Initial Environmental Examination

UPDATED January 2013

NEP: Kathmandu Valley Water Supply Improvement Project

Prepared by the Kathmandu Upatyaka Khanepani Limited, Ministry of Urban Development, Government of Nepal for the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 24 December 2012)

Currency unit – Nepalese rupee (NRs/NRe)

NRs1.00 = $ 0.01176

$1.00 = NRs 85.00

ABBREVIATIONS

ADB	–	Asian Development Bank
BDS	–	Bulk Distribution System
CBP Team	–	Capacity Building and Public-Private Partnership Support Team
CIAMP	–	Capital Investment and Asset Management Program
CITES	–	Convention of International Trade in Endangered Species
DWEC	–	District Wage Evaluation Committee
DNI	–	Distribution Network Improvement
DSC	–	Design and Supervision Consultant
EIA	–	Environmental Impact Assessment
EIRT	–	Environmental Issues Resolution Team
EMP	–	Environmental Management Plan
ENPHO	–	Environmental and Public Health Organisation
EPA	–	Environment Protection Act
EPR	–	Environment Protection Rules
HPCIDBC	–	High Powered Committee for Integrated Development for Bagmati Civilization
HWUSRUKV	–	Household Water Use Survey and Research in Urban Kathmandu Valley
IEC	–	Information, Education and Communication
lpcd	–	liters per capita per day
LPG	–	Liquefied Petroleum gas
ICIMOD	–	International Centre for Integrated Mountain Development
IDA	–	International Development Assistance
IEE	–	Initial Environmental Examination
INGO	–	International Non-governmental Organization
IUCN	–	International Union for Conservation of Nature
JICA	–	Japanese International Cooperation Agency
JBIC	–	Japanese Bank for International Cooperation
KUKL	–	Kathmandu Upatyaka Khanepani Limited
KVTDC	–	Kathmandu Town Development Committee
KVWSMB	–	Kathmandu Valley Water Supply Management Board
LICSU	–	Low Income Consumer Support Unit
MLD	–	million liters per day
MOUD	–	Ministry of Planning and Physical Works
MOE	–	Ministry of Environment
MOSTE	–	Ministry of Science and Technology and Environment
MWSDB	–	Melamchi Water Supply Development Board
MWSP	–	Melamchi Water Supply Project
NEWAH	–	Nepal Water for Health
NGO	–	Nongovernment organization
NTFP	–	Non-timber Forest Product
NWSC	–	Nepal Water Supply Corporation
OHS	–	Occupational Health and Safety
PAF	–	Project Affected Family
PID	–	Project Implementation Directorate
PPE	–	Personal Protective Equipment

PPP	–	Public Private Partnership
PPTA	–	Project Preparatory Technical Assistance
REA	–	Rapid Environmental Assessment
RBTS	–	Reed Bed Treatment System
RoW	–	Right of Way
RRP	–	Report and Recommendation of the President
RWSSFDB	–	Rural Water Supply and Sanitation Fund Development Board
SAPI	–	Special Assistance for Project Implementation
SDP	–	Kathmandu Valley Water Services Sector Development Program
SPAF	–	Severely Project Affected Family
SPS	–	Safeguards Policy Statement
SWC	–	Social Welfare Council
SWNCC	–	Social Welfare National Coordination Council
UDLE	–	Urban Development Through Local Efforts
UN	–	United Nations
UNEP	–	United Nations Environment Program
VDC	–	Village Development Committee
WSI	–	Wastewater System Improvement
WSS	–	Water Supply and Sanitation
WSTFC	–	Water Supply Tariff Fixation Commission
WUO	–	Water Utility Operator

WEIGHTS AND MEASURES

cm	–	centimetre
db	–	decibels
ha	–	hectare
kg	–	kilogram
km	–	kilometre
km^2	--	square kilometre
l	–	litre
m	–	meter
m^2	–	square meter
m^3	–	cubic meter
mg/l	–	milligrams per litre
ml	–	millilitre
MLD	–	million litres per day
mm	–	millimetre
$\mu g/m^3$	–	micrograms per cubic meter

NOTE

In this report, "$" refers to US dollars.

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EXECUTIVE SUMMARY

A. Purpose of the Initial Environmental Examination

1. The proposed Kathmandu Valley Water Supply Improvement Project[1] will support the efforts of the Government of Nepal towards improving water supply services in Kathmandu Valley. The project will invest in bulk water transmission and distribution network improvements and will complement past and ongoing Asian Development Bank (ADB) projects.[2] The resultant synergy is expected to lead to increased efficiencies, greater improvement in service delivery, and higher impact on health outcomes and quality of life for inhabitants of Kathmandu Valley.

2. The Government of Nepal and ADB require that the environmental impacts of development projects be identified and assessed as part of the planning and design processes, and that action is taken to reduce those impacts to acceptable levels. This is done through the environmental assessment process, which has become an integral part of lending operations and project development and implementation worldwide.

3. The purpose of this Initial Environmental Examination (IEE) is to examine the infrastructure components of the proposed project for the years 2012-2016, and to ensure no significant impacts on the environment during planning, construction, and operation. In the environmental assessment, potential environmental impacts are identified, their significance assessed, and actions devised to avoid these impacts or reduce them to an acceptable, insignificant level.

4. The project has been classified by ADB as environmental category B, indicating no significant impacts. The initial screening assessment of the project is described in the Rapid Environmental Assessment (REA) checklist in Appendix 1. An IEE is required by ADB to determine whether significant impacts warranting an environmental impact assessment (EIA) are likely. The IEE includes an Environmental Management Plan (EMP) to ensure that impacts during the life of the project are monitored and managed. The EMP is to be included in bidding and contract documents.

5. The IEE was prepared according to ADB's Safeguard Policy Statement (SPS, 2009) and the Government of Nepal's Environmental Protection Rules (EPR, 1997 and amendments 2007). The Government of Nepal, according to EPR 1997 and amendments 2007, requires an EIA study for all projects supplying drinking water to a population of more than 100,000, and the connection of new sources.[3] ADB requires that the IEE be updated based on detailed design, and submitted to ADB for review and approval prior to the awarding of contracts.

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[1] The project was prepared through PPTA 4893-NEP: Preparing the Kathmandu Valley Water Distribution, Sewerage, and Urban Development Project, approved on 13 December 2006. Due to restructuring of ongoing loans, the work of PPTA started in 2009, and final report was submitted in May 2010.

[2] Loan 1820-NEP (SF): Melamchi Water Supply Project was approved on 21 December 2000 and became effective on 28 November 2001. Loans 2058/2059-NEP (SF): Kathmandu Valley Water Services Sector Development Program were approved on 18 December 2003 and became effective on 7 December 2004.

[3] An Environmental Impact Assessment (EIA) was prepared in 2000 for Loan 1820-NEP (SF): Melamchi Water Supply Project (MWSP), and was approved by the then Ministry of Environment and Population and ADB. The previously approved EIA included all the components under the proposed project. Therefore, the government confirmed that the original EIA prepared in 2000 was still valid for the proposed project and that all government rules are fully complied, requiring no additional or new EIA study. A copy of the official letter confirming the government's decision on the original EIA and compliance with their environmental rules for the proposed project is in Appendix 8. The ADB Fact Finding Mission also met with the Ministry of Environment and Ministry of Planning and Physical Works on 18 March 2011 to confirm the government's decision on this matter.

6. The IEE incorporates lessons learned from the pilot Distribution Network Improvement (DNI) works conducted under Loan 1820. These lessons are reflected in the EMP, and ensure that contractors, the executing agency, and design supervision consultants (DSC) have clear roles and responsibilities in environmental management during implementation.

B. Rationale

7. Kathmandu Valley has a high urban population growth (5.3% per annum) and a high population density of 2,800 persons per km^2.[4] The total population of Kathmandu Valley in 2011 stands at 2.5 million. Rapid and largely unplanned urban growth, high population density, lack of sustainable water sources, and inadequate past investments in water supply infrastructure have resulted in abysmally poor availability and quality of drinking water.[5]

C. Proposed Project

8. The proposed project includes sections of the Bulk Distribution System (BDS) and DNI works as originally planned under the Melamchi Water Supply Project (MWSP)[6] and the drilling and development of tubewells in the Kathmandu Valley.

9. As a result of the restructuring of ADB Loan 1820, investments in ongoing projects were prioritized for source augmentation. The Melamchi tunnel and downstream transmission and distribution systems still need more investments. With completion of these ADB projects, including the Melamchi tunnel, Kathmandu Valley will receive an additional 170 million liters per day (MLD) of water, while the current average availability is only 100 MLD.[7] In order to utilize such substantial additional supply in an optimal manner, the project will provide priority investments in downstream transmission and distribution systems. To drive efficiencies and introduce best practices, the project will support selected district metering areas (DMAs) for introducing 24-hour water supply. As the projects are moving in the right direction and are likely to be completed by 2014, investments in the project are necessary and timely.[8]

10. The improved water supply system proposed under the project will serve a total population of 722,053 (470,000 directly and 252,053 indirectly) in an area of 1,700 ha, with a minimum water supply of 2 hours per day.

11. Detailed design of DNI packages will begin in the second quarter (Q2) of 2011, and Q2 2012 for BDS and reservoirs. Construction is scheduled to commence in Q1 2013, to be completed by end of 2016. The IEE is to be updated during detailed design and sent to ADB for review and approval prior to contract award. The EMP is to be incorporated into the civil works contract bidding and contract documents.

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[4] Central Bureau of Statistics, Government of Nepal, 2011.

[5] A baseline survey done by CRISIL under PPTA 4893-NEP in September 2010 estimates water availability at 20 liters per capita per day (lpcd), and average duration of water supply as 0.4 hours per day. Kathmandu Upatyaka Khanepani Limited (KUKL), the operator, assesses the current availability at 45 lpcd.

[6] Wastewater system improvements (WSI) in Kathmandu are planned under a separately funded ADB project. The project will be prepared through PPTA 7936-NEP: Preparing the Kathmandu Valley Urban Environment Improvement Project, scheduled to be approved in 2013.

[7] Though the current average availability of water is estimated at 100 MLD, availability varies widely, ranging from 70 MLD in the dry season to 140 MLD in the wet season.

[8] A District Metering Area (DMA) refers to a zone of water supply network which can be isolated and provided with a bulk meter to measure -water input quantity and with consumers' meters to measure the consumption; the difference gives the loss in the DMA.

D. Environmental Impacts, Mitigation, and Monitoring

12. Environmental impacts on the physical, biological, and socioeconomic and cultural environments during pre-construction, construction and operation, and maintenance have been considered in detail with the mitigating measures. An EMP is prepared and included in the IEE. The environmental impacts of the laying of pipes for the distribution and rehabilitation of water components and construction of reservoirs are not significant. Anticipated environmental impacts and mitigation measures have been proposed. A detailed environmental monitoring program has also been proposed, listing the environmental impact, its mitigating measures, the parameters to be monitored (including location, measurement, and frequency), and the cost. This monitoring program will evaluate the following: (i) the extent and severity of the adverse environmental impacts as compared to what was predicted; (ii) how effective the mitigating measures were, and their compliance with the regulations; and (iii) the overall effectiveness of the EMP. Costs of all mitigation measures during the construction phase will be included in the tender and contract documents, and will be borne by the contractors.

13. Awareness building measures that shall be undertaken by Kathmandu Upatyaka Khanepani Limited (KUKL)/PID include:

(i) training and awareness programs in health and sanitation, occupational health and safety measures (OHS), community health and safety, and usage of water and its importance (water cost, savings, reuse, recycling, water pollution, etc.) to the general public; and
(ii) community awareness and consultations prior to any construction activities.

14. The ADB SPS and the Government of Nepal rules require meaningful stakeholder consultations. Several meetings, workshops, and focus group discussions (FGDs) were held with stakeholders. PID also translated the IEE and made it available in their office and other public locations.

15. A uniform grievance redress mechanism (GRM) is proposed to address any environmental and social complaints during project implementation. A national community awareness and participation firm will be hired to facilitate programs during the project period. A safeguard unit is established within PID and headed by a senior environmental engineer.

16. All the costs related to cutting of trees shall be borne by the project itself. If, during the detailed design, it is found that tree cutting is unavoidable, it is mandatory to get permission from the Department of Forests, plant 25 saplings for every tree cut, and maintain them for 5 years. The cost for the cutting and nurturing of one tree for 5 years has been estimated at $600. These costs are included under the government's counterpart budget contribution.

17. The project also includes additional precautions to be taken while laying pipes within roads through heritage areas, including permissions from the Department of Archaeology, and additional supervision by trained heritage professionals during construction. No heavy equipment will be used and no buildings impacted.

E. Conclusion and Main Findings

18. The project will result in a significant improvement in public health and quality of life for Kathmandu's citizens. Some negative impacts are anticipated during construction, but in specific areas and for short duration (dust, noise, traffic problems, access to buildings, etc.). It is expected that the adverse environmental impacts of the water supply project for the Kathmandu Valley will in general not be significant, and can be easily and inexpensively mitigated and prevented through adequate measures and regular monitoring during design, construction, and operation. Based on this IEE, no further EIA study is required.

I. INTRODUCTION

A. Purpose of the Report

1. The Government of Nepal requested a project preparatory technical assistance (PPTA) from ADB for the Kathmandu Valley Water Supply and Wastewater System Improvement (PPTA4893-NEP). The PPTA aims to prepare a project feasibility study for developing a capital investment and asset management plan (CIAMP), detailed design documents for improving water supply distribution in a selected area and for preparing an ensuing loan in the pipeline in 2011.

2. The main urban concentration within the valley consists of the twin cities of Kathmandu and Lalitpur, followed by Bhaktapur, Madhaypur, and Kirtipur. The project will focus on investment in physical infrastructure and capacity building.

3. The CIAMP is prepared with the following ultimate objectives for 2025:

(i) optimizing the existing water supply and increasing the availability of potable water supply until all registered KUKL customers have equitable and regular access, as per KUKL's license conditions and with the aim of eventual access to water 24 hours per day for all consumers; and

(ii) facilitating the distribution of water from the existing raw water intakes, tube wells, and water treatment plants, and for the water treatment plant to be constructed under the Melamchi Water Supply Project (MWSP).

4. The purpose of this IEE is (i) to examine the proposed infrastructure components for the years 2012–2016, (ii) to ensure that impacts to the environment are avoided and/or mitigated, (iii) to ensure that there are no significant impacts, and (iv) to provide guidance for planning, construction, and operation. In the environmental assessment, potential environmental impacts are identified, their significance assessed, and strategies devised to avoid these impacts or reduce them to an acceptable level.

5. These strategies (called "mitigation measures") are then carried forward into the EMP. The EMP assigns responsibilities, timescales, and performance indicators/standards for each mitigation measure, to make sure that they are implemented and not ignored. An environmental monitoring plan is also included. This includes protocols and responsibilities for checking the operation of the project, to a range of relevant and agreed performance indicators.

B. Basis and Extent of the IEE

6. Government of Nepal legislation and ADB policy require that the environmental impacts of development projects are identified and assessed as part of the planning and design processes, and that action is taken to reduce those impacts to acceptable levels. This is done through the environmental assessment process, which has become an integral part of lending operations and project development and implementation worldwide.

II. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

A. ADB Policy

7. The Safeguard Policy Statement (SPS, 2009) of ADB stipulates addressing environmental concerns, if any, of a proposed activity in the initial stages of project preparation. For this, ADB categorizes the proposed components into categories (A, B, or C) to determine the level of environmental assessment required to address the potential impacts. The project has been categorized as B. This IEE has been prepared to address the

potential impacts, in line with the recommended IEE content and structure for category B projects. Stakeholder consultation was an integral part of the IEE. An EMP outlining the environmental measures to be adhered to during implementation of the project has also been prepared. The EMP forms part of the bidding and contract documents.

1. Government of Nepal Rules

8. **National Environment Protection Act (1997) and Environment Protection Rules (1997).** The legal provisions for environmental protection in Nepal are found in different acts and regulations in Appendix 3. The requirements for environmental assessment in Nepal were established by the National Environment Protection Act (1997), and the procedures are defined in the Environment Protection Rules (1997) and its amendment of 20 August 2007.

9. The Government of Nepal (according to EPR 1997) requires that all projects supplying drinking water to a population of more than 100,000 and the connection of new sources require an EIA. The proposed project (Kathmandu Valley Water Supply Improvement Project) is a de facto part of MWSP. It includes sections of the BDS and DNI works included in the original MWSP. Subproject 2 under the restructured Loan 1820 was subjected to EIA in 2000, and was approved by the then Ministry of Environment and Population of the Government of Nepal and ADB. Subproject 2 did not introduce any new infrastructure requiring a separate environmental examination, but was a scaled-down version of the BDS and DNI works included in the original MWSP. The environmental assessment, mitigation prescriptions, and monitoring plan given in the EIA Report of 2000 were still valid during the approved restructuring in 2008, and it was agreed by ADB and the government that undertaking a new EIA for subproject 2 was not necessary. The same applies to the current proposed project, as no new components or locations of facilities are being introduced. This was confirmed by the Ministry of Environment in March 2011, and the written confirmation is provided in Appendix 8.

10. Nepal is also a signatory to many international agreements and conventions related to environmental conservation, such as:

(i) Plant Protection Agreement for Asia and the Pacific Region, 1956;
(ii) Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 1973);
(iii) Convention Concerning the Protection of World Cultural and Natural Heritage (World Heritage Convention), 1972;
(iv) International Tropical Timber Agreement, 1983; and
(v) Convention on Biological Diversity, 1992.

11. **National Drinking Water Quality Standards (2006).** The Nepal Drinking Water Quality Standards and Guidelines (including standard limits, guidelines for the required frequency for water quality monitoring, and the process and schedule for measuring the standards in active use in the country) were established in 2006. The standards for drinking water are attached in Appendix 2.

12. **National Urban Policy (2007).** This policy highlights the historical imbalances and haphazard nature of urban development in Nepal. It views urban centres as catalysts for economic development linked to north-south and east-west access corridors, and flags poor sanitation, environmental degradation, and lack of services for the urban poor as requiring urgent attention. The urban policy proposes building the capacity of municipalities to plan and manage integrated local development activities, including the preparation of urban master plans to be moderated by central and regional authorities. Private sector involvement and investment in infrastructure development are specifically sought.

13. **National Urban Water Supply and Sanitation Sector Policy (2009).** This policy was recently formulated to provide support and guidance towards achieving equity in service delivery. This will ensure that financially marginalized households within the system areas are mainstreamed as valid customers of service through design and implementation of financial incentives where so required.

14. **Local Self-Governance Act (1999).** The Act provides the legal basis for the devolution of responsibilities and authorities for social, economic, institutional, and physical infrastructure development, including water and sanitation systems, to the local government. While periodic district plans have been formulated in 52 districts, a decade-long political conflict, as well as the absence of locally elected officials for most of this period, have frustrated implementation plans.

15. The following are required permits to be obtained by the project prior to construction:

(i) tree-cutting clearance from Forest Department;
(ii) ring road construction permit from Roads Department and metropolis/sub-metropolis permit for inner roads;
(iii) permit from Parks Department for works along access road in Shivapuri Nagarjun National Park; and
(iv) permit from Department of Archaeology, especially in Patan and Darbar Squares.

III. DESCRIPTION OF THE PROJECT

A. Existing Conditions of Water Supply Infrastructure

16. The Kathmandu Valley water distribution network system is a very complex and ad-hoc water network system developed more than 100 years ago. The present area being served by the KUKL system in the Kathmandu Valley comprises the municipal areas of Kathmandu, Lalitpur, Bhaktapur, Thimi, Kirtipur, and parts of adjoining village development committees (VDCs), primarily around Kathmandu, Lalitpur, and Bhaktapur.

17. The water distribution system has been installed and expanded at various times from the days of the Rana regime in the country over a hundred years ago, when the Bir Dhara and Tri Bhim Dhara systems were developed. Subsequently, the systems were upgraded and expanded in the 1960s with the assistance of the Indian Cooperation Mission (ICM). More of the development and expansion of the system, especially in Kathmandu and Lalitpur, took place when the World Bank provided assistance to a series of projects during the 1970s and the 1980s through the Water Supply and Sewerage Development Board. The Board was subsequently converted into a utility corporation, initially called the Water Supply and Sewerage Corporation, and later the Nepal Water Supply Corporation (NWSC). In February 2008, water sector assets in the Kathmandu Valley were transferred for operation to a government-owned company called the KUKL.

18. From the 1980s until now, a number of investments, with assistance from the World Bank, the Japanese International Cooperation Agency (JICA), and other donor agencies resulted in a more comprehensive water distribution system trying to provide services to the ever-growing population of the Kathmandu Valley. Apart from external support, internally generated resources have also been utilized to cater to the growing demand, often in a piecemeal manner.

19. At present, the water supply system has 30 surface sources and more than 50 operational tube wells located in different parts of the Valley. The sources feed into 21 water treatment plants with a combined treatment capacity of 85 MLD and 42 service reservoirs

with a combined storage capacity of approximately 40,800 m^3. Water is distributed to about 2 million consumers through about 1,250 km of pipelines, 165,000 private connections, and 1,196 public stand posts. The system is being managed by 10 branch offices of KUKL, with 6 of them for the Kathmandu Metropolitan City area and adjoining VDCs, 1 for Lalitpur and adjoining VDCs, 1 for Bhaktapur and adjoining VDCs, 1 for Kirtipur and adjoining VDCs, and 1 for Madhyapur Thimi and adjoining VDCs.

20. Deep tube wells are the main means of extracting groundwater for use in the water supply system. Out of 73 existing deep tube wells, only 54 are in operation at present. Most of the tube wells' electromechanical parts are in a bad condition, with most flow meters missing or broken. The tube wells used to be operated only in the dry season in order to supplement reduced surface water sources, but with demand exceeding supply, they are now also used in the wet season. Total dry season rate of production is 40.6 MLD, with a reduced wet season production of 2.2 MLD. To avoid ground subsidence and over-exploitation, KVWSMB is undertaking a Groundwater Management and Regulation Policy Preparation Study (ADB SDP Loan 2059) that will establish processes to regulate and control or prohibit the extraction and use of groundwater within the Kathmandu Valley. The ADB Melamchi Project (Loan 1820) will replace or install flow and water depth instrumentation in all ground water tube wells for extraction monitoring.

21. The present population of the valley's water supply service area is estimated at 2.7 million, with a water demand of 195 MLD. The total water production in the wet and dry seasons is about 140 and 100 MLD, respectively. The resultant water supply is constrained and intermittent. People in most of the areas hardly get 1 hour's supply every fourth day.

22. There are many problems in the distribution system besides deficiency in water. These include aging pipes, high percentage of leakage and wastage, illegal and spaghetti connections, unscientifically laid pipelines, supply contamination, and many others. There are also problems with production. The ground water is depleting due to over-extraction, and surface water catchments are becoming degraded.

23. **Water quality**. The most recent water quality assessment carried out by the Environmental and Public Health Organization (ENPHO) in 2009 highlighted the nature and problems of water quality in surface and groundwater sources currently being used by KUKL. The most common and significant water quality problem in the existing surface water sources is bacteriological contamination, mainly the presence of *E. coli* bacteria in nearly all surface water sources. This is mainly due to increased human activity in and around the water sources. The proposed intake for the project is from an isolated mountain stream located in the high hills with limited human habitation in the surrounding area, and therefore should be able to avoid such contamination.

24. In the case of groundwater sources in the valley, ammonia and iron are the major problems. Of the 50 wells tested and in operation, nearly 27 wells had water with ammonia levels above the recommended level of 1.5 mg/l. The highest recorded value for ammonia was 109 mg/l, with several in the range of 80 mg/l. Wells in the Manohara well field had water with ammonia in the range of 4-15 mg/l. Tube wells under the Tripureshwor branch in Kuleshwor, Kalanki, Lagan, and Tahachal had water with ammonia above 50 mg/l. Similarly, iron has been encountered in the water in nearly all the wells, with 48 of the wells containing water with iron above the permissible limit of 0.3 mg/l. The water with the highest iron content was in the tube well in Koteshwor, with 24.32 mg/l, and there are a number of wells with iron concentration in their water in the range of 10 mg/l.

25. Water in a couple of wells also indicated the presence of arsenic. It has been strongly recommended that these wells be regularly tested and possibly abandoned as drinking water sources under KUKL's regular operational activities. ENPHO also tested the water samples

for the presence of pesticides. Water from some of the wells in Bansbari and one in Jagati revealed the presence of pesticides like heptachlor and aldrin, which could be due to the use of pesticides in nearby agricultural fields.

B. Project Rationale

26. Kathmandu Valley is characterized by high urban population growth (5.3% per annum) and a high population density of 2,800 persons per km^2.[9] The total population of Kathmandu Valley in 2011 stands at 2.5 million. Rapid and largely unplanned urban growth, high population density, lack of sustainable water sources, and inadequate past investments in water supply infrastructure have resulted in abysmally poor availability and quality of drinking water.

C. Description of Proposed Project

27. The proposed project includes sections of the BDS and DNI works as originally planned under MWSP. The purpose of the proposed project is to improve the water supply system service delivery, to ensure compliance of KUKL's operating license. The project aims to ensure both availability of water supply and water quality in the distribution system.

28. The proposed water supply system improvements will be carried out in Kathmandu Valley. The negative environmental impacts of enhanced wastewater generation will be addressed in a subsequent ADB project, which will be processed to mitigate wastewater effluent impacts in a sustainable manner.

29. The proposed civil works and equipment packages consist of the following components: (i) water supply and BDS, water supply reservoirs, and water supply DNI; and (ii) procurement of equipment, vehicles, and materials.

30. Tables 1a-b show the nature and size of the various components of the proposed project to be constructed. Some details may change (e.g., pipe diameters and lengths and locations) during the detailed design phase, as this IEE is based on overall feasibility level assessment and costs.

31. **Water supply and Bulk Distribution System (BDS).** This component consists of the supply and complete laying of pipes of different diameters, as well as surface improvements works. The ductile iron (DI) pipes consist of pipes with diameters of 800–1,500 mm (4.76-km feeder mains), 600–1,400 mm (14.21-km ring mains), and 800–1,200 mm (14.11-km transversal mains). These will be laid in trenches within the Right of Way (RoW) alongside the main roads in different areas of the Kathmandu metro zone: Naxal, Gyaneshwar, Dilli Bazaar, Bagh Bazaar, Anamnagar, Ramshah Path, Tripureswor, Lagan, Thapathali, Baneshwor, Maitidevi, Ghattekuls, Singha Darbar, Koupondol, Chakupat, Chyasal, Mangal Bazaar, Sundhara, Tangal, Lagankhel, Pulchowk, Gabahal, and others.

32. **Water supply reservoirs.** Five service reservoirs for temporary storage of treated water prior to distribution will be constructed on previously acquired land (owned by KVWSMB) at the following locations: Mahankal Chaur II (30,000 m^3), Arubari (8,000 m^3), Bansbari (10,000 m^3), Balaju (12,000 m^3), and Khumaltar (8,000 m^3).

33. **Water supply distribution network improvement (DNI).** New distribution pipes to supply treated water to customers in Kathmandu and Lalitpur will reuse existing pipes of good condition, replace the non-functional existing pipes and expand the network into new areas, which will be laid in trenches along public roads. For the Kathmandu metro zone,

[9] Central Bureau of Statistics, Government of Nepal, 2011.

which is the main supply area of water from Melamchi, details of an approximate distribution system pipe network, with types, sizes, and lengths, are given below.

34. All pipes 150 mm in diameter and above shall be ductile iron (DI). The distribution pipelines for the eleven subzones of the Kathmandu metro zone will use pipes ranging in size from 75 to 140 mm, and made of HDPE (high density polyethylene). The total estimated pipe length is about 487,586 m. Larger diameter pipes of 150–1000 mm, acting as trunk mains and distribution mains, will be DI, with a total length of about 162,913 m.

