Initial Environmental Examination

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NEP: Kathmandu Valley Wastewater Management Project − Interceptor Sewer

Package No: KUKL/WW/IS-03

Prepared by the Project Implementation Directorate, Kathmandu Upatyaka Khanepani Limited, Ministry of Water Supply, Government of Nepal for the Asian Development Bank.

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CURRENCY EQUIVALENTS

(as of December 2017)

Currency unit	-	Nepalese rupee (NRs/NRe)
NRs1.00	=	$ 0.0097
$1.00	=	NRs 103.33

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

ABBREVIATIONS

ADB	Asian Development Bank
BAP	Bagmati Action Plan
BOD	Biological Oxygen
CBP	Capacity Building and Public-Private Partnership Support Team
CBS	Central Bureau of Statistics
CIAMP	Capital Investment and Asset Management Program
CITES	Convention of International Trade in Endangered Species of Wild Fauna and Flora
CASSC	Community Awareness and Safeguard Support Consultant
CEMP	Construction Environmental Management Plan
DBO	Design Build and Operate
DO	Dissolved Oxygen
DWEC	District Wage Evaluation Committee
DNI	Distribution Network Improvement
DSC	Design and Supervision Consultant
EA	Executing Agency
EARF	Environmental Assessment and Review Framework
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ENPHO	Environmental and Public Health Organisation
EPA	Environment Protection Act
EPR	Environment Protection Rules
ERP	Emergency Response Plan
HACCPP	Hazard Analysis and Critical Control Point Plan
HH	Household
HPCIDBC	High Powered Committee for Integrated Development of Bagmati Civilization
IEC	Information, Education and Communication
IFC	International Finance Corporation
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 Nongovernment Organization
ICSU	Income Consumer Support Unit
IUCN	International Union for Conservation of Nature
JICA	Japanese International Cooperation Agency
JBIC	Japanese Bank for International Cooperation
KUKL	Kathmandu Upatyaka Khanepani Limited Kathmandu
MoUD	Ministry of Urban Development
MoFE	Ministry of Forest and Environment
MoWS	Ministry of Water Supply
VWMPK	Valley Wastewater Management Project Kathmandu
VWSMB	Valley Water Supply Management Board
MSDS	Material Safety Data Sheets
MWSDB	Melamchi Water Supply Development Board
MWSP	Melamchi Water Supply Project
NEWAH	Nepal Water for Health

NGO	Nongovernment organization
NTFP	Non-timber Forest Product
NTNC	Nepal Trust for Nature Conservation
NWSC	Nepal Water Supply Corporation
OHS	Occupational Health and Safety
PD	Project Director
PID	Project Implementation Directorate
PIU	Project Implementation Unit
PLC	Programmable Logic Controllers
PPE	Personal Protective Equipment
PPP	Public-Private Partnership
PPTA	Project Preparatory Technical Assistance
REA	Rapid Environmental Assessment
RoW	Right of Way
RP	Resettlement Plan
SAPI	Special Assistance for Project Implementation
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 Programme
VDC	Village Development Committee
WWTP	Wastewater Treatment Plant

WEIGHTS AND MEASURES

cm	- centimetre
db	- decibel
ha	- hectare
kg	- kilogram
km	- kilometre
km^2	- square kilometre
l	- litre
m	- meter
$_m2$	- square meter
m^3	- cubic meter
mg/l	- milligrams per litre
ml	- millilitre
MLD	- million litres per day, mega litres per day (1 mega litre = $1000m^3$)
MSL/msl	- Mean Sea Level
mm	- millimetre
|jg/m^3	- micrograms per cubic meter

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This initial environmental examination is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature.

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Executive Summary

1. The proposed Kathmandu Valley Waste Water Management Project (KVWWMP) will support the ongoing efforts of the Government of Nepal towards improving the wastewater services in Kathmandu Valley. The project will invest in rehabilitation and expansion of sewerage network, modernization and new construction of wastewater treatment plants, and improvement of wastewater management in Kathmandu Valley, which will complement the past and ongoing Asian Development Bank (ADB) projects.[1] The project is expected to increase operational efficiency, improve service delivery, and result in positive impact on health and quality of life for inhabitants of Kathmandu Valley. ADB requires the consideration of environmental issues in all aspects of its operations as per its Safeguard Policy Statement (SPS 2009).

2. This initial environmental examination (IEE) has been prepared for the package IS-03 which includes (i) Interceptor sewer line along both banks of the Khasyang Khusung River (ii) Rehabilitation and expansion of sewerage network. This package construction work has been started from 15 December, 2017 and will be completed in 8 June 2019. This IEE is updated for Interceptor sewer line facilities along the both banks of the Khasyang Khusung river. The Interceptor sewer (IS) will be implemented as IS-03.

3. **Categorization.** The package is considered Category B as per the SPS 2009 as no significant impacts are envisioned. This IEE assesses the environmental impacts and provides mitigation and monitoring measures to ensure no significant impacts as a result of the project.

4. **Scope.** The project's expected impact will be sustainable wastewater services for the residents of Bhaktapur. The expected outcome will be an improved wastewater collection system and increased access of wastewater services to the residents of Bhaktapur (ward 2 and 6 of Bhaktapur Municipality and ward 2 and 3 of Changunarayan Municipality) including poor women and men. The project will further consolidate the continuing efforts of the government and ADB in institutional development and improvement of governance in the wastewater sector.

5. **Implementation Arrangements.** The Ministry of Water Supply (MoWS) will be the executing agency responsible for overall strategic planning, guidance, and management of the project, and for ensuring compliance with loan covenants. Kathmandu Upatyaka Khanepani Limited (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, MOWSS, and ADB; and (iii) coordination of all activities in the project. PID has already established a safeguards unit staffed with environmental, social, and legal specialists. The PID, KUKL will recruit two consulting firms, design, supervision and management consultant (DSC) and Community Awareness and Safeguard Support Consultant (CASSC) firm. The DSC will have an environmental and social safeguard specialist to facilitate PID in implementation and supervision of safeguards-related works.

6. **Description of the Environment.** The project is located in Kathmandu Valley which is densely populated. The project sites are located in existing right of ways (RoWs) and government-owned land of Khasyang Khusung River. There are no protected areas, wetlands, or estuaries in or near the subproject location. Trees, vegetation, and animals are those which are commonly found in urban areas. Traffic management will be necessary during the rehabilitation and construction of sewer pipes on busy roads.

7. **Environmental Management.** An Environmental Management Plan (EMP) is included as part of this IEE. It will guide all stakeholders including PID, KUKL, DSC and contractors in the environmentally sound design, construction and operation of

[1] Melamchi Water Supply Project (ADB 1820-NEP); Kathmandu Valley Water Supply Improvement Project (ADB 2776-NEP); Bagmati River Basin Improvement Project (ADB PPTA -43448).

infrastructure under this project. In particular the EMP (i) recommends the measures and means of testing to be implemented to reduce the likelihood of potential environmental impacts during the design, construction and operation phase of the project; (ii) provides the necessary tools to carry out onsite environmental performance monitoring; (iii) ensures compliance with recommended standards and safety measures; (iv) recommends the public consultation and disclosure procedures; and (v) provides a grievance redress mechanism. The EMP will be included in the civil work bidding and contract documents.

8. Locations and sitting of the proposed infrastructures were considered to further reduce impacts. These include (i) locating all facilities on government-owned land to avoid the need for land acquisition and relocation of people; (ii) laying of sewerage pipes in RoWs to reduce acquisition of land and impacts on livelihoods specifically in densely populated areas of the valley. The laying of interceptors along river banks could potentially cause soil erosion and sedimentation. These are common impacts and can be readily mitigated through the (i) identification of erosion prone areas using geotechnical surveys and incorporating drainage plans into the design; (ii) minimizing vegetation clearance along the slopes; and (iii) avoid piling of excavated material close to the river bank and upon private cultivated land.

9. Mitigation measures have been developed to reduce all negative impacts to acceptable levels. Mitigation will be assured by a program of environmental monitoring to be conducted during design, construction and operation phases. The environmental monitoring program will ensure that all measures are implemented and will determine whether the environment is protected as intended. It will include observations on- and off-site, document checks, photographs, monitoring of key parameters and interviews with workers and beneficiaries. Any requirements for corrective action will be reported to the ADB.

10. The stakeholders were involved in developing the IEE through discussions on-site and public consultation, after which views expressed were incorporated into the IEE and in the planning and development of the subproject. Several meetings, workshops, and focus group discussions were held with local residents, stakeholders and technical persons to keep them informed of the project and to get their feedback for the project design, as required. To provide for more transparency in planning, and for further active involvement of key stakeholders including the general public, the project information will be disseminated through disclosure of the translated versions of the IEE. A copy of the IEE will be disclosed on the ADB and project-related websites and will also be available from PID upon request.

11. The most noticeable long-term benefit of the project will be the improved wastewater management system in Kathmandu Valley which will in turn improve the water quality of the rivers overtime and safeguard public health.

12. **Consultation, Disclosure and Grievance Redress.** Public consultations and disclosures will be continuous in the future during the design, construction and operation phases. The Community Awareness and Social Safeguard Consultant (CASSC) with the help of the Safeguard unit of PID will be responsible for the public consultations and information disclosures. Grievances will be addressed by the grievance redress mechanism, which incorporates a clear and grassroots process for addressing public complaints quickly.

13. **Monitoring and Reporting.** The safeguards staff within the PID will monitor the implementation of the EMP with support from the DSC and CASSC. The DSC Environmental Safeguards Officer will prepare quarterly progress reports and submit to PID and PID will prepare semi-annual monitoring reports and submit to ADB. ADB will post the environmental monitoring reports on its website. These reports will describe the progress of the implementation of the EMP, any compliance issues and corrective actions.

14. **Conclusion and Recommendations.** Overall the potential impacts of the project will be very positive, benefitting both the environment and the people. Some negative impacts are anticipated during implementation, but in specific areas and for a short duration (e.g., dust, noise, traffic problems, erosion, sedimentation, etc.). It is expected that these environmental impacts of the project will in general not be significant and can be reduced and/ or prevented through adequate mitigation measures and regular monitoring during the design, construction, and operation phases of the project. Based on the findings of the IEE, there are no significant environmental impacts, and the classification of the project as category B is confirmed, and no further special study or detailed environmental impact assessment (EIA) needs to be undertaken to comply with ADB SPS (2009).

I. INTRODUCTION

A. Purpose of the Report

1. The Kathmandu Valley Wastewater Management Project (KVWMP) will support the ongoing efforts of the Government of Nepal toward improving the wastewater services in Kathmandu Valley. The main urban concentration within the valley consists of the two twin cities of Kathmandu and Lalitpur followed by Bhaktapur, Madhaypur, and Kirtipur.

2. The project has the ultimate objectives of:

(i) rehabilitating and expanding the sewerage networks and connecting to wastewater treatment plants (WWTPs); and
(ii) supporting operational and financial improvements and capacity building.

3. The purpose of this initial environmental examination (IEE) is (i) to provide information on existing geographic, ecological, social and temporal context including associated facilities with the package (IS-01) area of influence, (ii) to find out the likely positive and negative direct and indirect impacts to physical, biological, socioeconomic and physical cultural resources in the package area of influence, (iii) identify mitigation measures and any negative impacts that should be mitigated during planning, implementation and operation, (iv) to establish Grievance Redress Mechanism for resolving environmental issues, (v) to describe the monitoring measures and reporting procedures to ensure early detection conditions that require particular mitigation measures, (vi) to describe the process undertaking during project design to engage stakeholders and affected persons and the planned information disclosure measures and the process of carrying out consultation with affected people and facilitating their participation during project implementation, (vii) to identify who is responsible for carrying out the mitigation and monitoring measures.

4. The mitigation measures are then carried forward into the Environmental Management Plan (EMP). The EMP assigns responsibilities, time frames, and performance indicators or standards for each mitigation measure to make sure that it is implemented. An environmental monitoring plan is also prepared. This monitoring plan identifies methods and responsibilities for checking the operation of the project against a range of relevant and agreed performance indicators.

B. Basis and Scope of the IEE

5. Both Nepal's law and the 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 adverse impacts to acceptable levels. This is done through the environmental assessment process, which has become an integral part of project development and implementation worldwide. This IEE is updated for Interceptor Sewer line facilities along the both banks of the Khasyang Khusung River (local name 'Kasne Khusi'). The sewers which collect the wastewater from the designated service areas and conveys and discharge the wastewater to the proposed wastewater treatment plant at Sallaghari. The interceptor sewer line along the Khasyang Khusung river will be constructed as IS-03.

II. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

A. ADB Policy

5. 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 will form part of the bidding and contract documents for civil work.

B. ADB Safeguards policy

6. ADB's environmental safeguards policy principles are defined in SPS, 2009, Safeguard Requirements 1 and the IEE is intended to meet these requirements, Table II-1:.

Table II-1: ADB SPS, 2009 Safeguard Requirements 1: Environment

SPS 2009 - Safeguard Requirements	**Remarks**
Use a screening process for each proposed project, as early as possible, to determine the appropriate extent and type of environmental assessment (EA) so that appropriate studies are undertaken commensurate with the significance of potential impacts and risks.	REA has been undertaken (Appendix 1), indicating that subproject is NOT: (i) environmentally critical; and (ii) adjacent to or within environmentally sensitive/critical area.
SPS 2009 - Safeguard Requirements	Secondary influence areas. Significant adverse impacts during construction will be temporary and short-term, can be mitigated without difficulty. There is no adverse impact during operation. Hence, IEE is sufficient. The IEE including specific description of the environment and corridor of impact will be updated as necessary based on the final design and alignments.
Conduct EA to identify potential direct, indirect, cumulative, & induced impacts and risks to physical, biological, socioeconomic (including impacts on livelihood through environmental media, health and safety, vulnerable groups, and gender issues), and physical cultural resources in the context of the project's area of influence. Assess potential trans boundary global impacts, including climate change.	IEE has been undertaken to meet this requirement. (Section VI). No trans boundary & global impacts, including climate change.
Examine alternatives to the project's location, design, technology, and components and their potential environmental and social impacts and document the rationale for selecting the particular alternative proposed. Also	Analysis of "with-subproject "or "without subproject" is presented in Section III.

SPS 2009 - Safeguard Requirements	Remarks
consider the no project alternative.	
Avoid, and where avoidance is not possible, minimize, mitigate, &/or offset adverse impacts and enhance positive impacts by means of environmental planning & management. Prepare an EMP that includes the proposed mitigation measures, environmental monitoring and reporting requirements, related institutional or organizational arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators.	An EMP has been prepared to address this requirement. Section IX
Carry out meaningful consultation with affected people & facilitate their informed participation. Ensure women's participation. Involve stakeholders, including affected people & concerned NGOs, early in the project preparation process & ensure that their views & concerns are made known to & understood by decision makers and taken into account. Continue consultations with stakeholders throughout project implementation as necessary to address issues related to EA. Establish a GRM to receive & facilitate resolution of affected people's concerns & grievances on project's environmental performance.	Key informant and random interviews have been conducted (Appendix 8). A grievance redress mechanism for the resolution of valid project- related social and environmental issues/concerns is presented in Section VIII.
Disclose a draft IEE (including the EMP) in a timely manner, before project appraisal, in an accessible place & in a form & language(s) understandable to affected people & other stakeholders. Disclose the final EA, & its updates if any, to affected people & other stakeholders.	The draft IEE will be disclosed on ADB's website prior to project appraisal. Copies of both SPS- compliant IEE and Government of Nepal- approved IEE will be made available at the offices of the PMO, Project Implementation Support Unit (PISU) and Water Users' and Sanitation Committee (WUSC)for public consultation. For the benefit of the community, the summary of the IEE will be translated in the local language and made available at (i) offices of executing and implementing agencies, (ii) area offices, (iii) consultant teams' offices; and (iv) contractor's campsites. It will be ensured that the hard copies of IEE are kept at places which are conveniently accessible to people, as a means to disclose the document and at the same time creating wider public awareness. An electronic version of the IEE will be placed in the official website of executing and implementing agencies and the ADB website after approval of the IEE by ADB.
Implement the EMP and monitor its effectiveness. Document monitoring results, including the development and	EMP implementation, reporting and disclosure of monitoring reports are in this IEE.

SPS 2009 - Safeguard Requirements	Remarks
implementation of corrective actions, and disclose monitoring reports.	
Do not implement project activities in areas of critical habitats, unless (i) there are no measurable adverse impacts on the critical habitat that could impair its ability to function, (ii) there is no reduction in the population of any recognized endangered or critically endangered species, and (iii) any lesser impacts are mitigated. If a project is located within a legally protected area, implement additional programs to promote and enhance the conservation aims of the protected area. In an area of natural habitats, there must be no significant conversion or degradation, unless (i) alternatives are not available, (ii) the overall benefits from the project substantially outweigh the environmental costs, and (iii) any conversion or degradation is appropriately mitigated. Use a precautionary approach to the use, development, and management of renewable natural resources.	The subproject does not encroach into areas of critical habitats.
Apply pollution prevention and control technologies and practices consistent with international good practices as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health and Safety Guidelines. Adopt cleaner production processes and good energy efficiency practices. Avoid pollution, or, when avoidance is not possible, minimize or control the intensity or load of pollutant emissions and discharges, including direct and indirect greenhouse gases emissions, waste generation, and release of hazardous materials from their production, transportation, handling, and storage. Avoid the use of hazardous materials subject to international bans or phase-outs. Purchase, use, and manage pesticides based on integrated pest management approaches and reduce reliance on synthetic chemical pesticides.	This requirement is only minimally applicable to the subproject in the aspect of waste generation, e.g., effluent from septic tanks and generated sludge and sludge disposal from water supply and sanitation structures. The subproject will not involve hazardous materials subject to international bans/phase outs.
Provide workers with safe and healthy working conditions and prevent accidents, injuries, and disease. Establish preventive and emergency preparedness and response measures to avoid, and where avoidance is not possible, to minimize, adverse impacts and risks to the health and safety of local communities.	EMP provides measures to mitigate health and safety hazards during construction and operation.
Conserve physical cultural resources and	The subproject will not affect any physical

SPS 2009 - Safeguard Requirements	Remarks
avoid destroying or damaging them by using field- based surveys that employ qualified and experienced experts during environmental assessment. Provide for the use of "chance find" procedures that include a pre-approved management and conservation approach for materials that may be discovered during project implementation.	cultural resource. The EMP recommends the measure/s to mitigate adverse impact on physical cultural resources (PCRs) in case of chance find.

C. National Law and Rules

7. The requirement for environmental assessment in Nepal is established by the National Environment Protection Act (1997). The procedures are defined in the Environment Protection Rules, as amended. These rules require IEE for sewerage projects costing more than NRs. 50 lakhs (Schedule 1, Rule 3, and Section-I Clause 1-E). However, if any kind of project falls under listed below requires EIA,

- Historical, cultural and archaeological site (EPR, 1997, Schedule 2, Rule 3, sub-section K – 1), and
- Operation of any plan, project or programme relating to development work, physical activities with a cost of 250 million (EPR, 1997, Schedule 2, Rule 3, sub-section L).

8. The legal provisions for environmental protection in Nepal are found in different laws and regulations (Appendix 4).

D. International Environmental Agreements

9. 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
(v) Convention on Biological Diversity, 1992

E. Policies and Legal Framework of KUKL

10. The Government of Nepal remains fully committed to providing safe drinking water and sanitation services--considered as a fundamental human need and a basic human right--for all of its citizens. The Government is committed to providing improved water supply and sanitation services of medium and higher levels commensurate to the capacity to pay of the served populations. In the 1990s, political liberalization and a focus on decentralization saw important new actors in the sector emerge, namely the community groups, local governments, and the private sector, including nongovernment organizations (NGOs). However, the ever-growing urban population and increasing water demand has been placing a strain on the existing urban water supply and sanitation services. There have been a number of efforts to streamline planning and investment in the sector. Some of the major

efforts are examined below.

11. The National Urban Policy (2007) highlights the historical imbalances and haphazard nature of urban development in Nepal. It views urban centres as catalysts of economic development linked to north-south and east-west access corridors. The policy also flags poor sanitation, environmental degradation, and lack of services by the urban poor as requiring urgent attention. It proposes the building of 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 is specifically sought.

12. The National Urban Water Supply and Sanitation Sector Policy (2009) was formulated to provide the overall policy support and guidance toward achieving equity in service delivery by ensuring that the financially marginalized households within the service areas are mainstreamed as valid customers through the design and implementation of financial incentives, where required.

13. The Local Governance Operationalization Act, 2074 (2017) 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, including the absence of locally elected officials for most of this period, have frustrated implementation plans.

14. The Nepal Water Supply Corporation Act (2007), as amended, Water Supply Management Board Act (2006), and Water Supply Tariff Fixation Commission Act (2006) have facilitated the improved management of Kathmandu Valley's water and sanitation services. They established the legal basis for private sector management of water supply and independent tariff setting and regulations that are applicable to all urban areas.

15. The Ancient Monuments Protection Act (1991) states the rights and duties of the Government to make arrangements for the protection of historically and archaeologically important areas and monuments by preventing any misappropriation and misuse.

16. Nepal's procedures for environmental assessment of development projects are described in the Environment Protection Act (1997) and the Environment Protection Rules (1997), as amended). Projects that need EIA and IEE are identified in the rules. Accordingly, the responsibility for undertaking an IEE for this proposed project lies with the Kathmandu Upatyaka Khanepani Limited (KUKL/Project Implementation Directorate (PID) as the project proponent, on behalf of the Kathmandu Valley Water Supply Management Board (KVWSMB). Public involvement, including notification of stakeholders, dissemination of information, and consultation, is a requirement, particularly during the review and approval of the IEE report.

17. Public Notice of HPCIDBC about RoW of River: - The High-Powered Committee for Integrated Development of The Bagmati Civilization (HPCIDBC) had also published prohibition notice of construction of any structures on the Right of Way (RoW) of the Rivers of Kathmandu Valley. The notice was published on 19 Asadh 2063 (3 July 2012) in the government daily newspaper *(Gorkhapatra*) (Appendix 13). The HPCIDBC had not fixed the RoW for Khasyang Khusung river though, both the Bhaktapur municipality and Chagunarayan municipality have fixed the RoW of 12 m for the river. Hence, the RoW of 12 m will be used for executing the IS-03 work.

III. DESCRIPTION OF THE PROJECT

A. Existing Infrastructure Modernization and Expansion

18. In May to September 2011, a mapping exercise of the existing sewer systems in the five municipalities namely; Kathmandu, Lalitpur, Bhaktapur, Madhyapur-Thimi and Kirtipur, under KUKL/DSC/02 was carried out. A sewer asset management survey was carried out by KUKL Project Implementation Directorate (PID) on 2016. The exercise showed the approximate location and length of the sewers based on desktop analysis. However, the conditions of the sewers including the diameter, gradient, material type, joint details, and condition of manhole details were not covered by the study. **Error! Reference source not found.** shows the summary of existing sewer network length in the project district. The analysis records a total of 108.20 km of sewer existing in the project district, Bhaktapur.

Table III-1: Approximate Length of Existing Sewer Network in Bhaktapur District

Sn.	Municipality	Approximate length of existing sewer (Km)
1.	Bhaktapur	47.507
2.	Surya-Binayak	3.713
3.	Madhyapur Thimi	56.972
	Total	**108.192**

Source: Sewer asset management survey, PID 2016

B. Project Rationale

19. Improvement of wastewater systems are urgently needed in Kathmandu Valley because it is currently suffering from the lack of properly functioning sewerage systems. This project has been designed to raise the quality of the infrastructure and services of selected areas of Kathmandu Valley, thereby increasing the quality of life of the people.

20. Kathmandu Valley has gone through a phase of rapid and unplanned urbanization and industrialization without adequate infrastructure development. To improve the present conditions of the wastewater services in Kathmandu Valley, the Government, with the assistance of ADB, has embarked on a two-pronged improvement strategy that includes capital investments for infrastructure development, i.e. supply augmentation and system improvement, and institutional reforms.

21. Kathmandu Valley is the most densely populated region in Nepal whose population has been increasing rapidly, especially in Kathmandu, the center of administration, commercial, social, and economic activities. During the last 3 decades, growth in population has been significantly driven by in-migration. The in-migration is largely due to better employment and business opportunities and better educational and medical facilities, but also countrywide insurgency and security concerns in the recent years.

22. The rapid urbanization of Kathmandu Valley has brought negative impacts to its overall development. Water has become scarce as demand exceeds supply. Lack of operational wastewater system facilities has converted the holy Bagmati River including its other tributaries and sub-tributaries such as Hanumante, Manohara, Khasyang Khusung River into a highly polluted watercourse. Congested and crowded roads have brought hardship to travellers and road junctions have become garbage dumping sites. Despite these negative impacts, the urbanization of the valley has continued at a similar rate over the past 10 years. According to urban planners, from urban basic service management and disaster relief management aspects, Kathmandu Valley has a carrying capacity of only 5 million people.

23. Interceptor Sewer networks will be constructed improved and expanded.

24. KUKL, which legally commenced operation in February 2008, established a Project Management Unit. The Government and ADB in April 2009 have restructured the unit into a Project Implementation Directorate (PID) to manage and implement ADB-assisted projects. The PID includes a Safeguards Unit to monitor and evaluate all social and environmental aspects of ADB projects.

C. Description of Proposed Project

25. The proposed project includes (i) rehabilitation and expansion of sewerage network including property connections; (ii) rehabilitation and construction of interceptors along the streamsetc. Bhaktapur Muncipality and Changunarayan Municipality area the target area of the proposed project.For the better management of wastewater within Bhaktapur Municipality, the cleaning of existing sewers will be carried out in Sangam Chowk, Chochhen, Lachichha Gali, and Byasi Kamal Vinayak. Rehabilitation of existing combined sewer will be in Kamicha Galli, Gachhen, Dekocha, Hanumanghat, Chasukhel, Dockche, and Ichadole. Whereas separation by laying new storm water drain will be in Bhaktapur Industrial area, Wachu to gella, Thulo Byasi, Bhelukhel, Lakulach, Thucho tole.

26. The proposed interceptor sewer line of KKR, IS03, is along the both bank of the River situated at the border of Bhaktapur Municipality and Changunarayan Municipality within Bhaktapur District. In particular, the sewer provides service to ward number 6 and 2 of Bhaktapur Municipality and also, ward number 3 and 2 of Changunarayan Municipality.

27. Given the lack of information of the drainage network, it is difficult to identify the existing drainage network and expansion of sewerage network in Kathmandu valley. The project recommended an Assets Condition Survey to know the exact locations and conditions of the sewer network in the valley so that the cleaning of existing sewer and sewerage expansion can be made possible.

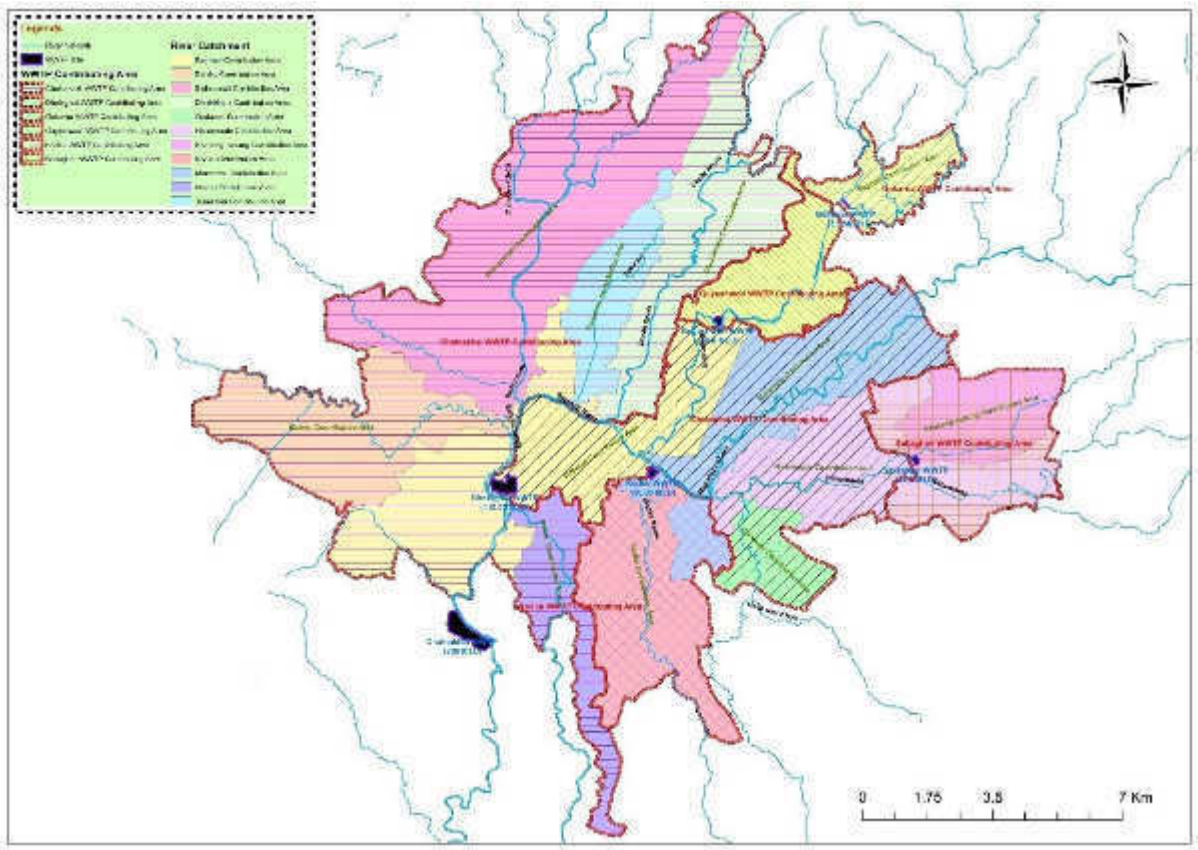


Figure III-1 Proposed IS Locations and Existing Natural Drainages within the Valley

28. The laying of new interceptors will be within the government own land and Right of Way (RoW) of Khasyang Khusung river.

29. The High-Powered Committee for Integrated Development of The Bagmati Civilization (HPCIDBC) had also published prohibition notice of construction of any structures on the Right of Way (RoW) of the Rivers of Kathmandu Valley. The HPCIDBC does not cover the RoW for Khasyang Khusung river though, both the Bhaktapur municipality and Chagunarayan municipality have fixed the RoW of 12 m for the river. Hence, the RoW of 12 m will be adopted for IS03 package.

30. The IS03 package includes the construction of Intercepting Sewerage System along both banks of the Khasyang Khusung River form Mili upstream to Sallaghari Hunumante bridge upto the Sallaghari WWTP downstream. The total Length of Interceptor Sewer along both bank of river is 7.86 km. Other major works include Hume pipe laying of 11.36 km; construction 182 Manholes, 3 Aqueducts/crossings and 14 overflow/outfall structures. The details of IS03 is given in the table below.

Table III-2: Interceptor Sewer Components and Features of the Project IS-03

Sn.	Particulars	Description
1.	Project	Extension and Construction of Intercepting Sewerage System along Khasyang Khusung River
2.	Total Length of Interceptor Sewer	7.86 km
3.	Major Work	Hume pipe laying: 11.36 km Manholes: 182 nos. Aqueducts/crossings: 3 Overflow/outfall structures: 14
4.	Contract No.	KUKL/WW/IS-03
5.	Contractor	LAMA-RAMAN-GOLDEN GOODS JV
6.	Contract Amount	NRs. 366,213,220.29 without provisional sum and VAT NRs. 413,820,938.93 including provisional sum and VAT
7.	Commencement Date	15 December, 2017
8.	Contract Period	18 months
9.	Completion Date	8 June 2019

Source: Detailed Design and Construction Supervision of Khasyang Khususng Interceptor, 2015

D. Detail design

31. The inceptor sewers along the both banks of the KKR start at the Milli/Wanti. KKR is the geographical boundary between Bhaktapur municipality on the left bank and Changunarayan municipality on the right bank. The wastewater is conveyed from the place of its production to the treatment plant through a network of sewers consisting of lateral (tertiary), branch, inceptor and trunk/interceptor sewers. The storm water from the inceptor sewer will be overflowed to the nearby stream or river through the diversion structures. The interceptor sewers would thus carry the dry weather flow (DWF). The sewer line along the left bank of KKR passes through Kalighat in Bhaktapur Minicipality. Kalighat is a ritual religious place where creamation of bodies takes place. At this point, the sewer line is proposed to detour from bank of the KKR for some distance and meet the left bank of the river downstream of the Kalighat. The right bank inceptor crosses the KKR through an aqueduct and meets the left bank inceptor at the manhole MH-KKL-94 near Sallaghari. The inceptor then runs towards the Sallaghari WWTP and discharges wastewater to the manhole MH-HUR-160 of the Hanumante interceptor. The wastewater is then conveyed to the Sallaghari WWTP through Hanumante interceptor.

32. Deko land development plan/pooling is under planning by Bhaktapur Municipality along the left bank of the KKR from Deko to Sallaghari. The design data of the land development plan provided by the Municipality has been taken into consideration in the design of Khasyang Khusung inceptors. The manholes have been located along the left bank of the KKR considering the proposed roads in the land development plan. The finished level of the manhole along the both banks of the KKR has been kept as per the road level in the land development plan. The various sections of the inceptors proposed under Contract Package KUKL/WW/IS-03 are presented in Table III-3.

Table III-3: Inceptor Sewer Sections

S. No.	Area/Catchment	Section	
		From Manhole	To Manhole
1	Khasyang Khusung River Right Bank	MH-KKR-01	MH-KKR-94
		MH-KKR-94	MH-KKL-90
2	Khasyang Khusung River Left Bank	MH-KKL-01	MH-KKL-90
		MH-KKL-90	MH-KKL-94
		MH-KKL-94	MH-HUR-160

33. The base map shows all the inceptor sewers including the IS03 is shown in the Figure III-2 and the schematic layout plan of sewer interceptor -IS03 is shown below in figure III-3 from which the sewer deviation in the Kalighat area is clear from the Manhole number KKL 34 to KKL38.

