Draft Initial Environmental Examination

April 2013

India: Karnataka Integrated Urban Water Management Investment Program
- Davangere (Urban Water Supply and Sanitation Subproject)

Prepared by Karnataka Urban Infrastructure Development and Finance Corporation, Government of Karnataka for the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 8 April 2013)

Currency unit	–	Indian Rupee (Re/Rs)
Re1.00	=	$ .0182832069
$1.00	=	Rs54.695

ABBREVIATIONS

ADB	Asian Development Bank
ADB SPS	Asian Development Bank Safeguard Policy Statement
APMC	Agricultural Produce Market Committee
BOD	Bio-Chemical Oxygen Demand
BPL	Below Poverty Line
CAP	Corrective Action Plan
CBO	Community Based Organizations
CC	Complaint Cell
CC Drain	Cement Concrete
CFE	Consent for Establishment
CFO	Consent for Operation
CGWB	Central Ground Water Board
CMC	City Municipal Council
CPCB	Central Pollution Control Board
dbA	Decibels
DI	Ductile Iron
DPR	Detailed Project Report
DS	Double Suction
EA	Executing Agency
EAC	Expert Appraisal Committee
EC	Environmental Clearance
EIA	Environmental Impact Assessment
ELSR	Elevated Storage Reservoir
EMP	Environmental Management Plan
GDP	Gross Domestic Product
GIL	Grasim Industries Limited
GoI	Government of India
GoK	Government of Karnataka
GLSR	Ground Level Service Reservoir
GRC	Grievance Redress Committee
GSDP	Gross State Domestic Product
ha	Hectares
HDPE	High Density Polyethylene
H&S	Health and Safety
IA	Implementing Agency
IEE	Initial Environmental Examination
IWRM	Integrated Water Resource Management
KIUWMIP	Karnataka Integrated Urban Water Management Investment Program
KMRP	Karnataka Municipal Reforms Project
KSCB	Karnataka Slum Clearance Board

KSPCB	Karnataka State Pollution Control Board
KSRTC	Karnataka State Road Transport Corporation
KTCP	Karnataka Town and Country Planning
KUIDFC	Karnataka Urban Infrastructure Development & Finance Corporation
KUWSDB	Karnataka Urban Water Supply & Drainage Board
M&M	Major and Medium
MFF	Multitranche Financing facility
MoEF	Ministry of Environment and Forest
MSL	Mean Sea Level
NEERI	National Environmental Engineering Research Institute
NGO	Non-Government Organisation
NKUSIP	North Karnataka Urban Sector Investment Program
NOx	Nitrogen Oxide
NRW	Non Revenue Water
OCRP	Office of Compliance Review Panel
OHT	Over Head Tank
OSPF	Office of the Special Project Facilitator
O&M	Operations & Maintenance
PC	Program Consultants
PCU	Project Co-ordination Unit
PMU	Project Management Unit
PIU	Project Implementation Unit
PWD	Public Works Department
RCC	Reinforced Cement Concrete
REA	Rapid Environmental Assessment
RF	Resettlement Framework
RP	Resettlement Plan
RSPM	Residual Suspended Particulate Matter
SC	Scheduled Caste
SEIAA	State Environmental Impact Assessment Authority
SIPMIU	State Investment Program Management and Implementation Unit
SPM	Suspended Particulate Matter
SPS	Sewage Pumping Station
ST	Scheduled Tribe
STP	Sewage Treatment plant
SW	StoneWare
TMC	Town Municipal Council
ToR	Terms of Reference
UGD	Under Ground Drainage
ULB	Urban Local Body
UDWSP	Urban Drinking Water & Sanitation Policy
USD	US Dollars
UWSS	Urban Water Supply & Sanitation
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plants

WEIGHTS AND MEASURES

Kl	kiloliter
km	kilometer
Ha	hectares
HAM	hectares meters
l/hd/dy	liters per head per day
lpcd	liters per capita per day
lps	liters per second
M	million
mbgl	meters below ground level
mcm	million cubic meters
Mg/l	milligram per liter
Mld	million liters per day
m	meter
mm	millimeter

NOTE{S}

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

TABLE OF CONTENTS

LIST OF APPENDIXES

EXECUTIVE SUMMARY

1. The Karnataka Integrated Urban Water Management Investment Program (KIUWMIP, the Program) aims to improve water resource management in urban areas in a holistic and sustainable manner. Investment support will be provided to modernize and expand urban water supply and sanitation (UWSS) while strengthening relevant institutions to enhance efficiency, productivity and sustainability in water use.

2. Davangere water supply and sewerage subproject is one of the subprojects proposed in Tranche 1. Water supply is currently intermittent, unreliable and suffers from huge losses and quality issues. Sewerage system including a wastewater treatment plant is presently in implementation under the ADB assisted NKUSIP; however this does not cover the entire town. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for Environmental Assessment are described in ADB's SPS (2009). This Initial Environmental Examination (IEE) addresses components proposed under Tranche 1 which includes water supply and sewerage components.

3. **Categorization.** Davangere water supply and sewerage subproject is classified as Environmental Category B as per the SPS as no significant impacts are envisioned. Accordingly this Initial Environmental Examination (IEE) has been prepared and assesses the environmental impacts and provides mitigation and monitoring measures to ensure no significant impacts as a result of the subproject.

4. **Subproject Scope.** The subproject is formulated under this Investment Program to address gaps in water and sewerage infrastructure in a holistic and integrated manner. The main objective of the Investment Program is to improve water efficiency, security and have an important effect on public health. Investments under this subproject includes: (i) rehabilitation of existing WTPs;(ii) construction and rehabilitation of service reservoirs; (iii) construction and rehabilitation of water distribution network; (iv) installation of water meters; (v) construction of new sewer network including pumping station; (vi) construction of new WWTP; and (vii) construction of household and community toilets.

5. **Implementation Arrangements.** Karnataka Urban Infrastructure Development & Finance Corporation (KUIDFC) is the Executing Agency (EA) responsible for overall technical supervision and execution of all subprojects funded under the Investment Program. Implementation activities will be overseen by a separate Program Management Unit (PMU) in its head office at Bangalore, in coordination with its regional office and 2 divisional offices established to supervise the implementing agencies in each geographical area. A team of senior technical, administrative and financial officials, including safeguards specialists, will assist the PMU in managing and monitoring Program implementation activities. The Implementing Agencies (IA) ULBs. Project implementation units (PIUs) dedicated exclusively to the project are set up in each town. The PIUs will be staffed by qualified and experienced officers and are responsible for the day-to-day activities of project implementation in the field, and will be under the direct administrative control of the PMU. Consultant teams are responsible for subproject planning and management and assuring technical quality of design and construction; and designing the infrastructure and supervising construction; and safeguards preparation.

6. **Description of the Environment.** Subproject components are located in Davangere urban area or in its immediate surroundings. The subproject sites are located in existing right of ways (RoWs) and government-owned land. There are no protected areas, wetlands,

mangroves, or estuaries in or near the subproject location. There are no forest areas within or near Davangere.

7. **Environmental Management.** An environmental management plan (EMP) is included as part of this IEE, which includes (i) mitigation measures for environmental impacts during implementation; (ii) an environmental monitoring program, and the responsible entities for mitigating, monitoring, and reporting; (iii) public consultation and information disclosure; and (iv) a grievance redress mechanism. A number of impacts and their significance have already been reduced by amending the designs. The EMP will be included in civil work bidding and contract documents.

8. Locations and siting of the proposed infrastructures were considered to further reduce impacts. These include (i) locating facilities on government-owned land to avoid the need for land acquisition and relocation of people, however the wastewater treatment plant (WWTP) will require the acquisition of privately owned agricultural land, which is addressed in the resettlement plan prepared for this subproject; (ii) laying of pipes in RoWs alongside main/access roads, to reduce acquisition of land and impacts on livelihoods specifically in densely populated areas of the city; and (iii) locating the WWTP strictly in accordance to the Davangere Master Plan in the outskirts of the town and ensuring its establishment approximately 200m away from the nearest dwelling.

9. Potential impacts were identified in relation to location, design, construction and operation of the improved infrastructure. Taking into consideration the future development around the proposed WWTP site, the following measures have been incorporated; (i) design of a compact, superior treatment process that reduce the likelihood of odor emission; and (ii) sensitive layout design and green buffer zone around the facility, and regulation of surrounding land use in strict compliance with Davangere Master Plan.

10. During the construction phase, impacts mainly arise from the need to dispose of moderate quantities of waste soil and disturbance of residents, businesses, and traffic. These are common temporary impacts of construction in urban areas, and there are well developed methods for their mitigation. Measures such as conducting work in lean season and minimizing inconvenience by best construction methods will be employed. Traffic management will be necessary during pipe-laying on busy roads. In the operational phase, all facilities and infrastructure will operate with routine maintenance, which should not affect the environment. Facilities will need to be repaired from time to time, but environmental impacts will be much less than those of the construction period as the work will be infrequent, affecting small areas only.

11. 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 construction. 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, and interviews with workers and beneficiaries. Any requirements for corrective action will be reported to the ADB.

12. 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. The IEE will be made available at public locations in the city and will be disclosed to a wider audience via the ADB and KUIDFC websites. The consultation process will be continued and expanded during project implementation to ensure

that stakeholders are fully engaged in the project and have the opportunity to participate in its development and implementation.

13. The citizens of the Davangere City will be the major beneficiaries of this subproject. With the improved water supply, they will be provided with a constant supply of better quality water, piped into their homes. The sewerage system will cover the presently uncovered areas under NKUSIP and will remove the human waste from those areas served by the network rapidly and treated at the WWTP, currently in implementation under NKUSIP, to acceptable standards. With the construction of toilets and targeted awareness program on sanitation proposed, in addition to improved environmental conditions, the subproject will improve the over-all health condition of the town. Diseases of poor sanitation, such as diarrhoea and dysentery, should be reduced, so people should spend less on healthcare and lose fewer working days due to illness, so their economic status should also improve, as well as their overall health.

14. The most noticeable net environmental benefits to the population of the towns will be positive and large as a result of improved: (i) water efficiency and security through the implementation of NRW reduction programs and expansion and rehabilitation water supply infrastructure respectively; and (ii) river water quality through the expansion of sewerage networks, treatment capacity and sanitation coverage.

15. **Consultation, Disclosure and Grievance Redress.** Public consultations were done in the preparation of the project and IEE. Ongoing consultations will occur throughout the project implementation period with the assistance of the NGOs. A grievance redress mechanism is described within the IEE to ensure any public grievances are addressed quickly.

16. **Monitoring and Reporting.** The PMU, PIU, and DSC consultants will be responsible for monitoring. The DSC will submit monthly monitoring reports to PMU, and the PMU will send semi-annual monitoring reports to ADB. ADB will post the environmental monitoring reports on its website.

17. **Conclusions and Recommendations.** Therefore the proposed subproject is unlikely to cause significant adverse impacts. The potential impacts that are 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. Based on the findings of the IEE, there are no significant impacts and the classification of the subproject as Category “B” is confirmed. No further special study or detailed environmental impact assessment (EIA) needs to be undertaken to comply with ADB SPS (2009) or GoI EIA Notification (2006).

I. INTRODUCTION

A. Introduction to KIUWRMIP

1. The Karnataka Integrated Urban Water Management Investment Program (KIUWMIP, the Program) aims to improve water resource management in urban areas in a holistic and sustainable manner. Investment support will be provided to modernize and expand urban water supply and sanitation (UWSS) while strengthening relevant institutions to enhance efficiency, productivity and sustainability in water use. The Program focuses on priority investments and institutional strengthening in water supply and sanitation within an IWRM context.

2. The program intends to enhance water security and improve river environment through integrated urban water management (IUWM) interventions. KIUWMIP aims to build on water supply and sanitation considerations within an urban settlement by incorporating urban water management within the scope of the entire river basin. IUWM will provide flexible planning amongst water user sectors within the watershed basins. This will allow for optimal sequencing of traditional and new infrastructure with alternative management scenarios to improve water use efficiency. The emerging IWUM approach offers a more diverse and versatile set of options for dealing with larger and more complex urban water challenges.

3. The Program will be implemented over a four-year period beginning in 2014, and will be funded by a loan via the Multitranche Financing Facility (MFF) of Asian Development Bank (ADB). The Executing Agency is the Karnataka Urban Infrastructure Development Finance Corporation (KUIDFC) and implementing agencies for the Investment Program will be respective Urban Local Bodies (ULBs). Byadgi, Harihar, Ranebennur and Davangere are the four towns chosen to benefit from the first tranche of the investment.

4. The expected outcome will be improved water resource planning, monitoring and service delivery in 4 towns of the Upper Tunga Bhadra subbasin. Tranche 1 will have 3 outputs; (i) Output 1: Expanded efficient UWSS infrastructure in 4 towns of the Upper Tunga Bhadra subbasin; (ii) Output 2: Improved water resource planning, monitoring and service delivery in Karnataka; and (iii) KUIDFC strengthened capacity. The IEE is based on an assessment of these components within the project area.

II. POLICY & LEGAL FRAMEWORK

A. Extent of the IEE Study

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

6. This IEE, for the Davangere Water Supply and Sewerage Subproject, discusses the environmental impacts and mitigation measures relating to the location, design, construction and operation of all physical works proposed under this subproject. IEE relies mainly on secondary sources of information and site reconnaissance surveys including on-site informal discussions with the local people. The IEE follows the process and documentation as per the ADB's Safeguard Policy Statement (SPS, 2009).

B. ADB's Environmental Safeguard Policy

7. ADB's Safeguard Policy Statement, 2009, requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for Environmental Assessment are described in detail in ADB Environmental Assessment Guidelines, 2003. This states that ADB requires environmental assessment of all project loans, programme loans, sector loans, sector development programme loans, financial intermediary loans and private sector investment operations.

8. The nature of the assessment required for a project depends on the significance of its environmental impacts, which are related to the type and location of the project, the sensitivity, scale, nature and magnitude of its potential impacts, and the availability of cost-effective mitigation measures. Projects are screened for their expected environmental impacts and are assigned to one of the following categories:

(i) Category A: Projects that could have significant environmental impacts. An Environmental Impact Assessment (EIA) is required.
(ii) Category B: Projects that could have some adverse environmental impacts, but of less significance than those for category A. An Initial Environmental Examination (IEE) is required to determine whether significant impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.
(iii) Category C: Projects that are unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are reviewed.

9. ADB has classed this subproject as Category B and following normal procedure for MFF loans has determined that one IEE will be conducted for each subproject, with a subproject being the water supply and sewerage infrastructure improvements proposed in a subproject town.

C. Government Law and Policies

10. The GoI EIA Notification of 2006 (replacing the EIA Notification of 1994), sets out the requirement for Environmental Assessment in India. This states that Environmental Clearance (EC) is required for specified activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence. Projects are categorized as A or B depending on the scale of the project and the nature of its impacts.

11. Category A projects require EC from the central Ministry of Environment and Forests (MoEF). The proponent is required to provide preliminary details of the project in the prescribed manner with all requisite details, after which an Expert Appraisal Committee (EAC) of the MoEF prepares comprehensive Terms of Reference (ToR) for the EIA study. On completion of the study and review of the report by the EAC, MoEF considers the recommendation of the EAC and provides the EC if appropriate.

12. Category B projects require environmental clearance from the State Environment Impact Assessment Authority (SEIAA). The State level EAC categorizes the project as either B1 (requiring EIA study) or B2 (no EIA study), and prepares ToR for B1 projects within 60 days. On completion of the study and review of the report by the EAC, the SEIAA issues the EC based on the EAC recommendation. The Notification also provides that any project or activity classified as

category B will be treated as category A if it is located in whole or in part within 10 km from the boundary of protected areas, notified areas or inter-state or international boundaries.

13. None of the components of this water supply and sewerage improvement subproject in Davangere falls under the ambit of the EIA Notification 2006, and, therefore EC is thus not required for the subproject.

14. Besides EIA Notification 2006, there are various other Acts, Rules, Policies and Regulations currently in force in India that deal with environmental issues that could apply to infrastructure development. These are listed in Appendix 2. The specific requirements of this subproject are shown in Table 1

Table 1: Action required to Ensure Subprojects Comply with National Environmental Laws

Component	Applicable Legislation	Compliance	Action required
Components that require tree cutting (OHSR)	Karnataka Preservation of Trees Act, 1976 and Karnataka Preservation of Trees Rules, 1977	This Act has put restriction on felling of trees in the State unless until permitted by the Tree Officer. Application for felling of trees shall be submitted and permission to be obtained.	Tree to be cut enumerated and application to be submitted in required format as per the Act. Compensatory plantation as stipulated in the tree cutting permission shall be adhered to.
Wastewater Treatment Plant (WWTP)	Water (Prevention and Control of Pollution) Act 1974	Consent for Establishment (CFE) and Consent for Operation (CFO) from Karnataka State Pollution Control Board KSPCB	Based on project review and site inspection KSPCB provides CFE before construction, and stipulate the disposal standards to be met during operation. After completion of construction, CFO is issued confirming compliance with the CFE conditions, if any
		Renewal of CFO during operation	Based on the performance of the WWTP and its compliance with the disposal standards CFO is renewed every year/two years
Diesel Generators	CPCB guidelines	Procure and operate generators manufactured by CPCB approved manufacturers	Procure generators only from approved manufacturers/suppliers the manufacturer/ supplier shall be registered with the CPCB and shall have valid certificates for “Type Approval” and “Conformity of Production”

III. DESCRIPTION OF THE PROJECT

A. Project Need

15. **Water Supply.** Currently water supply within Davangere is intermittent and varies across the town. The reported duration and frequency is 1-2 hours every 3 days. The situation is less than desirable in that the amount of water available to consumers is limited and the prolonged periods during which customers have to store water leads to significant deterioration of its quality, exasperated by the warm climate and a lack of customer understanding of the need for hygienic storage facilities. There is an increased risk of contaminated groundwater entering the water network when the mains are de-pressurised; a risk made greater by the accepted poor condition of the network and lack of maintenance.

16. The current per capita volume made available to customers is assessed at 86litres/head/day, compared with the norm of 135litres/head/day. Without metering facilities, the assessed figure can only be taken as indicative, and is an average. Supply periods for individual areas are based on the availability of water from the treatment works and are commenced and ended by the operation of control valves at the works, storage sites or within the network.

17. Currently, three schemes supply the town: the Bhadra Canal Water Supply System, the New Tunga Bhadra Water Supply System and the Kundawada Lake Scheme. Treatment is at the TV, Bathi and Kundawada treatment plants, respectively. In 1972, the Bhadra Canal Water Supply system was commissioned with an installed capacity of 19Mld. The system is supplied through an impounding reservoir which takes excess flow available in the Bhadra-Harihar Canal. The Canal is reported to have surplus water during the wet season from June to December each year, but can provide only a limited supply for around 10 days during the period from January to May. The available water from the Canal fills the reservoir and this is then used to supply the TV Station Treatment Plant.

18. In 2004, to cater for an increasing population, a comprehensive New Tungabhadra Water Supply system was commissioned with an installed capacity of 40Mld. Water is sourced from the Tungabhadra river at Rajannahalli, 20 km further upstream from the original intake location. Raw water is pumped to the new water treatment plant at Bathi on the outskirts of the City, near Dodda Bathi. To compensate for the low availability of water from the river in the dry season the Kundawada Lake Scheme was commissioned with an installed capacity of 20Mld. The scheme was designed to provide immediate relief and to serve as a stand-by arrangement against loss of the Bathi plant. The Kundawada Lake, supplied from the Bhadra-Harihar Canal, is the source for the Kundawada treatment plant. Water flows by gravity to the Kundawada Lake.

19. **Sewerage**. Davangere is partially covered with underground sewerage – this old system covers about 25% of the city in the central part. The sewerage system in Davangere is divided into three major districts 1, 2 & 3 and a smaller sub-district 1A. This existing sewerage system is mostly in District1 and District 2, coverage in District 3 is very limited. Under NKUSIP, it is proposed to improve the sewerage system in District 1 including the treatment works. However, due to lack of adequate funds, the project will not cover entire District 1. The capacity of the existing wastewater treatment plant (WWTP) is 19.45 MLD (stabilization pond based).

20. **Works under Implementation**. A subproject for improvement of water supply system in Davangere is being implemented under the ADB funded NKUSIP. The components under this include: raw water pumping main from Rajanahalli Head works to Kundawada Lake; raw water

pumping main from Rajanahalli to 'Y' junction at NH-4; raw water pumping Main from 'Y' Junction to Bathi WTP; raw water pumping main from 'Y' Junction to Kundawada Lake; installation of treated water pumps; construction of 1.5 ML (1,500m3) treated water reservoir; 20Mld capacity additional filters, and Bulk Flow meters in the outlet main. Besides NKUSIP, there are works in implementation by KUWSDB under UIDSSMT scheme.

21. Following works are proposed in District 1 under NKUSIP: 41 km of trunk sewers, main and branch sewers including interceptor sewers; and 20 MLD SBR based WWTP. Sewerage works are being undertaken in District 2 under UUIDSMT include: interceptor sewer (main sewer) to stop existing discharges of raw sewage into the natural drainage channels, and a 14.5 MLD WWTP.

B. Description of the Subproject

22. Table 2 shows the nature and size of the various components of the subproject. The descriptions shown in Table 2 are based on the present proposals at this project preparation stage. Certain details may change as development of the subproject progresses, particularly in the detailed design stage. It should also be noted that at this stage the infrastructure has been designed in outline only, to determine overall feasibility and budget costs.

23. Since the bulk water supply system for Davangere was comprehensively considered under NKUSIP, no investment for additional water abstraction and treatment proposals are considered in this Tranche-1 investment. The water supply proposals are mostly limited to storage and distribution, and minor improvement to WTPs.

24. There are large numbers of toilet-less households in Davangere. In the absence of access to individual/shared toilets or functional community toilets, a very large proportion of these households practice open defecation. It is estimated that approximately 8,453 households in Davangere do not have access to toilets.

25. Based on the disparity in access to sanitation facilities evident in the four towns, especially amongst the low income households and the need for demand promotion to promote ODF communities, OBA mechanism has been proposed to be used. The OBA mechanism will increase the access of sanitation to primarily low income households in the four towns through (i) construction and connection to the sewer network of new individual household toilets; (ii) construction, connection to the sewer network and operation of community toilets; and (iii) sanitation marketing to increase demand for toilet construction and use and promote open defecation free (ODF) communities.

26. Location of subproject components and conceptual layout plans are shown in Figure 1 to Figure 7.

27. **Implementation Schedule**. As per the suggested schedule, preparation of detailed project report and bids for this subproject will commence in the middle of 2013. Construction activities for this subproject are likely to start in April-2014, and should be completed in 24 months.

Table 2: Proposed Subproject & Component Descriptions

Infrastructure	Function	Description	Location
1. Water Supply			
Rehabilitation of	To minimize the	*Rehabilitation*	Within the 3 existing WTPs at

Infrastructure	Function	Description	Location
existing Water Treatment Plants (WTPs)	water losses in the WTP	Provide facility for recirculation of filter back wash Chlorination facility with necessary safety features Sludge drying beds Water quality testing laboratory	Bathi, Kundawada, and at TV Station; works will be conducted within the existing facilities
Clear Water Mains (strategic network)	To feed clear water to the reservoirs.	*New* 242.5 km 250-600 mm dia DI pipes	Pipes will be laid along the roads
Overhead Service Reservoirs (OHSR)	Provide increased water storage and a head of water required for gravity flow of water through the distribution system.	*New & Replacement* • 11 no,s new - Reinforced Cement Concrete (RCC) tanks, mounted 15 m above ground on an RCC supporting frame • Rehabilitation/repair of existing OHSRs	On small parcels of lands at KTJ Nagar, Dange Park, Ganesha layout, DCM Township, Bharat Colony, Devaraj Colony "C" Block, Banshankari layout, Shiv Kumar Swami Badavane, Yellamma Nagar, Devraj Urs "C" Block
Distribution network (new & replacement)	To convey treated water under gravity from service reservoirs to consumers	*Rehabilitation* 82 Km 90- 300 mm; HDPE/DI pipes	Pipes will be laid along the roads, and will be spread over the town
Bulk Water Meters and District Meters	Monitor water flow in the improved network	Bulk Meters (Dia. varying from 150mm to 1100mm) District Meters (Dia. varying from 80mm to 250mm)	WS Strategic Network and Primary mains Distribution Network
Domestic Meters	Monitor and regulate water usage by consumers and improve cost recovery	127,973 Domestic Meters, 15mm Dia. and 20mm.	Attached to the water delivery pipe at each house
2. Sewerage			
Sewer network	Convey wastewater from dwelling units and other categories of buildings to terminal sewage pumping station and WWTP	*New* Sewerage District 1 285 km 150-600 mm dia SW/RCC pipes Sewerage District 2	Sewers will be laid underground along the roads in the town in currently uncovered areas; The exact areas will be identified during the detailed design. However, will cover most of the town including high, medium and low dense areas.
Sewage pumping station	To collect and pump sewage	*New* One sewage pumping station (SPS), consists of-screens, gates, sump	SPS site is located in south-eastern outskirts of the town and is located in a corner of large campus of a Market Yard

Infrastructure	Function	Description	Location
		well, pumps and 300 mm pumping main	owned by government.
Toilets	Toilets at individual level and community level to cater to households without toilets	*New* 3805 - water flush toilets, outlets connected to sewers community toilets (total 43 -- water flush toilets, outlets connected to sewers	These are proposed to ensure access to toilets for all households, irrespective of tenure status or economic constraints. Space availability will determine the level of service for a household, i.e., individual or community toilets. Community toilets shall be designed keeping the needs of men, women, elderly, disabled and children in view. Individual toilets are located within the house premises, and community toilets are constructed in the neighbourhood, where space is available
Wastewater treatment plant	Treatment of collected effluent for to comply with disposal standards	*New WWTP - Sequential Batch Reactor (SBR) based, 5 MLD Capacity* • Mechanical screens • Grit removal, • Flow measurement & flow splitter box • **F**our square batch reactors with individual inlet flow control & a fully automated process • Mechanical sludge dewatering Short term (14 days) sludge holding area	The proposed site for WWTP is located in the south-eastern side of Davangere. This site was earmarked for Sewage Treatment facility Master Plan of Davangere prepared by DHUDA.[1] This site was selected considering the location adjacent to a natural stream (Bethur halla) into which the treated wastewater can be disposed. This site (area 8.15 acres or 3.3 ha) is privately owned, and the surrounding area is developing into residential area; at present development is very sparse. Bethur halla passes through eastern outskirts of Davangere, flows south to north/ northwest. The existing WWTP is located in the northern outskirts of the Town, which also disposes its treated water into Bethur Halla. This stream flows further north and joins River Tungabhadra at about 20 km, from the site. The site is currently approximately 200m from the nearest residential dwelling.

