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GOVERNMENT OF KARNATAKA

Karnataka Urban Water Supply Modernization Project (KUWSMP)

ENVIRONMENTAL AND SOCIAL ASSESSMENT (ESA) OF CONTINUOUS WATER SUPPLY PROJECT IN HUBBALLI-DHARWAD, KARNATAKA, INDIA

DRAFT FINAL REPORT
2014

KUIDFC

Karnataka Urban Infrastructure Development Finance Corporation (KUIDFC)

Abbreviations

AE	Assistant Engineer
AEE	Assistant Executive Engineer
CMC	City Municipal Corporation
CPCB	Central Pollution Control Board
CPHEEO	Central Public Health & Environmental Engineering Organisation
DoEE	Department of Ecology & Environment (DoEE)
DPR	Detailed Project Report
DRIP	Dam Rehabilitation and Improvement Project
EA	Environmental Assessment
EAC	Expert Appraisal Committee
EC	Empowered Committee
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EP	Environment Protection
ESMP	Environmental and Social Management Plan
FGD	Focused Group Discussions
GLSR	Ground Level Storage Reservoir
GoI	Government of India
GoK	Government of Karnataka
JE	Junior Engineer
Km	Kilometer
KSPCB	Karnataka State Pollution control Board
KUIDFC	Karnataka Urban Infrastructure Development Finance Corporation
KUWASIP	Karnataka Urban Water Sector Improvement Project
KUWSSDB	Karnataka Urban Water Supply Sewerage and Drainage Board
KUWSMP	Karnataka Urban Water Supply Modernization Project
LPCD	Litres per capita per day
mg/l	Milligrams per liter
MoEF	Ministry of Environment & Forests
NH	National Highway
NRRP	National Rehabilitation & Resettlement Policy (NRRP
O&M	Operation & Management
OD	Operational Directives
OHT	Over Head Tank
OP	Operational Policy
PAF	Project Affected Families (PAFs)
PIU	Project Implementation Units
PPP	Public Private Partnership
PSP	Private Sector Participation
PPE	Personnel Protective Equipment
R & R	Rehabilitation & Resettlement
RAP	Resettlement Action Plans
RPM	Respirable Particulate Matter
SEA	Social and Environmental Assessment
SEAC	State's Environmental Appraisal Committee
SEMF	Social and Environmental Management Framework
ESA	Environmental and Social Assessment
SH	State Highway
SPM	Suspended Particulate Matter

STP	Sewerage Treatment Plant
TDS	Total Dissolved Solids
ToR	Terms of Reference
UDD	Urban Development Department
UGD	Underground drainage
ULB	Urban Local Body
UWS	Urban Water Supply
UWSS	Urban Water Supply Sanitation
WB	World Bank
WSS	Water Supply and Sanitation

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EXECUTIVE SUMMARY

1.1. Background

In 2003, Government of Karnataka (GoK) with assistance from the World Bank launched Karnataka Urban Water Sector Improvement Project (KUWASIP) for providing a continuous water supply (24X7) to address issues of poor quality, intermittent supply, illegal connection and supply of contaminated ground water. The State Government selected five demonstration zones in three project towns of Hubli-Dharwad, Belgaum, and Gulbarga to pilot the 24X7 urban water supply (UWS). The project envisaged setting a policy, institutional and regulatory environment in the urban water sector, enabling service improvements, sustainable investments and coverage expansion. The project was successfully implemented and closed on 31st March 2011.

Based on the success of the project and with the support from the local communities, City wise scale up has been proposed through World Bank funding. The total project cost is for all the three cities is estimated at about 1809 crores in INR or $ 279 million in US. This up scaling project for the identified cities known as "Karnataka Urban Water Supply Modernization Project" (KUWSMP) has been approved by the GoK.

Karnataka Urban Infrastructure Finance Corporation (KUIDFC) on behalf of the Government of Karnataka is preparing the Karnataka Urban Water Supply Modernisation Project (KUWSMP). The project involves modernizing water supply systems and capacity for providing continuous piped water supply in the three cities of Hubballi-Dharwad, Kalaburgi and Belagavi.

An Environmental and Social Assessment (ESA) has been carried out to integrate environmental and social concerns with project design, identify potential adverse environment and social impacts during different phases of the project implementation (pre-construction, during construction and post construction) and recommend mitigation measures, complying with environmental and social safeguard policies of the World Bank, Government of India, and Government of Karnataka.

1.2. Project Area Profile

Hubballi-Dharwad (Hubli, name changed on 1st November 2014) is the second largest urban center in the state and the largest center for trade and commerce in North Karnataka region. Geographically Hubballi is situated at 15° 20'N latitude and 75° 13'E longitude and Dharwad is situated at 15° 25'N latitude and 75° E longitude. The altitude of the twin cities varies from 764 m to 593 m with Dharwad being at a higher elevation and comprises in 67 Municipal administrative wards with a total area of 202.28 sq.km

Water to the Hubballi and Dharwad Cities is supplied from two sources: 33.14 MLD of water is supplied from Neerasagar Reservoir situated about 23 kms from the Hubballi, around 71 MLD of water is supplied from the Renukasagar Reservoir located at around 42 kms from Dharwad and 8 MLD of water is supplied from Bore wells.

A summary profile of the city is presented in **Table I** below.

Table 1: Fact File

Sr. No.	Attributes	
1.	Population 2011	9,43,788
2.	Total no. of households	2, 00,418
2.	Area Hubballi-Dharwad Municipal Corporation	202.28 sq. km
3.	No. of Wards	67
4.	Population Decadal Growth rate (2001-2011)	20.07%
5.	Population Density (2011)	4666 person per sq.km
6.	Literacy Rate	77%
7.	Sex Ratio	989
8.	Economy	Small and medium industries hub with more than a lakh small and medium industries

1.3. Project Description

KUWSMP will support the Government of Karnataka (GoK) and the participating urban local body to achieve the project development objective to "Improve water service quality to a continuous supply (24x7) across Hubballi-Dharwad city through the establishment of institutionally and financially sustainable service delivery arrangements at ULB level". The key project activities include financing goods and services to improve water supply systems in these three cities to 24X7 by investing in improved capacity to meet water demand, reduced non-revenue water, network expansion, setting up of city level water institutions (SPV) and hiring an Operator to strengthen and manage the systems for a duration (12 years). The operator will also strengthen the city level institutions.

The Project period would be 12 years consisting of a design & implementation period of 4 years (the "transition phase" to convert the system to continuous pressurized supply) & operation & management period of 12 years – comprising the 4 year transition phase and a further 8 years when the supply is continuous and pressurized.

As part of project preparation, detailed studies were carried out by *M/s Tata Consulting Engineers In association with SREI Infrastructure Finance Ltd* in Sept 2012 to understand the physical and capital investments required for providing continuous water supply to Hubballi-Dharwad. However, the hired Operator shall study the existing system, measure performance and carry out assessments of the system and propose and implement investments that will ensure delivery of continuous water supply in the project cities. The activities of the Operator will include the following.

- Augmentation / development of water sources
- Rehabilitation of existing or laying of new transmission line(s),
- Rehabilitation or expansion or new water treatment plant(s)
- Development and / or expansion of pumping station(s)
- Renovation or rehabilitation or construction of new service reservoirs (underground or over-ground)

- Replacement and /or extension of distribution network
- Replacement and/ or provision new house service connections.

1.4. Environmental and Social Assessment of the Project

The Environmental and Social Assessment (ESA) was carried out with the objectives of:

- Identifying key social and environmental issues associated with the proposed water supply augmentation (24x7 water supply) such as rehabilitation works to be implemented at the pre-construction, construction and operation phases of project.
- Identifying the positive and adverse impacts of sub project activities on physical and social environments.
- Proposing suitable mitigation measures for potentially adverse environmental and social impacts, and measures for enhancement of positive impacts and preparing specific Environmental and Social Management Plans.
- Detailing out roles and responsibilities of various agencies involved in carrying out the proposed action plans.

The scope of work carried out under this study comprised of –

a) Reviewing all applicable policies including operational policies of the World Bank and environmental laws / regulations in India within which KUWSMP is to be implemented.
b) Detailed analysis of Environmental Profile of the project city including assessing and establishing base line water quality.
c) Socio-economic profiling of the cities through primary survey, stakeholder consultations, focus group discussions and analysis of secondary information.

1.4.1. Review of Environmental Policies and Institutions

The review of the environmental policies conclude that as the activities currently contemplated in this project fall under the rehabilitation & modernization project, these will not necessitate any detailed environmental impact assessment (EIA) studies. This project is identified as category B and the Operational Policy 4.01 will be applicable to assess the impacts however marginal or temporary it might be. Due to the dependence on multipurpose dams that share water for the drinking water needs of the city, Safety of Dams (OP 4.37) is triggered. OP 4.11 for Cultural Properties will be triggered, in cases of 'chance find' of cultural properties during the construction phase of the project.

The review reveals that various legal approvals and clearances on social and environmental aspects will have to be obtained during Transition and Sustaining stages. During constructions, the project would require consent from the state pollution control board to operate the DG set under Air (Prevention & Control of Pollution) Act, 1981 and also attract Noise Control Regulations under Environment (Protection) Act, 1986. Permissions/Approvals from Railways and State and National Highway Authorities is envisaged during Transition Phase. The storage and handling of chlorine for disinfecting the water, during Transition and Sustaining Periods, will necessitate consent from the Pollution Control Board as per the provisions of Manufacture, Storage and Handling of Hazardous Chemicals Rules, 1989.

1.4.2. Base Line Environmental Profile

The detailed base line environmental profiles do not indicate any sensitive environmental features that could be affected by the proposed activities under KUWSMP. Hubballi-Dharwad has a rich cultural past. Fort, Chandramoulesvara temple and Basavannadevi temple are historical monuments under the central protection category. Construction activities around these structures need to include adequate precautionary measures and clearances from NMA. The project activities are not expected to impact these structures. However, necessary approval shall have to be obtained from National Monuments Authority, for carrying out construction within 300 m of the monument. In addition construction activities need to consider precautionary measures to avoid damages of archaeological structures during excavation works.

Hubballi-Dharwad is presently maintained by HDMC. The underground sewerage system covers about 36 percent of the total road length of Hubballi and Dharwad Township.

At present there is no Sewage Treatment Plant (STP) in Hubballi-Dharwad and the sewage generated is treated in septic tanks and discharges into nearby natural drains. Two STPs of 40 MLD and 20 MLD capacity are under construction at Gabbur, Hubballi and Madihal, Dharwad, under the ADB supported North Karnataka Urban Sector Improvement Project (NKUSIP).

1.4.2.1. Base Line Sample Surveys

In order to establish the baseline water quality samples were collected and bacteriological & physiochemical analysis was conducted to analyze water quality as below:

- Raw water from Dharwad , Malaprabha water supply scheme Jackwell at Saundatti
- Treated water from Dharwad, after clear water reservoir at WTP at Amminbhavi.
- Raw water from Hubballi , Neerasagar lake , Bharth Dommavadi
- Treated water from Hubballi , Neerasagar lake , Bharth Dommavadi
- Sixteen water samples from public Public Taps.

The treated water sample from Amminabhavi met the IS 10500 standards. Turbidity was observed beyond the permissible limit in both raw water sample and treated water. The pH was recorded well in all water samples and fit for drinking purpose. Free residual chlorine was found within limit except at Amminbhavi reservoir which could be due to chlorination of water. Coliforms were found in both raw and treated water sample. Higher coliform numbers were counted in treated water sample followed by raw water sample. E. Coli was present in the raw water sample while absent in treated water sample at Amminbhavi.

1.4.3. Socio-Economic Profile

The base line socio economic profile of the project area does not indicate the presence any sensitive social features. The primary survey and stakeholder consultation revealed that current intermittent water supply is not satisfactory and respondents have to adopt coping mechanisms to overcome its deficiencies. Further it indicated that the respondents are aware of the benefits of 24x7 water supply and are willing to pay for the better supply.

1.5. Impacts and Environmental Management Plan

Hubballi-Dharwad is not located near any eco-sensitive area. The proposed project activities will have environmental impact on the adjoining settlement in terms of dust and noise during construction. Soil pollution and impact on water quality and hydrology will be marginal and temporary. The critical issues will be to ensure adequate safety and precautionary measures to minimise impacts during construction and provision of sanitation facilities in the construction area to avoid contamination surface / sub-surface sources during operation. While the impacts are not very severe and permanent, care has to be taken to ensure that the ambient environmental conditions do not deteriorate. The negative impacts that are likely due to construction activities in narrow and congested roads need critical attention. **Table 3** presents the summary of major impacts of the project and recommended mitigation measures.

1.6. Impacts and Social Management Plan

There are no significant adverse impacts by the project. The proposed project does not involve land acquisition, displacement of structures; does not cause any impact on community structures except for a few temporary inconveniences to the public during construction phase. The proposed project requires private land at 5 sites which is around 25% of the total land requirement. Implementation of the suggested mitigation measures during different phases of the project will prevent or minimize adverse impacts. A standalone document, Resettlement Policy Framework (RPF) has been prepared that consists resettlement planning and entitlement provisions. The RPF outlines the principles and approaches to be followed in minimising and mitigating the adverse social and economic impacts due to the project. **Table 4** below presents the summary of major impacts of the project and recommended mitigation measures.