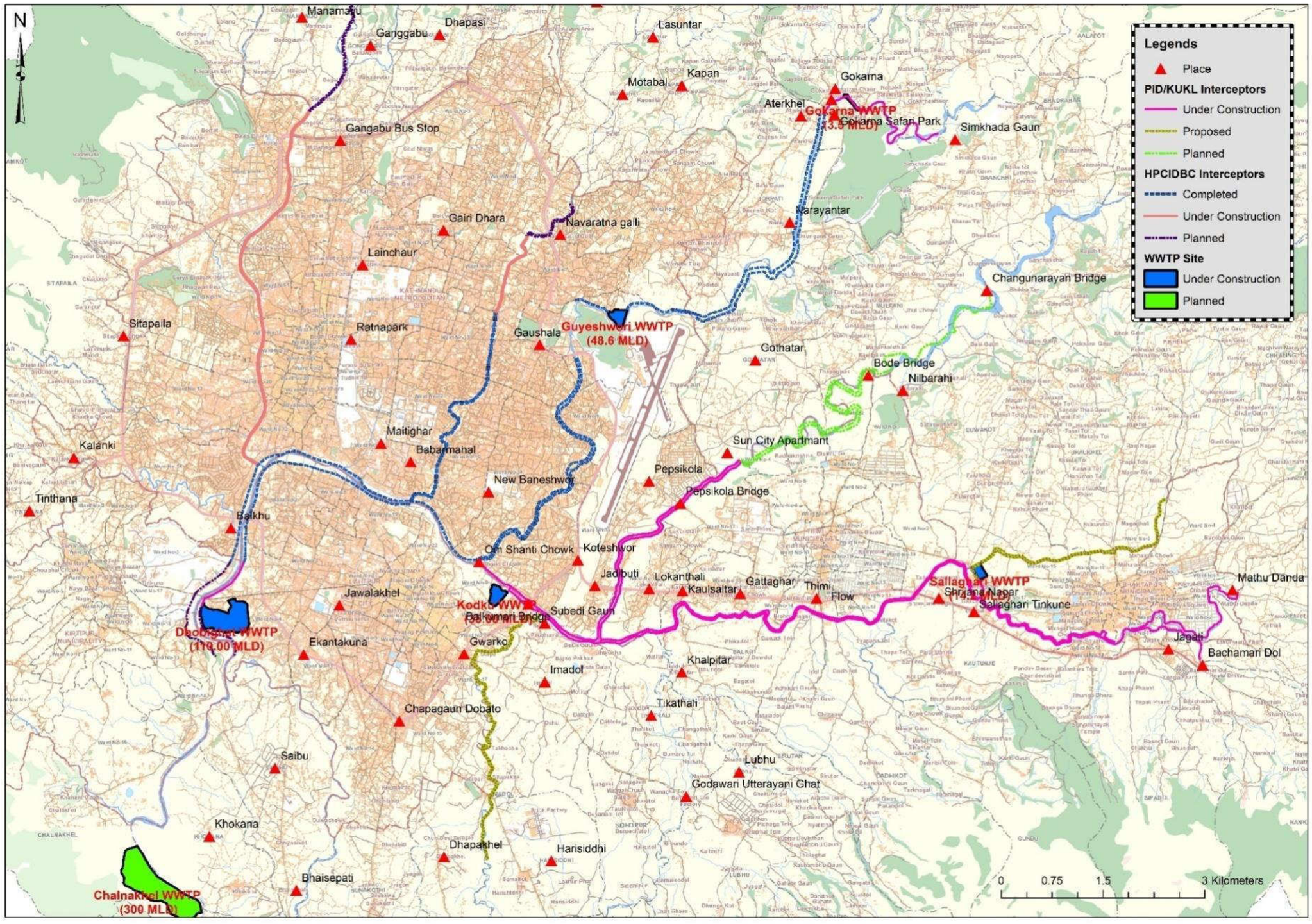


Figure III-2 Project Base Map

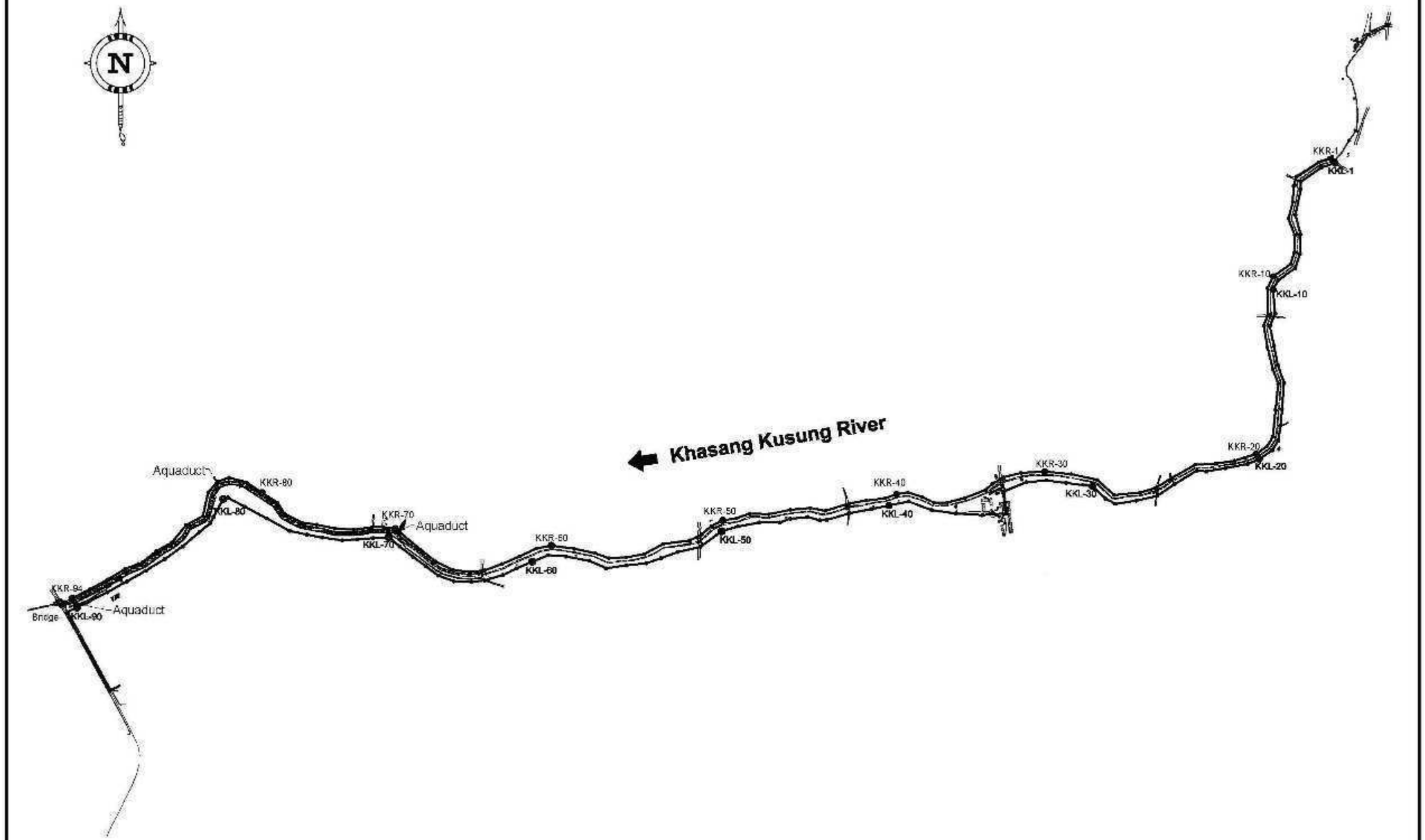


Figure III-3 Layout of Sewer Interceptor IS03

34. The chainage wise detail information of sewer inceptor and environmental condition area presented in the table below:

Table III-4: Chainage wise Details of Inceptor Wewer, IS03 Package

Manhole number		Chainage		Length	Diameter	Width required for excavation	Width of available ROW	Vegetation to be cleared? (Y/N)	Number of trees to be cut	Utilities to be shifted	Area for materials storage	Amount of excess materials to be disposed
From	To	From	To	m	mm	m	m					
KKR1	KKR2	0+000	0+029	29	500	1.28	12	yes (cultivated land)	0	None		
KKR2	KKR3	0+029	0+089	60	500	1.28	12	yes (cultivated land)	0	None		
KKR3	KKR4	0+089	0+111	22	500	1.28	12	yes (cultivated land)	0	None		
KKR4	KKR5	0+111	0+147	36	500	1.28	12	yes (cultivated land)	0	None		
KKR5	KKR6	0+147	0+186	39	500	1.28	12	yes (cultivated land)	0	None		
KKR6	KKR7	0+186	0+226	40	500	1.28	12	yes (cultivated land)	0	None		
KKR7	KKR8	0+226	0+265	39	500	1.28	12	yes (cultivated land)	0	None		
KKR8	KKR9	0+265	0+293	28	500	1.28	12	yes (cultivated land)	0	None		
KKR9	KKR10	0+293	0+340	47	500	1.28	12	yes (cultivated land)	0	None		
KKR10	KKR11	0+340	0+370	30	500	1.28	12	yes (cultivated land)	0	None		
KKR11	KKR12	0+370	0+430	60	500	1.28	12	yes (cultivated land)	0	None		
KKR12	KKR13	0+430	0+456	26	500	1.28	12	yes (cultivated land)	0	None		
KKR13	KKR14	0+456	0+506	50	500	1.28	12	yes (cultivated land)	0	None		
KKR14	KKR15	0+506	0+556	50	500	1.28	12	yes (cultivated land)	0	None		
KKR15	KKR16	0+556	0+591	35	500	1.28	12	yes (cultivated land)	0	None		
KKR16	KKR17	0+591	0+651	60	500	1.28	12	yes (cultivated land)	0	None		
KKR17	KKR18	0+651	0+711	60	500	1.28	12	yes (cultivated land)	0	None		
KKR18	KKR19	0+711	0+736	25	500	1.28	12	yes (cultivated land)	0	None		
KKR19	KKR20	0+736	0+767	31	500	1.28	12	yes (cultivated land)	0	None		
KKR20	KKR21	0+767	0+818	51	500	1.28	12	yes (cultivated land)	0	None		
KKR21	KKR22	0+818	0+861	43	500	1.28	12	yes (cultivated land)	0	None		
KKR22	KKR23	0+861	0+906	45	500	1.28	12	yes (cultivated land)	0	None		
KKR23	KKR24	0+906	0+966	60	500	1.28	12	yes (cultivated land)	0	None		
KKR24	KKR25	0+966	1+012	46	500	1.28	12	yes (cultivated land)	0	None		
KKR25	KKR26	1+012	1+047	35	500	1.28	12	yes (cultivated land)	0	None		
KKR26	KKR27	1+047	1+106	59	500	1.28	12	yes (cultivated land)	0	None		
KKR27	KKR28	1+106	1+157	51	500	1.28	12	yes (cultivated land)	0	None		
KKR28	KKR29	1+157	1+217	60	500	1.28	12	yes (cultivated land)	0	None		
KKR29	KKR30	1+217	1+277	60	500	1.28	12	yes (cultivated land)	0	None		
KKR30	KKR31	1+277	1+331	54	500	1.28	12	yes (cultivated land)	0	None		
KKR31	KKR32	1+331	1+371	40	500	1.28	12	yes (cultivated land)	0	None		
KKR32	KKR33	1+371	1+401	30	500	1.28	12	yes (cultivated land)	0	None		
KKR33	KKR34	1+401	1+421	20	500	1.28	12	yes (cultivated land)	0	None		
KKR34	KKR35	1+421	1+472	51	500	1.28	12	yes (cultivated land)	0	None		
KKR35	KKR36	1+472	1+512	40	500	1.28	12	yes (cultivated land)	0	None		
KKR36	KKR37	1+512	1+541	29	500	1.28	12	yes (cultivated land)	0	None		
KKR37	KKR38	1+541	1+571	30	500	1.28	12	yes (cultivated land)	0	None		

Manhole number		Chainage		Length	Diameter	Width required for excavation	Width of available ROW	Vegetation to be cleared? (Y/N)	Number of trees to be cut	Utilities to be shifted	Area for materials storage	Amount of excess materials to be disposed
KKR38	KKR39	1+571	1+605	34	500	1.28	12	yes (cultivated land)	0	None		
KKR39	KKR40	1+605	1+631	26	500	1.28	12	yes (cultivated land)	0	None		
KKR40	KKR41	1+631	1+659	28	500	1.28	12	yes (cultivated land)	0	None		
KKR41	KKR42	1+659	1+701	42	500	1.28	12	yes (cultivated land)	0	None		
KKR42	KKR43	1+701	1+739	38	500	1.28	12	yes (cultivated land)	0	None		
KKR43	KKR44	1+739	1+796	57	500	1.28	12	yes (cultivated land)	0	None		
KKR44	KKR45	1+796	1+830	34	500	1.28	12	yes (cultivated land)	0	None		
KKR45	KKR46	1+830	1+875	45	500	1.28	12	yes (cultivated land)	0	None		
KKR46	KKR47	1+875	1+925	50	500	1.28	12	yes (cultivated land)	0	None		
KKR47	KKR48	1+925	1+968	43	500	1.28	12	yes (cultivated land)	0	None		
KKR48	KKR49	1+968	2+000	32	500	1.28	12	yes (cultivated land)	0	None		
KKR49	KKR50	2+000	2+031	31	500	1.28	12	yes (cultivated land)	0	None		
KKR50	KKR51	2+031	2+060	29	500	1.28	12	yes (cultivated land)	0	None		
KKR51	KKR52	2+060	2+089	29	500	1.28	12	yes (cultivated land)	0	None		
KKR52	KKR53	2+089	2+119	30	500	1.28	12	Yes (bush land)	0	Electric pole and transformer (private)		
KKR53	KKR54	2+119	2+179	60	500	1.28	12	yes (cultivated land)	0	None		
KKR54	KKR55	2+179	2+228	49	500	1.28	12	yes (cultivated land)	0	None		
KKR55	KKR56	2+228	2+268	40	500	1.28	12	yes (cultivated land)	0	None		
KKR56	KKR57	2+268	2+308	40	500	1.28	12	yes (cultivated land)	0	None		
KKR57	KKR58	2+308	2+341	33	500	1.28	12	yes (cultivated land)	0	None		
KKR58	KKR59	2+341	2+389	48	500	1.28	12	yes (cultivated land)	0	None		
KKR59	KKR60	2+389	2+441	52	500	1.28	12	yes (cultivated land)	0	None		
KKR60	KKR61	2+441	2+476	35	500	1.28	12	yes (cultivated land)	0	None		
KKR61	KKR62	2+476	2+516	40	500	1.28	12	yes (cultivated land)	0	None		
KKR62	KKR63	2+516	2+560	44	500	1.28	12	yes (cultivated land)	0	None		
KKR63	KKR64	2+560	2+602	42	500	1.28	12	yes (cultivated land)	0	None		
KKR64	KKR65	2+602	2+636	34	500	1.28	12	yes (cultivated land)	0	None		
KKR65	KKR66	2+636	2+676	40	500	1.28	12	yes (cultivated land)	0	None		
KKR66	KKR67	2+676	2+718	42	500	1.28	12	yes (cultivated land)	0	None		
KKR67	KKR68	2+718	2+761	43	500	1.28	12	yes (cultivated land)	0	None		
KKR68	KKR69	2+761	2+821	60	500	1.28	12	yes (cultivated land)	0	None		
KKR69	KKR70	2+821	2+827	6	500	1.28	12	yes (cultivated land)	0	None		
KKR70	KKR71	2+827	2+835	8	500	1.28	12	yes (cultivated land)	0	None		
KKR71	KKR72	2+835	2+861	26	500	1.28	12	yes (cultivated land)	0	None		
KKR72	KKR73	2+861	2+887	26	500	1.28	12	yes (cultivated land)	0	None		
KKR73	KKR74	2+887	2+929	42	500	1.28	12	yes (cultivated land)	0	None		
KKR74	KKR75	2+929	2+971	42	500	1.28	12	yes (cultivated land)	0	None		
KKR75	KKR76	2+971	3+013	42	500	1.28	12	yes (cultivated land)	0	None		
KKR76	KKR77	3+013	3+047	34	500	1.28	12	yes (cultivated land)	0	None		
KKR77	KKR78	3+047	3+091	44	500	1.28	12	yes (cultivated land)	0	None		
KKR78	KKR79	3+091	3+120	29	500	1.28	12	yes (cultivated land)	0	None		
KKR79	KKR80	3+120	3+162	42	500	1.28	12	yes (cultivated land)	0	None		
KKR80	KKR81	3+162	3+205	43	500	1.28	12	yes (cultivated land)	0	None		

Manhole number		Chainage		Length	Diameter	Width required for excavation	Width of available ROW	Vegetation to be cleared? (Y/N)	Number of trees to be cut	Utilities to be shifted	Area for materials storage	Amount of excess materials to be disposed
KKR81	KKR82	3+205	3+245	40	500	1.28	12	yes (cultivated land)	0	None		
KKR82	KKR83	3+245	3+271	26	500	1.28	12	yes (cultivated land)	0	None		
KKR83	KKR84	3+271	3+276	5	500	1.28	12	yes (cultivated land)	0	None		
KKR84	KKR85	3+276	3+204	28	500	1.28	12	yes (cultivated land)	0	None		
KKR85	KKR86	3+204	3+359	55	500	1.28	12	yes (cultivated land)	0	None		
KKR86	KKR87	3+359	3+402	43	500	1.28	12	yes (cultivated land)	0	None		
KKR87	KKR88	3+402	3+453	51	500	1.28	12	yes (cultivated land)	0	None		
KKR88	KKR89	3+453	3+493	40	500	1.28	12	yes (cultivated land)	0	None		
KKR89	KKR90	3+493	3+553	40	500	1.28	12	yes (cultivated land)	0	None		
KKR90	KKR91	3+553	3+574	41	500	1.28	12	yes (cultivated land)	0	None		
KKR91	KKR92	3+574	3+602	46	500	1.28	12	yes (cultivated land)	0	None		
KKR92	KKR93	3+602	3+666	46	500	1.28	12	yes (cultivated land)	0	None		
KKR93	KKR94	3+666	3+711	45	500	1.28	12	yes (cultivated land)	0	None		
KKR94	KKL90	3+711	3+734	23	500	1.28	12	yes (cultivated land)	0	None		
KKL1	KKL2	0+000	0+032	32	500	1.28	12	No (planning road)	0	None		
KKL2	KKL3	0+032	0+089	57	500	1.28	12	No (planning road)	0	None		
KKL3	KKL4	0+089	2+105	60	500	1.28	12	No (planning road)	0	None		
KKL4	KKL5	2+105	0+165	60	500	1.28	12	No (planning road)	0	None		
KKL5	KKL6	0+165	0+210	45	500	1.28	12	No (planning road)	0	None		
KKL6	KKL7	0+210	0+254	44	500	1.28	12	No (planning road)	0	None		
KKL7	KKL8	0+254	0+288	34	500	1.28	12	No (planning road)	0	None		
KKL8	KKL9	0+288	0+335	47	500	1.28	12	No (planning road)	0	None		
KKL9	KKL10	0+335	0+359	24	500	1.28	12	No (planning road)	0	None		
KKL10	KKL11	0+359	0+414	55	500	1.28	12	No (planning road)	0	None		
KKL11	KKL12	0+414	0+444	30	500	1.28	12	No (planning road)	0	None		
KKL12	KKL13	0+444	0+489	45	500	1.28	12	No (planning road)	0	None		
KKL13	KKL14	0+489	0+534	35	500	1.28	12	No (planning road)	0	None		
KKL14	KKL15	0+534	0+576	42	500	1.28	12	No (planning road)	0	None		
KKL15	KKL16	0+576	0+636	60	500	1.28	12	No (planning road)	0	None		
KKL16	KKL17	0+636	0+672	36	500	1.28	12	No (planning road)	0	None		
KKL17	KKL18	0+672	0+708	36	500	1.28	12	No (planning road)	0	None		
KKL18	KKL19	0+708	0+733	25	500	1.28	12	No (planning road)	0	None		
KKL19	KKL20	0+733	0+768	35	500	1.28	12	No (planning road)	0	None		
KKL20	KKL21	0+768	0+797	29	500	1.28	12	No (planning road)	0	None		
KKL21	KKL22	0+797	0+847	50	500	1.28	12	No (planning road)	0	None		
KKL22	KKL23	0+847	0+891	44	500	1.28	12	No (planning road)	0	None		
KKL23	KKL24	0+891	0+912	21	500	1.28	12	No (planning road)	0	None		
KKL24	KKL25	0+912	0+972	60	500	1.28	12	No (planning road)	0	None		
KKL25	KKL26	0+972	1+019	47	500	1.28	12	No (planning road)	0	None		
KKL26	KKL27	1+019	1+067	48	500	1.28	12	No (planning road)	0	None		
KKL27	KKL28	1+067	1+115	48	500	1.28	12	No (planning road)	0	None		
KKL28	KKL29	1+115	1+140	25	500	1.28	12	No (planning road)	0	None		
KKL29	KKL30	1+140	1+180	40	500	1.28	12	No (planning road)	0	None		
KKL30	KKL31	1+180	1+240	60	500	1.28	12	No (planning road)	0	None		

Manhole number		Chainage		Length	Diameter	Width required for excavation	Width of available ROW	Vegetation to be cleared? (Y/N)	Number of trees to be cut	Utilities to be shifted	Area for materials storage	Amount of excess materials to be disposed
KKL31	KKL32	1+240	1+285	45	500	1.28	12	No (planning road)	0	None		
KKL32	KKL33	1+285	1+330	45	500	1.28	12	No (planning road)	0	None		
KKL33	KKL34	1+330	1+385	55	500	1.28	12	No (planning road)	0	None		
KKL34	KKL35	1+385	1+435	50	500	1.28	-	No (Existing black topped road)	0	Water supply pipe (possible)		
KKL35	KKL36	1+435	1+489	54	500	1.28	12	No (planning road)	0	None		
KKL36	KKL37	1+489	1+549	60	500	1.28	12	No (planning road)	0	None		
KKL37	KKL38	1+549	1+603	54	500	1.28	12	No (planning road)	0	None		
KKL38	KKL39	1+603	1+659	56	500	1.28	12	No (planning road)	0	None		
KKL39	KKL40	1+659	1+704	45	500	1.28	12	No (planning road)	0	None		
KKL40	KKL41	1+704	1+744	40	500	1.28	12	No (planning road)	0	None		
KKL41	KKL42	1+744	1+795	51	500	1.28	12	No (planning road)	0	None		
KKL42	KKL43	1+795	1+848	53	500	1.28	12	No (planning road)	0	None		
KKL43	KKL44	1+848	1+864	16	500	1.28	12	No (planning road)	0	None		
KKL44	KKL45	1+864	1+892	28	500	1.28	12	No (planning road)	0	None		
KKL45	KKL46	1+892	1+932	40	500	1.28	12	No (planning road)	0	None		
KKL46	KKL47	1+932	1+957	25	500	1.28	12	No (planning road)	0	None		
KKL47	KKL48	1+957	2+003	46	500	1.28	12	No (planning road)	0	None		
KKL48	KKL49	2+003	2+052	39	500	1.28	12	No (planning road)	0	None		
KKL49	KKL50	2+052	2+090	38	500	1.28	12	No (planning road)	0	None		
KKL50	KKL51	2+090	2+150	60	500	1.28	12	No (planning road)	0	None		
KKL51	KKL52	2+150	2+202	52	500	1.28	12	No (planning road)	0	None		
KKL52	KKL53	2+202	2+242	40	500	1.28	12	No (planning road)	0	None		
KKL53	KKL54	2+242	2+277	35	500	1.28	12	No (planning road)	0	None		
KKL54	KKL55	2+277	2+322	35	500	1.28	12	No (planning road)	0	None		
KKL55	KKL56	2+322	2+368	46	500	1.28	12	No (planning road)	0	None		
KKL56	KKL57	2+368	2+409	41	500	1.28	12	No (planning road)	0	None		
KKL57	KKL58	2+409	2+463	54	500	1.28	12	No (planning road)	0	None		
KKL58	KKL59	2+463	2+504	41	500	1.28	12	No (planning road)	0	None		
KKL59	KKL60	2+504	2+542	38	500	1.28	12	No (planning road)	0	None		
KKL60	KKL61	2+542	2+581	39	500	1.28	12	No (planning road)	0	None		
KKL61	KKL62	2+581	2+615	34	500	1.28	12	No (planning road)	0	None		
KKL62	KKL63	2+615	2+658	43	500	1.28	12	No (planning road)	0	None		
KKL63	KKL64	2+658	2+688	30	500	1.28	12	No (planning road)	0	None		
KKL64	KKL65	2+688	2+728	40	500	1.28	12	No (planning road)	0	None		
KKL65	KKL66	2+728	2+765	37	500	1.28	12	No (planning road)	0	None		
KKL66	KKL67	2+765	2+800	35	500	1.28	12	No (planning road)	0	None		
KKL67	KKL68	2+800	2+835	45	500	1.28	12	No (planning road)	0	None		
KKL68	KKL69	2+835	2+874	39	500	1.28	12	No (planning road)	0	None		
KKL69	KKL70	2+874	2+906	32	500	1.28	12	No (planning road)	0	None		
KKL70	KKL71	2+906	2+941	35	500	1.28	12	No (planning road)	0	None		
KKL71	KKL72	2+941	2+976	35	500	1.28	12	No (planning road)	0	None		
KKL72	KKL73	2+976	3+011	35	500	1.28	12	No (planning road)	0	None		
KKL73	KKL74	3+011	3+056	45	500	1.28	12	No (planning road)	0	None		

Manhole number		Chainage		Length	Diameter	Width required for excavation	Width of available ROW	Vegetation to be cleared? (Y/N)	Number of trees to be cut	Utilities to be shifted	Area for materials storage	Amount of excess materials to be disposed
KKL74	KKL75	3+056	3+091	35	500	1.28	12	No (planning road)	0	None		
KKL75	KKL76	3+091	3+131	40	500	1.28	12	No (planning road)	0	None		
KKL76	KKL77	3+131	2+191	60	500	1.28	12	No (planning road)	0	None		
KKL77	KKL78	2+191	3+245	54	500	1.28	12	No (planning road)	0	None		
KKL78	KKL79	3+245	3+289	44	500	1.28	12	No (planning road)	0	None		
KKL79	KKL80	3+289	3+300	11	500	1.28	12	No (planning road)	0	None		
KKL80	KKL81	3+300	3+346	46	500	1.28	12	No (planning road)	0	None		
KKL81	KKL82	3+346	3+361	15	500	1.28	12	No (planning road)	0	None		
KKL82	KKL83	3+361	3+393	32	500	1.28	12	No (planning road)	0	None		
KKL83	KKL84	3+393	3+443	50	500	1.28	12	No (planning road)	0	None		
KKL84	KKL85	3+443	3+493	50	500	1.28	12	No (planning road)	0	None		
KKL85	KKL86	3+493	3+542	49	500	1.28	12	No (planning road)	0	None		
KKL86	KKL87	3+542	3+592	50	500	1.28	12	No (planning road)	0	None		
KKL87	KKL88	3+592	3+642	50	500	1.28	12	No (planning road)	0	None		
KKL88	KKL89	3+642	3+692	50	500	1.28	12	No (planning road)	0	None		
KKL89	KKL90	3+692	3+719	27	500	1.28	12	No (planning road)	0	None		
KKL90	KKL91	3+719	3+744	25	600	1.44	-	No (Main road)	0	None		
KKL91	KKL92	3+744	3+781	37	600	1.44	-	No (Main road)	0	None		
KKL92	KKL93	3+781	3+836	55	600	1.44	-	No (Main road)	0	None		
KKL93	KKL94	3+836	3+891	55	600	1.44	-	No (Main road)	0	None		
KKL94	HUR160	3+891	3+945	54	600	1.44	-	No (Main road)	0	None		

Characteristics of the inceptor sewers

35. The length of the inceptor sewers of Khasyang Khusung inceptor has been determined to be 7.679 km; 3.945km along the left and the 3.734km along right bank of the river. In addition to the inceptor sewer the provision of 57.5 meters of 300 mm diameter has been made for connection to the sewer network of Deko Planning. The length of the various pipe diameters with the depth‘s distribution of the excavation shows that 92.2% of the pipe length has excavation depth below 3 m and 7.2% of the pipe length has excavation depth of between 3 to 4 m (Table III-5). Only 0.4% of pipe length has excavation depth of 4 to 5 m. More than 95% of the length of proposed sewers is of diameter of 500 mm and the rest with 600mm diameter.

Table III-5: Length of Excavation

S.N.	Diameter	Depth of Excavation					Total	
		0-1	1-2	2-3	3-4	4-5		%
	(mm)	(m)	(m)	(m)	(m)	(m)	(m)	
1	500	140	5013	1847	400	30	7430.00	96.8
2	600	0	23	55	171	0	249.00	3.2
Total		140	5036	1902	571	30	7679.00	100

Existing Outfalls

36. There are 3 existing outfalls; 2 at left bank and 1 at right bank, discharging raw sewage into KKR through outfall without any treatment. The raw sewage presently being discharged to the river is proposed to be diverted to the wastewater treatment plant. The details of the exiting outfalls with the connection point to the manhole of the inceptor sewer, pipe diameters and their invert RL are presented in the Table III-6.

Table III-6: Existing Outfalls and Their Connection Point

Existing outfall		**Connection Point**		
Bank of KKR	**Number**	**Manhole**	**Pipe Diameter (mm)**	**Invert RL (m)**
Right Bank of KKR	1	KKR-32	900	1312.394
Left Bank of KKR	2	KKL-40	600	1309.310
		KKR-46	600	1308.599

Manholes

37. A total of 182 manholes are proposed in which, more than 99 % of manholes are of Type III which has manhole diameter of 1.5 m and depth of less than 5 m (Table III-7).

Table III-7: Manhole Numbers

Manhole Type/Location	Type III	Type V	Total
Manhole Diameter (mm)	1500	1800	
Pipe Diameter (mm)	500-1000	1200	
Manhole Depth (m)	<5	<5	
Khasyang Khusung River Right Bank	88	1	89
Khasyang Khusung River Left Bank	93	0	93
Total Numbers	181	1	182
Total Percent	99.5	0.5	100.0

River Crossing Work

38. Altogether 3 aqueducts, above river bed type, have been proposed for river crossing work. The aqueduct across the KKR from manhole MH-KKR-94 to manhole MH-KKL-90 rest on a base slab, which also acts as the pile cap. A pair of pile, circular and with 400mm diameter, has been introduced at each end of aqueduct span. The length of the pile below river bed level is 3.0 m. The other two aqueducts are of smaller span which crosses the kholsis. These aqueducts rest on the manholes and are not supported on piles. The details of the proposed river crossing works are presented in Table III-8.

Table III-8: River Crossing Work

S.N.	Location	Length	Pipe Size	Section between Manholes	
		(m)	(mm x mm)	From	To
1	Khasyang Khusung Right	6	500 x 500	MH-KKR-69	MH-KKR-70
2	Khasyang Khusung Right	5	500 x 500	MH-KKR-83	MH-KKR-84
3	Khasyang Khusung Right to Left	23	600 x 600	MH-KKR-94	MH-KKL-90

Overflow Structure

39. Given the topographical nature of the sewer alignment, Type II overflow structures have been proposed in IS03 package. Type IIA overflow structure has been proposed at the place where existing sewer is discharging the wastewater into the river through an outfall. The existing sewer is connected to the Type IIA overflow structure and an overflow pipe to the outfall in the river is provided. Type IIB overflow structure has been proposed at places where there is likely that new sewer will be laid. Altogether 14 outflow structures are proposed of which 13 are of Type IIB (Table III-9).

Table III-9: Overflow Structures

S.N.	Area/Catchment	Number		
		Type IIA	Type IIB	Total
1	KKR Right Bank	1	9	10
2	KKR Left Bank		4	4
Total		1	13	14

River Training Works

40. Given the characteristics of the KKR, its bank and area above the both bank, the river training works is not required along the both banks of the KKR for sewer construction works. Woth the banks of the KKR have cultivated land throughout its length. Rich vegetation is found on both the banks of the river, which has improved the banks stopping the soil erosion from the banks during flood time. Also, different trees are growing on both the banks. Now the trees can be taken as in developed stage already. They have further improved the bank's total strength against soil eroding nature and resisting the bank's soil capacity with working as bio engineering River Training Structure. The growing trees have highly protected the proposed KKR banks and so no over excavation on its banks can be proposed. Similarly, the River is found lying on almost the flat terrain and it has not yet resulted any severe loss in the past. For most of the time and for more than ten months the river carries a minimal flow of discharge in its section. The undulations in the River valley are not found in the River section throughout its proposed length. Likewise, there is minimal house or no house on both the banks of the River in its close vicinity. Hence, river training works has not been proposed along both banks of the KKR in the proposed sewer routes.

E. Design Consideration:

41. The detailed engineering design is under the considerations of Design Horizon, Service Area, population and waste water quantity. The Sewerage network is designed for 15 years of service life, as adopted in the PPTA and Conceptual Wastewater Master Plan (CWWMP, 2010). Thus it is proposed to be designed for the design year of 2030.

42. Bhaktapur municipality area completely included in the service area of Kathmandu Valley Waster Water Management project while Changunarayan municipality is partly covered (PPTA, 2012). Approximately 36% of the area of Changunarayan municipality has been included as service area. The total coverage area of the service area in these municipalities is 1768.06 ha as shown in the table below (Table III-10). Further, the alignment of the IS03 passes through ward number 2 and 6 of Bhaktapur Municipality and 3 and 2 of Changunarayan municipality.

Table III-10: Coverage Area in the Project Municipality

S.N.	Service Area	Total Area	Coverage Area	
		(ha)	(ha)	(%)
1	Bhaktapur Municipality	670.61	670.61	100
4	Changunarayan Municipality	3043.96	1097.45	36
		3714.57	1768.06	48

43. Population projection is done for the year 2030 since the project has the design year of 2030. The design population of the service area within Bhaktapur municipality and Changunarayan municipality is 127,395 (Table III-11).

Table III-11: Population of Service Area

S. N.	Type of Area	Census Population		Growth Rate	Projected Population		
		2001	2011	(%)	2015	2020	2030
1	Bhaktapur Municipality	72,543	81,748	1.20	85,740	91,018	102,548
2	Changunarayan Municipality	9,231	12,565	3.13	14,356	17,093	24,847
	Total	81,774	94,313	-	100,096	108,111	127,395

44. PPTA and CWWMP have used the percent of population with off-site connection as 70, 70, 75 and 80 % in the years 2011, 2015, 2020 and 2030 years respectively. Adopting the same reference, a population of 101,917 out of 127,395 is estimated to offsite system (Table III-12).

Table III-12: Population Connected to Offsite System

SN	Service Area	Projected Population			Population Connected to off-site system		
		2015	2020	2030	2015	2020	2030
1	Bhaktapur Municipality	85,740	91,018	102,548	60,018	68,265	82,039
2	Changunarayan Municipality	14,356	17,093	24,847	10,049	12,820	19,878
Total		100,096	108,111	127,395	70,067	81,085	101,917

45. The total quantity of wastewater generation, Dry Weather Flow (DWF), is the sum of domestic and nondomestic (industrial and commercial) wastewater plus infiltration. The estimation of domestic sewage quantities is based on per capita water consumption of the population, as done in CWWMP (2010). For determining the domestic wastewater quantity generation, the per capita water demand of 100 lpcd up to the year 2020 and 120 lpcd in the year 2030 (also recommended by PPTA) and the return factor of 0.8 (considering the higher

discharge of wastewater from improved sanitation facilities and water supply conditions and also the Manual on Sewerage and Sewage Treatment", Ministry of Urban Development, December 2013). Similarly, the nondomestic wastewater is proposed to be taken as 10% of domestic wastewater. DSC considers the infiltration allowance of 0.1 lps/ha as adopted by CWMWP (2010) is very high as it gives infiltration quantity higher than the quantity of the domestic sewage in many instances. Instead DSC recommends an infiltration as 10% of domestic sewage which seems to be a realistic figure. Similarly, DSC adopted a peak factor of 2.5 for the design of the interceptor/inceptor sewers. The quantity of the wastewater generation in the service area of Bhaktapur Municipality and Changunarayan Municipality detailing the various types of the wastewater in different years is presented in Table below. It shows that, the total DWF in the years 2015, 2020 and 2030 are 6.73 MLD, 7.79 MLD, and 11.7 MLD respectively (Table III-13).