[1] DHUDA – Davangere-Harihar Urban Development Authority

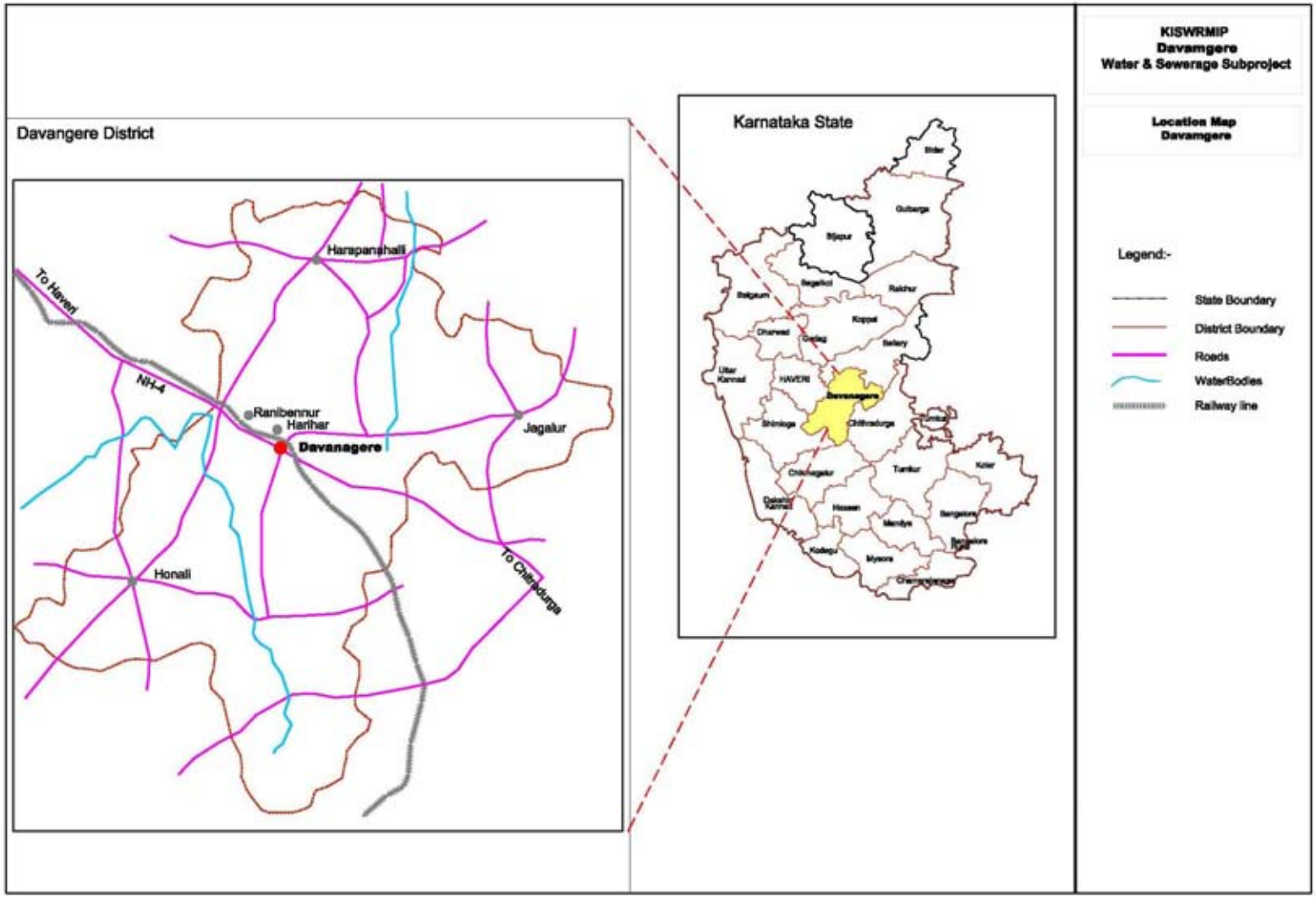


Figure 1: Location of Subproject Town

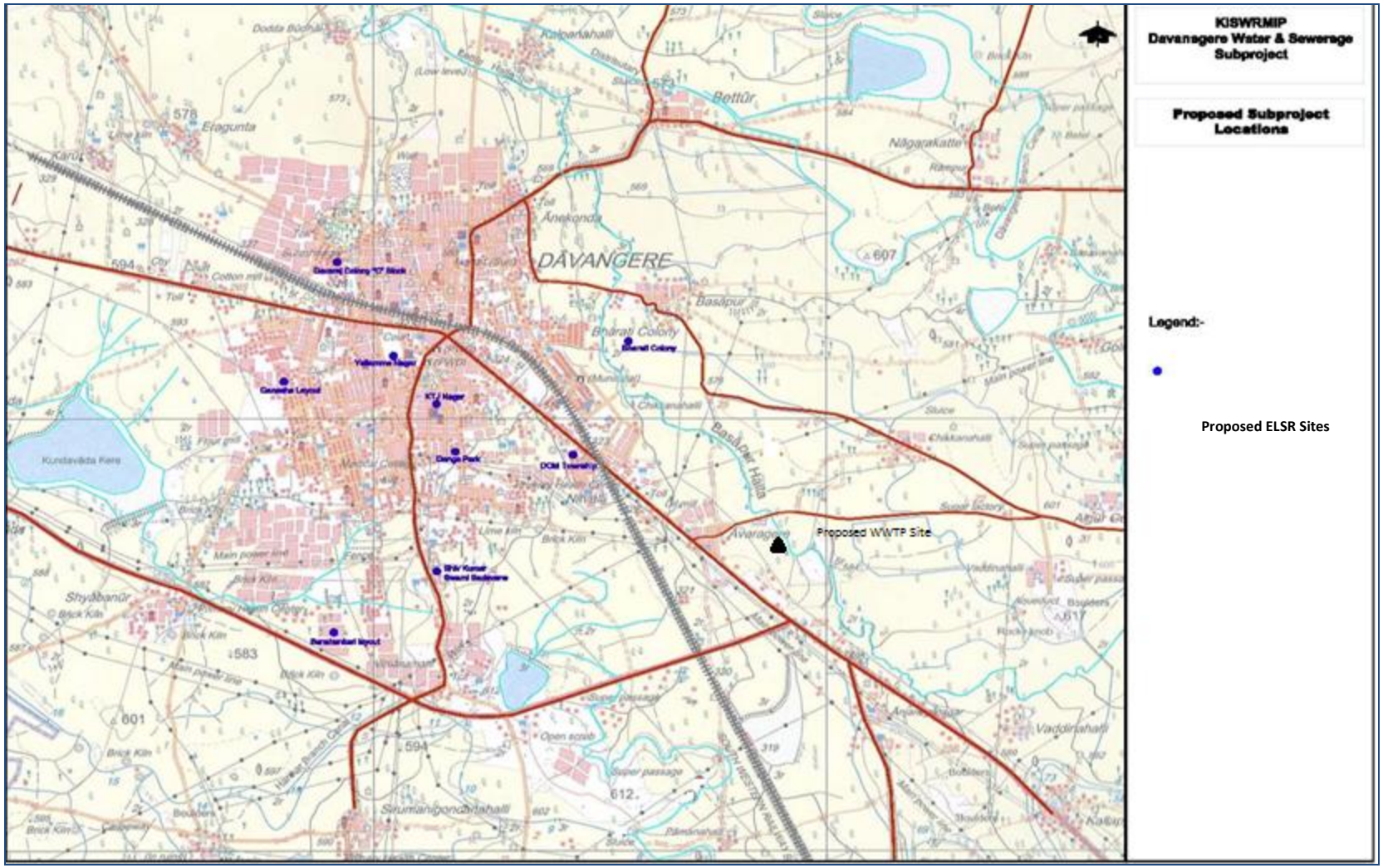


Figure 2: Location Subproject Sites in Town

Figure 3: Proposed Clear Water Feeder Main – Davangere

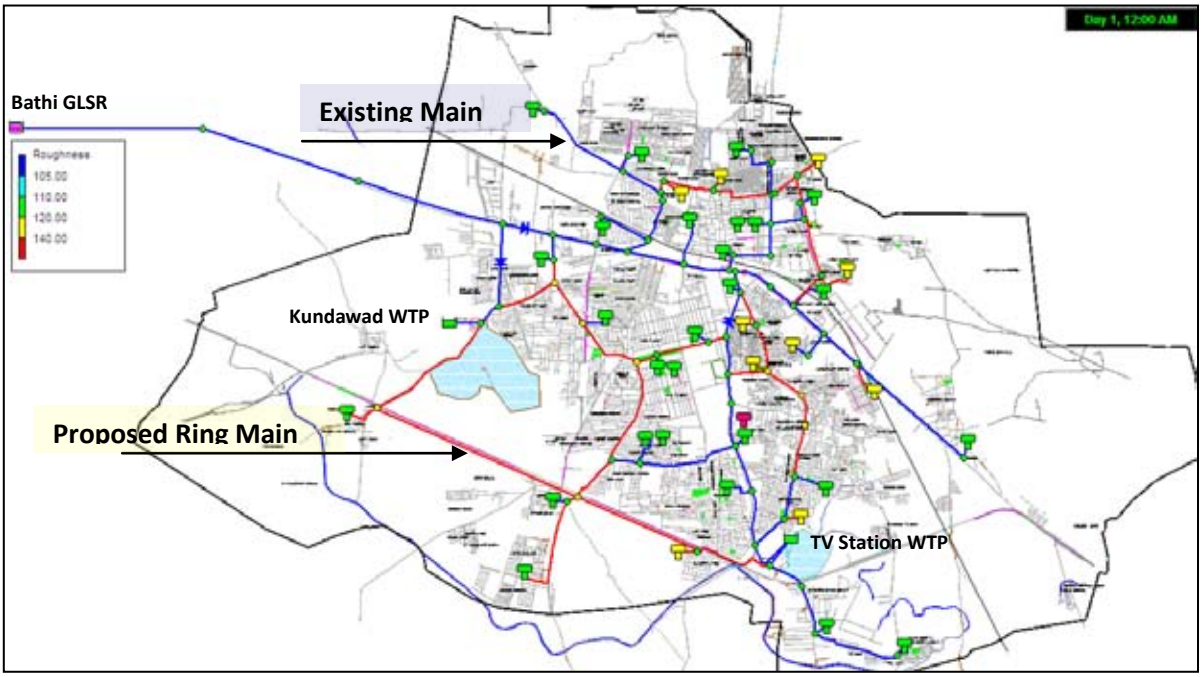


Figure 4: Proposed Distribution network – Davangere

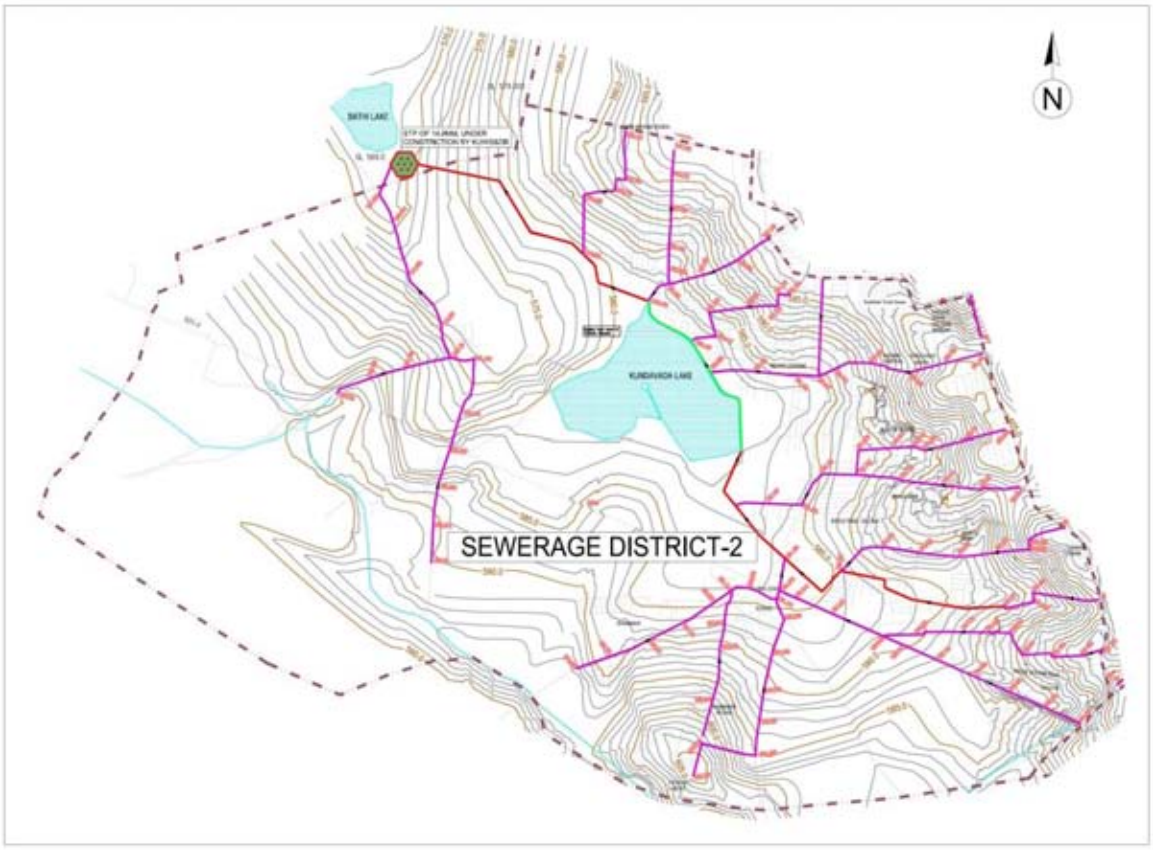


Figure 5: Sewerage Concept Plan for District 2 with Trunk Sewer of UIDSSMT, Main and Branch Sewers Proposed under KIUWRMIP

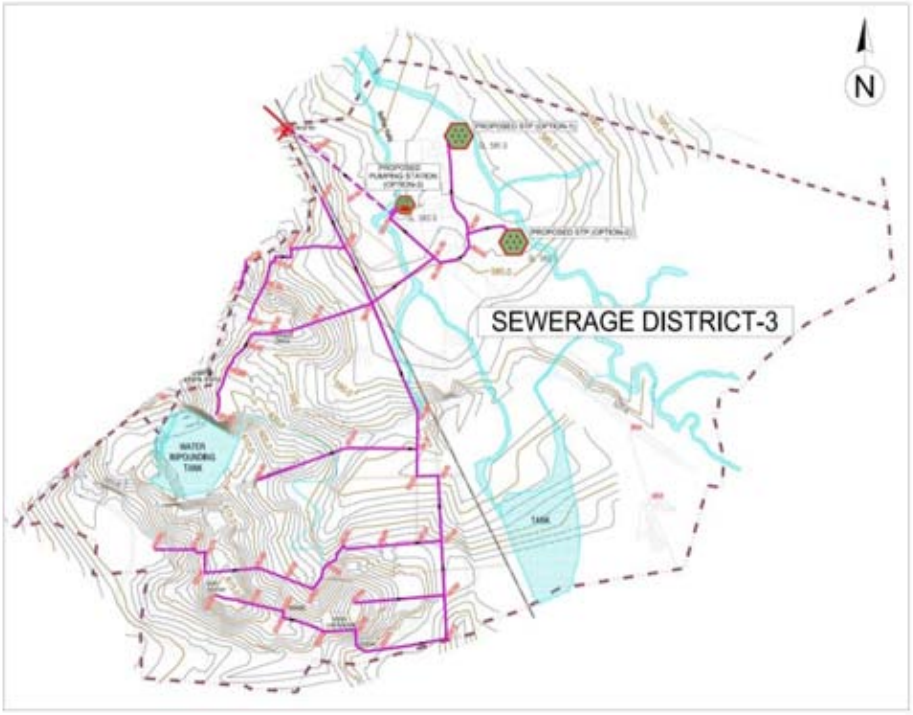


Figure 6: Sewerage Concept Plan for District 2 with Trunk Sewer of UIDSSMT, Main and Branch Sewers Proposed under KIUWRMIP

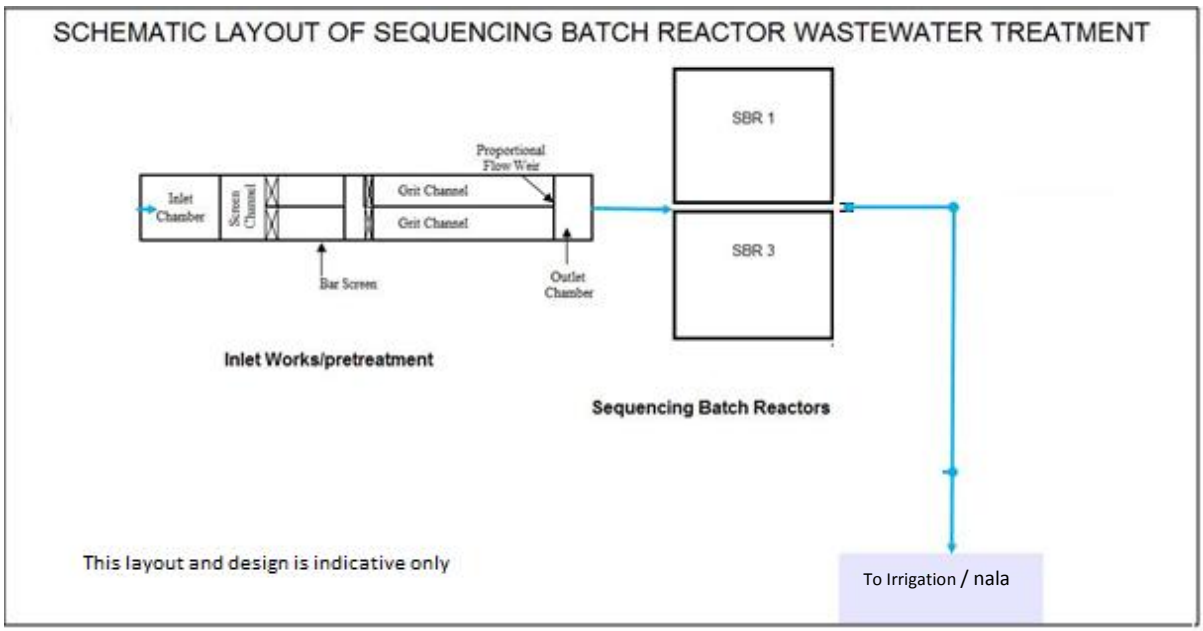


Figure 7: Schematic Layout Plan of WWTP

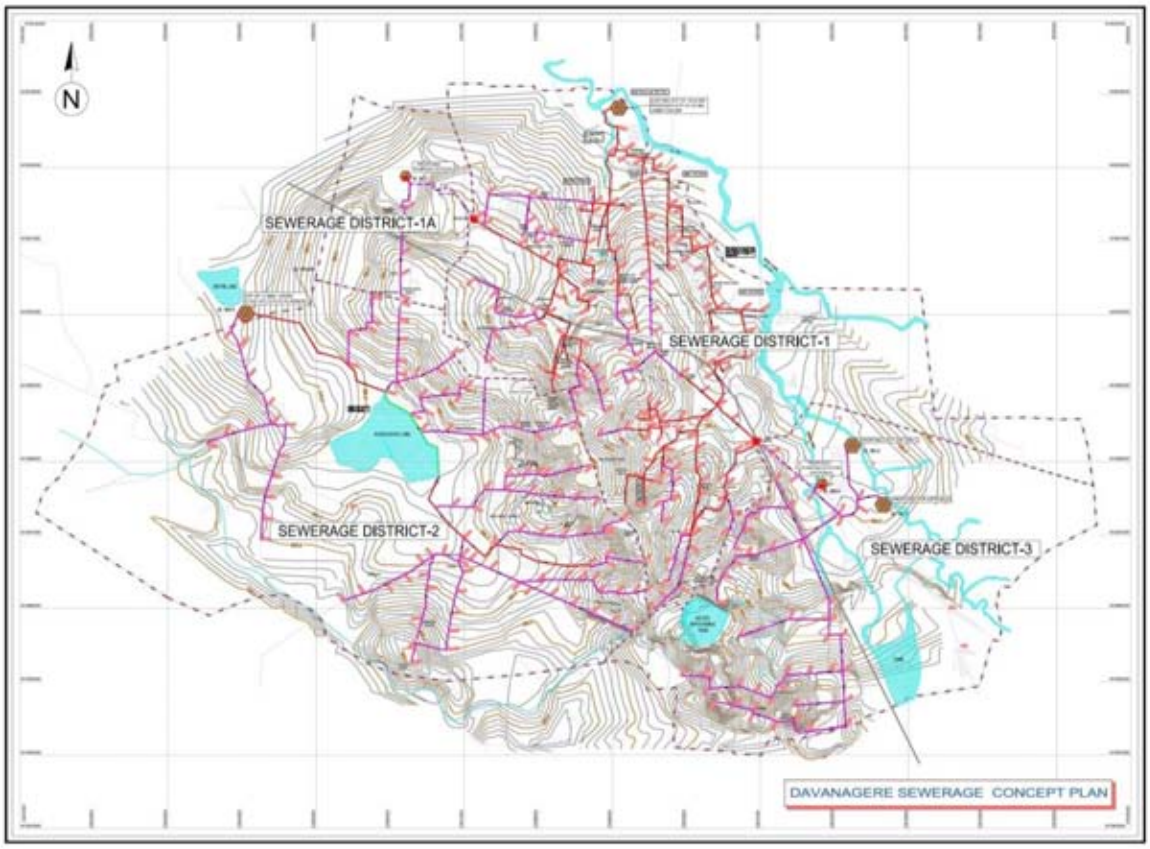


Figure 8: The Overall Sewerage Concept Plan for all Sewerage Districts of Davangere

IV. DESCRIPTION OF THE ENVIRONMENT

A. Physical Resources

1. Location

28. Geographically, Davangere Town is located at a latitude of 14°28′ N and longitude of 75°59′E, at an average altitude of 602.5 m above the mean sea level (MSL). It is the headquarter town of Davangere District, and is located at about 260 km from Bangalore. Davangere is primarily an educational and commercial centre for the vast hinterland. It is located on the main trade route that connects northern part of the country to the southern peninsula. Extending to an area of 66.08 sq km, the town's population is 435,128. National Highway No. 4 (NH 4) connecting Bangalore – Pune/Mumbai passes through the City.

2. Topography, Soil & Geology

29. Situated in the Deccan Plateau and close to River Tungabadhra (15 km), the topography of the town is almost flat and slopes gently towards north and west. The north eastern and south eastern part of the city drains towards north, to Bettur Halla, whereas the western and south

western part drains towards west to Bathi Tank. Red and black cotton soils are predominant in the region, which favours the growth of cotton, paddy and oil seeds. Red Sandy soil comprises of red loams, red sandy, sandy loams and medium black soils.

30. Predominant geological formation in the region consists of Granites, Gneiss & Schist. As per the seismic zoning map of India, Davangere City falls under Zone II, which is the lowest earth quake risk zone in India. This zone is termed as “low damage risk zone”.

3. Climate

31. Davangere enjoys semi arid climate, dryness in the major part of the year and hot summer. In general, southwest monsoon contributes 58% of total rainfall and northeast monsoon contributes 22% rainfall. The remaining 20% rainfall is received as sporadic rains in summer months. It receives low to moderate rainfall. The district falls under central dry agro-climatic zone of the Karnataka state and is categorized as drought prone. Normal climatic parameters of Davangere are increasing temperature from March to May, usually maximum in May month and minimum temperature that is coldest month during month of December.

32. The normal annual rainfall is 680 mm. However in the last decade (1996-2005) the average rainfall was just 589 mm much below the long term average. Year 2003 was the worst rainfall year, receiving just 388.6 mm.

33. The temperature varies between 35^{O}C to 38^{O}C during summer and 16^{O}C to 20^{O}C during winter. The hot summer season starts in early March and last till the beginning of June when the district comes under the influence of southwest monsoon.

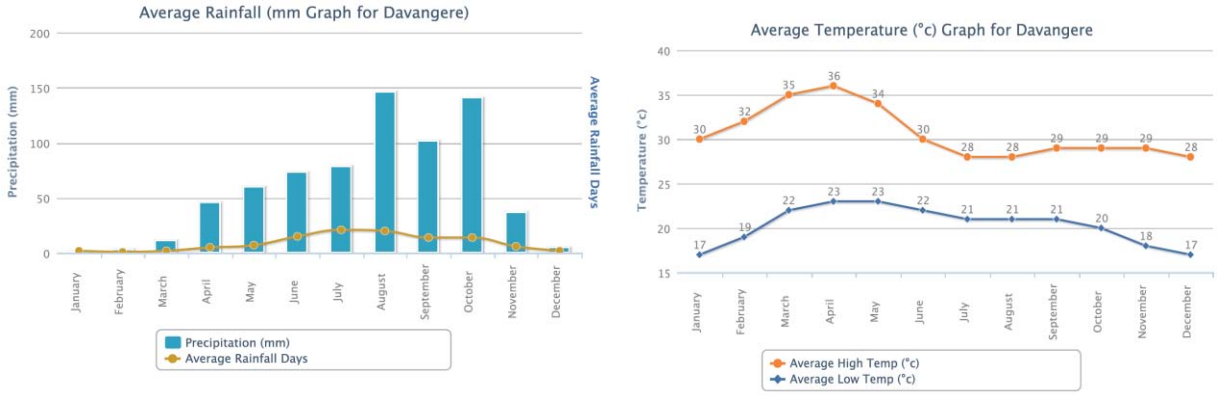


Figure 9: Average Monthly Rainfall and Temperature in Davangere

4. Air Quality

34. The major sources of sound pollution in the city are from the vehicles. Karnataka State Pollution Control Board (KSPCB) monitors air and noise pollution in the State in line with Air (Prevention and Control of Pollution) Act, 1981. KSPCB have monitoring stations located at various places across the state; however covers major cities, and industrial locations. There are no regular monitoring stations in Davangere.

35. Dust pollution in the city appears to be high, especially in areas such as Azad Nagar and Mandakki Bhatti due to presence of puffed rice factories and movement heavy goods vehicles and traffic. Poor quality roads and dry weather is compounding the dust problem in the city. As per a report of KSPCB (2005-06), suspended particulate matter (SPM) and respirable suspended particulate matter (RSPM) in the ambient air is well above the permissible (SPM value of 280 µg/m3 along the main corridor of the tow – PB Road, against the National Ambient Air Quality Standard of 140 µg/m3).

5. Surface Water

36. There are no notable rivers and streams in and around the town. Tungabhadra River flows at a distance of 15 km from the town. Kunduwada Kere (lake) situated in the south western part of the town is an important water body in the town. This is one of the water supply sources to the town besides River Tungabhadra. Bathi Tank is a small lake in the western part. Located on the downstream side of Kunduwada Lake, this tank receives outflow from Kunduwada, and the sewage/wastewater from western part of the town. Presently, a wastewater treatment plant is under construction near Bathi Tank to treat the sewage from eastern parts of the town.

37. Besides these, there are irrigation channels outside the town, originating from a reservoir at Budhihal, about 15 km southwest of the town.

6. Ground Water

38. In Davangere fractured granitic-gneisses, gneisses and hornblende-schists are the main water bearing formations. Ground water occurs within the weathered and fractured rocks under water-table conditions and semi-confined conditions. Aquifers are encountered between the depths of 8.46 and 32 m below ground level (bgl). Bore wells are drilled from a minimum depth of 35 to a maximum of 200 m bgl. Depth of weathered zone ranges from 5.5 mbgl to 30 mbgl. Yield ranges from 1.5 to 4.0 lps. Transmissivity ranges from 5.27 to 110.67 m2/day. Specific capacity ranges from 4.54 to 36.0 lpm/m draw down. The main source of ground water occurring in the district is through precipitation and return flow from applied irrigation. During May 2006 (pre-monsoon season) the minimum and maximum depth to water level was 4.28 mbgl and 7.65 m bgl respectively. During November 2006 (post-monsoon) water level ranged from 5.30 m bgl to 10.20 m bgl. Although overall groundwater development in Davangere Taluk is 61%, major parts including Davangere City fall under over exploited category (Central Ground Water Board, 2008).

Table 3: Groundwater Development in Davangere Taluk

Particulars	Details (in HAM)
Net annual ground water availability	10576.79
Existing gross ground water draft for all uses	6439.13
Allocation for domestic and industrial use for next 25 years	1032.85
Net ground water availability for future irrigation development	4827.88
Balance ground water irrigation potential available (ha)	5905.66

HAM – hectare meter

39. The Ground Water Quality in the district is generally potable and suitable for irrigation and domestic purposes. Electrical conductivity of ground water in general ranges from 584 to

2720 micro mhos /cm at 25 °C. Fluoride ranges from 0.2mg/l to 2.41 mg/l. Nitrate ranges from 10 to 352 mg/l.

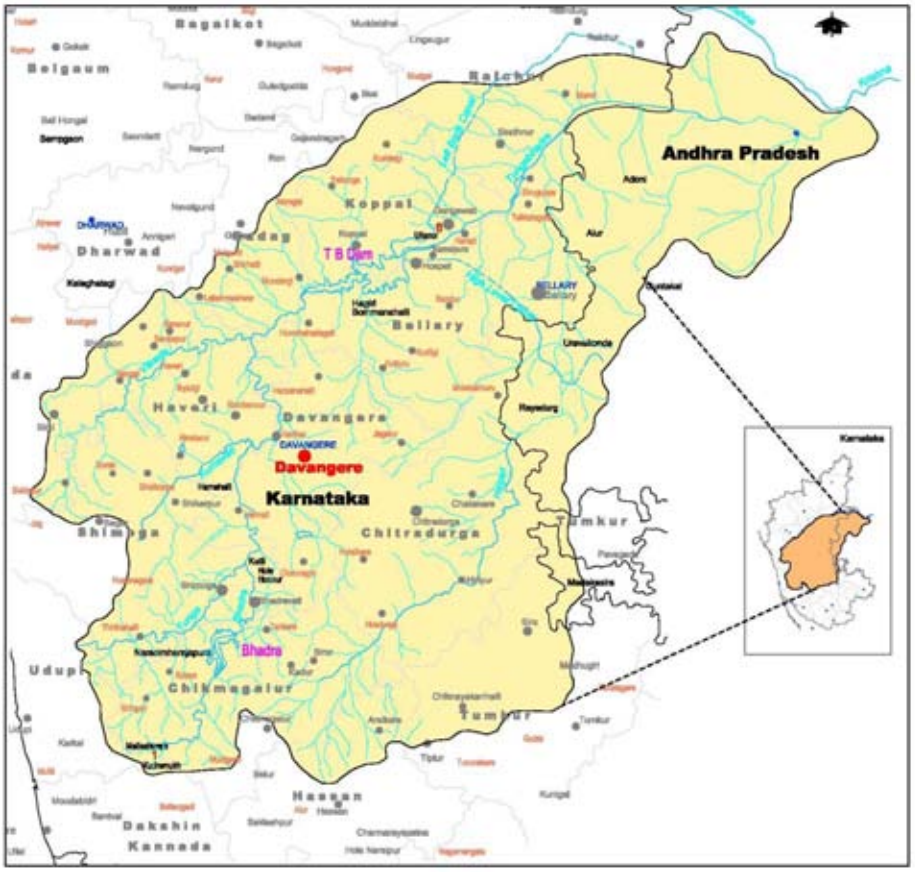


Figure 10: Location of Town in Tungabhadra Basin

B. Ecological Resources

40. Davangere is an urban area surrounded by land that was converted for agricultural use many years ago. There are no forest areas within or near Davangere. Owing to fertile lands and availability of irrigation facilities, the land around the town is extensively cultivated. The outer areas within the CMC limits also under cultivation.