35. The improved water supply system under the project will serve a total population of 754,150 in an area of 3139.19 ha. Tables 1a-b show the components of the scheme that have been assessed in this IEE.

36. There are 11 subzone service areas for DNI under the project. However, 20 other subzone service areas will receive indirect benefits from the improvement works due to the bulk distribution system feeding into the existing network. This includes areas with water scarcity in the west of Kathmandu, which will benefit from interconnection with the existing 400-mm diameter service main from the Balaju Service Reservoir, which would be used to boost the supply in Chhauni, Dallu, and the Chhetrapati areas.

37. **Drilling and Development of Tubewells in Kathmandu Valley:** All the proposed 20 sites of well drilling are within the Kathmandu Valley. Eleven tubewells will be constructed along the Bagmati River bank along the Guheswari to Gokarna stretch; 2 along the banks of the Mahadev Khola; 1 at Teku along the bank of the confluence of the Bagmati and Bishnumati rivers; 1 at Chyasal, along the bank of the Manohara river, 500 m away from the Kodku wastewater treatment plant; 2 at Bode along the bank of the Manohara river and 1 at Balkhu along the bank of the Bagmati river after the confluence of the Bagmati and Bishnumati rivers; 1 each at Sankha Park and Baansbari Bhaktapur. The production of the drilled wells will supplement water in the existing distribution network through existing treatment plants and to the isolated distribution system of particular areas. Most of the drilling area is public property. Public property is proposed by the local users and local authorities (Municipality, Ward office, VDC). Most of the drilling sites are accessible by all weather access. Provision for temporary approach roads have been made for the drilling sites which do not have access.

38. There will be 20 new tubewells that will be drilled to approximate depths ranging from 120 to 330 m; with the diameters of the wells from 200 to 250 mm; and the estimated discharge of the wells is expected to be from 500 to 1200 l/min (Table 1b). Electric power for the pumping stations will be obtained through the NEA grid.

39. The tubewell construction sites are located in the central and north region of the Kathmandu Valley. Geological formations of these areas are made of unconsolidated alluvial materials like clay and fine to medium and coarse sands with thick layers of water bearing aquifers. Groundwater quality of the northern area is better than that of other areas. The concentrations of iron and ammonia present in the groundwater of the Kathmandu Valley exceed the WHO standards as well as the Nepal Standards. The expected quality of iron from the new tubewells will contain iron from 1 ppm to 5 ppm and ammonia content from 1.5 ppm to 30 ppm. The limits of these water quality parameters should be within 0.3 ppm and 1.5 ppm, respectively. Hence the ground water obtained from the tubewells will have to be treated to minimize them to acceptable limits.

Figure 2: Location of 20 Tubewells

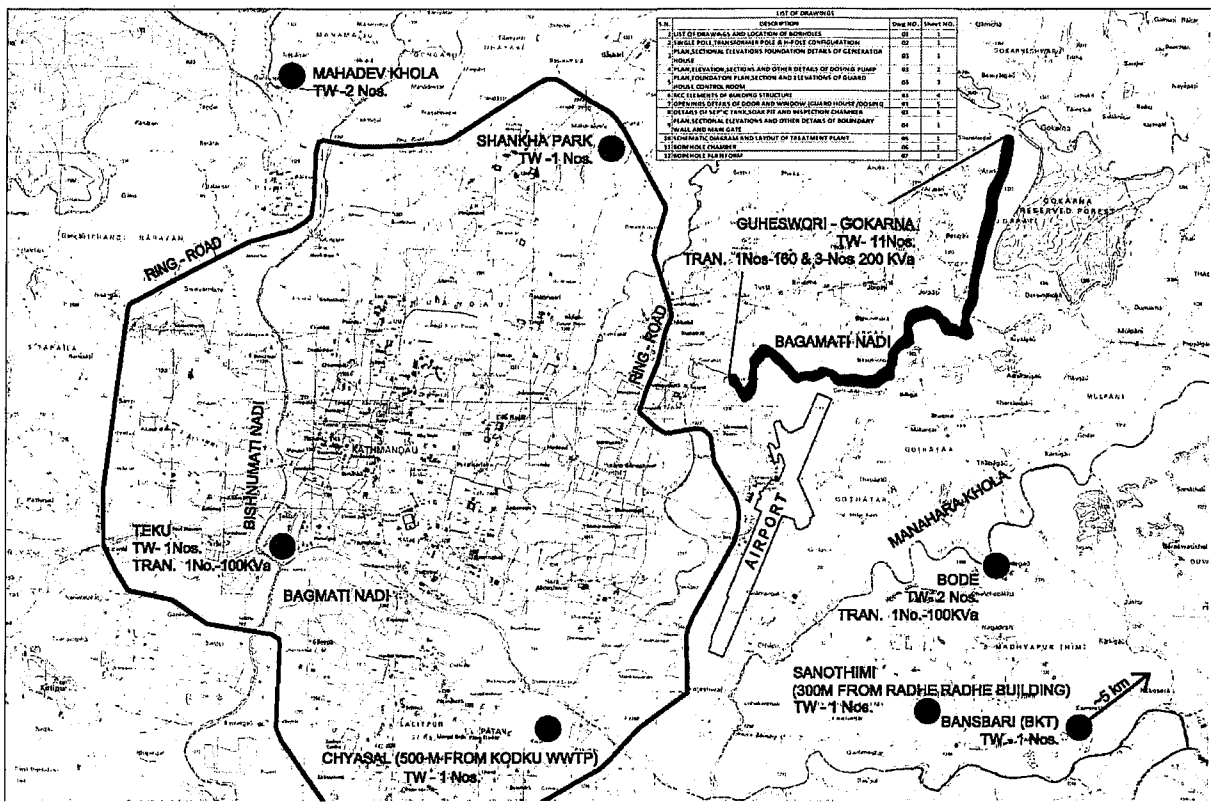


Table 1a: Proposed Water Supply Project Investments

Infrastructure	Function	Description	Location
a. Service reservoirs	Temporary storage of treated water prior to distribution	Construction of 5 reservoirs (2 of 8,000 m^3, capacity, 1 of 10,000 m^3 capacity, 1 of 12,000 m^3 capacity, and 1 of 30,000 m^3 capacity)	1. Construction of Mahankal Chaur II 30,000 m^3-capacity service reservoir near Arubari on previously acquired land 2.Construction of 8,000 m^3-capacity service reservoir on previously acquired land in Arubari 3. Construction of 10,000 m^3-capacity service reservoir on previously acquired land in Bansbari 4. Construction of 4,000 m^3 reservoir on new acquired land in Balaju and an additional 8,000 m^3 reservoir will be constructed after dismantling the existing reservoir 5.Construction of 8,000 m^3 -capacity service reservoir on previously acquired land to serve subzone A-8.5 at Khumaltar
b. Feeder mains	Transfer water from the ring main to the service reservoirs at Bansbari, Balaju, and Khumaltar	4.78 km of 800–1,500 mm diameter DI pipe	Supply and complete laying, including surface improvement works in trenches in the Right of Way (RoW) alongside main roads: 1. Narayan Gopal Chowk Ring Main to Bansbari reservoir 2. Ring Main to Balaju reservoir 3. Ring Main to Khumaltar reservoir
c. Ring main	Transfer water along the ring road to Kathmandu metropolis	14.21 km of 600–1,200 mm diameter DI pipe	Supply and complete laying including surface improvement works in trenches in the Right of Way (RoW) alongside main roads: 1. Chabahil to Narayan Gopal Chowk 2. Narayan Gopal Chowk to Balaju 3. Chabahil to Gaushala 4. Tinkune to Ekantakuna
d. Transversal main	Transfer water from the ring mains to the supply zones or the main distribution service area	14.11 km of 800–1,000 mm diameter DI pipe	Supply and complete laying including surface improvement works in trenches in the Right of Way (RoW) alongside main roads: 1. Gaushala to Baneshwar 2. Thapathali to Tinkune 3. Thapathali to Ekantakuna 4. Balaju to Lainchaur 5. Lainchaur to Thapathali
e. Distribution pipes	Distribute treated water to customers, reuse existing pipe of good condition, replacing existing pipes and expanding the network into new areas	1.All pipes 150 mm diameter or above will be DI; distribution pipes for Kathmandu Metro Zone will range from 75 to 140 mm in diameter, and will be of HDPE of about 487,586 m 2. Pipes 150-1000 mm in diameter acting as trunk mains, and distribution mains will be of DI, of about 162,913 m. Details of pipes are:	Supply and complete laying including surface improvement works in trenches alongside public roads in:

Infrastructure	Function	Description	Location
		DNI Package 1 (DNI 1,2, 6) Tertiary main HDPE pipe 155,265m Secondary main DI pipe = 44,733m Primary main DI pipe = 13,161 m Total length Package 1 = 213,159	**DNI Package 1 (DNI 1,2, 6)** DNI 1 (sub-zone A-3.1, A-3.2 and A-3.3: 436.62 ha, Population 2015: 84,378
		DNI Package 2 (DNI 3, 4, 5, 7) Tertiary main HDPE pipe 189,443 m Secondary main DI pipe = 50,128 m Primary main DI pipe = 10,514 m Total length Package 2 = 250,085 m	**DNI Package 2 (DNI 3, 4, 5, 7)** DNI 3 (sub-zone A-4.4, 16,227 ha; sub-zone A-6.2: 263.84 ha, Population 2015: 100,995 DNI 4 (part of sub-zone A-7, 142.92 ha; Population 2015: 40,216 DNI 5 (sub-zone A-8.2: 284.26 ha; Population 2015: 72,178 DNI 7 (sub-zone A-1.7: 271.45 ha; Population 2015: 111,004
		DNI Package 3 (DNI 8, 9, 10, 11) Tertiary main HDPE pipe 142,878 m Secondary main DI pipe = 38,033 m Primary main DI pipe = 6,344 m Total length Package 3 = 187,255 m	**DNI Package 3 (DNI 8, 9,10 ,11)** DNI 8 (sub-zone A-8.1: 348.55 ha; Population 2015: 38,292 DNI 9 (sub-zone A-4.6: 207.84 ha; Population 2015: 61,068 DNI 10 (sub-zone A-1.6: 102.87; Population 2015: 21,634 DNI 11 (sub-zone A-9.2: 190.16; Population 2015: 50,907

ha = hectare, km = kilometer, m^3= cubic meter, mm = millimeter.

Table 1b: Other Works: Drilling and Development of Tubewells in Kathmandu Valley

<table>
<tr><th>No.</th><th>Works</th><th>Quantity (nos.)</th><th>Remarks</th><th>Category</th></tr>
<tr><td>1</td><td>Drilling, development and operation of tubewells.</td><td>20</td><td>Guheswori – Gokarna stretch 11 nos.; Mahadev Khola 2 nos.; Bode 2 nos.; Sankha Park 1 no.; Bansbari Bhaktapur 1 no.; Teku 1 no.; Balkhu 1 no.; Chyasal 1 no. The groundwater will be pumped to the Mahankal Chaur, Balaju, Bode, Shanka Park, and Baansbari Bhaktapur treatment plants, respectively. Pressure filters will be installed in the remaining areas and the treated wáter will be pumped to the mains.
<table>
<tr><th>Tubewell</th><th>Nos</th><th>Q (lpm)</th><th>Depth (m)</th><th>Dia. (mm)</th></tr>
<tr><td>GG 1-3</td><td>3</td><td>900</td><td>120</td><td>250</td></tr>
<tr><td>GG 4-11</td><td>8</td><td>1200</td><td>250 to 290</td><td>250</td></tr>
<tr><td>MK</td><td>2</td><td>833</td><td>280</td><td>250</td></tr>
<tr><td>Bode 1</td><td>1</td><td>1000</td><td>300</td><td>250</td></tr>
<tr><td>Bode 2</td><td>1</td><td>1000</td><td>250</td><td>250</td></tr>
<tr><td>Teku</td><td>1</td><td>1000</td><td>280</td><td>200</td></tr>
<tr><td>Balkhu,</td><td>1</td><td>1000</td><td>280</td><td>200</td></tr>
<tr><td>Chyasal</td><td>1</td><td>1000</td><td>280</td><td>200</td></tr>
<tr><td>Shanka Park</td><td>1</td><td>900</td><td>330</td><td>200</td></tr>
<tr><td>Bansbari BKHT</td><td>1</td><td>500</td><td>280</td><td>250</td></tr>
</table></td><td>B</td></tr>
<tr><td>2.</td><td>Stringing of 11 Kva line including erection of poles</td><td>150 poles</td><td></td><td>C</td></tr>
<tr><td>3.</td><td>Installation of transformers (ranging from 100 to 200 Kva)</td><td>9</td><td></td><td>C</td></tr>
<tr><td>4.</td><td>Supply and installation of pumps, generators and other electrical appliances</td><td></td><td></td><td>C</td></tr>
<tr><td>5.</td><td>Supply and laying of DI pipes</td><td>4 km</td><td>Approximate</td><td>B</td></tr>
<tr><td>6.</td><td>Supply and laying of HDPE pipes</td><td>2 km</td><td>Approximate</td><td>B</td></tr>
<tr><td>7.</td><td>Supply and installation of bulk meters</td><td>20</td><td></td><td>C</td></tr>
<tr><td>8.</td><td>Supply and installation of pressure Water Treatment Plants Units</td><td>4</td><td></td><td>C</td></tr>
<tr><td>9.</td><td>Construction of building structures, including boundary walls at treatment plant sites.</td><td>4</td><td></td><td>C</td></tr>
</table>

GG: Guheswari to Gokarna Stretch; MK: Mahadev Khola; BKHT: Bhaktapur; Q: Estimated yield (l/min)

IV. DESCRIPTION OF THE ENVIRONMENT

A. Kathmandu Valley

40. Geographically, the Kathmandu Valley lies between latitudes 27°35' to 27°48'N and longitudes 85°12' to 85°33'E. The altitude of the district ranges between 1,372 m and 2,732 m above mean sea level. The major rivers flowing in the district are the Bagmati River, Bishnumati River, and Manohara River. The Bagmati River runs for 28 km within Kathmandu Valley. The Bishnumati, Manohara, Dhobikhola, Nagmati, and Balkhu Rivers are the main tributaries of the Bagmati River, which is important not only as a water source, but also from a religious point of view. One of the most famous Hindu temples, the Pashupati Nath Temple, is located on the banks of the Bagmati River.

41. Bhaktapur, one of the adjoining cities of Kathmandu, is located between latitudes 27° 37' to 27°44'N and longitudes 85° 02' to 85° 32'E. It is bounded by Kavrepalanchowk in the east, Kathmandu and Lalitpur in the west, Kathmandu in the north, and Kavrepalanchowk and Lalitpur in the south. The average elevation ranges from 1,372 m to 2,166 m above mean sea level. Rivers and streams are the predominant water resource in the Bhaktapur district. The main rivers are the Hanumanate and Manohara. The Bagmati River does not flow through Bhaktapur, but the Manohara and Hanumante are both major tributaries of the Bagmati River.

42. Lalitpur is another adjoining city of Kathmandu, and is located between latitudes 27°22 to 28°50'N and longitudes 85°14' to 85°26'E. It is bounded by Kavrepalanchowk in the east, Makwanpur in the west and south, and Bhaktapur and Kathmandu in the north. The Bagmati River flows as the boundary between Lalitpur and Kathmandu. The major tributary of the Bagmati River in the Lalitpur district is the Nakkhu Khola.

43. The Kathmandu Valley is accessible by major roads to different parts of the country, and to India in the south and China in the north. Kathmandu has an airport that caters to national and international airlines that fly to many parts of the country and abroad.

B. Physical Resources

1. Topography

44. The Kathmandu Valley is about 1,300 m above mean sea level, with an area of about 340 km^2. The valley has a bowl-like structure, surrounded by high hills, and the altitudes from the valley floor range from 500 m to 1,400 m. It lies between the Himalayas in the north and the Mahabharat range in the south. The prominent boundary features of the valley are Phulchowki Hill (3,132 m) in the southwest, Shivapuri (2,713 m) in the north, Chapa Devi (2,400 m) in the southwest, and Nagarjun (2,100 m) in the west. The major rivers flowing in the district are the Bagmati, Bishnumati,and Manohara Rivers.

2. Geology and Soils

45. The Kathmandu Valley is a synclinal tectonic basin, consisting of fluviolacustrine deposits from the Pleistocene age resting on top of Precambrian metamorphic bedrock. In Kathmandu municipality, the Gokarna and Kalimati formations are predominant, Gokarna to the northeast and Kalimati to the southwest. Bhaktapur city is located on a hill that is part of the Kalimati formation. In Latitpur municipality the Kalimati and Chapagaun formations are predominant. The Gokarna formation typically consists of light to brownish-grey; fine laminated and poorly graded silty sand, with intercalations of clay of variable thickness. Shallow sand and poorly graded (SP) soils, which are highly prone to liquefaction even with

small to moderate-intensity earthquakes (i.e., levels VII-VIII), are often found within the Gokarna formation.

46. The Kalimati formation is made of gray to dark silty clay and clayey silt. Organic clay, fine sand beds, and peat layers are commonly found. Silty-sand soil layers intercalated with silt or clay layers are often found from 5 m to 15 m down. Such layers are prone to liquefaction under moderate to high-intensity earthquakes (i.e., levels VIII-IX).

47. The Kalimati formation surrounds the Jawalakhel and Lagankhel hills, which are located on the Chapagau formation. At Jawalakhel Chowk, a soil investigation conducted by JICA under the Study on Earthquake Disaster Mitigation in Kathmandu Valley, 2000–2001, found a nonliquefiable soil profile of good strength capacity. Most of the soils with moderate to high liquefaction potential are to be found along riverbanks in the so-called recent flood plains. Generally, apart from soils located at the foot of mountains, soils in the Kathmandu Valley located above 1,300 m are expected to be either non-liquefiable or to have a low liquefaction potential.

3. Climate

48. Nepal receives about 1,500 mm of rainfall in a good monsoon regime in one year (DHM records). Rainfall is concentrated, and more than 75% of the annual rainfall occurs during the monsoon months from June through September. The months between October and May are dry, and any rainfall is sporadic. In the winter, rainfall is caused by the weather system originating in the Mediterranean. The winter rain reaches Nepal and causes significant precipitation in the west.

49. The climatic condition of the Bagmati watershed is quite variable because of the intricate topography. Temperature generally decreases with elevation, and is low in winter. With the advent of spring, the temperature increases. Climatically, the Bagmati watershed region can be classified into three regions:

(i) the tropical climate of the southern Terai, Bhabar, Chure (Shiwalik), and the Inner Terai, which has a mild and dry winter;
(ii) the warm temperate climate of the Mahabharat region above 2,000 m, with warm summers and cool winters; and
(iii) the cool temperate climate of the high Mahabharat region above 3,000 m, with cool summers and cold winters. Snow falls in the winter months and persists on the high slopes throughout the winter.

50. Rainfall occurs between the months of June and September due to the southeast monsoon. The humid monsoon air stream blowing from the Bay of Bengal is forced to rise as it meets the Himalayas. As a result, heavy rainfall occurs in some sections of the southern Himalayan slopes. Rainfall is also high along the Chure range. Regions close to the Indian border receive about 1,500 mm of rain a year, while at the foothills of Chure, the annual rainfall reaches 2,000 mm. On the northern side of the Chure, the rainfall diminishes again. In the leeward side, rainfall is reduced due to rain shadow effects. The orographic effect is pronounced, and governs the rainfall pattern.

C. Water Resources

1. Surface Water

51. Nepal is characterized by many small to large rivers, which flow from north to south. There are over 6,000 rivers in Nepal, and their total length exceeds more than 45,000 km. Out of the total numbers of rivers, 1,000 are more than 10 km long, and 100 are more than

160 km long. The surface water available is estimated to be around 224.7 billion m^3 per annum. In terms of flow rate, it is around 7,125 cubic foot per second (cusecs). Nepal receives a yearly average precipitation of more than 1,500 mm.

52. The Bagmati River forms a medium-sized river basin with a catchment area of 3,700 km^2 at the Nepal-India border. It extends between latitudes 20^0 42' to 27^0 50'N and longitudes 85^0 02' to 85^0 58'E. It originates from the Shivapuri hills in the Mahabharat range of mountains, and flows down south into the Terai plains before crossing the Indo-Nepal border. Along its course, the river passes through eight districts, namely Bhaktapur, Kathmandu, Lalitpur, Kavrepalanchowk, Makwanpur, Sindhuli, Rautahat, and Sarlahi. The basin as a whole can be divided into three parts:

(i) the upper Bagmati basin, comprised of Kathmandu Valley plus the upper part of the Nakhkhu Khola and Dakshinkali areas;
(ii) the Middle Bagmati basin, comprised of the remainder of the basin in the hills, including the Kulekhani Khola; and
(iii) the lower Bagmati basin, comprised of the basin in the Terai, plus some tributaries which originate in the Shiwaliks.

53. The major tributaries of the Bagmati River are Manohara, Bishnumati, Kulekhani, Kokhajor, Marin, Chandi, Jhanjh, and Manusmara. The Kathmandu Valley comprises 15% of the basin area in Nepal.

54. The major tributaries of the Bagmati River inside the Kathmandu Valley are Bishnumati, Balkhu, Tukucha, Dhobi Khola, Manohara, Kodku, and Nakhu Khola. These tributaries are highly polluted. Municipal waste and industrial effluents are directly discharged into these rivers, and have made the water unusable for human and ecological needs along most of its course. In addition, the Kathmandu Valley is facing a severe shortage of water due to rapid urbanization. The annual groundwater use for domestic and industrial purposes in the valley is almost 2 times the annual rechargeable groundwater available. The Bagmati River has a high religious value. It also adds to the aesthetics of the valley as it passes, along with its tributaries, through three major cities.

2. Surface Water Quality

55. The biochemical oxygen demand (BOD) level in different stretches of the Bagmati River in different seasons provides a clear indication of the high level of pollution all year round. (BOD levels range from 1.7 mg/l to 239.4 mg/l in the pre-monsoon, 2.1 mg/l–84.7 mg/l in the monsoon, and 2.3 mg/l–119.4 mg/l in the post-monsoon season). The main reason for the deteriorating water quality of the valley's rivers is discharge of untreated sewage from the urban areas of Kathmandu, although solid waste dumping along the river is also a contributing factor.

3. Groundwater

56. The groundwater aquifers of the Kathmandu Valley have been divided into three districts: Northern (157 km^2 with 59 km^2 recharge area), Central (114 km^2 with about 6 km^2 recharge area) and Southern (55 km^2 with about 21 km^2 recharge area) (Dixit and Upadhya, 2005). The heavy extraction of groundwater to meet domestic as well as commercial demands is alarming, and leads to the depletion of the groundwater level. There is haphazard extraction of water from both shallow and deep aquifers in Kathmandu Valley. According to the hydro-geological conditions of the valley and the recharge rate of the basin, only 15 MLD of groundwater can be safely extracted in a day (JICA, 1990). This rate is exceeded by more than 70% through NWSC tube wells alone. Due to the increase of built-up areas, groundwater recharge is reduced with the rerouting of the natural drainage. The

unsustainable extraction of groundwater causes land subsidence, which is already evident in many cities in Asia (e.g. Bangkok).

57. It is estimated that the groundwater of Kathmandu Valley is decreasing at an average rate of 2.5 m per year. However, it differs according to area, as the geological structure within the Kathmandu Valley is diverse.

58. Many households have installed pumps to extract groundwater from the shallow aquifer when NWSC could not meet their demands, but the bacteriological quality of the water is of concern and has to be looked into. There is an urgent need for legislation, rules, and regulations to stop groundwater mining in the Kathmandu Valley.

4. Groundwater Quality

59. Of the 57 deep tube wells tested, many had water that exceeded Nepal standards for color and turbidity, as well as ammonia, iron, and manganese content. Water in two of the wells exceeded the arsenic standard. In some wells, ammonia concentration in the water was found to be extremely high, at 50 times the threshold value of 1.5 mg/l. Water in 20 of the 57 wells showed bacterial contamination (ENPHO, 2009)

D. Ecological Resources

1. Shivapuri Nagarjun National Park

60. The Shivapuri Nagarjun National Park is the only national park near the Kathmandu Valley. Shivapuri is the second highest peak among the surrounding hills. It is 2,732 m high with numerous sharp ridges radiating to all sides. Situated north of the Kathmandu Valley, and due to its strategic location, Shivapuri was proclaimed a watershed area, and supplies more than a million liters of natural spring water to the city. After Shivapuri experienced several problems with soil erosion as a result of deforestation, overgrazing, and cultivation on steep slopes, reducing the quality and quantity of the water, the government initiated a program to protect Shivapuri and its adjoining areas as a watershed and wildlife reserve in 1975. In 2002, Shivapuri Watershed and Wildlife Reserve was officially given national park status. In 2009, Nagarjun was appendixed to the Shivapuri National Park and renamed the Shivapuri Nagarjun National Park.

61. A new water supply service reservoir outside the park boundary and adjacent to the existing water treatment plant (WTP) at Balaju is proposed to be constructed on land acquired under Loan 1820-NEP (MWSP). The new reservoir will replace the existing 80-year-old reservoir, which is in a dilapidated state. The existing Balaju reservoir is located within the Nagarjun Park, and will be dismantled. A new 8,000-m3 reservoir will be built on private land adjacent to the park boundary. There is an existing access road to the reservoir which is in good condition, and suitable for use by motor vehicles. The forest area will not be affected by the project.

62. To minimize adverse impacts, the new feeder main (150 m in length, 800 mm in diameter) will be constructed to the new proposed reservoir, following the existing access road. However, the existing pipeline corridor now lies within the Shivapuri Nagarjun National Park, whose boundary was recently extended. For installation of the new feeder main, it is proposed that the pipeline will follow the existing access road to avoid the cutting of trees. The exact number (if unavoidable) will be determined during detailed design to be done by the DSC. A provisional sum of funds is set aside by PID to cover such costs if necessary. However, there is no anticipated threat to the ecological integrity or biodiversity of the park, given the rehabilitation nature of the works at existing facilities and locations.

2. Forests

63. The Kathmandu Valley has 20,945 ha of forests, which constitutes 32.7% of the valley's total area. Except in a few conservation areas, the natural vegetation has been under intense pressure. The area under natural forest cover, excluding shrubs, is 9,580 ha (45.7% of the total forest land), of which only about 22% has good forest cover, with more than 50% of crown coverage. Mature hardwood forests are now confined to parks and sacred areas such as Nagarjun (Raniban), Gokarna, Shivapuri National Park, and Bajrabarahi forest. Shrubland occupies nearly 34% of the total forest area.

64. The forests in the valley are not in good condition, and most are in the regenerating stage. The crown coverage of rhododendron and quercus is more than 70%, and the crown coverage of Pinus roxburghii, and Schima castonopsis is less than 40%. About 1,312 plant species belonging to 162 vascular families are found in the valley, representing 26% of the total species of plants recorded in Nepal. About 7 species of gymnosperms, 170 species of ferns, and 97 species of orchids are found in the valley. About 256 species of birds have been reported from the Phulchowki area, and many birds are found in Nagarjun, Shivapuri, Tuadaha, Tokha, and Bajrabarahi. Many migratory birds are found at Taudaha pond. About 33 bird species have disappeared due to habitat destruction. Some patches of forest exist in Bajrabarahi, Hattiban, Balkumari, Karya Binayak, Mhaipi, Pashupatinath, Raniban, and Bansbari. These are mostly eucalyptus, Protea sp, Jacaranda sp, and camphor trees. Green belts are found in some city areas. Populus sp and Eucalyptus sp are mostly found along the ring road.

65. The Nagarjun National Park (15 km2) was annexed in 2009 to the Shivapuri National Park (144 km2) and called the Shivapri Nagarjun National Park to provide an extended habitat for the wildlife population and as a representation of intact mid-hill forest ecosystems, which are decreasing in the protected area system. The Shivapuri Nagajun National Park is one of the primary sources of freshwater for the Kathmandu Valley, providing about 40% of the drinking water (Department of National Parks and Wildlife Conservation, 2009).