Table III-13: Wastewater Quantity in MLD in Bhaktapur Municipality and Changunarayan Municipality

Service area	Domestic Sewage	Non-domestic Sewage	Infiltration	Average DWF	Peak DWF	Domestic Sewage	Nondomestic Sewage	Infiltration	Average DWF	Peak DWF	Domestic Sewage	Nondomestic Sewage	Infiltration	Average DWF	Peak DWF
	2015					2020					2030				
Bhaktapur Municipality	4.801	0.480	0.480	5.762	12.964	5.461	0.546	0.546	6.554	14.745	7.876	0.788	0.788	9.451	21.265
Changunarayan Municipality	0.804	0.080	0.080	0.965	2.171	1.026	0.103	0.103	1.231	2.769	1.908	0.191	0.191	2.290	5.153
Total of Service area	5.61	0.6	0.6	6.73	15.1	6.49	0.6	0.6	7.79	17.5	9.78	1	1	11.7	26.4

IV. DESCRIPTION OF THE PROJECT AREA

A. Background

i. Location

46. The Kathmandu Valley is the largest drainage basin of Nepal which lies between the latitudes 27°32'13" and 27°49'10" north and longitudes 85°11'31" and 85°31'38" east. It is located at a mean elevation of about 1,300 meters (4,265 feet) above sea level. The boundary of the Kathmandu Valley and project area developed from the map study along with the municipalities and rural municipality within the Kathmandu Valley are shown in Figure IV-1. The valley covers an area of 60,423.13ha of which Kathmandu, Lalitpur and Bhaktapur district comprises the 56%, 25% and 20% of the area respectively. The IS03 project municipalities; Bhaktapur municipality and Changunarayan municipality covers an area of 670.61ha and 6,080.08ha respectively (CBS 2011). Within service area, the area of Bhaktapur Municipality is completely included while only 36.05 % of Changunarayan municipality is included in service area (Design Design).

Figure IV-1Kathmandu Valley Boundary

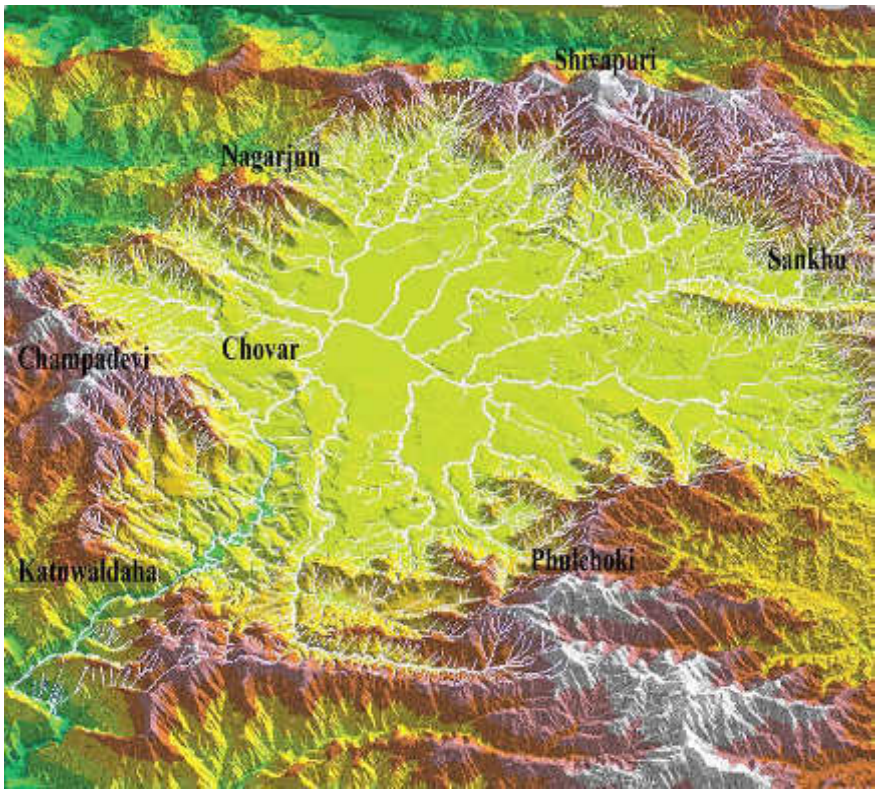
47. Bhaktapur, one of the adjoining cities of Kathmandu, is located between latitudes 27°37' to 27°44'N and longitudes 85°02' to 85°32'E. It is bounded by Kavrepalanchowk in the east, Kathmandu and Lalitpur in the west, Kathmandu in the north, and Kavrepalanchowk and Lalitpur in the south. The average 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 rivers. The Bagmati River does not flow through Bhaktapur; both the Manohara and Hanumante rivers are the major tributaries of the Bagmati River.

48. Bhaktapur is one of the three historic royal towns in Kathmandu Valley (15 km from Kathmandu) with rich architectural and urban heritage. It was founded in the 8th century A.D. and has remained relatively well preserved. The city is inhabited by 83,893 people. The main occupation of its inhabitants is agriculture; crafts (weaving, wood carving, metal crafts, clay

work, and stone carving) and businesses are secondary occupations. The Bhaktapur Durbar Square and the Changunarayan Temple are among the seven world heritage sites in Kathmandu Valley.

ii. Topography

49. Surrounded by green hills, Kathmandu Valley is about 25 km from east to west. The average altitude is 1,320 m ranging from 1200 to 2300 m above the mean sea level. Kathmandu valley is bowl shaped and is surrounded by four mountain ranges: Shivapuri (standing at elevation of 2,800 meters), Phulchowki (2,795 meters), Nagarjun (2,825 meters) and Chandragiri (2,300 meters).The Kathmandu Valley basin surrounded by the mountain ranges are as shown in Figure IV-2. Bagmati, Bishnumati, Dhobikhola, Manohara and Hanumante are prominent rivers rivers flowing in the Kathmandu Valley. The mountains from where these rivers originate are in the elevation range of about 3,000 m and have passes, which provide access to and from Kathmandu Valley.



Source: HPCIDBC (2012)

Figure IV-2Mountain Ranges of Kathmandu Valley

iii. Geology and Soil

50. Kathmandu Valley is a synclinal tectonic basin consisting of fluvio-lacustrine deposits from the Pleistocene age resting on top of Precambrian metamorphic bedrock. In Kathmandu Municipality, the Gokarna (to the northeast) and Kalimati (to the southwest) formations are predominant. In Latitpur Municipality, the Kalimati and Chapagaun formations are predominant. Bhaktapur City is located on a hill that is part of the Kalimati formation. The Kalimati formation is grey-to-dark silt clay and clayey silt. Organic clay, fine sand beds, and peat layers are commonly found. SM silty-sand soil layers intercalated with silt or clay layers are often found from 5 to 15 meters down. Such layers are prone to liquefaction under moderate to high intensity earthquakes (MMI = VIII-IX).

iv. Climate

51. The climate of Kathmandu Valley is sub-tropical cool temperate with maximum of 35.6°C in April and minimum of –3°C in January. The annual average humidity is 75%. The temperature in general is 19°C to 27°C in summer and 2°C to 20°C in winter. The monthly average maximum temperature is 28.9 °C and monthly minimum temperature is 13.8 °C. The average rainfall is 1465 millimeters, most of which falls during June to September. Rainfall is concentrated, and more than 75% of the annual rainfall occurs during the monsoon months beginning June through September. The months between October and May are dry and rainfall is sporadic.

v. Environmental Condition

52. The proposed Khasyang Khusung River is situated on almost flat terrain without any undulations. Cultivated land is existed on both bank of the KKR throughout the length. The major vegetation grown in the project alignment includes rice, wheat, corn, vegetables, and a variety of fruit including bananas and oranges. Some section comprises brick kiln excavation area and other private and public cultivated land along the river banks. The left bank has been mostly covered with vegetation. Trees of different species growing along the river bank throughout the length are protecting the river bank naturally. The river has been considered as a holy river at a Crimation Site (Kali Ghat) situated at the bank of the river at Kasan area. However, the river condition of the Khasyang Khusung cannot be taken as acceptable condition. Waste from the adjacent cultivated land and household toilet wastes are found to be disposed directly into the river. The flow of the river is very low and is like an open sewerage with very bad order prevails all along the river alignment. Direct disposal of solid waste, household sewer, agricultural waste, surface runoff etc. are the major sources of KKR water pollution. Further, opening and clearing of 12-meter width earthen track has been carried out by Bhaktapur Municipality under Deko planning along the left bank of the KKR. It is further revealed that the same sort of planning is under process at the right bank of the river from the Changunarayan Municipality.

B. River System

53. The urbanization of Kathmandu Valley is strongly associated with the river systems. Rivers in the valley have very high value for natural resources and human settlements in the basin, Most of the important temples, shrines, ghats, etc. are located in the river banks. Therefore, protection of rivers is very important for protection and conservation of both natural resources as well as culture heritage in the valley.

54. The Bagmati River is the principal river of Bagmati basin comprising of 57 rivers and rivulets as its tributaries. It originates at Baghdwar; about 15 km northeast of Kathmandu in Shivapuri hill and drains out through the Chobhar gorge in Kathmandu. It is 163 km long and is a tributary of the river Ganges.The average annual daily discharge of Bagmati at Pandhera Dovan some distance downstream of Kathmandu is 136 m^3/sec. The maximum discharge is 4050 m^3/sec and the minimum 5.8 m^3/sec. This river system consists of streams like Bishnumati, Dhobikhola, Manohara, Nakkhu, Kodku, Tukucha and Godavari River.

55. People see Bagmati as a source of civilization rather than just a river. There are so many shrines and cemeteries located in its bank. Gokarneshwar, Guheswori and Pashupatinath temples are famous shrines enlisted in the World Heritage which reflects its importance to all the races of human civilization. The Hindus and Buddhists, for whom the river water has special religious and spiritual values, consider the water of Bagmati as a holy water 'JAL'.

56. The urbanization of Kathmandu Valley is strongly associated with the deterioration of quality of river systems. The process of urbanization is now more rapid and massive, mainly because it is now rampant in the Kathmandu Valley. The present trends in the Valley clearly reflect that there will be a growing pressure on limited resources. The direct impacts of present urbanization are especially visible in the Bagmati River with its tributaries.

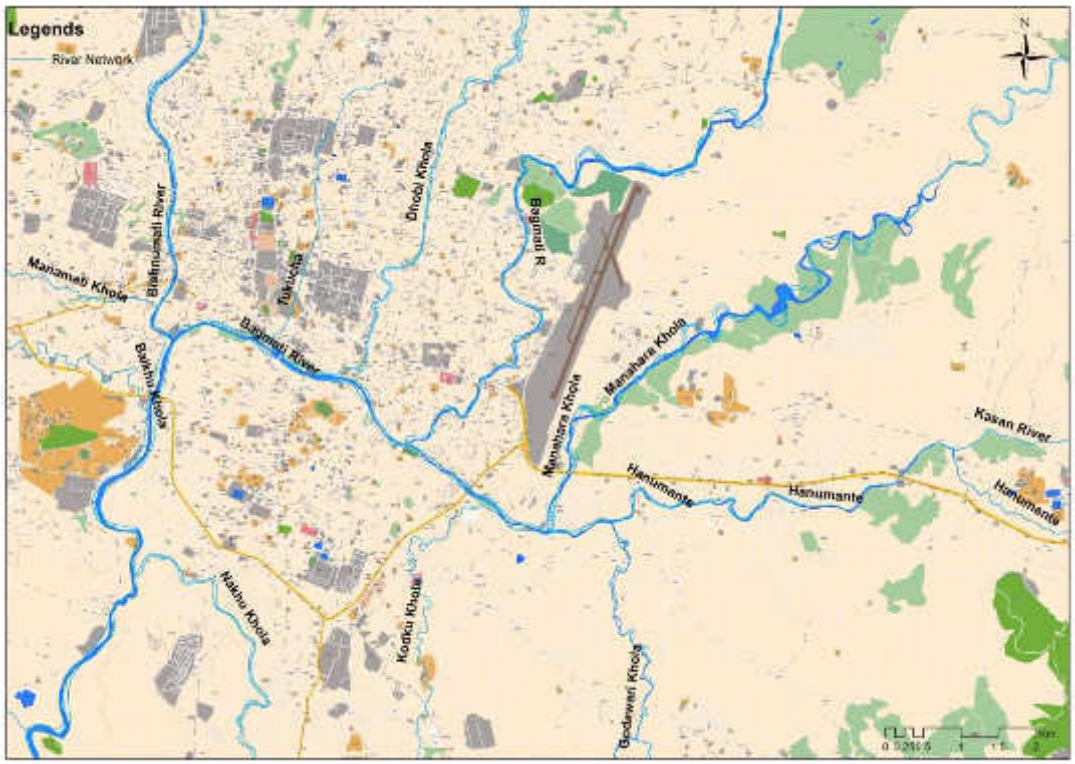


Figure IV-3River System of Kathmandu Valley

57. At present, the Bagmati River with its tributaries has been used as a dumping site for all types of wastes. The rich, cultural heritage along the river and the tributaries such as traditional monuments, Ghats and temples, is slowly eroding. The River has been widely used for different purposes from sand extraction to land encroachment.

58. The pollution in Bagmati River is caused by several factors like throwing of garbage, encroachment of river banks, withdrawal of sand and the disposal of untreated wastewater. The practice of quarrying sands from the river bank has also affected. Sands act as natural purifier. They trap pollutants and also maintain steady water table. The rampant digging of the sands for commercial purposes has destabilized the whole river system. The course of the river has already changed at many places.

59. It has been reported that more than half of the fish species in the Bagmati River have disappeared. This might indicate that some parts of the river are biologically dead. Shortage of water has forced certain section of the society to use the polluted water from the river which has caused heavy losses due to water born diseases.In recent times, the people of Kathmandu have expressed deep concern for Bagmati River environment indicating that there is a level of awareness which needs to be transformed into action.

60. In order to improve and reinstate the environment of Bagmati River and its tributaries within Kathmandu valley and up to Katwal Daha, the Government of Nepal (GoN) has formed the High Powered Committee for Integrated Development of the Bagmati Civilization (HPCIDBC) for Implementation and Monitoring of the Bagmati Area Sewerage Construction/Rehabilitation Project (BASP). The committee has already laid down interceptor sewers along both the banks of the Bagmati River from Gokarna to Sankhamul Bridge. The sewers from Gokarna to Tamraganga are connected to Guheswori Wastewater Treatment Plant and treated waste water is discharged in to the Bagmati River through Tamraganga/ Tilganga sewer tunnel bypassing the Pashupati Aryaghat area. The laying of interceptor sewers from Shankhamul to Balkhu is in progress.

61. This Kathmandu Valley Wastewater Management Project (KVWMP) has plan to implement the expansion of interceptor sewers, the expansion and improvement of the neighborhood

sewer network and construction of the new wastewater treatment plants in the Kathmandu Valley. The combined effect of the KVWMP and BASP is expected to improve the wastewater management capacity of Kathmandu Valley with improvement in the water quality of the rivers, their tributaries and ecosystem.

C. Existing Water Supply System

62. The Kathmandu Valley water distribution network system has been developed over more than 100 years and is very complex and *ad hoc*. The present service area being served by the KUKL system in the Kathmandu Valley comprises the municipal areas of Kathmandu, Lalitpur, Bhaktapur, Madhyapur Thimi, Kirtipur and parts of adjoining areas primarily around Kathmandu, Lalitpur and Bhaktapur.

63. The water distribution system has been installed and expanded at various times from the days of the Rana regime in the country over one 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 comprehensive development and expansion of the systems, especially in Kathmandu and Lalitpur, took place when the World Bank provided assistance to a series of IDA 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 Nepal Water Supply Corporation (NWSC). In February 2008, the water sector assets in the Kathmandu Valley were transferred for operation to a government owned company called Kathmandu Upatyaka Khanepani Limited (KUKL).

Surface Water Quantity

64. Kathmandu Valley has a chronic water shortage. The sole water utility operator, Kathmandu Upatyaka Khanepani Limited (KUKL) has not been able to meet water demand of rapidly growing population of urban and semi urban areas of KV within its service area. The present water demand is estimated to be 350 MLD by KUKL in 2012 while the supply is limited to about 150 MLD in wet season and about 90 MLD in dry season. There is thus a large disparity between demand and the supply. KUKL is adapting intermittent supply to cope with this shortage and customers are sometimes supplied with drinking water for only about an hour once every six days during wet season, and as little as 1-2 hours once every eight days during dry season in some locations. The demand for drinking water is increasing by about 6% annually.

65. The existing system taps water from 35 surface water sources and 59 deep tube wells located in different parts of the valley. The total production of water from all these sources is about 150 MLD in wet season and 90 MLD in dry season with an average production of about 120 MLD throughout the year. During the wet season, surface water constitutes about 90% of water production while this drops down to about 70% during dry season. The groundwater is a major source of water during dry season and constitutes about 30% of water supplied by KUKL.

66. As the water utility has not been able to meet water demand, many private and government institutions and industries have constructed their own deep tube-wells to use groundwater directly. KVWSMB estimates that the total quantity of groundwater being extracted in 2011 is 81.6 MLD, out of which 31.6 MLD is being used by KUKL for municipal supply and the balance (50 MLD) is extracted by private sector for uses in hotels, industries, bottled water manufacturing, tanker supplies and new housing colonies.

67. Tanker water supply is a flourishing business in Kathmandu Valley and is complementing the meagre supply of water by the utility. Their supply areas are mainly urban core and newly developed semi-urban areas where there is high density of hotels, hospitals and other

institutions. There are 700-800 water tankers in operation being operated by about 216 water tanker entrepreneurs. Most tanker companies have their own water sources and use both surface as well as groundwater source, but predominantly groundwater source. The combined production of these companies is about 12.58 MLD (11.10 MLD groundwater and 1.48 MLD surface water) in the dry season and about 6.36MLD (5.44 MLD groundwater and 0.92 MLD surface water) during the wet season. Research conducted in 2012 indicated that the total amount of water supplied through tankers is about 25.58 MLD in dry season and 15.36 MLD in wet season. This supply constitutes about 8% of water demand or about 44% of water reaching consumers from KUKL supplies.

68. The shallow wells are a common source of water used to supplement inadequate public supply for domestic use. Most houses in Kathmandu Metropolitan City (KMC) have either dug well or shallow tube-well (Rower pump). In 2009, the number of houses possessing a private well was about 74.3 % in KMC and 20.2% in Bhaktapur Municipality.

69. The other sources commonly used are bottled water, stone spouts, rain water harvesting arrangement and other springs and rivers.

70. The present consumption of water in Kathmandu Valley varies between municipalities and the availability of water. The population of KMC and LMC has higher water demand than other smaller municipalities. The population with private tube-wells has significantly higher consumption than people without them. The consumer survey carried out in 2009 showed that every house in Kathmandu with a private tube-well consumed 98 liters per capita per day (lpcd) in average whereas a house without private well consumed only 47 lpcd. The analysis of data from the baseline survey showed that the total water consumed for domestic purposes (from all sources) in Kathmandu valley is about 107.43 MLD. Table IV-1 presents the breakdown of water consumption in five municipalities and the VDCs (Consumer Survey, 2009).

71. The unconstrained water demand in the five municipalities and the VDCs is estimated by the baseline survey study to be in the range of 100-120 lpcd for fully plumbed connections, 50 lpcd for yard taps and 25 lpcd for public stand post. These demand values have been used for forecasting post-Melamchi water demand (year 2020 water demand) while preparing the Capital Investment and Asset Management Program (CIAMP) for Kathmandu Valley. The CIAMP has assumed the water demand to grow with economic growth and availability of water. The water consumption in the year 2025 in Metropolitan Kathmandu is expected to be 135 lpcd for fully plumbed, 70 lpcd for yard tap and 45 lpcd for public stand post. The total water demand within the service area in Kathmandu Valley is estimated in CIAMP to be 445 MLD and 685 MLD in the year 2020 and 2025 respectively.

Table IV-1: Water Consumption by consumers in Kathmandu Valley from all sources

Municipality Name	Population (Year 2011)	Population Served by KUKL	Population Served	Population with Private Well in the Compound			Population with Private Tubewell in the Compound			Total Water Consumption
				Percentage	Per Capita Consumption	Total Consumption	Percentage	Per Capita Consumption	Total Consumption	
		(%)	(No.)	(%)	(lpcd)	(MLD)	(%)	(lpcd)	(MLD)	(MLD)
Kathmandu	1,006,858	84.9	854,851	74.3	97.7	62.04	25.7	46.9	10.30	72.34
Lalitpur	223,265	87.9	196,268	59.4	88.2	10.05	40.6	48.6	3.95	14.00
Bhaktapur	83,893	63.0	52,853	20.2	67.4	0.72	79.8	29.1	1.23	1.95
Madhyapur	84,259	55.0	46,342	37.5	67.4	1.17	62.5	29.1	0.84	2.01
Kirtipur	66,070	55.0	36,339	31.7	67.4	0.78	68.3	29.1	0.72	1.50
VDCs	666,002	42.1	281,229	54.9	67.4	10.41	45.1	41.2	5.23	15.64
Total	2,132,165		1,467,882			85.17			22.27	107.44

Source: Consumer Survey, 2009

Surface Water Quality

72. The Biological Oxygen Demand (BOD_5) level in different stretches of the Bagmati River at different seasons provides a clear indication of high level of pollution at all seasons of the year (BOD_5 levels range from 1.7 to 239.4 mg/l in the pre-monsoon, 2.1 to 84.7 mg/l in the monsoon, and 2.3 to 119.4 mg/l in the post-monsoon seasons). The main reason for the deteriorating water quality of the Valley's rivers is discharge of untreated sewage in the urban areas of Kathmandu, although solid waste dumping along the river is also a contributing factor.

73. Water treatment plants were installed from the very beginning of system development in order to improve the raw water quality and make it safe for drinking purpose. Balaju water treatment was built as a component of Tri Bhim Dhara system and Maharajgunj water treatment plant as a component of Bir Dhara system. With the expansion of the networks, more water treatment plants were built.

74. There are 21 water treatment plants (5 major and 16 smaller) in Kathmandu Valley water supply system with a total treatment capacity of about 85 MLD. Most of WTPs are capable of treating surface water and groundwater containing a high content of suspended solids, iron and ammonia. Most of water treatment plants are in poor state of maintenance and have not been consistent in producing acceptable water quality.

75. Bacteriological water quality deterioration during transmission is a significant problem due to ingression of polluted water into water supply pipe from leaking sewers during intermittent water supply. Pollution of drinking water is now very frequent and KUKL receives many complaints about it.

76. Almost every report on drinking water quality of Kathmandu reveals that most of water supply is contaminated with bacteria. The chemical quality of most of the water is within WHO guidelines.

Table IV-2: Comparative Analysis and Projection of BOD and DO at Different Locations in Kathmandu Valley along the Bagmati River in 2014, 2020 and 2030.

Location	BOD (mg/L)				DO (mg/L)		
	2014	2020	2030		2014	2020	2030
Gokarna	15.07	16.72	20.10		6.01	6.01	5.85
Gaurighat	33.06	9.29	42.32		5.38	5.19	4.72
Minbhavan	86.46	97.05	109.03		2.49	2.36	2.18
Teku	117.61	131.4	148.04		1.31	1.17	1.05
Dhobighat	118.0	131.98	148.93		1.013	0.92	0.82

Source: Mishra, B.K., et al. Assessment of Bagmati river pollution in Kathmandu Valley: Scenario-based modelling and analysis for sustainable urban development. Sustain. Water Qual. Ecol (2017)

77. Table IV-2 showed the comparative plots of monthly Dissolved Dxygen (DO) and Biological Oxygen Demand (BOD) values at five locations on the Bagmati River from upstream to downstream areas. In general, there are consistent seasonal variations in DO and BOD levels strongly associated with river discharge as DO and BOD approach 0 mg/l and 200 mg/l during the dry months of the year. The higher concentrations of DO and BOD in the dry months are also associated with the lower capacity for natural self-purification and dilution of pollutants due to reduced flows. Although it was believed that the river water pollution will be largely sorted out after the establishment of the new/rehabilitated WWTPs, plots of 2020 and 2030 show that DO and BOD values will remain far beyond acceptable limits. These data demonstrate that the current, as well as new/rehabilitated wastewater treatment plants, are largely inadequate to alleviate the Bagmati river pollution. By 2030, river water pollution will be much worse. There will be an increase of wastewater generation due to the greater population and socio-economic development despite rehabilitation, up-gradation and new wastewater management systems. Therefore, the new/rehabilitated wastewater infrastructures need to be expanded further with the increase of population, lifestyle and other socio-economic development activities resulting in a significant increase of wastewater. The quantity of wastewater generation is closely connected with management or pattern of water consumption. Thus, the simulation results of the WEAP model with adaptation scenarios can contribute to the improvement of water consumption pattern. One of the alternative measures for reducing water consumption and wastewater generation could be changes in the water utility pricing system. Alternative pricing such as an increase in water utility service fee (sum of water supply and sanitary service charges) can help in optimal use (reduction) of water consumption and also increase revenue for sustainable operation and management of water infrastructures. Water quality simulation in this study was based on the mean behaviour of the system. However, the wastewater generation rate, as well as water quality parameters, may be significantly different depending on the location, community, catchment, daily variation in streamflow in the rainy season and various others. Obviously, in 2020 and 2030, if there are no drastic measures to control pollution sources, Bagmati River water quality will be no longer eligible to supply for any practical purposes. Therefore, to ensure the water quality in future eligible for different uses, it is required now to have timely solutions to solve this problem (Mishra, B.K., et al.).

Groundwater

78. The groundwater aquifers of Kathmandu Valley are 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 the domestic as well as commercial demands is alarming because it depletes the groundwater level. There is haphazard extraction of water from both shallow and deep aquifers in Kathmandu Valley at present. According to the hydro-geological

conditions of Kathmandu 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 being exceeded by more than 70% by the Nepal Water Supply Corporation (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).

79. It is estimated that the groundwater of Kathmandu Valley is decreasing at an average rate of 2.5 meters per year. The depletion varies by location as the geological structure within the Kathmandu Valley is diverse. If the current rate of groundwater extraction continues, water will be sufficient for the next 90 years only (http://guthi.net).

80. Many households have installed rower pumps to extract groundwater from the shallow aquifer when NWSC could not meet their demand, but the bacteriological quality of the water poses some concern and has to be looked into. Due to the necessity of stopping groundwater mining, it is urgent to enact a law and formulate rules and regulations on the extraction of groundwater in Kathmandu Valley.

Groundwater Quality

81. Of the 57 deep tube wells tested, many have exceeded the country's standards for color, turbidity, ammonia, iron, and manganese. Two of the wells exceeded the arsenic standard. In some wells, ammonia concentration was found to be extremely high (50 fold above the threshold value of 1.5 mg/l). Twenty of the 57 wells showed bacterial contamination (ENPHO, 2009).

D. Melamchi and Other Water Supply Projects

82. Major infrastructural development works are on-going in Kathmandu Valley for augmentation of water supply, and expansion and rehabilitation of distribution network. Melamchi Water Supply Project (Melamchi Water Diversion Subproject 1), which will bring in170 MLD water from Melamchi River to Kathmandu Valley in the first phase, is under implementation. The subsequent phases of Melamchi project would bring in 170 MLD water from Yangri Khola in the second phase and 170 MLD water from Larke Khola in the third phase. The Melamchi water diversion project involves construction of about 27.5 km tunnel, river intake and a de-silting basin. The water treatment plant proposed at Sundarijal is under construction. The construction work of the project has been on-going since April 2009. Although the originally scheduled completion date of tunnel construction is September2013, it is now expected that the project will be completed by April 2016.

83. KUKL is currently implementing Kathmandu Valley Subproject 2 of Melamchi Project (Loan 1820). It has completed some works for immediate improvement of water supply service in Kathmandu Valley. KUKL PID is now implementing distribution network improvement works and other related activities.

E. Existing Wastewater System

Introduction

84. This section provides an overview of the wastewater services. It covers issues relating to the wastewater collection network and conveyance system. It includes the neighborhood system, main inceptors and interceptors which ultimately convey wastewater to the treatment plants. The issues concerning the wastewater treatment systems have been dealt in the separate reports under different packages.

Development of Sewer System in Kathmandu Valley

85. The first sewers in the Kathmandu valley were constructed around 1800 AD during Malla period for surface drainage and kitchen sullage and the sewerage system of the core areas of the valley between 1898 and 1950 during Rana regime. These were combined sewers. These Rana sewers were brick sewers typically 600 m circular sections or 1050 x 1050 mm ovoid sections. These were constructed with a flushing system using gates to allow sudden release of flows (SMEC, 1990).

86. After the widespread introduction of the water flush household toilets in the beginning of 1950, the houses of adjoining sewers started discharging domestic sewage into these sewers. Under the three International Development Assistance (IDA) projects, the first project undertaken during (1976 - 1983) and second (1980 – 1985) were constructed as separate sanitary and storm water systems. The first IDA project during 1976-83 laid down approximately 26 km of sanitary sewers including cleaning of some Rana sewers. Also in the IDA projects two wastewater treatment plants (WWTPs) were constructed at Balkumari (now known as Kodku) and Sundarighat (now known as Dhobighat). The most recent WWTP constructed is the Guheshwori WWTP under Bagmati Area Sewerage Project (BASP). Since then, many agencies have constructed sanitary sewers and storm water conduits in the valley. During the course of time majority of households were connected indiscriminately to both storm water conduits and sanitary sewer pipes.

87. The Nepal Water Supply and Sewerage Corporation (NWSC) also constructed about 35km of trunk sewer from 1983 to 1990. Municipalities also initiated a Public Private Partnership (PPP) model to accelerate the construction of sewers. Under the PPP model a large quantity of sewer pipelines was constructed during the recent time in the city core areas and surrounding urban clusters of Kathmandu valley. Such sewers under PPP model were laid haphazardly without any proper planning and design.

Sewer Materials

88. Existing sewer materials are mostly concrete pipes, with collar jointed pipes and brick manholes. In a IS-03 project at Buddhanagar, concrete rubber ring jointed pipes have been used. This is in line with the recommendations of the CWWMP.

Construction Standards

89. The PPTA (2012) has raised serious concerns about the current construction standards of the sewerage network, especially based on inspections in Buddhanagar and Minbhawan areas. From other observations, the poor standard of work is found widespread. Pipes are laid with little attention to gradient, and bedding joints are not water-proof. The implications of the poor construction practices include:

- high infiltration and inflow of storm water and groundwater into sewerage network
- potential contamination of adjacent water pipes (especially as the water network is intermittent in operation)
- hydraulic capacity is impossible to determine due to the uneven grades between manholes
- blockages are likely to be more common
- poor covering leads to broken pipes
- poor bedding leads to settlement which leads to exfiltration/leakage of
- sewage from the pipe or excessive inflow/infiltration into the sewers
- poor quality of construction including that of manholes leads to depression in road surfaces
- little attention is paid on the impact of construction to local residents and customers, and to workers' health and safety.

House Connections

90. KUKL is the only authority responsible for house connections in the valley. However, many private land developers and house owners have been connecting to the city sewer network illegally without due procedure. As per PPTA report, this practice is widespread – e.g. the house owner approaches to the KUKL for legal permission only if there is a necessity of black-topped road cutting for connection to nearby manhole. KUKL has not been updating the house connection figures and the official figure of 93,000 is considered to be outdated.

Sewer Network Systems

91. In the past the Kathmandu valley used to have two different sanitary systems: the conservation system where wastes are collected, conveyed and disposed of without water and water carriage system where collection, conveyance and disposal using water borne system. The conservation system is no more in use.

92. The Kathmandu Valley has three separate systems to collect domestic sewage. They are separate, combined and partially combined/separate system. The combined system is designed to collect and convey both sanitary and storm water with storm relief (overflow) structures so that treatment plant is not overloaded during rainy season.

93. There are no reliable records of existing sewers of all five municipalities and their adjoining surrounding semi urban areas. According to the Conceptual Wastewater Master Plan 2010, the expected total length of sewers is of the order of 700 to 800 km, but this figure is not based on any measurement from the field or maps. The master plan has only presented a wastewater service area with existing sewer pipe network of Kathmandu valley. But no field verification of existing sewer network with details such as their sizes, grades and condition were carried out during preparation of conceptual master plan. The service areas adopted for master plan include all 5 municipalities and 17 surrounding VDCs (Tinthana, Sitapaila, Syuchatar, Gongbu, Manamaiju, Dhapasi, Mahankal, Gothatar, Mulpani, Jorpati, Gorkana, Kapan, Budhanilkantha, KhadkaBhadrakali, Imadol, Dhapakhel and Saibu).

Branch and Tertiary Systems

94. Branch and Tertiary Systems collect sewage directly from households and transfer to the larger main inceptor system. The total length of branch and tertiary sewer network is reported as 192 km (KVEO, 2007). The sewers usually used are 150 mm diameter reinforced concrete pipes with collar joints. The laying of sewer pipes as branch and tertiary network is rapidly expanding in newly developed urban areas. Municipalities have also initiated a Public Private Partnership (PPP) model to accelerate the construction of branch and tertiary sewer networks in the municipality's core urban areas. Municipalities and local communities have jointly connected a large number of households involving reinforced concrete sewer pipes under a public private participation (PPP) model in mostly core urban areas. The emphasis of these schemes is on solving local drainage problems. According to KUKL, the sizing of sewers appears to be haphazard and grading of sewer pipes is poorly controlled and quality of construction is found poor due to less supervision and monitoring by the technical teams.

95. The IDA implemented Phase I and II sewers are the most heavily blocked sewers as considered by the KUKL's sewerage operation and maintenance staff. Regarding the jointing of pipes in branch and tertiary networks, KUKL had carried out investigations on adopting spigot and socket joint types (with rubber ring). At that time, such types of joint were not available in the market place.

Main Inceptor Sewers

96. The records on main inceptor sewers, which combine flows from upstream system and discharge it to the trunk or interceptor sewer, are not available as many agencies especially municipalities are also involved in their design and construction. The main inceptor sewers are also constructed from reinforced concrete pipe with collar joints.

Interceptors

97. Interceptor sewers are the main trunk sewers which collect sewer from inceptor systems and they are usually laid along the river banks leading to the treatment plants or sites. If the sewer network connecting to the interceptor is a combined sewer, a predetermined flow only will be conveyed to the interceptor or trunk sewer during high flows. There is about 40 km of interceptors as per ICIMOD (2007) reports. The Nepal Water Supply and Sewerage Corporation (NWSC) also constructed about 35km of trunk sewer from 1983 to 1990.

98. As reported in the conceptual wastewater master plan and additional information received from the agencies involved in wastewater sector, the existing interceptors along the major rivers are shown in **Error! Reference source not found.**4.