C. Economic Development

1. Land Use

41. Davangere / Harihar Urban Development Authority (DHUDA) has formulated a development plan for Davangere outlining the land-use pattern up to the year 2021. The area usage under the suggested Land Use pattern in the City is presented below.

Table 4: Proposed Land Use for Davangere

Land-Use Pattern	Area (Km2)	Percentage Use
Residential	27.80	45.08%
Commercial	2.90	4.70%

Land-Use Pattern	Area (Km2)	Percentage Use
Industrial	6.37	10.33%
Public & Semi-Public	4.18	6.78%
Parks, Play-ground and Open Space	5.34	8.66%
Public Utilities	0.46	0.74%
Transport and Communication	12.95	21.04%
Water Shed	1.65	2.68%
Total	61.65	

2. Industry & Agriculture

42. Until recently the city was known as the "Manchester of Karnataka" because of its many cotton mills and supporting trades and businesses. Although these mills contributed to the industrial and commercial development of the city many of them were closed in the 1990's. Currently, the major agro-industrial activity in Davangere revolves around rice and sugarcane, with a number of rice mills and sugar mills in and around the city. There are vast agriculturally rich lands around the town, cultivated by Tungabhadra water. Sugar cane, paddy, jowar and cotton are the major crops grown in and around Davangere.

43. There is an industrial estate in Davangere developed by Karnataka Small Scale Industries Development Corporation (KSSIDC) and spread over an area of 19.35 acres. 14 units are working in this area and are mostly engineering fabrication units. There is another industrial area on Lokikere road, developed by Karnataka Industrial Area Development Board (KIADB), spread over 93.08 acres with 52 working units at present. The industrial mix is mainly engineering, fabrication and garment making.

44. Besides these there are few rice, sugar industries and distilleries in and around the town.

45. Davangere has a large Agriculture Produce Marketing Committee (APMC) yard that caters to the surrounding towns and villages which mainly deals with cotton, paddy and oil seeds. Due to good connectivity by roads and railway line with other parts of the region, it has become a focal point for trade and commerce

3. Infrastructure

46. **Water Supply**. Currently water supply within Davangere is intermittent and varies across the town. The reported duration and frequency is 1-2 hours every 3 days. The current per capita volume made available to customers is assessed at 86litres/head/day, compared with the norm of 135litres/head/day. Tungabhadra River and Kunduwada Lake are the main sources of water supply to the town.

47. **Sewerage and Sanitation**. Davangere is partially covered with underground sewerage – this old system covers about 25% of the city in the central part. The sewerage system in Davangere is divided into three major districts 1, 2 & 3 and a smaller sub-district 1A. This existing sewerage system is mostly in District1 and District 2, coverage in District 3 is very limited. Under NKUSIP, it is proposed to improve the sewerage system in District 1 including the treatment works. However, due to lack of adequate funds, the project will not cover entire

District 1. The capacity of the existing wastewater treatment plant (WWTP) is 19.45 MLD (stabilization pond based).

48. **Storm Water Drainage**. In the absence of a properly functioning sewerage system, the open drains are mostly catering to wastewater except during monsoon which carries both wastewater and surface runoff. These open drains dispose waste into Bathi Tank in the west, Bettur Nala in the east and Avaregere Lake in the southeast.

49. **Transportation**. The National Highway No. 4 connecting Bangalore and Pune/Mumbai is the major regional road running in the midst of the city. The city has direct rail connectivity with a broad gauge line connecting Bangalore – Hubli/Mumbai. This railway line contributes a major share in passenger and goods transportation. With a total length of over 1000 km, internal road network in the city is well developed, however are not in good in condition. Most of the roads in the central part are congested.

50. **Power Supply**. Hydal power is the main source of energy in Karnataka, with 61% of total installed capacity. Remaining is mostly from thermal power stations. Contribution of wind and solar energy, although increasing, is negligible. Government run Karnataka Power Corporation Limited (KPCL) is responsible for power generation while Karnataka Power Transmission Corporation Limited (KPTCL) is responsible for power transmission. The distribution to users in Davangere is provided by regional company – Bangalore Electricity Supply Company Limited. Power is supplied from the central grid by overhead cables carried on metal and concrete poles, mainly located in public areas alongside roads. The power supply in Davangere is poor; there are frequent outages in warmer months, and fluctuations in voltage.

D. Socio Cultural Resources

1. Demography

51. During the last decade the population of Davangere City had increased from 363,780 in 2001 to 435,128 in 2011 indicating a decadal growth rate of 19.6 percent. This growth is much less than the last decadal growth rate of 26.6%

Table 5: Population Growth of Davangere City

Year	Population	Decadal Growth Rate
	Nos.	%
1991	287,233	-
2001	363,780	26.6
2011	435,128	19.6

52. **Sex Ratio**. The sex ratio (female population per 1,000 of male population) in Davangere City, as per 2001 census, is 939, which is lower than the district and state urban average figures of 951 and 940 respectively.

53. **Literacy**. The literacy rate of the city is 84.89 percent (2011 census).

54. Largest proportion of population comprises Hindus followed by Muslims and then Christians. Almost all speak in Kannada followed by Hindi.

2. History, Culture & Tourism

55. Davangere was originally a small village, forming one of the suburbs of Bettur. Sultan Haider Ali gave it as jagir to a Maratha chief named Apoji Ram, who encouraged merchants to settle there. While Apoji Ram died without heirs, the place continued to grow, favoured by Tipu Sultan. After the fall of Tipu Sultan's regime, a European firm stepped in and started a cotton mill. These mills flourished as cotton was grown in plenty, in and around Davangere, as well as the adjacent town of Harihar. Climatic conditions and the nature of the soil (black gypsum) favoured its growth. Davangere Cotton Mills is a well-known name in the region.

56. Town has some locally important religious places. Durgambika Temple, said to be around 200 years old, attracts good number of devotees throughout the year. Subramanya Temple is another important temple in the City. Kundavada Lake, Sulakere Lake and Bath Gudda (hill) are the local tourist spots.

V. ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

A. Overview

57. As a general practice, an IEE should evaluate impacts due to the location, design, construction and operation of the project. Construction and operation are the two activities in which the project interacts physically with the environment, so they are the two activities during which the environmental impacts occur. In assessing the effects of these processes therefore, all potential impacts of the project should be identified, and mitigation is devised for any negative impacts. Following sections evaluate impacts of the proposed water supply and sewerage project in Davangere.

B. Location Impact

58. **Location.** These Impacts are associated with planning particularly on the site selection. They include impacts due to encroaching on sensitive areas and impacts on the people who might lose their homes or livelihoods due to the development of the proposed site.

59. Proposed subproject sites are carefully selected to avoid encroachment into sensitive areas and minimise the impacts on people livelihoods and homestead. Except wastewater treatment plant, for which 3.3 ha (8 15 acres) of privately owned agricultural land is being acquired, all the other subproject activities are proposed on government-owned unused vacant lands. Necessary Resettlement Planning study has been conducted along with the IEE study for acquisition of WWTP site.

60. **Wastewater Treatment Plant (WWTP) Site**. The site for WWTP is selected in the outskirts of the Davangere City in the south-eastern part. The area of the site is 8.15 acres (3.3 ha), and it was earmarked for sewage treatment facility in the Davangere Master Plan. This was the main consideration in selecting site besides its technical considerations of gravity flow from network to WWTP, The site is presently under cultivation, and is surrounded by agricultural fields, which are being converted into plots for residential development. Development at present is sparse, and the nearest house is located at about 200 m from the site. There are two schools and burial ground in the vicinity. The site is connected by Basapur Road.

61. Basapura Halla (a natural stream) flows adjacent to the site, northwards to join River Tungabhadra at about 20 km from the site. This carries mostly wastewater from Davangere except during monsoon.

62. Although site selection complies with Davangere Master Plan, the areas surrounding the WWTP site are developing into residential areas, and in future the development may come very close to the facility. Therefore considering the future development potential of the area, the following measures are suggested to mitigate any potential impact due to location of WWTP:

(i) Select a treatment process that is compact, aesthetically good, and generates no or fewer odours. Accordingly, it is proposed to develop the WWTP based on SBR (sequential batch reactor) process, The SBR being an aerobic and compact process in a closed system with automated operation, the odour generation is minimal and treatment is efficient.
(ii) Provide a green buffer zone of 10-15 m wide around the WWTP; this should be planted with trees in multi-rows. This will act as a visual screen around the facility and will improve the aesthetic appearance.
(iii) Regulate the surrounding land use in strict compliance with Davangere Master Plan
(iv) Design the layout plan of the facility such that potential odour generating units – inlet and primary treatment units and sludge thickener, are located away as far as possible from the nearest development, and be provided with green buffer zone.
(v) Provide backup power facilities for continuous and uninterrupted operation

63. All the sewer and water pipes will be laid within the municipal boundary, along the roads. Larger diameter pipes will mostly be laid along wider roads where there is enough space between the road carriageway and the buildings. All the overhead tanks are proposed in government/municipal owned land parcels.

64. Some of the sites proposed for levitated service reservoirs (ELSRs) are located in public parks (owned by CMC), where there are trees. The following measures shall be implemented to mitigate/minimize the impacts:

(i) Develop a site layout plan for OHSRs in such a way that it avoids/reduces the need to cut trees
(ii) Obtain permission from the Tree Officer for felling of trees
(iii) Plant two tree per each tree felled in the OHSR compounds

65. **Utilities.** Water supply pipelines, Telephone lines, electric poles, and wires within the proposed subproject locations may require to be shifted in few cases The mitigate the adverse impacts due to relocation of the utilities, IA will:

(i) Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during construction phase;
(ii) Conduct detailed site surveys with the construction drawings and discuss with the respective agencies during the construction phase before ground clearance; and

(iii) Require construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services. In case of disruption of water supply, alternative supply, through tankers, shall be provided.

66. Proposed rehabilitation works of WTPs will be carried out within the existing WTP facilities. Environmental enhancement measures such as tree plantation shall be taken up in the facilities as part of the subproject. This will also improve aesthetic appearance of the facility.

67. **Site selection of construction work camps, stockpile areas, storage areas, and disposal areas**. Priority is to locate these near the subproject locations. However, if it is deemed necessary to locate elsewhere, sites to be considered will not result in destruction of property, vegetation, irrigation, and drinking water supply systems. Residential areas will not be considered for setting up camps to protect the human environment (i.e., to curb accident risks, health risks due to air and water pollution and dust, and noise, and to prevent social conflicts, shortages of amenities, and crime). Extreme care will be taken to avoid disposals near the forest, water bodies, swamps, or in areas which will inconvenience the community. All locations would be included in the design specifications and on plan drawings. Construction work camps shall be located at least 200 m from residential areas. Material stockpiles shall be protected by bunds during the monsoon to arrest the silt laden runoff into drains. The subproject is likely to generate soil from excavations, which needs to be disposed safely. The following measures should be considered for disposal of surplus/waste soil:

68. **Site selection of sources of materials**. Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution. To mitigate the potential environmental impacts, locations of quarry site/s and borrow pit/s (for loose material other than stones) would be included in the design specifications and on plan drawings. Priority would be sites already permitted by Mines and Geology Department. If other sites are necessary, these would to be located away from population centers, drinking water intakes and streams, cultivable lands, and natural drainage systems; and in structurally stable areas even if some distance from construction activities.

69. For Davangere subproject, the quarry material required will be sand and stone aggregate, and the nearest quarries are near Harihar and Medleri (sand quarries along River Tunga Bhadra) and Chatra at Motebennur and Hunasikatte in Ranebennur Taluka for stone aggregate. These are existing quarries and are licensed by Mines and Geology Department. The material from the existing quarries will be adequate for the subproject construction, and therefore no new quarry sites will be developed for the purpose

C. Design Impact

70. These impacts arise from the design of the subproject including the technology used, scale of operation/throughput, waste production, discharge specification, pollution sources, and ancillary services.

71. The water supply rehabilitation proposals for Davangere does not involve any source augmentation measures, therefore there is no impact of depletion groundwater or surface water resources. The rehabilitation works proposed in the existing WTPs will improve the environmental performance and therefore no negative impacts envisaged.

72. Environmental audit of the existing Water Treatment Plants has been conducting during the IEE preparation to assess the compliance with environmental legislation and current environmental performance. This audit identified improvements required for the WTP, which are appropriately included in the subproject. This will improve the compliance and environmental performance. Environmental Audit report is presented in **Appendix 7**. The issues to be addressed are improvement to chlorine handling application system and wastewater and sludge management system.

73. At all the existing WTPs in Davangere, the wastewater generated from filter backwash and sludge from clarifiers is disposed off into open drains without any treatment. Water treatment process generates sludge from sedimentation of particulate matter in raw water, flocculated and precipitated material resulting from chemical coagulation, residuals of excess chemical dosage, plankton etc; and waste from rinsing and back washing of filter media containing debris, chemical precipitates, straining of organic debris and plankton. Following are included in the subproject design to dispose the sludge and back wash from existing WTPs:

(i) Provision of recirculation system for backwash water – backwash water from filter beds will be re circulated to WTP inlet and mixed with raw water; this arrangement will minimize wastage of water, which otherwise would have disposed to open drains, and also avoids the pollution of receiving water body

(ii) Provision of sludge drying – accumulated sludge from clariflocculator will be flushed to sludge drying beds, for natural drying.

(iii) Dried sludge will be used as soil conditioner. Periodic testing of dried sludge will be conducted to ensure that it does not contain heavy metals that make it unsuitable for food crops. Tests will be conduct to confirm the concentrations below the following standards. As there are no specific standards notified for sludge reuse, the compost quality standards notified under the Municipal Solid Waste Management & Handling Rules, 2000 have been adopted here. The MSWMH Rules stipulate that “In order to ensure safe application of compost, the following specifications for compost quality shall be met, namely:

Table 6: Dried Sludge for Use as Soil Conditioner

Parameters	Concentration not to exceed (mg/kg dry basis, except pH value and C/N ratio) *
Arsenic	10.00
Cadmium	5.00
Chromium	50.00
Copper	300.00
Lead	100.00
Mercury	0.15
Nickel	50.00
Zinc	1000.00
C/N ratio	20-40
PH	5.5-8.5
Arsenic	10.00

*Compost (final product) exceeding the above stated concentration limits shall not be used for food crops. However, it may be utilized for purposes other than growing food crops.
Source: Municipal Solid Waste (Management & Handling) Rules, 2000, Government of India.

74. There is invariably a safety risk when considerable quantities of chlorine are handled at the WTP. (Chlorine cylinders will be brought by trucks to the site, installed and operated to

disinfect the water supplies). Since facilities are located in the urban area, precautions will thus be needed to ensure the safety of both workers and citizens. There are no proper safety features in the facility for chlorine handling. To avoid any risk to workers and public, the chlorination facilities at the existing WTPs should be improved with all appropriate safety features and equipment to meet with any accidental eventuality, which may include:

(i) Chlorine neutralization pit with a lime slurry feeder
(ii) Proper ventilation, lighting, entry and exit facilities
(iii) Facility for isolation in the event of major chlorine leakage
(iv) Personal protection and safety equipment for the operators in the chlorine plant
(v) Visible and audible alarm facilities to alert chlorine gas leak
(vi) Laboratory facility shall not be housed within the chlorination facility
(vii) Provide training to the staff in safe handling and application of chlorine; this shall be included in the contract of Chlorinator supplier
(viii) Develop an emergency response system for events like chlorine leakage – an ERS template is provided at Appendix 5.

75. In line with the design adopted under the ongoing ADB funded NKUSIP, the sewerage system for Davangere is designed as a separate system of sewage collection (i.e. caters only wastewater). There is considerable length of existing surface drains in the project area that can be used for disposal of storm runoff. The underground gravity sewers will carry sewage from households to the WWTP. Davangere CMC should ensure that all existing septic tanks are phased out by bypassing the inlet and connecting the toilet discharge from each house directly to sewerage system.

76. **Wastewater Treatment Process**. A 5 MLD Wastewater Treatment Plant (WWTP) will be constructed as part of this subproject. Considering location of the site in an area with future development potential, a compact treatment process system has been selected. Thus it is proposed to develop the treatment facility based on Sequential Batch Reactor (SBR) process. An SBR based wastewater treatment plant of 20 MLD capacity is also being developed under the ongoing ADB funded North Karnataka Urban Sector Development Investment Program in Davangere City.

77. The treatment process is designed to meet the following disposal standards set up for disposal into inland water bodies[2] (Refer Appendix 3) by the Central Pollution Control Board (CPCB) under the Water (Prevention and Control of Pollution) Act, 1974.

- BOD of 30 mg/l
- Suspended solids level of 100 mg/l
- Faecal coliform less than 1000/100 ml

78. The SBR treatment process consists of the following stages:

- Inlet works with mechanical screens, grit removal, flow measurement & flow splitter box
- Four square batch reactors with individual inlet flow control & a fully automated process

[2] These are stringent compared to disposal standards for irrigation use (BOD-100 mg/l)

- Mechanical sludge dewatering
- Short term (14 days) sludge holding area

79. Treated sewage meeting the above disposal limits will make it suitable for unrestricted irrigation use. The WWTP site is surrounded by agricultural fields and therefore there is considerable demand for irrigation water. The treated effluent will be discharged into a natural drainage channel passing near the WWTP site. This natural channel runs through agricultural fields providing easy access for farmers to use for cultivation. This drainage channel is currently carrying untreated sewage from the town. Therefore the treated water disposal will have positive benefits.

80. This SBR based WWTP will require uninterrupted power supply for operation of all the activities from WWTP inlet to treatment (SBR operation) and to sludge dewatering and drying. Disruption in power supply will lead to process upset, may affect the efficiency of treatment, and result in treated effluent quality not meeting the disposal standards. In the context of urban local bodies in India, SBR is a recent and an advanced technology. Technical know-how is very limited or even nil with the local bodies. Although the system will be designed for automated operation with minimum human interference, it is necessary that the Davangere CMC has basic understanding of technical features (design and operation) and regular maintenance. Another critical aspect is change in raw sewage characteristics at inlet of WWTP may affect the process and output quality. The system is designed for municipal wastewater, which does not include industrial effluent. Characteristics of industrial effluent widely vary depending on the type of industry, and therefore disposal of effluent into sewers may greatly vary the inlet quality at WWTP, and will upset process and affect the efficiency. Although legally the disposal of effluent meeting certain standards is allowed into municipal sewers (refer Appendix 3), the monitoring of the same is not-practical. Nonetheless, there are no industries with problematic wastewater discharges in the catchment area of the proposed wastewater treatment plant.

81. The above issues need to be considered in design and operation of WWTP. Appropriate measures, such as the following, shall be integrated into planning and design of the WWTP.

(i) Continuous uninterrupted power supply should be provided for the facility
(ii) Back-up facility (such as generator) shall be provided and adequate fuel supplies shall be ensured for running of generator when required;
(iii) Provide an operating manual with all standard operating procedures (SOPs) for operation and maintenance of the facility; this should include guidance on the follow up actions in case of process disruptions, inferior quality of treated water; etc. Necessary training (hands-on and class room / exposure visits) shall be provided to the ULB staff dealing with WWTP.
(iv) The scope of work of facility contractor should include extended operation period (at least five years) to ensure smooth operation, training to the ULB staff and gradual transfer of facility to the Davangere CMC.
(v) Conduct regular wastewater quality monitoring (at inlet and at outlet of WWTP) to ensure that the treated effluent quality complies with the standards (Appendix 3)
(vi) Design should include online monitoring for at the minimum BOD, pH and Ammonia at the inlet and outlet of the plant.
(vii) Design should include provision for automated shutdown in the incidence of high BOD (above design capacity) entering the plant.

(viii) Prohibit/prevent disposal of wastewater/effluent from industrial units in the sewers; ensure regular checking to ensure no illegal entry of industrial wastewater into sewers.

82. The SBR being an aerobic process and conducted in a compacted and a closed system with automated operation, the odour nuisance will be minimal. However, bad odours may be generated from wet well, primary treatment units and sludge treatment. Besides operating the plant as per the standard operating procedures, the following measure should be included in the designs:

(i) Provide a green buffer zone of 10-15 m wide around the WWTP; this should be planted with trees in multi-rows. This will act as a visual screen around the facility and will improve the aesthetic appearance.

83. **Sludge Management**. Sewage sludge generally consists of organic matter, pathogens, metals and micro pollutants. The concentration of parameters such as metals can be influenced by input to the sewers system from industry. However, there are no industries with problematic wastewater discharges in the catchment area of the proposed wastewater treatment plant. Most importantly, as provided above, no industrial discharges are allowed into municipal sewer system.

84. The sludge from SBR basins will be collected into sludge sump and conveyed to centrifuge unit for dewatering the same. The necessary centrifuge feed pumps & Centrifuge will be provided. The sludge in the form of a wet cake will be further air-dried in the sludge drying beds and disposed off.

85. The treatment and drying processes kill enteric bacteria and pathogens, and because of its high content of nitrates, phosphates and other plant nutrients the sludge is an excellent organic fertilizer for application to the land. Adequate drying is however necessary to ensure maximum kill of enteric bacteria. To achieve adequate drying minimum drying period (days) shall be ensured. The drying period, which will be varying depending on the season, shall be determined during detailed design.

86. A sludge management plan shall be developed by the WWTP facility designer. Sludge shall be periodically tested for presence of heavy metals.

87. **Sewer system – collection & conveyance.** The sewerage system being implemented under NKUSIP for Davangere is designed as a separate system of sewage collection (i.e. caters only to wastewater). There is considerable length of existing surface drains in the project area that can be used for disposal of storm runoff. The underground gravity sewers will carry sewage from households to the WWTP. The expansion proposed under this subproject will also be designed as a separate system. To maximize the benefits as intended, Davangere CMC should ensure that all existing septic tanks are phased out by bypassing the inlet and connecting the toilet discharge from each house directly to sewerage system.

88. Accumulation of silt in sewers in areas of low over time, overflows, blockages, power outages, harmful working conditions for the workers cleaning sewers etc are some of the issues that needs to be critically looked into during the sewer system design. A properly designed system is a must for system sustainability. Another critical aspect is change in raw sewage characteristics at inlet of WWTP may affect the process and output quality. The system is designed for municipal wastewater, which does not include industrial effluent. Characteristics of

industrial effluent widely vary depending on the type of industry, and therefore disposal of effluent into sewers may greatly vary the inlet quality at WWTP, and will upset process and affect the efficiency. Although legally the disposal of effluent meeting certain standards is allowed into municipal sewers (refer Appendix 3), the monitoring of the same is not-practical.

89. Measures such as the following shall be included in sewer system design to ensure that the system provides the benefits as intended:

(i) Limit the sewer depth where possible
(ii) Sewers shall be laid away from water supply lines and drains (at least 1 m, wherever possible);
(iii) In all cases, the sewer line should be laid deeper than the water pipeline (the difference between top of the sewer and bottom of water pipeline should be at least 300 mm)
(iv) In unavoidable, where sewers are to be laid close to storm water drains or canals or natural streams, appropriate pipe material shall be selected (stoneware pipes shall be avoided)
(v) For shallower sewers, use small inspection chambers in lieu of manholes;
(vi) Design manhole covers to withstand anticipated loads & ensure that the covers can be readily replace if broken to minimize silt/garbage entry
(vii) Ensure sufficient hydraulic capacity to accommodate peak flows & adequate slope in gravity mains to prevent build up of solids and hydrogen sulfide generation
(viii) Equip pumping stations with a backup power supply, such as a diesel generator, to ensure uninterrupted operation during power outages, and conduct regular maintenance to minimize service interruptions. Consider redundant pump capacity in critical areas
(ix) Establish routine maintenance program, including:

- Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups. Cleaning should be conducted more frequently for problem areas.
- Inspection of the condition of sanitary sewer structures and identifying areas that need repair or maintenance. Items to note may include cracked/deteriorating pipes; leaking joints or seals at manhole; frequent line blockages; lines that generally flow at or near capacity; and suspected infiltration or exfiltration; and
- Monitoring of sewer flow to identify potential inflows and outflows

(x) Conduct repairs prioritized based on the nature and severity of the problem. Immediate clearing of blockage or repair is warranted where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, or sewer line blockages);
(xi) Review previous sewer maintenance records to help identify “hot spots” or areas with frequent maintenance problems and locations of potential system failure, and conduct preventative maintenance, rehabilitation, or replacement of lines as needed;
(xii) When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities

(using sandbags, inflatable dams, etc.). Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system.

(xiii) Prohibit/prevent disposal of wastewater/effluent from industrial units in the sewers; ensure regular checking to ensure no illegal entry of industrial wastewater into sewers

(xiv) Develop an Emergency Response System (ERS) for the sewerage system leaks, burst and overflows, etc. A Template for ERS is provided in Appendix 5.

D. Construction Impacts

1. Construction Method

90. The project involves construction of the following: (i) provision of facility for re-cycling of filter backwash water at existing Water Treatment Plants; (ii) Laying/replacement of water pipes (clear water rising mains, distribution network); (iv) installation of house connections, bulk water meters and consumer meters; and (vi) laying of sewer network. Following table shows the details of construction activities involved in the subproject.

Table 7: Construction Activities for the Subproject

Component	Construction method	Likely waste generated
Rehabilitation of existing WTPs	These works will be conducted at the existing three WTP facilities in the town. These are minor works, construction two small tanks and pipe fittings and other fixtures, chlorination facility, sludge drying beds. The work will be conducted by small team of skilled and unskilled workers and works will be confined to WTP facility compound.	Negligible
ELSR	The cavity for the foundations for the overhead service reservoirs (OHSR) will be excavated by backhoe, with soil being loaded onto trucks for disposal. Aggregate and concrete will be tipped into each void to create the foundations and floor, after which metal reinforcing rods will be added to create the outline of the walls of the reservoir and the vertical supporting pillars. Sections of reinforcing will then be encased in wooden shuttering and concrete will be poured in, and this process will be repeated to gradually create each structure from RCC, including the tank of the reservoirs. Surfaces will be smoothed and finished where necessary by hand. The work will be conducted by a team of 10-15 workers at each site.	1,000 m3 of excavated soil

Component	Construction method	Likely waste generated
Water supply pipelines	Trench excavation along the identified main roads of about 0.5-1.4 m wide and 1.2 – 2.3 m deep Trench will be excavated using backhoe and where not feasible will be done manually. Excavated soil will be placed along the trench, and pipes will be placed and joined, and the excavated soil will be replaced and compacted. Where the pipes are laid in the roadway, handheld pneumatic drill will be used to break the road surface. Construction activity will be conducted along the roads in the town; most of the roads in the centre of the town are congested with traffic, pedestrians and activities; roads outside are comparatively wide and less traffic. The work will be conducted by a team of 5 workers at each site	~200,000 m3 of excavated soil; 94% will be utilized for refill; remaining soil (~12,000 m3) need to be disposed off
Fixing of water meters	Minor civil work – conducted manually	Negligible
Sewer lines	Trench excavation along the identified main roads of about 0.4-1 m wide and 1.5- 4 m deep Trench will be excavated using backhoe and where not feasible will be done manually. Excavated soil will be placed along the trench. A bed of sand of 100 mm thick will be prepared at the bottom and pipes will be placed and joined. Excavated soil will be replaced and compacted. Where the pipes are laid in the roadway, handheld pneumatic drill will be used to break the road surface. Construction activity will be conducted along the roads in the town and will cover most part of the town excluding the dense core city areas where currently sewerage system is being implemented under NKUSIP. The work will be conducted by a team of 5 workers at each site	~225,000 m3 of excavated soil; 93% will be utilized for refill; remaining soil (~18,000 m3) need to be disposed off
Wastewater Treatment plant (WWTP)	This will include construction and fixing of Inlet works with mechanical screens, grit removal, flow measurement & flow splitter box; four square batch reactors with individual inlet flow control & a fully automated process; installation of mechanical sludge dewatering (centrifuge), and developing sludge drying beds. The SBR tank will be of RCC structure, and mostly a above-ground facility. The overflow from outlet weir shall be collected by a leading channel that discharges in to Primary Drain. The work involves excavation using backhoe excavator; concreting mixing on site, fixing scaffolding and pouring concrete to form concrete structures; fixing mechanical and electrical equipment; installation of centrifuge and development of sludge drying beds. Construction activity will be confined to a site located in the city outskirts	This activity will not generate any excess/surplus soil that need to be disposed; the excavated soil will be used to raise the ground level of the site

91. As detailed above, except linear components like pipes and sewers, construction activities of all other components are minor and will be confined to selected isolated sites (already in use or new). However, the material and waste transport to and from the site will use public roads.