3. Flora

66. Since Shivapuri lies in the transition zone between a subtropical and temperate climate, the vegetation consists of a variety of natural forest types, depending on altitude and aspects. Most of the areas below 1,800 m are covered with Schima castanopsis forest, in which pines (Pinus roxburghii) appear on the southern dry ridges, and utis (Alnus nepalensis) grow along the streams. A forest of oak species such as Quercus semicarpifolia and Quercus lamelosa, mixed with rhododendron and a variety of orchids, flourishes on the northern slopes. There are more than 2,122 species of flora, and 16 of them are endemic flowering plants in the Shivapuri Nagarjun National Park. A variety of medicinal herbs are found at higher altitudes. There are 129 species of mushrooms that have been identified and catalogued in the park.

4. Fauna

67. The Shivapuri National Park is home to 311 species of birds, 21 species of mammals, and more than 102 species of butterflies, some endemic and rare. This is out of the total of 800 species of birds, 130 species of mammals (of which 11 are threatened), and 600 species of butterflies found in Nepal, thus making the national park truly rich in flora and fauna. The threatened wildlife found here are wild boar (Sus scrofa), barking deer (Muntiacus muntijak), rhesus monkey (Macaca mulata), porcupine (Hystrix indica), goral (Naemorhedus goral), Himalayan black bear (Ursus thibetanus), leopard (Panthera pardus), pangolin (Manis spp.), clouded leopard (Pardofelis nebulosa), leopard cat (Primailurus bengalensis), and jungle cat (Felischaus).

E. Socioeconomics

1. Social and Household Profile

68. **Social classification**. The majority of the people living in the valley are Hindus, followed by Buddhists. Besides these, other religious followers living the Valley are minimal.The households are divided into different ethnic groups such as Newars, Brahmins, Chettris, Tamangs, and Magars. Newars are the prominent inhabitants, followed by Brahmins, Chettris, Tamangs, and Magars. These ethnic groups are not at the same level of socioeconomic development.

69. **Age**. The economically active age group between the ages of 15 and 44 constitute about 56% of the project's district population. The other main age group is between 5 and 14 years. Only about 5% of the population are 60 years and above. There are no significant differences in the percentage of age distribution in KUKL service areas.

70. Table 2 summarizes the distribution of gender and households of the five main districts in the valley.

Table 2: Household Profile in Kathmandu Valley

Metro/Sub-metro/ Municipality	Population			Total Households
	Male	Female	Total	
Kathmandu metro	532,728	473,928	1,006,656	277,789
Kirtipur municipality	36,726	29,344	66,070	21,854
Bhaktapur municipality	42,947	40,946	83,893	19,273
Madhyapur Thimi municipality	43,643	40,616	84,259	21,758
Lalitpur submetro	116,082	107,203	223,285	58,217

Source: Compiled from Census 2011 (preliminary), CBS.

2. Employment

71. The economy of the Kathmandu Valley is based on trade, commerce, and manufacturing industries, like carpets and garments. Other economic sectors are agriculture, education, transport, and hotels and restaurants. Tourism is a key component of the valley's economy. However, in the rural areas, the economy is still based on agriculture.

72. Kathmandu Valley has developed as a centre of trade links with India and China. According to the Economic Survey 2008/2009, in the fiscal year 2007/2008, Nepal exported 65% of its goods to India and 35% to other countries like Canada, Germany, Italy, Japan, the UK, and the US. The main export commodities are ready-made garments, woolen carpets, woolen and pashmina goods, and handicrafts, most of which are manufactured in the Kathmandu Valley. The majority of goods imported from other countries are also handled through the Kathmandu Valley. The valley is the entry point for most tourists. In 2008-2009, a total of 409,100 tourists (excluding Indians) arrived in Nepal, of which more than 90% entered through the Kathmandu international airport.

73. About 53% of the total population aged 10 and above are economically active (Census 2001). The majority of the population are engaged in agriculture and forestry (36%). The other major industries are manufacturing (17%), commerce (16%), construction (4%), and transportation/communication (3%).

74. However, the National Living Standard Survey 2010-2011 indicates that about 55.7% of the economically active population of 10 years of age and above in urban Kathmandu Valley is employed in the agriculture and non-agriculture sector, of which only 17% depends on farm activities. It means that about 83% of this group of population depends on non-farm

activities such as manufacturing (24.0%), trade (42.6%), service sectors (28.6%), and other works (4.8%)

75. The Annual Human Development Report of the United Nations Development Programme (UNDP) ranks countries according to five development indicators: Human Development Index (HDI), Human Poverty Index (HPI-1), Human Poverty Index for OECD Countries (HPI-2), Gender-related Development Index (GDI), and Gender Empowerment Measure (GEM). Nepal's HDI improved from 0.428 in 2010 to 0.458 in 2011. Nepal was ranked 138th out of the 169 countries included in the 2010 Human Development Report. The Nepal Three Year Interim Plan (TYIP) set the following targets: HDI=0.570, GDI=0.556, and GEM=0.450.

76. The improvement in the GDI is mainly attributed to the improvement in life expectancy. Until the late 1990s Nepal was the only country in the world where men could expect to live longer than women. Future improvements in the GDI can only come from improvement in the other dimensions of the GDI, which is relevant for the living conditions in Kathmandu Valley. The improvement in the GDI is already comfortably above the TYIP target of 0.450. One of the issues that the indicators raised where the project cities stand in terms of the indicators, was that indicator data at the municipal level is not available. However, review of the data suggests that the project cities approximate the national average.

3. Slums and Squatter Settlements

77. The rapid population growth has created a number of slums and squatter settlements in the Kathmandu Valley. Table 3 summarizes the findings of a survey conducted by LICSU, KUKL during 2008. There were 39 squatter settlements and 137 slums in the valley, where a population of 40,237 live in 8,846 households. Of these, 22% had no access to piped water supply, and none had adequate sanitation.

Table 3: Slums and Squatter Settlements in Kathmandu Valley

Type of Residence	Number of Households	Total Population	Average Household size	Percentage of Households Without Piped Water Supply
Slums				
Bhaktapur municipality	754	3274	4.34	32
Madhyapur Thimi municipality	382	1981	5.19	85
Lalitpur sub-metropolitan	391	1,866	4.77	62
Kathmandu metropolitan	3,784	16,575	4.38	58
Kirtipur municipality	1,674	7,767	4.64	64
Squatters				
Kathmandu metropolitan	1,861	8,774	4.71	95
Total	8,846	40,237	4.5	21.98

Source: Mapping of Slums, Squatters and Stand Posts in Kathmandu Valley updated by LICSU, KUKL, June 2008, AVIYAAN Consulting (P) Ltd.

78. Due to constraints in supply, KUKL is unable to supply the required water to these unregulated settlements. To help manage the water supply and sanitation problem in these areas, the government established the Low Income Consumer Support Unit (LICSU) in KUKL in 2008. The basic objective of LICSU is to serve drinking water to the urban poor. It has started to construct water tanks and stand posts and rehabilitate broken stand posts. In 2008, it was found that 395 public stand posts (38% of the total) were not working. However, KUKL has managed to distribute drinking water to these settlements through its own water tankers.

79. As KUKL is unable to provide adequate drinking water and sanitation services to the increasing slum and squatter settlements, the government has adopted a policy of handing

over completed schemes to user groups for operation and management. For this, user groups are required to share at least 20% of the total cost of the scheme. As a result, there is a significant number of water user groups in the Kathmandu Valley who are involved in operation and management of drinking water systems and sanitation in different places.

4. Economic Development

80. In comparison to the rest of Nepal, the Kathmandu Valley possesses basic facilities like water supply, sanitation, electricity, bottled gas, telecommunications, roads, education, security, and transportation. The valley is also the centre for several major industries, such as textile, food and beverage, non-metallic mineral products, publishing, and printing. Such facilities and opportunities are a huge attraction to the rural poor, resulting in high migration rates; hence, the rapid population growth and demand for urban services, especially water supply.

81. The valley's annual industrial output is estimated to be NRs.14.6 billion ($190 million), nearly 9.4% of the total national industrial output. The industrial sector employment is about 37,500 in the Kathmandu Valley, which is 22.1% of the national employment figure in the industrial sector. Similarly, indirect employment in the industrial sector is about 38,900, about 21.9% of the national figure.

82. Being a capital city and commercial centre for the country, Kathmandu and its surrounding valley is developing and urbanizing fast in comparison to the rest of Nepal. The Kathmandu Valley is the most important urbanized area in Nepal. New products and services are first introduced in the valley, giving inhabitants access to modern equipment and technology. An indication of confidence in economic growth is the high demand for new housing real estate and the number of new vehicles on the roads, which is rising rapidly. In addition, there are plans for major transportation improvements, such as the Kathmandu outer ring road and the new link road to India via the Terai.

5. Land Use

83. The land use and land cover statistics (Table 4) derived from the 1992 topographical sheet shows that almost 50% of the Bagmati watershed is occupied by forests. High relief areas of the Midlands and the Mahabharat range are characterised mainly by deciduous and coniferous forests, while hardwood and mixed hardwood forests characterize the Shiwaliks and low-lying areas of the Midlands and the Mahabharat range. Next to the forests are cultivated lands, which cover about 37% of the total area. The agricultural activities are confined mainly in the river valleys and the gentle slopes of the hilly region. Built-up areas occupy an insignificant portion, less than 1%, of the total area. The metropolitan city of Kathmandu, submetropolitan city of Lalitpur, and municipal cities of Bhaktapur, Madhyapur Thimi, and Kirtipur are the major built-up areas in the watershed.

Table 4: Land Use and Land Cover in the Bagmati River Basin

Land Use/Land Cover	Area (hectares)	Percent
Forest	186,340	49.6
Cultivation	141,986	37.8
Sand	18,118	4.8
Bush	13,367	3.6
Grass	5,241	1.4
Channel	4,441	1.2
Built-up area	2,378	0.6
Barren land	1,264	0.3
Orchard	785	0.2
Scattered tree	551	0.1
Nursery	360	0.1

Pond or lake	141	0.0
Others	628	0.2

Source: Preparation of Water – Induced Hazard Maps of Bagmati River Basin, 2005, WIDP/ SILT/ ERMC/ TECHDA.

6. Infrastructure

a. Transportation

84. Long-distance bus services from Kathmandu provide services to people throughout the country. Private transport includes buses, microbuses, vans, cars, jeeps, and three-wheelers, operated by petroleum, liquid petroleum gas (LPG), and batteries. The total length of roads in Kathmandu, Lalitpur, and Bhaktapur is 813 km, 337 km, and 181 km, respectively, for a total of 1,331 km (Department of Roads, 2004).

85. The Tribhuvan International Airport is just 30 minutes away from the centre of town. There are numerous daily flights from Kathmandu to international destinations, as well as regular flights to many areas of the country. Many international airlines fly to the Kathmandu international airport.

b. Drinking Water Supply

86. Not all households and people in the valley have safe drinking water. The dependence of households on a variety of sources for drinking water can be seen in Table 5.

87. Based on the 2005 data of the Department of Drinking Water and Sewerage, the percentages of the population receiving water by districts, and also for the Kathmandu Valley, are shown in Table 6. Less than 75% of the population receive drinking water supplies.

Table 5: Sources of Drinking Water

Item	Kathmandu		Lalitpur		Bhaktapur		Kathmandu Valley	
	Household	Percent	Household	Percent	Household	Percent	Household	Percent
Tap	197;851	84.1	57,237	83.0	30,755	73.5	285,843	82.6
Well	14,714	6.3	6,745	9.8	4,4843	11.6	26,302	7.6
Tube well	13,478	5.7	825	1.2	2,977	7.1	17,280	5.0
Spouts	6,082	2.6	3,099	4.5	2,632	6.3	11,813	3.4
River/stream	195	0.1	113	0.2	29	0.1	337	0.1
Others	1,616	0.7	477	0.7	277	0.7	2,370	0.7
Not stated	1,581	0.6	425	0.6	339	0.8	2,145	0.6
Total	235,317	100	68,921	100	41,852	100	346,090	100

Source: NWSC, 2005.

Table 6: Population Receiving Drinking Water

Districts	Estimated Population 2005	Population Benefiting 2005	Percentage Benefiting 2005
Kathmandu	1,246,110	947,630	76.05
Lalitpur	366,010	286,250	78.21
Bhaktapur	244,130	152,270	62.37
Total	1,856,250	1,386,150	74.67

Source: NWSC, 2005.

c. Surface Drainage, Sanitation and Sewerage

88. Storm water drainage systems in the valley function through side drains, but do not function well. The increased use of plastic bags has also worsened the problem, as drains are frequently clogged.

d. Electricity

89. Not all households in the valley have electricity. The proportion of households with electricity in Kathmandu, Lalitpur, and Bhaktapur are 96.81%, 87.64%, and 96.41%, based on data from the Nepal Human Development Report 2001. The overall proportion of households connected to electricity is approximately 95%.

e. Educational Establishments

90. The Kathmandu Valley has long been the considered the centre for higher education in Nepal. In 2007, there were 6,106 high school level institutions and 474 higher secondary, college, and university-level education institutions. The number of students enrolled during the period at the high school and higher education levels were 573,779 and 156,828, respectively.

91. Education has been progressing continuously, specifically in the Kathmandu Valley, and as a result, educational institutions, levels of education, and fields of study have been increasing. Table 7 shows the number of schools by level for the three districts.

Table 7: Total Number of Schools by Grades and Levels

Item	Primary	Lower Secondary	Secondary	Higher Secondary
Kathmandu	920	671	514	148
Lalitpur	277	147	108	47
Bhaktapur	243	137	85	9
Total in the valley	1,440	955	707	204

Source: Compiled from NIDI 2006; ICIMOD, MOE, UNEP, 2007.

92. Tribhuvan University, the national university, has 5 institutes (Engineering, Agriculture and Animal Sciences, Medicine, Forestry Science, and Science and Technology) and 4 faculties (Law, Management, Education, and Humanities and Social Sciences) which offer almost all the popular disciplines at different academic levels, including Master's and Doctoral degrees.

93. There are 3 medical and more than 12 engineering colleges offering up to Master's level education. The Council for Technical Education and Vocational Training is another regulatory body monitoring the curriculums for technical and vocational training, as well as diploma courses to produce skilled manpower.

f. Health Facilities

94. Kathmandu is a centre for all types of health services (general medicine, surgery, heart care, orthopedic care, kidney care, dental care, children's care, eye care, mental care, neurology, and others). The number of health facilities owned by the government or provided by NGOs and INGOs and the private sector is relatively better in Kathmandu than in other districts. More health institutions are available in Kathmandu than in Lalitpur and Bhaktapur. However, the number of people served by the health institutions in Kathmandu is less (1:9,574) than in Bhaktapur (1:5,637) or Lalitpur (1:4,119). This shows that the number of health institutions is low in comparison to the size of the population in Kathmandu.

g. Communications

95. There are 3,991 post offices, including the general post office, regional postal directorates, district post offices, area post offices, and additional post offices. A number of private postal care companies provide a wide range of postal services.

96. The telecommunication system in the Kathmandu Valley is excellent. As of 2005–2006, the Nepal Telecommunications' Authority has issued basic telephone service licenses

to 2 agencies, cellular mobile service licenses to 2 agencies, and internet (including e-mail) licenses to 38 agencies (more than 50,000 customers).

7. Economic Characteristics

a. Industries

97. Kathmandu Valley has many traditional cottage industries (textile weaving with handlooms, bricks and tiles, pottery, handicrafts such as idol making), precious ornaments, traditional food processing and preservation (rice milling, beaten rice, oil milling, sweetmeats, and traditional dairy products), wooden furniture and carving, bamboo crafts, traditional textile printing and dyeing, traditional art and paintings, copper and brass metal utensils, herbal medicines, forges, and leather crafts.

98. Three industrial districts, namely Balaju Industrial District, Patan Industrial Estate, and Bhaktapur Industrial Estate, exist in the Kathmandu Valley. Public sector brick factories, leather tanning, and shoe manufacturing are also established. Food and beverages, plastic products, construction materials, carpets, and ready-made garment industries have flourished. However, the number of industries and the employment they provide have decreased drastically within the last decade. Industries are also concentrated along the Kathmandu-Bhaktapur and Kalanki-Thankot roads. Most of the polluting industries, such as textile dyeing, tanning, and distilling, have been closed or transferred to places outside the valley.

99. Of the remaining industries, the main polluting industries in the valley are only small scale, and these include (i) brick kilns; (ii) wool dyeing and carpet washing; (iii) textile dyeing; (iv) pottery; (v) polyurethane and rubber foam; (vi) beaten rice; (vii) dairy products; (viii) metal casting; (ix) metal craft industries and gold plating; and (x) alcoholic and non-alcoholic beverages.

100. With the increase in industrial pollution and rising awareness of the general public of the adverse impacts of industrial pollution, complaints were noted and measures taken to address the issue. The Industrial Promotion Board formulated an industrial location policy. There have been revisions to the policy, and the latest location policy for industries specifies the following:

(i) the types of industries (list A) that can be established in municipal areas of the valley;

(ii) the types of industries (list B) that are not allowed in the valley; and

(iii) all types of industries that have pollution prevention and safety measures, which can be established inside any designated industrial district.

b. Agricultural Development

101. Rice is the main crop in the rural areas of Kathmandu and Bhaktapur, while maize is the prominent cereal crop of Lalitpur. The other cereal crops in the project districts are millet, wheat, and barley. Other agricultural produce such as lentil, soya beans, peas, and black gram are the main pulses grown, as well as potato and oil seeds.

102. Livestock rearing is the second most important activity. Most of the households in the rural areas rear animals for income, food, or draft power. Goats represent the highest number of domestic animals in Kathmandu Valley, followed by cattle and buffaloes, which have a ready market in the local city area.

103. Population increase in the Kathmandu Valley is bringing considerable changes to the cropping system. Rapid urbanization and the introduction of new agriculture technology have encouraged the valley's farmers to change from traditional crops (low value) to new crops (high value). Land under cultivation for green leafy vegetables is increasing rapidly in the urban and semi-urban areas.

104. The increased population growth and haphazard housing construction have resulted in the rapid decline of agricultural land. If this decline continues, it is expected that there will be no agricultural land left in the valley in the future.

c. Development Organizations

105. There are various NGOs and INGOs working in the water and sanitation sector in the valley. These organizations have focused mostly on slums, squatter settlements, and rural areas of the Kathmandu Valley. They have constructed water tanks of 5-m3 capacity and a number of latrines or toilets with drains in these communities. The major NGOs and INGOs working in the water and sanitation sectors are:

- Lumanti Support Group for Shelter;
- NGO Forum for Urban Water and Sanitation;
- Centre for Integrated Urban Development;
- Environment and Public Health Organization (ENPHO);
- Nepal Water for Health (NEWAH);
- Action Aid;
- Water Aid;
- Plan International;
- UDLE (Urban Development through Local Efforts); and
- Red Cross.

8. Physical Cultural Resources

106. The Kathmandu Valley is known for its ancient art, culture, craftsmanship, and numerous monuments of historic and archaeological importance, and has been described by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) as a "living heritage site." There are many temples, palaces, monasteries, and stupas that are centuries old. UNESCO has classified seven sites as World Heritage Sites. There are more than 360 vihars, chaityas, and monasteries, and many important religious and cultural sites on the riverbanks. The Patan Darbar Square and the Kathmandu Darbar Square, two World Heritage Sites, are within the project area. The project will lay small diameter pipes (around 150 mm) along the roadways, and no impacts to buildings or heritage sites are anticipated. Special construction measures are included in the EMP to ensure no impacts to physical cultural resources. Roads are to be rebuilt to their original condition. Archaeological impact assessment, or any other procedure approved by the Department of Archaeology, will be conducted based on consultations with the department, which requires a government archaeologist on site during excavation works. Consultations with UNESCO and the Department of Archaeology were conducted throughout the PPTA, and will continue throughout implementation.

F. Major Environmental Problems

107. **Air quality, traffic management, and noise pollution.** Increasing numbers of vehicles in Kathmandu Valley (274,000, based on the records of 2004-2005) have increased the air pollution load. Thirty-eight percent of the air pollution is due to vehicular movement; industrial emissions are also contributing substantially. The national ambient air quality standards are in Appendix 4. Recommended noise exposure limits for the work environment are in Appendix 5. Traffic management is critical for ensuring public approval of the works. The contractor is to prepare a traffic management plan and road safety plan. Some guidance for traffic management is provided in Appendix 10.

108. The Kathmandu Valley is particularly vulnerable to air pollution because of its bowl-shaped topography, which restricts air movement. The situation is worse during the winter, when temperature inversion during the night and early morning traps a layer of cool air under a layer of warmer air, trapping pollutants close to ground level for extended periods. Besides the topography, the relatively high elevation of the valley also results in increased vehicular emissions.

109. Vehicular emissions have become the main source of air pollution in Kathmandu Valley. An inventory of emission sources by the then Ministry of Science, Technology and Environment (MOSTE) indicated that exhaust fumes had increased more than 4 times in the 8 years between 1993 and 2001. According to a more recent inventory, vehicular emissions are responsible for 38% of the total PM10 emitted in Kathmandu Valley, compared to 18% from the agricultural sector and 11% from brick kilns (Table 8). Increase in emissions is mainly due to the increase in the number of automobiles, as well as poor transport management and poor vehicle maintenance.

Table 8: Comparison of Emission Inventories in 1993, 2001, and 2005

Sources	TSP (tons/yr)			PM_{10} (tons/year)		
	1993	2001	2005	1993	2001	2005
Mobile sources						
Vehicle exhausts	570	1,971	Not available	570	3,259	4,708
Road dust re-suspension	1,530	7,008	12,239	400	1,822	3,182
Subtotal	2,100	8,979	12,239	970	5,081	7,890
Stationary sources						
Industrial/commercial fuel	582	Not available	Not available	292	Not available	Not available
Domestic fuel combustion	2,328	Not available	630	1,166	NA	347
Brick kilns	5,180	6,676	1,850	1,295	1,688	1,437
Himal Cement	6,000	3,612	0	800	455	0
Stone crushers	Not available	Not available	1,720	Not available	Not available	372
Industrial boilers	Not available	28	28	Not available	15	15
Fugitive emissions						
Refuse burning	385	687	172	190	339	172
Agricultural sector	Not available	Not available	Not available	Not available	Not available	2,337
Cremation	Not available	Not available	Not available	Not available	Not available	79
Total	16,575	19,982	16,797	4,712	7,580	12,649

TSP = total suspended particles
Source: Shah and Nagpal 1997; Gautam 2006; MOE 2005.

110. **Settlement patterns.** Kathmandu Valley is developing haphazardly with the tremendous increase in population. It is estimated that, there will be nearly 4 million people

within the valley by 2025, compared to only 1.6 million in 2001. The valley's fertile lands are being fragmented, and construction of residential houses is going on unabated. This kind of growth has created problems in transportation, electricity supply, drinking water supply, and river pollution resulting in human health hazards.

111. **Water resources.** An extensive deterioration in river water quality and quantity in urban areas due to excessive pollution has already taken place. Increasing demand for drinking water has strained insufficient supplies and created water scarcity. Almost all major rivers have been tapped at source for drinking water supplies. The current water supply is only about 140 MLD during the rainy season and 100 MLD during dry season, with the estimated daily demand at 190 MLD. In the dry season, 60%-70% of the water supply comes from groundwater.

112. **Waste management**. The five municipalities generate approximately 435 tpd of solid waste, of which more than 70% comes from the Kathmandu metropolitan city. The final disposal sites are always controversial and opposed by the local people. Most of the time, the solid wastes have been disposed of at the riverbanks and in open areas. The current location of disposal is at Sisdol, 25 km west of Kathmandu. However, Sisdol was designated a landfill site for only three years, which have already passed. A new municipal waste disposal site has been identified, and is in the process of being developed.

113. The daily solid waste generation is assumed to be 0.25 kg per person per day. Studies have revealed that the composition of solid waste in Kathmandu is mainly organic (58%-66%), with 5% plastics. The use of plastic bags has increased over the years, and since it is nonbiodegradable, its use should be discouraged or even banned.

114. A major issue is the huge amount of solid waste in the Kathmandu Valley that accumulates from time to time, due to the demands of the people near the landfill site who block the way of the trucks carrying the solid waste. Another major issue is the dumping of hazardous and infectious wastes of hospitals and nursing homes together with domestic solid wastes.

115. Most of the plastics and reusable materials like bottles, metals, and others are picked up daily by scavengers, who are helping the municipality by reducing waste volume. Tourism is Nepal's topmost industry, and if it is to thrive, solid waste management should be managed well in all the municipalities and given top priority.

116. **Natural disaster preparedness**. Earthquakes and landslides are the two most prominent potential natural disasters in the Kathmandu Valley. The valley is located in a seismic zone; lack of public awareness about earthquakes, lack of adequate planning, and lack of coordination are the main factors that impact negatively on disaster preparedness. Excavation of slopes, deposition of loads on slopes, deforestation, irrigation, mining, and water leakage are the main human activities causing landslides.

117. **Water quality**. Bacteriological water quality deterioration during transmission is a problem in almost all urban areas due to the ingress of polluted water into the pipes because of intermittent supply, leakage, absence of chlorination, and no monitoring of water quality. Almost all available reports on the quality of the drinking water in Kathmandu reveal that most of the urban water supply is bacteriologically contaminated (Table 9). The chemical quality of most of the water is within WHO guidelines.

118. Most of the people of Kathmandu do not trust the quality of the water provided, so they boil the water before drinking. A small calculation shows that each household spends 30% more on top of the monthly water tariff for boiling and pumping. This excludes the cost of the storage reservoir and the overhead tank. This is a positive sign that people are willing to pay more for a reliable and safe supply of water.

Table 9: Water Quality of Different Water Sources, Kathmandu Valley

Parameters	Water Sources				WHO GV
	PTW	PUTW	Well	SS	
pH	6.5-8.2	6.5-7.5	7.5	7.5	6.5-8.5
Temp (oC)	13-18	12-15	15-18	15-18	25
Iron (mg/l)	ND-0.2	0.2	0.2	0.3	0.3-3.0
Chlorine (mg/l)	ND	ND	ND	ND	0.2
Chloride (mg/l)	10-30	22-45	22-45	23-45	250
N-NH4 (mg/l)	ND-0.2	0.2	0.2	0.2	0.04-0.4
PO4 – P (mg/l)	0.1	0.1	0.1	0.1	0.4-5.0
E.coli cfu/100 ml	10-131	3-20	48-200	58	0

PTW = Private tap water, PUTW = public tap water, SS = stone spout,
WHO GV = World Health Organisation guideline value.
Source: Pradhan et al. 2005.

119. **Health and sanitation**. There are individual septic tanks and soakpit systems and some pour-flush latrines and pit latrines in urban areas. There is pollution of groundwater due to the leachate, but the extent has not yet been quantified. Most of the effluent reaches the municipal drains, and ultimately, the rivers or agricultural lands. People without toilets defecate in open fields and banks of rivers. Public latrines hardly exist in urban towns, and if they do, they are very poorly maintained.

120. The Bagmati River is the main river system, with tributaries that drain the Kathmandu Valley. The visible pollution of the Bagmati and its tributaries within the city due to discharge of untreated domestic sewage, dumping of solid wastes, washing of vehicles, sand quarrying, and discharge of untreated industrial and hospital wastes is severe.

121. The treatment plants in Greater Kathmandu are non-functional. Many sewers overflow, as there is no regular cleaning and maintenance. UN Habitat estimated that there are 77,000 septic systems in the valley. Only 35% have a soakpit associated with a septic tank. The remaining tanks presumably discharge septic tank effluent directly to surface flows.