Table 3: Environmental Management Plan (EMP) for the proposed Project

Sr. No	Project Activities	Impacts	Mitigation Measures	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(4)	(5)	(6)
Design Phase					
1.	Pre-construction activities	The pre-construction phase will give rise to fugitive dusts and frequent exhaust emissions into the atmosphere as equipment is delivered to the pumping stations/ water treatment plant/ overhead tanks and along major roads and streets where the proposed new network will pass through.	• Air pollution control measure like water sprinkling • Limit hours of operation in populated areas • Use of barriers to reduce exposure • Plants, machinery and equipment may be handled so as to minimize generation of dust. • Low emission construction equipment generator sets and pollution free certified vehicles may be used	Operator	SPV
Construction Phase/Transition Phase					
2.	Laying of new raw water transmission line of 1644 mm diameter MS from Saundatti to Amminbhavi WTP	Increase dust levels in the area due to construction activities Accumulation of construction waste Increase water pollution during construction Deterioration of water quality Temporary Disruption of water supply Damage to standing crops during break down of the transmission main or maintenance operations Disruption of traffic due to movement of vehicles and equipments in Saundatti and Amminbhavi villages	• Air pollution control measure like water sprinkling • Limit hours of operation in populated areas • Use of barriers to reduce exposure • Plants, machinery and equipment may be handled so as to minimize generation of dust. • Low emission construction equipment generator sets and pollution free certified vehicles may be used • Dump solid waste in specified place to minimize contamination of water • Ensure implementation of Waste Management Plan for environmentally sound management • Alternate supply arrangements such as supply through tankers should be provided • Check leakages and prevent • Cross contamination of water should be avoided • Avoid traffic in populated areas as much as possible • Child labor must be strictly	Contractor	Operator and ULB/SPV
3.	Laying of a new line of 1294 mm diameter MS from Amminbhavi to Hubballi				

Sr. No	Project Activities	Impacts	Mitigation Measures	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(4)	(5)	(6)
4.	Laying of a new line of 1168 mm diameter MS is proposed from Amminbhavi to Dharwad to cater to the additional future demand		prohibited • Ensure implementation of Construction Camp Plan for labor camps • Ensure implementation of Health & Safety Management Plan for public and workers safety • Ensure implementation of Construction Plants & Equipments Management Plan for construction equipments • Preparation of traffic diversion plans and prior intimation of the construction schedule to the people in the areas of construction • Provision of temporary crossings/ bridges to avoid accidents and other construction hazards • Ensure implementation of Water bodies Management Plan during laying of pipeline near to water bodies • Prior Consultation should be carried out for implementation or laying of pipe line in private land and habitat • Mid-term environment audit should be carried out for performance of ESMP implementation • Restoration of road surface to original condition in earliest possible time		
5.	Laying of raw water gravity main from the reservoir to the pump house at Dhumwad of 1.4 km				
6.	Laying of raw water rising main from the pump house to the WTP of length 2.225 kms				
7.	Laying of a clear water transmission (gravity) line of 813 HS exists towards Hubballi (from the Airport to Hosur)				
8.	Additional clear water storage of 43 ML is proposed at Amminbhavi	• Increase dust levels in the area due to construction activities • Accumulation of construction waste • Increase water pollution during construction • Deterioration of water quality • Temporary Disruption of water supply • Disruption of traffic due to movement of	• Air pollution control measure • Use of barriers to reduce exposure • Quarterly Air/Noise quality monitoring may be conducted at construction sites. • Dump solid waste in specified place to minimize contamination of water • Ensure implementation of Waste Management Plan for environmentally sound management of waste • Measures to prevent	Contractor	Operator and ULB/SPV

Sr. No	Project Activities	Impacts	Mitigation Measures	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(4)	(5)	(6)
9.	Construction of new overhead and ground reservoirs	vehicles and equipments	accidental spills • Avoid traffic in populated areas as much as possible • Provide safety measures (mask, gloves, hat etc.) to minimize exposure • Organize awareness programs on environmental resource management • Child labor must be strictly prohibited • Ensure implementation of Construction Plants & Equipments Management Plan for management of construction equipments • Ensure implementation of Health & Safety Management Plan for public and workers safety. • Preparation of traffic diversion plans and prior		

Sr. No	Project Activities	Impacts	Mitigation Measures	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(4)	(5)	(6)
10.			intimation of the construction schedule to the people in the areas of construction • Using low noise generating equipment such as pneumatic hammers / drills, provision of encasings around generators and avoiding construction during nights • Ensure implementation of Project Planning and Design Plan before planning of activity • Site preparation should be as per Site Preparation Plan for site clearance • Ensure implementation of water for construction plan for water management • Alternate material or material should be reused for construction of WTP to reduce construction cost • Ensure implementation of Construction Camp Plan for labor camps • intimation of the construction schedule to the people in the areas of construction • Using low noise generating equipment such as pneumatic hammers / drills, provision of encasings around generators and avoiding construction during nights • Ensure implementation of Project Planning and Design Plan before planning of activity • Site preparation should be as per Site Preparation Plan for site clearance • Ensure implementation of water for construction plan for water management • Alternate material or material should be reused for construction of WTP to reduce construction cost • Ensure implementation of Construction Camp Plan for labor camps		

Sr. No	Project Activities	Impacts	Mitigation Measures	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(4)	(5)	(6)
10.	A new Clearwater pump house to accommodate the additional pumps to cater to the additional capacity at Amminbhavi	• Increase dust levels in the area due to construction activities • Accumulation of construction waste • Deterioration of water quality • Temporary Disruption of water supply • Increase soil pollution	• Air pollution control measure • Use of barriers to reduce exposure • Ensure implementation of Waste Management Plan for environmentally sound management of waste • Avoid traffic in populated areas as much as possible • Child labor must be strictly prohibited • Ensure implementation of Health & Safety Management Plan for public and workers safety. • Ensure implementation of Project Planning and Design Plan before planning of activity • Site preparation should be as per Site Preparation Plan for site clearance • Ensure implementation of water for construction plan for water management • Alternate material or material should be reused for construction of WTP to reduce construction cost	Contractor	Operator and ULB/SPV
11.	Construction of WTP at Amminbhavi	• Increase dust or other gaseous (SO2 & NO2) levels due to the movement of construction vehicles and equipments • Increase health risk in nearby areas • Increase health risk in construction Labor • Accumulation of construction waste • Accumulation of earth material	• Air pollution control measure like water sprinkling • Use of barriers to reduce exposure • Low emission construction equipment generator sets and pollution free certified vehicles may be used • Quarterly Air/Noise quality monitoring may be conducted at construction sites. • Dump solid waste in specified place to minimize contamination of water • Discharge wastewater at authorized locations and after treatment • Ensure implementation of Waste Management Plan for environmentally sound management of waste • Measures to prevent accidental spills • Child labor must be strictly prohibited • Ensure implementation of Construction Camp Plan for	Contractor	Operator and ULB/SPV

Sr. No	Project Activities	Impacts	Mitigation Measures	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(4)	(5)	(6)
			labor camps • Ensure implementation of Health & Safety Management Plan for public and workers safety • Ensure implementation of Construction Plants & Equipments Management Plan for management of construction equipments • Ensure implementation of water for construction plan for water management • Alternate material or material should be reused for construction of WTP to reduce construction cost • Preparation of traffic diversion plans and prior intimation of the construction schedule to the people in the areas of construction • Using low noise generating equipment such as pneumatic hammers / drills, provision of encasings around generators and avoiding construction during nights		
12.	Rehabilitation of existing WTPs	No major impact anticipated	• Ensure implementation of Health & Safety Management Plan for public and workers safety. • Ensure implementation of Waste Management Plan for environmentally sound management of waste • Cross contamination of water should be avoided	Contractor	Operator and ULB/SPV
13.	Dismantling of existing Elevated Service Reservoir	• Increase in Dust Level due to dismantling • Increase health risk in nearby areas especially Ayodhya Nagar, Keshwapur, Karwar Road, DC Compound, Saraswatpur and Navnagar which are very congested areas in the city. • Accumulation of demolition waste • Increase health risk in Construction labor • Temporary disruption of water • Increase noise levels	• Use of barriers to reduce exposure • Ensure prior information on dismantling of reservoirs to the community • Air pollution control measure like water sprinkling • Limit hours of operation in populated areas • Low emission construction equipment generator sets and pollution free certified vehicles may be used • Dump solid waste in specified place to minimize contamination of water • Ensure implementation of Waste Management Plan for	Contractor	Operator and ULB/SPV

Sr. No	Project Activities	Impacts	Mitigation Measures	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(4)	(5)	(6)
		due to demolition and movement of vehicles • Temporary disruption of traffic due to movement of vehicles especially DC Compound and Ayodhya Nagar • Disruption of water supply in the city	environmentally sound management of waste • Measures to prevent accidental spills • Provide safety measures (mask, gloves, hat etc.) to minimize exposure • Child labor must be strictly prohibited • Ensure implementation of Health & Safety Management Plan for public and workers safety. • Ensure implementation of Construction Plants & Equipments Management Plan for management of construction equipments • Ensure implementation of Cultural Properties Plan if any cultural property is being impacted due to interventions • Preparation of traffic diversion plans and prior intimation of the construction schedule to the people in the areas of construction • First aid facilities to be provided at the construction camps. Any case of disease outbreak may be immediately subjected to medical treatment. Mosquito repellant to be provided to the labors such as odomas, coil and sprays. The camps may maintain cleanliness and hygienic condition. • Prior Consultation should be carried out for implementation or laying of pipe line in private land and habitat • Provide bypass during demolition and completing works at shortest possible time • Provision of sprinkling of water & scaffolding. Sprinkling method is used for refilling of trenches so that shrinking should be minimized • There should be proper covering of excavated or dismantled material while transportation of these waste materials		
14.	Laying of about 2100 km of distribution line	• Increase dust levels due to excavation of	• Limit hours of operation in populated areas	Contractor	Operator and ULB/SPV

Sr. No	Project Activities	Impacts	Mitigation Measures	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(4)	(5)	(6)
		earth. • Increase noise levels due to movement of heavy vehicles • There may be cases of destruction of underlying cables(Telephones and internet) • Water pollution due to leakages or damages of existing distribution lines • Disruption of water supply to the consumers during implementation • Water conflicts due to shortage of water • Soil pollution due to leakages from vehicles and equipments • Soil erosion and accumulation of excavated materials • Increase occupational health risk of construction labours • Increase sanitation problems due to excavation • Increase risk on ground water contamination • Impact on city drainage system • Increase in traffic congestion on major roads and streets as a result of intermittent movement of equipment and materials.	• Laying of pipeline in alternate street to avoid traffic jam and inconvenience to community in congested areas • Use of barriers to reduce exposure • Refilling and replacement the excavated topsoil back in the same field and provision of soil barriers with the excavated earth to avoid spillage on the adjoining land. • Restoration of road surface to original condition in earliest possible time • Ensure implementation of Waste Management Plan for environmentally sound management of waste • Alternate supply arrangements such as supply through tankers should be provided • Check leakages and prevent • Cross contamination of water should be avoided • Provide sirens in vehicles to avoid any collision with human/animals • Child labour must be strictly prohibited • Locate handling sites away from populated areas • Ensure implementation of Construction Camp Plan for labor camps • Ensure implementation of Health & Safety Management Plan for public and workers safety. • Ensure implementation of Construction Plants & Equipments Management Plan for management of construction equipments. • Ensure implementation of Water bodies Management Plan during laying of pipeline near to water bodies • Ensure implementation of Cultural Properties Plan if any cultural property is being impacted due to interventions • Ensure implementation of water for construction plan for water management		

Sr. No	Project Activities	Impacts	Mitigation Measures	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(4)	(5)	(6)
			• Preparation of traffic diversion plans and prior intimation of the construction schedule to the people in the areas of construction • Preparation of utility shifting plans, procuring appropriate approvals / permissions in advance and completion of activities in the earliest possible time • Using low noise generating equipment such as pneumatic hammers / drills, provision of encasings around generators and avoiding construction during nights • Prior Consultation should be carried out for implementation or laying of pipe line in private land and habitat • Provide bypass during laying and completing works at shortest possible time		
Operation/Sustaining Phase					
15.	24X7 Continuous Supply of Water During Operation	• Operation Failure of Transmission Lines- due to mechanical failure or third party interference. • Bursting or breakage of distribution mains- as a result of increased pressure or aggressiveness of pumping. • Power outages, which may disrupt water supply. • Air quality impacts that would arise during the operation of the pumping stations would include emissions from generators • Generation of Additional Quantity of Wastewater from the Zones leading to contamination of surface / sub-surface sources • Flooding of Low Lying Areas due to overflow of storm water drains • Deficiencies in Storage and Handling of Chlorine at the water	• Before implementation of project an water connections census should take to reduce extra use of water • Illegal water tapping source should be identified • Ground water should be kept a backup supply source in system failure • Ensure Indian Drinking Water Standards (BIS:10500) • Alternate supply arrangements such as supply through tankers should be provided if Leakages, Contamination and shortage of Water • Check leakages and prevent • Cross contamination of water should be avoided • Plan and cost for adequate centralized / decentralized / individual sanitation facilities in the city • Plan and cost for augmentation and strengthening the storm water drainage network in the city • Ensure environmentally sound and safe storage and containment of oil and diesel for	Operator	ULB/SPV

Sr. No	Project Activities	Impacts	Mitigation Measures	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(4)	(5)	(6)
		treatment plant • Occurrence of chlorine intoxication if water is over chlorinated during treatment • Generation of sludge from WTP Leading to contamination of surface and sub surface sources • Generation of Waste Water	DG Sets • Ensure proper/efficient treatment of sludge before disposal. • Ensure routine maintenance practices; • Wastes should be collected, stored and managed on-site. Measures to ensure that wastes do not enter municipal water courses way must be ensured at all times during operations and maintenance in WTPs/Pumping stations. • Procure diesel generators with soundproofing. • Ensure environmentally sound and safe storage and containment of oil and diesel • Ensure implementation of Water bodies Management Plan during laying of pipeline near to water bodies • Ensure implementation of water quality Management for better water quality • Proper sludge management has to be prepared and followed by SPV / Operator • The untapped waste water component of 17% will be undertaken under the UGD program in a long term strategy and the cleaning of the existing sewerage network on continuous basis for smooth management.		

Table 4: Social Management Plan (SMP) for the proposed Project

Sr. No	Project Activities	Impacts	Mitigation Measures	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(4)	(5)	(6)
Design Phase					
1.	Awareness generation and people's confidence building Seeking participation of stakeholders Designing the project keeping in view the social, environmental and technical features	• People apprehension of the project • People's fear on loss of land and property • People's threat of inconvenience	➢ Meetings with stakeholders ➢ Loud speaker announcements on upcoming project seeking participation of people ➢ Insertions in cable TV on upcoming project and its benefits ➢ Hoardings indicating the temporary nature of inconvenience ➢ Design of socially acceptable, environmentally sensitive and technically feasible project engaging a team of consultants	ULB	ULB
Construction /Transition Phase					
2.	Replacement of existing PSC pipe and laying of new pipe	• Disruption of water supply to the consumers during implementation • Water conflicts due to shortage of water • Unhygienic condition in construction camp • Increase Health problems among labourers and Populace in general.	➢ Alternate supply arrangements such as supply through tankers should be provided. ➢ Awareness generation indicting temporary nature of disruption – targeting awareness more toward women who are the household water managers. ➢ Install speed breaker and sign ages near settlements ➢ Prepare traffic management plan. and prior intimation of the construction schedule to the people in the areas of construction. ➢ crossings/ bridges to avoid accidents and other construction hazards ➢ Provide safety measures (mask, gloves, hat etc.) to minimize exposure ➢ Provide sirens in vehicles to avoid any collision with human/animals ➢ Child labour must be strictly prohibited ➢ Provision of temporary ➢ Ensure implementation of Construction Camp Plan (ECOP) for labour camps ➢ Ensure implementation of Health & Safety Management Plan (ECOP) for public and workers safety	Contractor & Operator	ULB/SPV

Sr. No	Project Activities	Impacts	Mitigation Measures	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(4)	(5)	(6)
3.	Construction of WTP	• Noise pollution • Increase health risk in nearby areas • Increase health risk in construction Labour	• Limit hours of operation in populated areas • Use of barriers to reduce noise pollution • Plants, machinery and equipment may be handled in such a way so as to minimize generation of dust. • Dump solid waste in specified place to minimize contamination of water • Organize awareness programs on environmental resource management • Child labour must be strictly prohibited • Ensure implementation of Construction Camp Plan (ECOP,) for labour camps • Ensure implementation of Health & Safety Management Plan (ECOP 10,) for public and workers safety • Preparation of traffic diversion plans and prior intimation of the construction schedule to the people in the areas of construction • Provision of temporary crossings/ bridges to avoid accidents and other construction hazards • Using low noise generating equipment such as pneumatic hammers / drills, provision of encasings around generators and avoiding construction during nights	Contractor & Operator	ULB/SPV
4.	Rehabilitation of existing WTPs	• Noise pollution • Increase health risk in nearby areas • Occupational Hazard leading to Health risk in construction Labour	• Ensure implementation of Health & Safety Management Plan (ECOP) for public and workers safety.	Contractor & Operator	ULB/SPV
5.	Dismantling of existing Elevated Service Reservoir	• Accumulation of demolition waste • Increase health risk in Construction labour • Temporary disruption of water • Increase noise levels due to demolition and movement of vehicles • Temporary disruption of traffic due to	• Limit hours of operation in populated areas • Prepare traffic management plan • Provide safety measures (mask, gloves, hat etc.) to minimize exposure • Child labour must be strictly prohibited • Ensure implementation of Health & Safety Management Plan (ECOP) for public and workers	Contractor & Operator	ULB/SPV