92. Although construction of the of the pipelines and sewers involve quite simple techniques of civil work, the invasive nature of excavation and the subproject locations in the built-up areas of Davangere Town, where there are a variety of human activities, will result to impacts to the environment and sensitive receptors such as residents, businesses, and the community in general. These anticipated impacts are temporary and for short duration. Physical impacts will be reduced by the method of working and scheduling of work, whereby the project components will be (i) constructed by small teams working at a time; (ii) any excavation done near sensitive area like school, religious places and house will be protected as per standard construction practices. These are discussed in detail in the following sections.

93. Prior to starting of work, the contractor should prepare a method statement for pipeline and sewer works. This should be simple and explain the contractor's work process that is actually conducted on site, with safety and safeguard concerns. Method Statement is very important, particularly for pipeline/sewer works along the roads. Method Statement can be prepared for each stretch (say 1 km) /specific site based on the project area. Method Statement should be in a Table format with appended site layout map and cover the following:

- Work description
- No. Of workers (skilled & unskilled)
- Details of Plant, equipment & machinery, vehicles
- Work duration (total, and activity-wise, for example for pipe laying, from excavation to road resurfacing/testing)
- PPE (helmet, gloves, boots, etc) details for each type of work
- Details of materials at each site (type & quantity)
- Risks/hazards associated with the work (for example, Trench excavation will have risks such as trench collapse, persons/vehicles falling into trench, structural risk to nearby buildings, damage to buildings, infrastructure etc)
- Construction waste/debris generated (details & quantity)
- Detail the sequence of work process (step-by-step) including specific details of each work
- Contractor's supervision & management arrangements for the work
- Emergency: Designate (i) responsible person on site, and (ii) first aider
- Typical site layout plan including pipe trenching, placement of material, excavated earth, barricading etc
- The pipeline/sewers are to be laid along the roads, Roads are provided with side drains to carry rain water. The excavated soil, placed along the trench may get disturbed due to wind, rain water and the movement of workers, vehicles and pedestrians, and spill onto road way – disturbing road users, creating dust, road safety issues, etc, and also into nearby open drains. The following should be included in the site layout plan:

- Provide barricading/security personnel at the site to prevent entry/trespassing of pedestrian/vehicles into the work zone
- Location of temporary stockpiles and provision of bunds
- Separation of stockpiles areas with workers/vehicle movement paths to avoid disturbing the stockpiled soil
- Wetting of soil to arrest dust generation by sprinkling water

- Waste/surplus soil and concrete debris utilization and disposal plan – indicate expected duration of temporary stockpiling along the trench at each site and identify final surplus soil utilization/disposal site in consultation with PIU

2. Impact on Physical Resources

94. **Topography, Soils & Geology**. Subproject activities are not large enough to affect these features; so there will be no impacts.

95. **Sources of Materials**. Significant amount of gravel, sand and aggregate, will be required for this subproject. The construction contractor will be required to:

(i) Use quarry sites and sources permitted by Mines & Geology Department only
(ii) No new quarry sites shall be developed for the subproject
(iii) Verify suitability of all material sources and obtain approval of implementing agency
(iv) Submit on a monthly basis documentation of sources of materials.

96. **Air Quality**. It is most certain that work will be conducted during the dry season, so there is potential for creating dust from the excavation of dry soil, backfilling, transportation to disposal, and from the import and storage of sand/gravel for bedding. Emissions from construction vehicles, equipment, and machinery used for excavation and construction will also induce impacts on the air quality in the construction sites. Anticipated impacts include dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, 31ulphur oxides, particulate matter, nitrous oxides, and hydrocarbons) but temporary and during construction activities only. To mitigate the impacts, construction contractors will be required to:

(i) Consult with PIU on the designated areas for stockpiling of clay, soils, gravel, and other construction materials;
(ii) Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather;
(iii) Bring materials (aggregates, sand, etc gravel) as and when required;
(iv) Use tarpaulins to cover sand and other loose material when transported by vehicles;
(v) Clean wheels and undercarriage of vehicles prior to leaving construction site
(vi) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly; ensure valid Pollution Under Control (PUC) Certificates for all vehicles and equipment used in the construction activity

97. **Noise Levels.** The soils are deep in the subproject area and therefore activities like rock cutting/blasting that generate high noise are not anticipated. In isolated areas where a hard stratum is encountered (especially for deep sewers in some locations going more than 3 m deep) requiring using of pneumatic drills, there will be high noise during the activity. Also, where the pipelines are required to be laid in the roadway, pneumatic drills will be used to break open

the road surface. Pneumatic drills typically generate a equitant noise of 82-98 dBA, at 1 m distance from the activity. The sensitive receptors are the general population and socio-cultural institutions in the area. Noise will be for a short term (about 2-3 days at each location) thus impact is minimal and short-term. The construction contractor will be required to:

(i) Plan activities in consultation with the PIU so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance;
(ii) Construction work shall be limited to day light hours (6 AM to 6 PM)
(iii) Provide prior information to the local public about the work schedule;
(iv) Ensure that there are no old and sensitive buildings that may come under risk due to the use of pneumatic drills; if there is risk, cut the rocks manually by chiselling;
(v) Minimize noise from construction equipment/pneumatic drills by using silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers the sound impact to surrounding sensitive receptor; and
(vi) Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at a distance of 10 m or more from the vehicle/s.

98. **Surface Water Quality.** Davangere topography is primarily plain; the town receives moderate rainfall. The South – West Monsoon winds brings rainfall from June to September while the North – East monsoon winds delivers further rainfall from October to December. Due to these reasons and also that excavation will not certainly be conducted during rains, there is no impact on drainage and surface water quality is envisaged. In unavoidable case of excavation during monsoons, there may be temporary impacts like flooding of construction sites, mixing of construction waste and material within the runoff, etc. This may lead to silting and blockage of drains and water bodies. These potential impacts are temporary and short-term duration only and to ensure these are mitigated, construction contractor will be required to:

(i) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets
(ii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with Implementing Agency on designated disposal areas
(iii) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies
(iv) Provide temporary bunds for stockpiles and materials
(v) Place storage areas for fuels and lubricants away from any drainage leading to water bodies
(vi) Dispose any wastes generated by construction activities in designated sites

99. **Groundwater**. Subproject activities do not interfere with groundwater regime, no groundwater abstraction proposed nor do the activities affect groundwater quality.

100. **Landscape and Aesthetics**. The construction work is likely to generate considerable quantities of waste soil. The pipe laying work will generate surplus soil; as small diameter pipes/sewers are proposed it will generate only 5-10% as surplus as most of the soil will be used for refilling after the pipe is laid in trench. Indiscriminate disposal of the soil and waste may affect the local environment at the disposal location. These impacts are negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

(i) Prepare and implement Waste Management Plan – it should present how the surplus waste generated will temporarily stocked at the site, transported and disposed properly
(ii) Avoid stockpiling of excess excavated soils as far as possible
(iii) Avoid disposal of any debris and waste soils in the forest areas and in or near water bodies/rivers;
(iv) Coordinate with PIU for beneficial uses of excess excavated soils or immediately dispose to designated areas;

3. Impact on Ecological Resources

101. Subproject sites are located within the town area. There is no natural habitat left in these sites, and therefore no impacts on ecological resources envisaged.

4. Impact on Economic Development

102. **Land Use**. Subproject activities will not affect the land use. All subproject activities are being conducted in the vacant space along the road ways; and other facilities are being developed on government-owned vacant lands.

103. **Accessibility**. Transport infrastructure will be affected by the pipe/sewer laying work, as in the narrower streets there is not enough space for excavated soil to be piled off the road. The road itself may also be excavated in places where there is no available land to locate pipes alongside. Traffic will therefore be disrupted, and in some very narrow streets the whole road may need to be closed for short periods. Potential impact is negative but short term and reversible by mitigation measures. The construction contractor will be required to:

(i) Plan pipeline work in consultation with the traffic police
(ii) Plan work such that trench excavation, pipe laying, and refilling including compacting, at a stretch is completed in a minimum possible time;
(iii) Provide for immediate consolidation of backfilling material to desired compaction – this will allow immediate road restoration and therefore will minimise disturbance to the traffic movement;
(iv) Do not close the road completely, ensure that work is conducted onto edge of the road; allow traffic to move on one line;
(v) In unavoidable circumstances of road closure, provide alternative routes, and ensure that public is informed about such traffic diversions;
(vi) At all work sites public information/caution boards shall be provided – information shall inter-alia include: project name, cost and schedule; executing agency and contractor details; nature and schedule of work at that road/locality; traffic diversion details, if any; entry restriction information; competent official's name and contact for public complaints.
(vii) Prepare a Traffic Management Plan – a template is provided for reference at Appendix 4.

5. Impact on Socio Cultural Resources

104. **Impacts on social sensitive areas.** Since the work is being conducted in an urban area, sensitive areas like schools, hospitals and religious centre, the excavation of trenches and pipe/sewer laying activity will create nuisance and health hazard to children and people with ailments. The measures suggested under various heads in this section will minimize the impact

in general in all areas; however, special attention is necessary at these locations. Following measures shall be implemented in 250 m around the sensitive locations (schools, hospitals, and religious centres:

(i) No material should be stocked in this area; material shall be brought to the site as and when required
(ii) Conduct work manually with small group of workers and less noise; minimize use of equipment and vehicles
(iii) No work should be conducted near the religious places during religious congregations
(iv) Material transport to the site should be arranged considering school timings; material should be in place before school starts;
(v) Notify concerned schools, hospitals etc 2 weeks prior to the work; conduct a 30 minute awareness program on nature of work, likely disturbances and risks and construction work, mitigation measures in place, entry restrictions and dos and don'ts
(vi) Implement all measures suggested elsewhere in this report – dust and noise control, public safety, traffic management, strictly at the sites.

105. **Socio-Economic – Income.** Excavation of trenches and pipe/sewer laying work in the town will obstruct access to residences/commercial buildings adjacent to the pipeline. Disruption of access to commercial establishments may affect livelihood. Since many of the roads are narrow, construction activities may also obstruct traffic. The potential impacts are negative and moderate but short-term and temporary. The construction contractor will be required to:

(i) Leave space for access between mounds of excavated soil
(ii) Provide wooden planks/footbridges for pedestrians and metal sheets for vehicles to allow access across trenches to premises where required
(iii) Consult affected businesspeople to inform them in advance when work will occur
(iv) Address livelihood issues, if any; implement the Resettlement Plan (RP) to address these issues
(v) Provide sign/caution/warning boards at work site indicating work schedule and traffic information; prevent public entry into work sites through barricading and security; and
(vi) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.

106. **Socio-Economic – Employment**. Manpower will be required during the 24-months construction stage. This can result to generation of contractual employment and increase in local revenue. Thus potential impact is positive and long-term. The construction contractor will be required to:

(i) Employ at least 50% of the labour force, or to the maximum extent, local persons if manpower is available; and
(ii) Secure construction materials from local market.

107. **Socio-Economic – General.** The benefits of implementing 24 x 7 water supply surpasses the temporary construction impacts. Typical benefits are[3]:

[3] Water and Sanitation Program, *The Karnataka Urban Water Sector Improvement Project*, Field Note, 2010, Available Online URL: http://www.wsp.org/sites/wsp.org/files/publications/WSP_Karnataka-water-supply.pdf

(i) 24x7 supply delivers better quality water for public health - High levels of bacterial contamination are experienced in the first 10 minutes of repressurization of an intermittent system, in some cases persisting for up to 20 minutes. Maintaining full pressure removes that risk.

(ii) 24x7 supply gives significantly better service to all consumers - Access to clean water with improved quantity, timing, and pressure, including effective service to supply pipe „tail ends'.

(iii) 24x7 supply revolutionizes service to the poor - Consumers can access more water for improved health and hygiene while saving time in queuing and carrying, and gainfully using the time thus saved for employment opportunities.

(iv) 24x7 supply converts household coping costs into resources for the service provider - Coping costs that consumers need to incur are reduced; they pay for a better service.

(v) 24x7 supply reduces the burden on water resources - Continuous supply reduces water wastage arising from overflowing storage systems and open taps. It saves on stored household water that is discarded when new supply comes in. Because the network is renewed where needed, it also reduces losses arising from leaks in the old pipes.

(vi) 24x7 supply delivers effective „supply management' and „demand management' - Continuous supply makes possible the effective management of leakage through pressure management and flow measurement. Water conservation is also encouraged through metering and price signals via a volumetric tariff to consumers.

(vii) 24x7 supply enables improved efficiency of service provision - Operational efficiencies are achieved because of a reduced need for valvemen, and a conversion of these jobs into more efficient ones of meter reading and customer care. It also makes possible the management of illegal connections.

108. **Occupational Health and Safety**. Workers need to be mindful of the occupational hazards which can arise from working in height and excavation works. Potential impacts are negative and long-term but reversible by mitigation measures. The construction contractor will be required to:

(i) Develop and implement site-specific Health and Safety (H and S) Plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment; (c) H and S Training[4] for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents;

(ii) All trenches deeper than 2 m shall be protected with wooden bracing to avoid safety risks to workers, public and nearby buildings/structures

(iii) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site;

[4] Some of the key areas that may be covered during training as they relate to the primary causes of accidents include (i) slips, trips and falls; (ii) personal protective equipment; (iii) ergonomics, repetitive motion, and manual handling; (iv) workplace transport; and (v) legislation and responsibilities. Training can provide the foundations of competence but it does not necessarily result in a competent worker. Therefore, it is essential to assess staff competence to ensure that the training provided is relevant and effective. Supervision and monitoring arrangements shall be in place to ensure that training has been effective and the worker is competent at their job. The level of supervision and monitoring required is a management decision that shall be based on the risks associated with the job, the level of competence required, the experience of the individual and whether the worker works as part of a team or is a lone worker.

(iv) Provide medical insurance coverage for workers;
(v) Secure all installations from unauthorized intrusion and accident risks;
(vi) Provide supplies of potable drinking water;
(vii) Provide clean eating areas where workers are not exposed to hazardous or noxious substances
(viii) Provide H and S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;
(ix) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;
(x) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas;
(xi) Ensure moving equipment is outfitted with audible back-up alarms;
(xii) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and
(xiii) Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.
(xiv) Overall, the contractor should comply with IFS EHS Guidelines on Occupational Health and Safety (this can be downloaded fromhttp://www1.ifc.org/wps/wcm/connect/9aef2880488559a983acd36a6515bb18/2%2Boccupational%2Bhealth%2Band%2Bsafety.pdf?MOD=AJPERES)

109. **Community Health and Safety**. Hazards posed to the public, specifically in high-pedestrian areas may include traffic accidents and vehicle collision with pedestrians. In most of the cases location of project sites are along the road ways, hence safety risk to community is to be considered. The sewer line work may require deep trenches including in narrow streets; unprotected trench excavation may endanger the stability of nearby buildings/structures. Potential impact is negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

(i) Provide wooden bracing for all deep excavations that may require especially for sewer lines (> 2m); identify buildings at risk prior to start of excavation work and take necessary precautions for safe conduct of work
(ii) Plan material and waste routes to avoid times of peak-pedestrian activities
(iii) Liaise with IA/Davangere CMC in identifying risk areas on route cards/maps
(iv) Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure
(v) Provide road signs and flag persons to warn of dangerous conditions, for all work sites along the roads
(vi) Overall, the contractor should comply with IFS EHS Guidelines Community Health and Safety (this can be downloaded fromhttp://www1.ifc.org/wps/wcm/connect/dd673400488559ae83c4d36a6515bb18/3%2Bcommunity%2Bhealth%2Band%2Bsafety.pdf?MOD=AJPERES)

110. **Work Camps**. Operation of work camps can cause temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants. Potential impacts are negative but short-term and reversible by mitigation measures. Provision of proper living facilities and basic amenities (water, sanitation, fire safety, health and safety, etc) shall be ensured.

111. The construction contractor will be required to comply with the following. Overall, the contract should follow the IFC EHS guidelines specific to workers accommodation (this can be downloaded from http://www1.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/publications/publications_gpn_workersaccommodation).

(i) Consult with PIU before locating workers camps/sheds, and construction plants; as far as possible located within reasonable distance of work site
(ii) Minimize removal of vegetation and disallow cutting of trees
(iii) Living facilities shall be built with adequate materials, and should be in good condition and free from rubbish and other refuge
(iv) The camp site should be adequately drained to avoid the accumulation of stagnant water
(v) Provide water and sanitation facilities; water, meeting Indian drinking water standards shall be provided, in adequate quantities (supply of 60- 80 LPCD); all water storage structures must be cleaned regularly and covered properly to avoid any contamination
(vi) Provide separate facilities for men and women; sanitary facilities shall be properly build and well maintained; toilet and bath facilities should be provided on basis of 1 per 15 or less persons
(vii) Train employees in the storage and handling of materials which can potentially cause soil contamination;
(viii) Recover used oil and lubricants and reuse or remove from the site;
(ix) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
(x) Remove all wreckage, rubbish, or temporary structures which are no longer required; and
(xi) Report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.

112. **Social and Cultural Resources – Chance Finds**. Subproject area is not a potential archaeological area and therefore no impacts envisaged.

E. Operational & Maintenance Impacts

113. The improved water supply system should operate without the need for major repair and maintenance. Although the new sewerage system will need regular maintenance during operation; with a few simple precautions this can also be conducted without major environmental impacts.

114. The main requirement for maintenance of the new infrastructure will be for the detection and repair of leaks. The generally flat topography and the usage of good quality DI/HDPE pipes should mean that pipeline breaks are very rare, and that leaks are mainly limited to joints between pipes. The repair of household connections and the provision of new connections to

increase the number of people supplied should greatly reduce the incidence of illegal connections, which are often a major source of leaks.

115. The bulk meters will allow monitoring of amounts of water flowing through individual parts of the network, which will pinpoint areas where there are leaks. A small Leak Detection Team will then visit these areas with audio devices to locate individual leaks, which will then be repaired in essentially the same way that the pipes were installed. Trenches will be dug to reveal the leaking area and the faulty connection will be re-fitted, or the pipe will be removed and replaced if necessary.

116. The new sewerage system provided under the Investment Program will collect domestic wastewater and sewage produced by majority of the town population. The proposed treatment plants under implementation will treat the sewage collected from the town. The discharge after treatment will comply with Indian wastewater standards.

117. The sewer pipes will not function without maintenance, as silt inevitably collects in areas of low flow over time. The project will therefore provide equipment for cleaning the sewers, including buckets and winches to remove silt via the inspection manholes, diesel-fuelled pumps to remove blockages, etc. Piped sewers are not 100% watertight and leaks can occur at joints. The measures suggested for consideration during the design of sewer network will help in proper functioning of the system Any repairs will be conducted by sealing off the affected sewer and pumping the contents into tankers, after which the faulty section will be exposed and repaired following the same basic procedure as when the sewer was built. Trenches will be dug around the faulty section and the leaking joint will be re-sealed, or the pipe will be removed and replaced.

118. The proposed community toilets will not function without regular cleaning and maintenance. Therefore there is a need to develop and implement operation and maintenance (O&M) plans for community toilets with participation from the community. A memorandum of understanding (MoU) between Davangere CMC and community will be reached prior to any construction and operation of community toilets. As a minimum, the O&M plan should specify (i) cleaning procedures and frequency; (ii) responsible personnel; (iii) maintenance and repairs schedule; (iv) emergency contact numbers etc.

119. **Operation of WWTP**. WWTP operation will be mostly automated with less human intervention in the process, so scope for human error and its effect on efficiency is very limited. Design also includes provision for automated shutdown in the incidence of high BOD (above design capacity) entering the plant. However, it must be ensured that the facility is operated with standard operating procedures and only by trained staff. Ensuring uninterrupted power supply with back-up facility is a must.

120. Sludge will be regularly accumulated in the SBR basins during each process batch. This sludge from basins will be collected into sludge sump and conveyed to centrifuge unit for dewatering and thickening. The sludge in the form of a wet cake will be further air-dried in the sludge drying beds. The treatment and drying processes kill enteric bacteria and pathogens, and because of its high content of nitrates, phosphates and other plant nutrients the sludge is an excellent organic fertilizer for application to the land.

121. However, WTP operation It is suggested to develop an Emergency Response System (ERS) in case of release of bad odours from the facility. A Template for ERS is provided in Appendix 5. Sensitize and train staff in implementation of ERS.

122. **Operation of Water Treatment Plant (WTP)**. This involves various processes: pre-chlorination, alum dosing, flash mixing, flocculation, clarification, filtration, post-chlorination, wash water re-circulation and sludge disposal systems prechlorination, aeration, alum-mixing, flocculation, clarification, filtration, and disinfection. Chemicals such as Alum and chlorine will be used in the treatment processes.

123. The safety risk due to handling of large quantities of chlorine at the WTP should be negligible if all the suggested safety features and equipment to meet with any accidental eventuality are included in the design and development of the facility. During the operation phase, it is necessary that:

(i) chlorinator facility is operated only by trained staff and as per the standard operating procedures
(ii) In case of any accident and/or maintenance activity, the staff should follow documented procedures only
(iii) It is suggested to develop an Emergency Response System (ERS) for chlorine leakage. A Template for ERS is provided in Appendix 5. Sensitize and train staff in implementation of ERS.

124. **General**. The work will follow the same procedures during the construction stage. The Implementing Agency/Davangere CMC needs to prepare Operation and Maintenance (O&M) Manual and operate and maintain the system as per the manual. Preparation of O&M Manual may be included in the scope of DPR consultants (for item rate contracts) or Construction Contractor (for design-build or turnkey contracts). Measures to minimize the disturbance to general public/ business and dust control, as followed during the construction, is to be implemented during maintenance as well. Operation of sewage pumping station will be simple, but requires skilled workforce.

125. The provision of an improved and expanded water supply and sewerage system is expected to have indirect economic benefits from the expected improvement in the health, environment and economic well-being.

126. The citizens of the Davangere Town will be the major beneficiaries of this subproject. With the improved water supply, they will be provided with a constant supply of better quality water, piped into their homes. The sewerage system will remove the human waste from those areas served by the network rapidly and treated to an acceptable standard. With the construction of toilets and targeted awareness program on sanitation proposed, in addition to improved environmental conditions, the subproject will improve the over-all health condition of the town. Diseases of poor sanitation, such as diarrhoea and dysentery, should be reduced, so people should spend less on healthcare and lose fewer working days due to illness, so their economic status should also improve, as well as their overall health.

VI. INSTITUTIONAL ARRANGEMENTS

A. Implementation Arrangements

127. **Executing Agency (EA)**: Karnataka Urban Infrastructure Development & Finance Corporation (KUIDFC) is the executing agency (EA) responsible for implementing the Investment Program. Investment Program implementation activities will be monitored by KUIDFC through a separate Investment Program Management Unit (PMU) for the IWRM Project, which will be set-up within KUIDFC. The Managing Director, KUIDFC will head the PMU

and will be assisted by an Executive Director at the Regional office of KUIDFC at Dharwad to oversee the Investment Program progress. A team of senior technical, administrative and financial officials will assist the Executive Director in controlling and monitoring Investment Program implementation activities.

128. The Executive Director will be supported by a new Divisional Office established at Davangere. A Consultant Team will be appointed by EA and the team will work under the Divisional Programme Director (DPD) and will be involved in project planning, preparation of subproject and cost estimates, co-ordination, technical guidance and supervision, financial control, training and overall subproject management

129. All Investment Program decisions will be made by the Executive Director who shall operate from the PMU, Dharwad; only interactions with GoK, GoI and ADB shall be conducted through the KUIDFC office at Bangalore.

130. **Implementing Agency (IA):** The ultimate implementation responsibility lies with respective ULBs (in this case Davangere City Municipal Council). A Programme Implementation Unit (PIU) will be established in each ULB.

131. Other than the above institutional setup, District Level Programme Steering Committee will be set up in each district to monitor implementation of subprojects and institutional reforms. The District Level Programme Steering Committee shall consist of Deputy Commissioner of District, Divisional Program Director from concerned divisional office, Municipal Commissioners' / Chief Officers of Investment programme ULB and President / Chair of investment programme ULB. The District Level Programme Steering Committee will report to the PMU Executive Director: Dharwad.

132. At the Executing Agency (i.e. KUIDFC), environmental issues will be coordinated centrally by an environmental specialist at manager-level (designated as Manager-Environment), reporting to the General Manager (Technical). Manager – Environment (supported by an Environmental Expert (Assistant Manager Rank) will ensure that all subprojects comply with environmental safeguards. The IEE/EIA reports will be prepared by the Consultant Team, and will be reviewed by the Manager-Environment as per the ADB's Environmental Guidelines and forwarded to ADB for review and approval. The Manager-Environment will be assisted by an Environmental Specialist, who will be appointed by EA in divisional office at Davangere.

133. The responsibility fulfilling environmental requirements of GoI/GoK and conducting required level of environmental assessment as per ADB guidelines lies with the EA and IA. The Consultant Team will assist EA and IA in this regard.

134. The mitigation measures identified through IEE/EIA are incorporated into the Investment Program. Mitigation measures, which are to be implemented by the Contractor, shall form part of the Contract Documents. The other mitigation measures are undertaken by the IA (itself or in assistance with the Consultant Team) as specified in the IEE. During the construction phase, environmental specialist of Consultant Team will monitor the implementation of the EMP and report to the PMU. The Implementation of EMP and other environmental related measures and the results of environmental monitoring conducted during implementation will be reported to ADB through semi annual Environmental Monitoring Reports. These will also be made available on executing agency (KUIDFC) website for wider public access.

VII. ENVIRONMENTAL MANAGEMENT PLAN

A. Summary Environmental Impact & Mitigation Measures

135. Tables 8 to 10 show the potential adverse environmental impacts, proposed mitigation measures, responsible parties, and estimated cost of implementation. This EMP will be included in the bid documents and will be further reviewed and updated during implementation.