122. Storm water drains constructed more than 60 years ago in core areas are being used as combined sewers. Sanitary sewers have been added to some areas of Greater Kathmandu, and there are about 96,000 sewer connections (KUKL Annual Report, 2008). The rest discharge the effluent ultimately to the holy Bagmati River.

123. Not all households in the valley have toilet facilities. The households with toilets are at 96% in Lalitpur district, 97% in Bhaktapur district, and 99% in Kathmandu district (CBS 2011). Most of the households' toilets do not have septic tanks, and are directly connected to the sewerage lines that discharge into the nearby river. For the households with septic tanks, a municipal service is available for emptying the tanks on a demand basis. But even the municipal authority allows the septage being pumped up from the septic tanks to be dumped on the banks of nearby rivers. MOSTE is mandated to regulate unauthorized dumping. Domestic wastewater makes up approximately 93% of the total wastewater generation in the cities, and the remaining 7% is industrial wastewater. Table 10 shows the estimated wastewater production in the Valley.

Table 10: Estimation of Wastewater Production in Kathmandu Valley, 2011

District	Million litres/day
Kathmandu	69.92
Lalitpur	14.36
Bhaktapur	6.21
Total	89.48

Source: Shukla et al. 2011

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

124. Environmental impacts on the physical, biological, and socioeconomic and cultural environments during pre-construction, construction, and operation and maintenance are discussed here in detail with the mitigating measures. The ADB REA Checklist for water supply is given in Appendix 1. The summary of the anticipated environmental impacts and the mitigation measures are given in Table 11.

A. Pre-construction Phase

1. Environmental Impacts Due to Project Design

125. One of the most important aspects before construction is the identification of the likely adverse impacts and their mitigation measures during design and planning and before the commencement of construction.

126. Identification of erosion-prone areas prior to construction is important, as they cause soil erosion, sedimentation, and slope instability. To mitigate these adverse impacts, it is necessary to incorporate adequate drainage plans, identify measures and sites for handling excessive spoil materials, and stabilize unstable areas. The designs and specifications should consider minimum vegetation clearance.

127. During the preparation phase, the land areas required by the project should be demarcated or pegged. A resettlement plan (for temporary impacts to businesses) should be prepared, and compensation disbursed prior to impacts. Temporary areas required for the project should be identified. This is one of the most critical steps for the success of the project; if not done properly, social tensions could rise, and the project may be obstructed. The affected people should be informed and satisfied, and misunderstandings cleared. An awareness campaign is to be carried out to facilitate public understanding.

128. Haphazard construction of camps for workers without basic amenities could result in social stress and the degradation of the local environment. Therefore, it is very important that workforce camps with sanitary amenities in designated areas should be established.

129. An employment policy should be prepared so that local people may not be deprived of opportunities, thereby creating tension and dissatisfaction. Core labor standards need to be complied with. Wages should be settled by the District Wage Evaluation Committee (DWEC), with the list of employees finalized and equal pay given to men and women.

130. The project must obtain no-objection letters and agreements for (i) temporary easements to land and properties; (ii) construction in Darbar and Patan Squares and other heritage areas as necessary from the Department of Archaeology, as well as conducting Archaeological Impact Assessments or other procedures approved by DOA, if required; (iii) digging of roads from the Department of Roads, Lalitpur submetropolis and Kathmandu metropolis; and (iv) construction and cutting of trees in Balaju (if unavoidable, as works will be within the existing access road) from the Shivapuri Nagarjun National Park and Department of Forest.

131. Baseline photographs of the construction areas, heritage areas, and showing water quality of streams and rivers that would be impacted would help the project in identifying, justifying, and verifying the adverse impacts due to construction activities (e.g. cracks in houses, restoration of temporary sites to the original, water quality deterioration, and others).

132. Detailed traffic plans should be prepared by the contractor to help in mitigating traffic congestion and menaces to pedestrians and businesses.

133. Training manuals in Nepali should be prepared, with sketches illustrating community health and safety and potential occupational health and safety.

134. To mitigate the risk of pollution of raw water supply (deep tube well water), safe intake sites with minimum risk of pollution shall be selected. The design should consider adequate source and intake protection measures like: the well point should be located at a slightly higher elevation from a drainage point of view; and the annular space between the drilled hole and well casing should be sealed off and provision for grouting the well casing should be made. After completion of the construction, the well should be capped tightly. The deep well bored should be well protected with a concrete platform so that surface water does not enter the well. Furthermore, it should be made sure that once the boring is completed, the well must be chlorinated according to the standards so as to disinfect the pipes and screen that have been placed underground.

135. To avoid the risk of inadequate yield of the aquifer as excessive abstraction could deplete the aquifer and cause ground subsidence, a program for yield monitoring shall be designed; redesign the project with alternative water sources if the proposed abstraction rate exceeds the sustainable yield. The monitoring of water abstraction will be recorded daily in the logbook by the pump operator from the flowmeter which will be installed in the pipeline. If abstraction is exceeded, the flow will be controlled by the sluice valve located before the flowmeter.

136. To avoid the risk of pollution of water distributed to the users, design properly protected intake and storage tanks and locate the distribution pipes away from drains (to avoid infiltration of drain water). Treatment systems (iron removal, chlorination) should be well designed. To avoid ponding, a good drainage system should be designed

137. Inadequate disposal of sludge from reservoirs and treatment plant will cause nuisances to affected properties. For proper disposal of sludge, the location and designs for sludge disposal sites shall be made accordingly.

B. Construction Phase

1. Environmental impacts Due to Project Construction

a. Physical Environment

138. **Soil erosion and slope stability due to excavation**. Impacts likely to occur from the improvement and construction of the water distribution systems will include trench excavations (with extra sensitivity in heritage areas) and topsoil stripping, which may induce soil erosion, and slope instability. Haphazard disposal of spoil materials may create erosion problems, disturbances to the existing drainage lines, changes in the existing land use practices, and traffic, causing public disturbance and protest. Mitigating measures to be used are: (i) the separate stockpiling of topsoil in a safe yard for further use; (ii) spoil disposal at designated and stabilized sites; (iii) compaction of the backfill of excavated areas, including replacement of topsoil; (iv) avoiding work during the rainy season as much as possible; mulching to stabilize exposed areas; (v) use of bioengineering techniques (e.g. revegetating areas promptly); (vi) providing channels and ditches for post-construction flows; (vii) lining of steep channels and slopes (e.g. use of jute matting); and (viii) preventing off-site sediment transport using settlement ponds, silt fences, and quick backfilling. To encourage quick backfilling, short sections should be planned to complete works within 1-2 days, which will limit the time of disturbance to the community.

139. The impacts of surface water discharges to the local drainage from trench excavation can be mitigated by using settling tanks before discharging the water to waterways.

140. Excavation and laying of pipelines at river crossings could have adverse impacts on river water quality and the aquatic ecosystem. Mitigation measures include: (i) limiting construction to the dry season only; (ii) use of river diversions with bunds; (iii) prior notification to temple officials of construction activities; and (iv) pile driving and foundations at pipe bridge sites to be bunded off from the river.

Table 11: Impacts and Mitigation Measures for Water Supply

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Responsibility
Detailed design			
Incorporation of sloped areas in project design	Soil erosion and slope instability	• Incorporate measures and sites for handling excessive spoil materials • Incorporate drainage plan in final design	DSC/PID
Manual preparation	Health and safety of community and workers	• Prepare training manuals in Nepali with sketches on community health and safety and potential occupational health and safety	DSC/PID
Construction of reservoirs in high earthquake zone	Cracking of structure leading to facility failure and hazard to public	• Design all reservoirs and structures under the project to for appropriate seismic resistance	DSC/PID
Location of pipes and photographs of sites and existing utilities prior to construction, particularly in heritage areas	False claims from people; water quality changes due to construction. Interference with other utilities and photo record of existing character of heritage areas to avoid impacts to heritage structures during construction	• Place water pipes away from existing utilities during design • Provide budget for restoration/replacement of damaged utilities • Avoid placing alignment near heritage buildings • Photograph all sites within heritage areas to enable before and after comparison (note: all roads are to be reinstated to original character especially in heritage areas) • Ensure compliance with any Department of Archaeology (DOA) rules during design period including preparation of Archaeological Impact Assessment, or other agreed document by DOA if required .	DSC/PID/Contractor
Construction of tubewells	Risk of pollution of raw water supply (deep tube well water)	• A boundary wall of 20 x 15 m will be constructed at all tubewell sites to act as a buffer zone and trees will be planted around the boundary wall. • Safe intake sites with minimum risk of pollution shall be selected (e.g. a minimum distance of 100 m from garbage dumps/refuse piles and shrines) • Adequate source and intake protection measures shall take place; after completion of the construction, the well should be capped tightly; the deep well bored should be well protected with a concrete platform whose gradient should be away from the well bore so that surface water does not enter the well. • The well point should be located at a slightly higher elevation from a drainage point of view. It is suggested that the top of the pump housing pipe should be about 0.5 m above the existing ground surface. A borehole concrete chamber about 3 x 1.6 x 1.9 m with a 110 mm PVC drain pipe with an outlet chamber to drain the water will be constructed at each tubewell.	DSC/Contractor

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Responsibility
		• The annular space between the drilled hole and well casing should be sealed off and provision for grouting the well casing - the depth would depend on the hydro-geological conditions encountered during construction - should be made. • It should be made sure that once the boring is completed, the well must be chlorinated according to the standards so as to disinfect the pipes and screen that have been placed underground. • After construction is complete, all pits should be refilled; all excess construction material and debris removed. • Area around the well should be maintained to ensure that no pools of standing water are formed. • The soil around the 20 tubewell sites could be contaminated by the use of diesel pumps while drilling the tubewells and so the contractor should remove the contaminated soil and safely dispose it in designated sites.	
Sludge disposal	Inadequate disposal of sludge from reservoirs and treatment plant will cause nuisances to affected properties.	• Design of sludge disposal sites should be made at designated sites approved by the municipalities..	DSC/KUKL
Pre- construction			
Apply for relevant permits	Delay in project due to absence of necessary statutory permits and approvals	• Apply for all tree cutting, Archaeology, road cutting, etc., required. This is to be done early in the design period. • Consult relevant authorities and submit applications to get approvals. Submit such agreement and permits to DSC for official information. Obtain Letters of Approval and agreement for: (i) temporary acquisition/easements of land and properties; (ii) disruption of water supply and other utilities; (iii) required permits from relevant authorities (e.g., National Park, Department of Forest, Department of Archaeology, etc.) prior to construction works; (iv) permission/approval from Department of Archaeology prior to construction works in Patan and Darbar Squares; and (v) avoid tree cutting, and if necessary, cut only trees that are marked and have been agreed relevant authorities for removal and plant and rear tree saplings at the rate of 25 saplings for each felled tree.	DSC/PID

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Responsibility
Utilities	Telephone lines, electric poles and wires, water lines within proposed project area	• Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during construction phase • Require construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services	DSC
Pegging of the land area (permanent and temporary) and right of way required by the project	Illegal occupation/encroachment of property	• Ensure community consultations prior to the commencement of civil works • Delineate project land and prepare the list of project affected people and resources • Prepare resettlement plan for any foreseen income losses during construction • Provide compensation as per resettlement plan • Maintain records of trees and other properties likely to be affected • Avoid tree cutting, and if necessary, cut only trees that are marked and have been agreed relevant authorities and plant and rear tree saplings at the rate of 25 saplings for each felled tree. • Obtain necessary forest tree permits	KVWSMB/KUKL/Contractor/DSC
Identify the temporary areas required by the project and locate them with proper marking	May result in social tensions	• Prepare the details of contractor's temporary land use and other private properties and discuss with owners • Submit to DSC • Temporary easements should avoid displacement or resettlement impacts. • Follow resettlement plan, where applicable. • Ensure community consultations prior to the commencement of civil works	KVWSMB/KUKL DSC/Contractor
Construct workforce camp	Haphazard camps resulting in social stress and degradation of local environment	• Establish workforce camps in designated sites only and in consultation with local community. All camps are to include sanitary facilities for men and women.	Contractors/DSC
Make employment policy for local and affected people	Local people may be deprived of opportunities, minors may be employed	• Employ local people (and women in jobs and follow core labor standards) • Equal pay for men and women	Contractors/ DSC
Prepare traffic management plans	Traffic congestion and public annoyance	• Prepare and implement traffic plans to prevent traffic jams and annoyances to the public in coordination with relevant local authorities and communities.	KUKL/DSC/contractor
Construction phase: Physical environment			
Disposal of excess materials in	Soil erosion, and slope	• Separate stockpiling of topsoil for further use; spoil disposal at	Contractors/DSC

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Responsibility
designated area. Apply bio-engineering for controlling of erosion	instability due to topsoil stripping and excavation for trenches. Surface water discharges to local drainage from trench construction. Runoff from construction areas including stockpiled materials. Excavation and laying of pipeline at river crossings could impact the river water quality and ecosystem. Interception and interference with localized groundwater flows due to deep excavations.	designated and stabilized sites; excavated areas backfill to be compacted and include replacement of topsoil; adopt cut and fill approach; avoid work during the rainy season as much as possible; mulching to stabilize exposed areas; use bioengineering techniques (e.g. revegetating areas promptly); provide channels and ditches for post-construction flows; lining of steep channels and slopes (e.g. use of jute matting); prevent offsite sediment transport using settlement ponds, silt fences. • Use of settling basins at reservoir sites; use of straw for filtering of small discharges; routine inspection and monitoring of larger discharges to water courses. Excavation dewatering to use settlement tanks • Use of temporary bunds; use of catchment basins. Soil / sand stockpiles to be graded to prevent erosion. Use of river diversions with bundings • Local wells, springs and irrigation canals to be bunded from temporary spoil dumps; local wells and spring fed spouts or *kuwas* to be monitored particularly downhill of reservoir excavations plus temporary supply provided if flow is affected; permeable base and side backfill required at deeply excavated reservoir sites or an alternate source of drinking water provided at the existing location.	
Quarrying from river bed	Change in river hydrology and morphology	• No quarrying/mining activities in river/streams	Contractors/DSC
Dumping of waste in the river Construction of toilets in the camps Storing of materials in the project area Handling of toxic materials Dumping of excess material	Water and land pollution	• Provide designated areas with collection bins for wastes. • Provide toilet facilities and prohibit open defecation. • Prohibit washing of vehicles next to rivers and streams. • Proper storage of construction aggregates, hazardous and toxic materials, lubricating oils and used batteries in safe areas and the proper segregation and disposal of chemical containers, packaging materials, plastic bags etc. • Provide training to workforce on safe handling of toxic materials and OHS measures during construction.	Contractors/DSC
Quarrying operations Movement of vehicles Operation of crusher Earthworks Stockpiling of construction waste and construction materials	Air quality deterioration	• Dust suppression on roads or at open sites by sprinkling water as required at regular intervals. • Cover earth stockpiles using plastic sheets or cement jute bags. • Routine monitoring of dust (total suspended particulates) to meet air quality standards • Limit vehicle speed. • See that vehicles comply with the National Vehicle Mass	Contractors/DSC

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Responsibility
		Emission Standards, 2056 BS. • Regular maintenance of vehicles. • Provide proper ventilation in confined working areas.	
Movement of vehicles Operation of crusher Operation of construction machineries and equipment Horn honking	Noise and vibration	• Monitoring of noise levels regularly at site to meet the noise standards • Fit mufflers in vehicles to control noise. • Limit the speed of vehicles. • Regular maintenance of equipment. • Compensate and repair the damages caused by vibration if caused by construction activities.	Contractors/DSC
Construction phase: Biological environment			
Vegetation clearance	Vegetation clearance	• Avoid tree cutting, • Obtain necessary tree cutting permits • Cut only trees that are marked and have been confirmed by the Department of Forestry. • Plant and rear tree saplings at the rate of 25 saplings for each felled tree. • Stockpile the felled trees and take permission from concerned authority for its use • Compensate all private trees and community forests affected	Contractors/DSC
	Damages to fisheries and aquatic ecology of riverbeds and habitats.	• Dry season construction only and use of river diversions and bunding off of work sections	Contractors/DSC
Construction phase: Socioeconomic environment			
Laying of pipes on narrow roads or outside carriageway	Temporary easements and impacts to business activity including temporary relocation of vendors.	• Prior to construction, hold community meetings to inform them of construction works. Distribute project information. Advanced notice should be provided at least 1-2 weeks in advance. • Place KULK phone hotline on signs in visible areas. Make community fully aware of grievance mechanism and provide contact info of PID and KUKL branch offices • Maintain access to avoid disturbance to residents and businesses by providing planks and leaving spaces for businesses and residents to maintain access. • Manage traffic flows, conduct work at night where possible • Trenches open for only 1-3 days and works should be quickly completed • Avoid full street closure to fullest extent possible • Businesses losing income due to disturbance, are compensated as per the resettlement plan.	KVWSMB/KUKL/ Contractor /DSC/Grievance Redress Committee

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Responsibility
		• Avoid involuntary displacement • Temporary sites to be restored to natural and stable conditions as per agreement with land owner • Proponent report in writing that temporary areas have been vacated and restored to pre-project conditions before acceptance of the works • Provide employment opportunity to the affected people to extent possible • Assist vendors in shifting prior to construction and to return to original location when construction is complete in relevant sections • Avoid disturbance to tourist areas	
Reinstatement of damaged community services and infrastructures	Reinstatement of community services and infrastructures	• Compensate or reinstate/relocate community assets that are disturbed such as irrigation canals, electricity poles, telephone lines, drinking water pipes, sewerage lines, roads, etc. to the satisfaction of the people. • Avoid disturbance to any historic/heritage buildings or structures by taking necessary precautions (work away from any heritage buildings, hand digging, no heavy equipment, etc.) • Obtain prior permission from Department of Archaeology prior to construction in Patan and Darbar Squares • Roads in heritage areas are to be reinstated to original condition with same materials.	KVWSMB/KUKL/Contractor/DSC
Influx of outside workforce, money and unwanted activities	Increase in crime and community stress	• Prohibit gambling and alcohol consumption in contractors' campsites. • Instruct the outside workforce to respect the local cultures, traditions, rights etc. • Provide security in contractors' camps.	KVWSMB/KUKL/Contractor
Project activities relating to health and safety issues at work areas	Health and hygiene (unsafe working conditions, accidents, fire hazard, transmission of communicable diseases etc.)	• Ensure measures (fencing and/or barriers) to protect public from construction site • Provide regular health check-ups, proper sanitation and hygiene, health care, and control of epidemic diseases to the workforce. • Launch awareness programs concerning human trafficking and the possibility of spread of STDs and HIV/AIDS using brochures, posters, and signboards • Make available first aid kits, ambulance and fire extinguishers in campsites • Make available protection gears to all construction workers and	Contractors/DSC/KVWSMB/KUKL

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Responsibility
		compensate for the loss of life or any type of injuries • Provide insurance to the workers and training in OHS and community health and safety. • Ensure all work areas are clearly demarcated and marked and protect public from getting near to the trenches. • Provide alternate potable water supply during maintenance works and notify the public in advance.	
Work in archaeological and/or heritage areas	Loss of archaeological and cultural sites Finding of any archaeological artefact during excavation works. Heritage buildings and character of heritage areas	• Inform Department of Archaeology of plans and submit application for permission • Conduct Archaeological Impact Assessment, or other agreed document approved by DOA, if required • Obtain Department of Archaeology permission prior to works in designated areas of archaeological significance particularly in Patan and Darbar Squares • Ensure compliance with any Department of Archaeology (DOA) rules based on ongoing consultations with DOA during construct period including on-site field inspector • Protect archaeological and heritage sites, use manual digging and avoid heavy equipment during the digging of trenches for the laying of pipes • In case of a chance find the DOA has to be immediately notified. Appropriate action is to be taken either to relocate the artifact if situation permits as per the directions of the department or work at the location has to be abandoned and alternate plan has to be executed. • For pipe-laying works on roadways within Patan Square and Darbar Square, etc.) ensure the following measures: prior permission of DOA before construction works, no vibrating machinery near heritage buildings, only hand digging allowed, inform community prior to construction of sections, ensure no blockage to tourist areas, have clear signage related to KUKL works, ensure reinstatement of roads to original condition, ensure extra measures (fencing and/or barriers) to protect tourists and public from construction site, ensure a construction supervisor on site at all times and reinstate roads to original condition	Contractors/DSC/KVWSMB/KUKL
Traffic management at construction sites	Traffic congestion (temporary disruption to local access due to open trenches, excavation across	• Develop and implement a traffic plan and road safety plan to minimize traffic flow interference from construction activities • Coordinate with local authorities (police, VDC, local area committees, etc.) to manage traffic during construction period	Contractors/DSC

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Responsibility
	roads or road closures due to construction).	• Provide advance public awareness and public notification of construction activities, schedule, routing, and affected areas including road closures • Erect alternative routing signage in Nepali and English • Use of steel plates or other temporary materials across trench facilities in key areas such as pedestrian access and sidewalks and parking areas • Arrange for night time construction for activities in congested/ heavy daytime traffic areas • Arrange for onsite "grievance handling" through use of liaison officers • Undertake trench closure and facilitate surface rehabilitation or paving as quickly as feasible	
Operational phase			
Project activities relating to health and safety issues at work areas	Health and hygiene (unsafe working conditions, accidents, fire hazard, transmission of communicable diseases etc.)	• Provide regular health checkups, proper sanitation and hygiene, health care, and control of epidemic diseases to the workforce. • Make available first aid kits, ambulance and fire extinguishers in camp sites. • Make available protection gears to all construction workers and compensate for the loss of life or any type of injuries. • Provide insurance to the workers and training in OHS and Community Health and Safety. • Provide alternate potable water supply during maintenance works and notify the public in advance.	KUKL
Abstraction of groundwater	Risk of inadequate yield of the aquifer; excessive abstraction could deplete aquifer and cause ground subsidence and shortage of well water	• A program for yield monitoring shall be designed. Redesign project with alternative water source if proposed abstraction rate exceeds sustainable yield.	KUKL
Water quality	Water quality does not meet national drinking quality standards	• Conduct regular monitoring of water quality from treatment plants to ensure water delivered to public meets national standards • Implement appropriate treatment (aeration, filtration, softening etc. To manage elevated levels of iron, manganese and ammonia present in groundwater from the 20 new tubwells.	KUKL

DSC = Design and Supervision Consultants, EMP = Environmental Management Plan, HIV = Human Immuno Deficiency Virus, KUKL = Kathmandu Upatyaka Khanepani Limited, KVWSMB = Kathmandu Valley Water Supply Management Board, OHS = occupational health and safety, PID = Project Implementation Directorate, STD= sexually transmitted disease.

141. Deep excavations can intercept and interfere with the localized groundwater, thereby affecting flows from irrigation canals, springs, and wells, and causing water shortages. Mitigation measures include: (i) bunding of local wells and springs and irrigation canals from temporary spoil dumps; (ii) monitoring local wells and spring-fed spouts or kuwas, particularly downhill of excavations, plus temporary supply provided if flow is affected; (ii) requiring permeable base and side backfill at deep excavated sites; and (iv) an alternate source of drinking water provided at the existing location.

142. To avoid contamination of groundwater during tubewell construction, provide protection during and after drilling and disinfect the well after drilling.

b. Change in River Hydrology and Morphology

143. The construction, rehabilitation, and operation of water distribution networks could have impacts on the river hydrology and morphology due to quarrying from riverbeds for sand and gravel, particularly during the dry season. Water pollution could occur because of the dumping of spoil materials into the river, excavation of boulders from the river channel, direct disposal of liquid wastes, and leakage of oil and lubricants. Quarrying and mining activities in rivers and streams for extraction of construction materials shall not be carried out so as not to change the river cross-sections and longitudinal profiles, and should be carried out only from approved sources.

c. Water and Land Pollution

144. Dumping of wastes and discharge of wastewater effluents into rivers can pollute the river water, making it unhealthy for downstream users. Mitigation measures include: (i) avoiding putting up construction labor camps and facilities within the drainage area; (ii) providing designated areas with collection of bins for wastes; (iii) providing toilet facilities and prohibiting open defecation; and (iv) prohibiting washing of vehicles next to rivers and streams.

145. Pollution of land and water could also be mitigated by (i) the proper storage of construction aggregates, hazardous toxic materials, and lubricating oils in safe areas such as warehouses, along with used tires and exhausted batteries; and (ii) the proper segregation and disposal of chemical containers, packaging materials, and plastic bags. Provide training to the workforce on the safe handling of toxic materials and OHS measures during construction could help in mitigating many of the adverse impacts mentioned above.

d. Pollution Due to Air, Noise, and Vibrations

146. Earth excavation, construction materials and stockpiling, aggregate crushing, drilling, quarrying, and plying of vehicles will produce dust (total suspended particulates, PM_{10}), hydrocarbons (carbon monoxide, carbon dioxide, methane), sulfur dioxide, nitrous oxide, hydrogen sulfide, noise, and vibrations. Trucks plying non-metallic roads will produce huge amounts of dust, thereby reducing air quality and increasing noise levels to above 90 dB affecting people's health. Appendix 4 gives the national ambient air quality standards for Nepal.

147. Mitigating measures to be employed are:

(i) dust suppression on roads or at open sites by sprinkling water as required at regular intervals;
(ii) covering earth stockpiles using plastic sheets or cement jute bags;

(iii) routine monitoring of dust (TSP, PM_{10}), sound, and vibrations at regular intervals; (iv) limiting vehicle speeds and banning power horns;
(iv) seeing that vehicles comply with the National Vehicle Mass Emission Standards, 2056 BS;
(v) fitting of mufflers in vehicles to control noise;
(vi) regular maintenance of vehicles;
(vii) prohibiting the operation of crushing plants and construction vehicles between 7 p.m. and 6 a.m. in residential areas; and
(viii) compensating for the damages caused by vibrations to buildings, and providing proper ventilation in confined working areas.

148. Appendix 6 gives the recommended standards for vibration from construction sites. Adverse impacts could be caused by inadequate buffer zones around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities. Adequate alleviation measures (including developing buffer zones around the treatment plants) should be included in the project designs. Noise should be monitored as per Appendix 5. These are particularly relevant in heritage areas, where heavy machinery is prohibited.

2. Biological Environment

149. Although most of the construction and improvement works will take place in urban areas, there will be some impacts on the ecological resources (loss of trees and vegetation, loss of wildlife and endangered species, disruption of protected areas, damage to fisheries and riverbed aquatic ecology) due to (i) vegetation clearance and loss of species due to construction of project structures; (ii) fuel wood and non-timber forest products (NTFP) collection by the workforce and vegetation clearance for construction activities; and (iii) construction activities at pipeline crossings over riverbeds.

150. Mitigation measures are:

(i) avoiding tree cutting, and if unavoidable, cut only trees that are marked and have been approved by the Shivapuri Nagarjun National Park/Department of Forestry for removal, and planting and rearing tree saplings at the rate of 25 saplings for each felled tree;
(ii) prohibiting the use of fuel-wood and timber collection;
(iii) prohibiting hunting and the illegal collection of protected animals and plants;
(iv) providing liquefied petroleum gas (LPG) or kerosene to the workforce;
(v) stockpiling the felled trees and get permission from concerned authorities for their use; and
(vi) compensating all private trees and community forests affected.

151. To save the fisheries and riverbed aquatic ecology, work should be done in the dry season only, and river diversions and bunding off of sections carried out.