Sr. No	Project Activities	Impacts	Mitigation Measures	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(4)	(5)	(6)
		movement of vehicles	safety. • Ensure implementation of Cultural Properties Plan (ECOP,) if any cultural property is being impacted due to interventions • Preparation of traffic diversion plans and prior intimation of the construction schedule to the people in the areas of construction • First aid facilities to be provided at the construction camps. Any case of disease outbreak may be immediately subjected to medical treatment. Mosquito repellent to be provided to the labours such as odomas, coil and sprays. The camps to maintain cleanliness and hygienic condition. • Provision of scaffolding. • There should be proper covering of excavated or dismantled material while transportation of these waste materials		
6.	Construction of new overhead reservoirs	• Increase noise levels due to movement of heavy vehicles and construction equipment • Disruption of traffic due to movement of vehicles and equipments • Increase health risk in nearby area • Increase occupational health risk of construction labourers • Increase sanitation problems due to construction camp • Accumulation of construction waste	• Limit hours of operation in populated areas • Cross contamination of water should be avoided • Prepare traffic management plan • Preparation of traffic diversion plans and prior intimation of the construction schedule to the people in the areas of construction • Provide safety measures (mask, gloves, hat etc.) to minimize exposure • Organize awareness programs on environmental resource management • Child labour must be strictly prohibited • Ensure implementation of Health & Safety Management Plan for public and workers safety. • Ensure implementation of Cultural Properties Plan (ECOP) if any cultural property is being impacted due to interventions • Ensure implementation of Construction Camp Plan (ECOP) for labour camps	Contractor & Operator	ULB/SPV

Sr. No	Project Activities	Impacts	Mitigation Measures	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(4)	(5)	(6)
7.	Laying of pipeline and construction of ESR in sensitive locations like schools, hospitals, religious, cultural and tourist locations	• Increase noise levels due to movement of heavy vehicles and construction equipment • There will be disruption to the movement of vehicles • Increase in Dust levels due to earth work or replacement of pipe • There will be noise pollution hampering classes and lectures. • Landscape degradation and uneven dug surface will have possibility of accidents. • Disruption of water supply to the consumers during implementation	• Priority work planning in sensitive location • Limit hours of operation in sensitive zones during peak service hours. • Hospitals need special planning for emergency management • Laying of pipeline in alternate street, if possible, to avoid traffic disruptions and commuting problems • Install speed breaker and signages near settlements • Hoardings and signboards intimating the temporary nature of inconvenience • Construction activities to be scheduled carefully to minimize the impact of noise from construction machinery during school hours. • Barricades, temporary noise control measures and dust suppression measures through watering	Contractor & Operator	ULB/SPV
8.	Laying of pipeline and construction of ESR in commercial areas	• Loss of livelihood for vendors • Limited access to small shop and low sales	• Adequate provision for space shall be left so that the pedestrians have access to shops and local service providers • Immediate cleaning up of debris as part of planned process • Alternative livelihood planning to compensate or the temporary loss of livelihood	Contractor & Operator	ULB/SPV

9.	Construction of any nature and in any location	• Safety hazards and accidents
		• Occupational Hazards in all construction sites including health impacts due to absence of proper housing and sanitation facilities in labour camps
			• Fencing of the excavation site and providing proper caution sign boards
			• Protective measures to workers as per occupational and safety norms
			• Develop women sensitive work conditions with toilets blocks catering to women's needs
			• Include creches in worksites.
			• Develop and implement site-specific Health and Safety (H&S) Plan which will include measures such as:
			  • *excluding public from the site;*
			  • *ensuring all workers are provided with and use Personal Protective Equipment (PPE);*
			  • *health and safety Training for all site personnel;*
				Contractor & Operator	ULB/SPV

Sr. No	Project Activities	Impacts	Mitigation Measures	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(4)	(5)	(6)
			• *documented procedures to be followed for all site activities; and* • *documentation of work-related accidents;* • *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; • Training of workers on safety and health and set down rules and regulations of all new workers at the site, personal protective protection and preventing injuring to fellow workers. • 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; and		
10.	Focus on cultural properties	• Access to any of the cultural properties is severed during construction;	• Immediately after completion of construction, the Contractor will affect clearance of the precincts of cultural properties. • Access needs to be restored at the Contractor's cost.		
Operations/Sustaining Phase					

Sr. No	Project Activities	Impacts	Mitigation Measures	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(4)	(5)	(6)
11.	24X7 Continuous Supply of Water During Operation	• Disruption in water supply leading to inadequacy • Generation of Additional Quantity of Wastewater from the Zones leading to contamination of surface / sub-surface sources • Flooding of Low Lying Areas due to overflow of storm water drains • Occurrence of chlorine intoxication if water is over chlorinated during treatment	• Ensure alternate drinking water supply through tankers. In case of Contamination and/or shortage of Water • Involve ward level women's groups like SHGs and Neighbourhood Groups in monitoring. • Measures for water removal though pumping in case of flooding • Ensure implementation of Health & Safety Management Plan (ECOP for public and workers safety. • Ensure implementation of water quality Management (Eco for better water quality • Create awareness on precautions/preventive measures to be taken up in case of over chlorination.	Operator	ULB/SPV

Chapter 1. Introduction

The Karnataka Urban Infrastructure Finance Corporation (KUIDFC) on behalf of the Government of Karnataka is preparing the Karnataka Urban Water Supply Modernisation Project (KUWSMP). The project involves modernizing water supply systems and capacity for providing continuous piped water supply in the project cities. The project will be implemented in the three cities Hubli-Dharwad, Gulbarga and Belgaum in the state of Karnataka in India. The cities are 2nd, 4th and 5th biggest cities of the state by population and are located in the arid / semi-arid northern region of the state. Geologically, all the three cities are located in the Deccan Plateau and are known for their limited water resources (both surface and sub-surface). The project by virtue of the proposed water supply improvements would lead to positive improvements in the quality of water delivered to the consumers and associated health improvements due to reduced incidences of water borne diseases. To deal with environment land and social issues arising out of KUWSMP, Environmental and Social Assessments were conducted in the three cities and an ECoP and a Resettlement Policy and Framework (RP&F) is also prepared based on the assessments. This document describes the environment and social concerns of the Project and presents the principles and approach to be followed in minimizing and mitigating adverse environment and social impacts caused by construction of water supply schemes under the project.

1.1 Project Background

In 2003, Government of Karnataka (GoK) with assistance from the World Bank launched Karnataka Urban Water Sector Improvement Project (KUWASIP) for providing a continuous water supply (24X7) to address issues of poor quality, intermittent supply, illegal connection and supply of contaminated ground water. The State Government selected five demonstration zones in three project towns of Hubli Dharwad, Belgaum, and Gulbarga to pilot the 24X7 urban water supply (UWS). The project envisaged setting a policy, institutional and regulatory environment in the urban water sector, enabling service improvements, sustainable investments and coverage expansion. The project was successfully implemented and closed on 31st March 2011.

Based on the success of the project and with the support from the local communities, City wise scale up has been proposed through World Bank funding. The total project cost is for all the three cities is estimated at about 1809 crores in INR or $ 279 million in US. This up scaling project for the identified cities known as “Karnataka Urban Water Supply Modernization Project” (KUWSMP) has been approved by the GoK and includes setting up of city level utilities (SPV) and hiring of an Operator to identify and implement investments that will ensure delivery of continuous water supply in the project cities. The activities of the operator will include the following.

- Augmentation / development of water sources
- Rehabilitation of existing or laying of new transmission line(s),
- Rehabilitation or expansion or new water treatment plant(s)
- Development and / or expansion of pumping station(s)
- Renovation or rehabilitation or construction of new service reservoirs (underground or over-ground)

- Replacement and /or extension of distribution network
- Replacement and/ or provision new house service connections.

The project will finance, amongst others, physical investments in the water supply system to facilitate continuous water supplies (Component 1) along with the systems, procedures and equipment that will build the institutions to sustainably deliver those improved services (Component 2).

Component 1 - Capital Investment Program

Capital Works: These include bulk capacity augmentation; enhancing capacity or resilience of transmission/feeder mains; treatment plant renovations/capacity enhancement; pump station upgrades; service reservoir improvements; distribution network sectorization, pipeline rehabilitation/replacement; water meters for bulk supplies and consumer consumption; replacement of house connections; and new connections to low income households.

Service Improvement Plan: The Operator will prepare and implement a Service Improvement Plan (SIP), approved by the Client, which will set out the needed investments for capital works and utility systems & equipment. The initial SIP will be prepared during the Start Up Period and will be updated annually to capture new and better quality data. An Expert Reviewer will advise on the suitability of, and any amendments required to, the SIP.

Construction Management: The Operator will act as the Client's Construction Manager for implementing the SIP and will contract with third party contractors for delivery of the agreed capital works and the systems & equipment. A Technical Auditor will certify payments to be made by the Construction Manager.

Component 2 – Institution Building

SPV set up and operations: This will finance costs associated with operationalizing the SPVs including (i) preparation of institutional staffing, training and delegation plan; (ii) office equipment (iii) staff training costs and (iv) incremental operating costs during the project period.

Systems and Equipment for Service Delivery: This will finance all the systems and equipment needed to establish well-run service delivery arrangements at the city level including computer systems (MIS, GIS, Billing and Collection, Call Center, CMMS), preparation of Standard Operating Procedures, and purchase of operational equipment and vehicles.

Partial payment of Operator Fees during the transition period: The project will finance 50% of the operator fee during the transition period as a result of the additional costs incurred at this time due to intensive staff training, capacity building, and heavier operating costs (especially for leakage control). These important activities will allow the operator to turnaround and stabilize service delivery in readiness for the Sustaining Period.

Component 3 – Technical Assistance for Sector Development

The project will support activities aimed at further developing the urban water sector in the State.

Preparing a State Urban and Rural Water Supply and Sanitation Strategy: The study would cover policy, service delivery arrangements, performance standards, regulatory requirements, investment needs and sector financing.

Developing Low Cost Sanitation approach in project cities: The study would look at national, regional and international experiences and would include preparation of detailed designs for pilot implementation in each city.

Project Impact Evaluation: This would assess the impact of providing continuous water supplies at both the household level and the city level.

Improving Social Accountability: This would support implementation and routine capture of consumer feedback on the quality of WSS services in each city and make it available on line for easy access by all stakeholders.

Improved dam management: Preparation of Operation and Maintenance Plans and Emergency Preparedness Plans for the five dams providing water to the three cities and considered Large Dams under the Bank's policy "Safety of Dams" (OP4.37).

Component 4 - Project Management

This component finances activities to ensure efficient and effective project implementation. This includes, among others, equipment to establish PMU/PIU offices, consultants to support technical evaluations, third party monitoring, expert reviewer, safeguards and fiduciary auditing, construction quality assurance, communications and others.

1.2 Hubballi-Dharwad City and the proposed project

Hubballi-Dharwad (Hubli, name changed on 1st November 2014) is the second largest urban center in the state and the largest center for trade and commerce in North Karnataka region. Geographically Hubballi is situated at 15° 20'N latitude and 75° 13'E longitude and Dharwad is situated at 15° 25'N latitude and 75° E longitude. The altitude of the twin cities varies from 764 m to 593 m with Dharwad being at a higher elevation and comprises in 67 Municipal administrative wards with a total area of 202.28 sq.km

Water to the Hubballi and Dharwad Cities is supplied from two sources: 33.14 MLD of water is supplied from Neerasagar Reservoir situated about 23 kms from the Hubballi, around 71 MLD of water is supplied from the Renukasagar Reservoir located at around 42 kms from Dharwad and 8 MLD of water is supplied from Bore wells.

Hubballi-Dharwad is had an underground sewerage system since 1950. It is reported that the existing sewerage system is very old and laid in mid-seventies. The existing system is presently maintained by HDMC. It is learnt that the sewage collection system is partly in working condition. At many places, sewer lines are reported to be choked.

Detailed studies were carried out to understand the physical and capital investments required for providing continuous water supply to Hubballi-Dharwad in Sept 2012 and the study has identified the following key activities for the city.

- The raw water gravity main from the reservoir to the pump house at Dharwad of 1.4 km length (750 CI) is very old and has exceeded its design life and hence a new line has been proposed

- The raw water rising main from the pump house to the WTP of length 2.225 kms comprises of the old 675 HS line laid in 1955. Hence it is proposed to replace the balance length of 2.225 kms with 762 mm diameter MS.
- Clearwater reservoir of 4 ML and 5 ML exists which are over 40 years old and in average to poor condition. It is proposed to construct a new reservoir and discard the old one.
- Further to this a clear water transmission (gravity) line of 660 HS exists towards Hubballi. Of this a small stretch of new line has been laid within Hubballi (from the Airport to Hosur) of 660 mm diameter MS. It is proposed to replace the old line with 813 mm diameter MS upto the airport.
- A new raw water transmission line of 1644 mm diameter MS from Saundatti to Amminbhavi WTP is proposed to cater to the additional and future raw water requirement.
- New WTPs of a total capacity of 186.73 MLD is proposed at Amminbhavi to cater to the additional and future clear water requirements over the design period.
- Additional clear water storage of 43 ML is proposed at Amminbhavi over the design period.
- A new Clearwater pump house to accommodate the additional pumps to cater to the additional capacity is proposed at Amminbhavi.
- A new line of 1294 mm diameter MS is proposed from Amminbhavi to Hubballi to cater to the additional future demand.
- A new line of 1168 mm diameter MS is proposed from Amminbhavi to Dharwad to cater to the additional future demand.
- Proposed Treatment plants at Amminbhavi – 10 acres (6.7 ha)
- Mechanical Components and Equipment needs to be replaced. It is proposed to provide better water quality by rehabilitating water treatment equipment.
- Hubballi parallel pipe of 1294 mm diameter MS is proposed to be laid to cater to the additional and future demand of the city
- Majority of the Clearwater transmission / feeder lines within Dharwad city are old and have been discarded as they are old and have lost strength.
- Pipe of 1168 mm diameter MS is proposed from Amminbhavi to Dharwad to cater to the additional and future needs of the cities.
- A total of 50 water distribution zones and 3 bulk zones have been proposed for Hubballi-Dharwad of which ten (10) new locations have been identified for complete coverage of the entire project area. New phase wise constructions have been proposed for 15 new GLSRs and 15 new OHTs upto the year 2041.
- About 2100 km of distribution line is proposed to be re-laid.

1.3 Environmental and Social Assessment (ESA)

Environmental and Social Assessment (ESA) has been carried out to integrate environmental and social concerns with project design, identify potential adverse environment and social impacts during different phases of the project implementation (pre-construction, during construction and post construction) and recommend mitigation measures, complying with environmental and social safeguard policies of the World Bank, Government of India, and Government of Karnataka.