Table 8: Summary Environmental Impacts & Mitigation Measures – Pre-Construction

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation
Nuisance due to location of WWTP site in a developing area	• Select a treatment process that is compact, aesthetically good, and generates no or fewer odours. • Provide a green buffer zone of 10-15 m wide around the WWTP; this should be planted with trees in multi-rows. This will act as a visual screen around the facility and will improve the aesthetic appearance. • Regulate the surrounding land use in strict compliance with Davangere Master Plan • Design the layout plan of the facility such that potential odour generating units – inlet and primary treatment units and sludge thickener, are located away as far as possible from the nearest development, and be provided with green buffer zone. • iv. Provide backup power facilities for continuous and uninterrupted operation		
Poor waste management and safety provisions at the existing WTPs	• Provide recirculation system for backwash water – backwash water from filter beds shall be re circulated to WTP inlet and mixed with raw water; this arrangement will minimize wastage of water, which otherwise would have disposed to open drains, and also avoids the pollution of receiving water body • Provision of sludge drying – accumulated sludge from clariflocculator shall be flushed to sludge drying beds, for natural drying. • Dried sludge shall be used as soil conditioner. Periodic testing of dried sludge will be conducted to ensure that it is suitable for use		
Design and development of WWTP as per disposal standards set by CPCB (Pollution of surface water, groundwater and land resources)	• The WWTP should be designed for following treated water disposal standards (for more details refer Appendix 3): ✓ BOD of 30 mg/l ✓ Suspended solids level of 100 mg/l ✓ Faecal coliform less than 1000/100 ml • Continuous uninterrupted power supply should be provided for the facility; back-up facility (such as generator) shall be provided and adequate fuel supplies shall be ensured for running of generator when required • Provide energy efficient design; this should be one of the main criteria for evaluation of different bidders • Provide an operating manual with all standard operating	PIU and Design Consultant	Part of project cost

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation
	procedures (SOPs) for operation and maintenance of facility; this should include guidance on the follow up actions in case of process disruptions, inferior quality of treated water; etc. Necessary training (hands-on and class room / exposure visits) shall be provided to the ULB staff dealing with WWTP. • Develop a Sludge Management Plan • The scope of work of facility contractor should include extended operation period (at least five years) to ensure smooth operation, training to the ULB staff and gradual transfer of facility to Davangere CMC • Conduct regular wastewater quality monitoring (at inlet and at outlet of WWTP) to ensure that the treated effluent quality complies with the standards • Provide a green buffer zone of 10-15 m wide around the WWTP; this should be planted with trees in multi-rows. • Prohibit/prevent disposal of wastewater/effluent from industrial units in the sewers; ensure regular checking to ensure no illegal entry of industrial wastewater into sewers • Utilize treated water for irrigation use in the surrounding fields • Develop an emergency response system for events like release of bad odours – an ERS template is provided at Appendix 5.		
Risk due to handling and application of chlorine	Design and develop chlorination facility with all safety features and equipment to meet with any accidental eventuality, which may include • Chlorine neutralization pit with a lime slurry feeder • Proper ventilation, lighting, entry and exit facilities • Facility for isolation in the event of major chlorine leakage • Personal protection and safety equipment for the operators in the chlorine plant • Visible and audible alarm facilities to alert chlorine gas leak • Laboratory facility shall not be housed within the chlorination facility • Provide training to the staff in safe handling and application of chlorine; this shall be included in the contract of Chlorinator supplier • Supplier of Chlorinator equipment shall provide standard operating manual for safe operation and as well as maintenance and repairs; preferably these shall be provided both in English and Kannada Languages	PIU/IA	Part of project cost

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation
	• Develop an emergency response system for events like chlorine leakage – an ERS template is provided at Appendix 5. • During operation, it shall be ensured that chlorinator facility is operated only by trained staff and as per the standard operating procedures		
Tree cutting for OHSR construction	• Develop a site layout plan for OHSRs in such a way that it avoids/reduces the need to cut trees • Obtain permission from the Tree Officer for felling of trees • Plant two tree per each tree felled in the WTP compound	Contractor in coordination with PIU	Part of project cost
Disturbance/damage to existing utilities on the sites (Telephone lines, electric poles and wires, water lines within proposed project sites)	• Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during construction phase; • Conduct detailed site surveys with the construction drawings and discuss with the respective agencies during the construction phase before ground clearance, and • Require construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services. In case of disruption of water supply, alternative supply, through tankers, shall be provided	PIU and Design Consultant	Part of project cost
Sewer network	• Limit the sewer depth where possible. • Sewers shall be laid away from water supply lines and drains (at least 1 m, wherever possible); • In all cases, the sewer line should be laid deeper than the water pipeline (the difference between top of the sewer and bottom of water pipeline should be at least 300 mm) • In unavoidable, where sewers are to be laid close to storm water drains or canals or natural streams, appropriate pipe material shall be selected (stoneware pipes shall be avoided) • For shallower sewers, use small inspection chambers in lieu of manholes; • Design manhole covers to withstand anticipated loads & ensure that the covers can be readily replace if broken to minimize silt/garbage entry • Ensure sufficient hydraulic capacity to accommodate peak flows & adequate slope in gravity mains to prevent build up of solids and hydrogen sulfide generation	PIU and Design Consultant	Part of project cost

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation

	• Equip pumping stations with a backup power supply, such as a diesel generator, to ensure uninterrupted operation during power outages, and conduct regular maintenance to minimize service interruptions. Consider redundant pump capacity in critical areas
	• Establish routine maintenance program, including:
	  ○ Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups. Cleaning should be conducted more frequently for problem areas.
	  ○ Inspection of the condition of sanitary sewer structures and identifying areas that need repair or maintenance. Items to note may include cracked/deteriorating pipes; leaking joints or seals at manhole; frequent line blockages; lines that generally flow at or near capacity; and suspected infiltration or exfiltration; and
	  ○ Monitoring of sewer flow to identify potential inflows and outflows
	• Conduct repairs prioritized based on the nature and severity of the problem. Immediate clearing of blockage or repair is warranted where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, or sewer line blockages);
	• Review previous sewer maintenance records to help identify “hot spots” or areas with frequent maintenance problems and locations of potential system failure, and conduct preventative maintenance, rehabilitation, or replacement of lines as needed;
	• When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.). Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system.
	• Prohibit/prevent disposal of wastewater/effluent from industrial units in the sewers; ensure regular checking to ensure no illegal entry of industrial wastewater into sewers
	• Develop Emergency Response Plan for all emergencies such as leaks, overflows, bursts; a template of ERP is provided at Appendix 5		

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation
Community toilets – operation & maintenance impacts	• Develop and implement operation and maintenance (O&M) plans for community toilets with participation from the community. • A memorandum of understanding (MoU) between Ranebennur CMC and community will be reached prior to any construction and operation of community toilets. • As a minimum, the O&M plan should specify (i) cleaning procedures and frequency; (ii) responsible personnel; (iii) maintenance and repairs schedule; (iv) emergency contact numbers etc.	Davangere CMC PIU and Design Consultant	Part of project cost

Table 9: Summary Environmental Impacts & Mitigation Measures – Construction

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation
Construction impacts	Prepare and submit a Method Statement for pipeline and sewer works in a Table format with appended site layout map and cover the following: • Work description; No. Of workers (skilled & unskilled); Details of Plant, equipment & machinery, vehicles • Work duration (total, and activity-wise, for example for pipe laying, from excavation to road resurfacing/testing) • PPE (helmet, gloves, boots, etc) details for each type of work • Details of materials at each site (type & quantity) • Risks/hazards associated with the work (for example, Trench excavation will have risks such as trench collapse, persons/vehicles falling into trench, structural risk to nearby buildings, damage to buildings, infrastructure etc) • Construction waste/debris generated (details & quantity) • Detail the sequence of work process (step-by-step) including specific details of each work • Contractor's supervision & management arrangements for the work • Emergency: Designate (i) responsible person on site, and (ii) first aider • Typical site layout plan including pipe trenching, placement of material, excavated earth, barricading etc • The pipeline/sewers are to be laid along the roads, Roads are provided with side drains to carry rain water. The excavated soil, placed along the trench may get disturbed due to wind, rain water and the movement of workers, vehicles and pedestrians, and spill onto road way – disturbing road users, creating dust, road safety issues, etc, and also into nearby open drains. The following should be included in the site layout plan:	Contractor	Good construction practice to be followed by contractor – no additional costs

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation
	✓ Provide barricading/security personnel at the site to prevent entry/trespassing of pedestrian/vehicles into the work zone ✓ Location of temporary stockpiles and provision of bunds ✓ Separation of stockpiles areas with workers/vehicle movement paths to avoid disturbing the stockpiled soil ✓ Wetting of soil to arrest dust generation by sprinkling water ✓ Waste/surplus soil utilization and disposal plan – indicate expected duration of temporary stockpiling along the trench at each site and identify final surplus soil utilization/disposal site in consultation with PIU		
Disturbance/ damage to existing utilities on the sites (Telephone lines, electric poles and wires, water lines within proposed project sites)	• Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during construction phase	PIU	Part of project cost
	• Prepare a contingency plan to include actions to be done in case of unintentional interruption of services. • Conduct detailed site surveys with the construction drawings and discuss with the respective agencies during the construction phase before ground clearance; • In case of disruption of water supply, alternative supply, through tankers, shall be provided; water may be made available by the Davangere CMC, but it will the responsibility of contractor to supply to affected people	Construction Contractor	
Construction work camps, stockpile areas, storage areas, and disposal areas (disruption to traffic flow and sensitive areas and receptors)	• Prioritize areas within or nearest possible vacant space in the subproject location; • Construction work camps shall be located at least 200 m from residential areas • Do not consider residential areas for stockpiling the waste/surplus soil • Material stockpiles shall be protected by bunds during the monsoon to arrest the silt laden runoff into drains	Construction Contractor	Good construction practice to be followed by contractor – no additional costs
Source of construction materials	• Contractor should obtain material from existing mines approved/licensed by Mines and Geology Department/ Revenue Department. • Verify suitability of all material sources and obtain approval of implementing agency	Construction Contractor	Good construction practice to be

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation
(Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution)	• No new quarry sites shall be developed for the subproject purpose • Submit a monthly statement of construction material procured indicating material type, source and quantity.		followed by contractor – no additional costs
Air quality (dust and emissions from construction activity may degrade the air quality)	• Consult with PIU on the designated areas for stockpiling of clay, soils, gravel, and other construction materials; • Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather; • Bring materials (aggregates, sand, etc gravel) as and when required; • Use tarpaulins to cover sand and other loose material when transported by vehicles; • Clean wheels and undercarriage of vehicles prior to leaving construction site • Fit all heavy equipment and machinery with air pollution control devices which are operating correctly; ensure valid Pollution Under Control (PUC) Certificates for all vehicles and equipment used in the construction activity	Construction Contractor	Good construction practice to be followed by contractor – no additional costs
High noisy construction activities may have adverse impacts on sensitive receptors and structures	• Plan activities in consultation with the PIU so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance; • Construction work shall be limited to day light hours (6 AM to 6 PM) for all the works located within the town; • Provide prior information to the local public about the work schedule; • Ensure that there are no old and sensitive buildings that may come under risk due to the use of pneumatic drills; if there is risk, cut the rocks manually by chiselling; • Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers the sound impact	Construction Contractor	Good construction practice to be followed by contractor – no additional costs

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation
	to surrounding sensitive receptor; and • Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at a distance of 10 m or more from the vehicle/s		
Impacts on surface drainage and water quality due to contaminated runoff from construction areas in monsoon	• Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets • Stockpiles shall be provided with temporary bunds • Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with Implementing Agency on designated disposal areas • Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies • Place storage areas for fuels and lubricants away from any drainage leading to water bodies • Dispose any wastes generated by construction activities in designated sites	Construction Contractor	Good construction practice to be followed by contractor – no additional costs
Impacts on landscape and aesthetics due to construction activity	• Prepare and implement Waste Management Plan – it should present how the surplus waste generated will temporarily stocked at the site, transported and disposed properly • Avoid stockpiling of excess excavated soils as far as possible • Avoid disposal of any debris and waste soils in the forest areas and in or near water bodies/rivers; • Coordinate with PIU for beneficial uses of excess excavated soils or immediately dispose to designated areas	Construction Contractor	Good construction practice to be followed by contractor – no additional costs
Hindrance to traffic movement	• Plan pipeline (water & sewer lines) work in consultation with the traffic police • Plan work such that trench excavation, pipe laying, and refilling including compacting, at a stretch is completed in a minimum possible time; • Provide for immediate consolidation of backfilling material to desired compaction - this will allow immediate road restoration and therefore will minimise disturbance to the traffic movement; • Do not close the road completely, ensure that work is conducted onto edge of the road; allow traffic to move on one line; • In unavoidable circumstances of road closure, provide alternative routes, and ensure that public is informed about such traffic diversions; • At all work sites public information/caution boards shall be provided – information shall inter-alia include: project name, cost and schedule; executing agency and contractor details; nature and schedule of work at that road/locality; traffic diversion details, if any; entry restriction information; competent official's name and contact for public complaints. • Prepare a Traffic Management Plan – a template is provided for reference at Appendix 4.	Construction Contractor	Good construction practice to be followed by contractor – no additional costs

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation
Nuisance/ disturbance to sensitive areas (schools, hospitals and religious places) due construction work in the proximity (within 250 m of such place)	• No material should be stocked in this area; material shall be brought to the site as and when required • Conduct work manually with small group of workers and less noise; minimize use of equipment and vehicles • No work should be conducted near the religious places during religious congregations • Material transport to the site should be arranged considering school timings; material should be in place before school starts; • Notify concerned schools, hospitals etc 2 weeks prior to the work; conduct a 30 minutes awareness program at on nature of work, likely disturbances and risks and construction work, mitigation measures in place, entry restrictions and dos and don'ts • Implement all measures suggested elsewhere in this report – dust and noise control, public safety, traffic management, strictly at the sites.	Construction Contractor	Good construction practice to be followed by contractor – no additional costs
Impediment of access to houses and business	• Leave space for access between mounds of excavated soil • Provide wooden planks/footbridges for pedestrians and metal sheets for vehicles to allow access across trenches to premises where required • Consult affected businesspeople to inform them in advance when work will occur • Address livelihood issues; implement the Resettlement Plan (RP) to address these issues • Provide sign/caution/warning boards at work site indicating work schedule and traffic information; prevent public entry into work sites through barricading and security; and • Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.	Construction Contractor	Good construction practice to be followed by contractor – no additional costs
Employment generation	• Employ at least 50% of the labour force, or to the maximum extent, local persons if manpower is available • Secure construction materials from local market.	Construction Contractor	-
Workers occupational health & safety	• Develop and implement site-specific Health and Safety (H and S) Plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment; (c) H and S Training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents; • All trenches deeper than 2 m shall be protected with wooden bracing to avoid safety risks to workers, public and nearby buildings/structures • Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site; • Provide medical insurance coverage for workers; • Secure all installations from unauthorized intrusion and accident risks;	Construction Contractor	Good construction practice to be followed by contractor – no additional costs

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation
	• Provide supplies of potable drinking water; • Provide clean eating areas where workers are not exposed to hazardous or noxious substances • Provide H and S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; • Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted; • Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; • Ensure moving equipment is outfitted with audible back-up alarms; • Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; • Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively. • Overall, the contractor should comply with IFS EHS Guidelines on Occupational Health and Safety (this can be downloaded from http://www1.ifc.org/wps/wcm/connect/9aef2880488559a983acd36a6515bb18/2%2BOccupational%2BHealth%2Band%2BSafety.pdf?MOD=AJPERES)		
Community health & safety	• Provide wooden bracing for all deep excavations (> 2m); identify buildings at risk prior to start of excavation work and take necessary precautions for safe work • Plan material and waste routes to avoid times of peak-pedestrian activities • Liaise with Davangere CMC in identifying risk areas on route cards/maps; identify buildings at risk prior to start of excavation work and take necessary precautions for safe conduct of work • Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure • Provide road signs and flag persons to warn of dangerous conditions, for all the sites along the roads • Overall, the contractor should comply with IFS EHS Guidelines Community Health and Safety (this can be downloaded from http://www1.ifc.org/wps/wcm/connect/dd673400488559ae83c4d36a6515bb18/3%2BCommunity%2BHealth%2Band%2BSafety.pdf?MOD=AJPERES	Construction Contractor	Good construction practice to be followed by contractor – no additional costs

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation
Temporary worker camps	• The contractor should establish and operate the temporary worker camps in compliance with IFC EHS Guidelines specific to workers accommodation ((this can be downloaded from http://www1.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/publications/publications_gpn_workersaccommodation), including the following: • Consult with PIU before locating workers camps/sheds, and construction plants; as far as possible located within reasonable distance of work site • Minimize removal of vegetation and disallow cutting of trees • Living facilities shall be built with adequate materials, and should be in good condition and free from rubbish and other refuge • The camp site should be adequately drained to avoid the accumulation of stagnant water • Provide water and sanitation facilities; water, meeting Indian drinking water standards shall be provided, in adequate quantities (supply of 60- 80 LPCD); all water storage structures must be cleaned regularly and covered properly to avoid any contamination • Provide separate facilities for men and women; sanitary facilities shall be properly build and well maintained; toilet and bath facilities should be provided on basis of 1 per 15 or less persons • Train employees in the storage and handling of materials which can potentially cause soil contamination; • Recover used oil and lubricants and reuse or remove from the site; • Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; • Remove all rubbish, or temporary structures which are no longer required • Report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.	Construction Contractor	Good construction practice to be followed by contractor – no additional costs

Table 10: Summary Environmental Impacts & Mitigation Measures – Operation

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation
General maintenance and repair work of water supply and sewer system (nuisance and disturbance to people, disruption services etc)	• Follow standard procedures as prescribed by O&M Manual • Ensure that all necessary equipment and tools are available for regular maintenance, especially for sewer network • Ensure there is overflow of sewers due to blockages or leaks; in case of occurrence, attend to these at the earliest	Davangere CMC	Part of project O&M cost

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation
	• Implement all necessary mitigation measures suggested during construction (to avoid disturbance and inconvenience to people, business and traffic) • Ensure that the treated wastewater quality confirms with the following design standards (Water Act, 1974, refer Appendix 3 for details) ✓ BOD of 30 mg/l ✓ Suspended solids level of 100 mg/l ✓ Faecal coliform less than 1000/100 ml • Treat/dispose/utilize the sludge as per the sludge management plan. Ensure operation and maintenance of sewer network as per the standard operating procedures to avoid, over flows, blockages, etc and immediately conducting the maintenance work in case of such occurrences • Implement Emergency Response System (ERS template is provided in Appendix 5 for reference) for events such as chlorine leak,and burst/leaks/overflows of sewers etc) • Implement operation and maintenance (O&M) plans for community toilets with participation of the community.		

B. Environmental Monitoring Plan

136. A program of monitoring will be conducted to ensure that all parties take the specified action to provide the required mitigation, to assess whether the action has adequately protected the environment, and to determine whether any additional measures may be necessary. Regular monitoring of implementation measures by construction contractors will be conducted by the PIU with Consultant Team's support. Periodic monitoring and overseeing of implementation of mitigation measures will be PMU. Monitoring during operation stage will be conducted by the Operating Agency, Davangere.

137. Most of the mitigation measures are fairly standard methods of minimizing disturbance from building in urban areas (maintaining access, planning work to minimize public inconvenience and traffic disruptions, finding uses for waste material, etc). Monitoring of such measures normally involves making observations in the course of site visits, although some require more formal checking of records and other aspects. Sampling and quality monitoring of water supplied will be conducted regularly.

138. Following Table shows the proposed Environmental Monitoring Plan for this subproject, which specifies the various monitoring activities to be conducted during different phases of the project. The EMP describes: (i) mitigation measures, (ii) location, (iii) measurement method, (iv) frequency of monitoring and (v) responsibility (for both mitigation and monitoring).

Table 11: Environmental Monitoring Plan

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
Pre-Construction						
All mitigation measures related to project site, location and design	-	PIU / Design Consultant	DPR Review	As needed	PMU	NA
• Select a treatment process that is compact, aesthetically good, and generates no or fewer odours. • Provide a green buffer zone of 10-15 m wide around the WWTP; this should be planted with trees in multi-rows. This will act as a visual screen around the facility and will improve the aesthetic appearance. • Design the layout plan of the facility such that potential odour generating units – inlet and primary treatment units and sludge thickener, are located away as far as possible from the nearest development, and be provided with green buffer zone. • Provide backup power facilities for continuous and uninterrupted operation	-	PIU	Review & check the inclusion/ provision in DPR, as appropriate	Once before DPR approval	PMU	NA
• Provide recirculation system for backwash water – backwash water from filter beds shall be re circulated to WTP inlet and mixed with raw water; this arrangement will minimize wastage of water, which otherwise would have disposed to open drains, and also avoids the pollution of receiving water body • Provision of sludge drying – accumulated sludge from clariflocculator shall be flushed to sludge drying beds, for natural drying. • Dried sludge shall be used as soil conditioner. Periodic testing of dried sludge will be conducted to ensure that it is suitable for use	-	PIU	Review & check the inclusion/ provision in DPR, as appropriate	Once before DPR approval	PMU	NA
• Design and develop chlorination facility with all safety features and equipment to meet with any accidental eventuality, which may	-	PIU	Review & check the inclusion/	Once before DPR approval	PMU	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
include • Chlorine neutralization pit with a lime slurry feeder • Proper ventilation, lighting, entry and exit facilities • Facility for isolation in the event of major chlorine leakage • Personal protection and safety equipment for the operators in the chlorine plant • Visible and audible alarm facilities to alert chlorine gas leak • Laboratory facility shall not be housed within the chlorination facility • Provide training to the staff in safe handling and application of chlorine; this shall be included in the contract of Chlorinator supplier • Supplier of Chlorinator equipment shall provide standard operating manual for safe operation and as well as maintenance and repairs; preferably these shall be provided both in English and Kannada Languages • Develop an emergency response system for events like chlorine leakage – an ERS template is provided at Appendix 5. • During operation, it shall be ensured that chlorinator facility is operated only by trained staff and as per the standard operating procedure			provision in DPR, as appropriate			
• Identify and include locations and operators of the utilities in the detailed design documents	-	PIU / Consultant Team	Review & check the inclusion/ provision in DPR, as appropriate	Once before DPR approval	PMU	NA
• Require construction contractors to prepare a contingency plan	-	Contractor	Review the contingency	Once prior to the	PIU	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
			plan	relocation of utilities		
• Limit the sewer depth where possible. • Sewers shall be laid away from water supply lines and drains (at least 1 m, wherever possible); • In all cases, the sewer line should be laid deeper than the water pipeline (the difference between top of the sewer and bottom of water pipeline should be at least 300 mm) • In unavoidable, where sewers are to be laid close to storm water drains or canals or natural streams, appropriate pipe material shall be selected (stoneware pipes shall be avoided)		PIU / Consultant Team	Review & check the inclusion/ provision in DPR, as appropriate	Once before DPR approval	PMU /PMC	NA
• For shallower sewers, use small inspection chambers in lieu of manholes; • Design manhole covers to withstand anticipated loads & ensure that the covers can be readily replace if broken to minimize silt/garbage entry • Ensure sufficient hydraulic capacity to accommodate peak flows & adequate slope in gravity mains to prevent build up of solids and hydrogen sulfide generation • Equip pumping stations with a backup power supply, such as a diesel generator, to ensure uninterrupted operation during power outages, and conduct regular maintenance to minimize service interruptions. Consider redundant pump capacity in critical areas • Establish routine maintenance program, including: o Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups.		PIU / Consultant Team	Review & check the inclusion/ provision in DPR, as appropriate	Once before DPR approval	PMU /PMC	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
Cleaning should be conducted more frequently for problem areas. o Inspection of the condition of sanitary sewer structures and identifying areas that need repair or maintenance. Items to note may include cracked/deteriorating pipes; leaking joints or seals at manhole; frequent line blockages; lines that generally flow at or near capacity; and suspected infiltration or exfiltration; and o Monitoring of sewer flow to identify potential inflows and outflows • Conduct repairs prioritized based on the nature and severity of the problem. Immediate clearing of blockage or repair is warranted where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, or sewer line blockages);						
• Review previous sewer maintenance records to help identify "hot spots" or areas with frequent maintenance problems and locations of potential system failure, and conduct preventative maintenance, rehabilitation, or replacement of lines as needed; • When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.). Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system. • Prohibit/prevent disposal of		PIU / Consultant Team	Review & check the inclusion/ provision in DPR, as appropriate	Once before DPR approval	PMU /PMC	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
wastewater/effluent from industrial units in the sewers; ensure regular checking to ensure no illegal entry of industrial wastewater into sewers • Develop Emergency Response Plan for all emergencies such as leaks, overflows, bursts; a template of ERP is provided at Appendix 5						
Develop and implement operation and maintenance (O&M) plans for community toilets with participation from the community. A memorandum of understanding (MoU) between Ranebennur CMC and community will be reached prior to any construction and operation of community toilets. • As a minimum, the O&M plan should specify (i) cleaning procedures and frequency; (ii) responsible personnel; (iii) maintenance and repairs schedule; (iv) emergency contact numbers etc.		Davangere CMC, PIU / Consultant Team	Review & check the inclusion/ provision in DPR/O&M manual as appropriate	Once before DPR /O&M Manual approval	PMU /PMC	NA
Construction						
Prepare and submit a Method Statement for pipeline and sewers works in a Table format with appended site layout map • Method Statement can be prepared for each stretch (say 1 km) /specific site based on the project area.	At each work site	Contractor	• Review and approve method statement Site observations during construction	Approve statement before start of work Weekly during construction	PIU	NA
• Conduct detailed site surveys with the construction drawings and discuss with the respective agencies during the construction phase before ground clearance;	-	Contractor	Check contractor records Random checks on site, drawings and	Once prior to the start of ground clearance for construction	PIU	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
			interactions with respective agencies			
• Prepare a contingency plan to include actions to be done in case of unintentional interruption of services.	-	Contractor	Review the plan	Once prior to start of construction	PIU	NA
• In case of disruption of water supply, alternative supply, through tankers, shall be provided; water may be made available by the Davangere, but it will the responsibility of contractor to supply to affected people	Utility relocation site	Contractor	Site observations Informal public consultations	Weekly Once	PIU	NA
Prioritize areas within or nearest possible vacant space in the subproject location Construction work camps shall be located at least 200 m from residential areas • Do not consider residential areas for stockpiling the waste/surplus soil; • No worker camp shall be set up in north/western outskirts of the town, which are located close to sanctuary • The Contractor shall take all necessary precautions to prevent his workers from entering into sanctuary/forest area; removing, disturbing and damaging any trees/vegetation for fire wood and/or hunting animals; the contractor will be severely penalized if there are any violations by workers. • Appropriate signage/caution/warning boards have to be installed on the site indicating the proximity of the sanctuary and prohibitory orders on entering sanctuary area and also on collecting the fuel-wood. This signs should be in Kannada, Hindi and English.	Sites for worker camp, material store	Contractor	Site observations	Before & after such establishment	PIU	NA
• Material stockpiles shall be protected by bunds during the monsoon to arrest the silt	Stockpile sites	Contractor	Site observations	Weekly	PIU	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
laden runoff into drains						
• Contractor should obtain material from existing mines approved/licensed by Mines and Geology Department/ Revenue Department. • Verify suitability of all material sources and obtain approval of implementing agency • No new quarry sites shall be developed for the subproject purpose	-	Contractor	Check sources & approvals	Prior to approval of quarry for material	PIU	NA
• Submit a monthly statement of construction material procured indicating material type, source and quantity.	-	Contractor	Record check	Monthly	PIU	NA
• Consult with PIU on the designated areas for stockpiling of clay, soils, gravel, and other construction materials;	Stockpile site	Contractor	Site check & approval	Prior to approval	PIU	NA
• Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather • Bring materials (aggregates, sand, etc gravel) as and when required • Use tarpaulins to cover sand and other loose material when transported by vehicles; • Clean wheels and undercarriage of vehicles prior to leaving construction site	Work site	Contractor	Site observations Informal public consultations	Weekly	PIU	NA
• Fit all heavy equipment and machinery with air pollution control devices which are operating correctly; ensure valid Pollution Under Control (PUC) Certificates for all vehicles and equipment used in the construction activity	Work site	Contractor	Check valid PUC	Prior to start and quarterly there after	PIU	NA
• Plan activities in consultation with the PIU so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance;	Work site	Contractor	Check work schedule of contractor; public consultation	Prior to start of work	PIU	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
• Construction work shall be limited to day light hours (6 AM to 6 PM) for all the works located within the town; for facilities outside the town/habitation (i.e. WWTP) the timings may be relaxed with the permission of Davangere CMC and PIU, however no work should be conducted between 10 PM – 6 AM at any site. • Provide prior information to the local public about the work schedule;			records			
• Ensure that there are no old and sensitive buildings that may come under risk due to the use of pneumatic drills; if there is risk, cut the rocks manually by chiselling;	Work site	Contractor	Site observations	Weekly	PIU	NA
• Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers the sound impact to surrounding sensitive receptor; and	Work site	Contractor	Site observations	Weekly	PIU	NA
• Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at a distance of 10 m or more from the vehicle/s	Work site	Contractor	Noise monitoring	Quarterly	Contractor	NA
• Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets • Stockpiles shall be provided with temporary bunds • Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with PIU on designated disposal areas • Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies • Place storage areas for fuels and lubricants	Work site	Contractor	Site observations	Weekly	PIU	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
away from any drainage leading to water bodies • Dispose wastes generated by construction activities in designated sites						
• Avoid stockpiling of excess excavated soils as far as possible • Avoid disposal of any debris and waste soils in the forest areas and in or near water bodies/rivers; • Coordinate with PIU for beneficial uses of excess excavated soils or immediately dispose to designated areas • Prepare and implement Waste Management Plan – it should present how the surplus waste generated will temporarily stocked at the site, transported and disposed properly	-	Contractor	Waste Management Plan review & approval	Once prior to start of construction	PIU	NA
• Obtain permission from the Tree Officer for felling of trees • Plant two tree per each tree felled in the WTP compound	WTP site	Contractor	Check permission for tree cutting; site observation	Prior to tree cutting & after re plantation	PIU	NA
• Plan pipeline work in consultation with the traffic police • Plan work such that trench excavation, pipe laying, and refilling including compacting, at a stretch is completed in a minimum possible time; • Provide for immediate consolidation of backfilling material to desired compaction - this will allow immediate road restoration and therefore will minimise disturbance to the traffic movement • Do not close the road completely, ensure that work is conducted onto edge of the road; allow traffic to move on one line • In unavoidable circumstances of road closure,	Work site	Contractor	Work program review Site observations Informal public consultation	Once prior to start of construction Weekly during work	PIU	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
provide alternative routes, and ensure that public is informed about such traffic diversions; • Plan material and waste routes to avoid times of peak-pedestrian activities • Liaise with Davangere CMC in identifying risk areas on route cards/maps						
• At all work sites public information/caution boards shall be provided – information shall inter-alia include: project name, cost and schedule; executing agency and contractor details; nature and schedule of work at that road/locality; traffic diversion details, if any; entry restriction information; competent official's name and contact for public complaints.	Work site	Contractor	Site observations	Once prior to start of construction	PIU	NA
• Prepare a Traffic Management Plan – a template is provided for reference at Appendix 4.	Work site	Contractor	Review, approval and on-site implementation of TMP	Once prior to start of construction; weekly during work	PIU	NA
• No material should be stocked in this area; material shall be brought to the site as and when required • Conduct work manually with small group of workers and less noise; minimize use of equipment and vehicles • No work should be conducted near the religious places during religious congregations • Material transport to the site should be arranged considering school timings; material should be in place before school starts; • Notify concerned schools, hospitals etc 1 week prior to the work; conduct a 30-m awareness program on nature of work, likely	Work near sensitive areas	Contractor	Work program review Site observations Informal public consultation	Once prior to start of construction Weekly during work	PIU	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
disturbances and risks and construction work, mitigation measures in place, entry restrictions and dos and don'ts • Implement all measures suggested elsewhere in this report – dust and noise control, public safety, traffic management, strictly at the sites.						
• Leave space for access between mounds of excavated soil • Provide wooden planks/footbridges for pedestrians and metal sheets for vehicles to allow access across trenches to premises where required • Consult affected businesspeople to inform them in advance when work will occur • Address livelihood issues, if any; implement the Resettlement Plan (RP) to address these issues • Provide sign/caution/warning boards at work site indicating work schedule and traffic information; prevent public entry into work sites through barricading and security; and • Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.	Work site	Contractor	Site observations Informal public consultation	Weekly	PIU	NA
• Employ at least 50% of the labour force, or to the maximum extent, local persons if manpower is available • Secure construction materials from local market.	Work site	Contractor	Review records Worker consultation	Weekly	PIU	NA
• Develop and implement site-specific Environment, Health and Safety (EHS) Plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment; (c) H and S Training	Work site	Contractor	Review and on-site implementation of EHS Plan	Once prior to start of construction; weekly during work	PIU	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents; • All trenches deeper than 2 m shall be protected with wooden bracing to avoid safety risks to workers, public and nearby buildings/structures • Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site; • Provide medical insurance coverage for workers; • Secure all installations from unauthorized intrusion and accident risks; • Provide supplies of potable drinking water; • Provide clean eating areas where workers are not exposed to hazardous or noxious substances • Provide H and S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; • Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted; • Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; • Ensure moving equipment is outfitted with audible back-up alarms; • Mark and provide sign boards for hazardous						