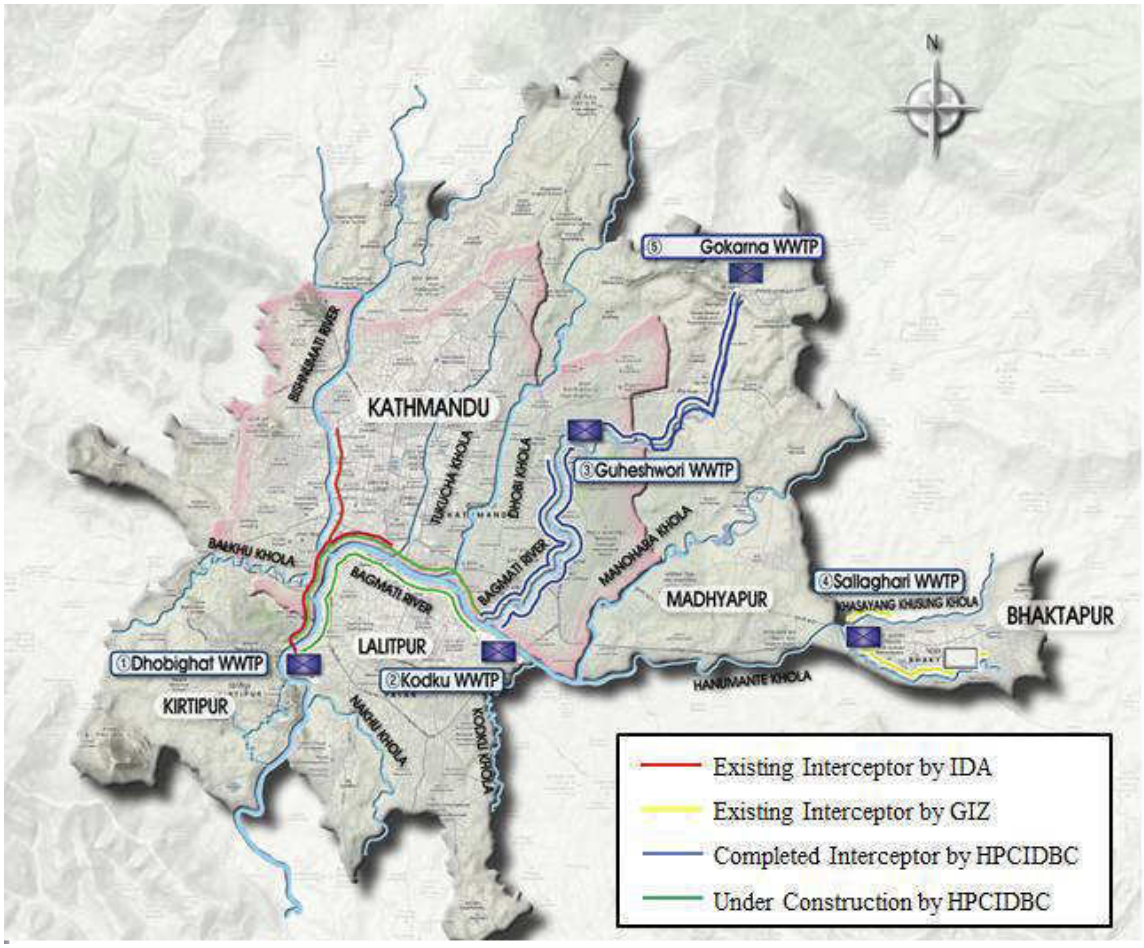


Figure IV-4 Existing Interceptors

The details of exiting interceptors along the major rivers are as follows:

A) IDA Interceptors

99. In the IDA first phase project (c1980), the following interceptors were constructed.

- Right bank of Bagmati River (from Tukucha Khola confluence to Sundarighat pumping station)
- Left bank of Bishnumati from Dhalko to Teku.

100. Meanwhile, the interceptor from Teku to Dhobighat has not been functioning for several years. In addition, a pressure main with 800 mm. dia. DI pipe from Sundarighat pumping station to Dhobighat WWTP (1.76 km.) was constructed but breached many years ago (early 1980s) and is not functioning.

B) HPCIDBC Interceptors

101. HPCIDBC has constructed around 22 km sewer network in the upstream catchment area of Guheshwori WWTP in recent years. HPCIDBC has been continuing the construction of interceptors from upstream of Bagmati River and planning laying down to Sundarighat pumping station. Although the construction of interceptors along Bishnumarti and Dhobi Khola are included in this package originally, HPCIDBC has intended to construct these interceptors. Hence, these interceptors have not been included in this package.

102. At present, HPCIDBC is also engaged with river improvement work of Bagmati River. Its works include laying of interceptors, and construction of 8m wide roads and 15 m green belts on both sides of Bagmati Rver from Jorpati to Dhobighat. Table IV-3 provides summary of interceptors under HPCIDBC program.

Table IV-3: Summary of Interceptors under HPCIDBC Program

Location	Length (m)	Status
Gokarna – Guheshwori	6,000 × 2	Under operation
Tilganga – Minbhawan	4,000 × 2	Construction completed
Minbhawan - Shankhamul Bridge	on both sides	Under construction
Shankhamul Bridge - Sundarighat	on both sides	Under construction

D) GTZ Interceptors

103. GIZ (previously GTZ) designed and constructed combined sewer and two WWTPs in Bhaktapur Municipality. With some minor deficiencies, the sewer network is still functioning. The south inceptor which used to feed wastewater to Sallaghari WWTP was out of operation for many years due to pumping breakdown. As an alternate to that inceptor, GIZ designed a new inceptor with gravity system in 2002 but this has not materialized to date. The PPTA proposed two Interceptors along both banks of Hanumante River. The GIZ designed inceptor cannot be used as right bank interceptor as new settlements have been developed along the proposed route. Besides, this interceptor cannot collect sewage from the whole catchment.

F. Existing Storm Water Disposal System

104. The storm water in Kathmandu Valley is drained to rivers through road side drains, storm sewers and combined sewers. The old sewers in Kathmandu Valley were constructed mainly for surface drainage and kitchen sullage. These brick sewers of 1050 x 1050 mm ovoid sections or 600 mm circular sections were constructed with a flushing system using gates to allow sudden release of flows to clean the system. These storm water sewers were converted to combined sewer after water flushed toilet system was introduced, and domestic sewage discharged into these sewers.

105. There has been large number of storm water drains and combined sewers constructed in urban areas of Kathmandu Valley by NWSC/KUKL and the municipalities. Many sewers have also been constructed under the community participation program where the beneficiaries contribute as much as 20 to 65% of the development cost and the rest is borne by either the municipalities or NWSC/KUKL. The ownership of these sewers is not fully identifiable and the maintenance of such sewers is either done by KUKL, the municipalities or by the community itself. In case of sewers where the maintenance is done by the community themselves, they have refrained from paying sewerage charges to KUKL.

106. In most parts of urban areas of the valley, there is no separation of sanitary sewer sand storm water drains. Most households are connected to either one or both forms of drainage depending on what type of sewer is closer or most convenient, which means that almost all sewers in Kathmandu Valley are presently operating as combined sewers. Only the town of Kirtipur has managed to maintain a separation of sanitary and storm water to some extent because there are road side open channels to collect storm water. They have adopted this since the early stage of development. The sewerage system constructed later has been used mainly as a sanitary sewer.

107. There is no clear demarcation about which agency is responsible for development and maintenance of the storm water system. Although the Department of Roads is primarily responsible for development and management of storm water drains, a lot of the responsibility also rests with KUKL as it is operating and maintaining many combined sewers. The management of combined sewers therefore by default also includes management of some storm water. As the local roads inside the municipality come under the jurisdiction of municipalities, the municipal authorities are also responsible. The municipalities complain that this additional responsibility has been given to them without allocating additional financial resources to manage it.

108. The responsibility for development and maintenance of the storm water drainage system will become more important when a policy of separation of sanitary sewer and storms ewer is implemented. KVWSMB and KUKL will be responsible for development and operation of sanitary sewers while new arrangements will be required to be put in place for development, operation and maintenance of storm water system.

G. Existing Solid Waste Disposal System

109. The PPTA (2012) has roughly estimated that about 20% of solid waste generation is spread to open water ways. The five municipalities in the valley generate approximately 650 tonnes of solid waste daily of which more than 70% comes from the KMC. The final disposal sites are always controversial and opposed by the local people and much of the solid waste is disposed at the river banks and in open areas. The current location of disposal is located at Sisdol - 25 km west from Kathmandu. However, this landfill site was designated for three years that have already passed. A new municipal waste disposal site has been identified and is in the process of being developed.

110. The daily solid waste generation is assumed to be 0.25 kg/p/d. Studies have revealed that the composition of solid waste in Kathmandu is mainly organic (58 to 66%) with 5% plastics. The use of plastic bags has increased over the years. Since plastic bags are not-bio-degradable their use should be discouraged or even banned.

111. The large amount of accumulated solid waste in the Kathmandu Valley is a major issue. This is due to the demands of the people nearby the landfill site who obstruct the trucks carrying the solid waste. One alarming issue is the dumping of hazardous and infectious wastes of hospitals together with domestic solid wastes – considering that over 20% of solid waste is dumped in Kathmandu to the waterways. Most of the plastics and reusable materials like bottles, metals etc. are picked up daily by scavengers.

112. Tourism is one of Nepal's most important industries and if it is to thrive, solid waste management should be tackled well in all the municipalities with a top priority.

113. There have been many well-intended attempts to improve the solid waste management situation of Kathmandu Valley. In addition to landfill solutions, it could also be useful to pay more attention to alternative technologies with smaller carbon footprints. This could include bio-gas production, bio-ethanol for fuel from bio-degradable waste organification technology for electricity generation. These options are very attractive for Public Private Partnership (PPP).

The products can be sold is a fuel for cars and energy industry and by-products to farmers as fertilizer.

114. Sewers collect considerable solid wastes which contribute to blockages. Dumping of solid waste along river banks also affects the quality of river water.

H. Issues and Implications for this Project

115. The on-going Melamchi water supply project is expected to be completed by 2015/16. This is expected to increase the wastewater flow in Kathmandu Valley significantly. The existing sewerage system is grossly inadequate to deal with this additional sewage flow. It is therefore necessary that the collection system is strengthened and the transmission and treatment systems are adequately developed to deal with the situation.

116. The ingression of sewage into water supply pipelines (in many core areas of Kathmandu) is one of the most serious problems presently faced by KUKL. The reasons for such ingression include the proximity of water supply pipes and sewers, intermittent and low pressure in the water pipelines, and blocked and leaking sewers (for example non-water tight brick sewers, sewers constructed of concrete pipes without installing collar for jointing). The corrosion of water pipes coming in contact with leaked sewage has led to leakage of GI pipe and subsequent ingression of sewage into water supply mains. The close coordination of water supply and sewerage projects in design and construction are essential to tackle this problem.

117. KUKL is currently carrying out distribution network improvement (DNI) to prepare network for Melamchi water. The improvement works will involve replacement of most of water supply pipes from trunk main to service pipeline and will involve excavation of many roads and lanes. The improvement works have already started in some areas on a pilot scale and major works are expected to start by the end of 2012. The construction of sewers under the present project will not start until 2014. So, there is a need to re-excavate roads to implement the project. This will create disruptions of traffic and inevitably cause problems to the public.

118. Combined sewers complicate collection and operation of sewers in both dry and wet seasons. The lack of coordination and demarcation between sanitary sewers and storm water systems needs to be addressed in order to ensure sustainable operation of the systems.

119. While deficiencies in the solid waste sector are beyond the scope of this report and this project, it is recognized that poor solid waste collection inevitably compromises the operation and effectiveness of any improved wastewater system.

I. Socio-economic Profile

General

120. The census population of Kathmandu valley is 2380771 of which majority of population, approximately 70% of total, lives in Kathmandu district. Bhaktapur district inhabit a population of 296710 of that, a total of 81,748 (28%) and 55,019 (19%) lives Bhaktapur Municipality and Changunarayan Municipality are respectively in 2011 (CBS 2011). In the project district, the average HH size is 4.44, sex ratio is 103.5 and population density is 2560. In Kathmandu valley, Hindu and Buddhist are the main religion with Christian and Muslims as minors. Similarly, Hindu, 88%, is the main religion in Bhaktapur district, followed by Buddhist,9%, and Christains, 2%. (CBS 2011). Similarly, the ethnicity of the district shows the dominancy of Newar (46%) followed by Chhetree (20%) and Brahman-Hill (19%). Regarding education, approximately, 77 % of the population in Bhaktapur are literate (CBS 2011).

Table IV-4: Ward Level Population of Project Municipality

Municiplaity	Ward	HH	total	male	Female
Bhaktapur	2	2273	10553	5271	5282
	6	1529	7212	3634	3578
Changunarayan	2	1396	6532	3323	3209
	3	1254	5820	2923	2897
Total		6452	30117	15151	14966

Employment

121. The economy of Kathmandu Valley is based on trade, commerce, and manufacturing industries (e.g., carpets and garments). Other important sectors are agriculture, education, transport, and hotels and restaurants. Tourism is also a key component of the Valley's economy. However, in the rural areas, the economy is still based on agriculture.

122. Kathmandu Valley has developed as a center of trade links with India and Tibet (People's Republic of China). According to the Economic Survey 2010-2011, Nepal in fiscal year 2009-2010 exported 71% of its goods to India and 29% to countries such as the United States, United Kingdom, Italy, Germany, Canada, and Japan. The main export commodities are ready-made garments, woolen carpets, woolen and pashmina goods, and handicrafts of which most are manufactured in Kathmandu Valley. Nepal imported 68% of goods from India and the rest, from other countries. The major import items are petroleum products, medicines, electronic goods, gold, transport equipment, and fertilizers. A significant share of imported goods is consumed in the valley. Kathmandu Valley is the entry point for the majority of tourists. In 2009, a total of 602,867 tourists arrived in Nepal, of which, more than 80% entered through the Kathmandu international airport.

123. About 53% of the total population aged 10 years and above in the valley are economically active (Census 2001). They are engaged in agriculture and forestry (36%), manufacturing (17%), commerce (16%), construction (4%), and transportation/ communication (3%). In Bhaktapur district, 30% of the populaion are involved in Agri-forestry and fishery workers followed by craft and related trade workers (19%) and service and sale workers (16%) (CBS 2011). In Bhaktapur municipality, major non-farm activity comprises trade/business (38.55%) followed by service (26.54%) and manufacturing (13.24) (CBS 2003).

124. According to the Census data (2001) and the Nepal Human Development Report (2004), the Human Development Index (HDI) and Gender-related Development Index (GDI) of Bhaktapur district was higher than the national level while poverty index is relatively lower (**Error! Reference source not found.**).

Table IV-5: Kathmandu Valley Development Indicators

District	Human Development Index (HDI)	Human Poverty Index (HPI)	Gender-related Development Index (GDI)
All Nepal	0.471	39.6	0.452
Bhaktapur	0.595	29.9	0.578

Source: Census 2001; UNDP. 2004. Nepal Human Development Report.

Slums and Squatter Settlements

125. The rapid population growth has created a number of slums and squatter settlements in Kathmandu Valley. A survey conducted by LICSU, KUKL (2008) shows that the slums in Bhakapur municipality comprises a total of 754 HHs with household size of 4.34 consisting a total of 3274 population. Of these, the share of households without piped water supply is 32.

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

Economic Development and Prospects for Growth

126. Compared to the rest of Nepal, Kathmandu Valley fares better because it has basic facilities such as water supply, sanitation, electricity, bottled gas, telecommunications, roads, education, security, and transportation. The valley is also the center for several major industries such as textile, food & 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 into the Valley; hence the rapid population growth and demand for urban services, especially water supply, within the Valley.

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

128. Being the capital city and a commercial center for the country, Kathmandu and its surrounding valley is developing and urbanizing fast, compared to the rest of Nepal. It is the most important urbanized area in Nepal. New products and services are first introduced in the Valley, giving the 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 Terai.

Infrastructure

Transportation

129. Long-distance bus services from Kathmandu provide services to the 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 Bhaktapur is 181 km (Department of Roads 2004).

Drinking Water Supply

130. Not all households and people in Kathmandu Valley receive safe drinking water. Various sources of drinking water for households are shown in **Error! Reference source not found.**. The CDS record shows that tap is the drinking water source for more than 90% of the households of Bhaktapur district.

Table IV-6: Sources of Drinking Water in Bhaktapur Municipality

Source of drinking water	**Households**	**%**
Tap	15,998	90.7
Tube well	107	0.6
Covered well/Kuwa	444	2.5
Uncovered well	217	1.2
Spouts	350	2.0
River/stream	4	0.0
Others	425	2.4
Not stated	94	0.5
Total	17,639	100.0

Source: CBS, 2011.

139. Based on the 2005 data of the Department of Drinking Water and Sewerage, the number and percentage of the population receiving water by district and for the Kathmandu Valley are shown in **Error! Reference source not found.**. It shows that less than 75% of the population receives piped drinking water supply from the then Nepal Water Supply Corporation (now KUKL). In Bhaktapur district, only 62.37% of the total population receives piped drinking water supply from the then Nepal Water Supply Corporation (now KUKL)

Table IV-7: Population Receiving Drinking Water

District	Estimated Population in 2005	Beneficiary Population in 2005	Percentage
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.

Electricity

131. Not all households in the valley have electricity, but the overall proportion of households connected to electricity is high at roughly 95%. Based on the Nepal Human Development Report 2001 (UNDP 2002), about 96.81%, 87.64%, and 96.41% of households in Kathmandu, Lalitpur, and Bhaktapur, respectively, have electricity.

Educational Institutions

132. 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. In Bhaktapur district, there are 9 Higher secondary schools, 85 Secondary Schools, 137 lower secondary schools and 243 primary schools in Bhaktapur district (Compiled from NIDI 2006; ICIMOD, Ministry of Environment, Science and Technology (MOEST), United Nations Environment Programme (UNEP) 2007).

Health Facilities

Kathmandu is the center for all types of health services (general medicine, surgery, heart care, orthopaedic care, kidney care, dental care, children's care, eye care, mental care, neurology, etc.). The number of health facilities owned by the Government or provided by local and international NGOs and the private sector is relatively higher (and with better services) in Kathmandu than in Lalitpur and Bhaktapur districts. However, the ratio of health institutions to the population served is higher in Kathmandu at 1: 9,574 compared to 1: 5,637 in Bhaktapur or 1: 4,119 in Lalitpur.

Economic Characteristics:

Industries

133. Kathmandu Valley has many traditional cottage industries: textile weaving or handlooms, brick and tiles, pottery, handicrafts, precious ornaments, traditional food processing and preservation (e.g., 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.

134. Kathmandu Valley has three industrial districts, namely, Balaju Industrial District, Patan Industrial Estate, and Bhaktapur Industrial Estate. Public sector brick factories, leather tanning, and shoe manufacturing are also found in the valley. Food and beverages, plastic products, construction materials, carpets, and readymade garment industries have flourished. However, the number of industries and employment provided by them has decreased drastically over the last decade. Industries are 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.

135. Of the remaining industries in the valley, the main polluting industries are only small scale. These include brick kilns, wool dyeing and carpet washing, textile dyeing, pottery, polyurethane and rubber foam, beaten rice, dairy products, metal casting, metal craft industries and gold plating; and alcoholic and non-alcoholic beverages.

Agricultural Development

136. Rice is the main crop in the rural areas of Kathmandu and Bhaktapur, whereas 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 bean, pea, and black gram are the main pulses grown, as well as potato and oil seeds.

Cultural Heritage

137. Kathmandu Valley is known for its ancient art, culture, craftsmanship, and numerous monuments of historic and archaeological importance that have been described by 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 river banks. The Patan Darbar Square, the Kathmandu Darbar Square, the Bhaktapur Darwar Square and The Changunarayan Temple are declared as world heritage sites, are within the project districts. However, no any installation of sewer will be carried out in the heritage sites by these construction packages.

V. POLLUTION PREVENTAION AND ABATEMENT THROUGH DESIGN

138. It is wise to seek the possible mitigation measures through project design as it would be vital in reducing/avoiding possible environmental impacts from the beginning. The design of IS03 package has adopted a couple of such measures as discussed below.

A. Design of Interceptor Sewer

139. The feasibility study of the Kathmandu Valley wastewater management (PPTA) has proposed that the infiltration should also be diverted to the river or stream thus by decreasing the design flow in the interceptor sewer. Such design will have adverse environmental impacts on the water quality of the river and living bodies. To avoid such consequence, the interceptor sewer has been designed to divert only the storm water into the river and carry the infiltration to the sewer and subsequently to the wastewater treatment plant for its treatment. Therefore, the design flow of the interceptor and inceptor sewers are to be adopted as follows.

Design flow of Interceptor/Inceptor sewer = DS x PF + NDS + IN

Design flow of Branch sewer and laterals = DS x PF + NDS + IN + SW

Where, DS = domestic sewage
NDS = Non domestic sewage
PF = Peak factor
IN = Infiltration
SW = Storm water

B. Diverting Discharge of Existing Outfalls

140. The existing outfalls; 2 at left bank and 1 at right bank, are discharging raw sewage into KKR through outfall without any treatment. This has polluted not only the River but also Bagmati River and its tributaries such as Hanumante and Manohara Rivers as these rivers finally converge to the Bagmati River. The raw sewage presently being discharged to the river is proposed to be diverted to the wastewater treatment plant. This is expected to improve the water quality of the rivers and their ecosystem. The details of the exiting outfalls with the connection point to the manhole of the inceptor sewer, pipe diameters and their invert RL are presented in the Table number III-5, III-6, III-7, III-8 and III-9.

C. Deviation of Sewer at Kalighat Area:

141. The sewer line along the left bank of KKR passes through Kalighat in Bhaktapur Municipality. Kalighat is a ritual religious place where cremation of bodies takes place. The Crimation Site is situated at the left bank of the river at chainage 1+720. It was found during the survey that local people did not agree to allow the sewer line passing through the site. Respecting the cultural ethic, it is proposed to detour the sewer line from river bank for some distance and meet the left bank of the river downstream of the Kalighat. Deviating the sewer has already lessen the possible cultural impacts.

VI. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

142. The proposed sewer alignment does not pass through any environmentally sensitive areas including cultural heritage site, protected area / buffer zone, wetland, mangrove, special area for protecting biodiversity. Trees of different species growing along both banks the river bank throughout the length. These trees and the vegetation belt near the bank especially at the left bank are not only protecting the river bank but also providing habitat for a number of wild animals. The vegetation and wild animals harboring are the common species of Nepal and will not be disturbed by proposed project as far as possible. Similarly, sewer will be laid within the Right of Way (RoW) of river thereby land acquisition will not be required. Cultivated land is existed on both bank of the KKR throughout the length. The opening and clearing of 12-meter width earthen track has been carried out by Bhaktapur Municipality under Deko planning al the left bank of the KKR. Hence, majority of length of sewer line is along the same track. Some of the proposed sections comprises brick kiln excavation area and other private and public cultivated land along the river banks.

143. There are 8 river crossing structures such as small bridges existed along the proposed KKR. These structures will be taken into account during the time of excavation and installation for sewerage inceptor. Five of crossing structures connect the main roads that have frequent flow of vehicle. They are located at Mili, Deko, Kalighat, Barkhe and Ittapakhe. Among those areas, impacts on the community settlements and infrastructure would be of issues mainly in Kalighat. The settlement in this area is relatively dense and the project could induce short term impacts to the community infrastructures including electricity, and water supply pipes (if any) especially at the left bank of the river. There is also a local crimination site in Kalighat area near the left bank of KKR however; the alignment of the sewer pipe will be deviated at this point to avoid the possible impacts. The water spout, identified near to the cremation site and a Shiva Temple situated at the road at chainage 1+730 at cremation site diversion will be given a great consideration while laying of sewer inceptor near these areas. The KKR is considered as a holy river at the Cremation Site though; the river condition cannot be taken as acceptable condition. Waste from the adjacent cultivated land and household toilet wastes are found to be disposed directly into the river. Direct disposal of solid waste, household sewer, agricultural waste, surface runoff etc. are the major sources of KKR water pollution. Further, an electric transformer and pole of Himpipe factory, near Barkhe bridge crossing the KKR and at the right bank of the river, will be relocated for the project as it lies along the sewer alignment at the right bank of KKR.

144. Environmental impacts on the physical, biological, and socio-economic and cultural environments during design, construction, and operation phases are discussed in the Rapid Environmental Assessment (Appendix 1) in detail together with the mitigating measures. Most of the impacts will be local, insignificant, and relatively small during construction and operation. Implementation of proposal has no any significant impacts upon environment. However, other impacts anticipated are direct disposal of materials on the river excavated for laying sewer pipe line, dust pollution and issues due to the operation of labor camp sites. Over excavation for the installation of sewerage pipes all along the river banks will be avoided. During the time of operation, direct disposal of solid waste on river will be avoided. And the campaigns of solid waste disposal and sanitary will be carried out. EMP has been prepared in order to safeguard environmental aspects during the time of construction. Also, it provides measures to reduce/mitigate the potential impacts from sewer pipe installation and labour camp establishment.

145. EMP table has been prepared for IS03. The summary of anticipated environmental impacts and the corresponding mitigation measures are shown in Table IX-1.

A. Design Phase

Environmental impacts due to project design

146. One of the most important activities before construction is the identification of the likely adverse impacts and their mitigation measures before construction works commence.

147. Identification of erosion-prone areas prior to construction is important to prevent or minimize soil erosion, sedimentation, and slope instability. To mitigate these adverse impacts, it is necessary to incorporate drainage plans into the project design, identify measures and sites for handling excessive spoil materials, and stabilize unstable areas. In particular, geotechnical investigations need to be carried out prior to conducting design of interceptors to identify areas that are fragile. The project considers the vital role of the vegetation belt nearby the river bank. The design and specifications should consider minimum vegetation clearance and avoid piling of excavated materials close to river or along the river banks and to the adjacent private lands affecting cultivation.

148. During the preparation phase, the land areas required by the project should be demarcated and sign posted accordingly. Ongoing consultation with affected communities should be conducted and due notifications to any interruptions as a result of construction should be provided in a timely manner. The impacts on the community settlements and infrastructure would be of issues mainly in Kalighat area. The settlement in this area is relatively dense and the project could induce short term impacts to the community infrastructures including electricity, and water supply pipes (if any) especially at the left bank of the river. There is also a local crimination site in Kalighat area near the left bank of KKR. The alignment of the sewer pipe will be deviated at this point to avoid the possible impacts. Further, an electric transformer and pole of Himpipe factory, near Barkhe bridge crossing the KKR and at the right bank of the river, will be relocated for the project as it lies along the sewer alignment at the right bank of KKR. A due consideration will be given while working in these sites ensuring minimum impacts and will be compensated loss if any.

149. 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 these camps be provided with sanitary amenities at designated areas. As Nepal has no standards regarding the number of ablution blocks to be constructed in temporary labor camps, the 2009 IFC Guidelines (Appendix 9), that is, 1 toilet for every 15 persons (separate for men and women) will be followed. For establishment of labour camp, designated areas will be provided along with collection bins for wastes. An effort will be taken for providing toilet facility separately with the facility of temporary shoke-pit that shall be reclaimed and rehabilitated after the completion of work. It is a must to ensure the prohibition of open defecation and direct disposal of toilet and kitchen wastes around the construction site and all along the bank of Khasang Kusung. For IS03, establishment of labour camps near the premises of Kali Ghat Crimation Site shall be prohibited. And also, about camps shall be established only at the public open spaces as far as possible without disturbing any existing environmental condition.

150. An employment policy that avoids depriving the local communities of opportunities should be prepared to prevent tensions and dissatisfaction. The local people, especially the project-affected families and women above the age of 16 (Children's Act 1992), should be given preference in employment. Wages should be settled based on the District Wage Evaluation Committee resolution or guidelines and the list of employees submitted to the Design and Supervision Consultant.

151. Letters of approval and agreements should be obtained for the following: (i) temporary acquisition of land and properties for use by contractors, (ii) digging of roads from the Department of Roads and the concerned municipalities. The interceptor sewer alignment are not proposed within any archaeological and cultural heritage sites. Chance find protocol will be provided to contractors prior to the commencement of activities. Additional precautions in these sites include the following:

(i) photographing all sites within the heritage area if existed 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, etc.); and
(iii) adopting the following measures for sewer works in roadways within dense settlement and narrow road width and congestion areas: (a) informing the community prior to daily construction of sections, (b) putting up clear signage related to KUKL works, (c) ensuring reinstatement of roads to original condition, (d) ensuring extra measures (fencing and/or barriers) to protect the public from construction site, and (e) ensuring that a construction supervisor is onsite at all times

152. Cultivated land is existed on both bank of the KKR throughout the length of the sewer alignment of IS03. Further, Bhaktapur Municipality has been opening and clearing of 12-meter width earthen track along the left bank of the KKR under Deko planning. And, the sewer alignment is along the same track. Since, most of the area above the right bank is under cultivation at the right bank, ttemporary acquisition of land and properties for use by contractors shall be done at the beginning of the work at right bank. For the construction work at the left bank area, the work has been executed in a well co-ordination with BKT municipality. The design data of the land development plan, under planning by Bhaktapur Municipality, has been taken into consideration in the design of Khasyang Khusung inceptors (Appendix 14). Incorporating suggestion by Bhaktapur municipality, the manholes have been located along the left bank of the KKR considering the proposed roads in the land development plan within the RoW.

153. Baseline photographs of the construction areas and water quality of streams and rivers that would be impacted will help the project in identifying/justifying/verifying the adverse impacts due to construction activities (e.g. cracks in houses, restoration of temporary sites to their original condition, water quality deterioration, etc.).

154. Detailed traffic plans should be prepared to help in mitigating traffic congestions and disturbance to pedestrians and businesses. A traffic management planning document that can be easily used by contractors to develop detailed plans should be formulated. Refer to Appendix 9 of the IEE prepared for NEP: Kathmandu Valley Water Supply Improvement Project (http://www.adb.org/sites/default/files/linked-docs/34304-043-nep-ieeeab.pdf).

155. The training manual should be written in Nepali (or local languages) with notes and sketches on community health and safety and occupational health and site safety.

B. Construction Phase

Environmental impacts due to project construction and migration measure

a. Physical Environment

Soil erosion and slope stability due to excavation

156. Impacts likely to occur from the improvement and construction of sewerage systems will include trench excavations and topsoil stripping, which may induce soil erosion and slope instability. This is will be an issue particularly near the rivers where interceptors will be constructed. Haphazard disposal of spoil materials may create erosion problems, disturbances to the existing drainage lines, and changes to the existing land use practices. Mitigating measures to be used are separate stockpiling of topsoil in a safe yard for further use, spoil disposal at designated and stabilized sites, compaction of the backfill of excavated areas including replacement of topsoil, avoiding work during the rainy season as much as possible,

mulching to stabilize exposed areas, use of bioengineering techniques (e.g., re-vegetating areas promptly), providing channels and ditches for post-construction flows, lining of steep channels and slopes (e.g., use of jute matting), preventing off-site sediment transport using settlement ponds, and silt fences. Prior to the construction of interceptors along the rivers, erosion and sedimentation control such as blankets, geofabrics and/ or vegetation need to be completed including the installation of appropriate drainage systems.

157. Impacts of surface water discharges on the local drainage from trench excavation should be mitigated by the use of settling tanks before discharging the water to waterways.

158. Excavation and laying of pipelines/siphons at river crossings could have adverse impacts on the river water quality and the aquatic ecosystem. Mitigation measures to be used include construction to be done in the dry season only, use of river diversions with bundings the water of KKR is much polluted and the impact of the construction of such structures is not significant.

159. Deep excavations can intercept and interfere with the local groundwater thereby affecting flows from irrigation canals, springs, and wells and causing water shortages. Mitigation measures to be used include the following: (i) local wells, springs, and irrigation canals to be bunded from temporary spoil dumps; (ii) local wells and spring fed spouts or kuwas to be monitored, particularly downhill of excavations plus temporary supply provided if flow is affected; and (iii) permeable base and side backfill required at deep excavated sites or an alternate source of drinking water provided at the existing location. One water spout is identified near to Kalight cremation site. The excavation work and laying of sewer inceptor near the area will be executed with a due consideration so that it will not affect the water table of the spout. Change in river hydrology and morphology.

160. The construction, rehabilitation, and operation of the sewerage system could have impacts on the river hydrology and morphology due to quarrying from river beds for sand and gravel, particularly during the dry season. Water pollution problems 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/mining activities in river/streams for extraction of construction materials shall be avoided but should be done in approved sites only.

Water and land pollution

161. Dumping of wastes or discharging wastewater effluents from labour camp can pollute the river water, making it unhealthy for downstream users. Mitigation measures to be used include avoiding construction of labour camps facilities within the drainage area, providing designated areas with collection of bins for wastes, providing toilet facilities and prohibiting open defecation, and prohibiting washing of vehicles next to rivers and streams.

162. Pollution of land and water could also be mitigated by observing proper storage of construction aggregates, hazardous toxic materials, lubricating oils, used tyres, and exhausted batteries; and segregating and disposing of chemical containers, packaging materials, plastic bags, etc. Used oil and lubricants should be recovered and reused or removed from the sites. Storage areas for fuels and lubricants should be away from any drainage leading to water bodies. All fuel use areas (e.g., generator) must have drip basins installed to prevent any leakages and recycled. All fuelling, repair, and maintenance work should be done on a concrete surface provided with a catch tank that can be cleaned and all spilled fuel recovered and recycled. Provision of training on the safe handling of toxic materials and occupational health and safety measures during construction could help in mitigating many of the adverse impacts mentioned above.

Pollution due to air, noise, and vibrations

163. Earth excavation, construction materials stockpiling, aggregate crushing, drilling, quarrying, and plying of vehicles will produce dust (TSP, PM_{10}), hydrocarbons (CO, CO_2, CH_4), SO_2, NO_X, H_2S, etc.), noise, and vibrations. Plying of trucks on non-metallic roads will produce huge amounts of dust that can deteriorate the air quality and increase the noise levels to above

90 dB. Appendix 5 gives the national ambient air quality standards for Nepal.

164. Mitigating measures to be employed include the following: (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 sound and vibrations at regular intervals; (iv) limiting vehicle speeds (10-15km/hr) and banning power horns; (v) ensure that vehicles comply with the National Vehicle Mass Emission Standards, 2056 BS; (vi) fitting of mufflers in vehicles to control noise; (vii) regular maintenance of vehicles; (viii) prohibiting the operation of crushing plants and construction vehicles between 7 p.m. and 6 a.m. in residential areas; (ix) compensating the damages caused by vibrations to buildings, and (x) providing ventilation in confined working areas. Appendix 7 gives the recommended standards for vibration in construction sites. Similarly, Noise should be monitored as provided for in Appendix 6.

b. Biological Environment, Ecology and Biodiversity

165. Cultivated land is existed on both bank of the KKR throughout the length. Similarly, Bhaktapur Municipality has been opening and clearing of 12-meter width earthen track along the left bank of the KKR under Deko planning. And, the sewer alignment is along the same track. Therefore, it is anticipated that the sewer construction and pipe laying work will have insignificant impact on the local ecology and biodiversity. However, most of the area above the right bank is under cultivation. The major crops grown in the area includes rice, wheat, corn, and vegetables. It is anticipated that the proposed works of laying inceptors along both side of KKR may impact on standing crops along the river bank temporarily. The temporary impact means that there remains the possibility of harvest immature crops or may lost the yield due to movement of equipment and vehicle, digging trench and dumping soil. There is also possibility that land can be cultivated immediate after laying of inceptors. However, the project will provide compensation for the crops loss while executing the work. Approximately 30 cm of topsoil from the cultivated land will be piled up at safer location before excavation for the trench and will be replaced after the backfilling along the excavated trench.

