	Contractor and PPTA	SNNP
Personnel's Occupational Health and	Impacts on workers' health during transport	- Provide Safety Manual - Provide Safety Plan - Provide protection	Contractor	PPTA

Work activity /stage	Potential impact	Proposed mitigation measure	Responsible for implementation of mitigation measures	Responsible for supervision and oversight.
Safety	of, and working with drillrigs	gear and strictly enforce use - Supervision and Inspection - Protection gears - Provide safe supply of water - Provide adequate sanitation facilities		
Dismantling of drilling holes	Ingress of surface water into boreholes	- At the conclusion of each borehole to be capped	Contractor	PPTA
De-mobilisation	Soil and water contamination from wastes	- All sites, access tracks etc. to be cleared of all wastes and wastes to be disposed of - Re-planting of cleared sites, access tracks etc.		
Rehabilitation	Soil erosion. Loss of habitat	- Re-planting of cleared sites, access tracks etc.	Contractor	SNNP/PPTA

I. Monitoring and Reporting

119. Throughout the mobilisation, carrying out the Investigative Works and during demobilisation, the PPTA consultant will monitor the progress and impacts of the Works.

120. In consultation with National Park Authorities and HPCIDCB, the PPTA consultant will establish a system for preparing monthly reports on safeguards performance monitoring, issues resolution, and corrective action plans. These reports will be submitted to ADB, WECS and SNNP.

121. All conflicts / disagreements and agreements, no matter how trivial, must be logged and dated, with details of the persons involved and subject matter, by the Contractor at site, by the PPTA Consultant when monitoring the adherence by the Contractor to the EMP, or by HPCIDCB if receiving complaints etc.

Summary of Monitoring and Reporting

Environmental Features	Aspect to be Monitored	Time and Frequency of Monitoring and Reporting	Responsible party (Implementation/ Supervision)
Physical Works	Handling of drilling	Project site	Drilling Contractor &

Environmental Features	Aspect to be Monitored	Time and Frequency of Monitoring and Reporting	Responsible party (Implementation/ Supervision)
Progress	mud, waste.	Bi – Weekly	PPTA Consultant
Occupational Health and Safety	Water supply and sanitation. Implementation of worker's safety measures	Project site Bi – Weekly	Drilling Contractor & PPTA Consultant

J. Implementation Arrangements

122. The main institutions that will be involved in environmental management activities are the HPCIDBC as the implementing agency, the Department of National Park and Wildlife Conservation, the PPTA Consultant as overseeing agency, and Drilling and Surveying Contractors.

123. The PPTA consultant, in coordination with officials from SNNP, will ensure that all work is being carried out as per the EMP included in the contract conditions. Contractors will be responsible for implementing the environmental management plan and will report to PPTA consultant.

K. Budget

124. A budget for the implementation of the EMP is provided in Appendix B.

IX. CONCLUSION AND RECOMMENDATIONS

125. The environmental impacts associated with the proposed survey and drilling works have been assessed and described in the previous sections of this document. The findings establish that the Investigative Works will be carried out within a confined area and there will no cutting of mature trees. Clearing of bushes and grass for the access tracks for the drillrigs will be carried out in consultation with SNNP officials to avoid any adverse impacts.

126. Impacts during drilling operations such as noise, workers health and safety, waste management etc. will be taken care of by adopting mitigation measures as listed in the EMP. The EMP will be included in the drilling contractors' specifications and contract and the PPTA consultant will ensure its implementation by continuous supervision and monitoring.

127. Upon completion of the works all cleared areas will be re-planted and re-growth is expected to be relatively fast, and the areas will return to their present, natural condition within few years.

128. It is therefore concluded that the Investigative Works have no significant environmental impacts, and when implemented, the EMP will fully comply with ADB's SPS 2009 and Government requirements.