1.4 ESA Objectives

Within the broad framework of mitigation of the adverse influences in the environmental and social domains of the ensuing water supply project influences through ESA, the broad objectives are:

- Identification of key social and environmental issues associated with the proposed water supply augmentation (24x7 water supply) such as rehabilitation works to be implemented at the pre-construction, construction and operation phases of project.
- Identification of the positive and adverse impacts of sub project activities on physical and social environments.
- Propose suitable mitigation measures for potentially adverse environmental and social impacts, and measures for enhancement of positive impacts. This will be attained through a comprehensive Environmental and Social Assessment Studies and preparing "Environmental Code of Practice" that will ensure sound environmental and social management in the project and preparing specific Environmental and Social Management Plans.
- Detail out roles and responsibilities of various agencies involved in carrying out the proposed action plans.

In addition to the above mentioned objectives, ESA will also suggest additional detailed environmental and social studies / activities that may be required to be carried out to ensure sustainability and monitoring of ESMP.

1.5 Methodology and Approach to ESA.

The approach in carrying out the ESA has been a mix of technical as well as participatory exercise. A comprehensive approach and methodology, with a step-wise approach, has been adopted to develop the Environmental and Social Management Plan for project area which is shown in Figure 1.1.

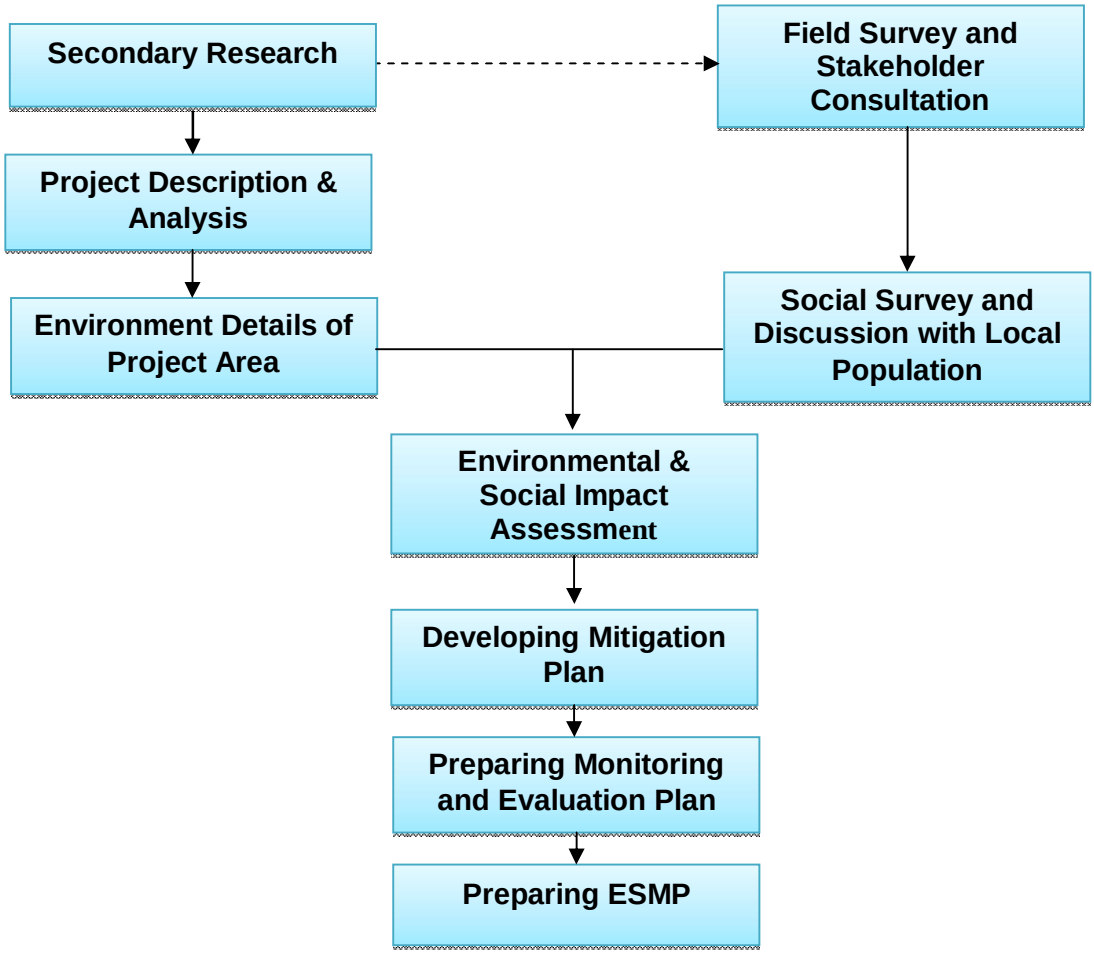


Figure 1.1: Flow diagram of Approach and Methodology

The steps have been elaborated as follows:

Step 1: A comprehensive policy & regulatory review at national & state level has been carried out by summarizing the applicable policies and regulations. Applicable Safeguard policies of the World Bank have also been reviewed & summarized.

Step 2: Secondary and primary data collection and analysis. All the relevant data from secondary sources has been presented geographically & in database format. Identification of issues with different attributes has been further confirmed through stakeholder consultations and selected ground truthing. This leads to identification of issues, causes and broad level impacts.

Step 3: Extent and level of impacts has been assessed by using trend analysis, outputs from the earlier studies.

Step 4: Based on the impact analysis of adaptive and mitigated activities has been formulated and the Environmental and Social Management Plan (ESMP) has been devised.

Step 5: A monitoring and evaluation (M&E) plan including a list of key environmental and social indicators for monitoring at various levels has been prepared.

Step 6: An institutional assessment has been carried out and outputs of steps 4 and 5 have been mapped with respective institutions so that 'roles' and "responsibilities" for implementation are assigned during implementation.

1.6 Scope of ESA

A. Environmental Assessment will encompass the following:

Review of the key activities undertaken in pre-construction, construction and post construction phase and initial design of proposed 24x7 Water Supply Systems. The study includes review and analysis of available engineering reports. The outcome is further strengthened by discussions with various stakeholders (KUIDFC, KUWSDB, ULBs, design consultants, transaction advisors) and is inter-linked to various environmental aspects.

Detailed Environmental Profile of the project city: The available secondary information and primary monitoring / investigations with regards to the physical, biological and socio-economic conditions are collected and analyzed. The outcome includes basic demographic and socio-economic characteristics, existing water supply situation, status of other related infrastructure (wastewater, solid waste, drainage, roads, ground water, etc.). It also describes physical environmental profiling considering air, water, noise, soil quality, attributes at different locations; ecological profiling in terms of aquatic / terrestrial flora and fauna and other environmental features in project areas. This section also entails mapping of physical feature and environment attributes.

Assess base line water quality and health profile of project city: This includes primary sample survey to assess water quality at critical locations of water supply network like source, treatment plant, service reservoirs and consumer points especially in slums and determining associated health impacts of water quality. It also entails soil sampling and inventory of possible locations of cross contamination or leakages duly correlated with existing drainage network.

The health profile and other household information of project city: from available secondary information and adequate primary household surveys, collected and analyzed.

Stakeholder consultations (jointly carried out along with other activities of social assessment) to understand the key environmental, social and health issues associated with current water supply systems and proposed project interventions to guide formulation of EMP. Stakeholder Consultation was conducted in the city for identification of issues, impacts and their mitigation **Policy, Regulatory and Institutional Framework:** the environment management plan, its implementation and monitoring is to be reinforced by incorporating all applicable operational policies of the World Bank and environmental laws / regulations in India. It includes review policies, laws and acts regarding environment and analysis of institutional framework in terms of agencies involved in planning, designing, operating and maintaining the project activities and the relevant regulatory agencies, so as to assess

- the capacity,
- willingness and
- resource requirement of the institutions for effective integration / management of environmental aspects

Identification and analysis of key environmental issues: this includes analysis of the base line environmental data collected from various departments in terms of changes in the physical, biological or socio-economic environment and other negative and positive impacts likely to result

from the proposed project improvements. It also covers provision of broad alternatives for various sub-components, choices of sites and identifies issues of particular concern for each such alternative / intervention regarding augmentation of water sources, its reliability and sustainability, location and; operation of water treatment plants, pumping stations -

Environmental Management Plan (EMP): The environmental management plan included (a) the recommended mitigation actions and management plan for the potential negative impacts identified; (b) the measures (prevention, mitigation and compensation) complying with the nature, scale and potential of the anticipated environmental impacts; (c) monitoring and supervision plan; and (d) defining roles and responsibilities of all agencies involved (contractors, the project implementation and monitoring agencies).

The measures to be included are both structural and non-structural measures.

The structural measures could comprise of

- Appropriate changes in the designs,
- Protection of physical entities to minimize impacts on ecology and hydrology.

The Non-structural approaches could include

- Construction schedules designed to minimize conflicts and
- Training agencies in principles and methods of environmental protection.

B. Social Assessment will include the following

The scope of work for social assessment will include the following

Review of the experiences from the predecessor project in the demo zones through stakeholder's consultations involving communities and other stakeholders. Experience sharing consultation with ULB staff and officials, elected members - past and present- of the ULBs, staff of Urban Water Supply Board, media, prominent institutions, NGOs, health institutions/service providers etc.

Review of reports on demo zone including (a) Project Appraisal document; (b) Implementation Completion Report; (c) Rapid social assessment and communications strategy; (d) M&E reports; (e) impact assessment study; (f) IEC materials; (g) land acquisition framework; and (h) resettlement action plans.

Socio Economic Profiling: Socio-economic profile includes different caste/religious groups (the dominant and marginal groups), socio-economic profile, occupational categories, gender relations, etc. It also covers analysis of geographical spread of the ULB and its relationship with socio-economic composition of the society with special emphasis on gender analysis.

Baseline survey of sample house holds for key parameters socio-economic profile, current service levels, coping costs, health parameters, an assessment of willingness to pay and ability to pay.

Indigenous people: Identify any indigenous people; examine the applicability or otherwise of the Bank's Operational Directive on Indigenous Peoples (OP 4.10). If the policy is found applicable on indigenous group, prepare a tribal development plan that meets the requirements of Bank policy.

Land Acquisition Requirements: It covers review exiting R&R framework and update in consultation with KUIDFC. Identification of land acquisition requirements and develop the process and framework for land acquisition, compliance with provisions of the Bank's OP/BP 4.12 on

involuntary resettlement. For land acquisition which may take place in the first eighteen months, the consultant will prepare Resettlement Action Plan , following the Projects Resettlement Policy Framework (RPF) , OP 4.12 and new LA and R&R Act 2013.

Stakeholder Consultations: It covers primary stakeholders, NGOs, CBOs, elected representatives, ULB officials, other Government departments, eminent citizens, other opinion makers and the general public. Stakeholder Consultation includes: (a) semi structured interviews, (b) PRA methods, (c) direct observation, (d) focus group discussions, (e) sample surveys of households and (f) secondary literature review.

Resettlement Policy Framework :

Outlines Resettlement Action Plan (RAP) addressing key social issues; presents entitlement matrix for the project, poverty / gender / tribal development frameworks; road map for carrying out specific social Assessment and Rehabilitation Action Plans for each of these activities, Terms of Reference for preparing these RAPs.

Resettlement Action Plan (RAP):

This includes Resettlement Action Plan (RAP) addressing key social issues, land acquisition; entitlements as per SMF and also poverty/gender/tribal development plans as required for the project.

Chapter 2. Study Area and Project Description

2.1 Hubballi Dharwad City and its characteristics

Hubballi-Dharwad (earlier name Hubli-Dharwad), name changed on 1st Nov 2014) is the second largest city of the state of Karnataka. Geographically project city Hubballi lies between 15° 20'N 74° 5'E and Dharwad lies 15° 25'N 75° E. The altitude of the twin cities varies from 764 m to 593 m with Dharwad being at a higher elevation and comprises in 67 Municipal administrative wards with a total area of 202.3 Sq.km which is shown in **Figure 2.1.**

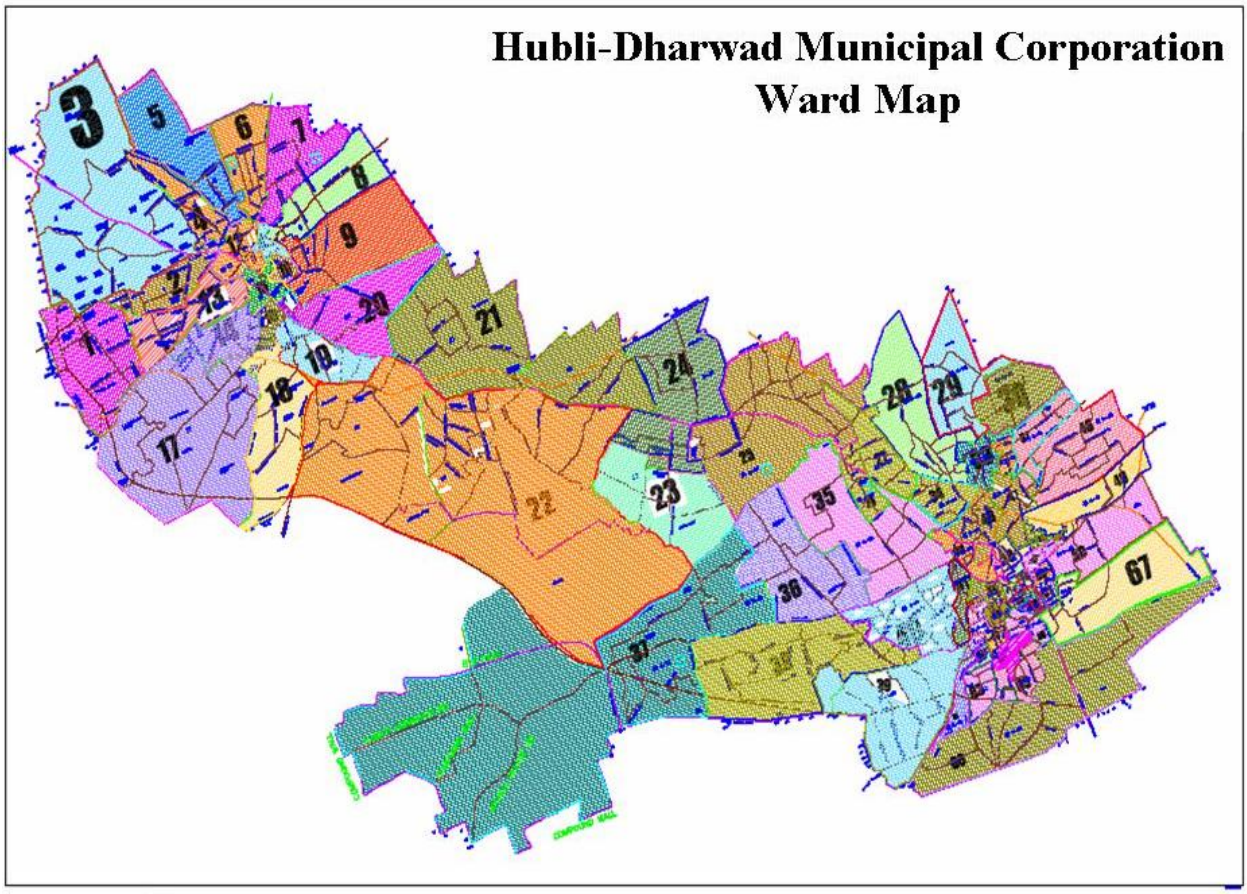


Figure 2.1: Location Map

Table 2.1: Fact File

Sr. No.	Attributes	
1.	Population 2011	9,43,788
2.	Total no. of households	2, 00,418
2.	Area Hubballi-Dharwad Municipal Corporation	202.28 sq. km
3.	No. of Wards	67
4.	Population Decadal Growth rate (2001-2011)	20.07%
5.	Population Density (2011)	4666 person per sq.km
6.	Literacy Rate	77%
7.	Sex Ratio	989
8.	Economy	Small and medium industries hub with

Sr. No.	Attributes	
		more than a lakh small and medium industries

(Source: Census 2011 and ULB records)

The city is divided into 67 Municipal administrative wards, the area and population is presented in Annexure 4.