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; • Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively. • Overall, the contractor should comply with IFS EHS Guidelines on Occupational Health and Safety (this can be downloaded from http://www1.ifc.org/wps/wcm/connect/9aef2880488559a983acd36a6515bb18/2%2BOccupational%2BHealth%2Band%2BSafety.pdf?MOD=AJPERES)						
• Provide road signs and flag persons to warn of dangerous conditions, in case of location near the road • Overall, the contractor should comply with IFS EHS Guidelines Community Health and Safety (this can be downloaded from http://www1.ifc.org/wps/wcm/connect/dd673400488559ae83c4d36a6515bb18/3%2BCommunity%2BHealth%2Band%2BSafety.pdf?MOD=AJPERES)	Work site	Contractor	Review and on-site implementation of EHS Plan	Once prior to start of construction; weekly during work	PIU	NA
• The contractor should establish and operate the temporary worker camps in compliance with IFC EHS Guidelines specific to workers accommodation ((this can be downloaded from http://www1.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+su	Workers camp site	Contractor	Site observations and facilities	Once prior to start of construction; monthly during work	PIU	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
stainability/publications/publications_gpn_workersaccommodation), including the following: • Consult with PIU/Davangere CMC before locating workers camps/sheds, and construction plants; ; as far as possible located within reasonable distance of work site • Minimize removal of vegetation and disallow cutting of trees • Living facilities shall be built with adequate materials, and should be in good condition and free from rubbish and other refuge • The camp site should be adequately drained to avoid the accumulation of stagnant water • Provide water and sanitation facilities; water, meeting Indian drinking water standards shall be provided, in adequate quantities (supply of 60- 80 LPCD); all water storage structures must be cleaned regularly and covered properly to avoid any contamination • Provide separate facilities for men and women; sanitary facilities shall be properly build and well maintained; toilet and bath facilities should be provided on basis of 1 per 15 or less persons • Train employees in the storage and handling of materials which can potentially cause soil contamination; • Recover used oil and lubricants and reuse or remove from the site; • Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; • Remove all wreckage, rubbish, or temporary structures which are no longer required • Report in writing that the camp has been						

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
vacated and restored to pre-project conditions before acceptance of work.						

Environmental Quality Monitoring						
Construction						
Ambient air quality and noise	5 points (shall be selected during detailed design stage)	-	• SPM, RSPM, SOx, NOx • Day and night time noise (dBA) • Monitoring method as prescribed by CPCB	Once before start of construction Quarterly (yearly 4-times) during construction	Contractor	$ 100 per sample – sum $ 4,100
Operation						
Monitoring of quality of water supplied to	All Service reservoirs		pH, Cl, F, NO3, TC, FC, Hardness, Turbidity BOD, Total Alkalnity, Total coliform and E-coliform	Monthly once	Davangere CMC	Part of laboratory O&M Costs
	Consumer end-random sampling in all zones		pH, Cl, F, NO3, TC, FC, Hardness, Turbidity BOD, Total Alkalnity, Total coliform and E-coliform	Yearly once	Davangere CMC	Part of laboratory O&M Costs
Monitoring of treated wastewater quality from WWTP	Inlet and outlet of WWTP	Operator	Parameters as specified by KSPCB Concentration of various parameters shall be within the specific limits by KSPCB	Monthly	Davangere CMC	Part of laboratory O&M Costs
	Inlet	operator	Analysis of Wastewater characteristics including heavy metals such as Mercury (as Hg), Lead (as Pb), Cadmium (as Cd), Chromium (as Cr), Zinc (as Zn) and Nickel (as Ni) Concentration of various parameters shall be within the specific limits by KSPCB	Yearly twice	Davangere CMC	Part of O&M costs

	Inlet and outlet of WWTP	Operator	Parameters as specified by KSPCB Concentration of various parameters shall be within the specific limits by KSPCB	Monthly	Davangere CMC through accredited lab/ KSPCB	Part O&M costs
Sludge quality and suitability as manure	Sludge drying beds WTP & WWTP	Operator	Analysis for concentration of heavy metals and confirm that value are within the following limits (all units are in mg/kg dry basis except pH) • Arsenic - 10.00 • Cadmium - 5.00 • Chromium - 50.00 • Copper - 300.00 • Lead - 100.00 • Mercury - 0.15 • Nickel - 50.00 • Zinc - 1000.00 PH - 5.5-8.5	Yearly once	Davangere CMC through accredited lab	Part O&M costs

C. Environmental Management & Monitoring Costs

139. Most of the mitigation measures require the Contractors to adopt good site practices, which are part of their normal procedures, so there are unlikely to be major costs associated with compliance. These costs of mitigation by the contractors are included in the budgets for the civil works. Mitigation and monitoring provided by the PIU/PMU or their consultants will be part of incremental administration costs. Costs required for environmental quality monitoring is indicated in Table 12.

Table 12: Environmental Management and Monitoring Costs

Item	Responsible Agency	Quantity/Details	Total Cost (US$)	Source of funds
Air quality monitoring	Contractor	41 samples	4,100	Included in the project cost as BOQ item
Tree plantation & maintenance for 2 years at WWTP site, WTPs etc	Contractor	-	10,000	Included in the project cost as BOQ item
Monitoring of implementation of mitigation measures	PIU / PMU / Consultants	As required	Part of incremental admin costs	-
Water quality monitoring	Operating agency/Davangere CMC	As required	Part of O&M costs of operator	O&M funds
Total costs			**$ 14,100**	

D. Grievance Redress Mechanism

140. A project specific grievance redress mechanism (GRM) will be established to receive, evaluate and facilitate concerns of, complaints and grievances of the DPs in relation to project's social and environmental performances. The main objective of the GRM will be to provide time bound action and transparent mechanism to resolve social and environment concerns.

141. A project GRM will cover the project's towns for all kinds of grievances and will be regarded as an accessible and trusted platform for receiving and facilitating project related complaints and grievances. The multi-tier GRM for the program will have realistic time schedules to address grievances and specific responsible persons identified to address grievances and whom the DPs have access to interact easily.

142. Awareness on grievance redress procedures will be created through Public Awareness Campaign with the help of print and electronic media and radio. The resettlement NGO will ensure that vulnerable households are also made aware of the GRM and assured of their grievances to be redressed adequately and in a timely manner.

143. There will be multiple means of registering grievances and complaints by dropping grievance forms in complaint/ suggestion boxes at accessible locations, or through telephone hotlines, email, post or writing in a complaint registrar book in ULB's project office. There will be complaint registrar book and complaint boxes at construction site office to enable quick response of grievances/ complaints for urgent matters. The name, address and contact details of the persons with details of the complaint / grievance, location of problem area, date of receipt

of complaint will be documented. The RPMU's Social development / Resettlement Officer will be responsible at the project level for timely resolution of the environmental and social safeguards issues and registration of grievances, and communication with the aggrieved persons. Annex 1 is the draft PID to be distributed to all affected communities and DPs which include the contact numbers of the respective ULB officer(s) responsible for the KISWRMIP.

E. Grievance Redress Process

144. There will be several tiers for grievance redress process. Simple grievances for immediate redress will first be resolved at site by Contractor.. If unaddressed for up to 7 days the complainants may go to PIU officer in ULB responsible for resettlement/social issues. Project engineer and the resettlement NGO will assist in resolving the issues. Name, designation and contact number of personnel responsible for grievance redress at ULB and RPMU, will be posted at Contractor's and PMDSC's site office in full visibility of public. NGO will be involved in community mobilization and awareness campaign among the communities. Grievances of immediate nature should be resolved at site/ within ULB/PIU level within 15 days of registration of grievances.

145. All grievances that cannot be resolved by ULB/PIU within 15 days will be forwarded to RPMU's Social safeguards/R&R Officer and PMDSC specialist who will review and resolve within 15 working days of grievance registration with the assistance of the Resettlement NGO and concerned PIU/ULB personnel, if required.

146. The grievances of critical nature and those cannot be resolved at RPMU level should be referred to Grievance Redress Committee (GRC)/Steering Committee (ST) set up at district level to be settled within 30 days. All documents related to grievances, follow up action taken to resolve along with explanatory note on nature, seriousness and time taken for grievance redress shall be prepared by RPMU Social safeguard / R&R Officer and circulated to GRC/SC members at least a week prior to scheduled meeting. The decision taken at the GRC/SC level will be communicated to the DPs by RPMU Social safeguards/R&R officer through ULB/PIU and resettlement NGO.

147. For any issues that remain unresolved by the GRC or SC or the decision taken at such meetings are not acceptable, the complainants /DPs can approach the Court of Law as per Govt. of Karnataka legal procedure.

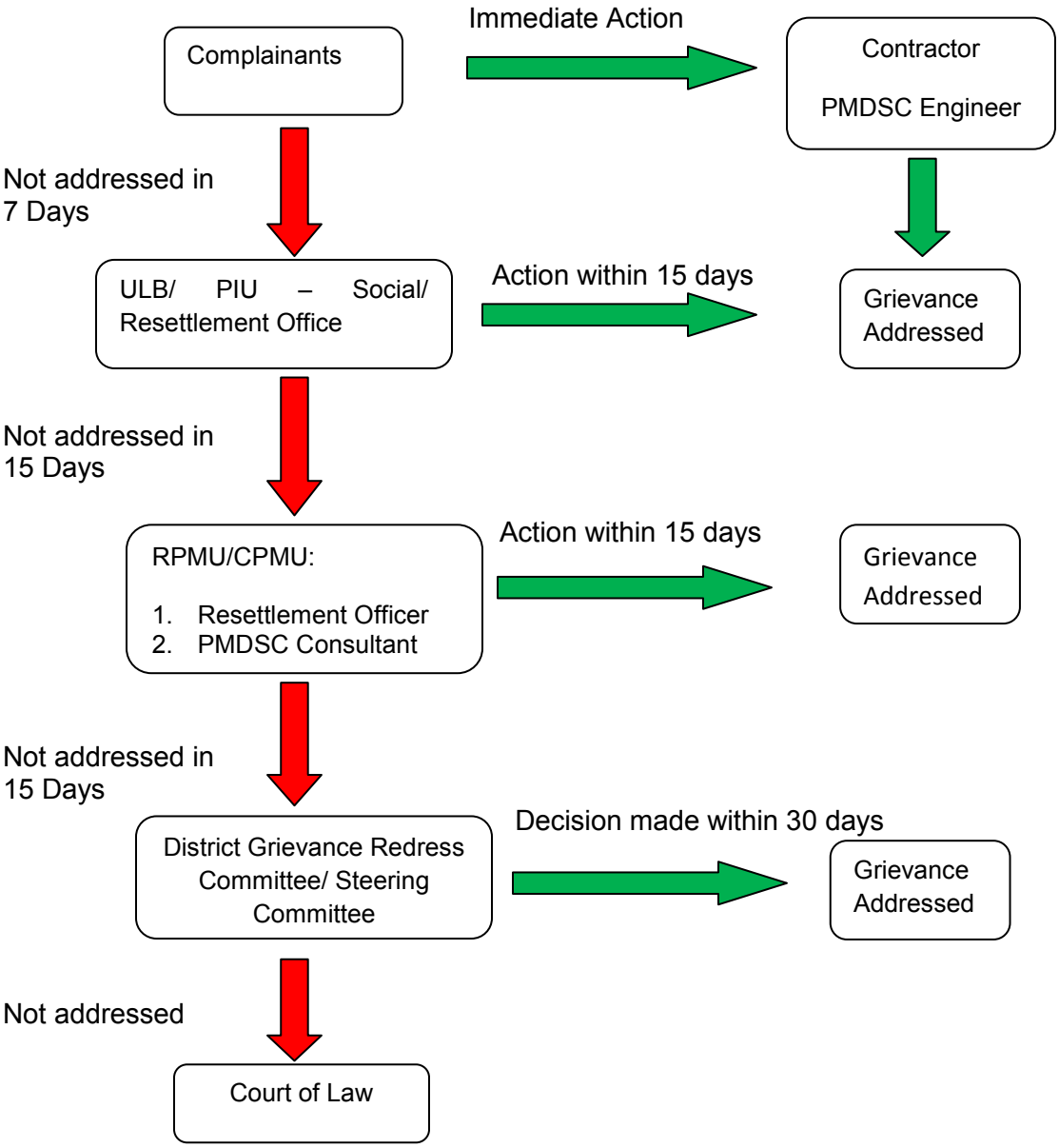
F. GRC / SC composition and selection of members

148. The GRC/ SC for the project will be headed by Dy. Commissioner (DC) of the district with members as followed: (1) ULB Commissioners of project towns,(2) Revenue Department (Registrar) official, (3) RPMU Social safeguard/ R&R Officer of KIUWMIP, (4) ULB officer who will convene the periodic meeting of GRC and will shoulder responsibility of keeping records of grievances/ complaints in details with help from resettlement NGO. Other members, such as, NGO/CBO representatives, wards council representatives, DPs' representatives will be selected by the ULB Commissioner to represent in the GRC/SC meeting. NGO should also deploy one person in the team who will be responsible for coordinating with all GRC members and the DPs for grievance redress.

149. 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 Indian

Resident Mission (INRM). The complaint can be submitted in any of the official languages of ADB's DMCs. The ADB Accountability Mechanism information will included in the PID to be distributed to the affected communities, as part of the project GRM. A Grievance Redress Mechanism is shown in the Figure 11.

Figure 11: Grievance Redress Process



VIII. PUBLIC CONSULTATION & INFORMATION DISCLOSURE

A. Project Stakeholders

150. Most of the main stakeholders have already been identified and consulted during preparation of this IEE, and any others that are identified during project implementation will be brought into the process in the future. Primary stakeholders are:

(i) Residents, shopkeepers and businesspeople near the work sites;
(ii) Public representatives and prominent citizens of the town
(iii) Davangere City Municipal Council
(iv) KUIDFC, GoK

151. Secondary stakeholders are:

(i) Other concerned government institutions (utilities, regulators, etc)
(ii) NGOs and CBOs working in the affected communities;
(iii) Other community representatives (prominent citizens, religious leaders, elders, women's groups);
(iv) The beneficiary community in general; and
(v) ADB as the funding agency

B. Consultation & Disclosure Till Date

152. A series of public consultation meetings were conducted during the project preparation. Various forms of public consultations (consultation through ad hoc discussions on site) have been used to discuss the project and involve the community in planning the project and mitigation measures.

153. Besides, a public consultation workshop was conducted on October 3, 2012 at Davangere for all the four project towns to discuss the proposed project and likely environmental issues and mitigation measures. Key stakeholders – public representatives, officials from various agencies, district level officers, from each project town, including Davangere, were participated in the workshop. Minutes of this consultation meeting is appended at Appendix 6.

C. Future Consultation & Disclosure

154. EA and IA shall extend and expand the consultation and disclosure process significantly during implementation of the Investment Program.

(i) Consultation during detailed design:

- Focus-group discussions with affected persons and other stakeholders (including women's groups, NGOs and CBOs) to hear their views and concerns, so that these can be addressed in subproject design where necessary; and
- Structured consultation meetings with the institutional stakeholders (government bodies and NGOs) to discuss and approve key aspects of the project.

(ii) Consultation during construction:

- Public meetings with affected communities (if any) to discuss and plan work programmes and allow issues to be raised and addressed once construction has started; and
- Smaller-scale meetings to discuss and plan construction work with individual communities to reduce disturbance and other impacts, and provide a mechanism through which stakeholders can participate in subproject monitoring and evaluation;

(iii) Project disclosure:

- Public information campaigns (via newspaper, TV and radio) to explain the project to the wider town population and prepare them for disruption they may experience once the construction programme is underway;
- Public disclosure meetings at key project stages to inform the public of progress and future plans, and to provide copies of summary documents in Kannada; and
- Formal disclosure of completed project reports by making copies available at convenient locations in the study towns, informing the public of their availability, and providing a mechanism through which comments can be made.

155. Based on ADB requirements, the following will be posted on ADB website: (i) this IEE, upon finalization and approval of ADB; (ii) a new or updated IEE, if prepared, reflecting significant changes in the Project during design or implementation; (iii) corrective action plan prepared during Project implementation to address unanticipated environmental impacts and to rectify non-compliance to EMP provisions; and (iv) environmental monitoring reports. Documents will also be available on the websites of KUIDFC and Davangere CMC.

IX. RECOMMENDATION & CONCLUSION

A. Recommendation

156. The process described in this document has assessed the environmental impacts of all elements of the infrastructure proposed under the Davangere Water Supply and Sewerage Subproject. Potential negative impacts were identified in relation to design, construction and operation of the improved infrastructure. Mitigation measures have been developed in generic way to reduce all negative impacts to acceptable levels. These were discussed with specialists responsible for the engineering aspects, and as a result some measures have already been included in the outline designs for the infrastructure. This means that the number of impacts and their significance has already been reduced by amending the design. Various design related measures suggested for: uninterrupted power supply provision; standard operating procedures for operation and maintenance; extended operation by turnkey contractor and imparting necessary training for ULB staff; providing necessary safety and personal protection equipment for workers engaged in sewer cleaning (protection against oxygen deficiency, harmful gaseous emissions) and sludge handling, and development of green buffer zone around the sewage treatment plant.

157. The site selected for the WWTP was earmarked for the sewage treatment facility in Davangere Master Plan. This site is located in the south-eastern outskirts of the city, and surrounded by agricultural fields and upcoming residential areas. Considering the future development various measures are included in the subproject design, including: design of a compact, superior process with few odours; sensitive layout design and green buffer zone around the facility, and regulation of surrounding land use in strict compliance with Davangere Master Plan.

158. The proposed WWTP will be constructed on a private land. The land will be acquired from the private owner. Necessary Resettlement Planning study has been conducted, and appropriate mitigation/compensatory measures suggested. All the other subproject sites are either situated on government owned vacant land parcels or along the public roads (for pipelines and sewers).

159. During the construction phase, impacts mainly arise from the need to dispose waste soil; and from the disturbance of residents, businesses, traffic and important buildings by the construction work. These are common impacts of construction in urban areas, and there are well developed methods for their mitigation. Since the water pipeline and sewer work are conducted along the roads, there is potential to create disturbance. To minimize this, the contractor should develop a Method Statement, which should be approved by the PIU prior to start of work, and should conduct the work strictly in line with the Method Statement.

160. There were limited opportunities to provide environmental enhancements, but certain measures were included. For example it is proposed that the project will employ in the workforce people who live in the vicinity of construction sites to provide them with a short-term economic gain; and ensure that people employed in the longer term to maintain and operate the new facilities are residents of nearby communities.

161. Once the system is operating, the facilities will operate with routine maintenance, which should not affect the environment. Necessary safety precautions are suggested for proper functioning and operation of sewer network. The operation and maintenance will comply with the standard operating procedures. SOPs / O&M Manual will be developed during the detailed design stage, and the staff will be provided with necessary training.

162. The citizens of the Davangere City will be the major beneficiaries of this subproject. With the improved water supply, they will be provided with a constant supply of better quality water, piped into their homes. The sewerage system will remove the human waste from those areas served by the network rapidly and treated to an acceptable standard. With the construction of toilets and targeted awareness program on sanitation proposed, in addition to improved environmental conditions, the subproject will improve the over-all health condition of the town. Diseases of poor sanitation, such as diarrhoea and dysentery, should be reduced, so people should spend less on healthcare and lose fewer working days due to illness, so their economic status should also improve, as well as their overall health. The sewerage system proposed in this subproject, combined with the system under implementation in NKUSIP, will collect wastewater including sewage from entire town and treat Indian standards. Adequate capacity of WWTP is already included in the NKUSIP and other projects under implementation.

163. Mitigation will be assured by a program of environmental monitoring conducted during construction and operation to ensure that all measures are implemented, and to determine whether the environment is protected as intended. This will include observations on- and off-site, document checks, and interviews with workers and beneficiaries, and any requirements for

remedial action will be reported to the PIU/PMU. There will also be longer-term surveys to monitor the expected improvements in the quality of domestic water and the health of the population. There will also be regular and periodic monitoring surveys for quality of water (at intake, reservoirs and at consumer end).

164. Finally, stakeholders were involved in developing the IEE through face-to-face discussions and on site meetings, after which views expressed were incorporated into the IEE and the planning and development of the project. A city level consultation workshop was conducted for larger public participation in the project. The IEE will be made available at public locations in the city and will be disclosed to a wider audience via the ADB website. The consultation process will be continued and expanded during project implementation to ensure that stakeholders are fully engaged in the project and have the opportunity to participate in its development and implementation.

B. Conclusion

165. The subproject is unlikely to cause significant adverse impacts. The potential impacts that are 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.

166. 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) or GoI EIA Notification (2006). If necessary, tree cutting permission should be obtained from the designated Tree Officer of Davangere.

167. This IEE needs to be updated as the subproject preparation progresses to detailed design to reflect the latest subproject design.

Site Photographs

Photo 1: Proposed OHSR site1

Photo 2: Proposed OHSR site1

Photo 3: Proposed OHSR Site 3

Photo 4: Proposed OHSR Site 4

Photo 5: Chlorination facility at Doddebhati WTP

Photo 6: Poor quality of Roads in Davangere

Photo 7: Bethur Halla at WWT site carrying sewage

Photo 10: Proposed WWTP Site

Photo 8: Basapura Halla carrying sewage

Photo 11: Upcoming development near WWTP site

Photo 9: Irrigation canals in souther part of the city

Photo 12: Consultation with local people

Appendix 1: REA Checklist

RAPID ENVIRONMENTAL ASSESSMENT (REA) CHECKLIST
Davangere Water Supply & Sewerage Subproject

Screening Questions	Yes	No	Remarks
A. Project Siting Is the project area…			
▪ Densely populated?	**x**		Subproject activities extend to the entire city including the densely populated areas. There are no major negative impacts envisaged, because water supply/ sewer network will be located in unused government lands alongside the existing roads and can be constructed without causing disturbance to, houses, and commercial establishments. In narrow streets, disruption to road users is likely, and measure like best activity scheduling/ traffic management, alternative routes, prior information to road users, houses and shops will minimize the impact to acceptable levels.
▪ Heavy with development activities?	**x**		Davangere is a developing town; urban expansion is considerable.
▪ 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**	
▪ Water Supply			

Screening Questions	Yes	No	Remarks
B. Potential Environmental Impacts Will the Project cause…			
▪ pollution of raw water supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion runoff?		x	Subproject will utilize the existing surface sources; no source improvement / augmentation proposed in the subproject
▪ impairment of historical/cultural monuments/areas and loss/damage to these sites?		x	There is no historical / cultural monument in the project location.
▪ hazard of land subsidence caused by excessive ground water pumping?		x	No ground water source will be used for this project.
▪ social conflicts arising from displacement of communities ?		x	The subproject does not involve land acquisition or displacement.
▪ conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?		x	No source improvement/ augmentation proposed in the subproject
▪ unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents)?		x	Raw water quality is satisfactory. Water will be treated to drinking water standards before delivery.
▪ delivery of unsafe water to distribution system?		x	Subproject involves distribution of treated water supplies
▪ inadequate protection of intake works or wells, leading to pollution of water supply?		x	Subproject will utilize the existing surface sources; no source improvement/ augmentation proposed in the subproject
▪ over pumping of ground water, leading to salinization and ground subsidence?		x	No ground water is proposed to be abstracted.
▪ excessive algal growth in storage reservoir?		x	Regular cleaning of storage reservoir shall be ensured to avoid algal growth in the reservoir.
▪ increase in production of sewage beyond capabilities of community facilities?		x	Sewerage system is currently being constructed under ADB assisted NKUSIP. The capacity of this system has been designed to accommodate proposed expansion under this subproject.
▪ inadequate disposal of sludge from water treatment plants?		x	No new treatment plants are proposed under this subproject.
▪ inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities?		x	Subproject does not include pumping equipment/stations

Screening Questions	Yes	No	Remarks
▪ impairments associated with transmission lines and access roads?	x		Anticipated during construction activities. However impacts are temporary and short in duration. The EMP includes measure to mitigate impacts.
▪ health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals.		x	Necessary safety measures have been taken into consideration in the design and included in the EMP.
▪ health and safety hazards to workers from handling and management of chlorine used for disinfection, other contaminants, and biological and physical hazards during project construction and operation?		x	Necessary safety measures have been taken into consideration during O&M and included in the EMP.
▪ dislocation or involuntary resettlement of people?	x		There may be temporary disturbance to business and squatters/vendors during construction. A resettlement plan has prepared to mitigate/compensate these impacts.
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		x	Not applicable.
▪ noise and dust from construction activities?	x		Short term impact on air quality due to dust generation during construction activities is anticipated. Appropriate dust suppression measures will be taken to minimize dust generation due to construction activities at site. No significant increase in noise level is anticipated due to construction. All equipment and machineries will conform to the Statutory norms.
▪ increased road traffic due to interference of construction activities?	x		Proper traffic management and planning will be ensured during construction.
▪ continuing soil erosion/silt runoff from construction operations?	x		Construction activities (pipe laying, etc.) on hill slopes may increase the chance of land slide and soil erosion. Careful stacking of excavated materials will be ensured to avoid slippage and erosion especially on hill slopes. Construction work during monsoon shall be carried out with due care so that silt run off due to construction operation is prevented. No construction will be allowed during rains.

Screening Questions	Yes	No	Remarks
▪ delivery of unsafe water due to poor O&M treatment processes (especially mud accumulations in filters) and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in distribution systems?		x	Trained and skilled staff will be deployed for O&M. Also, quality of treated water will be regularly monitored through water sample testing to ensure delivery of safe water to consumers.
▪ delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?		x	uPVC pipes will be used for distribution system and are non corrosive in nature.
▪ accidental leakage of chlorine gas?		x	Necessary safety measures have been taken into consideration during design and O&M and included in the EMP.
▪ excessive abstraction of water affecting downstream water users?		x	Subproject will utilize the existing surface sources; no source improvement/augmentation proposed in the subproject
▪ competing uses of water?		x	Not applicable.
▪ increased sewage flow due to increased water supply	x		Sewerage system of adequate capacity including treatment is currently being implemented under ADB assisted NKIUSP.
▪ increased volume of sullage (wastewater from cooking and washing) and sludge from wastewater treatment plant	x		Sewerage system of adequate capacity including treatment is currently being implemented under ADB assisted NKIUSP.
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		x	No such impact anticipated as the import of workforce will be limited to skilled workers; local communities in the vicinity of the project would be employed as much as possible.
▪ social conflicts if workers from other regions or countries are hired?		x	Not anticipated as local communities within the project vicinity will be employed as much as possible.
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during operation and construction?		x	Not applicable. Construction will not involve use of explosives and chemicals.
▪ 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	Operational area will be clearly demarcated and access will be controlled. Only workers and project concerned members will be allowed to visit the operational sites.