APPENDIX A: Screening of Protected Bird Species with Respect to their Possible Presence in or in the Vicinity of the Nagmati Dam Site

Bird Species	Status	Likely in SNNP (BCN and DNPWC 2010)	Season	Habitat	Nesting Season	Food	Likely at Nagmati Site
Hodgson's Bushchat (Saxicola insignis)	Vulnerable (IUCN 2012) and Endangered nationally (BCN and DNPWC 2011)	Yes	Winter visitor for Nepal	Grass land, tall grass and Reeds nearby river	June	Insects and fruits	Least possibility. Only one single unusual record from Chisapani area which is aerially 4 km far from Nagmati
Saker Falcon (Falco cherrug)	Endangered (IUCN 2012)	Yes	Wintering and passage migrants	Open country	NA	Dove, pigeon, insects, rodents	Possible
White-rumped Vulture (Gyps bengalensis)	Critically Endangered (IUCN 2012, BCN and DNPWC 2011)	Yes	Residential (All year)	Open country, Tall tree and human habitation	Oct- April	Scavenger	Least possibility
Grey-sided Laughingthrush (Garrulax caerulatus)	Vulnerable nationally (BCN and DNPWC 2011) Globally Least Concern (IUCN 2012)	Yes	Residential (All year)	Forest and bush	NA	Insects, fruits	Possible

Blue-winged Laughingthrush (Garrulax squamatus)	Vulnerable nationally (BCN and DNPWC 2011 and Least Concern (IUCN 2012)	Yes	Residential (All year)	Forest and bush	NA	Insects, fruits	Possible
White-tailed Stonechat (Saxicola leucurus)	Vulnerable Nationally (BCN and DNPWC 2011) and Least Concern (IUCN 2012)	Yes (Field survey 2012	Residential (All year)	Grass land	NA	Insects, fruits	Confirmed at downstream location
Brown Wood Owl (Strix leptogrammica)	Vulnerable Nationally (BCN and DNPWC 2011) and Least Concern (IUCN 2012)	Yes	Residential (All year)	Primary Forest	NA	Rodents, birds and reptiles	Least Possibility
Spot-bellied Eagle Owl (Bubo nepalensis)	Nationally Endangered (BCN and DNPWC 2011) Least Concern (IUCN 2012)	Yes	Residential (All year)	Primary Forest	Dec-March	Rodents, birds and reptiles	Least Possibility
Lammergeier Vulture *(Gypaetus barbatus)*	Vulnerable Nationally (BCN and DNPWC 2011) and Least Concern (IUCN 2012)	Yes	Residential (All year)	Open country and cliff	NA	Scavenger	Least Possibility

Egyptian Vulture *(Neophron percnopterus)*	Vulnerable Nationally (BCN and DNPWC 2011) and Endangered (IUCN 2012)	Yes	Residential (All year)	Open country and cliff	NA	Scavenger	Least Possibility
Himalayan Griffon *(Gyps himalayensis)*	Vulnerable Nationally (BCN and DNPWC 2011) and Endangered (IUCN 2012)	Yes	Residential (All year)	Open country and cliff	NA	Scavenger	Least Possibility
Cinereous Vulture *(Aegypius monachus)*	Near Threatened (IUCN 2012) and Nationally Endangered (BCN and DNPWC 2011)	Yes	Uncommon winter visitor	Open country	NA	Scavenger	Least Possibility

APPENDIX B: Cost Quotation for the Environmental Management Plan Implementation for the Oversight of Drilling at Nagmati Dam site in the Upper Bagmati Area

Table 1: Quotation

Name of the activity	Unit	Field Rate (Rs)	Qnty	Total (Rs)
A. Remuneration and DSA				
A.1 Wild Life Expert	days	7200	6	43.200
A.2 Birds Expert	days	7200	6	43.200
A.3 Vegetation Expert	days	7200	6	43.200
A.4 Vegetation Technician	days	3600	6	21.600
A.5 Noise Sampling Technician	days	3000	6	18.000
A.6 Site survey Technician	days	3000	6	18.000
A.7 Environment Specialist[12]	days	16800	14	235.200
B. Sampling and Analysis Cost				
B.1 Water Analysis	samples	3300	6	19.800
B.2 Soil sample analysis	samples	1650	12	19.800
B.3 Air sample analysis	samples	15000	3	45,000
B.4 Noise Sampling instrument hiring	samples	1200	6	7.2000
C. Vehicle Hiring	days	6	5000	30,000
D. Per Diem to National Park staff	days	60	1000	60,000
			Total	**604.200**

[12] Extension for Local Environment Specialist