2.1.1 Population

In 2011, the total population of HDMC was 9, 43,778. The city has experienced a low population growth during the last three decades (22.99 percent from 1981 to 1991, 21.24 percent, from 1991 to 2001 and 20.007 percent, from 2001 to 2011), compared to 52.54 percent decadal growth rate in the 1961-71, inspite of being the second largest urban center in the state and the largest center for trade and commerce in North Karnataka region.

In 2011, the total population of the city was 943788. Population ranged from 6051 (ward no. 49) to 31796 (ward no. 54). Analysis of population distribution (ward wise) showed that ward numbers 54, 40, 43, 11, 51, 50 and 42, were most populated, while ward number 60, 59, 44, 39 and 25 were least populated.

Table 2.2: **Population growth trends and density-Hubballi-Dharwad**

Year	Population	Growth Rate (decadal - %)
1951	196180	
1961	248561	26.70
1971	379166	52.54
1981	527108	39.02
1991	648298	22.99
2001	786018	21.24
2011	943788	20.07

Source: Census of India, 2011

2.1.2 Economy and Industry

Hubballi-Dharwad region is emerging as small and medium industries hub with more than a lakh small and medium industries. The Government of India has set up a software technology park on Pune-Bangalore Road or NH-4. The Government of Karnataka has setup Arya Bhatta Tech Park in Navanagar region of Hubballi, which is occupied by IT and IT-services related companies. It also has a cotton mill which is the official producer of the Indian National Flag. The small and medium industries include machine tools, electrical, steel furniture, food products, pharma, rubber and leather industries and tanning industries. The city has a manufacturing unit of TATA Motors in Belur industrial area. The city also has a diesel loco shed set up by Indian railways. Major companies/industries present in Hubballi are Tata Marcopolo, Kirloskar Group, Spicer India, JMT Auto, Apex Auto, Hindustan Petroleum, Murdeshwar Ceramics, Weir-BDK, VRL Group, Sankalp Semiconductor, Universal Group of Industries and Microfinish Valves.

2.1.3 Road

Hubballi is connected by road to all major cities of Karnataka state and also to neighbouring Maharashtra and Andhra Pradesh states. The major road linkage is the National Highway number 4 connecting Pune and Bengaluru which cuts through the city. Other major roads are the Sholapur / Bijapur Road, Gadag Road, Karwar Road, Sulla Road, Haliyal Road and Goa Road. Daily bus services from Hubballi and Dharwad bus stands are available for Mumbai, Pune, Belgavi, Kolhapur, Goa, Hospet, Sirsi, Bhatkal, Bangalore, Mangalore, Mysore and almost all other cities and towns in Karnataka and neighbouring States. The length of the type of roads is Cement Concrete 102 km, Black Topped 445 km, Surface Roads 1553 km and total length of the road is 2100 km

2.1.4 Rail

Hubballi is a major rail junction on the Mumbai to Bangalore route and for trains to Bijapur & Hospet. Hubballi is also well connected to some places like Vasco da Gama & Margao in Goa. Hubballi is an important junction in the rail route between Bangalore and Goa. Both Dharwad and Hubballi are linked by road and rail facilities with other parts of the country.

2.1.5 Air

Air connectivity at Hubballi - Dharwad is available with the Airport located towards the West of Hubballi. Direct Flights are operational to Bangalore, Mumbai and Hyderabad. The Hubballi Airport is currently under up gradation and expansion and currently additional lands have been acquired for this purpose.

2.1.6 Tourism

Chandramouleshwar Temple is very near to Unkal circle and Unkal Lake (on Old NH4 between Hubballi and Dharwad). It is on old Pune – Bangalore highway NH4, about 3 km north from Hubballi city centre.

A fort which was built in 1904 over the area of about 76 acres is located on highway NH4, about 15km from Hubballi city centre. The famous Durgadevi temple is also situated in this area.

2.2 Current Water Supply System

The section presents existing situation of water supply in the Hubballi-Dharwad cities. The sector presents analysis of existing water availability, water source, transmission and distribution system, treatment plant, service reservoirs and consumer connections. Data is derived from Detail Project Report prepared on Water Supply by Tata Consulting Engineers.

Currently about 103.73 MLD of total water supply and per capita supply is 109 lpcd is supplied to Hubballi-Dharwad City mainly from two sources namely, Neersagar Reservoir, Renukasagar Reservoir. Numbers of interventions are proposed within the city in place of existing water supply infrastructure all pipe lines will be relayed at the old pipe line place.

*(Availability of water supply system was analysed and as presented in **Annexure V**)*

2.2.1 Source of Water Supply & Sanitation System

The existing water supply to Hubballi and Dharwad twin cities is mainly from two sources viz. Renukasagar Reservoir and Neersagar Reservoir. Thus the main source to Hubballi & Dharwad twin cities is surface water. However, for some of the areas in the cities the source of water is ground

water. Hubballi Dharwad Municipal Corporation owns many bore wells; either with hand pump or with power pump in the twin cities and about 8.0 MLD of water is extracted and supplied from these bore wells. In addition to these, number of private bore wells and open wells also exist in the cities. Bulk water is also being supplied from villages (raw water) between Saundatti and Amminbhavi from Malaprabha Water Supply Scheme (MWSS) and Kundgol Town (treated water) from Neersagar Water Supply Scheme (NWSS).

1. Malaprabha Water Supply Scheme (MWSS)

Malaprabha water supply scheme source is Renukasagar reservoir, located on Malaprabha River near Saundatti. It is about 53 km from Hubballi and 42 km from Dharwad. Raw water is pumped from the jackwell to the WTP, Amminbhavi at a distance of 30 kms. Most of the infrastructure presently being used under MWSS has been constructed in mid-2000 and completed by 2010.

2. Neersagar Water Supply Scheme (NWSS)

The source of the Neersagar Water Supply Scheme is Neersagar Reservoir on Bedti Nala, located near Dhumwad Village. The Neersagar Reservoir is located towards the South-West of Hubballi - Dharwad at a distance of about 23 kms from Hubballi and 17 kms from Dharwad. This is the old scheme which has been in operation for more than 55 years.

The NWSS consists of a Neersagar reservoir, jack well / intake, raw water transmission (gravity) main, raw water pumping station at Dhumwad, raw water transmission (pumping) main, WTP at Kanvihonnapur, clear water transmission and distribution to Hubballi and Dharwad. The system is designed for 40.86 MLD (9 MGD) in 20 hrs. However, presently the scheme is being augmented for a discharge of about 52 MLD (47.7 MLD in 22 hrs).

3. Ground Water Source

Some areas of the city are supplied from ground water source from bore wells. 1596 bore wells out of 1814 are functioning. 1047 out of 1596 are fitted with power pumps of capacity varying between 1 HP and 12 HP. The approximate yield/supply from these bore wells fitted with power pumps is 8 MLD.

Water from bore wells supplied either through a separate distribution system or filled into a public stand post for further collection. The bore wells are operated and maintained by KUWSDB. The bore wells act as a source of water in areas where there is no network coverage (with surface source) or during non-supply days of surface water. Also most of the industrial areas promoted by KIADB are supplied through bore wells supplies due to shortage of treated surface water.

As indicated by the Authorities, the quality of ground water in Hubballi-Dharwad meets the permissible CPHEEO standards for potable water.

*(Availability of water in these reservoirs was analysed and as presented in **Annexure V)***

2.2.2 Water Treatment Plant

Hubballi – Dharwad cities are supplied treated water through WTPs at two locations, viz., Kanvihonnapur (NWSS) and Amminbhavi (MWSS).Kanvihonnapur WTP has now been upgraded to 47.7 MLD capacities. The WTP was constructed in 1955 and 1969 in two stages and has been rehabilitated recently. Most of old valves and pipes have been replaced in 2010.

Amminbhavi WTP consists of two WTPs of capacities 73.8 and 68 MLD, making it a WTP with a total capacity of 141.8 MLD. The WTP is operational for 22 hours per day. The WTP of 73.8 MLD was constructed in 2004 and that with 68 MLD has been commissioned in 2011. This WTP is at a distance of 12 kms from Dharwad and 23 kms from Hubballi.

2.2.3 Clear Water Pumping System

The clear water transmission system of NWSS from Kanvihonnapur WTP to Hubballi city is by gravity system through a 660 mm diameter HS line laid in 1955 upto Keshwapur GLSR. The total length of this transmission main is about 15.7 kms. Of this approximately 5 kms of new line of 660 mm diameter MS has been laid between the Airport and Hosur Cross in 2010. There are tapings from this line to various service reservoirs and also a number of tapings directly feeding the distribution system of many areas.

The clear water transmission system of NWSS from Kanvihonnapur WTP to Dharwad city is fed through a 450 mm diameter CI/HS rising main of length 9.3 km which was laid in 1955. However after commissioning of MWSS Stage III in September 2011 this line has been taken out of service and now water is being pumped to Dharwad from Kanvihonnapur.

The Clearwater transmission system of MWSS from Amminbhavi WTP to Hubballi city (N R Betta) is through 1168 mm diameter MS line of length 23 kms laid in 2007. Further to this, new feeder lines within the city has been laid of diameters ranging from 813 mm to 508 mm of approximately 25 kms taking a tapping from the main transmission line (1168 mm dia).

2.2.4 Water Distribution Pumping Stations

At present there are ten Distribution Pumping Stations, one each at the WTPs, five in Hubballi and 3 in Dharwad. It is proposed to use only two Pumping Stations - one at the Amminbhavi WTP and the other in Nehru Nagar in Hubballi.

2.2.5 Service Reservoirs

In Hubballi there exist 15 nos. overhead service reservoirs and 7 nos. ground level service reservoirs. In Dharwad there exist 21 nos. overhead service reservoirs and 12 nos. ground level service reservoirs. 2 clear water reservoirs in the city.

2.2.6 Distribution System

About 103.73 MLD of water is supplied to the city population. The city is divided into 67 Municipal administrative wards and the existing distribution of water is done through 17 GLSR's and 34 ESR's . Totally 40 water supply distribution zones and in addition to this many areas of the cities are fed directly from the transmission / feeder mains. The main areas where supply is directly through the transmission mains are, Tarihal, Gokul Village, the areas along Gokul Road, Hosur, Sai Nagar, Gulgangikoppa, etc.

2.2.7 Distribution Pattern

Prior to commissioning of MWSS – III, the distribution supply to the city was carried out on a 5 day cycle for a period of about 2 – 4 hours. However since September 2011 after commission of MWSS – III the supply to the city frequency to the cities has been reduced to once in 2-3 days for a period of 4-5 hrs. It was also indicated that in areas such as Old Hubballi, Tabibland, Raj Nagar (Dharwad),

Saidapur, etc. the consumers use suction pumps to draw water during supply hours due to unavailability of adequate pressure.

Majority of the distribution system comprises of PVC pipes of 90 mm, 110 mm diameter and CI pipes of 80 to 150 mm diameter. PVC and CI pipes alone comprise about 93% of the distribution network. The remaining 7% of the distribution network comprises of materials such as DI, GI, HDPE, RCC, and MS. Majority of the PVC pipes are of the age group of 10 – 15 years and the CI pipes are greater than 30 years.

2.2.8 Consumer Connections

The twin cities of Hubballi – Dharwad at present has over 109,015 connections. There are 106,238 domestic connections, 827 non-domestic connections and 1,950 nos. of commercial and industrial connections. The cities have a 24x7 water supply system for a portion of the areas one each in Hubballi and Dharwad. This scheme was executed by KUIDFC and is presently operated and maintained by a Private operator.

2.2.9 Existing Sewerage System

Hubballi-Dharwad has had an underground sewerage system since 1950. It is reported that the existing sewerage system is very old and laid in mid-seventies. The existing system is presently maintained by HDMC. It is learnt that the sewage collection system is partly in working condition. At many places, sewer lines are reported to be choked. The underground sewerage system covers about 36 percent of the total road length of Hubballi and Dharwad Township. Hubballi town has an underground sewerage system covering 35 percent of road length whereas the coverage is about 37 percent of road length in Dharwad.

In addition to the above facilities, the city population has individual sanitation facilities such as septic tanks (26,850 households) and other sanitation arrangements. It is estimated that about 165035 households (85.49%) of the total 193,034 households have sanitation facilities. The remaining 27,999 households hence would require sanitation facilities.

2.2.10 Existing Sewage Treatment Plant

At present there is no STP in Hubballi-Dharwad and the sewage generated is treated in septic tanks and discharges into nearby natural drains.

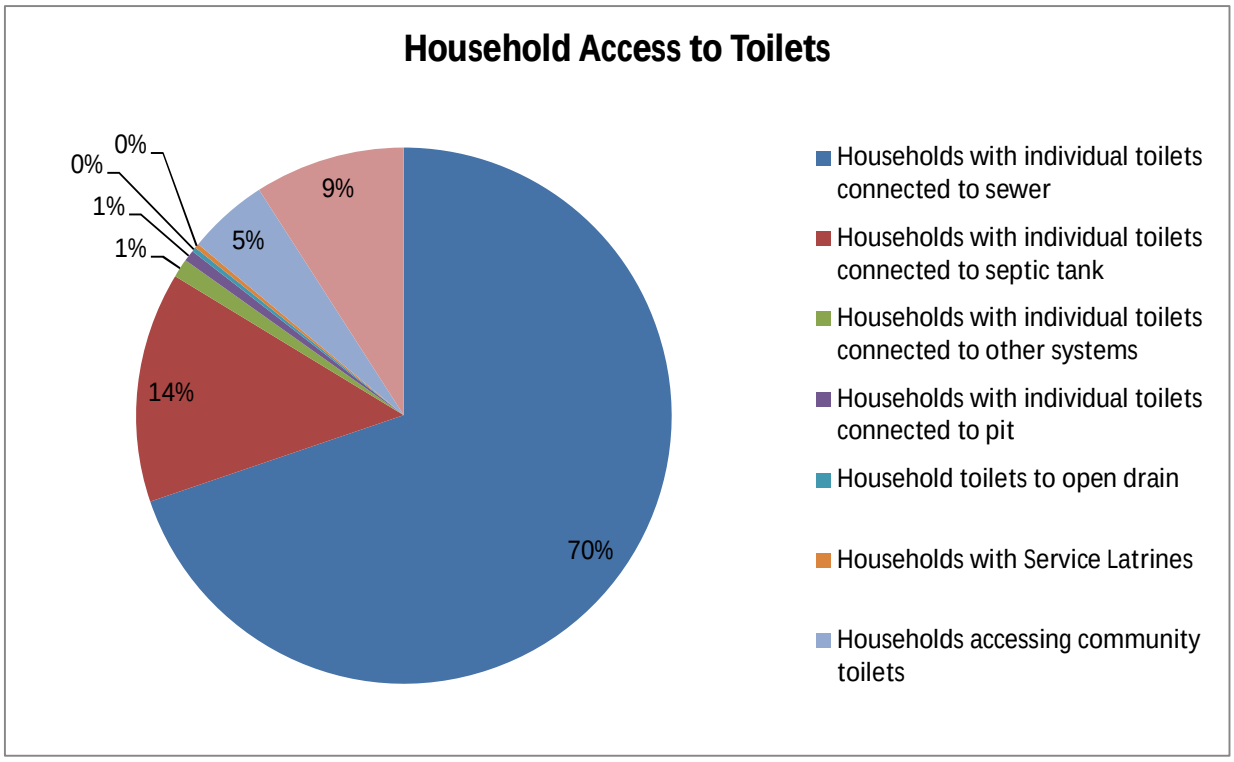
2.2.11 Proposed Sewerage System for the City

In order to improve the sewerage facilities in the city, a sewerage scheme comprising STP of 40 MLD capacity in Gabbur, Hubballi and 20 MLD capacity in Madihal, Dharwad, total of which 60 MLD as part of the ADB supported North Karnataka Urban Sector Improvement Project (NKUSIP). This project is expected to cover 9,43,788 population. The proposed system will cover additional 13% of Hubballi and 20% of Dharwad households of the city.