Screening Questions	Yes	No	Remarks
Sewerage			
C. Potential Environmental Impacts Will the Project cause…			
▪ impairment of historical/cultural monuments/areas and loss/damage to these sites?		**x**	There are no such areas near the subproject sites
▪ interference with other utilities and blocking of access to buildings; nuisance to neighboring areas due to noise, smell, and influx of insects, rodents, etc.?		**x**	No blocking/interference with other utilities expected.
▪ dislocation or involuntary resettlement of people?	**x**		Subproject involves acquisition of land for WWTP construction. There may also be temporary disturbance to business and vendors during construction. A Resettlement Plan has been prepared and will be implemented.
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		**x**	Not applicable. Sewerage system will cover entire population (both poor and non-poor) and will have positive health impacts due to improved sanitation conditions.
▪ impairment of downstream water quality due to inadequate sewage treatment or release of untreated sewage?		**x**	Treatment process will be designed to meet the inland water disposal standards set by the Central Pollution Control Board (CPCB). Periodic water quality monitoring will be conducted to ensure treated wastewater complies with the standards.
▪ overflows and flooding of neighboring properties with raw sewage?		**x**	Sewerage system has been designed considering the population growth. It has been designed to accommodate sewage until year 2028. Design considers standard peak factors and therefore no such impact envisaged.
▪ environmental pollution due to inadequate sludge disposal or industrial waste discharges illegally disposed in sewers?		**x**	Proper sludge collection, treatment and disposal systems are part of the WWTP. This sewerage system will cater only to domestic wastewater. Moreover there are no industries in the town that will discharge into sewers

Screening Questions	Yes	No	Remarks
▪ noise and vibration due to blasting and other civil works?		x	No blasting activities envisaged. Temporary nuisance/disturbance due to construction activities will be minimized with appropriate mitigation measures.
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical,and biological hazards during project construction and operation?		x	Not anticipated. The EMP ensures occupational health and safety measures are implemented.
▪ discharge of hazardous materials into sewers, resulting in damage to sewer system and danger to workers?		x	There are no sources of hazardous material that will find its way into the sewers. Wastewater other than municipal, i.e. industrial, entering the sewerage system must meet the stipulated standards, and therefore it is unlikely that problematic waste will be discharged into the sewers.
▪ inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances, and protect facilities?		x	WWTP will be located in the outskirts of the town. The site is approx. 200 m away from the nearest dwelling. Land nearby is agricultural. A Greenbelt composed of plants and trees is included to minimize all nuisances.
▪ road blocking and temporary flooding due to land excavation during the rainy season?		x	Flooding is unlikely as work will be mostly conducted during dry season.
▪ noise and dust from construction activities?	x		No major noise generating activities like rock blasting is envisaged. Dust will be temporary and will be controlled with proper dust suppression measures.
▪ traffic disturbances due to construction material transport and wastes?	x		Proper traffic management and planning will be ensured during construction.
▪ temporary silt runoff due to construction?	x		Construction activities (pipe laying, etc.) on hill slopes may increase the chance of land slide and soil erosion. Careful stacking of excavated materials will be ensured to avoid slippage and erosion especially on hill slopes. Construction work during monsoon shall be carried out with due care so that silt run off due to construction operation is prevented. No construction will be allowed during rains.

Screening Questions	Yes	No	Remarks
▪ hazards to public health due to overflow flooding, and groundwater pollution due to failure of sewerage system?		x	Not anticipated. The system is designed to accommodate adequate capacity. Staff and workers will be trained in O&M.
▪ deterioration of water quality due to inadequate sludge disposal or direct discharge of untreated sewage water?		x	Not anticipated. Treated wastewater will meet the disposal standards and the design includes adequate sludge treatment.
▪ contamination of surface and ground waters due to sludge disposal on land?		x	Sludge will be treated/dried and ensured that it is harmless before its disposal on land.
▪ 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	All necessary health and safety training and necessary personal protection equipment will be given to workers and staff during operation of sewerage system
▪ large population increase during project construction and operation that causes increased burden on social infrastructure (such as sanitation system)?		x	No such impact anticipated as the import of workforce will be limited to skilled workers; local communities in the vicinity of the project would be employed as much as possible.
▪ social conflicts between construction workers from other areas and community workers?		x	Not anticipated as local communities within the project vicinity will be employed as much as possible.
▪ 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 applicable. Construction/ operation will not involve use of explosives and chemicals.
▪ 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	Operational area will be clearly demarcated and access will be controlled. Only worker and project concerned members will be allowed to visit the construction sites. During operation, entry into WWTP will be restricted.

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 1)?		**x**	There is a low risk of natural hazards in the project areas. All towns are land locked and expansively cultivated. The general topography of the towns are plains with isolated hills fringing some of the towns. The towns are located in an area of low seismological intensity. The towns are generally dry throughout the year except during the monsoon from June to September. Davanegere and Rannebenur receive the lowest rainfall (annual average rainfall between 300 – 600mm). Whereas Byadgi and Harihar receive higher rainfall (annual average rainfall between 700 – 1000 mm).
▪ Could changes in temperature, precipitation, or extreme events patterns over the Project lifespan affect technical or financial sustainability (e.g., changes in rainfall patterns disrupt reliability of water supply; sea level rise creates salinity intrusion into proposed water supply source)?	**x**		Low precipitation and increased temperatures could result in disruption to water supply and security. The project proposes improved water security through the rehabilitation and restoration of river bank reservoirs in selected vulnerable towns.
▪ 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 socio-economic conditions of both the poor and non-poor populations of the towns.
▪ Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., by using water from a vulnerable source that is relied upon by many user groups, or encouraging settlement in earthquake zones)?		**x**	Not applicable.

* Hazards are potentially damaging physical events.

Appendix 2: Environmental Related Legislations in India

i. The Water (Prevention and Control of Pollution) Act, 1974, amended 1988
   - The Water (Prevention and Control of Pollution) Rules, 1975
   - The Water (Prevention and Control of Pollution) Cess Rules, 1971

ii. The Air (Prevention and Control of Pollution) Act 1981, amended 1987
   - The Air (Prevention and Control of Pollution) Rules, 1982

iii. The Environment (Protection) Act, 1986, amended in 1991 and including the following Rules/Notification issued under this Act
   - The Environment (Protection) Rules, 1986, including amendments
   - The Municipal Solid Wastes (Management and Handling) Rules, 2000
   - The Hazardous Wastes (Management and Handling) Rules, 1989
   - The Bio-Medical Waste (Management and Handling) Rules, 1998
   - Noise Pollution (Regulation and Control) Rules, 2000,
   - Wild Life (Protection) Amendment Act, 2002
   - Environmental Impact Assessment Notification, 2006
   - Environmental Standards of Central Pollution Control Board (CPCB)

iv. The Indian Wildlife (Protection) Act, 1972, amended 1993
   - The Wildlife (Protection) Rules, 1995

v. The Indian Forest Act, 1927

vi. Forest (Conservation) Act, 1980, amended 1988
   - Forest (Conservation) Rules, 1981 amended 1992 and 2003
   - Guidelines for Diversion of Forest Lands for Non-Forest Purpose under the Forest (Conservation) Act, 1980

vii. Ancient Monuments and Archaeological Sites and Remains Act 1958
   - Ancient Monuments and Archaeological Sites and Remains Rules 1959
   - Government of India Notification of 1992 under the above-stated Rules

Appendix 3: Environmental Disposal Standards

1. General Standards for Discharge of Environmental Pollutants Part - A: Effluents

Parameter	Inland surface water	Public sewers	Land for irrigation	Marine/coastal areas
Suspended solids mg/l, max.	100	600	200	(a) For process waste water (b) For cooling water effluent 10 per cent above total suspended matter of influent.
Particle size of suspended solids	shall pass 850 micron IS Sieve	-	-	(a) Floatable solids, solidsmax. 3 mm (b) Settleable solids, max 856 microns
pH value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
Temperature	shall not exceed 5oC above the receiving water temperature			shall not exceed 5oCabove the receiving water temperature
Oil and grease, mg/l max,	10	20	10	20
Total residual chlorine, mg/l max	1.0	-	-	1.0
Ammonical nitrogen (as N),mg/l, max.	50	50	-	50
Total kjeldahl nitrogen (as N);mg/l, max. mg/l, max.	100	-	-	100
Free ammonia (as NH3), mg/l,max.	5.0	-	-	5.0
Biochemical oxygen demand (3 days at 27oC), mg/l, max.	30	350	100	100
Chemical oxygen demand, mg/l, max.	250	-	-	250
Arsenic(as As).	0.2	0.2	0.2	0.2
Mercury (As Hg), mg/l, max.	0.01	0.01	-	0.01
Lead (as Pb) mg/l, max	0.1	1.0	-	2.0
Cadmium (as Cd) mg/l, max	2.0	1.0	-	2.0
Hexavalent chro-mium (as Cr + 6),mg/l, max.	0.1	2.0	-	1.0
Total chromium (as Cr) mg/l, max.	2.0	2.0	-	2.0
Copper (as Cu)mg/l, max.	3.0	3.0	-	3.0
Zinc (as Zn) mg/l, max.	5.0	15	-	15
Selenium (as Se)	0.05	0.05	-	0.05
Nickel (as Ni) mg/l, max.	3.0	3.0	-	5.0
Cyanide (as CN) mg/l, max.	0.2	2.0	0.2	0.2
Fluoride (as F) mg/l,	2.0	15	-	15

Parameter	Inland surface water	Public sewers	Land for irrigation	Marine/coastal areas
max.				
Dissolved phosphates (as P),mg/l, max.	5.0	-	-	-
Sulphide (as S) mg/l, max.	2.0	-	-	5.0
Phenolic compounds (as C6H50H)mg/l, max.	1.0	5.0	-	5.0
Radioactive materials: (a) Alpha emitters micro curie mg/l, max. (b)Beta emittersmicro curie mg/l	10^{-7} 10^{-6}	10^{-7} 10^{-6}	10^{-8} 10^{-7}	10^{-7} 10^{-6}
Bio-assay test	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent
Manganese	2 mg/l	2 mg/l	-	2 mg/l
Iron (as Fe)	3mg/l	3mg/l	-	3mg/l
Vanadium (as V)	0.2mg/l	0.2mg/l	-	0.2mg/l
Nitrate Nitrogen	10 mg/l	-	-	20 mg/l

These standards shall be applicable for industries, operations or processes other than those industries, operations or process for which standards have been specified in Schedule of the Environment Protection Rules, 1989.

Standards for Diesel Generator Sets: Stack Height

The minimum height of stack to be provided with each generator set can be worked out using the following formula:

H = h+0.2x ÔKVA

H = Total height of stack in metre

h = Height of the building in metres where the generator set is installed

KVA = Total generator capacity of the set in KVA

Based on the above formula the minimum stack height to be provided with different range of generator sets may be categorised as follows:

For Generator Sets	Total Height of stack in metre
50 KVA	Ht. of the building + 1.5 metre
50-100 KVA	Ht. of the building + 2.0 metre
100-150 KVA	Ht. of the building + 2.5 metre
150-200 KVA	Ht. of the building + 3.0 metre
200-250 KVA	Ht. of the building + 3.5 metre
250-300 KVA	Ht. of the building + 3.5 metre

Similarly for higher KVA ratings a stack height can be worked out using the above formula.

PART-E Noise Standards

Noise limits for domestic appliances and construction equipments at the manufacturing stage in dB(A).

Window air conditioners of 1 -1.5 tonne	68
Air coolers	60
Refrigerators	46
Diesel generator for domestic purposes	85
Compactors (rollers), front loaders, concentrate mixers, cranes (movable), vibrators and saws	75

Appendix 4: Traffic Management Planning (TMP)

A. Principles for TMP around the Water Pipes 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. The following principles will help promote safe and efficient movement for all road users (motorists, bicyclists, and pedestrians, including persons with disabilities) through and around work zones while reasonably protecting workers and equipment.

(i) Make traffic safety and temporary traffic control an integral and high-priority element of every project from planning through design, construction, and maintenance.
(ii) Inhibit traffic movement as little as possible.
(iii) Provide clear and positive guidance to drivers, bicyclists, and pedestrians as they approach and travel through the temporary traffic control zone.
(iv) Inspect traffic control elements routinely, both day and night, and make modifications when necessary.
(v) Pay increased attention to roadside safety in the vicinity of temporary traffic control zones.
(vi) Train all persons that select, place, and maintain temporary traffic control devices.
(vii) Keep the public well informed.
(viii) Make appropriate accommodation for abutting property owners, residents, businesses, emergency services, railroads, commercial vehicles, and transit operations.

3. **Figure A2 to Figure A12** illustrates the operating policy for TMP for the construction of water pipes and the sewers along various types of roads.

C. Analyze the impact due to street closure

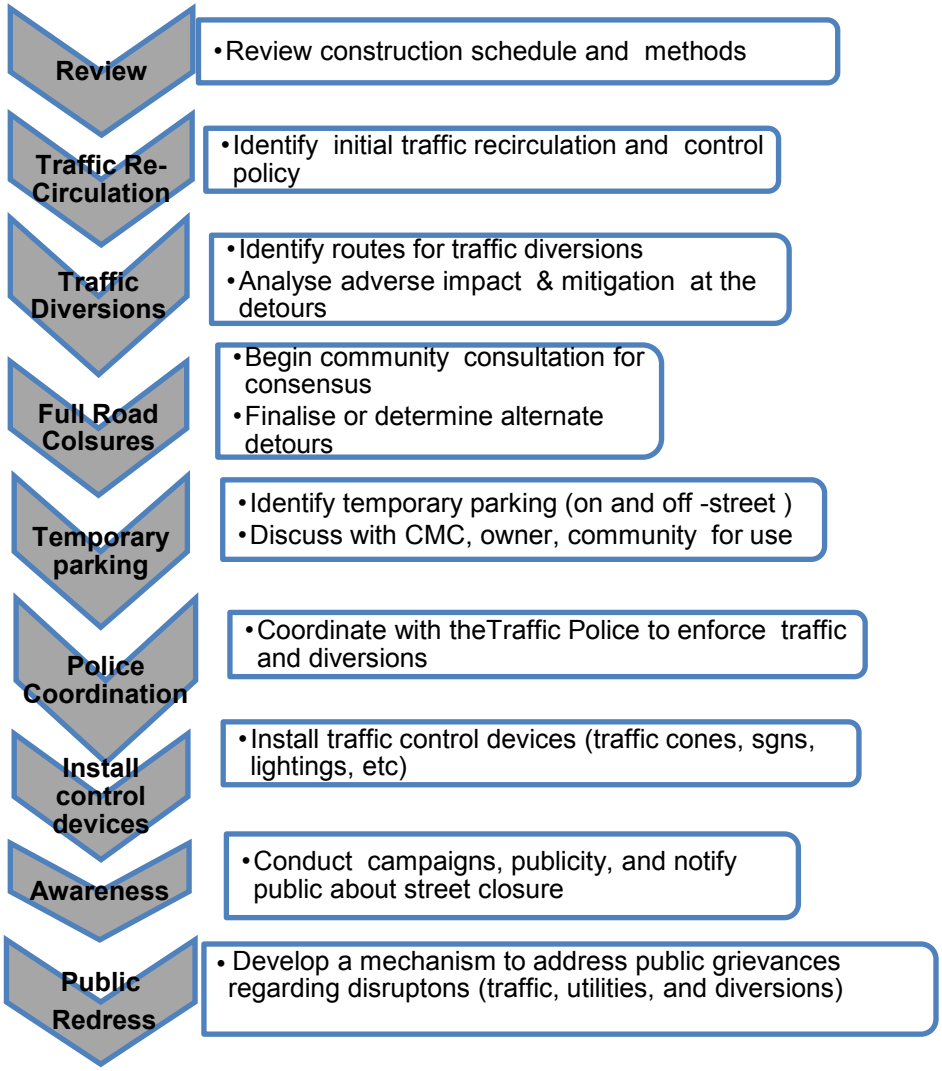
4. Apart from the capacity analysis, a final decision to close a particular street and divert the traffic should involve the following steps:

(i) approval from the Davangere City Corporation / Public Works Department (PWD) to use the local streets as detours;

(ii) consultation with businesses, community members, traffic police, PWD, 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.

5. 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 Saturday night and ending on Monday morning prior to the morning peak period.

Figure A1: Policy Steps for the TMP



D. Public awareness and notifications

6. 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.

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 public notices, ward level meetings and city level meeting with the elected representatives.

8. The PIU 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 conduct the awareness programs/campaigns on road safety during construction.

10. The campaign will cater to all types of target groups i.e. children, adults, and drivers. Therefore, these campaigns will be conducted in schools 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 PIU, 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 (name, telephone, mobile number of the contact person; and
(vi) indicate the office hours of relevant offices.

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

11. 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. The following traffic control devices are used in work zones:

- Signs
- Pavement Markings
- Channelizing Devices
- Arrow Panels
- Warning Lights

12. 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 along major roads, and the minor internal roads. As such, the traffic volume and road geometry vary. The main roads carry considerable traffic; internal roads in the new city areas are wide but in old city roads very narrow and carry considerable traffic. 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”).

13. **Figure A2 to Figure A12** illustrates a typical set-up for installing traffic control devices at the work zone of the area, depending on the location of work on the road way, and road geometrics:

- Work on shoulder or parking lane
- Shoulder or parking lane closed on divided road
- Work in Travel lane
- Lane closure on road with low volume
- Lane closure on a two-line road with low volume (with yield sign)
- Lane closure on a two-line road with low volume (one flagger operation)
- Lane closure on a two lane road (two flagger operation)
- Lane closure on a four lane undivided Road
- Lane closure on divided roadway
- Half road closure on multi-lane roadway
- Street closure with detour

14. 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.

15. Traffic police should regulate traffic away from the work zone and enforce the traffic diversion result from full street closure in certain areas during construction. Flagggers/ personnel should be equipped with reflective jackets at all times and have traffic control batons (preferably the LED type) for regulating the traffic during night time.

16. In addition to the delineation devices, all the construction workers should wear fluorescent safety vests and helmets in order to be visible to the motorists at all times. There should be provision for lighting beacons and illumination for night constructions.

Figure A2 & A3: Work on shoulder or parking lane & Shoulder or parking lane closed on divided road)

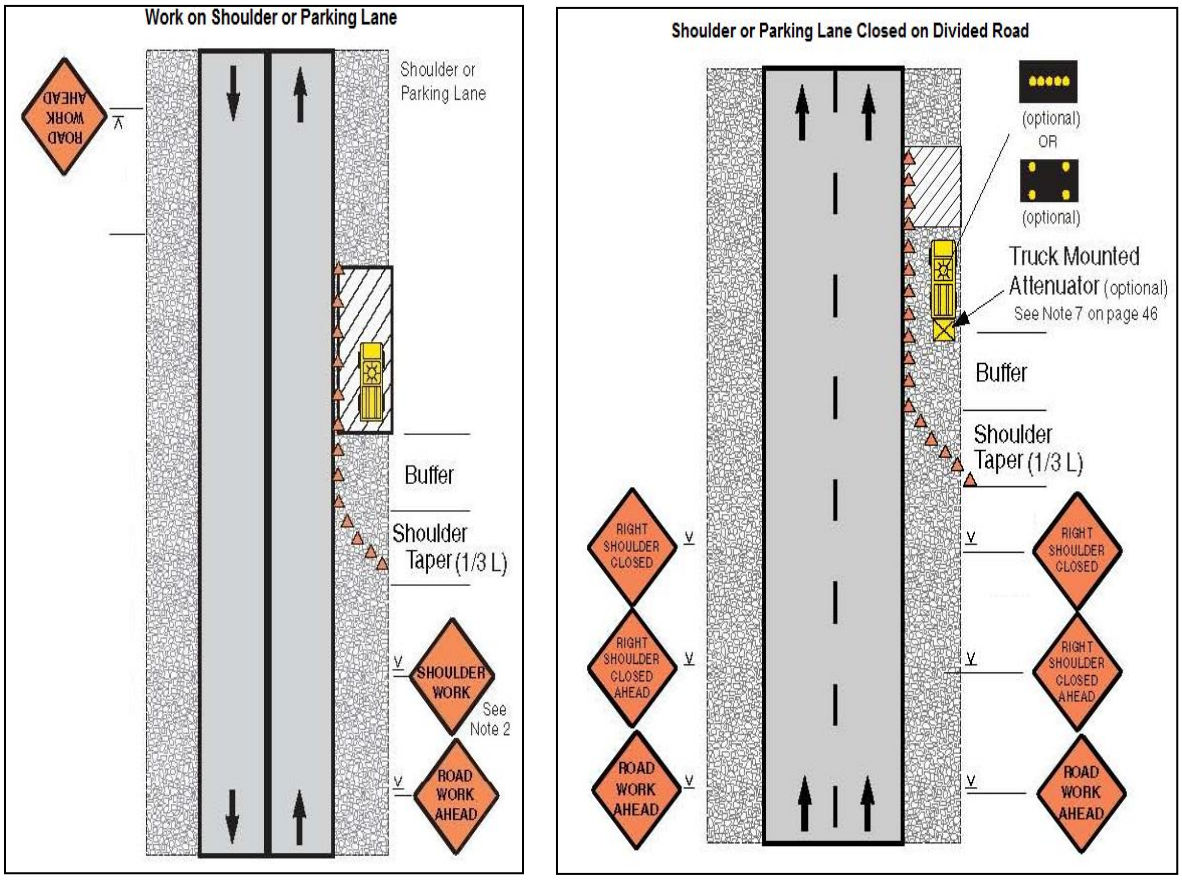
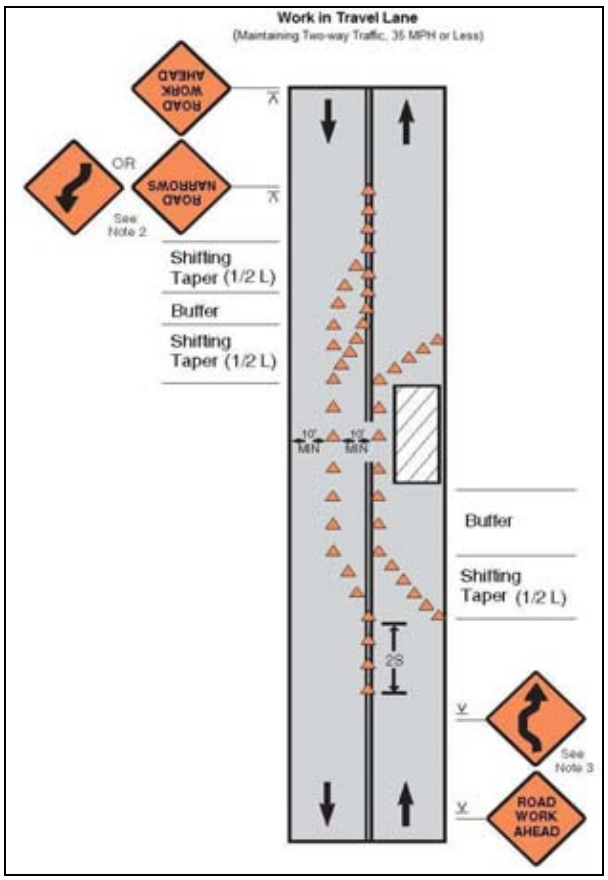


Figure A4 & A5: Work in Travel lane & Lane closure on road with low volume



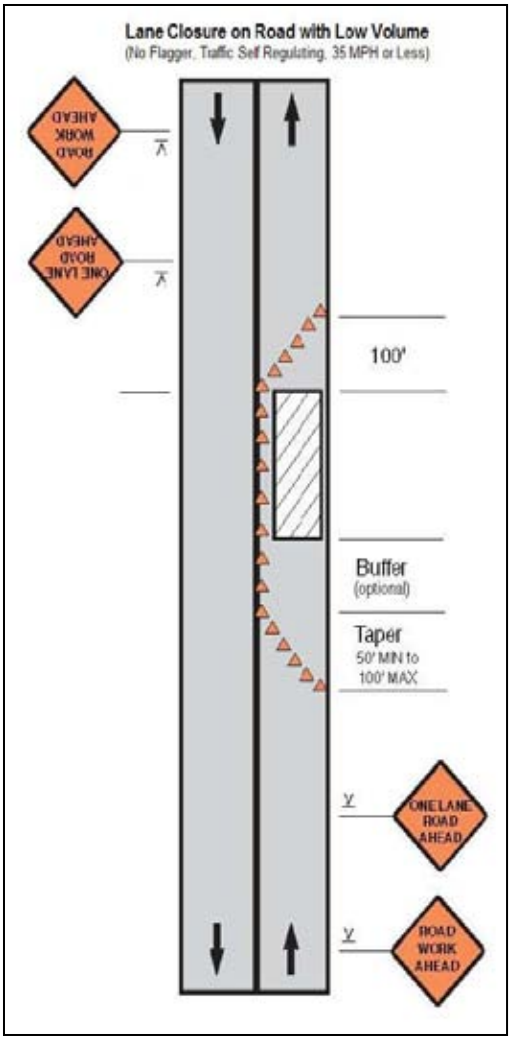
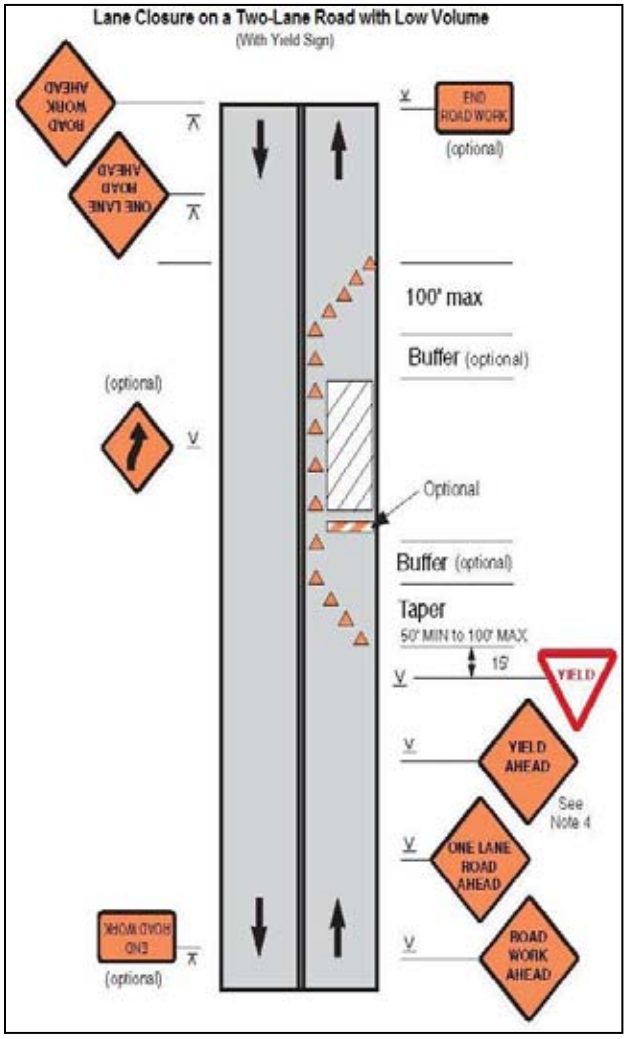


Figure A6 & A7: Lane closure on a two-line road with low volume (with yield sign) & Lane closure on a two-line road with low volume (one flagger operation)