3. Socioeconomic and Cultural Environment

152. Local labor and women should be given preference for employment as far as feasible and practical, and women should make up part of the unskilled workforce.

a. Compensation and Rehabilitation as per the Resettlement Plan

153. Temporary disruption for DNI pipe connection works will be approximately 1-4 days, and for BDS, 5-7 days. Trench sections for DNI connection works will be 100-200 m in length, and 50-100 m for BDS. Contractors are required to maintain access to shops to avoid or limit the disturbance to the extent possible. Mitigation measures are incorporated into their contracts as outlined in the EMP and will be monitored by the construction supervision consultants. Contractor's temporary land use and easements on land require compensation to affected people, and are among the most important impacts of any construction project to ensure that its progress is not to be hampered. The mitigation measures are:

(i) avoiding involuntary displacement;
(ii) avoiding impacts to business income by providing continued access;
(iii) providing continued access to shops;
(iv) avoiding full street closure to extent possible, and limiting number of full closure days where unavoidable;
(v) holding community meetings prior to construction to ensure awareness;
(vi) ensuring trenches are open only 1-3 days in areas of businesses activity;
(vii) if income loss occurs, compensation resettlement according to agreed entitlements policy and resettlement plan;
(viii) making arrangements for a grievance redress committee to look into the grievances;
(ix) restoring temporary sites to their natural or stable conditions as per agreements with the land owners;
(x) planting exposed areas of temporary sites with endemic vegetation;
(xi) making sure that the proponent reports in writing that temporary areas have been vacated and restored to pre-project conditions before acceptance of the works;
(xii) providing employment opportunities to the affected people;
(xiii) providing all possible assistance to the displaced people until they are settled;
(xiv) providing disturbance and rehabilitation costs;
(xv) protecting the traditional rights of the local people; and
(xvi) compensating for any loss of crops, trees, and other natural resources and establishing a technical committee to assess the compensation for damages caused by vibrations of construction equipment and vehicles. Photographs of the damaged structures should be taken and compared to the baseline photographs taken before construction.

b. Reinstatement after Construction

154. Areas should be reinstated to their original condition by the contractor. Construction activities could have adverse impacts on community services and infrastructure, and should be mitigated using careful construction measures. Any adverse impacts to community assets that could be disturbed by construction activities, such as temples, bridges and irrigation channels, electricity poles, telephone lines, drinking water pipes, sewerage lines, roads, and others will be mitigated, compensated, reinstated, or relocated to the satisfaction of the community. When excavating trenches for the installation of new water supply pipes in heritage sites (e.g. Patan and Kathmandu Darbar Squares), manual labor shall be employed and the use of mechanical equipment avoided. Works must occur away from buildings to the extent possible, and supervised. Roads must be reinstated to their original condition.

4. Occupational Health and Safety

155. There could be adverse impacts on the health and hygiene of the workers due to unsafe working conditions, accidents, fire hazards, and transmission of communicable

diseases. To mitigate these adverse impacts, the project must (i) provide regular health checkups, proper sanitation and hygiene, health care, and control of epidemic diseases to the workforce; (ii) launch awareness programs concerning human trafficking and the possibility of spread of STDs and HIV/AIDS using brochures, posters, and signboards; (iii) make available first aid kits, ambulances, and fire extinguishers in camp sites; (iv) make available personal protection equipment (PPE) to all construction workers, and compensate for the loss of life or any type of injuries; and (v) provide insurance to the workers. Health and safety training for all site personnel is very important. Another significant impact is the effect on people and communities if water supplies are closed down for extended periods during work on the pipe networks, which could include health risks. If water supply has to be stopped, advance notice to the affected people should be given, and alternative provisions of potable water arranged.

156. The potential occupational health and safety impacts and hazards and mitigation measures for the laying of drinking water pipes in trenches are given in Table 14. Before construction begins, the contractor will inform and provide training to its workers on the potential occupational health and safety impacts and hazards and mitigation measures to be used during construction. The training must be done in Nepali (or the local language of the workers), with handouts distributed and information posters displayed. As most of the workers would be uneducated, pictorial presentations should be used during training, depicting the hazards and the mitigation measures.

5. Community Health and Safety

157. In addition to the construction workforce, the contractor should be aware of the adverse health and safety impacts of the construction works on communities along the construction areas. Anticipated impacts and mitigations are:

(i) holding community meetings and awareness campaigns prior to construction works;
(ii) passing out project information to local community;
(iii) ensuring that there are barriers in populated residential, business, or tourist areas to ensure that the public is not allowed near work site;
(iv) addressing poor quality of drinking water and polluted drinking water sources;
(v) ensuring traffic management;
(vi) avoiding full road disclosure;
(vii) finishing work quickly, backfill trenches within 1-3 days, and reinstate roads quickly thereafter; and
(viii) being prepared for the possibility of accidents happening to the people of the community due to trench excavations.

6. Archaeological sites

158. Kathmandu Valley has a rich and varied cultural heritage, including many temples, stupas, and shrines. The archaeological and cultural sites should be protected, and in case of relocation, the local communities must be consulted. There is a risk that any work involving ground excavation could uncover and damage archaeological and historical remains. If there are any chance finds, work has to be stopped, the Chief District Officer contacted immediately, and the findings reported in writing to the Department of Archaeology within 35 days, according to the Ancient Monuments Protection Act, 1956, and Rules, 1989.

159. The Ancient Monuments Preservation Rules 2046 (1989) states:

> 4.1.1 Pursuant to Subsection (5) of Section 3 of the Act, any person or Association willing to install telephone and electricity, to dig the land for drinking water, to construct and repair the road, to shoot a film, cinema, to celebrate festival and fare,

to dance or to park vehicles or to place the poster and photograph, shall have to submit an application to the Department, for its approval in format as prescribed in Schedule-1 (Appendix 9).

4.3.2 If the Local Officer found any information of finding of any archaeological object in his working District, he shall have to fill the description of such object in the form as prescribed in Schedule-4 (Appendix 9) within 35 days from the date of finding of such object, and, if possible, the photograph of such project also shall have to be sent to the Chief Archaeology Officer.

160. Two UNESCO Heritage Sites (Kathmandu Durbar Square, subzones A 1.7 and A 3.3, and Patan Durbar Square, subzone A 8.2 and A 8.3) are located in areas where distribution network improvements are planned. Prior permission will have to be obtained from the Department of Archaeology as stated in The Ancient Monuments Preservation Rules 2046 (1989) Section 4.1.1 above. Additional precaution in these sites include:

(i) photographing all sites within the heritage area to enable before and after comparison (all roads are to be reinstated to original character, especially in heritage areas, and buildings are to be left untouched);
(ii) avoiding disturbance to any historic or heritage buildings or structures by taking necessary precautions (working away from heritage buildings, hand digging, no heavy equipment, and others); and
(iii) for pipe-laying works in roadways within UNESCO heritage areas (e.g., Patan Square and Darbar Square), ensuring the following measures: (a) no vibrating machinery near heritage buildings; (b) only hand digging allowed; (c) informing the community prior to daily construction of sections; (d) ensuring no blockage to tourist areas; (e) having clear signage related to KUKL works; (f) ensuring reinstatement of roads to original condition;, (g) ensuring extra measures (fencing and/or barriers) to protect tourists and public from construction site, and (h) ensuring that a construction supervisor is onsite at all times; and
(iv) roads to be reinstated to original condition by contractor.

Table 12: Potential Occupational and Community Health and Safety Impacts and Mitigation Measures

SN	Potential Adverse Impact	Mitigation Measures
1	Delivery and unloading of pipes and fittings: pipes may move/roll or be tampered with by others.	• Provide secure stockpile for pipes and fittings; unload and stock pipes strictly in accordance with the manufacturers' recommendations and minimize height of pallets/stockpile; use correct manual handling techniques and mechanical aids where possible; carry pipes close to the ground while moving and control lifted weights.
2	Injury to a member of the public during pipe delivery	• Provide fencing and/or barricades as per site risk assessment. Apply signage and pedestrian control. • Devise and implement system for site inspection and security. • Ensure security and equipment necessary to minimize vandalism.
3	Traffic and vehicular accidents to cause personal injury to the public, contractors, and employees	• Traffic control plan must be developed and areas kept clean and clear of obstacles.
4	Slips, trips and falls, strains and sprains; manual handling injuries such as back damage	• Conduct site inspection to ensure access/space is adequate for the task activities.
5	Existing underground services to cause explosion and electrocution, and damage services	• Inform site in-charge before you dig/excavate; check relevant authority (e.g. power, water, telephone) records for existing location of services. • If in doubt use the experienced service of people in the locality. When using hand prodders to locate pipes, they must never be driven into the ground by hammers or other implements. • Confirm location of services by "pot holing" techniques.
6	Excavation by plant and equipment to create noise, falling objects, damage to existing surfaces, material spillage, and injuries by moving parts	• Operations of plant must be done by licensed personnel. Use personal protective equipment (PPE) – hardhat, high visibility vest, hearing protection etc. • Maintain a safety working area around the moving plant. • Protect surfaces from plant movements. Ensure plant noise control. Maintain clean-up equipment on site. • Maintain (specified) spillage control equipment. • Employ observers where appropriate.
7	Falling objects during storage of materials during excavation	• No materials to be placed or stacked near the edge of any excavation. • No load to be placed or moved near the edge of the excavation where it is likely to cause collapse of side of work. No load handling/movement across excavation. No rollable objects stored uphill from excavation.
8	Overhead and underground power cables to cause electrocution during excavation	• Determine location of underground services. If underground power cables are located in the vicinity, exercise extreme care while excavating. Consider any restriction on kinds of tools and equipment that may be required and comply with the requirements.
9	Sloping ground to cause the falling of rolling objects	• Maintain good housekeeping (remove debris and trip hazards, maintain site tidiness). • Select locations to minimize potential for movement. Keep stack materials at level below excavation. • Secure/retain potential falling/rolling objects.
10	Trench collapse and falling objects	• Support/bench/batter excavation. • Keep safe distance from edge of trench. Materials not to be placed or stacked near the edge of trench. • No load must be placed or moved near the edge of trench where it is likely to cause collapse

SN	Potential Adverse Impact	Mitigation Measures
		of the trench. • All trenches must have safety barricades when left open for a period of time. • Provide submersible pump to dewater trenches where ground is water-charged. • Use personal protective equipment. There must be no load/personnel movement across trench.
11	Falling into trenches	• Install a shoring system. Where possible backfill trenches. • Erect 1.8 m minimum security fence if open excavation is to be left unattended, or cover open excavation with steel plating if left unattended. • There must be no personnel movement across trench.
12	Other risks associated with confined spaces such as gases, etc.	• Where trench/conduit is considered a confined space, use experienced trained personnel. • No smoking and use of mobile phone use, and avoid sparking.
13	Trip hazard; dust-eye injury; environmental damage due to storage of fill	• Secure fill stockpile. Provide a dedicated area for fill. • Ensure watering of material. • Provide necessary environmental protection measures. • Cover fill when unattended or unable to be watered.
14	Manual handling (shovelling) to cause strains and sprains; injuries such as back damage	• Practice manual handling awareness. • Ensure adequate rest periods and, job rotation, minimize repetitious twisting and shovelling.
15	Contaminated soil impacting health of persons	• Use protective clothes/shoes/gloves.
16	Defective materials causing injuries	• There should be visual inspection of materials by experienced persons.
17	Storage of hazardous materials causing injuries and illnesses	• Handling and storage must be done carefully under guidance.
18	Earth mounds to cause engulfment and dust to cause eye injuries	• Control operation of mobile plant must be done by a competent person. • Ensure watering of material. • Control slopes. • Delineate earth mounds. • Put up warning signage. • Cover area when unattended or not watered.
19	Pipes may move/roll or be tampered with by others causing injury	• Provide secure stockpile area for pipes and fittings. • Unload and stack pipes strictly in accordance with the manufacturers' recommendations. • Minimize height of pallets/stockpile. • Secure pipes to prevent movement irrespective of slope of surface, and secure pipes to prevent movement, e.g. sand bags. • Place against fixed objects, which will prevent the movement of pipes. Orientate/select position to minimize potential for movement, e.g. place pipes normal to slope of ground. • Place pipes in secure compound if site is left unattended. • Minimize waiting time for pipes on site prior to laying. Identify high-risk locations in advance, e.g. sloping or soft ground. • Ensure availability of sand/gravel bags/pegs/timber or other materials for retaining or securing pipes.
20	Accessing trenches/conduits can cause collapse of trench and falling objects, and electrocution if using power tools in water environments.	• Use shoring system. • String only sufficient pipes for day's work.

SN	Potential Adverse Impact	Mitigation Measures
		• Return all pipes not laid at end of day to secure stockpile areas.
21	Personal injury due to working plant and equipment	• Use only maintained equipment fitted with yellow flashing lights and reversing alarms. • Maintain a safe distance from working plant. • Wear PPE, including high visibility clothing and hard hat. • Put up perimeter fencing • Place trained personnel on the lookout. • Have a first aid kit at the site.
22	Injuries due to lifting pipes and swinging loads	• Use correct manual handling techniques. • Use mechanical aids where possible. • Maintain control of loads when lifting and moving. • Carry pipes close to ground while moving if mechanical aid is used.
23	Delivery pipe/joint failure causing body injuries during pressure testing of pipes	• Use only competent person to perform the task. • Adequately secure connecting pipes (safety pins for lever couplings). • To prevent joint or pipe section failure, fix brackets close enough together to prevent excessive movement. • Don't exceed pipe operating pressure, ensure pipe is of correct diameter. • Ensure pipe is not damaged. • Ensure adequate support where a change in direction or reducer occurs. • Pressure for air testing must not exceed 32 kilopascals (kPa).
24	Injury due to failure of existing pipeline under pressure when cutting existing pipelines	• Use PPE. • Ensure adjacent stop valves are operational/closed. • Secure adjacent valves against movement. Relieve pressure in system.
25	Injury from high water pressure Burns during welding. Electrocution during house connection services	• Use PPE. • Relieve pressure in system. • Exercise care with torch and PPE. • Earth straps and insulating gloves must be used as services are used for household earthing. • Always ensure pipes are cleaned back to bare metal prior to fitting the bridging straps to ensure a direct electrical contact between the pipes and the strap.
26	Public hazards due to inadequate compaction; construction refuse; inadequate re-surfacing during site restoration High hydraulic/pneumatic pressures during site restoration causing injury due to pipe blowouts of plugs	• Carry out compaction to specified standard; clear site of debris and refuse; resurface without leaving gaps or uneven surfaces; and erect fence around hazardous areas until they are safe and restored. • Ensure plugs and compressors are installed and secured against movement; release air before removing plugs and clear area of pipe ends being tested.
27	Inadequate training, consultation, planning, and improvisation causing task-specific injuries due to inexperience, inadequate consultation, or failure to provide appropriate equipment	• All personnel on-site must be trained and kept aware and should be suitably qualified, and competent supervision must be provided on-site.
28	Misuse of equipment/fire hazards causing fire/explosions.	• Care must be taken when refuelling machinery with petrol to ensure engines aren't running and there are no naked flames in the vicinity; oxy-acetylene and gas equipment must be used strictly in accordance with the manufacturers safe operating procedures. • All personnel working on the site are to be trained in the correct operation of the tools and

SN	Potential Adverse Impact	Mitigation Measures
		equipment they are using. • All tools and equipment are to be serviceable and in safe condition. • All electrical tools are to be fitted with current test tags. • Fire extinguishers are to be located on site. • No work during high fire danger unless dry vegetation is cleared and/or watered down prior to carrying out hot work. • Avoid driving or parking motor vehicles on long dry grass as the heat generated by the exhaust could start a fire.
29	Exposure to ultra violet light, glare can cause skin cancer, sunburn, eye damage	• Use of protective clothing, sunscreen, flap on hard hat and proper sunglasses.
30	Weather conditions (e.g. hot, cold, wet, flooding/inundation, electrical storms, high winds) can cause dehydration and dizziness	• Supply adequate drinking water in work area. • Provide protection from UV rays. Use of PPE.
31	Slippery surfaces can cause slips and falls	• Non-slip safety footwear must be worn at all worksites. • Exercise extreme care when working in wet and slippery areas. • Personnel should never run at worksite.
32	Untidy site can cause slips and falls	• Keep worksite clean and tidy at all times.
33	Materials stored may be dislodged and fall onto people or property particularly when site is unattended	• Materials to be stored in a safe manner.
34	Public safety may be at risk due to pipes or drums accidentally rolling onto the roadway causing an accident, or may be rolled by unauthorized persons particularly when site is unattended, causing injury to persons	• All materials must be secured by blocks or wedges, sandbags or other means. • All pipes not laid during the course of a day are to be returned to the stockpile and secured appropriately.
35	Public safety may be at risk due to improper storage of plant	• Store/park plant and equipment off site and in a secure area.
36	Nuisance due to excavated soil Deterioration of air quality due to dust	• Practice safe disposal and reuse of excavated soil. • Remove waste soil as soon as it is excavated. Sprinkle water to avoid dust.
37	Soil erosion, silt runoff and settling of street surfaces Water could get polluted; land values degraded and be a nuisance to pedestrians Street surfaces would settle, bringing about ponding of water.	• Precautionary measures should be taken during construction. Proper backfilling of excavated trenches should be done and construction activities should be, as far as possible, avoided during the rainy season. Temporary diversions and signboards for pedestrians must be provided.
38	Workers and the public at risk from accidents on site	• Prepare and implement a site health and safety plan that includes measures to: (i) exclude the public from all construction sites; (ii) ensure that workers use protective equipment; (iii) provide health and safety training for personnel; (iv) follow documented procedures for site activities; (v) keep accident reports and records; and (vi) as far as possible, hire local people (who know the local conditions).
39	Local residents and sites of social/cultural importance may be disturbed by noise, dust and impeded access	• Carry out the work as quickly as possible to minimise disturbances. • Consult residents; inform them of work in advance.
40	Pollution of water distributed can cause health hazards.	• Locate distribution pipes away from drains to avoid infiltration of drain water.

PPE = personal protective equipment.

7. Traffic Management

161. Traffic congestion and temporary disruption of local access due to open trenches, excavation across roads, or road closures due to construction could have impacts on pedestrians, vehicles, and businesses. To mitigate this, traffic management plans should be developed for areas along the construction works of utmost importance, to minimize traffic flow interference from construction activities. Appendix 10 provides basic principles and strategies for managing traffic. Advance local public notifications via VDCs of construction activities, schedules, routings, and affected areas, including road closures, should be made. Erect signage in Nepali and English. Steel plates or other temporary materials should be used across trench facilities in key areas such as footpaths or livestock routes Pedestrian access, sidewalks, and parking areas, as well as night time construction for activities in congested or heavy daytime traffic areas, should be arranged. The project should make provisions for onsite grievance handling and undertake trench closure and facilitate rehabilitation as quickly as feasible. There must be coordination with the Kathmandu Metropolitan Traffic Police Division, the authority in charge of traffic management, and permission must be obtained from the Department of Roads for digging on the main urban roads, and from the municipalities (Lalitpur submetropolis and Kathmandu metropolis) for digging on inner urban roads.

C. Operational Phase

1. Water Supply System

162. Health problems could occur due to inadequate supply of potable water. Adequate treatment of water (including chlorination) should be done before distribution. Water quality monitoring (according to the National Drinking Water Quality Standards, 2006) should be done regularly, and residual chlorine checked daily from taps. Regular inspection of pipes for leakage and maintenance should be done.

163. Flushing of drinking water pipes could have adverse impacts on surface water due to suspended solids, residual chlorine, and other contaminants. To minimize the impacts, the flush water must be discharged into designated areas agreed upon with local and environmental officials.

164. The potential impacts of the proposed water supply project are summarized in the IEE.

2. Potential Environmental Enhancement Measures

165. Possible environmental measures that shall be carried out by KUKL before the project commences are:

(i) training and awareness programs in health and sanitation, OHS, community health and safety, and usage of water and its importance (water cost, savings, reuse, recycle, water pollution) for the general public; and
(ii) community meetings prior to any construction works to make public aware of temporary disturbances during construction.

166. Sufficient human resources should be invested in maintaining drinking water systems. The efficiency of the treatment plants should be well recorded by regularly monitoring the water characteristics. There are many environmental youth clubs in the Kathmandu Valley. They can be mobilized to monitor water quality and report problems to KUKL.

3. Transboundary and Cumulative Impacts

167. There will be no environmental transboundary and cumulative impacts, such as air pollution, abstraction of water, loss of habitat, or pollution of international waterways. Environmental and socioeconomic impacts have already been mentioned earlier. The project will help create employment opportunities and enhance the local labour skills in pipe laying for future works in Nepal.

VI. INFORMATION DISCLOSURE, CONSULTATION, AND PARTICIPATION

168. The ADB SPS requires meaningful stakeholder consultations. A number of stakeholder workshops were held. The draft IEE will be made available in local language and posted on ADB's and project-related websites. Public consultations were held throughout the entire process of the EIA study for MWSP and the preparation of project and related safeguard documents. Several consultations were held in the Kathmandu Valley, in different wards and with different heterogeneous groups. The project objectives were explained, and people were asked for their opinions and suggestions

169. The public was informed from time to time about the construction of reservoirs, water transmission lines water treatment plants, and land acquisition together, with the project's resettlement, rehabilitation and compensation modalities. MWSP formed an NGO committee comprised of donors, MWSDB, and NGOs, which held monthly meetings in Kathmandu. Similarly, the MWSP staff attended regular discussion forums organized by NGOs, such as the Sunday Forum of WAFED, the discussion forums held by the NGO for Urban Water and Sanitation, Nepal Vasa Misha Khala, Society of Business and Professional Women, Society of Public Health Engineers-Nepal, Nepal Engineering Council, Nepal Engineering Association, and Melamchi Concern Group, various FM radio programs, and others..

170. In addition, MWSP disseminated project information through different media (print and electronic media, interaction forums, and newsletters, both in Nepali and English), and prepared a resettlement action plan in 2001. During the preparation of the resettlement plan, numerous consultations were made at different levels of society, including among local stakeholders, experts, and government officials.

171. A number of household surveys and community consultations have been undertaken in the Kathmandu Valley as part of the preparation and design of the MWSP to determine water sector priorities and needs of the public in general and specific communities. Table 13 provides a summary of the findings.

172. All safeguards documents were endorsed by the executing agency, and ADB will upload all documents on their own website. The full IEE reports are available to interested parties upon request from PID. Translated versions of the IEE were also made available and disclosed in public locations.

Table 13: Summary of Household Water Use Surveys in Kathmandu Valley

A.	**Household water use survey (December 2003)**			
	Sample size	300 households in urban areas		
	86% of the population satisfied with the quality of water supplied by KUKL			
	94% were not satisfied with the quantity of water supplied			
	78% were discharging wastewater into municipal drain directly			
	15% discharged their wastewater into a septic tank			
	9% discharged septic tank effluent into municipal drains			
B.	**TA. 6219 –REG: Survey of Water Demand in the DNI Demonstration Area, University of Tokyo, February 2008**			
	Survey done May 2005 (dry), July-August 2005 (wet), and March 2006 (winter)			
	Sample sizes	Min Bhawan (demo-scheme area) = 422 households Anam Nagar and Chabahhil (control groups) (256+259) = 515 households		
	General comment: Low quality service of KUKL (low pressure, intermittent and irregular supply, haphazard meter reading etc.). Due to the low pressure of water, people use electric pump for sucking water from main. The following are the extent of water sucking from the pump in different sample areas:			
	Study area	Dry season	Wet season	Winter season
	Min Bhawan	74.2 %	50.4 %	67.2 %
	Anam Nagar	69.2 %	68.5 %	71.6 %
	Chabahhil	26.3 %	20.3 %	32.3 %
	17.6% households had insufficient water from KUKL or just enough for drinking and cooking purposes in the wet season, a percentage which jumped to 86.2% in the dry season.			
	80.3% and 12.4% households were satisfied with the quantity of water of KUKL during wet and dry season respectively.			
	60% of the households were satisfied with quality of water throughout the year			

KUKL = Kathmandu Upatyaka Khanepani Limited

173. A baseline survey has recently been completed by the University of Tokyo, as part of TA4893-NEP which studied KUKL services to customers in the Kathmandu Valley to provide guidance on present water use and future demands.

174. The implementing agency (PID) will extend and expand the consultation and disclosure process during the detailed design and construction of the project. A community awareness firm will be recruited to ensure ongoing consultations and public awareness during project implementation. This will be coordinated with the PID, DSC, and contractors to ensure that communities are made fully aware of project activities in all stages of construction. A community awareness participation plan was also prepared for the project, and is to be implemented by the recruited firm in coordination with PID and DSC safeguards staff.

175. Several meetings, workshops, and FGDs (Table 14) were held with stakeholders, mainly technical persons to keep them abreast of the TA and to get feedback so as to include them in the Capital Investment and Asset Management Program (CIAMP). PID will also make copies of the IEE report and any other project reports for interested people in the Nepali language.

Table 14: Meetings, Workshops, Consultations, and Focus Group Discussions Held

S No.	Date	Topic
1	8 July 2009	Inception consultative workshop
2	17 July 2009	Focus group discussion on wastewater management in Kathmandu Valley
3	23 July 2009	Focus group discussion on population projections and water demand
4	14 August 2009	Focus group discussion on asset condition survey and water supply zoning
5	30 August 2009	Steering Committee meeting
6	16 September 2009	Focus group discussion on conceptual wastewater master plan options
7	22 October 2009	Focus group discussion on selected DNI pilot area
8	29 October 2009	Focus group discussion on draft CIAMP
9	5 November 2009	Meeting on CIAMP
10	13 January 2010	Presentation and discussion meeting on PPTA progress, draft CIAMP, and interim feasibility reports
11	13 January 2010	Focus group discussion on wastewater
12	1 March, 5 March 2010 17 March 2010	Consultations with UNESCO staff Mr. Tap Raj Panta and Ms. Nipuna Shrestha Consultation with Mr. Bhim Prasad Nepal, Chief, National Archives, Department of Archaeology
13	8 March 2010	Consultation with warden, Mr. Manoj Kumar Shah, Shivapuri Nagarjun National Park
14	21 April 2010	KUKL consultative workshop on the project loan feasibility study
15	16 March 2011	Mr. Axel Plathe, Head of Office and UNESCO Representative to Nepal, UNESCO
16	18 March 2011	Meeting with Mr. Bishnu Raj Karki, Director General, Department of Archaeology
17	21 March 2011	Meeting with Mr. Purushottam Ghimire, Joint Secretary, Chief of Environmental Division, Ministry of Environment
18	22 March 2011	Mr. K.P Archarya, Director General, Department of National Parks and Wildlife

CIAMP = Capital Investment and Asset Management Program, DNI = Distribution Network Improvement, KUKL = Kathmandu Upatyaka Khanepani Limited, PPTA = Project Preparatory Technical Assistance, UNESCO = United Nations Educational, Scientific, and Cultural Organization.

176. In addition, the TA 4893-NEP resettlement team did a survey of 219 households (including squatters and encroachers, businesses, and shops) in the DNI pilot area to obtain further information on community water sector needs. Results of the survey are included in the resettlement plan.

177. Consultations were made with the UNESCO office in Kathmandu, who advised the project to coordinate with the Department of Archaeology from initial planning to implementation. The Ancient Monument Preservation Act for the Protected Monument Zones would be the basis for the safeguard activities within the Protected Monument Zones.

178. An application will be filed by PID with the Department of Archaeology, with detailed drawings of the proposed work according to the prescribed format for obtaining permission to proceed (Appendix 7). If the Department of Archaeology requires further assessment, the project will prepare such documents and obtain approval from the DOA prior to commencement of construction.

179. Consultations were held with the assistant warden of Shivapuri Nagarjun National Park for the rehabilitation of the existing 80-year-old reservoir and the laying of an 800 mm-diameter pipe. The procedure would be for PID to write to the warden with the detailed drawings for permission. The warden will send his comments to the Department of National Parks and Wildlife, and PID will follow it up with the department, which will issue the permit.

VII. GRIEVANCE REDRESS MECHANISM

180. A grievance redress mechanism (GRM) will be established to receive, evaluate, and facilitate the resolution of affected people's concerns, complaints, and grievances about the social and environmental performance of the project. The GRM aims to provide a trusted way to voice and resolve concerns linked to the project, and to be an effective way to address affected people's concerns. The GRM for the project is outlined below, and consists of three levels with time-bound schedules and specific persons to address grievances.