2.2.12 Sanitation Facilities Hubballi-Dharwad

Sanitation facilities in Hubbali-Dharwad as per 2011 census data indicate that 69.78% households are having individual toilets which are connected to sewer lines and 21.12% toilets are not connected to sewer lines. It also reveals that 9.08% households are practicing open defecation

Figure 2.2: Household Access to Toilets



Source: KUWSMP

2.2.13 Existing Storm Water System

The disposal of storm water takes place through a network of open drains. The open drains are laid along the roads long time back and most of them are earthen drains. It is reported that about 1136 km of drain is provided along the roads in the two towns. The general terrain of Hubballi and Dharwad is favorable for natural drainage. The condition of most of the roadside drains is bad as they are choked up due to solid waste dumped inside the drains. In rainy season, the flooding of these drains occurs and it creates unhygienic conditions in the surrounding areas as well as blockage of roads.

2.3 Study of Alternatives

The Project Report addressed many technical issues pertaining to the Water supply component with respect to the Existing system, its conditions, and rehabilitation requirements, necessity of additional infrastructure requirements, Project area, and water demands for various consumers like Residential, Non Residential and Industrial users.

The existing piping system in the distribution and Transmission system was analyzed with respect to the existing field conditions, present O&M practices through interactions with the concerned line man/ section officers, Laboratory test reports and its probable impact with respect to the 24x7 up-scaling was analyzed. Based on the above aspects, its probable integration with the proposed system was analyzed and accordingly conclusions were drawn. A brief summary of the design alternatives is provided below.

2.3.1 Reduced Per-capita supply

Reduction in per capita supply from normative 135 LPCD to 100LPCD including the bulk supply system

2.3.2 Improved Operational Duration

The present operational durations of pumping stations and treatment plants are about 20 hours a day. Analysis was carried out to assess the quantity improvements by increasing the operational durations of pump stations to 22 hours and 24hours a day respectively.

Bulk Quantity enhancement of the transmission main was analysed by replacing the existing pumping machinery to higher capacity pumps. The impacts on the initial capital investments and the increased O&M expenses were also analysed.

2.3.3 Distribution System Integration

It is observed that about 26% of the project cost is estimated for the distribution network improvements only. Almost all distribution pipes is proposed for replacement that was arrived based on the analysis carried out both in the site and at the laboratory and have also analysed other available options for project improvements in the Distribution system. The technology availability on pipe rehabilitation and its usage for the present scenarios were explored.

- Option-1: Complete replacement of the distribution network
- Option-2: 25% replacement of the existing distribution network
- Option-3: 50% replacement of the existing distribution network
- Option-4: 75% replacement of the existing distribution network

Emphasis was mainly on the UFW reductions, DMA formations, Pipe leakage repairs and rehabilitation etc.

*(Detailed analysis report for alternatives is provided in **Annexure I)***

2.3.4 Conclusions on alternative Studies

Various possible alternatives have been analysed for the improvements in the system both in terms of the Bulk water supply and distribution system our conclusions and recommendations are as follows:

Per-capita consumption analysis: Considering increasing economic standards of the city and community demand for adequate water supply, a per capita supply level of 135LPCD was considered for up-scaling the water supply in Hubballi-Dharwad

Bulk water supply: Various viable options of bulk improvements have been analysed with respect to the increase in hours of operation for Pumping stations and treatment plants. The possibility of overloading the treatment plants, replacements of existing pumping machinery was also analysed. Upon careful analysis of the system, it is observed that source reliability, power reliability along with the probable O&M expenses plays a major role in accepting the preferred alternative.

Under the given circumstances, the consultants feel that 20 hours operational durations of Pumping stations and treatment plants, along with equal extraction of water from both the sources would be the ideal situation for Hubballi-Dharwad city. This can also help in addressing the minimum needs of the city in the event of failure of any one of the sources.

Distribution system: Various alternatives for the existing distribution system integration have been analyzed by the consultants. Techniques for UFW reduction, pipe rehabilitation works were also studied. Upon careful analysis of the alternatives, the consultants recommend that complete replacement of the existing distribution system for the following reasons.

- Rehabilitation of the existing system has constraints such as minimum diameters, straight stretches of pipe lines, etc apart from time consuming process and may not be an

economical option. This also requires details of underground assets mapping of various utilities.

- The behavioral characteristics of the pipes when subjected to 24x7 water pressure are unknown. This may have serious impact when 24x7 system is implemented.
- The end results of the pipe network after rehabilitation depends on the quality of the workman ship and the technology involved. There are every chances of quality compromise when implemented to such a large extent.
- The residents of the area would be severely affected due to stoppage of water supply, blocking and digging of roads during the rehabilitation works.
- This aspect will be further analysed by the operator and distribution system will be re designed with optimum use / replacement of the distribution systemUFW reduction programs is a time consuming process involving formation of DMA, carrying out water balance analysis, leak detection studies, repair of leaks. This is an iterative and continuous process to be carried out until the desired levels are achieved. The time factor plays a critical role in the overall process

2.3.5 Demand Projection

The demand projection worked out as the design criteria for the project horizons year is as indicated below:

Table 2.3: Proposal for Water Demand Projection

SL No	Description	2011	2021	2026	2031	2041	Remarks
1	Domestic						As per population projection
2	Hubballi Dharwad	131.08	157.43	171.59	186.39	217.96	@135lpcd
3	Enroute Villages*	3.83	5.29	6.02	5.42	7.21	@55 lpcd
4	Kundgol Town	2.5	3.32	3.74	4.17	5.04	@135 lpcd
5	**FIRE**	3.12	3.41	3.57	3.72	4.02	As per CPHEEO guidelines
6	Industries[1]						
a	Within Project area	12.46	23.20	26.67	29.34	32.84	
b	Outside project area	0	18.66	27	37.44	55.18	
	Total (Net Demand)	152.97	211.31	238.58	267.48	322.24	Without losses
	Clear Water Demand*	165.72	228.92	258.4	290.07	350.04	**10% distribution losses**
	Raw Water	178.92	247.15	279.04	312.84	376.89	**5% WTP and**

[1] TCE Design Report

SL No	Description	2011	2021	2026	2031	2041	Remarks
	Demand						**Transmission losses**

(Source: Table 78, page 87, Project Report- Final, Karnataka Urban Water Sector Improvement Project- Upscaling 24x7 Water Supply To Cover Entire Corporation – Hubballi-Dharwad; Tata Consulting Engineers In association with SREI Infrastructure Finance Ltd.)

2.3.6 Source studies

The population of the Hubballi-Dharwad cities and Kundgol town is expected to reach 14,14,776 by the year 2031 and 16,51,827 by the year 2041 as per population projections. The present treated water requirement for twin cities and Kundgol town is 166 MLD. This demand is expected to reach 228 MLD by the year 2031 and 289 MLD by the year 2041. The present supply capacity is about 115 Mld (41 MLD + 74 Mld) from surface sources and about 8 Mld from ground water source. There is a need for augmentation of present water supply system to take care of immediate as well as future water demand of the city. Considering transmission and treatment plant losses of 5% the raw water requirement to meet the water demand by the year 2041 is 312 MLD (114 Mcum per year). In addition to city requirement, bulk raw water is also being supplied to the enroute 8 villages between Saundatti and Amminbhavi from existing Malaprabha Water Supply Scheme (MWSS). The enroute village population will be 1,31,092 by the year 2041 and the raw water requirement is 9 MLD. The total raw water requirement of City, nearby Industrial areas, Kundgol town and enroute villages is 377 MLD (138 M cum per year) by the year 2041.

The project proposes to utilize 43.33 MLD of water from Neersagar reservoir and 58.73 MLD from Renukasagar reservoir to meet future water requirements of the city. Availability of water in these reservoirs was analysed and as presented in **Annexure V**, 312 MLD of water is available to meet the requirements of Hubballi-Dharwad.

2.3.7 Water Treatment Plant

The water treatment plant requirements are worked out based on the demand estimation. The existing treatment facility available has been reviewed and phase wise requirements of WTP have been worked out and the details are as Indicated in Table given below

Table 2.4: Treated Water Demand for the Hubballi-Dharwad City

S. No	Water Treatment Plant	Years				
		2011	2021	2026	2031	2041
WATER TREATMENT PLANTS – EXISTING(MLD)						
	NWSS					
1	Kanvihonnapur	41.17	41.17	41.17	41.17	41.17
	MWSS					
2.	Amminbhavi (MWSS-EIWSS)	63.74	63.74	63.74	63.74	63.74
3.	Amminbhavi (MWSS III – Ph 1)	58.73	58.73	58.73	58.73	58.73
A	**Sub Total**	**163.63**	**163.63**	**163.63**	**163.63**	**163.63**

WATER TREATMENT PLANTS – PROPOSED (MLD)						
1.	Amminbhavi (MWSS III – Ph 2)	58.73	58.73	58.73	58.73	58.73
2.	Amminbhavi (MWSS IV – Ph 1)	-	64	64	64	64
3.	Amminbhavi (MWSS IV – Ph 2)	-	-	-	64	64
B	**Sub Total**	**58.73**	**122.73**	**122.73**	**186.73**	**186.73**
WATER TREATMENT PLANT CAPACITY – TOTAL (MLD)						
	Total(A+B)	**222.36**	**286.36**	**286.36**	**350.36**	**350.36**

(Source: Table 90, page 107, Project Report- Final, Karnataka Urban Water Sector Improvement Project- Upscaling 24x7 Water Supply To Cover Entire Corporation – Hubballi-Dharwad; Tata Consulting Engineers In association with SREI Infrastructure Finance Ltd.)

2.3.8 Storage Capacity

Reliability on availability of water is the most important aspect of the 24*7 system. Hence it is suggested to provide about 50% of the daily requirements as the storage to be provided in the reservoirs at various locations in the system to cater to the fluctuating needs of the system. About 36% of the demand requirements are proposed to be stored in the Service reservoirs. The balance 15% is proposed to be stored in Ground level tanks near the Treatment plant areas.

Table 2.5: Storage requirements of Hubballi-Dharwad City

SI No	Description	Total Demand (MLD)	Storage Capacity (ML)	Remarks
1	Service Reservoirs	283.13	102	
2	GLR at Lakshitek	41.17	6.2	In WTP area
3	GLR at Basavankolla	309.19	48.40	In WTP area
	Total		**154.60**	

(Source: Table 96, page 115, Project Report- Final, Karnataka Urban Water Sector Improvement Project- Upscaling 24x7 Water Supply To Cover Entire Corporation – Hubballi-Dharwad; Tata Consulting Engineers In association with SREI Infrastructure Finance Ltd.)

The above approach can take care of the following fluctuations.

- Minor Disruption in the Raw water Pumping stations, treatment plants
- Fluctuations in demand

2.3.9 Pumping System

The following are of the clear water pumping stations (after WTP) in the proposed system.

Majority of the distribution pumping stations have been discarded in the proposed scheme and only two have been proposed. The clear water pumping station at Kanvihonnapur has been discarded and the entire clear water produced would be conveyed to Hubballi by gravity.

Apart from this the distribution pump houses which are would be part of the proposed scheme are the Nehru Nagar Pump house (Existing) and another near Gokul Village (Proposed). These pumping stations are proposed to be in operation only under an emergency condition wherein NWSS is non – operational and the entire water is drawn from MWSS. Hence under normal operational conditions the only locations wherein pumping will be required are at the raw water pump houses in Saundatti and Dhumwad and clear water pumping at Amminbhavi.

Table 2.6: Details of clear water pump stations

S. No.	Location	Remarks
1	Clear Water Pumping station at Amminbhavi	Existing
2	Clear Water Pumping station at Amminbhavi	Proposed
3	Distribution Pumping station at Nehru Nagar (Hubballi) (after 2031)	Existing
4	Distribution Pumping station Near Gokul Village (Hubballi)	Proposed

(Source: Table 97, page 115, Project Report- Final, Karnataka Urban Water Sector Improvement Project- Upscaling 24x7 Water Supply To Cover Entire Corporation – Hubballi-Dharwad; Tata Consulting Engineers In association with SREI Infrastructure Finance Ltd.)

2.3.10 Clear water Transmission System

Majority of the Clearwater transmission system in Hubballi has been laid recently in 2010 and have accordingly been integrated into the proposed design. However most of the clear water transmission lines within Dharwad are old and are lead jointed CI lines which are proposed to be replaced. Due to increase in the demand and formation of new zones additional pipe lines/parallel pipe have been proposed as per the design requirements.

2.3.11 Local Distribution System

The proposed distribution system network for the project area is divided into 52 zones for the equitable distribution of water. The command and capacities of the existing service reservoirs and the pressures obtained within the zones have been analyzed. New reservoirs under constructions have been considered and accordingly the requirement of additional Reservoirs has been worked out.

Accordingly 52 water distribution zones have been formed. Each zone is planned to be fed with an independent service reservoir. Suitable interlinking of the zones has been proposed between adjacent zones to for easier O&M during emergencies and repairs. The summary of the distribution pipe network is provided in table given below.

Table 2.7: Summary of distribution Network

S. No.	Summary	Length (KM)
1	Total Road Length	**1920.97**
2	Total Pipe Length proposed	**2108.12**
3	Total Existing Pipe line to be used in proposed system	**69.47**

(Source: Table 103, page 125, Project Report- Final, Karnataka Urban Water Sector Improvement Project- Upscaling 24x7 Water Supply To Cover Entire Corporation – Hubballi-Dharwad; Tata Consulting Engineers In association with SREI Infrastructure Finance Ltd.)