166. The river bank is covered with vegetation that comprises mainly trees along with bushes. Trees of different species have been growing along the river bank throughout the length. The vegetation belt harbor number of common species of wild animals. However, the river condition of the Khasyang Khusung cannot be taken as acceptable condition. Waste from the adjacent cultivated land and household toilet wastes are found to be disposed directly into the river. The flow of the river is very low and is like an open sewerage with very bad order prevails all along the river alignment. Direct disposal of solid waste, household sewer, agricultural waste, surface runoff etc. are the major sources of KKR water pollution. The area around the sewer alignment does not lie in the ecologically important habitat (protected area, buffer-zone). None Archaeological site lies in the area. The biodiversity including crop, vegetation and wild animals inhabiting in the proposed area include only common species.

167. The impacts of the installation of sewer line IS03 on biological environment as can be listed as

- Removal of vegetation especially tall grasses and bushes for the construction structures including sewer pipe, manhole, will also affects the animals dwelling the vegetation
- Impacts on the aquatic ecology while installing the aqueduct
- Impacts on the wild animals including birds harbouring the trees and the vegetation

168. Executing the IS03 project will induce no significant adverse impact on the biological environment. However, mitigation measures for ensuring minimum impacts on the biological environment consist of the following: (i) Providing LPG/kerosene to the workforce; (ii) compensating all the affected trees (iii) Disposal of construction materials and solid wastes generated from the camps into the rivers shall be avoided and river diversions and bunding of sections should be carried out.

c. Socio-Economic and Cultural

Physical cultural resources (PCR)

169. The sewer line along the left bank of KKR passes through Kalighat in Bhaktapur Municipality. Kalighat is a ritual religious place where cremation of bodies takes place. The river has been considered as a holy river at a Crimation Site situated at the bank of the river at chainage 1+720. It was found during the survey that local people did not agree to allow the sewer line passing through Kalighat. It has thus proposed to detour the sewer line from bank of the KKR for some distance and meet the left bank of the river downstream of the Kalighat. The sewer is proposed along the road proposed in the land development plan of the Bhaktapur Municipality. A Shiva Temple is situated near to the diversion alignment proposed at cremation site. The temple is located at chainage 1+730 near the cremation site, will also be considered during the construction. Construction of labor camp and storage of construction aggregates, hazardous and toxic materials, lubricating, oils and used batteries will be avoided near the premises of the cremation site and temple.

***Environment* compensation**

170. The contractor's temporary land use and housing acquisition and compensation to affected people are two of the most important aspects of any construction project. The mitigation measures include the following: (i) compensation for crops destroyed along the sewer alignment according to the Government's rules; (ii) establishment of a "grievance redress committee"; (iii) restoration of temporary sites to their natural or stable conditions as agreed with the land owners; (iv) 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; (vi) provision of disturbance and rehabilitation costs to local businesses; (vii) protection of the traditional rights of the local people; (viii) compensation for any loss of crops, trees and other natural resources; and (ix) establishment of 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).

Reinstatement of damaged community services and infrastructure

171. Construction activities could have adverse impacts on community services and infrastructure. Any adverse impacts (e.g., cracks in buildings and structures during trenching, use of rollers for compaction and pneumatic drills, and unusable access roads) on community assets such as, temples, bridges and irrigation channels, electricity poles, telephone lines, drinking water pipes, sewerage lines, roads, etc. will be mitigated, compensated, reinstated, or relocated to the satisfaction of the community.

172. Mitigation is to be done through coordination with concerned utilities personnel and the local people, detailed design drawings, geotechnical testing in sensitive areas, and traffic management and emergency response plans.

Influx of outside workers, money, and unwanted activities

173. Alcohol abuse, gambling, prostitution, and other social disharmony are likely to occur in the construction site. There will be an influx of workers to the project site. This can increase crime and social stress, create unwanted congestion, and exert pressure on the limited local resources. The mitigation measures to be carried out consist of prohibiting gambling and alcohol consumption in construction camp sites; instructing the outside workforce to respect the local cultures, traditions, rights etc.; and providing security in the camps.

Health and safety

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

mitigate these adverse impacts, these should be undertaken: (i) provide regular health check-ups, 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 sexually transmitted diseases (STDs) and HIV/AIDS using brochures, posters, and signboards; (ii) make available first aid kits, ambulance, and fire extinguishers in camp sites; (iii) provide personal protection equipment to all construction workers and compensation for the loss of life (a zero tolerance to loss of life policy should be developed and implemented) or for any type of injuries; and (iv) provide insurance to the workers. Health and safety training for all site personnel is very important and must be mandatory. Another significant impact is the effect on people and communities, particularly health, if water supply is interrupted for extended periods during works on the sewer networks. If water supply has to be stopped, notice should be given to the affected people and alternative provisions of potable water arranged.

d. Occupational Health and Safety

175. The potential occupational health and safety impacts or hazards and mitigation measures for the laying of drinking water pipes and sewers in trenches are given in Table IX-1. Before constrzzuction begins, the contractor will inform and provide training to its workers on occupational health and safety and mitigation measures to be used during construction. The training must be done in Nepali (or local language of the workers) with handouts distributed and information posted in conspicuous places. As most of the workers would be uneducated, pictorial presentations depicting the hazards and the mitigation measures should be used during the training. Appropriate signage providing safety messages including restrictions to public access need to be erected at construction sites.

e. Community Health and Safety

185. The contractor should be aware of the adverse health and safety impacts of the construction works on communities along the construction areas.

Traffic management

176. Traffic congestion and temporary disruption to 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 these, traffic management plans should be developed for key areas along the construction site. There should be a traffic management planning document that can be easily used by contractors to develop detailed plans. Refer to (Appendix 10). Advance local public notifications of construction activities, schedules, routings, and affected areas including road closures should be made. Erect signage in Nepali and English languages. Use steel plates or other temporary materials across trench facilities in key areas such as footpaths or livestock routes; arrange for pedestrian access and sidewalks and parking areas; and arrange for night-time construction for activities in congested or heavy day-time traffic areas. Arrange for onsite "grievance handling." Undertake trench closure and facilitate rehabilitation as quickly as feasible. Coordinate with the Kathmandu Metropolitan Traffic Police Division, the authority in charge of traffic management. Obtain permission from the municipalities for digging in inner urban roads.

C. Operation Phase

177. The release of untreated wastewater or sewage could cause downstream pollution and adversely impact the aquatic ecosystem and pose health risks to humans. The following should be undertaken to address the impacts:

178. Hazards to public health due to overflow flooding and groundwater pollution due to failure of the sewerage system could have adverse impacts on human health and the environment. The system will have to be carefully designed and operated. The project design should include stand-by generators (the diesel generator is the second backup power). The first source is the

power generated from the gasification plant. The constant source of electricity supply, if available, will also be used. An emergency response plan (ERP) that includes notification and reporting protocols will need to be developed. The ERP is important for managing wastewater systems during emergencies as pipe breaks, equipment malfunctions, power outages takes place, and leakage or spills of hazardous materials happen. Floods, earthquakes, and storms can also damage collection systems and equipment. Having emergency response procedures can save lives, prevent diseases, and minimize environmental and property damage. The ERP should be developed in coordination with all the key stakeholders, including the Executing Agency (EA), project implementation units, consultants, contractors, and other key government organizations. A modified ERP Template (www.rcap.org) is attached in Appendix 11.

179. Health and safety hazards to workers could occur from toxic gases and hazardous materials which may be contained in sewage flow and exposure to pathogens in sewage and sludge. The workers should be trained in the management of occupational health and safety hazards and provided with personal protective equipment. Inoculations should be administered on a regular basis.

180. Discharge of hazardous materials and illegal disposal of industrial waste discharges into sewers could damage the wastewater system and be dangerous to workers. It is important to ensure that the existing industries do not illegally discharge their effluents into the sewer system. Regulations should be developed and enforced by the Ministry of Environment, Science and Technology to control illegal waste discharges into the sewers. A trade waste policy, including setting discharge criteria from industries, needs to be developed.

181. Sewer cleaning staff will be at risk of communicable diseases. KUKL should ensure that the operation and maintenance staff of sewerage system are fully aware of the hazards by training them in hygiene procedures to avoid infection from wastewater, sludge handling, and health and safety procedures against exposure to hazardous gases. Workers should be inoculated against infectious diseases and kept under medical supervision. Emergency procedures need to be developed by KUKL and protective clothing to sewer cleaning workers should be provided.

182. Improper operation will lead to the accumulation of wastewater along some manholes that may cause smell and nuisance to the surrounding residential areas. To address this, the project should prepare and strictly follow standard operating procedures (SOP) and provide regular training to staff.

183. Hazards may occur due to blockage of sewer lines causing overflows and nuisance to people, serious health and sanitation problems, and contamination of soil and groundwater. Workers and operators stationed at sewers and confined spaces should be provided with safety equipment or gas detectors and awareness and safety training. Fire extinguishers should be readily available and in place to maintain safety. Workers who come in contact with raw or partially treated sewage and sludge should be provided with protective wear (e.g., gum boots, gloves and face masks). To avoid sewer blockages, catchment management is important. Avoid root intrusion, create public awareness, educate the public on the types of waste to be disposed of to the sewer system, provide sufficient staff and equipment for cleaning, and establish a system for registering public complaints (grievance redress mechanism) and urgent clearance of system blockages.

Potential Environmental Enhancement Measures

184. Potential environmental measures that shall be taken by KUKL before the project commences are training and awareness programs on health, occupational health and safety measures, and community health and safety to the general public.

185. Sufficient human resources should be trained in maintaining the sewerage systems.

186. There are many environmental youth clubs in Kathmandu Valley. They should be mobilized to observe the sewer system in their areas and report problems like overflows to KUKL. By 2010, there were 4,321 youth services affiliated or registered with the Social Welfare

Council: 697 were from Kathmandu, 43 from Bhaktapur, and 130 from Lalitpur. Out of the registered 30,284 NGOs working in the environmental protection sector, 514 were from Kathmandu, 69 from Lalitpur, and 9 from Bhaktapur.

Cumulative Negative Impacts

187. Although there will be temporary increase in the noise levels, fugitive dust, and common air emissions near the construction areas, no adverse residual effects to human health will occur because the impacts are short-term, localized, and not significant.

188. The possible cumulative negative impacts of the project are noted as:

- Emissions of common air contaminants and fugitive dust may increase near the construction sites but will be short term and localized. Greenhouse gas emissions may increase due to vehicle and equipment operation, disposal of excavated material, concrete production, etc.
- Noise levels near the construction sites will increase but the duration will be short. Ground vibrations due to concrete mixers, rollers, and excavators may be annoying, and damages may occur especially to older buildings.
- Traffic management during construction will be very important Although there will be temporary increase in the noise levels, fugitive dust, and common air emissions near the construction areas, no adverse residual effects to human health will occur because the impacts are short-term, localized, and not significant.

Opportunities

189. The Bagmati river will be less polluted than it is today when it reaches the Indian border. The WWTPs will contribute to reducing the current level of water pollution.

190. The project will help develop employment opportunities and enhance the local skills in sewer pipe laying and construction and overlaying of sewer pipelines for future works in Nepal. Concrete sewer pipes can be manufactured locally, which can boost the local construction industries.

VII. INFORMATION DISCLOSURE, CONSULTATION, AND PARTICIPATION

200. As part of the feasibility studies, an extensive consultation program with key stakeholders was carried out, in line with the requirements pertaining to environment and social considerations of ADB. The tools used for consultations were stakeholder workshops and meetings, interviews, structured questionnaires, and focus group discussions (FGD). These consultations provided inputs for identification of the felt needs of the communities, and the relevant stakeholders.

201. During the business survey, business/shops of different core areas of cities were informed about the project activities such as replacement, rehabilitation, cleaning of sewer, separation of storm water drain and sewer, new laying of sewer etc. in the main road and inner roads of the cities. They were informed about the possible impacts such as disruption to the local inhabitants, and pedestrians during construction. During the business survey, the business owners and the shop keepers were informed about the possibility of disruption to the business and the survey was a preliminary activity to determine possible profit losses if full closure of the road was required during construction. They were informed that future public consultations and disclosures would be held regarding possible disruption to businesses and issues of compensation modality would be discussed. They were also informed that they will get more information about the project activities during topographical survey.

202. The Project Affected People of Kathmandu Valley have been informed about the rehabilitation/modernization of existing and new construction of WWTPs and laying of new interceptors and inceptors; rehabilitation and cleaning of existing interceptors/inceptors and replacing existing brick sewers. Discussions were held with the participants in a closed circle and the details of the dates, number of participants are given in

Table VII-1and in Appendix 8.

Table VII-1: Meetings, Workshops, Consultations and Focus Group Discussions Held

SNo.	Date	Topic	No. of participants	Institutions
1	26 March 2012	Scope and objectives of PPTA -7936 and PPTA-43448; ongoing activities of HPCIDBC; BAP implementation	6	Project Manager and Deputy Project Manager HPCIDBC; PPTA Team
2	19 April 2012	Scope and objectives of PPTA -7936; ongoing activities and problematic areas of Lalitpur Municipality	4	Environment Section Chief and Drainage Section Chief Lalitpur Municipality; PPTA Team
3	19 April 2012	Scope and objectives of PPTA -7936; ongoing activities and FGD on problematic areas of Kathmandu Metropolitan City	4	Division Chiefs, PPTA Team
4	20 April 2012	Scope and objectives of PPTA -7936; ongoing activities and FGD on problematic areas of Bhaktapur Municipality; vision on wastewater management	5	Ex-Mayor and Engineers, PPTA Team

SNo.	Date	Topic	No. of participants	Institutions
5	20 April 2012	Scope and objectives of PPTA -7936; ongoing activities and FGD on problematic areas of Madhyapur Thimi Municipality	4	Engineer and Community Development Officer of Municipality, PPTA Team
6	24 April 2012	Scope and objectives of PPTA -7936; ongoing activities and FGD on problematic areas of Kirtipur Municipality	3	Municipality Engineer, PPTA Team
7	26 April 2012	FGD on identification of project intervention areas	17	Kirtipur Municipality, Lalitpur Sub-Metropolitan City, Bhaktapur Municipality, Madhyapur Thimi Municipality, KVWSMB, KUKL, PID, PPTA Team
8	31 May 2012	Ongoing activities of CBP Team, status of sewer networks, GIS activities in KUKL	6	CBP Team Leader, GIS expert, PPTA Team
9	22 June 2012	Meeting on coordination on the wastewater sector	13	MoWSS, HPCIDBC, PID, KUKL, Kathmandu Metropolitan City, KVWSMB, PPTA
10	28 June 2012	FGD in Sallaghari WWTP	14	Local people
11	29 June 2012	Ongoing activities of DSC under HPCIDBC, design criteria of sewer lines	15	PID, KUKL, BDA, Stakeholders
12	19 July 2012	FGD in Thulo Byasi, Bhaktapur	20	Local people
13	14 August 2012	Consultative Stakeholders Workshop on Interim Report	53	PID, ADB, MOWSS, KUKL, HPCIDBC, PPTA Team, Municipalities

203. In addition, the Resettlement Team undertook a random survey of 90 households (vendors, hawkers businesses and shops to obtain information on the loss of income due to temporary disruption of business during laying/rehabilitation/cleaning of sewerage pipeline in different problematic areas of the Municipalities. Results of the survey are included in the Resettlement Plan.

204. Consultations have been made with the UNESCO office in Kathmandu (Appendix 8) who advised the Project to "...make necessary coordination with the Department of Archaeology throughout the initial planning to implementation stages. The Ancient Monument Preservation Act for the Protected Monument Zones would be the basis for the safeguard activities within the Protected Monument Zones".

205. Mr. Bhim Prasad Nepal, the Chief of the National Archives, the Department of Archaeology, who was involved in the drafting of the Ancient Monuments Preservation Rules 2049 (1989), considered that an Archaeological Impact Assessment (AIA) would not be necessary for the Project since all works would be done in the existing public roads. However, an application should be made by KUKL/PID to the Department of Archaeology with detailed drawings of the proposed work according to the prescribed format (Appendix 8) for obtaining permission to proceed.

206. PID will make copies of the IEE report and any other project reports available to interested people in the Nepali language (if required) to ensure that stakeholders understand the objectives, policy, principles and procedures. These reports will be made available at public places, including the offices of PID, KUKL main office and branch offices, and the Kathmandu Metropolitan city, Lalitpur Sub-Metropolitan city and Madhyapur Thimi, Bhaktapur, and Kirtipur Municipalities Offices.

207. The PID will extend and expand the consultation and disclosure process during the detailed design stage and construction period of the project. A community awareness firm will be recruited to ensure ongoing consultations and public awareness during project implementation. The CASSC firm will continue the consultations with the affected communities through distribution of leaflets, about the project activities and entitlement matrix and the project contact persons for outreach and queries. Intensive consultations will be made on those sewer pipeline areas where people have different opinion for the installation of sewer pipelines.

208. The community awareness consultant (CASSC) will further coordinate with the PID, design and DSC, and contractors to ensure that communities are made fully aware of project activities in all stages of construction. A community awareness and participation plan were also prepared for the project and will be implemented by the recruited firm in coordination with the PID and DSC safeguards staff. Community groups such as tole committees and vendor associations will be consulted and made aware of the civil works and project activities prior to construction and even during the time of construction.

209. Further, public consultation program with key stakeholders has been carried out during the year of 2016/17 in line with the requirements pertaining to environmental and social considerations of ADB. During the detailed design of WWTPs and Interceptors, discussions and consultation meetings were held with Bhaktapur Municipality, Suryabinayak Municipality, Mahalaxmi Municipality and Madhyapur Municipality. During the consultation information about the project including project alignment and location of WWTPs and Interceptors has been discussed with the participants. Informal discussions and consultations were held with farmers present in the field and disclosed project information. They were also informed the possibilities of some disturbances and crop losses that might take place during construction works.

Table VII-2: Summary of Public Consultations

SN	**Date/ Month**	**Location**	**No. of Participant**			**Topics Discussed**	**Issues Raised/**
			Male	Female	Total		
1	July 5, 2016	Meeting with Municipal Authorities (Madhyapur Thimi, Bhaktapur and Suryabinayak) for TP-02, IS-01	33	3	36	Coordination Meeting	N/A
2	March 1, 2017	Bhaktapur Municipality Ward No 17 for IS-01 and IS-02	32	3	35	Information dissemination of the project to the all interested stakeholders of the Municipality.	N/A
3.	June 7, 2017	Bhaktapur Municipality Ward No 17 for IS-01 and IS-02	50	21	71	Information dissemination of the project to the all interested stakeholders of the Municipality.	N/A
4	June 12, 2017	Changunarayan Municipality for IS-03	8	1	9	Information dissemination of the project to the all interested stakeholders of the Municipality ward people	N/A
5	June 14, 2017	Bhaktapur Municipality Ward No 8 for IS-01 and IS-02.	17	1	18	Information dissemination of the project to the all interested stakeholders of the Municipality ward people	N/A

VIII. GRIEVANCE REDRESS MECHANISM

210. A grievance redress mechanism (GRM) has been 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 four levels with time-bound schedules and specific persons to address grievances. Minutes of GRC formation at local level is presented in Appendix 15.

211. **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 complaints on site. The PID branch offices can also be involved in grievance redress at this stage. The KUKL hotline and PID office phone numbers 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.

212. **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.

213. 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 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 PID, affected persons, and local area committee, among others determined to provide impartial, balanced views on any issues. The GRC should consist of around 5 persons. A hearing will be called with 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 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.

214. 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 Error! Reference source not found..

215. GRC Composition. Below is the GRC members composition under the project:

(i) GRC Chairman - PID Director
(ii) GRC Members:
(iii) Concerned municipality representative
(iv) Tole Community representative as AP's representative
(v) Appointed NGO representatives as independent party
KUKL/ KVWSMB/DSC (as relevant)

216. ADB Accountability Mechanism. In the event when the established GRM is not in a position to resolve the issue, Affected Person also can use the ADB Accountability Mechanism (AM) through directly contact (in writing) to the Complain Receiving Officer (CRO) at ADB headquarters or to ADB Nepal Resident Mission (NRM). The complaint can be submitted in any of the official languages of ADB's DMCs. The ADB Accountability Mechanism information will available in the PID to distribute to the affected communities, as part of the project GRM.

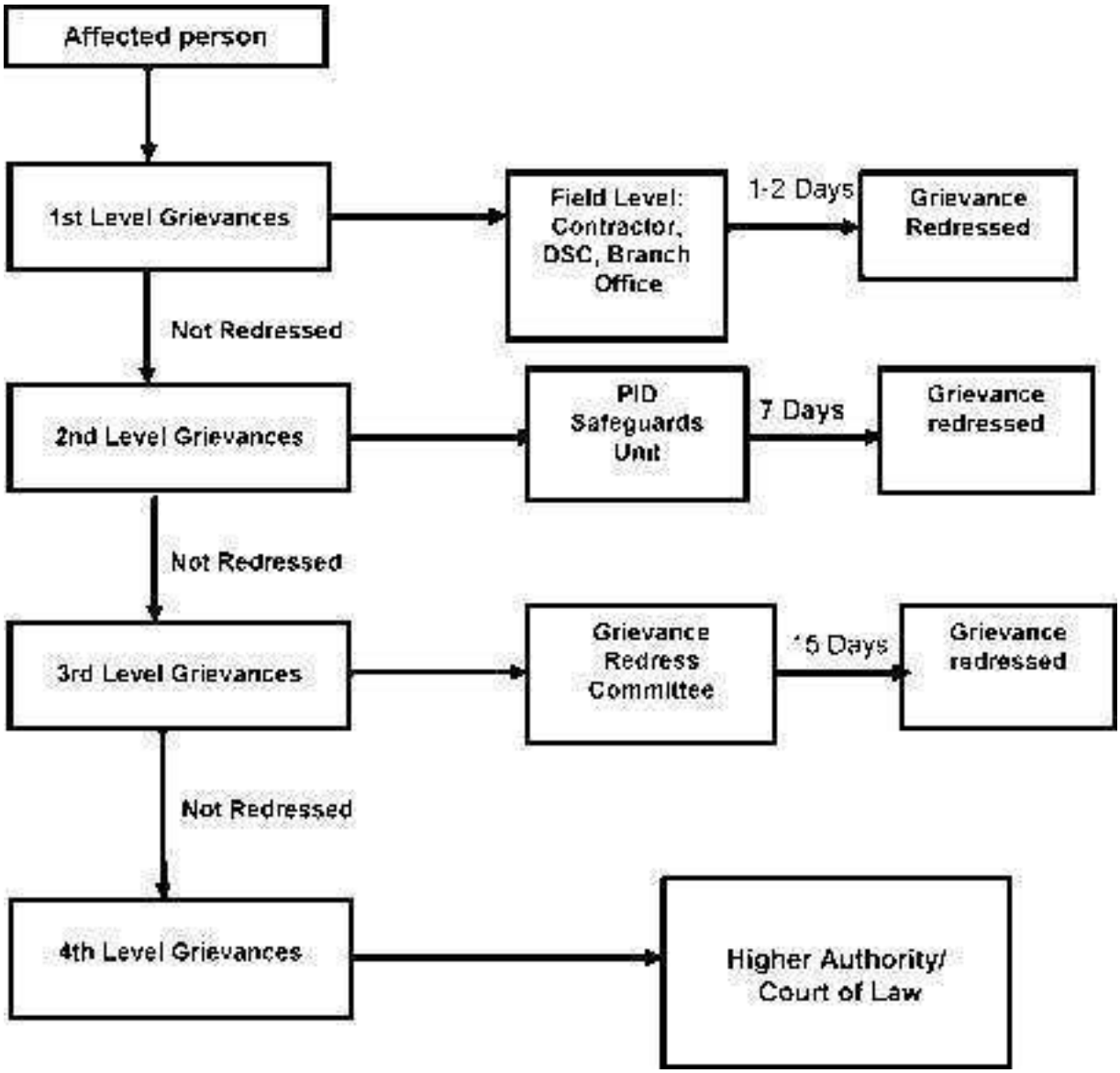


Figure VIII-1 Grievance Redress Mechanism (GRM)

IX. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

A. Environmental Management Plan and Objectives

217. The basic objectives of the EMP are to:

(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) recommend a plan of action and a means of testing the plan to meet existing and projected environmental problems;
(iii) establish the roles and responsibilities of all parties involved in the project's environmental management;
(iv) describe mitigation measures that shall be implemented to avoid or mitigate adverse environmental impacts and maximizing the positive ones;
(v) ensure implementation of recommended actions aimed at environmental management and its enhancement; and
(vi) ensure that the environment and its surrounding areas are protected and developed to meet the needs of the local people and stakeholders.

B. Mitigation and monitoring

218. Anticipated environmental impacts and mitigation measures have been dealt in detail in Section D and Table16.

219. A detailed self-explanatory environmental management and monitoring program is presented in Table IX-2. 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: (i) the extent and severity of the adverse environmental impacts as compared to what was predicted, (ii) how effective the mitigating measures were and compliance with the regulations and the (iii) overall effectiveness of the EMP.

220. The environmental monitoring of the Wastewater System includes field supervision and reporting of project activities prior to and during the project construction and operation in order to ensure that the works are being carried out in accordance to the approved design and that the environmental mitigation measures are fully implemented in accordance with the EMP.

Table IX-1: Environmental Management and Monitoring Plan of IS-03

Project Stage	Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibility	Cost (NRs.)
Construction Phase	Earthworks	Soil erosion and slope instability due to topsoil stripping and excavation for trenches	Separate stockpiling of topsoil from the cultivated land for further use; approximately 30 cm of topsoil from the cultivated land shall be pileup at safer location before excavation for the trench and shall replace after the backfilling along the excavated trench. Compaction of backfill is required and shall include replacement of topsoil all along the cultivated land; adopt cut and fill approach; avoid excavation work during the rainy season.	Contractors/DSC	Contractor cost
		Surface water discharges to Khasang Kusung and other local drainage from trench construction	Provide channels and ditches for post-construction flows; line steep channels and slopes; do mulching to stabilize exposed areas; use bioengineering techniques (e.g., re-vegetating areas promptly); prevent off-site sediment transport using settlement ponds, silt fences along the alignment where necessary during the time of construction.	Contractors/DSC	Contractor cost
		Runoff from construction areas including stockpiled materials into natural drainages and Khasang Kusung.	Cover stockpiling materials with tarpaulin sheets during rainy season in order to prevent runoff of stockpiling materials. Grade soil/sand stockpiles to prevent erosion. Construct catchment basins or drainage around the stockpiling area to collect runoff water and drain properly into the natural drainage to avoid runoff of construction materials into water bodies.	Contractors/DSC	Contractor cost
		Excavation and laying of pipeline/ siphons, aqueduct and overflow wire at river crossings could impact the river water quality and ecosystem	Carry out construction during the dry season only; maintain flow of natural drainages and maintain bank of such drainages meeting to Khasang Kusung.	Contractors/DSC	Contractor cost
		Interception and interference with localized groundwater flows due to deep excavations.	Avoid deep excavation for the trench as far as possible. Monitor local wells and spring fed spouts or kuwas if identified during the time of construction and excavation of trench. Relocate such infrastructure consulting with locals and its belongings if possible with minimal cost. Consult with DSC to settle such unforeseen issues requiring further variation.	Contractors/DSC	Contractor cost
	Back filling and Disposal of excavated material	Water and land pollution	Excavated material shall be managed within the construction site avoiding contamination to water bodies. Direct disposal of excavated material and spoil into the Kahasng Kusung shall be avoided. Excavated material shall be backfilled into the trench with proper compaction. Other excess excavated materials shall be overlay on the top along the alignment maintaining landscape and slope to drain surface runoff properly. Any soil humps of the excavated material shall not be remained at the construction site	Contractors/DSC	Contractor cost

			after the compaction.		
	Quarrying from river bed	Change in river hydrology and morphology	Prohibit quarrying/mining activities in river/streams to extract construction materials throughout the Khasang Kusung River. Quarry site shall be environmentally safe and has acquired environmental permits such as IEE from the concern ministry prior to the excavation.	Contractors/DSC	Contractor cost
Construction Phase	Stock piling of construction materials Handling of toxic materials	Water and land pollution	Ensure site is well-signed indicating the restrictions and construction activities including sign of safety. Store construction aggregates, hazardous and toxic materials, lubricating, oils and used batteries in safe areas and away from any drainage leading to water bodies; have designated bounded areas for storage. Prohibit washing of vehicles along the bank of Khasang Kusung River. Avoid storing of construction aggregates, hazardous and toxic materials, lubricating, oils and used batteries near the premises of water bodies and Kali Ghat Cremation Site. Provide training to workforce on safe handling of toxic materials and occupational health and safety measures during construction. Use personal protective equipment at all times while on site. Stock piling shall be carried out at open spaces. Contractor shall solicit consent from the land owner if it is on the private land.	Contractors/DSC	Contractor cost
	Stock piling of 700mm Hume pipes, iron and steel bars and other construction materials	Local disturbance, difficult in mobilization of locals and traffic	Practice good housekeeping for the storing of materials. Construction materials shall not be stored near the settlements and along the existing road sides disturbing mobility and traffic. Transportation of such goods shall be avoided during office hours. Stock piling shall be carried out at open spaces. Contractor shall solicit consent from the land owner if it is on the private land.	Contractors/DSC	Contractor cost
	Movement of vehicles carrying 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. Use tarpaulins to cover sand and other loose materials during transport. Cover stockpiling materials with tarpaulin sheets during rainy and windy season in order to prevent runoff and erosion of stockpiling materials. Limit speed to 10-15 km/hr for construction vehicles; site to be signed specifying speed limits. Ensure that vehicles comply with the National Vehicle Mass Emission Standards, 2056 BS. Do regular maintenance of vehicles.	Contractors/DSC	Contractor cost
	Operation of Labour Camps	Land and water pollution	Provide designated areas for the establishment of labour camps with collection bins for wastes. Labout camps shall be established only at the public open spaces as far as possible without disturbing any existing environmental condition. Avoid disturbance to vegetation during the establishment	Contractors/DSC	Contractor cost

			of camp. Labour camps shall not be established on private lands without consent of landowners. Provide toilet facilities around the labour camp area and prohibit open defecation and direct disposal of toilet and kitchen wastes around the construction site and all along the bank of Khasang Kusung. Prohibit establishment of labour camps near the premises of Kali Ghat Crimation Site and other settlement areas situated near by the river alignment. Potable water shall be supply regularly to the labour camp. Provide separate camps for men and women labours. Temporary shoke-pit shall be constructed for the dispose of toilet waste established near camps; all the camp area including pits shall be reclaimed and rehabilitated after the completion of work. Make available first aid kits, ambulance and fire extinguishers in camp sites. Provide good lighting systems and communication system including security in labour camps. Avoid brawl and disturbance to local community at the vicinity of camps.		
	Operation of crusher Movement of vehicles related to crusher and carrying aggregates	Noise and vibration	Contractor if establish crusher; shall not be operated during the off hours (night time from 6pm to 8am). Crusher shall be established at least 800meter away from the settlement areas. The operation of crusher shall not exceed the National Noise Standard 2069 established for mixed residential area i.e. 63 db. Avoid power horns in construction vehicles to reduce noise. Limit the speed of vehicles to 10-15 km/hr. Avoid unnecessary running of vehicles, equipment and machines at the construction and crusher sites. Avoid parking of construction vehicles on private land and along the existing road sides disturbing local traffic.	Contractors/DSC	Contractor cost
	Operation of excavator and concrete mix plant	Air, Noise, Accidents and other hazards.	Operate excavator and concrete mix plant safely. Avoid any accident from the operation. Excavator operator shall wear all the safety gears during operation. Workers working with concrete mix plant shall also wear all personal protective equipment. Concrete mix plant shall be established at least 150 meter away from the water bodies and Khasang Kusung. Concrete mix plant shall not be operated during the off hours (night time from 6pm to 8am). Effluent liquid cements from concrete mix plant shall not be disposed directly into ground and water bodies during operation. All empty cement bags shall be managed properly and shall not remain everywhere all around the project construction site and shall be disposed out of the construction site or reuse as far as possible.	Contractors/DSC	Contractor cost

			Ensure the empty cement bags and plastics including other wastes do not go into the sewerage pipes installed into trench.		
	Construction and installation of project structures	Loss of vegetation/trees due to its clearance especially within the stretch along the Khasang Kusung River during the installation of sewerage pipe and crib wall along the river bank. Damages to fisheries and aquatic ecology of riverbeds and avian habitats.	Cutting trees along the Khasang Kusung shall be avoided as far as possible as the river bank has been protected naturally by the trees growing along the river bank. Trees growing along the bank shall not be affected during the time of excavation for laying hume pipes and shall be taken into account. Cut only trees that are marked and have been approved by the Department of Forestry. Solicit instruction from DSC before cutting any trees and removing any vegetation. Plant and rear tree saplings at the rate of 25 saplings for each felled tree at identified plantation sites along the river bank. During the construction; installation of crib wall shall be carried out in such a way that construction work will not affect any tree along the river bank. However, contractor shall solicit instruction from DSC before cutting and removing any affected trees. Do construction during dry season only. Provide separate water supply for construction works. Avoid utilization of water from Khasang Kusung River and local water resources that has been consuming by the local community. Contractor shall use local water supply only if the water is available plenty.	Contractors/DSC	Contractor cost
	Reinstatement of damaged community services and infrastructures.	Reinstatement of community services and infrastructures	Compensate or reinstate/relocate community assets that are disturbed by the construction work such as electricity poles, telephone lines, drinking water pipes, road lengths etc. to the satisfaction of the people. Coordinate with concerned utilities, local people, design maps of the area with utilities and emergency response plans (develop and include an emergency response plan/template that includes notification and reporting protocols). A Shiva Temple situated at the side of the road at chainage 1+730 near Kali Ghat cremation site diversion shall also be taken into account. Water sprout situated near to the Kali Ghat cremation site shall be taken into account during the time of excavation for trench along the road alignment in the diversion section near Kali Ghat Cremation. Water spout and boundary wall of the water spout shall not be affected with the excavation and installation of sewerage pipes.	KVWSMB/KUKL/ Contractor/DSC	Contractor cost
	Influx of outside workforce, and unwanted activities.	Increase in crime and community stress	Prohibit gambling and alcohol consumption in labour “camp sites”. Instruct the workforce to respect the local cultures, traditions, rights, etc.	KVWSMB/KUKL/ Contractor	Contractor cost