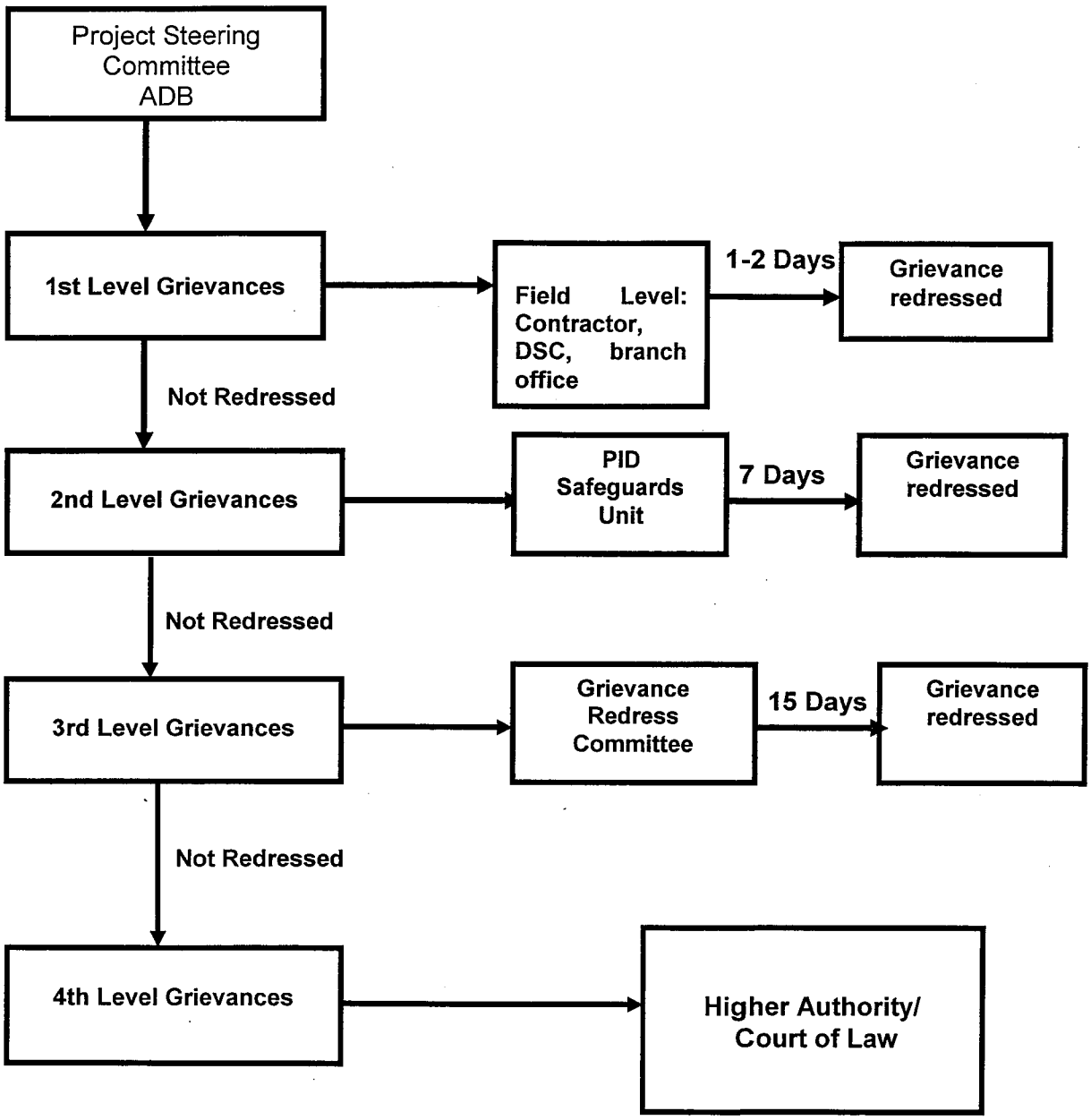
181. **First level of GRM.** The first level and most accessible and immediate contact for the fastest resolution of grievances are the contractors and supervision consultants on site. Prior to construction of any works, the community awareness consultants, DSC, and contractors are to hold local community meetings to notify the local residents and businesses of the temporary disturbance, and to inform them of the project. If a local area committee (LAC) exists, they should also be informed. If any complaints arise, the contractors, DSC, and PID can immediately resolve the complaint on site. The PID branch offices can also be involved in grievance redress at this stage. The KUKL hotline and PID office phone number will be posted in public areas within the project area and construction sites. Any person with a grievance related to the project can contact the project to file a complaint. The PID branch offices are staffed with a consumer relations officer to field and resolve complaints. The consumer relations officer or branch manager will document the complaint, and immediately address and resolve the issue with the contractor within 1-2 days, if the complaint remains unresolved at the field level. The branch manager may seek the assistance of the DSC safeguards specialists (the environmental specialist or social safeguards specialist) to help resolve the issue. The consumer relations officer or branch manager will notify the PID safeguards unit that a complaint was received, and whether it was resolved. The branch manager will fully document the following information: (i) name of the person, (ii) date complaint was received, (iii) nature of complaint, (iv) location, and (v) how the complaint was resolved.

182. **Second level of GRM.** Should the grievance remained unresolved, the branch manager will forward the complaint to the PID safeguards unit. The person filing the grievance will be notified by the consumer relations officer or Branch Manager that the grievance was forwarded to the PID safeguards unit. For resettlement issues, the resettlement officer will address the grievance; for environmental issues, it will be the environmental officer. Grievances will be resolved through continuous interactions with affected persons, and the PID will answer queries and resolve grievances regarding various issues, including environmental, social, or livelihood impacts. Corrective measures will be undertaken at the field level by the PID safeguards staff within 7 days. The relevant safeguards unit staff will fully document the following information: (i) name of the person, (ii) date complaint was received, (iii) nature of complaint, (iv) location, and (v) how the complaint was resolved.

183. **Third level of GRM.** Should the grievance remain unresolved, the PID's project director will activate the third level of the GRM by referring the issue (with written documentation) to the local Grievance Redress Committee (GRC) of the KUKL, who will, based on review of the grievances, address them in consultation with the PID safeguards unit, project director, and affected persons. The local GRC will consist of members of the PID, affected persons, and local area committee, among others determined to provide impartial, balanced views on any issues. The GRC should consist of around five persons. A hearing will be called with the GRC, if necessary, where the affected person can present his or her concern/issues. The process will promote conflict resolution through mediation. The local GRC will meet as necessary when there are grievances to be addressed. The local GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within 15 days. The functions of the local GRC are as follows: (i) to provide support to affected persons on problems arising from environmental or social disruption, asset acquisition (if necessary), and eligibility for entitlements, compensation, and assistance; (ii) to record grievances of affected persons, categorize and prioritize them, and provide solutions within 15 days; and (iii) to report to the aggrieved parties developments regarding their grievances and decisions of the GRC. The PID safeguards officers will be responsible for processing and placing all papers before the GRC, recording decisions, issuing minutes of the meetings, and taking follow-up action to see that formal orders are issued and the decisions carried out.

184. **Fourth level of GRM.** In the event that a grievance is not addressed by the contractor, DSC, branch office, PID, or GRC, the affected person can seek legal redress of the grievance in the appropriate courts, the fourth level of the GRM, which is the formal legal court system. The grievance redress mechanism and procedure is depicted in Figure 2.

Figure 2: Grievance Redress Mechanism (GRM)



DSC= design and supervision consultant, PID=project implementation directorate.

VIII. ENVIRONMENT MANAGEMENT PLAN

185. The basic objectives of the EMP are as follows:

(i) to ensure that all mitigation measures and monitoring requirements will actually be carried out at different stages of project implementation and operation—pre-construction, construction and operation, and maintenance;
(ii) to recommend a plan of action and a means of testing the plan to meet existing and projected environmental problems;
(iii) to establish the roles and responsibilities of all parties involved in the project's environmental management;
(iv) to describe mitigation measures that shall be implemented to avoid or mitigate adverse environmental impacts and maximize the positive ones;
(v) to ensure implementation of recommended actions aimed at environmental management and its enhancement; and
(vi) to ensure that the environment and its surrounding areas are protected and developed to meet the needs of the local people and other stakeholders and safeguard the interests of the common people.

186. A safeguard unit within the PID is already established and headed by a senior environmental engineer with adequate support staff.

A. Mitigation and Monitoring

187. Anticipated environmental impacts and mitigation measures have been dealt with in detail in Section V.

188. A detailed self-explanatory environmental monitoring program is presented in Tables 14-16. The Table lists the environmental impact, its mitigating measures, the parameters to be monitored (including location, measurement, and frequency), and the cost. The program will evaluate the following: (i) the extent and severity of the adverse environmental impacts as compared to what was predicted; (ii) how effective the mitigating measures were, and their compliance with the regulations; and (iii) the overall effectiveness of the EMP during pre-construction and construction.

189. The environmental monitoring of the project includes field supervision and semi-annual reporting of project activities prior to and during construction and operation, in order to ensure that the works are being carried out in accordance with the approved design, and that the environmental mitigation measures are fully implemented in accordance with the EMP. A sample environmental monitoring report is provided in Appendix 11. To help timely identification of the actions for correction, a system of monitoring has been proposed involving (i) front line monitoring and (ii) monitoring by the government line agencies. The following monitoring mechanism has been proposed:

(i) The safeguard unit of the project should report the environmental monitoring results of project implementation to KVWSMB and KUKL through PID.
(ii) The PID safeguard unit is to ensure that (a) all permits and authorizations related to statutory compliance are obtained prior to construction and complied with, including Department of Archaeology, Department of Parks, (b) community consultations are occurring, and (c) any works in heritage sites are carefully implemented to ensure no impacts.
(iii) The construction contractor is responsible for implementing the EMP,
(iv) and is to prepare monthly progress reports to PID and DSC. PID will take immediate corrective actions where necessary.

(v) DSC should prepare a quarterly EMP monitoring report and submit this to KVWSMB and PID/KUKL. PID must take immediate corrective actions where necessary.
(vi) PID will consolidate quarterly reports and submit semi-annual progress reports on EMP implementation to ADB.
(vii) The senior environmental engineer of the safeguards unit should oversee the environmental monitoring activities undertaken by DSC.
(viii) The senior environmental engineer of the safeguard PID unit should routinely be informed on the status of EMP implementation.

B. Environmental Permits

190. The MOE is in charge of environmental control and management for all sector agencies. The MOUD has the overall responsibility for environmental monitoring of all water supply projects.

191. The following are required permits to be obtained by the project prior to construction:

(i) tree cutting clearance from Forest Department;
(ii) ring road construction permit from Roads Department and metropolis/submetropolis permit for inner roads;
(iii) permit from Department of Archaeology, especially in Patan and Darbar Squares.

Table 15: Pre-construction Environmental Monitoring Program

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Environmental permits	Not applicable	DSC	Follow up with relevant authorities on permits including Departments of Archaeology, Roads, Forest, Parks, etc.	Checking of records	Permits issued	As required	PID
Baseline environmental condition – ambient air quality	Project location	DSC	Establish baseline values of (i) respirable particulate matter (RPM) and (ii) suspended particulate matter (SPM)	Air sample collection and analyses by in-house laboratory or accredited third party laboratory	Government of Nepal Ambient Air Quality Standards	Once prior to start of construction	PID
Baseline environmental condition - water quality	Project location	DSC	Establish baseline values of suspended solids (TSS), pH biological oxygen demand (BOD), fecal coliform for surface water; pH, ammonia, arsenic and iron for groundwater	water sample collection and analyses by in-house laboratory or accredited third party laboratory	Government of Nepal Water Quality Standards	Once prior to start of construction for surface water and after drilling is complete for groundwater	PID
Utilities	As per site requirement	DSC	(i) List of affected utilities if any and operators; (ii) bid document to include requirement for a contingency plan for service interruptions	Checking of records	(i) List of affected utilities and operators prepared; (ii) requirement for a contingency plan for service interruptions included in bid documents	Once	PID
Social and cultural Heritage	As per site requirement and Department of Archaeology permission in Patan and Darbar Squares	DSC	Chance finds protocol	Checking of records	Chance finds protocol provided to construction contractors prior to commencement of activities. Permission of Department of	Once	PID

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
					Archaeology prior to construction.		
Construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas	As per site requirement	DSC to determine locations prior to award of construction contracts.	List of selected location for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas	Checking of records	List of selected sites for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas provided to construction contractors prior to commencement of works	Once	PID
Sources of materials	As per site requirement	DSC to prepare list of approved quarry sites and sources of materials	(i) List of approved quarry sites and sources of materials; (ii) bid document to include requirement for verification of suitability of sources and permit for additional quarry sites if necessary.	Checking of records	(i) List of approved quarry sites and sources of materials provided to construction contractors; (ii) bid document to include requirement for verification of suitability of sources and permit for additional quarry sites if necessary.	Once	PID

DSC = design and supervision consultant, PID = project implementation directorate.

Table 16: Construction Environmental Monitoring Program

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Sources of materials	Quarries and sources of materials	Construction contractor	Construction contractor documentation	(i) Checking of records; (ii) visual inspection of sites	(i) Sites are permitted; (ii) report submitted by construction contractor monthly (until such time there is excavation work)	Monthly submission for construction contractor as needed for PID	PID/DSC
Air quality	Construction sites and areas designated for stockpiling of materials	Construction contractor	(i) Location of stockpiles; (ii) complaints from sensitive receptors; (iii) heavy equipment and machinery with air pollution control devices; (iv) ambient air for respirable particulate matter (RPM) and suspended particulate matter (SPM); (v) vehicular emissions such as sulfur dioxide (SO_2), nitrous oxides (NOx), carbon monoxide (CO), and hydrocarbons (HC)	(i) Checking of records; (ii) visual inspection of sites	(i) Stockpiles on designated areas only; (ii) complaints from sensitive receptors satisfactorily addressed; (iii) air pollution control devices working properly; (iv) Government of Nepal Ambient Quality Standards for ambient air quality; (v) Government of Nepal Vehicular Emission Standards for SO_2, NOx, CO and HC.	Monthly for checking records	PID in coordination with Ministry of Environment/DSC
Surface and ground water quality	(i) Construction sites; (ii) areas for stockpiles, storage of fuels and lubricants and waste materials;	Construction contractor	(i) Areas for stockpiles, storage of fuels and lubricants and waste materials; (ii) number of silt traps installed along drainages leading to water bodies; (iii) records of surface and ground water quality inspection; (iv) effectiveness of water management measures;	Visual inspection	(i) Designated areas only; (ii) silt traps installed and functioning; (iii) no noticeable increase in suspended solids and silt from construction activities (iv) Government of Nepal Standards	Monthly	PID in coordination with Ministry of Environment/DSC

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			(v) for inland water: suspended solids, oil and grease, biological oxygen demand (BOD), and coliforms.		for inland waterways		
Noise levels	(i) Construction sites; (ii) areas for stockpiles, storage of fuels and lubricants and waste materials; (iii) work camps	Construction contractor	(i) Complaints from sensitive receptors; (ii) use of silencers in noise-producing equipment and sound barriers; (iii) Equivalent day and night time noise levels	(i) Checking of records; (ii) visual inspection	(i) Complaints from sensitive receptors satisfactorily addressed; (ii) silencers.in noise-producing equipment functioning as design; and (iii) sound barriers installed where necessary	Monthly	PID in coordination with Ministry of Environment/DSC
Existing utilities and infrastructure	Construction sites	Construction contractor	(i) Existing utilities contingency plan	(i) Checking of records; (ii) visual inspection	Implementation according to utilities contingency plan	As needed	PID/DSC
Landscape and aesthetics	(i) Construction sites; (ii) areas for stockpiles, storage of fuels and lubricants and waste materials; (iii) work camps	Construction contractor	(i) Waste management plan; (ii) complaints from sensitive receptors; (iii) PID to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.	(i) Checking of records; (ii) visual inspection	(i)No accumulation of solid wastes on-site; (ii) implementation of Waste Management Plan; (iii) complaints from sensitive receptors satisfactorily addressed.	Monthly	PID/DSC
Accessibility	(i) Construction sites; (ii) traffic haul road	Construction contractor	(i) Traffic Management plan; (ii) complaints from sensitive receptors; (iii) number of signages placed at project location.	Visual inspection	(i) implementation of Traffic management plan, if required; (ii) complaints from sensitive receptors satisfactorily addressed; (iii) signages visible and located in designated areas	Monthly	PID/DSC

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Socioeconomic - income	Construction sites	Construction contractor	(i) Complaints from sensitive receptors; (ii) number of walkways, signages, and metal sheets placed at project location.	Visual inspection	(i) Complaints from sensitive receptors satisfactorily addressed; (ii) walkways, ramps, and metal sheets provided (iii) signages visible and located in designated areas	Quarterly	PID/DSC
Socioeconomic - employment	Construction sites	Construction contractor	(i) Employment records; (ii) records of sources of materials	Checking of records	High number of employees from local area workforce	Quarterly	PID/DSC
Occupational health and safety	Construction sites	Construction contractor	(i) Site-specific Occupational Health and safety (OHS) Plan; (ii) Equipped first-aid stations; (iii) Number of accidents; (iv) Supplies of potable drinking water; (v) Clean eating areas where workers are not exposed to hazardous or noxious substances; (vii) record of OHS orientation trainings (vii) personal protective equipment; (viii) percentage of moving equipment outfitted with audible back-up alarms; (ix) sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal.	(i) Checking of records; (ii) visual inspection	(i) Implementation of OHS plan; (ii) number of work-related accidents; (iii) Percentage usage of personal protective equipment; (iv) number of first-aid stations, frequency of potable water delivery, provision of clean eating area, and number of sign boards are according to approved plan; (v) Percentage of moving equipment outfitted with audible back-up alarms	Quarterly	PID/DSC

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Community health and safety	Construction sites	Construction contractor	(i) Traffic management plan; (ii) complaints from sensitive receptors (iii) barriers around trenches and tubell drilling sites (iv) signage (v) KUKL hotline posted at site	Visual inspection	(i) Implementation of traffic management plan; (ii) complaints from sensitive receptors satisfactorily addressed	Quarterly	PID/DSC
Work camps	Work camps	Construction contractor	(i) Complaints from sensitive receptors; (ii) water and sanitation facilities for employees; and (iii) PID report in writing that the camp has been vacated and restored to pre-project conditions	Visual inspection	(i) Designated areas only; (ii) complaints from sensitive receptors satisfactorily addressed	Quarterly	PID/DSC
Chance finds	Construction sites	Construction contractor	Records of chance finds	Checking of records	Implementation of chance finds Protocol	As needed	PID/DSC

192. Table 17 defines the roles of different organisations and groups in environmental monitoring.

Table 17: Institutional Responsibilities in Environmental Monitoring

SN	Organization	Roles and Responsibilities		
		Pre-construction phase	Construction phase	Operation phase
1	Ministry of Urban Development (MOUD)	Review and endorse IEE report, review design and tender documents in order to examine whether or not mitigation prescriptions are included, and instruct KUKL.	Review EMP reports (i) to ensure EMP implementation (ii) effectiveness of the implementation measures (iii) compliance, and (iv) monitoring of construction twice a year.	Continue to monitor environmental performance of facilities as per government rules.
2	Kathmandu Valley Water Supply Management Board (KVWSMB)/ Kathmandu Upatyaka Khanepani Limited (KUKL) and Projection Implementation Directorate (PID)	Ensure all land owners compensated and land is ready for construction. Review final project design and tender documents, instruct IEE implementation at the construction stages. Ensure all permits and authorizations are obtained.	Conduct frontline monitoring on (i) mitigation implementation; (ii) effectiveness; (iii) enhancement programs; (iv) appoint monitoring team; (v) ensure public participation; (vi) resettlement plan implementation; (vii) environmental compliance; and (viii) prepare quality monitoring report to submit to MOUD/MOE. Address grievances. Submit semi-annual monitoring reports to ADB.	Ensure smooth operation of water supply systems. Conduct effluent discharge monitoring on receiving surface water bodies within the Valley.
3	Design and supervision consultant (DSC)	Incorporate all provisions of EMP in the final design, incorporate all mitigation measures in the tender documents, assist in site inspection during land intake, and Baseline monitoring of air and water quality, noise level and vibrations and overall environmental status of the project area.	(i) Hold community awareness prior to construction approval of construction works; (ii) monitor the contractor's performance on EMP implementation/mitigation effectiveness/impact monitoring and labor employment as per regulations; (iii) instruct contractor for corrective actions; (iv) impose fine/or null payment in case of non-compliance; and (v) prepare quarterly monitoring report to ID and participate in inspection. Periodic monitoring of air quality, water quality and noise and vibration levels at the project area, monitoring of impacts on physical, biological and socioeconomic components of the environment in the project area, conducting trainings and community awareness and periodic meetings with stakeholders, and submit quarterly progress reports, including monitoring results and mitigation activities. Address grievances.	Not Applicable
4	Construction contractor	Prepare environmental implementation plan for contracts, select temporary land use sites, and assist the	Hold community awareness prior to construction. Address grievances. Get permission to start work from DSC,	Not Applicable

SN	Organization	Roles and Responsibilities		
		Pre-construction phase	Construction phase	Operation phase
		supervising engineer in joint site inspection of KVWSMB/KUKL for approval.	ensure that all prescriptions of EMP are included in the work activities, ensure employment opportunities for the locals and maintain records of employment, and submit to the supervising engineer, carry out corrective measures as recommended by DSC, participate in monitoring and inspection, prepare an operational manual to submit to DSC, provide training to the monitoring personnel, and submit monthly reports on EMP compliance to DSC.	

ADB = Asian Development Bank, EMP = Environmental Management Plan, IEE = Initial Environmental Examination, MOE = Ministry of Environment, MOHP = Ministry of Health and Population.

193. **Implementation arrangements.** The Ministry of Urban Development (MOUD) will be the executing agency responsible for overall strategic planning, guidance, and management of the project, and for ensuring compliance with loan covenants. As part of institutional reforms under the ongoing loans, three organizations were created: (i) Kathmandu Valley Water Supply Management Board (KVWSMB), the asset owner; (ii) Kathmandu Upatyaka Khanepani Limited (KUKL), the asset operator and service provider; and (iii) the Water Supply Tariff Fixation Commission (WSTFC), the regulator. KVWSMB will continue to discharge its responsibilities as asset owner of water supply and wastewater systems, and monitor performance of KUKL as provided in the lease and license agreement between KVWSMB and KUKL. KUKL will be the implementing agency and the existing project implementation directorate (PID) in KUKL will be responsible for (i) project planning, implementation, monitoring, and supervision; (ii) reporting to KUKL board of directors, MOUD, and ADB; and (iii) coordinating all activities in the project. The experience of PID and KUKL in implementing subproject 2 of Melamchi Water Supply Project will be useful in taking advance action..

194. For safeguards, the PID has already established a safeguards unit staffed with an environmental specialist. The implementation arrangements are illustrated in Appendix 9.

195. **Consulting services.** These services will be required for supporting the MOUD and KUKL in project management, engineering design, construction supervision, safeguards implementation and monitoring, procurement of goods and services, institutional development, capacity building, community awareness and participation, and other functions. The PID, KUKL will recruit two consulting firms, a design, supervision and management consultant (DSC) and a community awareness and participation firm. The DSC will have an environmental and social specialist to facilitate implementation and supervision of works.

196. **Reporting requirements.** Contractors are to submit monthly EMP implementation status reports to DSC. DSC will submit quarterly monitoring reports to PID, and PID will submit semi-annual monitoring reports to ADB. A sample monitoring report is provided in Appendix 11. If any unanticipated environmental and social risks and impacts arise during construction, implementation, or operation of the project that were not considered in the IEE, the EMP, and the resettlement plan, the government is to (i) promptly inform ADB of the occurrence of such risks or impacts, with detailed description of the event and proposed corrective action plan; (ii) report any actual or potential breach of compliance with the measures and requirements set forth in the EMP and the RP promptly after becoming aware of the breach; and (iii) ensure that no proceeds of the loan are used to finance any activity

included in the list of prohibited investment activities provided in Appendix 5 of the SPS (2009).

197. The reporting system should be based on site supervision to see whether mitigation measures are carried out according to the monitoring plan. The construction contractor should develop an environmental implementation plan based on the EMP. The environmental implementation plan should be approved by PID/KUKL and DSC. DSC is responsible for checking the monthly progress reports submitted by the contractor, and for field verifying whether or not the contractor has complied with the approved conditions as stated in the EMP.

198. DSC should then prepare a quarterly environmental monitoring report based on the monthly report submitted by the contractor, and submit this to PID/KUKL for review. The report should also include cases of compliance and non-compliance and the corresponding further mitigation measures to be adopted to correct such non-compliance. The report should also include the outcome of the monitoring, important issues identified, and the measures to be undertaken to ameliorate them.

199. **Cost estimates.** As part of good engineering practices in the project, there have been several measures undertaken, such as erosion prevention, rehabilitation of borrow areas, safety, signage, provision of temporary drains, and others, the costs of which will be included in the design costs of the project. The IEE costs include monitoring costs during construction and capacity building costs for environmental management. Costs of all mitigation measures during the construction phase will be included in the tender and contract documents and will be borne by the contractors. PID, using government counterpart funds, will bear any resettlement-related costs. A domestic community awareness and participation consultant firm will be hired to facilitate community awareness and participation programs on an intermittent bas, and a budget will be included for these relevant costs.

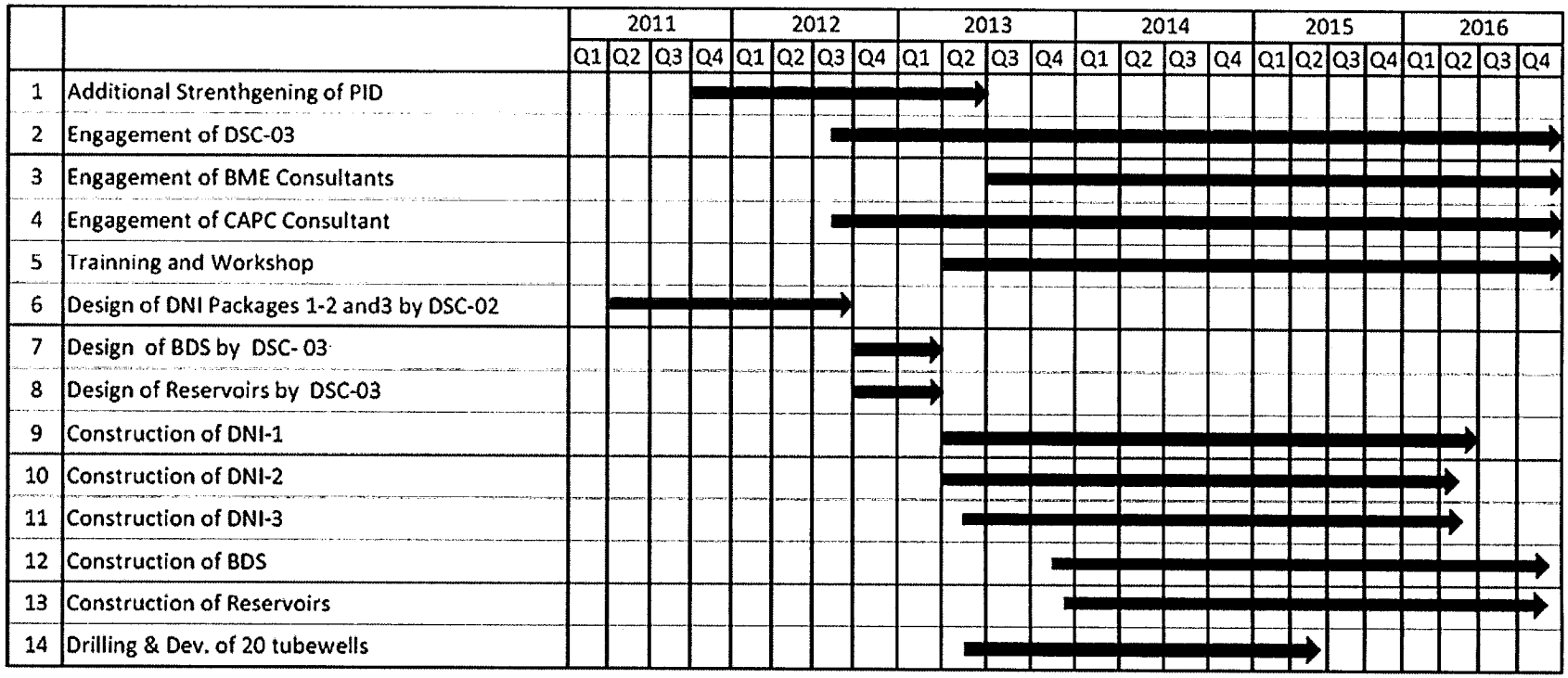
200. All costs related to cutting and replanting of trees shall be borne by the project itself through the PID. It is mandatory to plant 25 saplings for every tree cut, and to maintain them for 5 years. The project will follow the existing track during the laying of the pipeline so as to avoid the cutting of trees. The cost of maintaining a tree for 5 years has been estimated at $600. It is not expected that trees will be cut; however, for budget purposes, a total amount of $180,000 has been earmarked, in the event that 300 trees would require cutting. The tree-cutting budget is part of the government counterpart funds under the project budget. The government will make available or authorize MOUD and KUKL to make available necessary financial and human resources to fully implement the EMP.