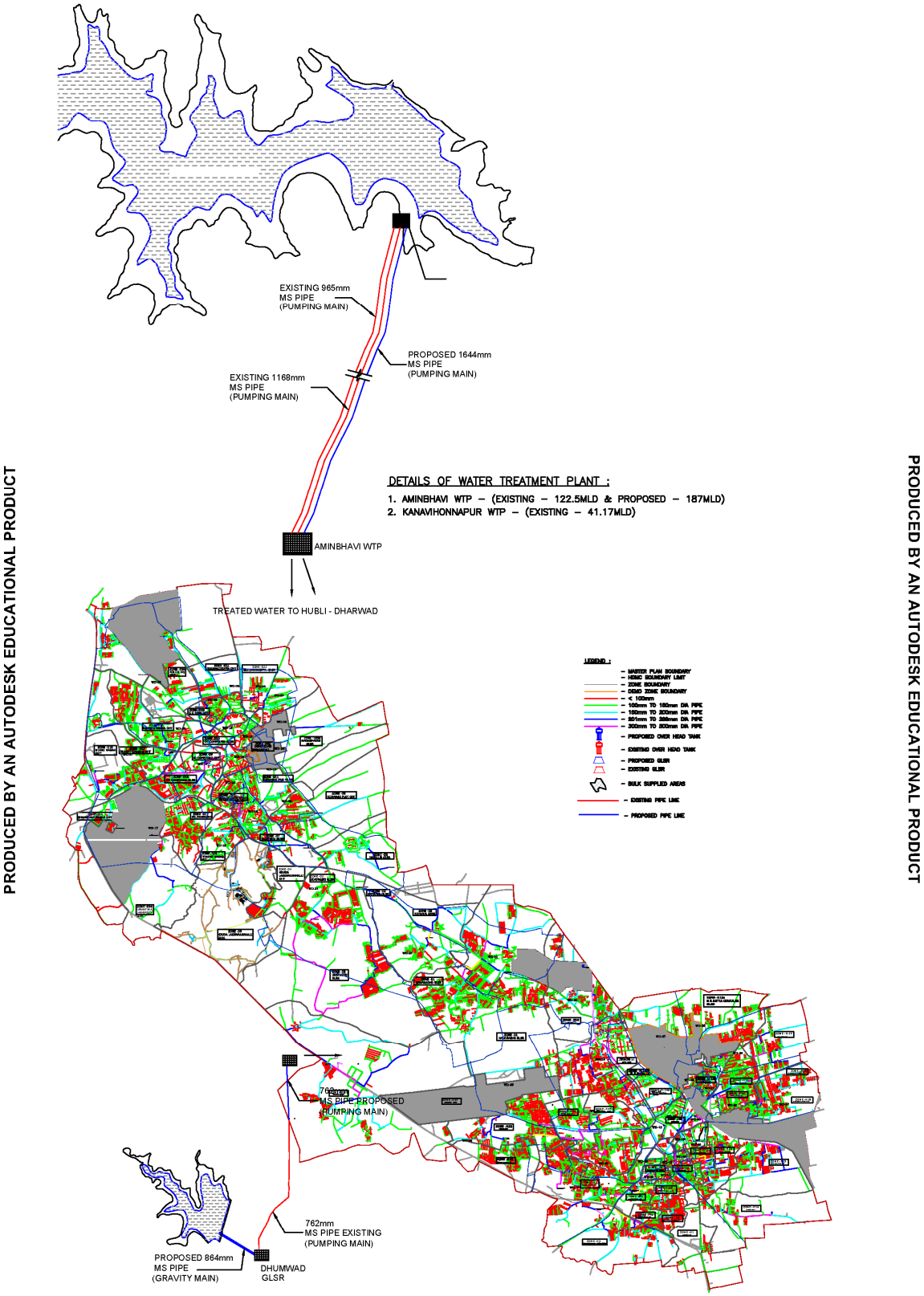


Figure 2.3: Flow Diagram of Water Supply – Existing and Proposed

2.3.12 SCADA

The SCADA system shall be used for effective monitoring of water supplied and consumed. In this contest flow meters are proposed to be installed at inlet and outlet of WTP, pumping station, reservoirs and DMA. Flow and pressure information measured at these locations will be transferred through GPRS/GSM wireless technology and will be stored at a central location. It is proposed to set up a SCADA unit at the corporation office.

Chapter 3. Legislative, Regulatory & Policy Framework

3.1 Introduction

The chapter reviews various policies, regulations and administrative framework within which "Karnataka Urban Water Supply Modernization Project" (KUWSMP) is to be implemented. It includes operational policies / directives of the World Bank, sector-specific Environmental Policies & Regulations of the Government of India and the institutional profile of various agencies such as KUIDFC, KUWSDB, Project Local Bodies, KSPCB and other bodies associated with the project.

Policy and regulatory frameworks at national and state level have been formulated to provide for social and environmental safeguards in the last two decades. The policy framework includes in particular water sector related policies and policies related to environmental safeguards, both at the national and state level. Sector policies include Constitutional Provisions, National Water Policy and State Water Policy. Environmental & Social Safeguard related policies include National Environment Policy, National Forest Policy, State's Forest Policy & National Policy on Resettlement & Rehabilitation, State Resettlement & Rehabilitation and Karnataka Urban Drinking Water and Sanitation Policy. The EIA notification of 2006 forms the basis of environmental & social assessment of water resources project in Country as well in State of Karnataka. Detailed review on various applicable policies and legislative framework has been discussed in the inception report and this section would just highlight the necessary protective measures.

3.2 Applicable Policy, Rules & Regulation to project interventions / activities: Environmental

3.2.1 EIA Notification

EIA is Guidelines for environmental impact assessment governing all development interventions that take place within the boundaries of India provided by the Government of India. EIA notification was first issued by Ministry of Environment and Forests (MOEF) in 1994 and later amended in 2002 and 2006. Under the latest EIA Notification, 14th September 2006, all projects listed in Schedule -1 of the Notification require prior environmental clearance. The objective of the notification is to formulate a transparent, decentralized and efficient regulatory mechanism to:

- Incorporate necessary environmental safeguards at planning stage
- Involve stakeholders in the public consultation process
- Identify developmental projects based on impact potential instead of the investment criteria.

As per new notification, Category A projects require submission of EIA report as per issued Terms of Reference (TOR) by national environmental appraisal committee and public consultation before getting environmental clearance from Expert Appraisal Committee (EAC), MOEF while Category B projects require clearance from State's Environmental Appraisal Committee (SEAC)/SEIAA. Since the activities currently contemplated in this project fall under the rehabilitation & modernization project, this notification appears not to be applicable. ***However, environmental and social due diligence needs to be carried out, while preparing detailed project report for rehabilitation and modernization sub components.***

3.2.2 Legal Framework of Government of India for Environmental Compliance

The Government of India has laid out various policy guidelines, acts and regulations pertaining to environment. The Environment (Protection) Act, 1986 is umbrella legislation for the protection of environment. As per this Act, the responsibility to administer the legislation has been jointly entrusted to the Ministry of Environment and Forests (MOEF), Government of India and the Central Pollution Control Board (CPCB)/ State Pollution Control Boards (SPCBs).

3.2.3 Key Environmental Laws and other related Regulations

The key environmental laws and regulations as relevant to the investments under the project are given in the table below. The key environmental regulations can also be accessed at Ministry of Environment, Forest and Climate Change (www.moef.nic.in/rules-and-regulations).

Table 3.1: Applicable Environmental Laws and Regulations

Rules & Regulation	Major Provisions	Remarks
The Environmental Protection Act, 1986	Chapter 1, Item 2 Chapter II, Item 3 (1), (2) Chapter III, Items 7, 8, 9, 11, 15, 17 Environment (Protection) Rules 1986, Item 3	Umbrella act applicable for all activities. No specific approvals / clearances required
The Water (Prevention and Control of Pollution) Act, 1974	Chapter 1, Item 2, Chapter V, Item 24, 25, 26, 28, 31, 32, 33, Chapter VII, Item 42, 43, 44, 45, 46, 48, 49 Water (Prevention & Control of Pollution) Rules 1975, Schedule IV	Applicable for the construction facilities such as labour camps, concrete batching plants, etc.
Forest Conservation Act 1980, and 1988 amendment	Item 2, 3 (A), 3(B) Forest Conservation Rules, Item 2, 6, 7, 8, 9	Not Applicable, as no forest land would be acquired
Wildlife Protection Act (1972) (as amended up to 1993)	Item (24), (14), (15), (16), (17), (23), (24), (25), (26), (27), (28), (36), (37), Chapter 3, Chapter 4, (Part I, Part II, Part III, Schedule I, Part IV), Schedule II (Part I, Part II), Schedule III, (Part IV, Part V & Part VI)	Not applicable; No protected area is close to present activity.
The Air (Prevention and Control of Pollution) Act, 1981	Chapter I, Item 2, Chapter IV, Item 19, 20, 21, 26, 28, 29 National Ambient Air Quality Standards Schedule VII of EPA Act	Applicable during the construction phase e.g. operation of batching plant if required.
EIA notification dated September 14, 2006	Rule 2, Rule 3, Rule 4, Rule 5, Rule 7, Schedule 1 (c)	Not applicable
Noise Pollution (Regulation and Control Act) 1990	Sections 3, 4, 5, & 5A	Applicable for construction activities
The Municipal Solid Wastes (Management and Handling) Rules, 2000	Item 3, 5, 7, 9, Schedule 2, Schedule 3, Schedule 4	It will be applicable during the construction phase e.g. from Construction Camp, disposal of construction debris and operation phase for the WTP sediments

Rules & Regulation	Major Provisions	Remarks
Hazardous Wastes (Management & Handling) Rules, 2008	Chapter 1, Item 2 Chapter II, Item 4 (1)	Applicable during both construction and operation phase.
National Water Policy,2012	Clause 1.3 (iv & ix), 3.1,3.2, 3.6, 5 (5.1 to 5.4), 6.1, 6.2, 6.3, 7 (7.1, 7.2, 7.3 & 7.4), 8,2, 8.3, 9.6, 10, 11.3 & 11.5	Applicable in both construction and operation phase
National Environment Policy, 2006	Sub-Section 5.2.5 (i & ii), 5.2.8, 5.2.9, 5.2.10, 5.6 & 5.7	Application is restricted for mainstreaming and not required for clearance from Competent Authority.
National Forest Policy, 1988	Clause 4.4.1 & 4.8.1	Applicable only if forest land involved; unlikely as both existing and proposed water supply pipeline are part of project, which do not pass through any forest areas
National Policy on Resettlement & Rehabilitation, 2007	Chapter 1, Item 1 (1.1), (1.4), (1.6) and (1.7) Chapter II, Item 2 (2.1) Chapter III, Item 3 (3.1) Chapter IV, Item 4 (4.1 4.2.1, 4.2.2, 4.3.1, 4.3.2 and 4.4.1) Chapter VI (6) Chapter VII (7) Chapter VIII (8.1 & 8.2)	The proposed project rehabilitation and modernization is unlikely to involve any need of resettlement and rehabilitation (R&R).
Karnataka Preservation Tree Act, 1976	Chapter 1 & 5	Compensatory action as per the act shall be done
Manufacture, Storage and Import of Hazardous Chemicals Rules 1989, amended 1994 and 2000	Part I, II Column 2, 3, 4 Schedule I, II, III, IV, V, VI, VII, VIII, IX, X	The Rules provide indicative criteria for hazardous chemicals and require occupiers to identify major accident hazards and prepare on-site and off-site emergency plans

3.3 Applicable Policy, Rules & Regulation to project interventions / activities: Social

All strategic interventions on human development, spread across all social issues, need directives of policies and legal support to operationalize the appropriate actions. These policies and legislations help to overcome the constraints and support administrator, implementer, community and individual in delivery of justice. This section includes the National policies and Acts as detailed under

3.3.1 National Policies and Acts

i. National Tribal Policy, 2006.

ii. The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013.

National Policies and Acts

The National Tribal Policy (2006)

The Policy has the following objectives:

Regulatory Protection

- Providing an environment conducive to the preservation of traditional and customary systems and regime of rights and concessions enjoyed by different ST communities, and reconciliation of modes of socio-economic development with these.
- Preventing alienation of land owned by STs and restoring possession of wrongfully alienated lands.
- Protection and vesting of rights of STs on forestlands and other forest rights including ownership over minor forest produce (MFP), minerals and water bodies through appropriate legislations and conversion of all forest villages into revenue villages.
- Providing a legislative frame for rehabilitation and resettlement in order to minimize displacement, ensure that affected persons are partners in the growth in the zone of influence, provide for compensation of social and opportunity cost in addition to market value of the land and rights over common property (NPV).
- Empowerment of tribal communities to promote self-governance and self-rule as per the provisions and spirit of the Panchayats (Extension to the Scheduled Areas) Act, 1996.
- Protection of political rights to ensure greater and active participation of tribal peoples in political bodies at all levels.

The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013.

The Act is applicable to the whole of India except the state of Jammu and Kashmir. The provisions of this Act relating to land acquisition, compensation, rehabilitation and resettlement, shall apply, when:

- Government acquires land for its own use, hold and control, including land for Public sector undertakings.
- Government acquires land with the ultimate purpose to transfer it for the use of private companies for stated public purpose
- Government acquires land for Public Private Partnership Projects.

Only Rehabilitation & Resettlement provisions will apply when:

- Private companies purchase land for a project, and the same exceeds the area thresholds set by the State Governments for such purchase.
- Schedule I outlines the proposed minimum compensation based on a multiple of market value.
- Schedule II through VI outlines the resettlement and rehabilitation entitlements to land owners and livelihood losers, which shall be in addition to the minimum compensation per Schedule I.

*(Detailed resettlement & rehabilitation policies is presented in **Annexure II**)*

3.3.2 Other legislations in the social domain applicable to construction projects

Construction stage generally involves equity, safety and public health issues. The construction agencies therefore will be required to comply with laws of the land, which include the following legislation presented in Table 3.2.

Table 3.2: Legislations applicable to construction projects

S. No.	Act	Provisions under the Act
1	Contract Labor (Regulation and Abolition) Act, 1970	The Act provides for certain welfare measures to be provided by the contractor to contract labour
2	Minimum Wages Act, 1948	The employer is supposed to pay not less than the Minimum Wages fixed by the Government as per provisions of the Act.
3	Payment of Wages Act, 1936	The Act lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers
4	Equal Remuneration Act, 1979	The Act provides for payment of equal wages for work of equal nature to Male and Female workers and not for making discrimination against Female employees
5	Workmen's Compensation Act 1923	The Act provides for compensation in case of injury by accident arising out of and during the course of employment
6	Payment of Gratuity Act, 1972	The gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years
7	Employees PF and Miscellaneous Provision Act 1952	The Act provides for monthly contributions by the employer plus workers
8	Maternity Benefit Act, 1951	The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage, etc.
9	Payment of Bonus Act, 1965	The Act provides for payments of annual bonus subject to a minimum of 83.3% of wages and maximum of 20% of wages
10	Industrial Disputes Act, 1947	The Act lays down the machinery and procedure for resolution of industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment
11	Industrial Employment (Standing Orders) Act; 1946	The Act provides for laying down rules governing the conditions of employment
12	Trade Unions Act, 1926	The Act lays down the procedure for registration of trade unions of workers and employers. The trade unions registered under the Act have been given certain immunities from civil and criminal liabilities
13	Child Labor (Prohibition and Regulation) Act, 1986	The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes. Employment of child labor is prohibited in Building and Construction Industry
14	Inter-State Migrant Workmen's (Regulation of Employment and Conditions of Service) Act, 1979	The inter-state migrant workers, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, travelling expenses from home to the establishment and back, etc.;
15	The Building and Other	The employer of the establishment is required to provide

S. No.	Act	Provisions under the Act
	Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and the Cess Act of 1996	safety measures at the building or construction work and other welfare measures, such as canteens, first-aid facilities, ambulance, housing accommodation for Workers near the workplace, etc.
16	The Factories Act, 1948	The Act lays down the procedure for approval of plans before setting up a factory, health and safety provisions, welfare provisions, working 4-6 hours and rendering information-regarding accidents or dangerous occurrences to designated authorities

3.4 Applicable Policy, Rules & Regulation at State level

Policy and regulatory frameworks at national and state level have been formulated to provide social and environmental safeguards in the last two decades as presented in Table 3.3.