	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, 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 sexually transmitted diseases (STDs) and HIV/AIDS using brochures, posters, and signboards. Provide insurance to workers and training in occupational health and safety. Give importance to community health and safety: • Provide alternate potable water supply during maintenance works and notify the public in advance • Prevent pollution of air in agricultural land, vegetation, and human settlements due to dust and vehicular emissions. • Avoid wastewater pollution on land, humans, receiving waters, and the environment. • Minimize nuisance due to traffic noise and vibrations. • Prevent nuisance from odor and noise from wastewater treatment plants. • Avoid traffic accidents and traffic jams. • Prevent the possibility of accidents to the people of the community due to trench excavations. • Make available protection gears to all construction workers and compensate for the loss of life or any type of injuries.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		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 minimise vandalism.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Traffic can cause personal injury to the public, contractors, and employees; and vehicle accidents.	Develop a traffic control plan and keep areas clean and clear of obstacles.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Slips, trips and falls, strains and sprains; manual handling of injuries such as back damage	Conduct site inspection to ensure access/space is adequate for the task activities.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Existing underground services can cause explosion, electrocution, and damage	Inform site in-charge before digging/excavation; 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.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Excavation by plant and equipment will create noise, falling objects, damage to existing surfaces, material spillage, and injuries by moving	Operations of plant by licensed personnel. Use personal protective equipment–hardhat, high visibility vest, hearing protection etc. Maintain a safety working area clear of any clutter etc. Around the moving plant. Protect surfaces from plant movements. Ensure plant noise control.	Contractors/DSC /KVWSMB/KUKL	Contractor cost

		parts.	Maintain clean-up equipment on site. Avoid spillage of diesel and other chemicals into the water body and ground. Collect any spillage with sponge material or use sawdust to soak spillage in order to avoid contamination into water bodies. Employ observers where possible.		
		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.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Overhead and underground power cables can 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. Liaise with relevant authority.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Sloping ground can cause the falling of rolling objects.	Maintain good housekeeping (remove debris, trip hazards, site tidiness). Select locations to minimize potential for movement. Stack materials at level below excavation. Secure/retain potential falling/rolling objects.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Trench collapse and falling objects.	Support / bench / batter excavation. Keep safe distance from edge of trench (at least 0.6 m away from sides of trench depending on soil type and conditions to be decided by DSC during detailed design and to be barricade/fenced to debar the public). Materials not to be placed or stacked near the edge of trench. No load to be placed or moved near the edge of trench where it is likely to cause collapse of the trench. All trenches to have safety barricades when left open for a period of time.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Water logging and pounding in the excavated trench and as a mosquito breeding site	Provide submersible pump to dewater trenches where ground is water-charged. Use personal protective equipment. No load/personnel movement across trench. Avoid mosquito breeding in the excavated trench.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Falling into trenches	Backfill the trenches where possible to avoid falling into it or any accidents. Erect 1.8 meter (min) security fence if open excavation is to be left unattended, or cover open excavation with steel plating if left unattended. Erect safety signage boards to prohibit into the area and to avoid personnel movement across trench.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Other risks associated with confined spaces.	Where trench/conduit is considered to be a confined space, use experienced trained personnel. Labour shall wear all safety PPEs. No smoking and use of mobile phone use, and avoid sparking.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Trip hazard; dust–eye injury;	Provide necessary environmental protection measures:	Contractors/DSC	Contractor

		environmental damage due to storage of fill.	Secure fill stockpile. Provide a dedicated area for fill. Watering of material. Provide necessary personal protective equipment to workers. Cover /fill when unattended or unable to be watered.	/KVWSMB/KUKL	cost
		Manual handling (shovelling) can cause strains and sprains, injuries such as back damage, injuries due to lifting pipes and swinging loads	Correct manual handling techniques. Provide adequate rest periods, allowed job rotation, minimize repetitious twisting and shovelling. Use mechanical aids where possible. Maintain control of loads when lifting and moving. Use Personal Protective Equipment. Carry pipes close to ground while moving if mechanical aid is used.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Contaminated soil can cause impact on health of persons.	Use protective clothes/shoes/gloves.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Defective materials can cause injuries.	Visual inspection of materials by experienced persons/ engineers.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Storage of hazardous materials can cause injuries and illnesses.	Handling and storage to be done carefully under guidance.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Earth mounds can cause engulfment and dust can cause eye injuries.	Control operation of excavator and other construction equipment by license holder only. Watering on excavated materials if required during windy season. Control slopes. Avoid earth mounds of the excavated materials as soon as possible. Put up warning signage. Cover earth mounds when unattended or unable to be watered.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Personal injury due to working plant and equipment. Injury due to loading, unloading and laying of hume pipes in the trench.	Maintain a safe distance from working plant/ loader. Wear personal protective equipment including high visibility clothing and hard hat, etc. Put up perimeter fencing. Place trained personnel on the look-out. Prevent outside and unauthorized people into the working sites to maintain safety. First aid kit shall be in place at the site.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Public hazards due to inadequate compaction, construction refuse, and inadequate re-surfacing during site restoration.	Compaction to specified international standard (backfill shall be compacted to a dry density of not less than 90% of the maximum dry density); clear site of debris and refuse; re-surface without leaving gaps or uneven surfaces and erect fence around hazardous areas until they are safe and restored.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Inadequate training, consultation, planning and improvisation can cause task-specific injuries due to inexperience, inadequate consultation or failure to provide required equipment.	All personnel on-site should be trained and kept aware, and should be suitably qualified. Provide competent supervision to be on-site.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Weather conditions (e.g. hot, cold, wet, flooding/inundation, high winds) can cause dehydration and dizziness.	Supply adequate drinking water in the work area. Make available first aid kit all the time.	Contractors/DSC /KVWSMB/KUKL	Contractor cost

		Slippery surfaces can cause slips and falls.	Wear non-slip safety footwear in all work sites. Ensure extreme care when working in wet and slippery areas. Personnel should never run on worksite.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Untidy site can cause slips and fall, particularly when site is unattended.	Keep worksite clean and tidy at all times, free from clutter and rubbish. Store materials in designated areas as specified in site plans.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Public safety make be at risk due to pipes or drums accidentally rolling onto the roadway causing an accident or may be rolled by unauthorised persons particularly when site is unattended causing injury to persons.	All materials to 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.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Public safety may be at risk due to improper storage of plant.	Store/park plant and equipment off site and in a secure area.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Soil erosion, silt runoff, and settling of street surfaces. Water could get polluted; land values degraded and are a nuisance to pedestrians. Street surfaces would settle, bringing about pounding of water.	Precautionary measures should be taken during construction such as backfilling of excavated trenches maintaining slope and drainage for surface runoff. Construction activities should be, as far as possible and avoided during the rainy season. Provide temporary diversions and sign boards for pedestrians.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Local residents and sites of social/cultural importance may be disturbed by noise, dust and impede access	Carry out the work as quickly as possible to minimize disturbances. Consult residents; inform them of work in advance. Erect “work to commence” and “work in progress” signage.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Pollution of water distributed can cause health hazards.	Place water distribution pipes away from sewers to avoid infiltration of sewage (the bottom of the water service pipe must be at least 0.3 m above the top of the sewer line to avoid seepage with the water pipe above the sewer)	Contractors/DSC /KVWSMB/KUKL	Contractor cost
	Dislocation of archaeological artefacts, if any	Likely impact upon Kali Ghat Cremation site situated along the Khasang Kusung Khola during excavation works.	Given the suggestion from local, deviate the sewer alignment so that it will not pass directly through the site.	Contractors/DSC /KVWSMB/KUKL	Contractor cost
		Grievances due to construction	Arrange for onsite “grievance handling” through the use of liaison officers. Undertake trench closure and facilitate surface rehabilitation or paving as quickly as feasible.		

DSC = Design and Supervision Consultant, DWEC = District Wage Evaluation Committee, KUKL = Kathmandu Upatyaka Khanepani Limited, KVWSMB = Kathmandu Valley Water Supply Management Board, MOPE = Ministry of Population and Environment, PID = Project Implementation Directorate, WWTP = Wastewater Treatment Plant.

C. Implementation Arrangements

1. Environmental Procedures and Institutions

221. The Ministry of Population and Environment (MoPE) is in charge of environmental control and management for all sector agencies. The Ministry of Water Supply and Sanitation (MoWSS) has the overall responsibility for environmental monitoring of all water supply and sewerage projects. In case of an EIA, it has to be finally approved by MoPE. In case of an Initial Environmental Examination (IEE), the final approval lies with MoWSS.

222. The MOWSS 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 water and wastewater organizations were created - Kathmandu Valley Water Supply Management Board (KVWSMB), the asset owner; KUKL, the asset operator and service provider; and 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 monitoring of performance of KUKL as provided in the lease and license agreement between KVWSMB and KUKL. KUKL will be the implementing agency, and the existing PID in KUKL will be responsible for (i) project planning, implementation, monitoring, and supervision; (ii) reporting to KUKL Board of Directors, MoWSS, and ADB; and (iii) coordination of all activities. The experience of PID, KUKL in implementing Kathmandu Valley Water Supply Improvement Project (ADB 2776-NEP) will be useful in taking advance actions for the Project.

223. Some clearances are required to be taken before the Project commences:

• In the forest regulations, if the project "will result in clear cutting of national forest" or "falls within protected area". The Forest Act, 1993 Article 68 mentions that in order to implement any project with "priority status" and "with no other alternatives than to use the forest", "only in such situation and conditioned that there will not be any adverse environmental effect by implementing such schemes", the Government of Nepal may give permission to use some part of forest (organized forest/conserved forest/community forest/lease hold forest) to implement such projects. The Ministry of Forests and Soil Conservation (2009) also requires that all the costs related to the clearing off the forest, its transportation to the approved location and works related to environmental mitigation shall be borne by the project itself. It is mandatory to plant 25 saplings for every tree cut and maintain/nurture them for 5 years. If the proponent cannot nurture the saplings, the proponent will provide the total cost involved to the National Parks and Wildlife who shall rear/nurture the saplings for 5 years. The clearance is sought from the Department of National Parks and Wildlife. Laying of the new sewers will be aligned to avoid the cutting of trees. If during the detailed design, it is found that tree cutting is unavoidable, then the above procedures will be followed. However, the proposed sewer alignments do not fall under any national and government forest area, conservation area, protected area and national parks. Similarly, the proposed treatment plants area also does not fall under any such protected and conservation area. All the lands of treatment plants belong the project and no any private land partials are existed within the boundary of those treatment plant. Some of the trees existed within the boundary shall be considered as private trees and the project will provide appointed contractor to cut the required trees in piecemeal basis. The contractor will be responsible to plant tree saplings in the ratio of 1:25 and will also be responsible to protect it at list for 5 years.

224.

225. Table IX-2 defines the roles of different organisations and groups in environmental monitoring:

Table IX-2: Institutional/organizational Responsibilities in Environmental Monitoring

SN o.	Organization	Roles and Responsibilities		
		Pre- construction phase	Construction phase	Operation phase
2	Ministry of Water Supply (MoWS)	• Review IEE document and submit to donors; approve IEE report, • review design and tender documents in order to examine whether or not mitigation prescriptions are included and instruct	• review EMP Report (i) to ensure EMP implementation (ii) effectiveness of the implementation measures and (iii) compliance	• review bi-annual monitoring reports, and • annual site inspection.
3	Kathmandu Valley Water Supply Management Board (KVWSMB)/ Kathmandu Upatyaka Khanepani Limited (KUKL) and Projection Implementation Directorate (PID)	• review final design and tender documents and forward them to MoWSS, • instruct PID to update RAP and get it approved, • establish 'Safeguard Unit/Utility Management Coordination Sub-committee /appoint Design and Supervision Consultant (DSC) • obtain all necessary permissions and permits, notify, carry out land acquisition (if required), and crop compensation evaluation • select contractor, award	• conduct frontline monitoring on mitigation implementation (i) effectiveness (ii) enhancement programs (iii) appoint monitoring team (iv) ensure public participation (v) RAP implementation (vi) environmental compliance and (vii) prepare quality monitoring report to submit to MoWSS.	• ensure smooth operation of water supply and sewerage systems
4	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 receiving water quality, noise level and vibrations and overall environmental status of the project area.	• approval of construction works • monitoring of the contractor's performance on EMP implementation/ mitigation effectiveness / impact monitoring • labour employment as per regulations • instruct contractor for corrective actions • impose fine/or null payment in case of non-compliance and • prepare monthly monitoring report/ participate in inspection • periodic monitoring of air quality, receiving water quality and noise and vibration levels at the project area • monitoring of impacts on physical, biological and	

5	Construction Contractor	• prepare EMEP for contracts, • select temporary land use sites, and • assist the supervising engineer in joint site inspection of KVWSMB/ KUKL for approval.	• get permission to start work from DSC • 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	

2. Monitoring and Reporting Procedures

226. The Construction Contractor should develop a construction environmental management plan (CEMP) based on the EMP. The CEMP should be approved by PID/KUKL and DSC. Contractors are to submit monthly CEMP implementation status reports to DSC. DSC should submit quarterly reports to PID which should be reviewed by the Safeguard Unit of PID. PID should submit semi-annual monitoring reports to ADB in a similar format provided in Appendix 12. The reporting system should be based on site supervision to see whether mitigation measures are carried out according to the Monitoring Plan. DSC is responsible for checking the monthly progress reports submitted by the Contractor and field verified whether or not the Contractor has complied with the approved conditions as stated in the CEMP.

227. DSC should then prepare a quarterly environmental monitoring report based on the monthly report submitted by the Contractor and submit to PID/KUKL for review. The report is developed based on field inspection, investigation, consultation and information given in the monitoring report. 10 copies of the reports should be submitted to PID/KUKL every month, which should be distributed to the responsible agencies for review. The Environmental Specialist of DSC should then review the comments and suggestions from the various authorities and act accordingly.

228. Monthly progress reports, including bi-annual and annual reports on the implementation of EMP should be produced on a regular basis. The monthly progress report should contain information on the works carried out and the results of all monitoring and investigation works performed during that particular month. The report should also include cases of compliance and non-compliance and the corresponding further mitigation measures to be adopted to correct the non-compliances and also include the outcome of the monitoring, important issues identified and the measures to be undertaken to ameliorate them.

3. Procurement plan and cost estimates

229. The EMP will be incorporated into the bidding and contract documents and the contractors will make available a budget for all such environmental mitigation measures.

230. A domestic Community Awareness and Safeguard Support Consultant (CASSC) firm will facilitate community awareness and participation programs over the 5-year period. The cost for the public awareness specialist, support team, and IEC (Information, Education and Communication) materials has been estimated as $600,000.

231. The Contractors and their supervisory staff should be made aware on the importance of meeting environmental safeguard standards in the contracts, and the importance of preparing, submitting and getting the Environmental Mitigation Execution Plan (EMEP) (to be prepared for each subproject, according to the EMP) approved before construction starts. A one-day orientation programs will be provided to construction contractor as and when required. The orientation program will consist of (i) environmental issues in interceptor sewer construction and laying of sewer pipes, (ii) implementation of mitigation measures, (iii) monitoring of implementation and (iv) preparation of the Environmental Mitigation Execution Plan.

232. Costs for the operation and maintenance phase trainings of KUKL staff, including monthly monitoring.

233. All the costs related to cutting of trees (if there are any and which will be known once the final alignment of the pipelines have been fixed by DSC), their transportation to an approved location and works related to environmental mitigation shall be borne by the project itself. The new sewers will be laid so as to avoid the cutting of trees. If during the detailed design, it is found that tree cutting is unavoidable, it is mandatory to plant 25 saplings for every tree cut and maintain them for 5 years. The cost for the cutting and nurturing of 1 tree for 5 years has been estimated as $600 that will be borne by the project.

The estimated EMP cost included in BOQ is presented in the following table.

SN	Particulars	Stages	Unit	Quantity	Rate (NRs.)	Cost (NRs.)	Cost covered by
A.	**Mitigation Measures**						
1	Resettlement cost of Social	Construction	LS			8,238,831.00	Project
2	Legislation, permits, and agreements	Permit for excavation, tree-cutting permits, etc	Lump sum	LS			These consents are to be obtained by contractor at his own expense.
3	Environmental assessment and environmental clearances as per EPA 1997 and EPR, IEE presentation at review committee related expenses	Preconstruction	Lump sum	1			PMO cost
4	Public consultations and information Disclosure	Information disclosure and consultations during preconstruction and construction phase, including public awareness campaign through media	As per requirement	Lump sum			covered under DSMC contract
5	GRM implementation	Costs involved in resolving complaints (meetings, consultations, communication, and reporting/inform action dissemination)		Lump sum			PMO cost
6	Any unanticipated impact due to project Implementation	Mitigation of any unanticipated impact arising during construction phase		Lump sum			Civil works contract–

SN	Particulars	Stages	Unit	Quantity	Rate (NRs.)	Cost (NRs.)	Cost covered by
7	Social Safeguard and GESI activities	Costs involved in resolving complaints (meetings, consultations, communication, and reporting/ informing	As per requirement	Lump sum			Civil works contract
C.	Reinstatement of relocation of public utilities within land services. i.e. Electric pole, transformer, telephone poles, underground water supply pipe, street lighting, etc. as per instruction of engineer. (Spec. 12.5.8)	Construction				5,000,000.00	
	Total					13,238,831.00	

4. Implementation Schedule

234. Detailed design of interceptor packages and sewer network began in third quarter of 2013. Construction is scheduled to commence in the mid of 2014 to be completed by mid of 2018.

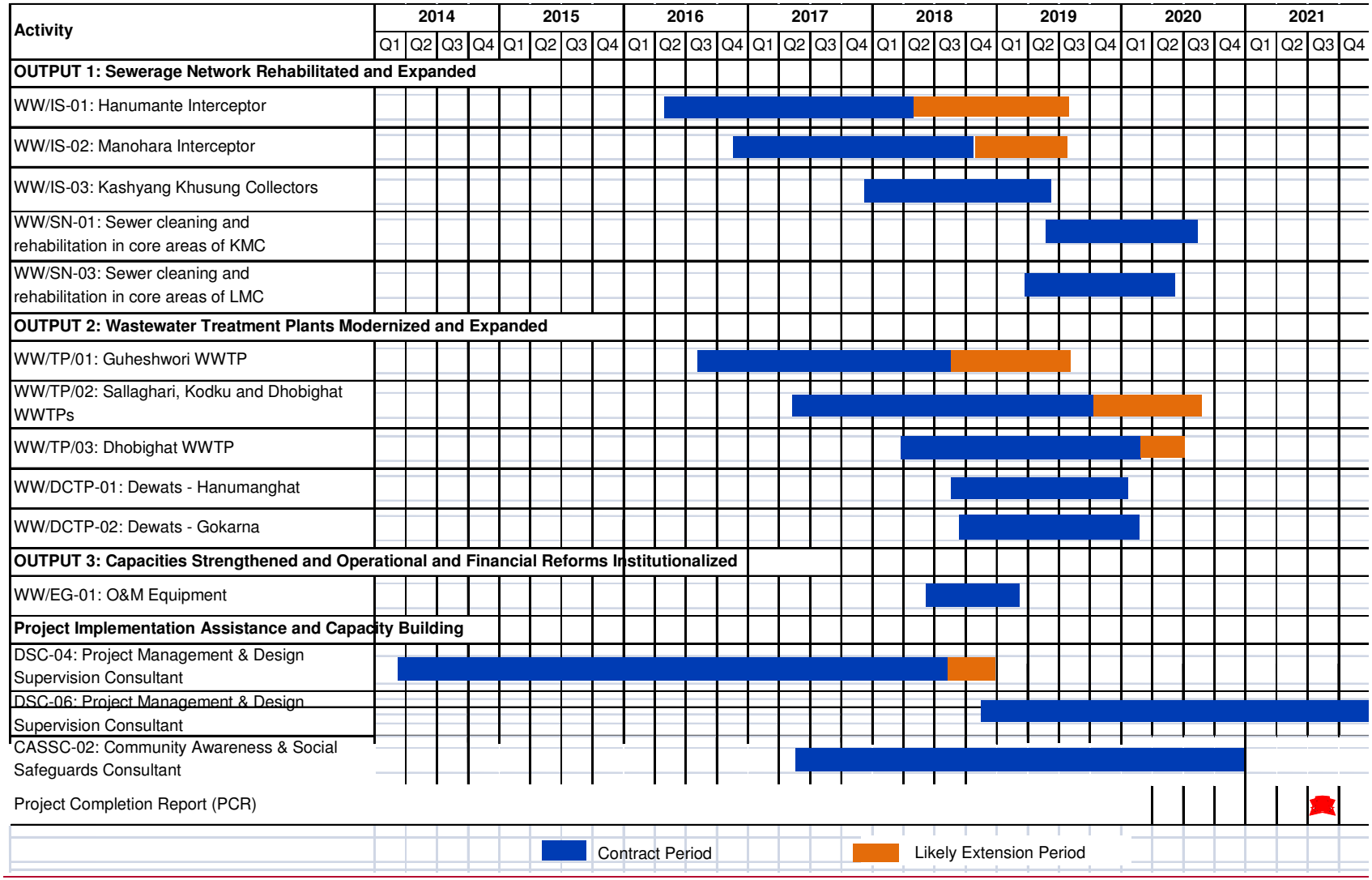
235. The project implementation schedule is given in Table IX-3 for a period of 5 years. Most of the activities have been scheduled on a continuous basis.

236. Under the General Manager of KUKL, there is a Technical Division (headed by a Deputy Technical Manager). Under the Technical Division, there are 10 Branch Offices in the Valley headed by a Deputy Manager each. Before operation, KUKL/PID/DSC, with the help of the Safeguards Unit and the Technical Division of KUKL will develop detailed work plans for implementing mitigation measures and monitoring plans based on the EMP. These plans will be incorporated into the project contracts which will then be submitted to the relevant Branch Offices to help in supervising the works.

237. Before construction, KUKL/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. KUKL/PID will also detail the responsibilities of their environmental management offices and prepare their work schedules.

238. Before operation, KUKL/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.

Table IX-3: Project Implementation Schedule



X. CONCLUSIONS AND RECOMMENDATIONS

239. Overall the impacts of the Project will be very positive, benefitting the environment and the people. Some impacts are anticipated during implementation but in specific areas and for short duration (dust, noise, traffic problems, erosion, sedimentation etc.). It is expected that the adverse environmental impacts of the planned project for will in general not be significant and can be reduced and/ or prevented through mitigation measures and regular monitoring during the design, construction and operation phases.

240. This IEE is updated for Interceptor Sewer line facilities along the both banks of the Khasyang Khusung River. as IS-03.

241. 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 as detailed in the EMP.

242. 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 Kathmandu Valley Wastewater Management Project

1. The Kathmandu Valley Wastewater Management Project (KVWMP) will support the ongoing efforts of the Government of Nepal toward improving the wastewater services in Kathmandu Valley.

2. The proposed infrastructure components of this project includes (i) rehabilitation and expansion of sewerage network including property connections; (ii) rehabilitation and construction of interceptors along the streams; (iii) rehabilitation and construction of 5 wastewater treatment plants of 90.5 MLD capacity; and (iv) energy generation of approximately 910 KW through sludge digestion and gasification, etc.

3. **Categorization (Environment)** - Category B. No significant impacts. Potential impacts are site specific, few if any of them are irreversible, and in most cases mitigation measures can be designed readily. An IEE with EMP was prepared.

Screening Questions	Yes	No	Remarks
B. Project Siting Is the project area.			
a) Densely populated?	x		Extension of interceptors will be in non-populated areas.
b) Heavy with development activities?		x	In established residential areas
c) Adjacent to or within any environmentally sensitive areas?			
Cultural heritage site		x	
• Protected Area		x	
• Wetland		x	
• Mangrove		x	
• Estuarine		x	
• Buffer zone of protected area		x	
• Special area for protecting biodiversity		x	
• Bay		x	
Potential Environmental Impacts Will the Project cause.			
■ impairment of historical/cultural monuments/areas and loss/damage to these sites?	x		

Screening Questions	Yes	No	Remarks
■ interference with other utilities and blocking of access to buildings?	x		Detailed surveys will be conducted of all services and as constructed drawings obtained where possible to locate existing services and to prevent disruption during construction. Budget for restoration/replacement of damaged utilities will be made available and a contingency plan in case of disruption prepared and implemented.
■ nuisance to neighboring areas due to noise, smell, and influx of insects, rodents, etc.?		x	Not anticipated.
■ dislocation or involuntary resettlement of people?		x	No displacement of communities required in this project.
■ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		x	Not applicable.
■ impairment of downstream water quality due to inadequate sewage treatment or release of untreated sewage?		x	Project involves construction of WWTPs designed to allow for expansion as wastewater flows increase in the future. WWTPs to be operated using WWTP safety plans that use a risk based approach to operation.
■ overflows and flooding of neighboring properties with raw sewage?		x	Sewers will be designed to meet peak flow to ensure no overflows of raw sewage. provide stand-by generators for pumping stations. Train operators for regular inspection, cleaning, and maintenance of plant and sewers.
■ environmental pollution due to inadequate sludge disposal or industrial waste discharges illegally disposed in sewers?		x	Sludge will be treated and managed to produce energy at Sallaghari WWTPs via gasification, anaerobic digestion etc.
■ noise and vibration due to blasting and other civil works?	x		No blasting activities. Restrictions on operational hours of crushing plants and construction vehicles etc will be applied.
■ risks and vulnerabilities related to occupational health and safety due to physical, chemical, and biological hazards during project construction and operation?		x	Use of PPE at all sites will be applied strictly. The EMP ensures occupational health and safety measures are included. No hazardous chemicals will be used during construction and operation.
■ discharge of hazardous materials into sewers, resulting in damage to sewer system and danger to workers?		x	Not anticipated. Sewerage to be collected from residential areas. Some commercial connections are anticipated. Waste from these industries discharged to the sewer network will be restricted through the implementation of appropriate discharge standards and monitoring through regular audits conducted by health inspectors.
■ inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances, and protect facilities?		x	Establishment and maintenance of environmental buffer zones in WWTP along with secure fencing. Design of pumping stations will include appropriate housing for pumps for noise proofing and protection of the facility.
■ road blocking and temporary flooding due to land excavation during the rainy season?		x	Not anticipated. Construction activities to be conducted during non-rainy season.

Screening Questions	Yes	No	Remarks
■ noise and dust from construction activities?	x		Anticipated during construction activities. However impacts are temporary and short in duration. The EMP ensures measures are included to mitigate the impacts.
■ traffic disturbances due to construction material transport and wastes?	x		Anticipated during construction activities. However impacts are temporary and short in duration. A traffic management plan will be developed and implemented by the contractor. Contractors will also coordinate with the local traffic police.
■ temporary silt runoff due to construction?	x		Run-off during construction is anticipated. However impacts are temporary and short in duration. The EMP ensures measures are included to mitigate the impacts. Spoil disposal will be immediate and any stockpiling will be away from drain channels etc.
■ hazards to public health due to overflow flooding, and groundwater pollution due to failure of sewerage system?		x	Not anticipated. Sewer system to be designed to accept future flows and peak flows. Design to also include stand-by generators for pumping stations.
■ deterioration of water quality due to inadequate sludge disposal or direct discharge of untreated sewage water?		x	Not anticipated. The EMP ensures measures are included to manage the sludge. Design of plants include management of sludge for energy generation. Design to include plant to accept future flows. Water safety plans for the plants will be developed and implemented to ensure effluent complies with government standards and minimize operational failure.
■ contamination of surface and ground waters due to sludge disposal on land?		x	Not anticipated. Sludge to be managed and used for energy generation.
■ health and safety hazards to workers from toxic gases and hazardous materials which maybe contained in confined areas, sewage flow and exposure to pathogens in untreated sewage and unstabilized sludge?		x	Not anticipated. The EMP ensures measures are included to mitigate the impacts. Occupational, health and safety training provided to all personnel. PPE to be worn at all times. Emergency response plans to be developed and implemented. Personnel will also be provided with relevant inoculations.
■ large population increase during project construction and operation that causes increased burden on social infrastructure (such as sanitation system)?		x	Priority in employment will be given to local residents. Contractors will provide workers camps with sanitary amenities that meet the IFC 2009 guidelines.
■ social conflicts between construction workers from other areas and community workers?		x	Priority in employment will be given 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 construction and operation?		x	Not anticipated. Construction will not use explosives and chemicals. The EMP ensures measures are included to manage storage, use and disposal of fuel for construction equipment. Storage will be in designated areas away from water bodies. Fuel use areas to have drip basins/ catch tank (for fuelling) to prevent leakage and catch spills. Fuel to be recycled where possible or disposed in designated areas.

Screening Questions	Yes	No	Remarks
■ 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	Operation area will be clearly demarcated and restrict public access.

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		Kathmandu Valley is located in a seismic zone.
■ Could changes in precipitation, temperature, salinity, or extreme events over the Project lifespan affect its sustainability or cost?		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	The project will improve the socioeconomic conditions of both, the poor and non-poor populations of Kathmandu valley.
■ Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., increasing traffic or housing in areas that will be more prone to flooding, by encouraging settlement in earthquake zones)?		x	Improved wastewater services could potentially attract migrants to the area.

Appendix 2: Bagmati River pollution

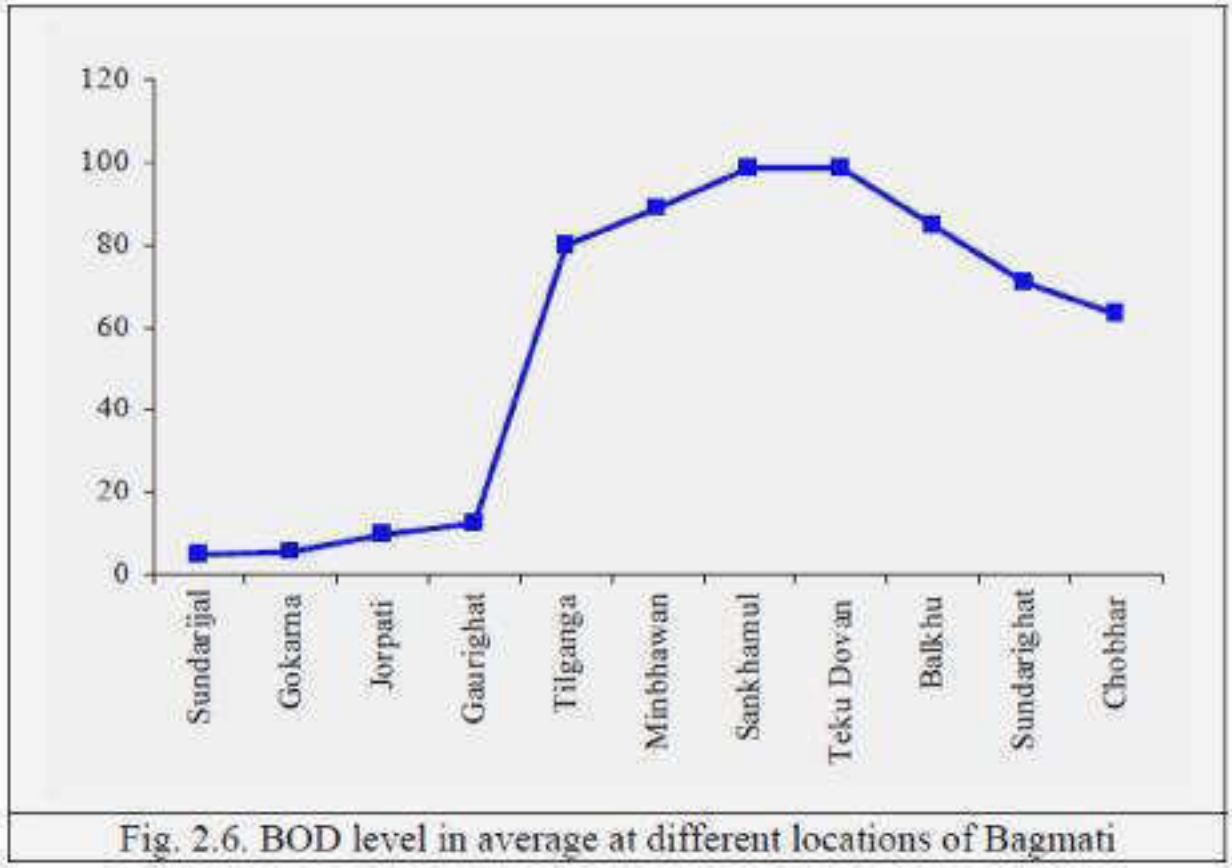


Fig. 2.6. BOD level in average at different locations of Bagmati

Y- Axis: BOD (mg/l); X-Axis: Locations in Kathmandu Valley

Table 3.1. Waiter quality parameters

Parameters	Sundarijal	Khokana
TSS mg/1	5	70
Chloride mg/1	1	24
Ammonia mg/1	0.03	11
BOD mg/1	1.3	65
Coliforai counts per 100 ml	1000	1.000.000
DO mg/1	S.9	1.7

Source: MWSP (2000)

Source: BAGMATI ACTION PLAN (2009-2014), DRAFT REPORT, March 31, 2008 Submitted to: National Trust for Nature Conservation
Submitted by Joint Venture of Astra Development Network Pvt. Ltd, GeoSpatial Systems Pvt. Ltd, Innovative Solution Pvt. Ltd

Polluted Bagmati River

Appendix 3: Tolerance limits for wastewater to be discharged into inland surface waters from combined wastewater treatment plant (generic standards)

Characteristics	Tolerance Limit
Total Suspended solids, mg/L, Max	50
Particle size of total suspended particles	Shall pass 850-micron Sieve.
pH	5.5 to 9.0
Temperature	Shall not exceed 40 degree C in any section of the stream within 15 meters down-stream from the effluent outlet.
Biochemical oxygen demand (BOD) for 5 days at 20 degree C, mg/L, Max	50
Oils and grease, mg/L, Max	10
Phenolic compounds, mg/L, Max	1
Cyanides (as CN), mg/L, Max	0.2
Sulphides (as S), mg/L, Max	2
Radioactive materials:	
a. Alpha emitters, c/ml, Max	7-Oct
b. Beta emitters, c/ml, Max	8-Oct
Insecticides	Absent
Total residual chlorine, mg/L	1
Fluorides (as F), mg/L, Max	2
Arsenic (as As), mg/L, Max	0.2
Cadmium (as, Cd), mg/L, Max	2
Hexavalent chromium (as Cr), mg/L, Max	0.1
Copper (as Cu), mg/L, Max	3
Lead (as Pb), mg/L, Max	0.1
Mercury (as Hg), mg/L, Max	0.01
Nickel (as Ni), mg/L, Max	3
Selenium (as Se), mg/L, Max	0.05
Zinc (as Zn), mg/L, Max	5
Ammonia nitrogen, mg/L, Max	50
Chemical Oxygen Demand, mg/L, Max	250
Silver, mg/L, Max	0.1

Source: Urban Environment Management Framework 2068 (2011), GON

Note:
This generic standard applies to discharge of wastewater into inland surface waters from combined wastewater treatment plants. The municipal wastewater treatment plants in the proposed project will collect and treat only domestic wastewater from Kathmandu Valley. Therefore, in the absence of generic standards for domestic wastewater to be discharged into inland surface water from municipal wastewater treatment plants, this standard will only be applied as a guide. The project will assist in the development and implementation of domestic sewage discharge standards.