201. **Implementation schedule**. The EMP implementation schedule is given in Figure 3 for a period of 5 years. Most of the activities have been scheduled on a continuous basis. Detailed design of DNI packages began in Q2 2011, and in Q4 2012 for BDS and reservoirs; and construction is scheduled to commence in Q2 2013, to be completed before the end of 2016. The IEE/EMP will be updated based on detailed design, and submitted to ADB for review and approval prior to award of contracts. Drilling and development of 20 tubewells is scheduled to commence in Q2 2013, to be completed in Q2 2015.

202. Before construction, PID will develop detailed responsibilities and requirements for contractors, and will provide detailed cost estimates of mitigation measures and environmental monitoring in the construction contracts. PID will also detail the responsibilities of their environmental management offices and prepare their work schedules.

203. Before operation, PID will develop detailed work plans for environmental management and monitoring during operation, based on the EMP. These work plans will be submitted to the concerned persons to help them supervise implementation.

Figure 3: EMP Implementation Schedule



DSC = Design Supervision and Management Consultants, PID = Project Implementation Directorate

IX. CONCLUSIONS AND RECOMMENDATIONS

204. Overall the environmental impacts of the project will be positive. Some negative impacts are anticipated during construction, but in specific areas and for short duration (dust, noise, traffic problems, access to buildings). It is expected that the adverse environmental impacts of the planned water supply project for the Kathmandu Valley will in general not be significant, and can be easily and reasonably mitigated and prevented through mitigation measures and regular monitoring during design, construction, and operation, as outlined in the EMP.

205. The project will contribute significantly to the improvement of the health and quality of life of the people due to the water supply improvements.

206. The project is unlikely to cause significant adverse impacts. The potential adverse impacts associated with design, construction, and operation can be mitigated to standard levels without difficulty through proper engineering design and the incorporation or application of recommended mitigation measures and procedures.

207. Based on the findings of the IEE, the classification of the project as category "B" is confirmed, and no further special study or detailed EIA needs to be undertaken to comply with ADB SPS (2009).

APPENDIX 1: RAPID ENVIRONMENTAL ASSESSMENT (REA) CHECKLIST

WATER SUPPLY SCREENING QUESTIONS A. PROJECT SITING	Yes	No	REMARKS
IS THE PROJECT AREA...			
▪ Densely populated?	√	☐	In many areas of the Kathmandu Valley, the average urban density exceeds 40,000-45,000 persons per km^2, and at the core of Kathmandu the density exceeds 80,000 per km^2. Although Kathmandu Valley only covers 0.43% of the total area of Nepal, it has about 7% of the total population.
▪ Heavy with development activities?	☐	√	Mostly in established residential areas
▪ Adjacent to or within any environmentally sensitive areas?			
• Cultural heritage site	☐	√	The Kathmandu Valley has a number of historic cities. Cultural sites (temples) may be located adjacent to the roadway where work will take place.
• Protected area	☐	√	There are no environmentally sensitive areas within the project area. The project will occur primarily within the Kathmandu Valley urban boundaries.
• Wetland	☐	√	
• Mangrove	☐	√	
• Estuarine	☐	√	
• Buffer zone of protected area	☐		
• Special area for protecting biodiversity	☐	√	
• Bay	☐	√	
B. POTENTIAL ENVIRONMENTAL IMPACTS Will the project cause...			
▪ pollution of raw water supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion runoff?	☐	√	The intakes are located in isolated intact watersheds. Additional water treatment is included under the ongoing ADB Melamchi Project (Loan 1820). The distributed water is to comply with the National Drinking Water Quality Standards as per the approved EMP for the project.

▪ impairment of historical/cultural monuments/areas, and loss/damage to these sites?	√	☐	The project will ensure the following: (i) consultations with any government agency or NGOs (including UNESCO) with responsibility (and jurisdiction) over cultural/archaeological sites; (ii) permissions received from the same; (iii) construction guidelines in EMP; and (iv) chance finds requirements. Potential adverse impacts during construction will be addressed through EMPs. All mitigation requirements will be included in the contract documents. Any regulations during construction will be included and monitored through the EMP.
▪ hazard of land subsidence caused by excessive ground water pumping?	☐	√	To avoid ground subsidence and over-exploitation, KVWSMB is undertaking a Groundwater Management and Regulation Policy Preparation Study (ADB SDP Loan 2059) that will establish processes to regulate and control or prohibit the extraction and use of groundwater within the Kathmandu Valley. The ADB Melamchi Project (Loan 1820) will replace / install flow and water depth instrumentation on all ground water tube wells for extraction monitoring.
▪ social conflicts arising from displacement of communities ?	☐	√	No displacements required. Land for service reservoirs was previously acquired under the ongoing ADB Melamchi Project (Loan 1820) and monitored through implementation of approved resettlement plan. Temporary impacts to businesses may occur during construction and are to be addressed through specific measures, including compensation, in the EMP. Any involuntary resettlement impacts identified will be addressed through the resettlement planning process.
▪ conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?	☐	√	Conflicts in abstraction are addressed through the ongoing ADB Melamchi Project (Loan 1820) Resettlement Plan. The approved resettlement plan provides allowances for water mill and irrigation users affected by the project, as well as the social uplift program (SUP) targeted at affected communities. The ongoing project is closely monitored by ADB, and any conflicts are managed through corrective actions in coordination with the government.
▪ unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents)?	☐	√	Addressed through the ongoing ADB Melamchi Project (Loan 1820). Any distributed water will comply with the National Drinking Water Quality Standards as per the approved EMP for the project.
▪ delivery of unsafe water to distribution system?	☐	√	Water will be treated under the ongoing ADB Melamchi Project (Loan 1820) which will construct WTPs and water quality improvement work, including supply and replacement of laboratory equipment.
▪ inadequate protection of intake works or wells, leading to pollution of water supply?	☐	√	The ongoing Melamchi Project (Loan 1820) includes fencing and other protection work for water intakes to prevent pollution of water supply.

▪ over-pumping of ground water, leading to salinization and ground subsidence?	☐	√	Salinization due to salt bearing strata is not a problem in the Kathmandu Valley. To avoid ground subsidence and over-exploitation, KVWSMB is undertaking a Groundwater Management and Regulation Policy Preparation Study (ADB SDP Loan 2059) that will establish processes to regulate and control or prohibit the extraction and use of groundwater within the Kathmandu Valley. The ADB Melamchi Project (Loan 1820) will replace/install flow and water depth instrumentation on all ground water tube-wells for extraction monitoring.
▪ excessive algal growth in storage reservoir?	☐	√	Storage reservoirs are only for treated water. The water is chlorinated and the reservoirs covered to prevent algal growth
▪ increase in production of sewage beyond capabilities of community facilities?	√	☐	The follow-on ADB project will improve the existing collection and treatment systems by rehabilitating existing treatment plants and expanding the sewerage network, as well as providing a septage treatment facility. All wastewater must meet government standards for treatment.
▪ inadequate disposal of sludge from water treatment plants?	☐	√	Disposal of sludge to be done at designated sites as per the approved EMP of the ongoing ADB Melamchi Project (Loan 1820).
▪ inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities?	☐	√	Noise impacts to be monitored as per the approved EMP of ongoing ADB Melamchi Project (Loan 1820).
▪ impairments associated with transmission lines and access roads?	√	☐	Good construction practices will mitigate transmission line impairments and will be specified in the EMP. A section-wise approach will also limit impairments to traffic and businesses during construction.
▪ health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals?	☐	√	Handling of hazardous materials associated with treatment facilities addressed in the approved EMP of ongoing ADB Melamchi Project (Loan 1820)
▪ health and safety hazards to workers from the management of chlorine used for disinfection and other contaminants?	☐		
▪ dislocation or involuntary resettlement of people?	☐	√	No involuntary resettlement impacts envisioned. Lands for service reservoirs were previously acquired under the ongoing ADB Melamchi Project (Loan 1820) and monitored through implementation of the approved resettlement plan. Temporary impacts to businesses may occur during construction, and are to be addressed through specific measures, including compensation, in the EMP. Any involuntary resettlement impacts identified will be addressed through the resettlement planning process.
▪ social conflicts between construction workers from other areas and community workers?	☐	√	The contractor will be encouraged to hire local workers from the local labor force.
▪ noise and dust from construction activities?	√	☐	Good construction practices will mitigate noise and dust ,and will be specified in the EMP.
▪ increased road traffic due to interference of construction activities?	√	☐	Traffic management plan will form part of the EMP.
▪ continuing soil erosion/silt runoff from construction operations?	√	☐	Good construction practices will mitigate soil erosion and silt runoff and will be specified in the EMP.

▪ delivery of unsafe water due to poor O&M treatment processes (especially mud accumulations in filters) and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in distribution systems?	☐	√	Any distributed water must comply with the National Drinking Water Quality Standards and must be addressed in the approved EMP of the ongoing ADB Melamchi Project (Loan 1820).
▪ delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?	☐	√	
▪ accidental leakage of chlorine gas?	☐	√	The ongoing MWSP Subproject 1 design includes provision of gas detectors, alarms, automatic water sprinklers, PPE, showers for staff, and training in case of accidental leakage of chlorine gas. Under MWSP Subproject 2 Calcium hypochlorite (Bleaching powder) is used for disinfection of water.
▪ excessive abstraction of water affecting downstream water users?	☐	√	Conflicts in abstraction addressed through the ongoing ADB Melamchi Project (Loan 1820) resettlement plan.
▪ competing uses of water?	☐	√	Addressed in ongoing Loan 1820. The approved resettlement plan for Loan 1820 provides allowances for water mills and irrigation users affected by the project, as well as the social uplift program (SUP) targeted at affected communities. The ongoing project is closely monitored by ADB and any conflicts are managed through corrective actions in discussion with the government.
▪ increased sewage flow due to increased water supply?	√	☐	The follow-on ADB wastewater project will improve the existing wastewater collection and treatment systems to meet increased sewage flows by rehabilitating existing treatment plants and expanding the sewerage network, as well as providing septage treatment facility. All wastewater effluents must meet government treatment standards. Sludge disposal will be addressed in EMP.
▪ increased volume of sullage (wastewater from cooking and washing) and sludge from wastewater treatment plant?	√	☐	

▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?	√	☐	The enhanced water supply system would make Kathmandu a more desirable place to live. Investments in rural water supply and small towns would be required by the government to mitigate this risk.
▪ social conflicts if workers from other regions or countries are hired?	√	☐	Local people will be hired to the extent possible under the project.
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel, and other chemicals during operation and construction?	☐		No hazardous materials will be transported or stored during construction period.
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation, and decommissioning?	√	☐	Community health and safety measures are included in the EMP.

Climate Change and Disaster Risk Questions The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.	Yes	No	Remarks
• Is the project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami, or volcanic eruptions and climate changes (see Appendix I)?	√	☐	Earthquakes and landslides are identified as the two prominent potential natural disasters in the Kathmandu Valley. The valley is located in a seismic zone.
▪ Could changes in temperature, precipitation, or extreme events patterns over the project lifespan affect technical or financial sustainability (e.g., changes in rainfall patterns disrupt reliability of water supply; sea level rise creates salinity intrusion into proposed water supply source)?	√	☐	Water supplies originate from glaciers, which, if reduced in size due to climate change, may put pressure on the water system.
▪ Are there any demographic or socio-economic aspects of the project area that are already vulnerable (e.g.,high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?	√	☐	Kathmandu has a high population of poor people. The project will provide universal water connections to poor and non-poor households.
▪ Could the project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., by using water from a vulnerable source that is relied upon by many user groups, or encouraging settlement in earthquake zones)?	☐	√	The water source is secured and available for the Kathmandu Valley population.

RAPID ENVIRONMENTAL ASSESSMENT (REA) CHECKLIST

WATER SUPPLY: Drilling, development and operation of tubewells

Instructions:

(i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Environment and Safeguards Division (RSES) for endorsement by the Director, RSES and for approval by the Chief Compliance Officer.

(ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.

(iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title: Loan 2776-NEP(SF): Kathmandu Valley Water Supply Improvement

Sector Division: SAUW

Screening Questions	Yes	No	Remarks
A. PROJECT SITING IS THE PROJECT AREA			
▪ DENSELY POPULATED?		x	Scattered population at the location of the tubewells
▪ HEAVY WITH DEVELOPMENT ACTIVITIES?		x	None
▪ ADJACENT TO OR WITHIN ANY ENVIRONMENTALLY SENSITIVE AREAS?			
• CULTURAL HERITAGE SITE		x	No cultural heritage sites are adjacent to or within the subproject sites.
• PROTECTED AREA		x	There are no environmentally sensitive areas within the project area except for the Balaju Treatment plant located at the Shivapuri National Park but will not be affected as groundwater from the Mahadev Khola tubewells will be injected to the already existing trunk main that feeds the existing Balaju Treatment Plant.
• WETLAND		x	
• MANGROVE		x	
• ESTUARINE		x	
• BUFFER ZONE OF PROTECTED AREA		x	
• SPECIAL AREA FOR PROTECTING BIODIVERSITY		x	
• BAY		x	
B. POTENTIAL ENVIRONMENTAL IMPACTS Will the Project cause...			
▪ pollution of raw water supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion runoff?		x	The tubewells will be located in isolated areas (not densely populated). The raw ground water will be treated at the respective treatment plants to comply with the National Drinking Water Quality Standards.
▪ impairment of historical/cultural monuments/areas and loss/damage to these sites?		x	Not expected

Screening Questions	Yes	No	Remarks
▪ hazard of land subsidence caused by excessive ground water pumping?		x	To avoid ground subsidence and over exploitation, pump tests will be carried out and the results will control the abstraction rate. To avoid ground subsidence and over-exploitation, KVWSMB is undertaking a Groundwater Management and Regulation Policy Preparation Study (ADB SDP Loan 2059) that will establish processes to regulate and control or prohibit the extraction and use of groundwater within the Kathmandu Valley.
▪ social conflicts arising from displacement of communities ?		x	No displacements required..
▪ conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?		x	None
▪ unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents)?		x	The raw water quality will be treated to meet the National Drinking Water Quality Standards. Only disinfection will be required before distribution
▪ delivery of unsafe water to distribution system?		x	Water will be disinfected to meet the National Drinking Water Quality Standards. The subproject will also improve the existing distribution capacity.
▪ inadequate protection of intake works or wells, leading to pollution of water supply?		x	The subproject includes fencing and other protection works of water intakes to prevent pollution of water supply, and will be accessible only to authorized persons.
▪ over pumping of ground water, leading to salinization and ground subsidence?		x	Salinization due to salt bearing strata is not a problem in Kathmandu Valley. To avoid ground subsidence and over-exploitation, KVWSMB is undertaking a Groundwater Management and Regulation Policy Preparation Study (ADB SDP Loan 2059) that will establish processes to regulate and control or prohibit the extraction and use of groundwater within the Kathmandu Valley. The subproject will install flow & water depth instrumentation on the ground water tube wells for extraction monitoring. Pump tests will be carried out and the results will control the abstraction rate.
▪ excessive algal growth in storage reservoir?		x	Storage reservoirs are only for treated water. The raw water will be treated and chlorinated and stored in existing covered reservoirs to prevent algal growth

Screening Questions	Yes	No	Remarks
▪ increase in production of sewage beyond capabilities of community facilities?	x		The follow-on ADB project will improve the existing collection and treatment systems by rehabilitating existing treatment plants and expanding the sewerage network, as well as providing a septage treatment facility. All wastewater must meet government standards for treatment.
▪ inadequate disposal of sludge from water treatment plants?		x	Disposal of sludge to be done at designated sites by the existing water treatment plants.
▪ inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities?		x	Noise impacts to be monitored. Furthermore, the tubewells will be located in isolated areas away from the residential areas with boundary walls.
▪ impairments associated with transmission lines and access roads?	x		Expected during pipe-relaying but impacts will be temporary and short in duration. Good construction practices to mitigate transmission line impairments and to be specified in the EMP. A section-wise approach will also limit impairments to traffic and businesses during construction and laying of pipes.
▪ **health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals.**		x	The existing treatment plants where the groundwater will be pumped to have set up precautions in the handling of hazardous materials associated with treatment facilities.
▪ health and safety hazards to workers from handling and management of chlorine used for disinfection, other contaminants, and biological and physical hazards during project construction and operation?		x	Personal protective equipment will be provided to workers. Regular training will also be conducted to ensure that workers are aware of the health hazards of chemicals. O&M manual will be developed which will specifically deal with the handling and storage of chlorine and emergency response.
▪ dislocation or involuntary resettlement of people?		x	No IR impacts envisioned. Land for the tubewell complexes are government land.
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		x	The subproject will not affect indigenous peoples or other vulnerable groups. The contractor will be encouraged to hire local workers from the local labor force.
▪ noise and dust from construction activities?	x		Expected but impacts will be temporary and short in duration. Good construction practices to mitigate noise and dust and to be specified in the EMP.
▪ increased road traffic due to interference of construction activities?	x		Expected but impacts will be temporary and short in duration. Traffic management plan to form part of the EMP.
▪ continuing soil erosion/silt runoff from construction operations?		x	Good construction practices to mitigate soil erosion and silt runoff and to be specified in the EMP.
▪ delivery of unsafe water due to poor O&M treatment processes (especially mud accumulations in filters) and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in distribution systems?		x	Any distributed water to comply with the National Drinking Water Quality Standards and addressed in the EMP.

Screening Questions	Yes	No	Remarks
▪ delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?		x	The O&M manuals will include maintenance schedules and monitoring program.
▪ accidental leakage of chlorine gas?		x	Not applicable as calcium hypochlorite will be used in the chlorination process and chlorine gas will not be used.
▪ excessive abstraction of water affecting downstream water users?		x	Not applicable as groundwater will be abstracted and not surface water.
▪ competing uses of water?		x	Not applicable as groundwater will be abstracted and not surface water.
▪ increased sewage flow due to increased water supply		x	The groundwater is to augment the existing shortage of water supply.
▪ **increased volume of sullage (wastewater from cooking and washing) and sludge from wastewater treatment plant**		x	Not applicable
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		x	Priority in employment will be given to local residents. Construction contractors will be required to provide a worker's camp, if required, with basic facilities.
▪ social conflicts if workers from other regions or countries are hired?		x	The contractor will be encouraged to give priority in employment to local residents.
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during operation and construction?		x	Construction will not involve use of explosives and chemicals. Trenching will be done manually.
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		x	Construction areas will be clearly demarcated and access controlled. Only workers and project staff will be allowed to visit operational sites.

Climate Change and Disaster Risk Questions The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.	Yes	No	Remarks
• Is the Project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and climate changes (see Appendix I)?		x	Not applicable
▪ Could changes in temperature, precipitation, or extreme events patterns over the Project lifespan affect technical or financial sustainability (e.g., changes in rainfall patterns disrupt reliability of water supply; sea level rise creates salinity intrusion into proposed water supply source)?		x	Not applicable
▪ Are there any demographic or socio-economic aspects of the Project area that are already vulnerable (e.g.,high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?		x	Not applicable

▪ Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., by using water from a vulnerable source that is relied upon by many user groups, or encouraging settlement in earthquake zones)?		x	Not applicable

* Hazards are potentially damaging physical events

APPENDIX 2: NATIONAL DRINKING WATER QUALITY STANDARDS (2062 B.S.)

Type	Parameter	Unit	Maximum Concentration Limits	Remarks
Physical	Turbidity	NTU	5 (10)	
	pH	-	6.5-8.5*	
	Colour	TCU	5 (15)	
	Taste and odor	-	Should not be objectionable	
	Total dissolved solids	mg/l	1,000	
	Electrical conductivity	µs/cm	1,500	
Chemical	Iron	mg/l	0.3 (3)	
	Manganese	mg/l	0.2	
	Arsenic	mg/l	0.05	
	Cadmium	mg/l	0.003	
	Chromium	mg/l	0.05	
	Cyanide	mg/l	0.07	
	Fluoride	mg/l	0.5 - 1.5 *	
	Lead	mg/l	0.01	
	Ammonia	mg/l	1.5	
	Chloride	mg/l	250	
	Sulphate	mg/l	250	
	Nitrate	mg/l	50	
	Copper	mg/l	1	
	Calcium	mg/l	200	
	Zinc		3	
	Mercury		0.001	
	Aluminium		0.2	
	Residual chlorine	mg/l	0.1 - 0.2[a]	Only for system using chlorine
Microbiological	*E. coli*	MPN/100 ml	0	
	Total coliform	MPN/100 ml	0 (95 % in Sample)	

mg/l = milligrams per litre, ml = millilitre, pH = negative decimal logarithm of the hydrogen ion activity in a solution
[a] These values suggest minimum and maximum limit.
Note: The value inside bracket ( ) is valid if there is no alternative.

APPENDIX 3: ENVIRONMENT RELATED ACTS AND REGULATIONS IN NEPAL

Acts

1) Ancient Monuments Protection Act, 1956
2) Civil Aviation Act, 1958
3) Aquatic Animals Protection Act, 1960
4) Plant Protection Act, 1964
5) National Parks and Wild Life Conservation Act, 1987
6) Public Road Act, 1974
7) Trust Corporation Act, 1976
8) Tourism Act, 1978
9) King Mahendra Nature Conservation Trust Act, 1982
10) Soil and Watershed Conservation Act, 1982
11) Nepal Petroleum Act, 1983
12) Nepal Electricity Authority Act, 1984
13) Mines and Mineral Act, 1985
14) Pashupati Area Development Trust Act, 1987
15) Solid Waste (Management and Resource Mobilization) Act, 1987
16) Town Development Act, 1988
17) Kathmandu Valley Development Authority Act, 1988
18) Nepal Water Supply Corporation Act, 1989
19) The Constitution of the Kingdom of Nepal, 1990
20) Pesticides Act, 1991
21) Village Development Committee Act, 1991
22) District Development Committee Act, 1991
23) Municipality Act, 1991
24) Water Resources Act, 1992
25) Forest Act, 1992
26) Electricity Act, 1992
27) Motor Vehicle and Transportation Management Act, 1992
28) Labour Act, 1992
29) Industrial Enterprises Act, 1992
30) Nepal Tourism Board Act, 1996
31) Environment Protection Act, 1996

Rules

1) National Parks and Wild Life Conservation Rules, 1973
2) Plant Protection Rules, 1974
3) Wild Life Reserve Rules, 1977
4) Himalayan National Park Rules, 1979
5) Mountaineering Rules, 1979
6) King Mahendra Nature Conservation Trust Rules, 1984
7) Petroleum Rules, 1984
8) Khaptad National Park Rules, 1987
9) Ancient Monuments Protection Rules, 1989
10) Solid Waste (Management and Resource Mobilization) Rules, 1989
11) Water Resources Rules, 1993
12) Pesticides Rules, 1993
13) Labour Rules, 1993
14) Electricity Rules, 1993
15) Forest Rules, 1994
16) Buffer Zone Management Rules, 1995
17) Royal Bardiya National Park Rules, 1996
18) Conservation Area Management Rules, 1996
19) Vehicle and Transportation Management Rules, 1997
20) Environment Protection Rules, 1997

APPENDIX 4: NATIONAL AMBIENT AIR QUALITY STANDARDS FOR NEPAL

Parameters	Units	Averaging Time	Concentration in Ambient Air, maximum	Test Methods
TSP (Total suspended particulates)	$\mu g/m^3$	Annual	-	
		24 hours[a]	230	High volume sampling
PM_{10}	$\mu g/m^3$	Annual	-	
		24 hours[a]	120	Low volume sampling
Sulfur dioxide	$\mu g/m^3$	Annual	50	Diffusive sampling based on weekly averages
		24 hours[b]	70	
Nitrogen dioxide	$\mu g/m^3$	Annual	40	
		24 hours[b]	80	
Carbon monoxide	$\mu g/m^3$	8 hours[b]	10,000	
		15 minute	100,000	Indicative samples[c]
Lead	$\mu g/m^3$	Annual	0.5	Atomic Absorption Spectrometry, analysis of PM_{10} samples[d]
		24-hours	-	
Benzene	$\mu g/m^3$	Annual	20	Diffusive sampling based on weekly averages
		24-hours	-	

$\mu g/m^3$ = micrograms per cubic meter

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

[b] 24 hourly standards for NO_2 and SO_2 and 8-hour standard for CO are not to be controlled before MOSTE has recommended appropriate test methodologies. This will be done before 2005.

[c] Control by spot sampling at roadside locations: Minimum one sample per week taken over 15 minutes during peak traffic hours, i.e. in the period 8 a.m.-10 a.m. or 3 p.m.-6 p.m. on a workday. This test method will be re-evaluated by 2005.

[d] If representativeness can be proven, yearly averages can be calculated from PM10 samples from selected weekdays from each month of the year.

APPENDIX 5: RECOMMENDED NOISE EXPOSURE LIMITS FOR THE WORK ENVIRONMENT - ADOPTED FROM OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)

S.No.	Noise Exposure (dB)	Permissible Exposure (Hours and Minutes)
1	85	16 hrs.
2	87	12 hrs. –18 min.
3	90	8 hrs.
4	93	5 hrs – 18 min.
5	96	3 hrs.– 30 min.
6	99	2 hrs. – 18 min.
7	102	1 hr. – 30 min.
8	105	1 hr.
9	108	40 min.
10	111	26 min.
11	114	17 min.
12	115	15 min.
13	118	10 min.
14	121	6.6 min.
15	124	4 min.
16	127	3 min.
17	130	1 min.

hr. = hour, min. = minutes, dB = decibel.
Source: Marsh, 1991.

RECOMMENDED AVERAGE EQUIVALENT SOUND LEVELS FOR PROTECTING THE PUBLIC HEALTH AND WELFARE

S.No.	Land Use	Measure	To Protect Against Activity Interference and Hearing Loss Effects (dB)
1	Residential including farm residences	Leq (24)	55
2	Commercial	Leq (24)	70
3	Hospitals	Leq (24)	55
4	Industrial	Leq (24)	70
5	Educational	Leq (24)	55
6	Recreational areas	Leq (24)	70
7	Farmland and general unpopulated land	Leq (24)	70

Source: U.S Environmental Protection Agency, 1974.
Note: Leq (24) = Equivalent sound level in decibels for 24 hours

APPENDIX 6: RECOMMENDED STANDARDS FOR VIBRATION FROM CONSTRUCTION SITES

Type of Restriction	Area Classified	
Standard value	I and II	85 dB
Work prohibited time	I	7 p.m.. – 7 a.m.
	II	10 p.m. – 6 a.m.
Maximum working duration	I	10 hrs. per day
	II	14 hrs. per day
Maximum consecutive working days	I and II	6 days
Working Prohibited Days	I and II	Saturdays and holidays

dB = decibel, hrs. = hours

Source: Vibration Regulation Law 64 of 1976, Japan.