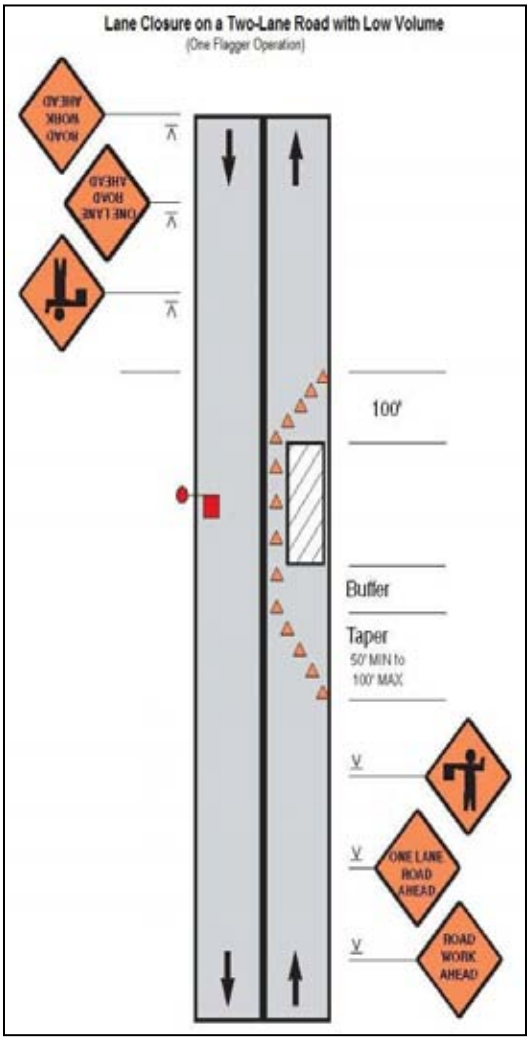
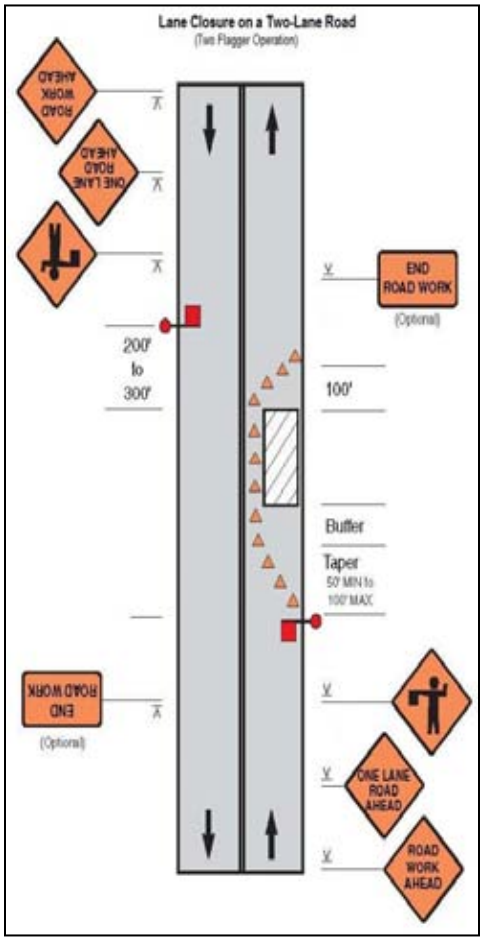


Figure A8 & A9: Lane closure on a two lane road (two flagger operation) & Lane closure on a four lane undivided Road



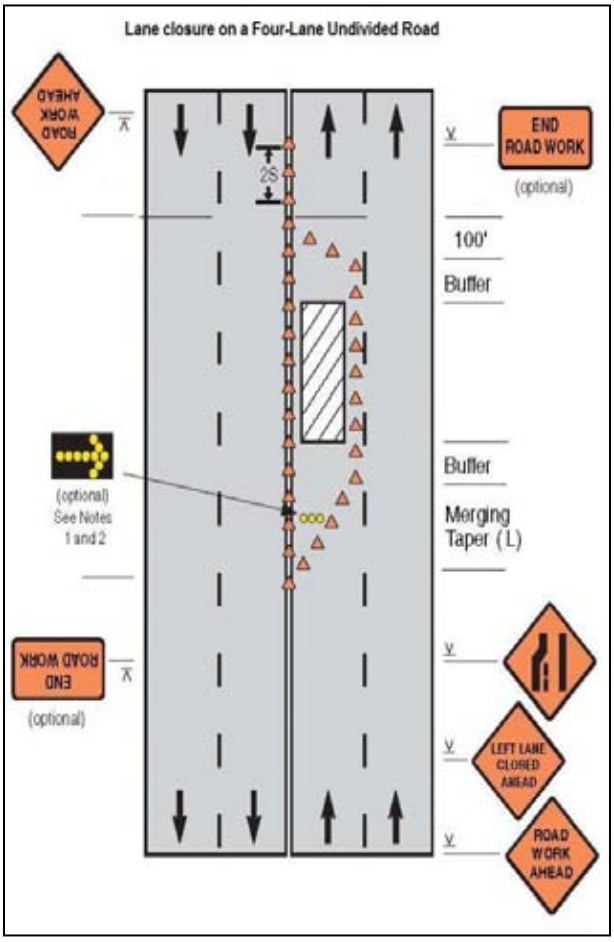
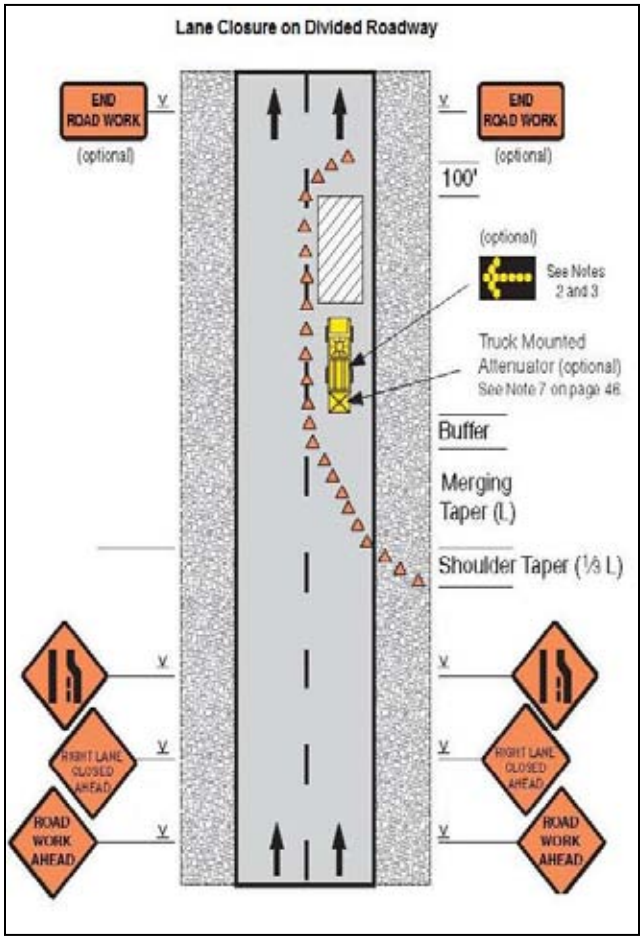


Figure A10 & A11: Lane closure on divided roadway & Half road closure on multi-lane roadway



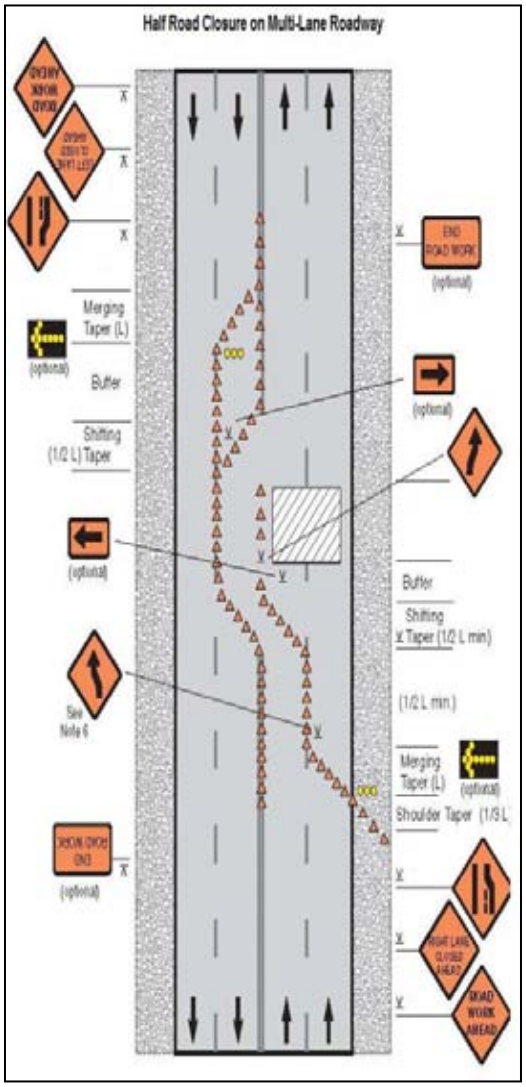
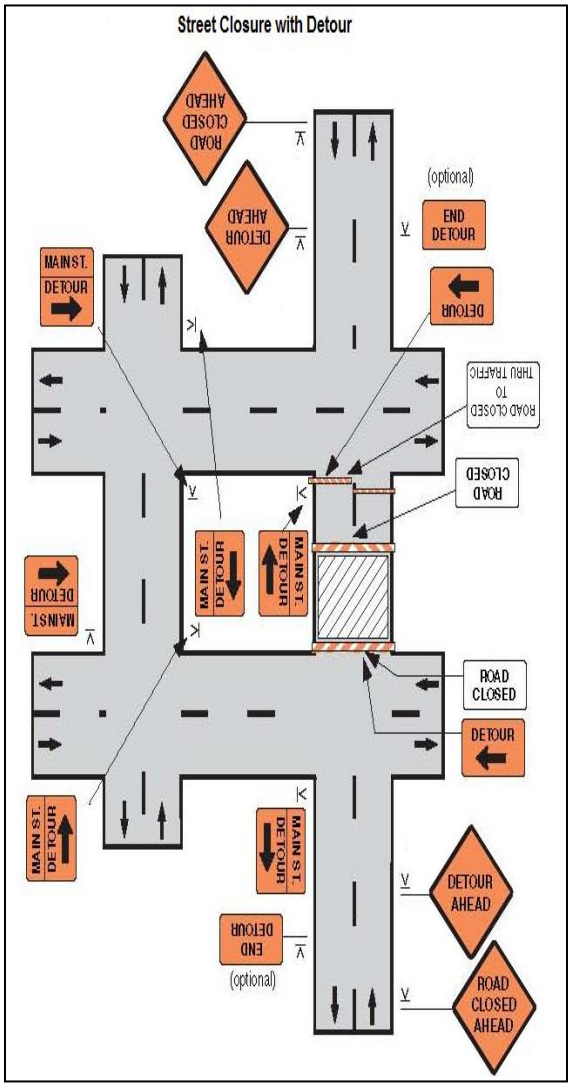


Figure A12: Street closure with detour



Appendix 5: Emergency Response Plan Template – (Chlorine leakage, Sewer Network Operation, power outage at WWTP etc)

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……. Water & Wastewater System Manager(s)	Responsible for overall management and decision making for the water & 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 manager.	Phone: Mobile:
Mr/Ms …….. Water &	In charge of operating the water supply & wastewater systems, performing inspections,	Phone:

Name and Title (as required)	Examples of Responsibilities During an Emergency	Contact Numbers
Wastewater System Operator(s)	maintenance and sampling and relaying critical information, assessing facilities, and providing recommendations to the system manager	Mobile:
Mr/Ms Water & Wastewater Treatment Plant Operator(s)	In charge of running treatment plants and chlorine handling system, performing inspections, maintenance and sampling and relaying critical information, assessing facilities, 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 carefully 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
Chlorine leakage at WTP		
Burst of sewer line		
Leak of sewer line		
Overflow of sewer line		
Power outage at SPS		

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**
Urban Local Body				
Wastewater Operator (if contractor)				
Primacy Agency Contact				
Wastewater Systems Manager 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**
Bangalore Electricity Supply Company				
Electrician				
Water Testing Lab.				
Wastewater systems operator/manager				
Plumber				
Pump Supplier				
“Call Before You Dig”				

Service / Repair Notifications				
Organization or Department	**Name & Position**	**Telephone**	**Night or Mobile Phone**	**Email**
Rental Equipment Supplier				
Pipe Supplier				

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:	

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.

Designate a spokesperson and alternates

Spokesperson	Alternate

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				
Other Considerations				

Section 7.
Response Actions for Specific Events

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

1. Analyze 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. Vandalism or terrorist attack

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

E. Flood

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

F. Earthquake

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

G. Hazardous materials spill into collection system

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

H. Electronic equipment failure

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

I. Other

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

Section 8.
Returning to Normal Operation

Returning to normal operations

Action	Description and Actions

Section 9.
Plan Approval

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 6: Minutes of the Stakeholder Consultation Meeting (October 3, 2012, Davangere)

The meeting was attended by key stakeholders from four project towns of Byadgi, Ranebennur, Harihar and Davangere including public/elected representatives from each town, ULB officials, officials from other line departments and executing agency KUIDFC, and NGOs/CBOs. The meeting was chaired by Davangere District Deputy Commissioner,

The PPTA consultants made detailed presentations – in Kannada and English on overall program, pilot towns, technical studies, poverty social development aspects, and environmental and social safeguard issues related to proposed subprojects in respective towns.

DavangereTown Meeting Session

- Davanagere ULB commissioner Mr.Bhemappa offered help to resolve issues and to finalise the proposals to improve water and wastewater systems. He made following comments.
- O&M of the water supply and wastewater system is a major problem in the ULB without adequate staff.
- Expressed concern about WWTP not being used properly because of the shortage of staff in the ULB.
- Promised support and coordination during project implementation.
- Deputy Mayor of Davanagere, Mr.Mahesh Raichur expressed concern about quality of work.

KUIDFC

- Mr.Arifullah Sharief stated that, the Draft Feasibility Studies (DFSs) are subject to change to address stakeholder comments and concerns.
- Mr.Arifullah Sharief suggested to use Ashraya Scheme Government Order(GO) for land acquisition in Byadgi and other ULB, if required. (GO states that, compensation for land acquisition can be paid at 3 times to the guidance value of the land)

Other discussions

- Provision for Sewer Connections – include connection cost as a separate item. Check with project staff of KMRP/NKUSIP.
- Surrounding areas of ULBs and gaps in the existing sewerage system of the town – Check whether the villages and settlements are within the ULB's jurisdiction/ boundary and also population densities.
- Demarcate the roads where larger diameter sewers and WS mains are proposed in all ULBs, to carryout sample surveys and to check impacts during construction. Identify streets where complete road closure is required?
- Wastewater treatment scenario in Davanagere without considering 19.45 MLD existing Waste Stabilisation Ponds – Review and check whether an additional treatment plant is required?

- Maps or drawings to be prepared to show proposals/ options for both water supply and wastewater system.
- Refine the cost estimates to show following items separately: Laying of sewer network: Road restoration cost; Construction of collection chambers and connections from individual properties to collection chambers; Land cost for WWTPs and Pumping Stations; Construction cost of WWTP
- Identify industrial demand and location for recycling treated wastewater
- Preparation of comparison table for the selection of pipe material for sewerage and water supply system
- Plan awareness program for the sanitation in each ULB

Appendix 7: Environmental Audit of the Existing Water Treatment Plants in Davangere

I. Introduction

1. The objectives of this environmental audit are to (i) assess the compliance of the existing water treatment plants (WTPs) to be rehabilitated under KIUWRMIP with environmental legislation; (ii) improve environmental performance through monitoring the effectiveness of the management system; and (iii) increase the Davangere CMC's knowledge of itself and its activities, thus increasing its ability to continually improve and minimize future potential liabilities.

2. The environmental audit was carried out by the PPTA consultants during IEE report preparation from May 2012 to December 2012. The methodology adopted for this audit was to initially review existing plans and technical information and list various activities being carried out in the WTP. Due diligence was carried out to physically check whether environmental performance, health and safety, etc. were in compliance with national and state prescribed standards and guidelines. Team visited the WTP was and observed operations. Meetings and discussions with key personnel were held in the various stages of the audit.

3. A more detailed environmental audit and risk assessment shall be carried out by competent and independent third party auditors during detailed design stage.

II. Description of Existing Water Treatment Plants at Davangere

	Bathi WTP	Kundwada WTP	TV Station WTP
Location	Northwestern side of the Davangere city, beyond city limits Latitude: 14° 28' N Longitude: 75°59' E	Northwestern side of the Davangere city, within city limits Latitude: 14° 28' N Longitude: 75°59' E	Southern side of the Davangere city, within city limits Latitude: 14° 28' N Longitude: 75°59' E
Start of operation (year)	2004	2004	1972
Owned by	CMC, Davangere		
Contact person and designation	Mr Gururajachar B Assistant Engineer (water supply) +91 9449747436		
Capacity	40 million liters per day (MLD)	20 MLD	19 MLD
Water supply source	Rajanahalli headworks, Tungabhadra River	Bhadra Canal and Kundwada lake	Bhadra-Harihar Branch Canal
Water treatment process	Technology: The treatment process is conventional, and has following units: Cascade Aerator, Raw Water Channel with Parshall Flume for continuous flow measurement, Coagulant & Flocculent chemical makeup tanks, Flash Mixing tank, Clarifier including a flocculation zone in the centre, eight sand filters, Chlorine gas storage cylinders and dosing unit, back wash water	Technology: The treatment process is conventional, and has following units: Cascade Aerator, Raw Water Channel with Parshall Flume for continuous flow measurement, Coagulant & Flocculent chemical makeup tanks, Flash Mixing tank, Clarifier including a flocculation zone in the centre, eight sand filters, disinfection tanks (bleaching powder), back wash water	Technology: The treatment process is conventional, and has following units: Cascade Aerator, Raw Water Channel with Parshall Flume for continuous flow measurement, Coagulant & Flocculent chemical makeup tanks, Flash Mixing tank, Clarifier including a flocculation zone in the centre, eight sand filters, disinfection tanks (bleaching powder), back wash water

	Bathi WTP	Kundwada WTP	TV Station WTP
	storage for filters **Materials**: All civil structures are made of reinforced cement concrete, and mechanical units like the clariflocculator bridge, etc. are of mild steel. Process: the water from raw water pumping main enters into the inlet, and the first unit is cascade aerator. After aeration water passes through parshall flume, where flow is measured. Coagulant and flocculent chemicals (alum and polymer) are added to the water, and mixed in the flash mixer tank, and then flows into clariflocculator. Clarified water flows into sand filters (8 no,s) for filtration and the filtered water is disinfected with chlorine, and allowed to flow into clear water tank from where water pumped into service reservoirs for distribution .	storage for filters **Materials**: All civil structures are made of reinforced cement concrete, and mechanical units like the clariflocculator bridge, etc. are of mild steel. Process: the water from raw water pumping main enters into the inlet, and the first unit is cascade aerator. After aeration water passes through parshall flume, where flow is measured. Coagulant and flocculent chemicals (alum and polymer) are added to the water, and mixed in the flash mixer tank, and then flows into clariflocculator. Clarified water flows into sand filters for filtration and the filtered water is disinfected with bleaching powder and allowed to flow into clear water tank from where water pumped into service reservoirs for distribution .	storage for filters **Materials**: All civil structures are made of reinforced cement concrete, and mechanical units like the clariflocculator bridge, etc. are of mild steel. Process: the water from raw water pumping main enters into the inlet, and the first unit is cascade aerator. After aeration water passes through parshall flume, where flow is measured. Chemical (alum) is added to the water, and mixed in the flash mixer tank, and then flows into clariflocculator. Clarified water flows into sand filters for filtration and the filtered water is disinfected with bleaching powder and allowed to flow into clear water tank from where water pumped into service reservoirs for distribution . at present existing clariflucculator is being renovated
Backwash water and sludge management	-filter backwash water is let into open drains as there is no recycling of backwash into inlet - the settled sludge from the bottom of the clarifier tank is periodically flushed into the drains. -this practice of discharge of backwash and sludge directly into the drains, wastes water, pollutes and silts receiving water bodies. -	-filter backwash water is let into open drains as there is no recycling of backwash into inlet - the settled sludge from the bottom of the clarifier tank is periodically flushed into the drains. - this practice of discharge of backwash and sludge directly into the drains, wastes water, pollutes and silts receiving water bodies. -	-filter backwash water is let into open drains as there is no recycling of backwash into inlet - the settled sludge from the bottom of the clarifier tank is periodically flushed into the drains. - this practice of discharge of backwash and sludge directly into the drains, wastes water, pollutes and silts receiving water bodies. -
Chlorination system	Chlorine dosage system is not proper; there are no safety precautions in place. Chlorine cylinders (900 kg tonners) are placed haphazardly at the facility; the dosage system is not properly functional; no safety systems like leak	Bleaching powder is added as disinfectant.	Bleaching powder is added as disinfectant.

	Bathi WTP	Kundwada WTP	TV Station WTP
	detection or emergency alarm or lime slurry pit available in the facility. Operators are not aware of safety measures or actions to be performed during any emergency.		

III. Compliance with Applicable National and State Laws, Rules, and Regulations

Law, Rules, and Regulations	Description and Requirement	Bathi WTP	Kundwada WTP	TV Station WTP
		Y = compliant (if applicable, specify expiration date of permit/clearance) *N = non-compliant*[5] *N/A = not applicable (state justification)*		
EIA Notification	The EIA Notification of 2006 and 2009 (replacing the EIA Notification of 1994) states that environmental clearance is required for certain defined activities/projects.	N/A Environmental clearance is not required as WTPs are not listed in the EIA Notification's "Schedule of Projects Requiring Prior Environmental Clearance"		
Manufacture, Storage, and Import of Hazardous Chemical Rules, 1989	Storage of chlorine (threshold quantity greater than 10 tons but less than 25 tons) in WTPs will require clearance from Karnataka Pollution Control Board (WBPCB).	N/A Normally 3 or 4 tonners (of capacity 900 kg) are stored at the site	N/A Treated water is disinfected by mixing bleaching powder	N/A Treated water is disinfected by mixing bleaching powder
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments	Consent to operate from KSPCB	N/A In Karnataka, WTPs do not require consent from KSPCB		
Air (Prevention and Control of Pollution) Act of 1981, Rules of 1982 and amendments.	Consent to operate from WBPCB	no source of air emissions (e.g., standby power generators)		
Environment (Protection) Act, 1986 and CPCB Environmental Standards	Emissions and discharges from the facilities to be created, refurbished, or augmented shall comply with the notified standards.			
	a. Air emissions	no monitoring conducted		
	b. Effluent	no monitoring conducted		
CPHEEO Drinking Water Quality Standards	Applicable standards for drinking water at the consumer end	No water quality monitoring data is available at the facility Laboratory facility is	No water quality monitoring data is available at the facility No laboratory	No water quality monitoring data is available at the facility No

[5] Compliant = There is sufficient and appropriate evidence to demonstrate that the particular regulatory requirement has been complied with; non-compliant = clear evidence has been collected to demonstrate the particular regulatory requirement has not been complied with.

Law, Rules, and Regulations	Description and Requirement	Bathi WTP	Kundwada WTP	TV Station WTP
		available within the WTP however no regular monitoring Is conducted.	facility available at the WTP	laboratory facility available at the WTP
Noise Pollution (Regulation and Control) Rules, 2002 amended up to 2010	Applicable ambient noise standards with respect to noise for different areas/zones	no monitoring conducted		
National Institute of Occupational Safety and Health (NIOSH) Publication No. 98-126	Applicable noise exposure levels and duration that no worker exposure shall equal or exceed	no monitoring conducted		
Forest (Conservation) Act, 1980 and Forest Conservation Rules, 2003 as amended	As per Rule 6, every user agency, who wants to use any forest land for non-forest purposes shall seek approval of the central government.	N/A WTPs are not located in notified forest lands.		
Ancient Monuments and Archaeological Sites and Remains Rules of 1959	No development activity is permitted in the "protected area," and all development activities likely to damage the protected property are not permitted in the "controlled area" without prior permission of the Archaeological Survey of India (ASI). Protected property includes the site, remains, and monuments protected by ASI or the State Department of Archaeology.	N/A		
The Child Labor (Prohibition and Regulation) Act, 1986	No child below 14 years of age will be employed or permitted to work in any of the occupations set forth in the Act's Part A of the Schedule or in any workshop wherein any of the processes set forth in Part B of the Schedule are present.	No children between the ages of 14 and 18 will engage in hazardous work.		

IV. Institutional Arrangement

Parameter	Bathi WTP	Kundwada WTP	TV Station WTP
Operations	7 days a week 24 hours a day 3 working shifts per day	Standby – when required summers/	7 days a week 24 hours a day 3 working shifts per day
Manager per shift	1 Junior Engineer	1 Junior Engineer	1 junior engineer
Water supply engineer on-site			
Estimated number of technical employees on-site per shift	5 -6	2 - 3	3-4
Estimated number of laborers on-site per shift	-		

Parameter	Bathi WTP	Kundwada WTP	TV Station WTP
Estimated number of employees in charge of environmental management and monitoring	-		
Frequency of water quality monitoring (raw water)	not conducted	not conducted	not conducted
Frequency of water quality monitoring (treated water for distribution)	not conducted	not conducted	not conducted
Frequency of water quality monitoring (sludge supernatant)	not conducted	not conducted	not conducted
Frequency of water quality monitoring (WTP effluents)	not conducted	not conducted	not conducted
In-house laboratory for water quality analyses (Yes/None). If none, provide name of third-party laboratory.	Yes	None	None

V. Corrective Action Plan

	Gaps	Corrective Action	Time Frame	Responsible Person	Indicator for CMC/ KUIDFC	Indicator for ADB	Budget
A. Compliance With National, State, and Local Laws and Rules							
1	Monitoring of raw and treated water as per CPHEEO Drinking Water Quality Standards	Conduct regular monitoring of water (frequency, parameters and methodology as per CPHEEO Manual requirements for drinking water supply).	O & M phase	Davangere CMC (during O&M phase)	Provision of laboratory as part of the subproject and budget Inclusion in the Environ-mental Monitoring Program	ADB to approve IEE with EMP prior to bidding	Included in CMC cost (during O&M phase)
2	Monitoring of air emissions and effluent not being conducted	EMP to include air emissions and effluent monitoring	Constructio n phase O&M phase	Contractors (during constructio n phase) Davangere CMC (during O&M	EMP implemen-tation to include monitoring of air emissions and effluent.	ADB to approve IEE with EMP prior to bidding	Included in contractors cost (during construc-tion phase) Included in CMC cost (during

	Gaps	Corrective Action	Time Frame	Responsible Person	Indicator for CMC/ KUIDFC	Indicator for ADB	Budget
				phase)			O&M phase)
3	Monitoring of ambient noise levels not being conducted	EMP to include noise level monitoring	Construction phase O&M phase	Contractors (during construction phase) Davangere CMC (during O&M phase)	EMP implementation to include monitoring of ambient noise levels.	ADB to approve IEE with EMP prior to bidding	Included in contractors cost (during construction phase) Included in CMC cost (during O&M phase)
4	Monitoring of workers' noise exposure levels and duration not being conducted	EMP to include worker noise exposure level and duration monitoring	Construction phase O&M phase	Contractors (during construction phase) Davangere CMC (during O&M phase)	EMP implementation to include monitoring of workers noise exposure levels and duration.	ADB to approve IEE with EMP prior to bidding	Included in contractors cost (during construction phase) Included in CMC cost (during O&M phase)
B. Institutional Arrangement							
1	Unidentified employees responsible for environmental management and monitoring	PMU to designate environmental coordinators for EMP implementation	During program implementation	Davangere CMC (during O&M phase)	PMU Environmental Coordinators to work closely with WTP staff. IEE with EMP to specify TOR of PMU Environmental Coordinators	Institutional arrangement for EMP implementation clearly defined in the IEE. ADB to approve IEE with EMP prior to bidding.	Included in CMC cost
2	No information on capacity of WTP engineers to conduct environmental quality monitoring	Build capacity of CMC, PMU Environmental Coordinators, and WTP operators	During program implementation	PIU/ consultant Team	Number of trainings conducted	Semi-annual report to include documentation of trainings conducted	Included in DSC cost
C. Others							
1	No	Public	During	DSC,	GRM	Semi-	Included in

	Gaps	Corrective Action	Time Frame	Responsible Person	Indicator for CMC/ KUIDFC	Indicator for ADB	Budget
	documen-tation of complaints/ grievances from people regarding noise/odor	consultation to include stakeholders from communities adjacent to the WTP	program implemen-tation	Contractors , and CMC	documen-tation and reporting all throughout the program implement-tation	annual report to include summary of complaints/ grievances, remedial actions taken, and, if necessary, additional environment al mitigation measures	CMC cost
2	Physical and chemical quality of supernatant not being determined prior to discharge.	EMP to include supernatant monitoring	Decommis-sion phase and defects liability period O&M phase	Contractors (during decommis-sioning and defects liability period) Davangere CMC (during O&M phase)	Results to be submitted to PMU	Semi-annual report to ADB (during decommis-sioning and defects liability period)	Included in contractors cost (during decommis-sioning and defects liability period) Included in CMC cost (during O&M phase)
3	Sludge quality not being determined prior to reuse	EMP to include sludge quality monitoring	Decommis-sion phase and defects liability period O&M phase	Contractors (during decommis-sioning and defects liability period) Davangere CMC (during O&M phase)	Results to be submitted to PMU	Semi-annual report to ADB (during decommis-sioning and defects liability period)	Included in contractors cost (during decommis-sioning and defects liability period) Included in CMC cost (during O&M phase)