Appendix 4: Environment Related Acts and Regulations in Nepal

Acts

1) Ancient Monuments Protection Act, 1991
2) Civil Aviation Act, 1958

3) Aquatic Animals Protection Act, 1960
4) Plant Protection Act, 1964
5) National Parks & Wildlife 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 & Watershed Conservation Act, 1982
11) Nepal Petroleum Act, 1983
12) Nepal Electricity Authority Act, 1984
13) Mines & Mineral Act, 1985
14) Pashupati Area Development Trust Act, 1987
15) Solid Waste (Management & 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) Municipality Act, 1991
22) Water Resources Act, 1992
23) Forest Act, 1992
24) Electricity Act, 1992
25) Motor Vehicle & Transportation Management Act, 1992
26) Labour Act, 1992
27) The Local Governance Operationalization Act, 2074 (2017)
28) Industrial Enterprises Act, 1992
29) Nepal Tourism Board Act, 1996
30) Environment Protection Act, 1996
31) Children' s Act, 1992

Rules

1) National Parks & Wildlife 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 & 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 & Transportation Management Rules, 1997
20) Environment Protection Rules, 1997

Appendix 5: National Ambient Air Quality Standard, 2012 for Nepal

Parameters	Units	Averaging Time	Concentration in Ambient Air, maximum	Test Methods
TSP (Total Suspended Particulates)	µg/m³	Annual	-	
		24-hours*	230	High Volume Sampling
PM10	µg/m³	Annual	-	
		24-hours*	120	Low Volume Sampling
Sulphur Dioxide	µg/m³	Annual	50	Diffusive sampling based on weekly averages
		24-hours**	70	To be determined before 2005.
Nitrogen Dioxide	µg/m³	Annual	40	Diffusive sampling based on weekly averages
		24-hours**	80	To be determined before 2005.
Carbon Monoxide	µg/m³	8 hours**	10,000	To be determined before 2005.
		15 minute	100,000	Indicative samplers ***
Lead	µg/m³	Annual	0.5	Atomic Absorption Spectrometry, analysis of PM_{10} samples****
		24-hours	-	
Benzene	µg/m³	Annual	20	Diffusive sampling based on weekly averages
		24-hours	-	
PM10	µg/m³	24-hours	40	
Ozone	µg/m³	8-hours	157	

***Note:** 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

****Note:** 24 hourly standards for NO_2 and SO_2 and 8 hours standard for CO are not to be controlled before MOPE has recommended appropriate test methodologies. This will be done before 2005

*****Note:** 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 8am - 10am or 3pm - 6pm on a workday. This test method will be re-evaluated by 2005

******Note:** If representativeness can be proven, yearly averages can be calculated from PM10 samples from selected weekdays from each month of the year.

Appendix 6: Recommended noise exposure limits for the work environment (adopted from Occupational Safety and Health Administration (OSHA)

S.No	Noise Exposure (dBA)	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.

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 (dBA)
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 7: Source: Vibration Regulation Law 64 of 1976, Japan

Type of Restriction	Area Classified	
Standard Value	I & II	85 dBA
Work Prohibited Time	I	7.00 P.M. - 7.00 A.M.
	II	10.00 P.M. - 6.00 A.M.
Maximum Working Duration	I	10.00 hrs. per Day
	II	14 hrs. per Day
Maximum Consecutive Working Days	I & II	6 Days
Working Prohibited Days	I & II	Saturdays & Holidays

Recommended Standards for Vibration from Construction Sites

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

- Areas where maintenance of quiet is particularly needed to preserve the residential environment.
- Areas which require maintenance of quiet since they are need for residential purposes.
- Areas need for commercial and industrial as well as residential propose which are in need of measures to prevent vibration pollution since a considerable number of houses are located.
- The neighbourhood of schools, hospitals and the like.
- Area II stands for areas where there is a need to preserve the living environment of in habitants and other than 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 they are used for residential purpose.
II	70 dB	65 dB	Areas need 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 which are in need of measures to prevent the living environment of local residents from deteriorating.

Source: Vibration Regulation Law 64 of 1976, Japan
Note: Vibration level shall be measured at the boundary line of the road.

Appendix 8: Focus Group Discussions, Stakeholders Consultations/ Workshops and Meetings

Minutes of Focus Group Discussion on identification of project intervention areas

A Focus Group Discussion (FGD) was held with an objective of involving key stakeholders and receiving their input in identification and prioritization of the project intervention areas in relation to the sewerage network improvement.

Date: 26th April 2012 (Thursday)

Time: 11:00 - 14:00

Venue: Falcha/SAP Nepal, Babarmahal,

Kathmandu Presence:

S.N.	Name	Designation	Institution
1	Krishna Bhola Maharjan	Engineer	Kirtipur Municipality
2	Rudra Prasad Adhikari	Civil Engineer	Lalitpur SubMetropolitan City
3	Prabin Shrestha	Arch. Infrastructure Planner/PWD	”
4	Narayan Kumar B.C.	Sr. Finance Officer	KVWSMB
5	Shree Krishna Nyaichyai	Civil Engineer	Bhaktapur Municipality
6	Satya Narayan Sah	Sr. Engineer	Madhyapur Thimi Municipality
7	Sudan Raj Panthee	Deputy Project Director	KUKL/PID
8	Richard H. Pope	Vice General Manager	KUKL
9	Shekhar Adhikari	Deputy Manager	KUKL
10	Noor Kumar Tamrakar	DTL	PPTA
11	Himesh A. Vaidya	Sr. Engineer	PID/KUKL
12	Carlo Pandolfi	GIS Expert	PPTA
13	Darryl Jackson	Wastewater Engineer	PPTA
14	Raja Ram Pote Shrestha	Wastewater Engineer	”
15	Susheela Chand	Office Manager	”
16	Abadh Kishor Mishra	Project Director	PID/KUKL
17	Chandra Lal Nakarmi	Manager	KUKL

Deputy Project Director of KUKL/PID Mr. Sudan Raj Panthee opened the FGD with brief introduction of the programme. It was followed by brief introduction of all the participants. Wastewater Engineer (Int.) Mr. Darryl Jackson made a power point presentation and briefed on the background and scope of PPTA and the selection criteria for identification of project intervention areas. Wastewater Engineer (Nat.) Mr. Raja Ram Pote Shrestha recalled the meeting with all five municipalities in respective municipality before the FGD and requested to make a presentation on problematic areas based on maps and tables provided to them by PPTA team earlier. He informed that the identified areas from this FGD will be considered for further detail analysis and will be screened through technical and other criteria for inclusion in project development. He also facilitated the FGD.

A. Bhaktapur Municipality:

Er. Shree Krishna Nyaichyai briefed about the existing sewerage system in Bhaktapur Municipality. He informed that the municipality has two different problems in core area and in new developed urban areas. GTZ developed sewerage system with combined system in core area, which has been running till date. The major problem in core area is related with overflow of pipes during rainy season due to clogging of pipe in some places. The north inceptor is a gravity run system and has been running to some extent but south inceptor which consisted of

pumping system is out of order due to problems in pumping system.

The new settlements have been developed in north and both sides of Arniko Highway in south. Although the municipality prohibits disposal of sewage into Hanumante river, they have been discharging on their own. The sewage discharge from these areas and surrounding VDCs causes pollution of Hanumante and Khasyang Khusung river.

The major problematic areas in the municipality are Kamal Vinayak (Ward No. 4) and other 3 newly developed land pooling areas.

The municipality is planning to implement land pooling project with 75 Ha, which will include sewerage network as well.

The major areas of concern/priority for the municipality is to rehabilitate/relay north inceptor to make it operable without pumping system and rehabilitate existing south inceptor and sewer lines in core area, lay interceptor sewers along Hanumante and Khasyang khusung river to intercept sewer from newly developed areas and treatment of wastewater at Sallaghari WWTP.

B. KUKL:

Er.Shekhar Adhikari, Chief of Sewerage Operation Department (SOD)/KUKL highlighted the role played by SOD in managing wastewater in the valley. He raised the necessity of south inceptor in Bhaktapur and informed that other problematic areas in the Bhaktapur are Byasi to Kamal Vinayak and Bhaktapur Industrial Area.

He informed that KUKL has not constructed any sewer line in Madhyapur and have received no complaints so far. But there is a high demand of Jetting machine in Kirtipur because of frequent clogging. The major problematic areas are Baghbhairav, Nayabazar, Khasibazar etc.

The problematic areas in Lalitpur are Kumaripati and Mangalbazar, where Jetting machine has to be used every week because of clogging and small size pipes. The other areas are Lagankhel to Batukbhairav and Jawalakhel to Ekantakuna. The sewer lines in this area are clogged with fatty materials because of haphazard disposal by restaurants.

He briefed that there are several problematic area in Kathmandu. The most problematic areas are Jamal area, Kamalpokhari-Putalisadak and Tripureshwor. The SOD has been managing these areas through diversion of wastewater into nearby other sewer lines. The Thamel area is suffering from clogging due to small pipe size and fatty materials.

Mr. Richard Pope, Vice GM of KUKL appreciated the PPTA efforts and informed that improvement in wastewater sector is very necessary. He stressed on the synchronization of works between water supply and wastewater works especially in DNI areas. He also emphasized to give due attention to rehabilitate sewer lines in narrow lanes.

Mr. Carlo Pandolfi briefed the meeting about asset condition assessment survey and the preparation of GIS of sewerage network which the PPTA is preparing to carry out. He informed that the survey work will start by the end of May 2012 and requested for the cooperation of municipalities and KUKL in conducting this survey.

Mr. Darryl Jackson concluded the FGD and informed that the suggestions will be considered to identify and prioritize areas for intervention. He thanked all the participants for positive feedback and informed that similar interaction will be conducted in future to finalise the areas.

Minutes of Meeting on Coordination on Wastewater Sector

A meeting was organized with an objective of coordinating activities of different

stakeholders working on wastewater management sector in Kathmandu Valley.

Date: 22nd June 2012 (Friday)

Time: 15:00 - 16:00

Venue: Meeting Hall, Ministry of Urban Development (MoUD), Singh Durbar, Kathmandu Presence:

S.N.	Name	Designation	Institution
1	Mr. Tana Gautam	Secretary	MoUD
2	Mr. Gajendra Thakur	Project Manager	HPCIDBC
3	Mr. Abadh Kishore Mishra	Project Director	PID
4	Mr. Anil Bhadra Khanal	Deputy Project Director	,,
5	Mr. Sanjeev Bikram Rana	,,	,,
6	Mr. Himesh A. Vaidya	Eng. Section Chief	,,
7	Mr. Prayag Lal Joshi	Chairman	KUKL
8	Mr. Kiran Amatya	General Manager	,,
9	Mr. Narayan B. Bhattarai	Division Chief	Kathmandu Metropolitan City
10	Mr. Narayan Kumar B.C.	Sr. Finance Officer	KVWSMB
11	Mr. Hannu Pelkonen	Team Leader	PPTA Team
12	Mr. Noor Kumar Tamrakar	DTL	,,
13	Mr. Raja Ram Pote Shrestha	Wastewater Engineer	,,

Mr. Tana Gautam, Secretary of MoUD chaired meeting and initiated it briefing on the objective of organizing this coordination meeting. He requested an active participation to make the meeting success. Thereafter, Mr. Abadh Kishore Mishra, PID Director elaborated the agendas of the meeting.

Mr. Noor Kumar Tamrakar made a power point presentation and briefed on the background and scope of the PPTA. He also informed the expected outputs of the project and requested the participants to express their opinion on the several coordination issues like scope of work, design parameters, ongoing & planned programmes of different stakeholders, coordination mechanism etc. The presentation was then followed by discussion.

Major Issues Discussed:

1. Several agencies like KUKL/PID, High Powered Committee for Integrated Development of Bagmati Civilization (HPCIDBC), Municipalities are working on wastewater sector in Kathmandu valley. There are some other stakeholders like Kathmandu Valley Development Authority (KVDA), Department of Roads (DoR), Department of Survey, Town Development Fund (TDF) and some other agencies working in this sector and their activities should be coordinated to have better results.
2. Kathmandu Municipalities has gradually decreased laying of sewer lines. In recent years, it has been supplying hume pipes to some limited local users committees.
3. The design parameters used by various agencies are different and there must be common understanding to apply uniform design guidelines to sewer network improvement work.
4. HPCIDBC intends to be river basin management organization. It is not interested to operate Guhyeswari WWTP and if KVWSMB comes with suitable proposal, it is ready to handover. The issue of wastewater tariff collection in Guhyeswari WWTP area has also been discussed.
5. The HPCIDBC is planning to lay Interceptors along banks of all nine rivers in the valley. It is expected that the contract will awarded to lay Interceptor upto Balkhu

within three months. The necessity of coordination of these activities with PPTA team was discussed.

6. There are several sewer network problems in the valley and KUKL alone cannot improve the whole situation. The proposed ADB project is an opportunity, which will not come again and again. Considering this, the fund should be utilized not only for WWTP and Interceptor construction but also for neighborhood network improvement. But before that, asset condition survey should be carried out to propose improvement projects. Implementation should be realistic and not very ambitious.

Decisions:

1. It was agreed to form two committees on coordination issues. One Coordination Committee will be formed to oversee all coordination issues, which will be headed by MoUD. Another will be technical coordination committee, where KUKL/PID, HPCIDBC, KVDA, Municipalities and both ADB PPTA will represent. The meeting will be conducted at least once in a month.
2. There will be uniform design guidelines on sewerage works carried out by various agencies, which will be proposed by technical committee.

The Chairperson of the meeting thanked all the participants for fruitful discussion and informed that the suggestions will be considered to improve the working modalities of different agencies.

Summary of Proceedings

Consultative Stakeholders Workshop on Interim Report

Background:
The consulting team (FCG in association with TMC and ERMC) is working under PPTA 7936 funded by Japanese Fund for Poverty Reduction and executed by the Asian Development Bank to prepare a project for wastewater service improvement in Kathmandu Valley for a project grant from Asian Development Bank and other development partners.

The proposed wastewater service improvement investment has focussed on: a) neighbourhood sewer rehabilitation, improvement and expansion; b) construction of new interceptor and inceptor sewers to convey sewage from neighbourhood network to WWTPs; c) Modernisation, expansion and construction of new WWTPs to treat sewage before discharge into river system and d) institutional development and capacity-building programs for efficient and effective management of wastewater sector. The consultants have prepared an interim report on the project feasibility study and Project Implementation Directorate (PID)/KUKL has organised a consultative stakeholder"s workshop.

Objectives:
The objectives of the meeting are to discus and obtain a broad consensus on the range of necessary improvement works on wastewater management of Kathmandu Valley and to develop investment programs for ADB financial assistance for a period of 2013-18.

Time: 09:00am – 16:25 pm
Date: 14th August 2012 (Tuesday)
Venue: Hotel Everest, New Baneshwor, Kathmandu, Nepal

PROGRAMME
9:00 - 9:30 AM : Registration and Tea
9:30 – 9:45AM : Informal Opening Session
9:30 AM : Call on Dignitaries to Dais by the MC/Moderator
: Welcome Remarks Mr. Abadh Kishore Mishra, Project Director, PID
: Opening Remarks Mr. Kenichi Yokoyama, Country Director, ADB
: Opening Remarks Mr. Tana Gautam, Secretary MoUD
9:45 – 10:05 AM : Presentation on Project Overview, components and implementation by Mr. Hannu Pelkonen, Team Leader, PPTA
10:05 – 10.25 AM : Presentation on Existing Wastewater Management in KV Mr. Tirtha Raj Poudel Manager, Sewerage Operation Department, KUKL
10:25 – 10:40 AM : Discussion
10:40 – 11:05 AM : Refreshment (Light)

11:05 – 11:35 AM : Presentation on Sewer Network by Mr. Raja Ram Pote Shrestha, Wastewater Expert, PPTA, including: issues related to combined/separate sewers operation and maintenance of sewerage network issue of synchronization and/or double excavation of water pipeline networks and sewerage networks;
11:30 – 11:45 PM : Discussion Session11:45 – 12:15 AM : Presentation on Wastewater Treatment Plants and related Issues, Sludge Management and Energy Generation by Mr. Ari Niemela, Wastewater Treatment
Plant Expert, PPTA, including: comparative analysis of various wastewater treatment technologies and the
Recommendations applicability of and recommendations for decentralized wastewater treatment systems (DEWATS) in KV.

12:15 – 12:30 PM : Discussion Session
12:30 – 12:45 PM : Institutional and Capacity Building Issues, by Mr. Rajendra Giri, Institutional Expert, including: suggestions for proper institutional structure and capacity building of institutions responsible for O&M of wastewater systems in KV; demarcation of role and responsibilities among various institutions involved in wastewater management in KV
12: 45 – 1:00 PM : Discussion
1:00 – 2:00 PM : Lunch
2:00 – 2:25 PM : GIS Development on Sewerage and Water Supply Infrastructure in KUKL, by Mr. Carlo Pandolfi, GIS Expert, including recommendations to develop sewerage GIS and the action plan by the CBP team to develop such GIS;
2:25 – 2:40 PM : Discussion
2:40 – 3:00 PM : Resettlement, Gender and Social issues, by Ms. Gita Adhikari, Social Development Specialist, including important concerns and recommendations to make the project more inclusive focusing on social and gender aspects and ensuring community participation

3:00 – 4:00 PM : Main Discussion Session, opening by Mr. Noor Tamrakar, DTL, including O&M and sustainability of wastewater management with special emphasis on availability of personnel, uninterrupted power and O&M budget – key issues
4:00 – 4:10 PM : Conclude/Remarks on Discussion, by Mr. Noor Tamrakar, DTL
4:10 – 4:25 PM : Closing Remark by Mr. Prayag Lal Joshi, Chairperson, KUKL

Meeting Proceedings:
The Workshop was conducted in two sessions namely Opening Session and Technical Session.

A. Opening Session:
Mr. Abadh Kishore Mishra, Project Director of Project Implementation Directorate (PID) made first welcome remarks. He welcomed all the participants and briefed about the background of KVWMP. He informed the activities carried out by PPTA and the objectives of the present workshop. He emphasized on the improvement of waste water network, upgrading of existing wastewater treatment plants and construction of new plants. He expressed his view that the water supply and sewerage system will be more effective in the Valley after the completion of Melamchi Water Supply Project by the end of 2015. He requested all invitees to actively participate in the discussion.

Mr. Kenichi Yokoyama, Country Director of Asian Development Bank (ADB) highlighted the role of this PPTA to improve urban environment of Kathmandu Valley and asked to coordinatewith other similar projects especially with another ADB funded Bagmati River Basin Improvement Project. He emphasized two key issues which should be considered seriously by the government. There is a need to enhance project readiness for smooth implementation of the project. The disbursement rate is less than 9 % out of 25% targeted in most of the on-going ADBs projects. So it needs to expedite and implement the projects without any delay. Second issue is related with operation and maintenance of wastewater management system including sewerage network and WWTP. He asked to consider an uninterrupted power supply as a key challenge in implementing the proposed project. He asked to complete PPTA works resolving all pending issues by taking advanced actions in coordination with KUKL, HPCIDBC, PID, DSC and other agencies. He also requested the strong commitment of the government for successful completion of this project.

Mr. Tana Gautam, Secretary, Ministry of Urban Development (MoUD) informed that the Government of Nepal has considered this project very seriously. He informed that the KVWMP is the priority project for Kathmandu Valley and expected that the project will contribute to government policy of providing sanitation to all by 2017. He highlighted the present status of waste water and emphasized the need to treat the waste water before discharging into the river. He lauded the role of ADB in implementation of

projects on water and sanitation. He concluded his remarks asking all participants to contribute from their sides to make the project a successful.

Speaking from the Chair, **Mr. Prayag Lal Joshi, Chairman, KUKL** mentioned that the sewerage and drainage are the complicated issues in the valley. He requested to consider some critical issues like land availability for WWTP, social problems and synchronization of sewerage works with DNI activities. There are multiple actors involved in this sector which had made the system more complicated. There is no coordination between and among them and the work has been done haphazardly. He closed the opening session requesting all for active participation and contribution in the discussion.

B. Technical Session: Interim Report Findings Presentation

Mr. Hannu Pelkonen, **Team Leader of PPTA** made first presentation and elaborated on the overall Project overview, components, scope and magnitude of the project and implementation. He also introduced the objective and the development of the interim report, prepared by the PPTA and submitted to MoUD, KUKL, PID and ADB.

Thereafter, **Mr. Tirtha Raj Poudel, Manager of Sewerage Operation Department, KUKL** made presentation on Existing Wastewater Management in Kathmandu Valley. He briefed about the existing wastewater management system of Kathmandu and role of KUKL in managing it. He informed that KUKL activity at the moment is limited to cleaning and repairing some sewer lines due to limited budget, human resources and other technical constraints.

Mr. Raja Ram Pote Shrestha, Wastewater Expert of PPTA presented on Sewer Network, Interceptors and Related Issues. He briefed the existing condition on network informing that the actual condition is not known. He highlighted some key issues in managing sewer network like issues related to combined/separate system, O & M of sewerage network and issue of synchronization and/or double excavation of water pipeline networks and sewerage networks. He then presented proposed projects on network and interceptors with justification and limitation. He raised some major coordination issues which are very important for successful implementation of the proposed project.

Mr. Ari Niemela, Wastewater Treatment Plant Expert of PPTA made presentation on Wastewater Treatment Plants and related Issues, Sludge Management and Energy Generation. He briefed on the existing wastewater treatment system in the valley and informed the operational condition of existing WWTPs. He elaborated the proposed WWTP projects with comparative analysis of various wastewater treatment technologies and the recommendations. He also discussed on applicability of and recommendations for decentralized wastewater treatment systems (DEWATS) in KV.

Mr. Rajendra Giri, Institutional Development Expert of PPTA presented on Institutional and Capacity Building Issues. He elaborated on existing institutional issues in KUKL on wastewater sector and roles played by various agencies in this sector. He suggested a list of manpower and capacity building activities required to implement and sustain this project.

Mr. Carlo Pandolfi, GIS Expert of PPTA made presentation on GIS Development on Sewerage and Water Supply Infrastructure in KUKL. He briefed the current situation and ongoing activities of KUKL in relation to GIS. He presented on proposed structure and recommendations of the PPTA team to develop sewerage GIS and action plan to be taken by CBP team to develop such GIS.

Mr. Sushil Babu Aryal, Social Safeguard Specialist of PPTA presented on Resettlement Issues. He briefed about the potential resettlement issues in project implementation and proposed some mitigation measures.

Ms. Gita Adhikari, Social Development Specialist of PPTA made presentation on Gender and Social Issues. She informed the findings of the FGD and other consultation meetings with the community people. She highlighted some important concerns and recommendations to make the project more inclusive focusing on social and gender aspects to ensure community participation.

Mr. Noor Tamrakar, Deputy Team Leader of PPTA presented on Operation and Maintenance of Sewerage System. He elaborated on the existing O & M issues in this sector in KUKL with due consideration of financial issues. He highlighted key issues on O&M and sustainability of wastewater management with special emphasis on availability of personnel, uninterrupted power and O&M budget.

C. Discussion:

The presentation has been followed by floor discussion, where the following remarks/issues were raised.

Mr. Prayag Lal Joshi, Chairman, KUKL

He commented on the involvement of multiple agencies in the construction of sewerage and drainage system without proper design. This has created a serious problem in the functioning of the system. Such haphazard system of construction should be discouraged.

Ms. Laxmi Sharma, Project Officer, ADB/NRM

She raised the issue on the involvement of different organization in the construction of drainage and sewerage system. Since, KUKL has been given the mandate for the management of sewerage, why permission is given to different organizations to connect the storm water into sewerage system. She also raised the issues of quality work and insufficient manpower for the project implementation. She requested to have better coordination with the Department of Urban Development and Building for implementation of provision of construction of septic tank while issuing building permit for new house construction.

Mr. Gajendra K. Thakur, Project Manager, HPCIDBC

Mr. Thakur mentioned the deterioration of water quality in the river due to the approval of new house plan/construction by the Municipality without mandatory construction of Septic Tank. Prior to 2050 BS (1993), one could not construct a new house without constructing Septic Tank. After 1993, the Municipality did not administer strict rule of compulsory construction of Septic Tank. People started to discharge wastewater from their house directly into the river. He also requested to mention expenditure done by HOCIDBC in managing wastewater system, which is about NRs. 30 million per year.

Mr. Ganesh Thapalia, Kathmandu Metropolitan City

Mr. Thapalia defended the existence of the policy of compulsory construction of Septic tank when one seeks approval of housing plan from Kathmandu Metro. He argued that there is a problem in the upstream of river. The river is being polluted from the upstream. Further, he mentioned the problem of sludge management in Kathmandu Metro. He asked the audience where to dispose the sludge which comes from the Septic tank. The present coordination problems with different organization involved in waste water sector has made the wastewater management in the valley more difficult. He requested that Kathmandu Metro should be informed about the project activities and the assistance required from the Metro to solve the problem. He also requested all to cooperate in the awareness programs launched by Kathmandu Metro for cleaning the rivers of Kathmandu Valley.

Mr. Satya Narayan Shah, Engineer, Madhyapur Thimi Municipality

Mr. Shah opined that the centralized system of wastewater treatment will not be practical in Nepal. He gave the example of the failure of Bhaktapur Wastewater Treatment Project constructed in 1970s. He recommended decentralized wastewater management system through local community based small treatment plant. He informed that the Municipality used to have only on-site sanitation system in the past, which later on polluted dug wells. As a result they now emphasized on sewerage system.

He suggested the need of good relationship between KUKL and Municipality in solving the problem. He also raised the issue of tariff on the sewerage. The Municipality does not have any taxation system on the sewerage management. For the effectiveness of Septic tank, sufficient water should be available which we do not have.

Mr. Mahesh Bdr. Basnet, Chairman, HPCIDBC

Mr. Basnet opined that the pollution of river increased dramatically after the starting of PPP model program for laying of sewer by Municipalities which discharged raw sewage directly into the river. If small WWTP had been constructed, the present problem would not have come. He attributed deteriorating river water quality on not following the rule and regulations of the government. He requested the concerned organization/authority to implement the restriction or prohibition of discharging waste water into the river. He also commented on the recent amendment of reducing right of way in Dhobikhola bank corridor from 12 meter to 9 meter. He pointed out that the PPP model started by Municipality encouraged people to lay sewer and drain lines haphazardly.

Mr. Tirtha Raj Poudel, Manager, KUKL

Mr. Poudel opined that there may a need to dig the same road many times unless proper coordination of DNI works and Sewerage network construction is done. He asked for synchronization of DNI activities and proposed network improvement works. He commented on proposed laying of interceptor sewers on both side of the *Tukucha* River since there is no space to construct. Mr. Poudel also stressed on the importance of land acquisition for the proposed Wastewater Treatment Plant at Khokana. He urged implementation of different rules and regulations to manage wastewater system in the valley.

Mr. Richard Popes, Vice General Manager, KUKL

Mr. Popes expressed the view that since there is not much space for locating WWTPs and not much

expertise in design and management of wastewater treatment plant and so Kathmandu should have centralized system of WWTP and not isolated many treatment plants. Every treatment plant will be different based on quality of raw sewage and has to be designed differently. So having centralized WWTP simplifies both the design and the operation and maintenance of the plant. He emphasized that the interceptor sewers should be designed at right level and proper technology should be adopted for laying it.

Mr. Rammani Bhattarai, Executive Officer, Bhaktapur Municipality

Mr. Bhattarai requested the workshop organizer to conduct such workshop on government holidays, so that everybody can participate whole day in the workshop.

The Workshop was concluded with closing remarks by **Mr. Prayag Lal Joshi, Chairman of KUKL.** He summed up the discussion and presented his views on the proposed project. Mr. Joshi opined that the project has covered everything but left out some policy aspects in planning, formulation of laws, regulations, organizations responsibility, and enforcement mechanism for separate system (i.e. storm water and sewerage). He suggested the consultant to look on the decentralized wastewater treatment system in the valley. He requested the consultant to recommend some specific training programs to the KUKL staff. He further requested to recommend scientific tariff structures and collection procedure for the sewerage.

At the end, he thanked all the experts for presenting different technical papers and the participants in actively participating in the discussions and providing very useful inputs.

Appendix 9: IFC/EBRD | Guidance on Workers' Accommodation

Sanitary and toilet facilities

It is essential to allow workers to maintain a good standard of personal hygiene but also to prevent contamination and the spread of diseases which result from inadequate sanitary facilities. Sanitary and toilet facilities will always include all of the following: toilets, urinals, washbasins and showers. Sanitary and toilet facilities should be kept in a clean and fully working condition. Facilities should also be constructed of materials that are easily cleanable and ensure privacy. Sanitary and toilet facilities are never shared between male and female residents, except in family accommodation. Where necessary, specific additional sanitary facilities are provided for women.

Benchmarks

1. Sanitary and toilet facilities are constructed of materials that are easily cleanable.
2. Sanitary and toilet facilities are cleaned frequently and kept in working condition.
3. Sanitary and toilet facilities are designed to provide workers with adequate privacy, including ceiling to floor partitions and lockable doors.
4. Sanitary and toilet facilities are not shared between men and women, except in family accommodation.

Toilet facilities

Toilet arrangements are essential to avoid any contamination and prevent the spread of infectious disease.

Benchmarks

1. An adequate number of toilets is provided to workers. Standards range from 1 unit to 15 persons to 1 unit per 6 persons. For urinals, usual standards are 1 unit to 15 persons.
2. Toilet facilities are conveniently located and easily accessible. Standards range from 30 to 60 metres from rooms/dormitories. Toilet rooms shall be located so as to be accessible without any individual passing through any sleeping room. In addition, all toilet rooms should be well-lit, have good ventilation or external windows, have sufficient hand wash basins and be conveniently located. Toilets and other sanitary facilities should be ("must be" in cold climates) in the same building as rooms and dormitories.

Showers/bathrooms and other sanitary facilities

Hand wash basins and showers should be provided in conjunction with rooms/dormitories. These facilities must be kept in good working condition and cleaned frequently. The flooring for shower facilities should be of hard washable materials, damp-proof and properly drained. Adequate space must be provided for hanging, drying and airing clothes. Suitable light, ventilation and soap should be provided. Lastly, hand washing, shower and other sanitary facilities should be located within a reasonable distance from other facilities and from sleeping facilities in particular.

Benchmarks

1. Shower/bathroom flooring is made of anti-slip hard washable materials.
2. An adequate number of hand wash facilities is provided to workers. Standards range from 1 unit to each 15 persons to 1 unit per 6 workers. Hand wash facilities should consist of a tap and a basin, soap and hygienic means of drying hands.
3. An adequate number of shower/bathroom facilities is provided to workers. Standards range from 1 unit to 15 persons to 1 unit per 6 persons.
4. Showers/bathrooms are conveniently located.

5. Shower/bathroom facilities are provided with an adequate supply of cold and hot running water.

Source:
http://www1.ifc.org/wps/wcm/connect/9839db00488557d1bdfcff6a6515bb18/workers accomodation.pdf?MOD=AJPERES

Appendix 10: Traffic Management Planning (TMP)

A. Principles for TMP around the Sewer 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 sewer works.

C. Analyse 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

Steps	Review	Review **construction schedule and methods**
1.	Traffic Re-Circulation	Identify initial traffic recirculation and control policy
2.	Traffic Diversion	Identify routes for traffic diversions.
3.	Full Road Closures	Begin community consultation for consensus.
4.	Temporary Parking	Identify temporary parking (on and off-street)- Discuss with ward, owner, community for use
5.	Police Coordination	Coordinate with the Traffic Police to enforce traffic and diversions
6.	Install Control Devices	Install traffic control device (traffic cones, signs, lightings, etc).
7.	UMC Sub-committee	Coordinate with the UMC sub-committee to reconcile with the future plans of utility agencies
8.	Awareness	Conduct campaigns, publicity, and notify public about street closure
9.	Public Redness	Develop a mechanism to address public grievances disruptions (traffic, utilities, and diversions.

7. 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.

8. 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.

9. 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.

10. The campaign will cater to all types of target groups i.e. children, adults, and drivers.

11. 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)** advise 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.

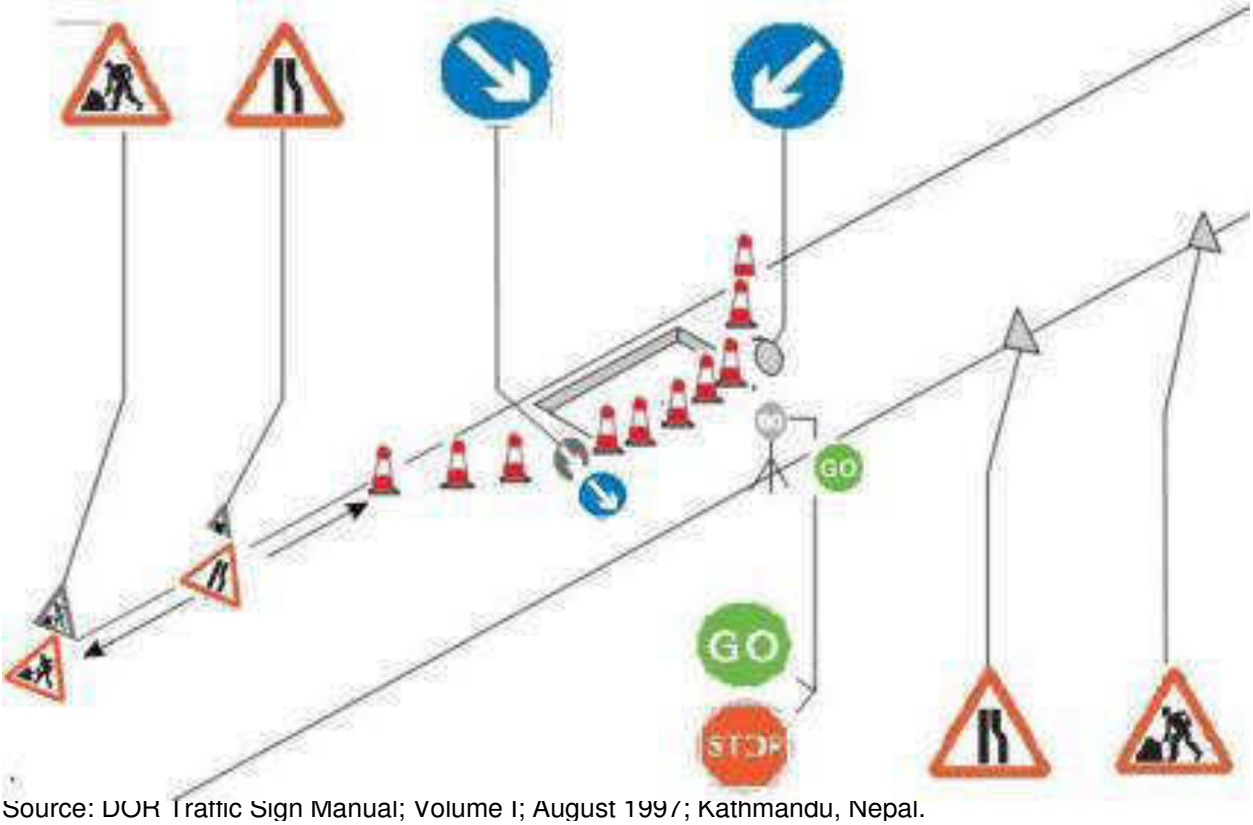
E. Install traffic control devices at the work zones and traffic diversion routes

12. 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 them 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.