Notes:

1. Area I, stands for areas to which one of the following descriptions applies:

(i) areas where maintenance of quiet is particularly needed to preserve the residential environment;

(ii) areas which require maintenance of quiet for residential purposes;

(iii) areas which must maintain quiet for commercial and industrial as well as residential purposes, and where there is a need to prevent vibration because a considerable number of houses are located therein; and

(iv) the neighborhoods of schools, hospitals, and the like.

Area II stands for areas where there is a need to preserve the living environment of inhabitants, other than of those in Area I.

2. Vibration level shall be measured at the boundary line of the specified construction work site.

RECOMMENDED LIMITS FOR ROAD TRAFFIC VIBRATION

Area	Day time	Night time	Applicable areas
I	65 dB	60 dB	Areas where maintenance of quiet is particularly needed to preserve a good living environment, and where quiet is called for us as the place is used for residential purposes.
II	70 dB	65 dB	Areas that need quiet for commercial and industrial as well as residential purposes, where there is a need to preserve the living environment of local inhabitants, and areas mainly serving industrial proposes where measures are needed to prevent the living environment of local residents from deteriorating.

dB = decibel

Source: Vibration Regulation Law 64 of 1976, Japan. .

Note: Vibration level shall be measured at the boundary line of the road.

APPENDIX 7: SCHEDULES 1 AND 4 OF THE ANCIENT MONUMENTS PRESERVATION RULES 2046 (1989)

Schedule-1

(Relating to Sub- rule 4.1.1)

Department of Archaeology

.....

I am / We are going to carry out the following construction work in ..... monuments conserved zone, located in .....of.....District, ...Zone, within the following time period. Therefore, I/ We have filed this application for obtaining the approval of the Department. I am / We are ready to bear any punishment, as per the prevailing laws, if construction work is made other than written in this application.

Description of the construction work, which is going to be carried out within the monuments conserved areas and tentative time period to complete the construction: -

.....

Of the applicant,

Name and Surname –

Signature –

Date –

Permanent Address—

Temporary Address–

Schedule 4
(Relating to Subrule 4.3.1)
The Description of Archaeological Object Form 2

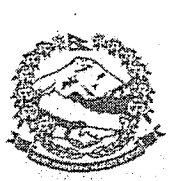
Zone:
District:

SNo.	Archaeological Object				Archaeological Object Found					Remarks
	Name	Material composition	Age (probable year)	Measurements (length, width, thickness, etc.)	VDC/Municipality	Ward no.	Village	Tole	Description of area	

The Local Officer:
Date:

Modified by the Ancient Monument Conservation (First Amendment) Rules, 2049 (1992) Appendix 10:

APPENDIX 8: GOVERNMENT LETTERS CONFIRMING COMPLIANCE WITH GOVERNMENT RULES



नेपाल सरकार
भौतिक योजना तथा निर्माण मन्त्रालय
(खानेपानी महाशाखा)

URL : www.moppw.gov.np
email : info@moppw.gov.np
फोन नं. ४२११८८०
४२११९३१
४२११६४५
फ्याक्स नं. ४२११७२०
सिंहदरबार, काठमाडौं,
नेपाल ।

पत्रसंख्या : ०६६/०६८
च.नं. ९६५

KUKL / PID
Regd. No: १४८०-०६६-१२-३०
File No:-
☑ DPDM ☐ DPDE
☐ Finance ☐ Others
To:
For
☐ File
☐ Action
☐ Information
☐ Necessary
☐ Call meeting on

मिति :२०६७।१२।३०

श्री आयोजना कार्यान्वयन निर्देशनालय
काठमाडौं उपत्यका खानेपानी लिमिटेड
अनामनगर ।

विषयः- Aide Memoire र डकुमेन्ट सार्वजनिक गर्ने बारे ।

प्रस्तुत विषयमा काठमाडौं उपत्यका खानेपानी तथा सरसफाई आयोजनाको Safeguards सम्बन्धी डकुमेन्ट ADB को वेवसाइटमा प्रकाशनको लागि मिति ०६७।१२।३० को नेपाल सरकार (सचिव स्तरीय) निर्णयबाट स्वीकृत भएको व्यहोरा अनुरोध छ ।

(ई. राजकुमार मल्ल)
सह-सचिव

कृपया पत्राचार गर्दा प्राप्त पत्रसंख्या र मिति उल्लेख गर्नु होला ।

सन् २००० मा EIA स्वीकृत भएको मेलम्ची खानेपानी आयोजनाको Financing मा भएको परिवर्तनको फलस्वरूप आयोजनाको Scope मा आएको परिवर्तनको सम्बन्धमा छलफल गर्न मिति २०६८।१।२ मा वातावरण मन्त्रालयको वातावरण महाशाखा प्रमुखको कार्यकक्षमा बसेको बैठकमा निम्न महानुभावहरूको उपस्थितिमा देहाय बमोजिमको निर्णय गरियो ।

उपस्थिति:

श्री पुरुषोत्तम घिमिरे — सह-सचिव, वातावरण मन्त्रालय

श्री राजकुमार मल्ल — सह-सचिव, भौतिक योजना तथा निर्माण मन्त्रालय

श्री सुमन प्रसाद शर्मा — आयोजना निर्देशक, आयोजना कार्यान्वयन निर्देशनालय/KUKL

श्री प्रेमनिधि के.सि. — Safeguard Unit chief, आ.का.नि./KUKL

श्री भाइराजा मानन्धर — सि.डि.ई., वा.मू.शाखा, वातावरण मन्त्रालय

श्री सलिल देवकोटा — वातावरण विज्ञ, PID/DSC 2

निर्णय:

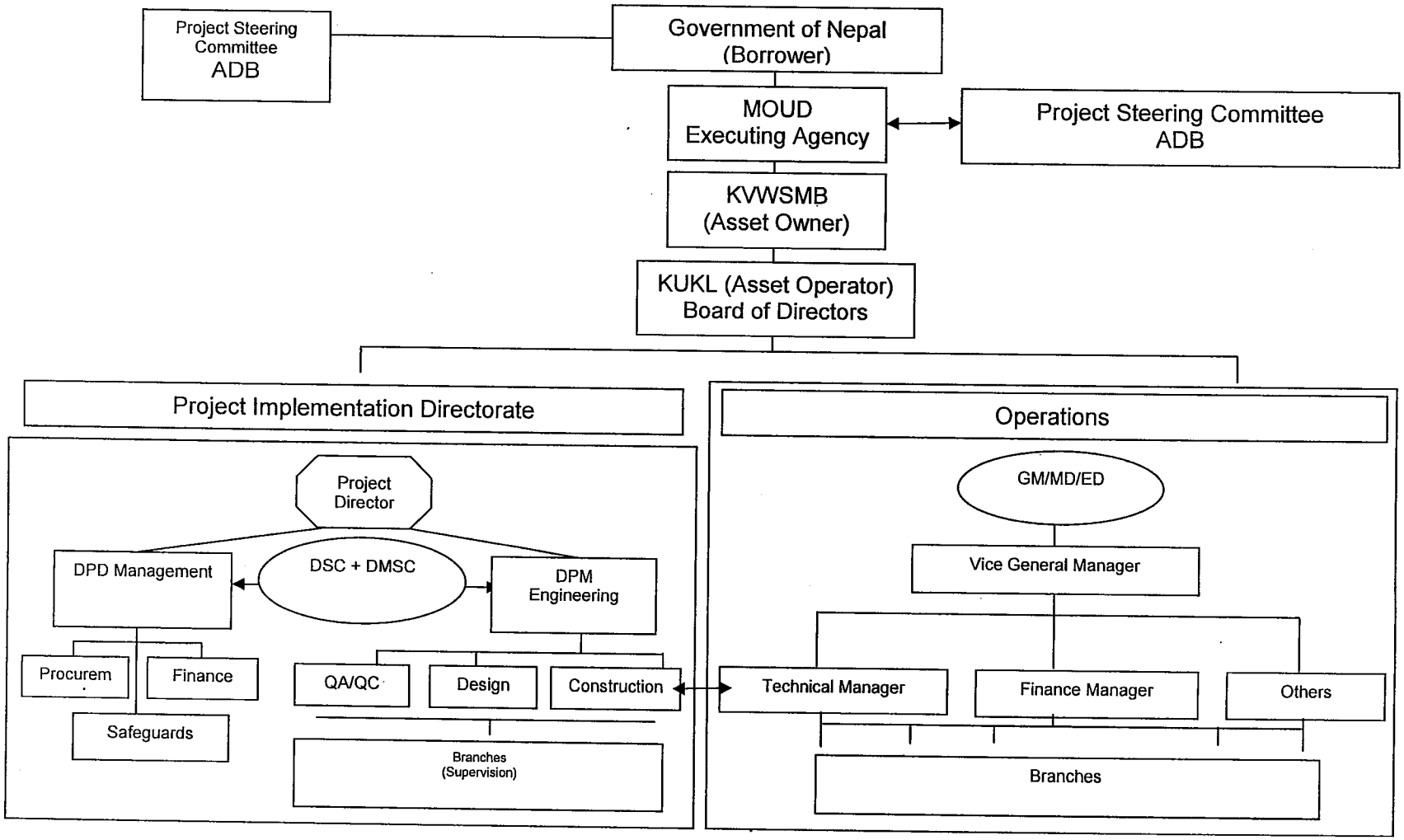
मेलम्ची खानेपानी आयोजनाको Financing मा गरिएको परिवर्तनको फलस्वरूप आयोजनाको Scope मा आएको परिवर्तन स्वीकृत EIA को Scope को परिधि भित्रै रहेको हुँदा सन् 2000 मा स्वीकृत भएको EIA प्रतिवेदन हालसम्म कायम (Valid) रहेको व्यहोरा स्पष्ट गरियो ।

०६८।१।२

०६८।१।२

०६८।१।२

APPENDIX 9: PROJECT IMPLEMENTATION ARRANGEMENTS



APPENDIX 10: TRAFFIC MANAGEMENT PLANNING (TMP)

A. Principles for TMP around the Distribution Network Improvement (DNI) Construction Sites

1. One of the prime objectives of this TMP is to ensure the safety of all the road users along the work zone, and to address the following issues:

(i) the safety of pedestrians, bicyclists, and motorists travelling through the construction zone;
(ii) protection of work crews from hazards associated with moving traffic;
(iii) mitigation of the adverse impact on road capacity and delays to the road users;
(iv) maintenance of access to adjoining properties; and
(v) addressing issues that may delay the project.

B. Operating Policies for TMP

2. Figure A12.1 illustrates the operating policy for TMP of the DNI works.

C. Analyze the impact due to street closure

3. Apart from the capacity analysis, a final decision to close a particular street and divert the traffic should involve the following steps:

(i) approval from the ward office or community to use the local streets as detours;
(ii) consultation with businesses, community members, traffic police, Department of Roads, etc, regarding the mitigation measures necessary at the detours where the road is diverted during the construction;
(iii) determining of the maximum number of days allowed for road closure, and incorporation of such provisions into the contract documents;
(iv) determining if additional traffic control or temporary improvements are needed along the detour route;
(v) considering how access will be provided to the worksite;
(vi) contacting emergency service, school officials, and transit authorities to determine if there are impacts to their operations; and
(vii) developing a notification program to the public so that the closure is not a surprise. As part of this program, the public should be advised of alternate routes that commuters can take or will have to take as result of the traffic diversion.

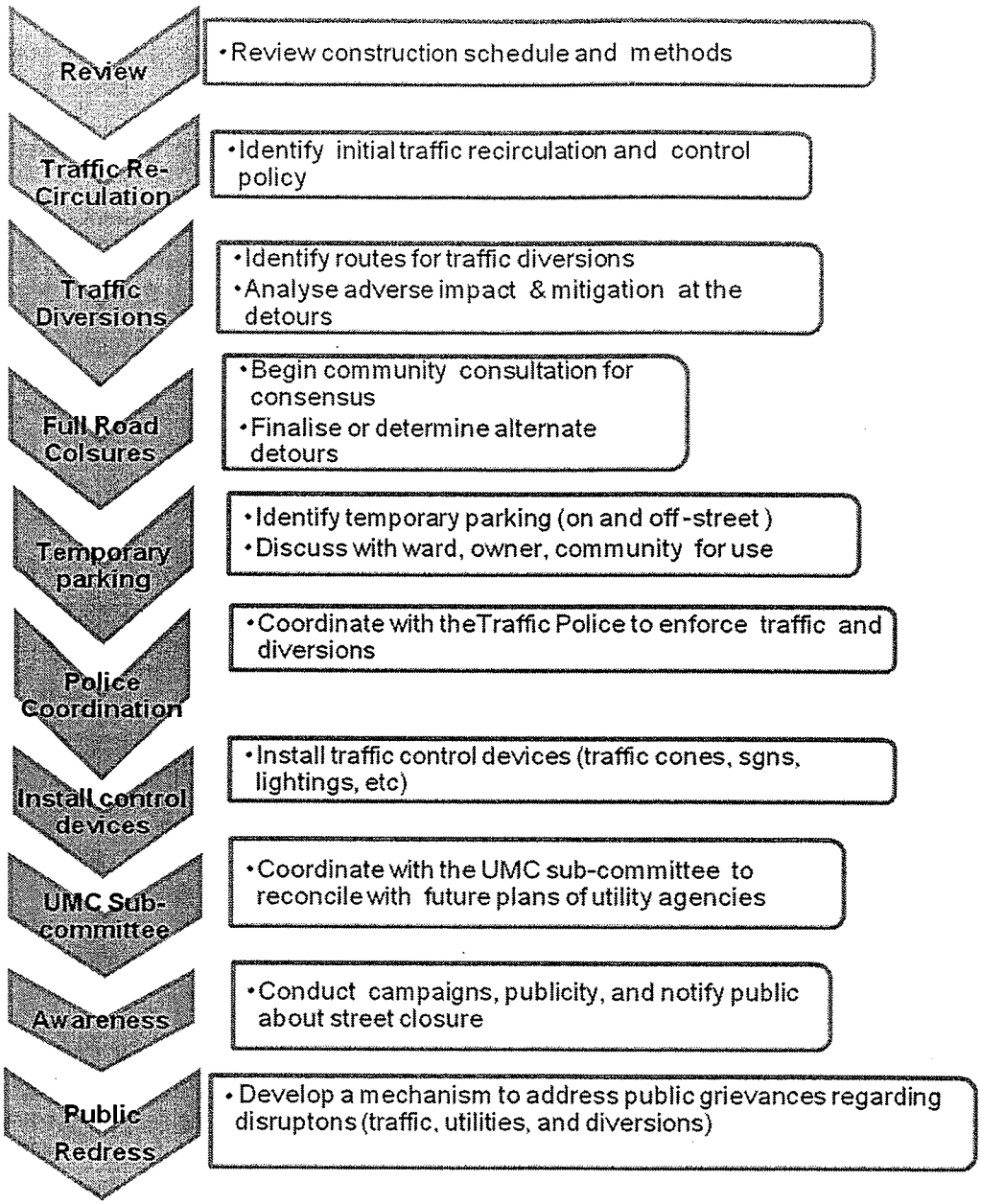
4. If full road-closure of certain streets within the area is not feasible due to inadequate capacity of the detour street or public opposition, the full closure can be restricted to weekends with the construction commencing on Friday night and ending on Sunday morning prior to the morning peak period.

D. Public awareness and notifications

5. As per discussions in the previous sections, there will be travel delays during the constructions, as is the case with most construction projects, albeit on a reduced scale if utilities and traffic management are properly coordinated. There are additional grounds for travel delays in the area, as most of the streets lack sufficient capacity to accommodate

additional traffic from diverted traffic as a result of street closures to accommodate the works.

Figure A12.2: Policy Steps for the TMP



6. The awareness campaign and the prior notification for the public will be a continuous activity which the project will carry out to compensate for the above delays and minimize public claims as result of these problems. These activities will take place sufficiently in advance of the time when the roadblocks or traffic diversions take place at the particular streets. The reason for this is to allow sufficient time for the public and residents to understand the changes to their travel plans. The project will notify the public about the roadblocks and traffic diversion through print, TV, and radio media. In addition, the project, in collaboration with the utility management coordinator, will also seek the assistance of the ward office, local clubs, and others to post the public notice regarding street closure and traffic diversions in the future.

7. The utility management coordinator will also conduct an awareness campaign to educate the public about the following issues:

(i) traffic control devices in place at the work zones (signs, traffic cones, barriers, etc.);
(ii) defensive driving behaviour along the work zones; and
(iii) reduced speeds enforced at the work zones and traffic diversions.

8. It may be necessary to employ a road safety education specialist to design an appropriate program for road safety, and to conduct the awareness programs.

9. The campaign will cater to all types of target groups i.e. children, adults, and drivers. Therefore, these campaigns will be conducted in schools, civic centres and community centres. In addition, the project will publish a brochure for public information. These brochures will be widely circulated around the area and will also be available at the KUKL project directorate, office of both the contractor and consultant, and the contractor's site office. The text of the brochure should be concise to be effective, with a lot of graphics. It will serve the following purpose:

(i) explain why the brochure was prepared, along with a brief description of the project;
(ii) advice the public to expect the unexpected;
(iii) educate the public about the various traffic control devices and safety measures adopted at the work zones;
(iv) educate the public about the safe road user behaviour to emulate at the work zones;
(v) tell the public how to stay informed or where to inquire about road safety issues at the work zones (website, name, telephone, mobile number of the contact person; and SMS service or traffic information on FM radio, e.g. Ujyalo FM Station); and
(vi) indicate the office hours of relevant offices.

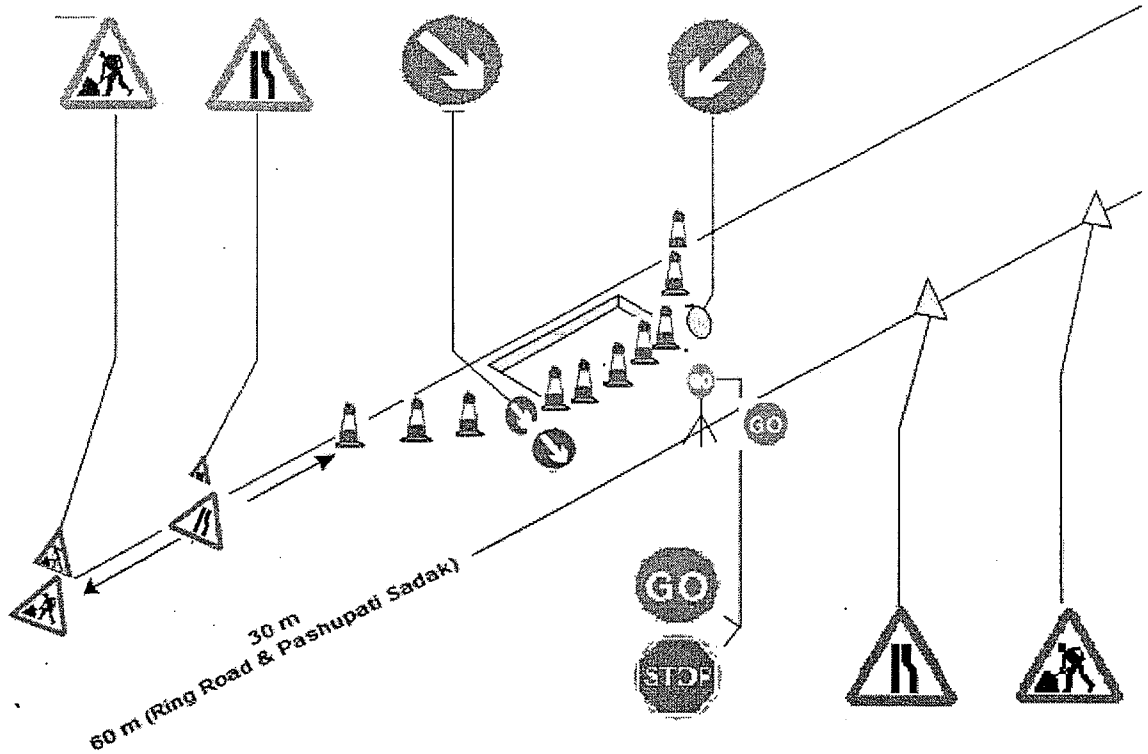
E. Install traffic control devices at the work zones and traffic diversion routes

10. The purpose of installing traffic control devices at the work zones is to delineate these areas to warn, inform, and direct the road users about a hazard ahead, and to protect the former as well as the workers. As proper delineation is a key to achieve the above objective, it is important to install good traffic signs at the work zones.

11. Procedures for installing traffic control devices at any work zone vary, depending on road configuration, location of the work, construction activity, duration, traffic speed and volume, and pedestrian traffic. Work will take place both at both minor streets and major streets such as Pashupati Sadak and the Dhumbarahi-Chabahil section of Ring Road. As such, the traffic volume and road geometry vary, with the latter requiring more elaborate settings. However, regardless of where the construction takes place, all the work zones should be cordoned off, and traffic shifted away at least with traffic cones, barricades, and temporary signs (temporary "STOP" and "GO"). The work will closely follow the guidelines outlined in the DOR Traffic Sign Manual 1997 (which includes DOR 1996 document "Safety at Roadwork") and other literature available in this respect.

12. **Figure A12.3** illustrates a typical set-up for installing traffic control devices at the work zone of the area.

Figure A12.3: Basic Layout for Delineation of a Work Zone (small area)

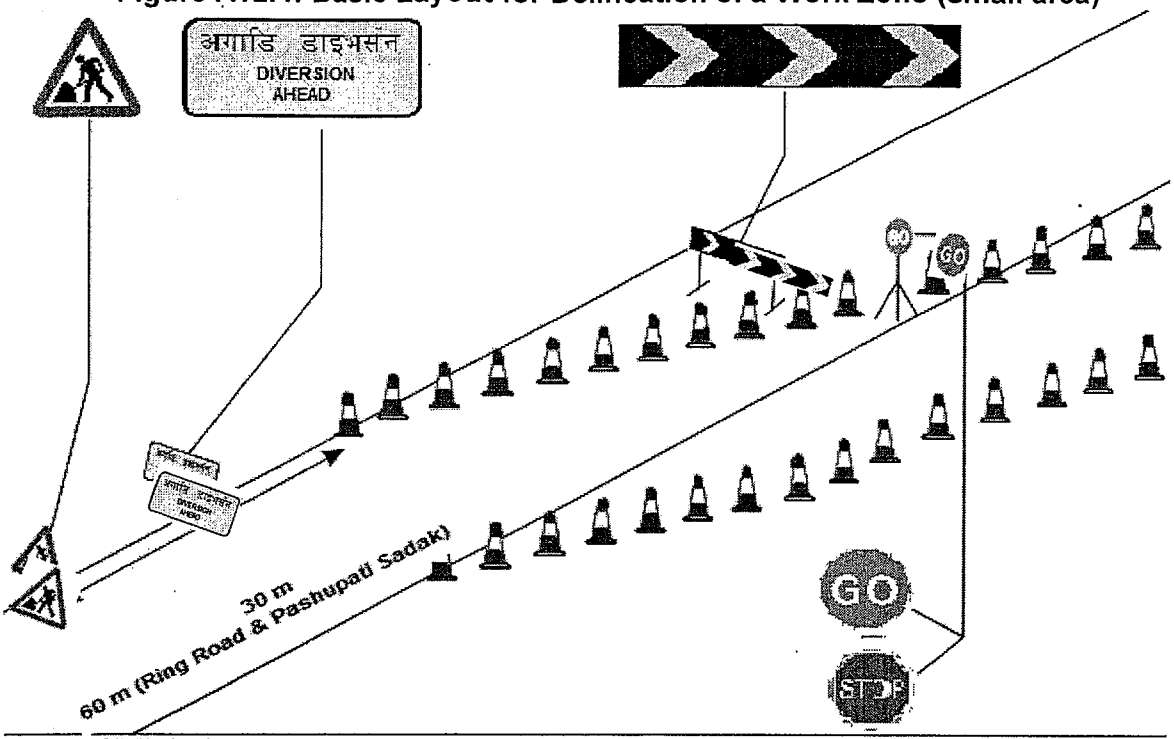


Note:
The Road Narrrows Ahead warning-sign shown are only required to cordon the DNI work-zones at Pashupati Sadak and Ring Road (Chabahil- Dhumbarahi section)

13. The work zone should take into consideration the space required for a buffer zone between the workers and the traffic (lateral and longitudinal) and the transition space required for delineation, as applicable. For the DNI works, a 30 cm clearance between the traffic and the temporary STOP and GO signs should be provided. In addition, at least 60 cm is necessary to install the temporary traffic signs and cones. Figure 5 clarifies that the "ROAD NARROWS" warning-sign is only necessary at the DNI works zones along Pashupati Sadak and the Ring Road section, where high traffic speeds are likely during the off-peak hours and at night. All the temporary traffic signs should be reflectorized, especially for the works to be conducted during the night time, as per the DOR Traffic Sign Manual 1997.

14. All the traffic diversions should be properly delineated through proper "DIVERSION AHEAD" and "ROADWORK AHEAD" signs as indicated in Figure A12.4. In addition, the "B46" temporary warning sign for sharp bends used at the temporary diversion should be in place after the start of the taper of the traffic cones. Flashing beacons should be installed at the entry to the work zone and traffic diversion for night construction, or if backfilling of the DNI trench does not take place after the completion of a day shift.

Figure A12.4: Basic Layout for Delineation of a Work Zone (small area)



Source: DOR Traffic Sign Manual; Volume I; August 1997; Kathmandu, Nepal.

15. Traffic police should regulate traffic away from the work zone and enforce the traffic diversion result from full street closure in certain areas during construction. For the DNI and BDS works, one personnel is necessary at each entry to the diversion from both directions. These personnel should be equipped with reflective jackets at all times and have traffic control batons (preferably the LED type) for regulating the traffic during night time.

16. In addition to the delineation devices, all the construction workers should wear fluorescent safety vests and helmets in order to be visible to the motorists at all times. There should be provision for lighting beacons and illumination for night constructions. In light of the ongoing load-shedding problem in Nepal, it is practical to use solar-powered LED lights, which are energy efficient, wherever feasible.

APPENDIX 11: SAMPLE ENVIRONMENTAL MONITORING FORMAT

a. Work Details

Table 1: Work Details and Risks

Locations	Sub-project components (package no.)	Name of the contractor	Listing of works under the package	Starting date (land clearance) and schedule date of completion	What type of works continue at present	Progress percentage	Expected changes from approved scope	Fulfilment of objectives- Type of remedial measures needed	Key assumptions and risks that affect attainment of the objectives

b. Implementation of Environmental Management Plan

Table 2: Status of Environment, Forest, and Other Clearances

City/ Town	Work (package no.)	Applicable legislation/type of clearance	Clearance given by and date	Subject/ issue	Remarks/action needed

Table 3: Compliance with Environmental Management Plan

Description of Impact	Mitigation measures proposed	Implementation status	Details/ remarks on implementation	Monitoring methods and frequency	Monitoring conducted by	Monitoring remarks (Excellent/Satisfactory/Partially Satisfactory/Below Satisfaction/Poor/Very Poor)	Remarks and actions taken to improve implementation
Detailed Design							
Pre- construction							
Construction							

Table 4: Measurement of Pollutants

Components	Package/ location	Period of monitoring	Parameters/pollutants	Standard	Base line status	Monitoring result during project Implementation	Remarks
Noise							
Air quality							
Water quality							
Soil quality							
Process generated Sludge							