13. 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. 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.

14. 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)



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

15. 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 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 works zones 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 nighttimes, as per the DOR Traffic Sign Manual 1997.

16. 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 sewer 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.

17. 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. One person 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.

18. 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: Emergency Response Plan Template

Section 1.
System Information

Keep this basic information easily accessible to authorized staff for emergency responders, repair people, and the news media.

System information

System Name and Address		
Directions to the System		
Basic Description and Location of System Facilities		
Population Served and Service Connections	people	connections
System Owner		
Name, Title, and Phone Number of Person Responsible for Maintaining and Implementing the Emergency Plan		Phone Mobile

Section 2.
Chain of Command - Lines of Authority

The first response step in any emergency is to inform the person at the top of this list, who is responsible for managing the emergency and making key decisions.

Chain of command - lines of authority

Name and Title (as required)	Examples of Responsibilities During an Emergency	Contact Numbers
Mr/Ms ..... **Wastewater System Manager**	Responsible for overall management and decision making for the wastewater system. The Wastewater System Manager is the lead for managing the emergency, providing information to regulatory agencies, the public and news media. All communications to external parties are to be approved by the wastewater system manager.	Phone: Mobile:
Mr/Ms ..... **Wastewater System Operator**	In charge of operating the wastewater collection system, performing inspections, maintenance and sampling and relaying critical information, facilities, and providing recommendations to the wastewater system manager.	Phone: Mobile:
Mr/Ms **Wastewater Treatment Plant Operator**	In charge of running wastewater treatment plant, performing inspections, maintenance and sampling and relaying critical information, assessing and providing recommendations to the system manager.	Phone: Mobile:
Mr/Ms ..... **Office Administrator**	Responsible for administrative functions in the office including receiving phone calls and keeping a log of events. This person will provide a standard pre-scripted message to those who call with general questions. Additional information will be released through the wastewater system manager.	Phone: Mobile:
Mr/Ms ..... **Field Staff**	Delivers door hangers, posts notices, and supports wastewater system operator.	Phone: Mobile:

Section 3.
Events that Cause Emergencies

The events listed below may cause wastewater system emergencies. They are arranged from highest to lowest probable risk.

Events that cause emergencies

Type of Event	Probability or Risk (High-Med-Low)	Comments

Section 4.
Emergency Notification

Notification call-up lists - Use these lists to notify first responders of an emergency.

Emergency Notification List				
Organization or Department	**Name & Position**	**Telephone**	**Night or Cell Phone**	**Email**
Local Law Enforcement				
Fire Department				
Emergency Medical Services				
Wastewater Operator (if contractor)				
Primacy Agency Contact				
Interconnected Wastewater System				
Neighboring Wastewater System (not connected)				
KUKL Contact				

Priority Customers				
Organization or Department	**Name & Position**	**Telephone**	**Night or Mobile Phone**	**Email**
Hospitals or Clinic(s)				
Public or Private Schools				
Public Water System				

Notification List				
Organization or Department	**Name & Position**	**Telephone**	**Night or Mobile Phone**	**Email**
Police				
Regulatory Agency				
Authorized Testing Laboratory				

Service / Repair Notifications				
Organization or Department	**Name & Position**	**Telephone**	**Night or Mobile Phone**	**Email**
Nepal Electricity Authority				
Electrician				
Gas Supplier				
Water Testing Lab.				
KUKL				
Nepal Telecommunications				
Plumber				
Pump Supplier				
"Call Before You Dig"				
Rental Equipment Supplier				
Polymer Supplier				
Pipe Supplier				

Media Notification List				
Organization or Department	**Name & Position**	**Telephone**	**Night or Mobile Phone**	**Email**
Newspaper - Local				
Radio				
Radio				
TV Station				

Notification procedures

Notify wastewater system customers

Who is Responsible:	
Procedures:	

Alert local law enforcement, or regulatory officials, and local health agencies

Who is Responsible:	
Procedures:	

Contact service and repair contractors

Who is Responsible:	
Procedures:	

Contact neighbouring wastewater systems, if necessary

Who is Responsible:	
Procedures:	

Contact downstream water systems, if necessary

Who is Responsible:	
Procedures:	

Procedures for issuing a health advisory

Who is Responsible:	
Procedures:	

Other procedures, as necessary

Who is Responsible:	
Procedures:	

Section 5.
Effective Communication

Communication with customers, the news media, and the general public is a critical part of emergency response.
Designated public spokesperson
Designate a spokesperson (and alternate) and contact regulatory agency for delivering messages to the news media and the public.

Spokesperson	Alternate

Designate a spokesperson and alternates _____

Section 6.
The Vulnerability Assessment

This is an evaluation of each wastewater system component to identify weaknesses or deficiencies that may make them susceptible to damage or failure during an emergency. It also assesses facilities for security enhancements that may guard against unauthorized entry, vandalism, or terrorism.

Facility vulnerability assessment and improvements identification

System Component	Description and Condition	Vulnerability	Improvements or Mitigating Actions	Security Improvements
Collection System				
Sewage Pumping				
Effluent Disposal				
Computer and Telemetry System				

Section 7.
Response Actions for Specific Events

In any event there are a series of general steps to take:

1. **Analyse the type and severity of the emergency;**
2. **Take immediate actions to save lives;**
3. **Take action to reduce injuries and system damage;**
4. **Make repairs based on priority demand; and**
5. **Return the system to normal operation.**

The following tables identify the assessment, set forth immediate response actions, define what notifications need to be made, and describe important follow-up actions.

A. Power outage _____

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

B. Collection system blockage or line break

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

C. Collection system pumping facilities failure

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

D. Treatment system failure

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

E. Effluent disposal failure

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

F. Chemical contamination

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

G. Vandalism or terrorist attack

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

H. Flood

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

I. Earthquake

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

J. Hazardous materials spill into collection system

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

K. Electronic equipment failure

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

Cyber attack

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

M. Other

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

Section 8.

Returning to Normal Operation

Action	Description and Actions

Section 9. Plan Approval

This plan is officially in effect when reviewed, approved, and signed by the following people:

Name/Title	Signature	Date

Section 10.
Certificate of Completion

I certify to the Government of Nepal that this wastewater system has completed an Emergency Response Plan (ERP).
I certify that this document was prepared under my direction or supervision.

Wastewater Systems: _____

System Name: _____

Address: _____

Print Name of Person Authorized to Sign this Certification on behalf of the System:

Title:

Signature:

Phone: **Fax:** **Email:**

Completion of the following:
□ Security Vulnerability Assessment

□ Emergency Response Plan

Source: www.rcap.org (modified)

Appendix 12: Sample Semi-Annual Environmental Monitoring Report Template

This template must be included as an appendix in the EIA/IEE that will be prepared for the project. It can be adapted to the specific project as necessary.

1. Introduction

- Overall project description and objectives
- Description of sub-projects
- Environmental category of the sub-projects
- Details of site personnel and/or consultants responsible for environmental monitoring
- Overall project and sub-project progress and status

No.	Sub-Project Name	Status of Sub-Project				List of Works	Progress of Works
		Design	Pre Construction	Construction	Operational Phase		
		□	□	□	□		
		□	□	□	□		
		□	□	□	□		

2. Compliance status with National/ State/ Local statutory environmental requirements __

No.	Sub-Project Name	Statutory Environmental Requirements	Status of Compliance	Action Required

3. Compliance status with environmental loan covenants

No. (List schedule and paragraph number of Loan Agreement)	Covenant	Status of Compliance	Action Required

3. Compliance status with the environmental management and monitoring plan

- Provide the monitoring results as per the parameters outlined in the EMP. Append supporting documents where applicable, including Environmental Site Inspection Reports.
- There should be reporting on the following items which can be incorporated in the checklist of routine Environmental Site Inspection Report followed with a summary in the semi-annual report send to ADB. Visual assessment and review of relevant site documentation during routine site inspection needs to note and record the following:
- What are the dust suppression techniques followed for site and if any dust was noted to escape the site boundaries;
- If muddy water was escaping site boundaries or muddy tracks were seen on adjacent roads;
- Adequacy of type of erosion and sediment control measures installed on site, condition of erosion and sediment control measures including if these were intact following heavy rain;
- Are their designated areas for concrete works, and refuelling;

- Are their spill kits on site and if there are site procedure for handling emergencies;
- Is there any chemical stored on site and what is the storage condition?
- Is there any dewatering activities if yes, where is the water being discharged;
- How are the stockpiles being managed;
- How is solid and liquid waste being handled on site;
- Review of the complaint management system;
- Checking if there are any activities being under taken out of working hours and how that is being managed.

Summary Monitoring Table

Impacts (List from IEE)	Mitigation Measures (List from IEE)	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name of Person Who Conducted the Monitoring
Design Phase						
Pre-Construction Phase						
Construction Phase						
Operational Phase						

Overall Compliance with CEMP/ EMP

No.	Sub-Project Name	EMP/ CEMP Part of Contract Documents (Y/N)	CEMP/ EMP Being Implemented (Y/N)	Status of Implementation (Excellent/ Satisfactory/ Partially Satisfactory/ Below Satisfactory)	Action Proposed and Additional Measures Required

Approach and methodology for environmental monitoring of the project

- Brief description on the approach and methodology used for environmental monitoring of each sub-project

Monitoring of Environmental Impacts on Project Surroundings (ambient air, water quality and noise levels)

- Brief discussion on the basis for monitoring
- Indicate type and location of environmental parameters to be monitored
- Indicate the method of monitoring and equipment to be used
- Provide monitoring results and an analysis of results in relation to baseline data and statutory requirements

As a minimum the results should be presented as per the tables below.

Air Quality Results

Site No.	Date of Testing	Site Location	Parameters (Government Standards)		
			PM10 pg/m3	SO2 pg/m3	NO2 pg/m3

Water Quality Results

Site No.	Date of Sampling	Site Location	Parameters >		Government Standards)			
			pH	Conductivity pS/cm	BOD mg/L	TSS mg/L	TN mg/L	TP mg/L

Noise Quality Results

Site No.	Date of Testing	Site Location	LAea (dBA) (Government Standard)	
			Day Time	Night Time

Summary of Key Issues and Remedial Actions

- Summary of follow up time-bound actions to be taken within a set timeframe.

Appendices

- Photos
- Summary of consultations
- Copies of environmental clearances and permits
- Sample of environmental site inspection report
- Other

SAMPLE ENVIRONMENTAL SITE INSPECTION REPORT

Project Name Contract Number

NAME: _____ DATE: _
TITLE: _____ DMA: _
LOCATION: _____ GROUP:

WEATHER CONDITION:

INITIAL SITE CONDITION: _____

CONCLUDING SITE CONDITION:

Satisfactory ____ Unsatisfactory ____ Incident _____ Resolved_____ Unresolved

INCIDENT:
Nature of incident:

Intervention Steps:

Incident Issues

Resolution

Signatur

Project Activity Stage	Survey	
	Design	
	Implementation	
	Pre-Commissioning	
	Guarantee Period	

Emissions	Waste Minimization
Air Quality	Reuse and Recycling
Noise pollution	Dust and Litter Control
Hazardous Substances	Trees and Vegetation

Site Restored to Original Condition Yes No

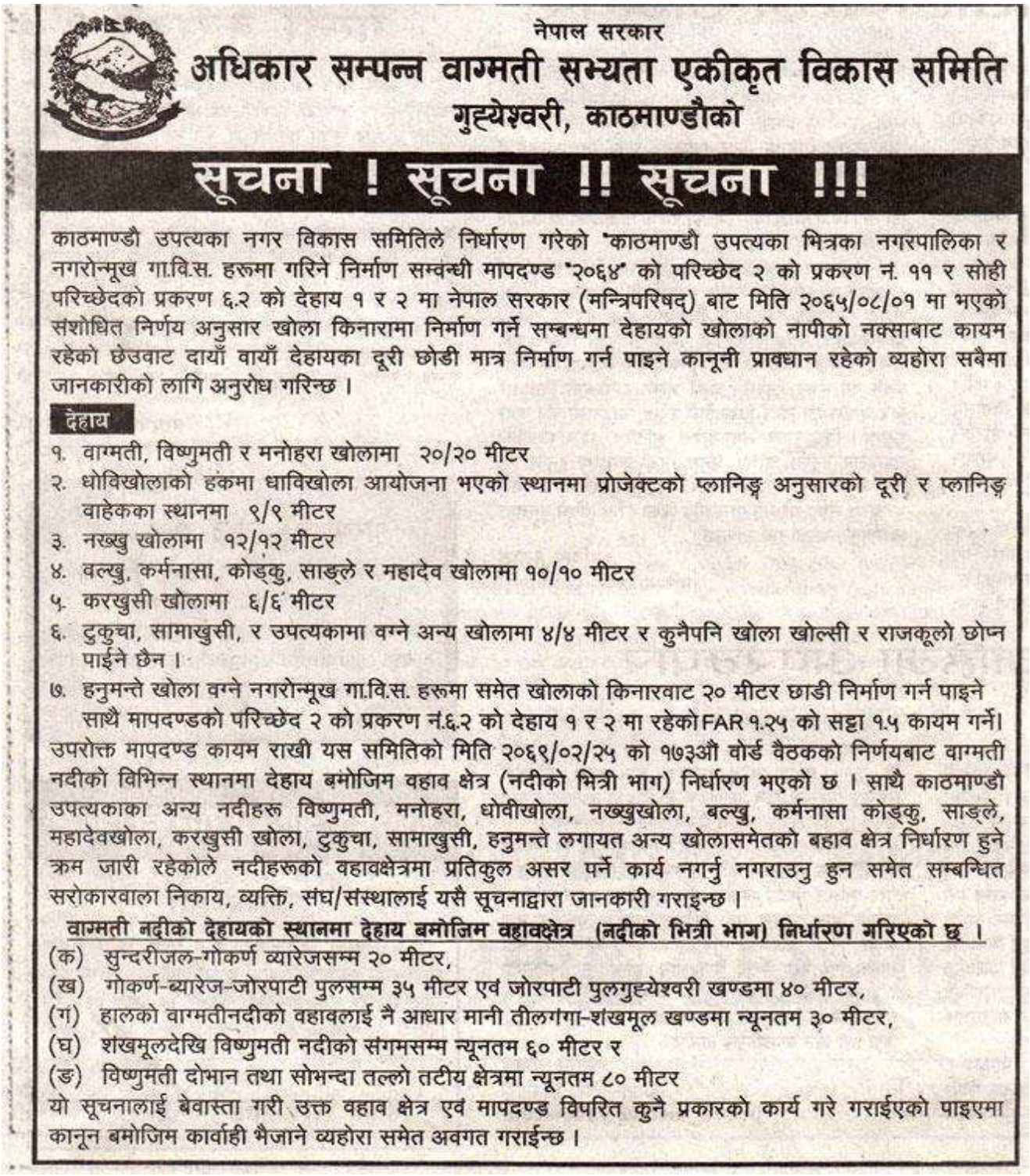
e

Sign off

Name
Position

Appendix 13

Public Notice of HPCIDBC about RoW of River published in newspaper



नेपाल सरकार

अधिकार सम्पन्न वाग्मती सभ्यता एकीकृत विकास समिति

गुह्येश्वरी, काठमाण्डौको

सूचना ! सूचना !! सूचना !!!

काठमाण्डौ उपत्यका नगर विकास समितिले निर्धारण गरेको "काठमाण्डौ उपत्यका मित्रका नगरपालिका र नगरोन्मूख गा.वि.स. हरूमा गरिने निर्माण सम्वन्धी मापदण्ड "२०६४" को परिच्छेद २ को प्रकरण नं. ११ र सोही परिच्छेदको प्रकरण ६.२ को देहाय १ र २ मा नेपाल सरकार (मन्त्रिपरिषद्) बाट मिति २०६५/०८/०१ मा भएको संशोधित निर्णय अनुसार खोला किनारामा निर्माण गर्ने सम्बन्धमा देहायको खोलाको नापीको नक्साबाट कायम रहेको छेउवाट दायाँ वायाँ देहायका दूरी छोडी मात्र निर्माण गर्न पाइने कानूनी प्रावधान रहेको व्यहोरा सबैमा जानकारीको लागि अनुरोध गरिन्छ ।

देहाय

१. वाग्मती, विष्णुमती र मनोहरा खोलामा २०/२० मीटर
२. धोविखोलाको हंकमा धाविखोला आयोजना भएको स्थानमा प्रोजेक्टको प्लानिङ्ग अनुसारको दूरी र प्लानिङ्ग वाहेकका स्थानमा ९/९ मीटर
३. नख्खु खोलामा १२/१२ मीटर
४. वल्खु, कर्मनासा, कोङ्कु, साङ्ले र महादेव खोलामा १०/१० मीटर
५. करखुसी खोलामा ६/६ मीटर
६. टुकुचा, सामाखुसी, र उपत्यकामा वग्ने अन्य खोलामा ४/४ मीटर र कुनैपनि खोला खोल्सी र राजकूलो छोप्न पाईने छैन ।
७. हनुमन्ते खोला वग्ने नगरोन्मूख गा.वि.स. हरूमा समेत खोलाको किनारवाट २० मीटर छाडी निर्माण गर्न पाइने साथै मापदण्डको परिच्छेद २ को प्रकरण नं.६.२ को देहाय १ र २ मा रहेको FAR १.२५ को सट्टा १.५ कायम गर्ने।

उपरोक्त मापदण्ड कायम राखी यस समितिको मिति २०६९/०२/२५ को १७३औं वोर्ड वैठकको निर्णयबाट वाग्मती नदीको विभिन्न स्थानमा देहाय बमोजिम वहाव क्षेत्र (नदीको भित्री भाग) निर्धारण भएको छ । साथै काठमाण्डौ उपत्यकाका अन्य नदीहरू विष्णुमती, मनोहरा, धोवीखोला, नख्खुखोला, बल्खु, कर्मनासा कोङ्कु, साङ्ले, महादेवखोला, करखुसी खोला, टुकुचा, सामाखुसी, हनुमन्ते लगायत अन्य खोलासमेतको बहाव क्षेत्र निर्धारण हुने क्रम जारी रहेकोले नदीहरूको वहावक्षेत्रमा प्रतिकुल असर पर्ने कार्य नगर्नु नगराउनु हुन समेत सम्बन्धित सरोकारवाला निकाय, व्यक्ति, संघ/संस्थालाई यसै सूचनाद्वारा जानकारी गराइन्छ ।

वाग्मती नदीको देहायको स्थानमा देहाय बमोजिम वहावक्षेत्र (नदीको भित्री भाग) निर्धारण गरिएको छ ।

(क) सुन्दरीजल-गोकर्ण व्यारेजसम्म २० मीटर,
(ख) गोकर्ण-व्यारेज-जोरपाटी पुलसम्म ३५ मीटर एवं जोरपाटी पुलगुह्येश्वरी खण्डमा ४० मीटर,
(ग) हालको वाग्मतीनदीको वहावलाई नै आधार मानी तीलगंगा-शंखमूल खण्डमा न्यूनतम ३० मीटर,
(घ) शंखमूलदेखि विष्णुमती नदीको संगमसम्म न्यूनतम ६० मीटर र
(ङ) विष्णुमती दोभान तथा सोभन्दा तल्लो तटीय क्षेत्रमा न्यूनतम ८० मीटर

यो सूचनालाई बेवास्ता गरी उक्त वहाव क्षेत्र एवं मापदण्ड विपरित कुनै प्रकारको कार्य गरे गराईएको पाइएमा कानून बमोजिम कार्वाही भैजाने व्यहोरा समेत अवगत गराईन्छ ।

Appendix 14

CSE फोन नं. : ६६१२४०१

भक्तपुर नगरपालिकाद्वारा संचालित

देको-मिवा-इतापाके जग्गा एकिकरण आयोजना

Deko-Miba-Itapake Land Pooling Project

शहीद स्मृति खेल मैदान परिसर, भक्तपुर, वडा नं. २

पत्र संख्या : ४४१

चलानी नं. : ०६४।६५

मिति : २०७४।१२।१६

श्री आयोजना कार्यान्वयन निर्देशनालय (PID)
काठमाडौं उपत्यका खानेपानी लिमिटेड
अनामनगर, काठमाडौं ।

विषय :– खस्याङ खुसुङ खोला किनारमा Trunk Sewerage line को Alignment बारे ।

उपरोक्त सम्बन्धमा भक्तपुर नगरपालिकाद्वारा संचालित यस देको मिवा ईतापाके जग्गा एकीकरण आयोजना क्षेत्रमा समेत पर्ने खस्याङ खुसुङ खोला किनारमा राखिने Trunk Sewer Line बिछ्याउने तहाँको योजना अगाडि बढिरहेको देखिन्छ । आयोजना क्षेत्रको Sanitary design अन्तर्गत उक्त Trunk Sewer Line को Design Level बारेमा यस अधि आयोजना कार्यालय, परामर्शदाता (Aviyaan Consulting Pvt Ltd) र तहाँ कार्यालय पटक पटक छलफल भई समन्वयको प्रयास भई आएको तहाँलाई अवगतै छ ।

यस आयोजनाको Sanitary Design अनुसार Storm water system र Sewerage system का लागि अलग अलग Network design गरिएको छ। जस अनुसार उक्त Trunk Sewer Line खस्याङ खुसुङ खोला छेउमा निर्माणाधीन १२ मि सडकको दक्षिणी पेटीमा राख्ने प्रस्ताव रहेको छ भने तहाँको डिजाईनमा सडकको केन्द्र रेखामा राख्ने योजना रहेको भनी फिल्डमा खटिएका परामर्शदाता र कन्ट्याक्टरका प्रतिनिधिहरुबाट मौखिक जानकारी प्राप्त भएपछि २०७५ / १/१३ गते आयोजना कार्यालयमा तहाँको प्रतिनिधि ई. श्री किशोर पन्थी, ई. सुरत कुमार बम, ई. संगितान्जली कोइराला, परामर्शदाताका तर्फ बाट ई. श्री शैलेन्द्र बुढा समेतको उपस्थितिमा छलफल गर्दा बनिसकेका रिटेनिंग वालको सुरक्षा र भविष्यमा आवश्यक नियमित मर्मत सम्भारलाई दृष्टिगत गरी उक्त १२ मि. सडकको दक्षिणी पेटी (१.५ मी. चौडा) संगै सडकको Carriage way मा पर्ने गरी निर्माण गर्न उपयुक्त हुने निष्कर्ष निस्केको छ ।

सो सम्बन्धमा मिति २०७५/२/११ गते बसेको आयोजनाको उपभोक्ता समिति बैठकबाट समेत खस्याङ खुसुङ खोला किनार निर्माणाधीन १२ मी. बाटोको दक्षिणी पेटी (१.५ मी चौडा) सगै सडकको Carriage way मा राख्ने निर्णय भएकोले उक्त निष्कर्ष र निर्णयानुसार गर्न गराउनु भई सहयोग गर्न हुन अनुरोध गर्दछु । साथै यसरी ढल Alignment राख्दा पेटीमा House Connection र Utility lines को लागि व्यवस्था गर्न सहज हुने विषयमा समेत उपभोक्ता समितिमा छलफल भएको व्यहोरा समेत अनुरोध छ ।

बोधार्थ :
श्री भक्तपुर नगरपालिका नगर कार्यपालिकाको कार्यालय भक्तपुर : जानकारीको लागि अनुरोध छ ।
श्री काठमाडौं उपत्यका खानेपानी लिमिटेड, भक्तपुर शाखा : जानकारीको लागि अनुरोध छ ।
श्री रविन्द्र खर्बुजा, उपभोक्ता समिति अध्यक्ष : जानकारीको लागि अनुरोध छ ।
श्री DOHWA / ERMC/ BDA DSC-04 : जानकारीको लागि अनुरोध छ ।

RECEIVED
31 May 2018
RECEIVED
DSC04-2018-2019

२०७४।१२।१६
(ब.आ.ई. दिल भक्त जयना)
आयोजना प्रमुख

गुनासो व्यवस्थापन संयन्त्र समितिको गठन

आज मिति २०७५ साल असार १३ गते तदनुसार 27 June 2018 बुधवारका दिन काठमाडौं उपत्यका खानेपानी लिमिटेड आयोजना कार्यान्वयन निर्देशनालय अन्तर्गतबाट संचालित काठमाडौं उपत्यका फोहर पानी व्यवस्थापन आयोजना (KVWWMP) ले खस्याङ खुसुङ खोलाको दुवै किनारमा ढलको पाइप राख्ने क्रममा व्यक्तिगत, धार्मिक, सांस्कृतिक, ऐतिहासिक, पुरातात्विक र धारहरुको भौतिक संरचनामा संभावित परिवर्तन कालागी व्यक्ति, संस्था र समुदायबाट आउने गुनासो र राय सुझावलाई तत्काल समाधान गर्ने उद्देश्यबाट यस चाँगुनारायण नगर पालिका वडा नं-२ का वडा अध्यक्ष श्री शिवहरि के.सी. ज्यू को अध्यक्षतामा वडा स्तरीय गुनासो व्यवस्थापन संयन्त्र समिति गठन गर्ने निर्णय गरियो।

उपस्थिति

क्र.सं.	नाम	पद	मोबाइल नं.	दस्तखत
१.	शिवहरि के.सी.	अध्यक्ष	९८४९६९८६२६ ~~९८४९६८६४२~~	[signature]
२.	सोम प्रसाद प्रधान	सदस्य	9851094430	[signature]
३.	मोहन पोखेल	"	9843054370	[signature]
४.	रेखा दुलाल (अधमी)	[illegible]	9849296613	[signature]
५.	[illegible]		९८४८०४५८६९	[signature]
६.	राजकुमार साहु	[illegible]	९८४१९३२८५०	[signature]
७.	राजन बाढुकला	" "	९८४१४६१४४८	[signature]
८	पुजा कुमार गर्मी	" "	९८४११४०८५९	[signature]
९	बलराम सुवाल		९८४१२४६५९५	[signature]
१०.	राकेश [illegible]	[illegible]	९८४१०५१८८३	[signature]
११.	[illegible]	[illegible]	[illegible]	[signature]
१२.	कल्पना [illegible] सुवाल	वडा सदस्य	9841130754	[signature]
	कहिला [illegible]			
१३	उमेश [illegible]		9841140014	[signature]

छलफल तथा निर्णय

१) यस भक्तपुर जिल्लाको केन्द्रमा बहेको खस्याङ् खुसुङ् खोलामा दुवै किनारमा छलको पाइप सारण्डे कार्य प्रारम्भ भै सकेकाले सो पाइप साण्डा दायाँ बायाँ खोल्ने लगायतका कार्य गर्दा व्यक्तिगत, धार्मिक, सांस्कृतिक, ऐतिहासिक पुरातात्विक, घाटहरुको मौलिक संरचनामा संभावित परिवर्तनका लागि व्यक्ति, संस्था र समुदायबाट आउने गुनासो र राय सुझावलाई तत्काल समाधान गर्ने उद्देश्यबाट मध्यपुर थिमि न.पा. वडा नं ४ ~~श्री सोम प्रसाद प्रधानज्यूको संयोजकत्वमा~~ को वडाध्यक्ष ~~श्री त्रिवेणी ... ज्यु को अध्यक्षतामा~~ तपसिल बमोजिम को गुनासो सम्बोधन गर्ने समिति गठन गर्ने निर्णय गरियो। स्थानिय रुपमा समाधान गर्न सकिने गुनासो तत्काल समितिले समाधान गर्ने र समाधान गर्न स्थानिय रुपमा अप्ठ्यारो परेका गुनासो, राय सुझाव माथिल्लो निकाय (~~अ~~ PID) मा लेखि पठाउने समेत निर्णय गरियो।

गुनासो समिति का आवश्यक नाम निम्नानुसार

१. श्री लोक प्रसाद प्रधान - संयोजक
२. श्री लोकेन्द्र कुमार पौडेल - सदस्य
३. श्री कल्पना देवी सुवाल - "
४. श्री रेखा दुलाल आचार्य - "
५. श्री राज कुमार लघु - "
६. श्री कृष्ण मञ्जु सुवाल - "
७. श्री पूर्ण कुमार गापी - "
८. श्री बलराम सुवाल - "
९. श्री आशाराम बैद्य - "
१०. श्री राजन बाघुवाल - "
११. श्री हरि प्रसाद ग्याकेरु - "

SOUTH ASIA REGIONAL DEPARTMENT
SAFEGUARDS INFORMATION LOG FOR SAUW PROJECTS

Project:	NEP: Kathmandu Valley Wastewater Management Project (Interceptor Sewer- IS-01) of L-3000		
Loan No.:	3000	**Package No.:** KUKL/WW/IS-03	Interceptor Sewer – IS-03
Components:	This IEE is updated for Construction of Intercepting Sewerage System along both banks of the Khasangkusung River. The sewers which collect the wastewater from the designated service areas and conveys and discharge the wastewater to the proposed wastewater treatment plants at Sallaghari. Khasangkusung interceptor sewer line will be constructed as IS-03. Total Length of Interceptor Sewer is 7.86 km. The Major works include Hume pipe laying of 11.36 km; Manholes: 182 nos.; Aqueducts/crossings: 3 andoverflow/outfall structures: 15		
Contract Type:	NCB		
Date of IEE:	Updated July 2018		

Draft IEE	**Updated/Revised IEE**	**Others**
		A draft IEE has been prepared based on preliminary design. The draft IEE is disclosed on ADB website (https://www.adb.org/sites/default/files/linked-documents/43524-014-nep-ieeab.pdf) which included interceptors. The civil works contract is on-going. The revised/updated IEE has been submitted to ADB for review and clearance.

	Section	**Status**		**Comments/Remarks (include date accomplished or obtained, if applicable)**	**Comments incorporated**
1.	Environmental assessment report (EIA/IEE/envi due diligence) has been prepared?	**Yes** X	**No**		• Baseline environmental conditions have been updated and references have been cited properly. • Site specific potential impacts are identified and updated.
2.	EIA/IEE/envi due diligence based on project components and detailed engineering design?	**Yes** X	**No**		• Detail and brief information about the project design including chainage wise information have been added • Please refer 'Detail Design' and Design consideration, Chainage wise information (para 32 to 46). • No disposal site required.
3.	Statutory Requirements		Forest Clearance		• No forest along the alignment of IS03, vegetation is existed along the river bank.

	Section	Status		Comments/Remarks (include date accomplished or obtained, if applicable)	Comments incorporated
					• No one tree is proposed to be cut for the sewer line installation.
			No Objection Certificate		• The work is executed in a well co-ordination with BKT municipality (Appendix 14). • The design data of the land development plan, under planning by Bhaktapur Municipality, has been taken into consideration in the design of Khasyang Khusung collectors • Incorporating suggestion by Bhaktapur municipality, the manholes have been located along the left bank of the KKR considering the proposed roads in the land development plan within the RoW • Otherwise, no letter or approval has been taken
			Site Location Clearance		
			Environmental Compliance Certificate		Not required
			Permit to Construct (or equivalent)		
			Permit to Operate (or equivalent)		
			Others		-
5.	Policy, legal, and administrative framework	Adequate	Not Adequate		Updated
		X			
		EIA/IEE/envi due diligence included discussion on:			
			National regulation/law on EIA		
			Environmental agency		
			Relevant international environmental agreements		Updated

	Section	Status			Comments/Remarks (include date accomplished or obtained, if applicable)		Comments incorporated
			Environmental standards (IFC's EHS Guidelines)				Included in Chapter II ADB SPS requirements are discussed. Information that contractor's measures and practices are in line with internationally-accepted practices (as required by ADB SPS) included.
6.	Anticipated environmental impacts and mitigation measures	EIA/IEE/envi due diligence satisfactorily discussed impacts and risks on:		Mitigation measures provided?			• Additional information has been added that would make ease to assess applicability of mitigation measures • Site specific EMP under preparation by contractor.
				Yes X	No		
			Biodiversity conservation			.	• Added the information on titled Biological Environment, Ecology and Biodiversity of the area (para 174-177). • The existing flora and fauna species are common species of Nepal.
			Pollution prevention and abatement	X			• Updated in chapter VI • A chapter V. Pollution Prevention and Abatement through Design' as been added to show how the adverse impacts have been mitigated through design (Para 147-150).
			Health and safety	X			Updated in chapter IX

	Section	Status			Comments/Remarks (include date accomplished or obtained, if applicable)		Comments incorporated
			Physical cultural resources (PCR)	X			Updated in Chapter VI (para 178)
			Cumulative impacts				No mitigation measures required.
			Transboundary impacts			Not applicable	Updated accordingly
7.	Impacts from Associated Facilities	Addressed	Not Addressed		Not applicable	No associated facilities. WWTPs where wastewater will be conveyed and treated are part of L3000.	Not included
					X		
8.	Analysis of Alternatives	**Yes**	**No**				Not required for Cat B
9.	EMP budget included	**Yes**	**No**				EMP cost included.
		X					
10.	EMP implementation integrated in PAM, and in bid and contract documents	**Yes**	**No**				Included in PAM during loan processing. Included in Section 8 of bid documents.
		X					
11.	Consultation and Participation	**Yes** X	**No**				Preliminary consultations have been conducted. Consultations Summary post-detailed design has

	Section	Status		Comments/Remarks (include date accomplished or obtained, if applicable)	Comments incorporated
					been included in the updated IEE. Consultations conducted meet ADB SPS requirements for "meaningful consultations".
		X			
12.	Grievance Redress Mechanism	**Yes**	**No**	GRM mechanism included in IEE.	Local level GRC established at several wards along the alignment.
		X			
		Description of GRM		Included in IEE (main text)	
		Identification of GRC members		Done.	
13.	Disclosure		Endorsement to disclose on ADB website		May be disclosed at ADB website
			Disclosed on project website		May be disclosed at project website
			Relevant information available to stakeholders and affected people in language and form they understand		Information provided in local language
14.	Mobilized PID Environment Officer	**Yes**	**No**		
		X			Safeguard Unit Chief appointed.
15.	Mobilized PIU Environment Specialist	**Yes**	**No**	Not applicable. NO PIU in L3000	
16.	Mobilized DSC Environment Specialist	**Yes**	**No**		
		X			DSC environment Specialist available and has updated the document.
17.	Confirm bid and contract documents and/or EMP include requirement for the contractor to appoint EHS supervisor and/or nodal	**Yes**	**No**		
		X			EMP included in BOQ.

	Section	Status		Comments/Remarks (include date accomplished or obtained, if applicable)	Comments incorporated
	person for environmental safeguards				
18.	If contract awarded already, confirm contractor's appointment of EHS supervisor and/or nodal person for environmental safeguards	Yes X	No		Yes contract has been appointed. The contractor 'Lama-Raman-Golden Goods JV' has appointed Mr.Binod Manandhar as EHS supervisor.
19.	Awareness training on compliance to safeguard requirements	**Yes** X	**No**		Updated, Table VII-1
20.	Monitoring and Reporting	**Yes** X	**No**		Updated