Table 3.3: Rules and regulations at State Level

S. No.	Act	Provisions under the Act
1.	Karnataka Forest Act, 1963	This Act restricts the powers of the state in respect of de-reservation of forests, use of forestland for non-forest purposes and cutting of trees
2.	Karnataka Urban Water Supply & Drainage Board Act, 1973	To undertake the investigation, preparation and execution of schemes for the regulation and development of drinking water and drainage facilities in the urban areas, it is considered necessary to have a statutory board at the State level which will help in bringing about co-ordination in the activities relating to the implementation of such schemes.
3.	State Water Policy, 2002	Under this act, there should be an integrated and multi-disciplinary approach to the planning, formulation, clearance and implementation of projects, including catchment area treatment and management, environmental and ecological aspects, the rehabilitation of affected people and command area development.
4.	Karnataka Ground Water Act, 2011	To give priority for drinking water and for protection of drinking water sources in the State
5.	Karnataka Urban Drinking Water and Sanitation Policy, 2002	The policy focuses on raising the levels of efficiency in the management of drinking water systems in urban areas so as to give satisfactory service to the citizens while at the same time discouraging over exploitation of resources and preventing wastage.
6.	Karnataka Town and Country Planning Act, 1961	Applicable in both construction and operation phase. As per this act, the obligatory duties of the Municipal Corporation limits its role to construction and maintenance of such facilities as roads, water supply, sewerage, solid waste management, firefighting, schools & public places, markets etc. The law also specifies certain discretionary duties of urban local bodies like promotional activities such as welfare programs for citizens, housing and provision of services (transport, promoting companies, co-operative societies to provide services in the city, acquisition of land, its development and management of facilities)
7.	Karnataka Municipal Corporations Act, 1976	Applicable in both construction and operation phase. As per this act, the obligatory duties of the Municipal Corporation limits its role to construction and maintenance of such facilities as roads, water supply, sewerage, solid waste management, firefighting, schools & public places, markets etc.

3.5 World Bank Policies

The operational guidelines under which World Bank (WB) projects are appraised are based on EAs in the "project cycle". WB's EA source book, directives, policies, drafts terms of reference and technical updates have guided the preparation of this EA. All central and state EA regulations and conventions referred were dealt in accordance with the WB procedures ensuring that all issues raised have been identified and satisfactorily addressed. The WB classify Category "A" projects as those "likely to have significant environmental impacts that are diverse and unprecedented". On the other hand Category "B" projects are those whose "potential adverse environmental impacts on human populations or environmentally important areas-including wetlands, forests, grasslands, and other natural habitats are less adverse than those of Category A projects[2]. The applications of World Bank Safeguard Policies in project are summarized in the Table 3.4.

Table 3.4: Application of Bank Safeguard Policies

WB Safeguard Policy	Summary	Application to the Project and Compliance Mechanisms
Environmental Assessment (OP/BP 4.01)	This is an umbrella policy to address environmental management issues in the project. The environmental consequences of the project are taken in to consideration during the project cycle and are taken into account in selection, siting, planning and designing of projects. It emphasizes upon the mitigation measures so as to reduce the adverse environmental consequences.	This project is identified as category B and the Operational Policy 4.01will be applicable to assess the impacts however marginal or temporary it might be. The proposed investments could have adverse but geographically limited environmental impacts. Physical/civil works are of rehabilitation nature on existing canal system and are unlikely to cause any significant adverse environmental or social impacts. Most impacts are likely to be limited to the rehabilitation phase of the infrastructure and no long-term adverse impacts are expected. The social and environmental assessment has been carried out and a range of preventive and mitigation measures are proposed as part of the Environmental and Social Management Plan (ESMP). Wherever required, Environmental Management Plans (EMP) is also prepared.
Natural habitats (OP 4.04, BP 4.04)	This policy emphasizes upon the conservation of the natural habitats like land, water, etc. It focuses upon the natural resource management so as to ensure environmentally sustainable development. It aims to support the protection maintenance and rehabilitation of the natural habitats and critical and semi-critical ecosystems.	This OP is not applicable to the project. The project investments would not convert any critical or non-critical natural habitats. Any identified adverse impact is limited in nature and scope, both spatially and temporally. Further, any unlikely adverse impact on natural habitats would be addressed through the screening criteria included in the ESMP and an EMP has been prepared to deal with such possibilities. Finally, support for management of wetland and waterlogged areas will be enhanced in the project.
Forestry (OP 4.36, BP 4.36)	This policy emphasizes upon the management, conservation, and sustainable development of forest	No forestry activities or activities on forest land are envisaged. Additionally, there are no forests in the projects areas. This OP is not applicable to

[2] World Bank Operational Policy, 4.01, Environmental Assessment, January 1999

WB Safeguard Policy	Summary	Application to the Project and Compliance Mechanisms
	ecosystems and their associated resources.	the project
Safety of Dams (OP 4.37, BP 4.37)	This policy is concerned with the safety of new and existing dams on which Bank financed projects are directly dependent. The policy distinguishes between construction of new dams and existing dams / dams under construction.	This OP is applicable to the project, due to the dependence on multipurpose dams that share water for the drinking water needs of the project cities. Hence, no significant impacts are anticipated due to the project activities. To ensure compliance to the policy, an assessment was carried out the measures are being implemented under the World Bank financed Dam Rehabilitation and Improvement Project (DRIP) and also through KUWSMP. The Dam Safety Panel and Unit in the State of Karnataka would be responsible under the DRIP to ensure issues of dam safety are addressed. `
Cultural Properties (OP 4.11)	The policy ensures avoidance of impacts on cultural properties and supports development of mitigation and enhancement measures through porjects	No archaeological or other cultural sites of significance are impacted by the proposed project. This OP is however is triggered, considering the historical back ground of the project cities and to address the instances of 'chance find' of cultural properties during the construction and operation phase of the project.
Indigenous Peoples (OP 4.10, BP 4.10)	This policy asserts that the adverse impacts of the development projects on the indigenous people should be mitigated or avoided and the benefits of the project should be accrued to them.	A detailed spatial census analysis does not indicate any tribal population in the proposed project area. Therefore, no impact (adverse or positive) is expected by project on tribal. This OP is not applicable to the project.
Involuntary Resettlement (OP 4.12)	This policy aims at avoiding, if not minimizing adverse impacts on the local population due to project and where unavoidable it ensures that those affected improve or at least restore their livelihood.	The system rehabilitation and modernization is unlikely to involve any land acquisition in this city and therefore R&R. However, to address any issues if any comes up, this OP is made applicable to the project.
Projects in Disputed Areas (OP 7.60, BP 7.60)	This policy is concerned with the disputed area in project	The project is not in a disputed area and the OP is not applicable to the project.

The analysis of the above policy, legal and regulatory framework indicated that a number of acts, regulations and agencies are involved at national, state and district level. All the agencies are functioning as per their mandate while there appears to be lack of integrating mechanism for overall development of the water sector in the state. With regard to planning and implementation of Karnataka Urban Water Supply Modernization Project (KUWSMP) is the main agency involved to provide drinking water and sanitation facilities in all urban areas. An institutional structure is also proposed for the overall execution of project.

3.6 Legal Monitoring Agency for Environmental Safeguards

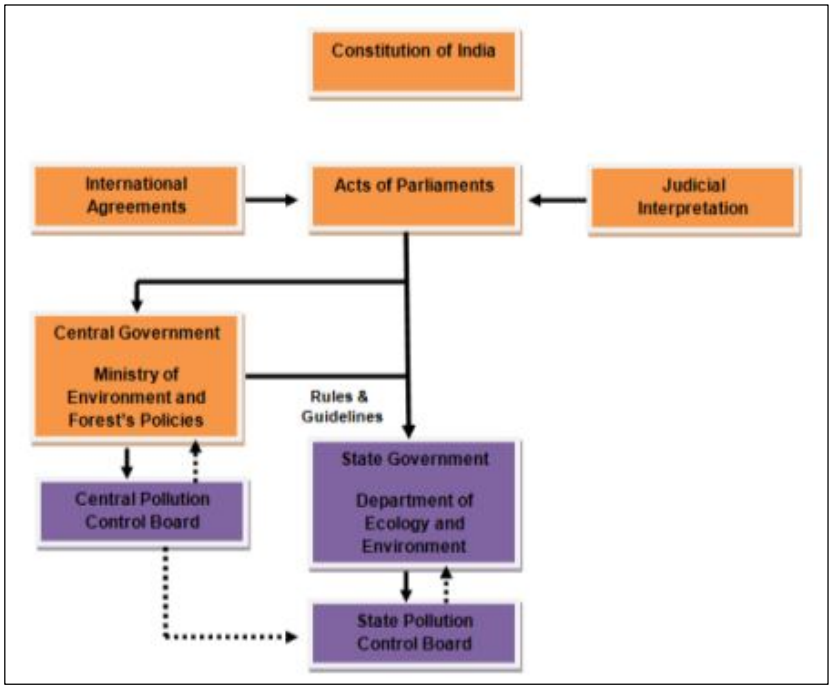


Figure 3.1 Legal and institutional framework for environmental safeguards

The Karnataka Department of Ecology & Environment (DOEE) is primarily responsible for protecting and preserving environmental quality in the state. The Karnataka State Pollution Control Board (KSPCB) is responsible for enforcing the regulations, and has a wider role in environmental governance than any other government body in the state and it reports both to the Central Pollution Control Board (CPCB) in Delhi and the DoE. In addition to monitoring and enforcing industrial environmental standards, the KSPCB also monitors other environmental issues, such as municipal solid waste, and biomedical waste. The supervisory powers exercised by Ministry of Environment & Forests (MOEF) are not vested with the DoE as per the regulatory framework but instead lie with KSPCB. DOEE is dependent on the state government for resources, whereas, KSPCB raises most of its financial resources through consent fee and water cess.

3.6.1 Other Line Agencies Involved

Table 3.5 shows the relevant departments and agencies and their roles and responsibilities.

Table 3.5: Line Departments and their Key Roles and Responsibilities

Department	Key Activities
Forest Department	The main function of the Forest Department is to protect, conserve and manage the forest. In the recent years, it has been noticed that the forest reserves have been decreasing. Henceforth, Joint Forest Management has been initiated so as to ensure protection of forest against encroachers, grazing and also to increase the vegetation cover. In addition to this, it has also pioneered research and development for improving the quality of seedlings. Green belt can be developed in the waste lands so as to increase vegetation cover. Further, plants which are of ecological and economic importance can be encouraged on the waste lands. Cooperation with the Forest Department should be encouraged in relation to natural habitats.
Department of Water Resource	The main responsibility of the Water Resource Department is to supply, conserve and manage the water resources in the State.

Department	Key Activities
Department of Urban Development	The main functions of the Urban Development Department is to plan, regulate, control and facilitate urban development for creating major infrastructure facilities, development of residential layouts, construction of houses for under privileged citizens. To facilitate and finance creation of infrastructure to provide adequate water supply from assured and safe sources of supply and proper sanitation to all the Urban Local Bodies through Karnataka Urban Water Supply and Drainage Board (KUWSDB).
Social Welfare Department	The main objective of this department is to bring the target groups into the main stream of development by making them self-reliant. Various laws and policies are being implemented for the upliftment of the SCs/STs under protective discrimination basis.
Karnataka Pollution Control Board	The main function of KSPCB is to prevent, control or abate pollution. It advises the State Government on the matters concerning the prevention, control and abatement of pollution. Further, it disseminates information relating to pollution

In general, there is little available expertise/ functional position in the agencies with respect to environment and social sector to address various social and environmental issues. However, activities under the project will support greater attention to environmental and social issues.

3.6.2 Institutional Setup for Project

The Environmental Management Plan (EMP) and Resettlement Action Plan process does not stop once a project (planning and design) got approval for implementation. During implementation of project, Construction Supervision Consultant, CSC (if any) and Contractor will be responsible for ensuring that the environmental commitments made to regulatory agencies, lending agencies and other stakeholders during the EIA process are met. To execute EMP and RAP is a cumulative responsibility of all three parties involved, indicative responsibility mechanism has been presented in EMP and RAP, as developed for up gradation projects.

The institutional stakeholders in implementation of EMP and RAP are as shown in the following figure:

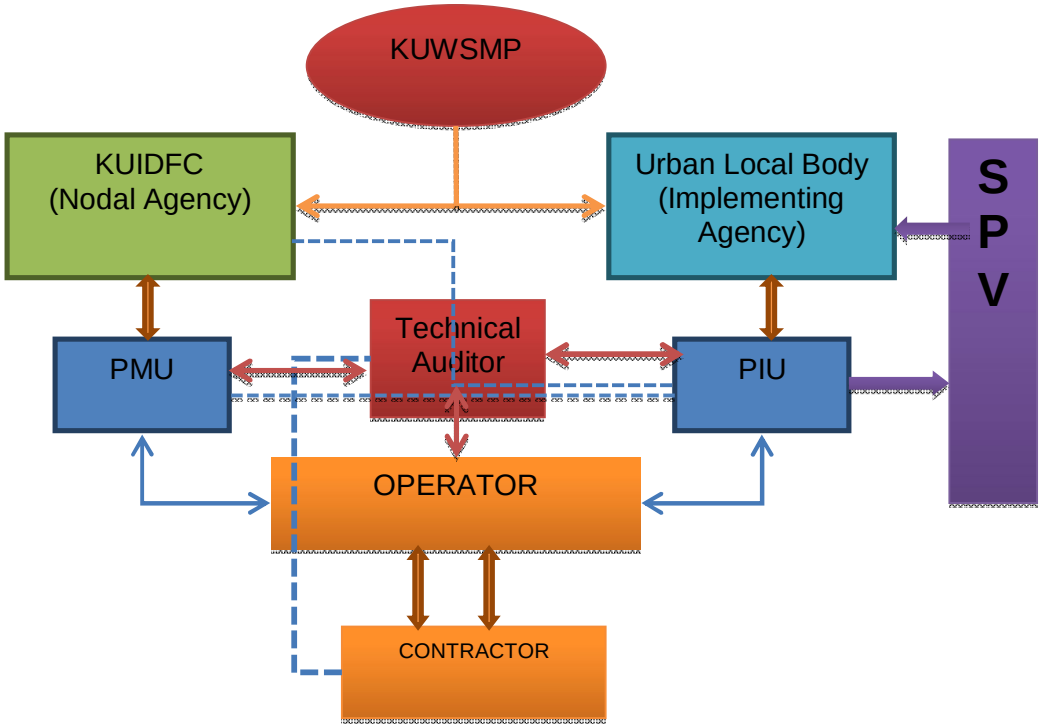


Figure 3.2: Roles and Responsibilities of Stakeholders

Environmental and Social Cell - shall be integrated under the PMU at KUIDFC and PIU at ULB/ SPV level and can serve for mainstreaming social and environmental safeguards for the project. The proposed cell will be include Environmental and Social experts The Cell will consist of M & E, Communication Experts and Civil Engineer to assist the Corporation for effective implementation of ESMP.. The Cell officials and local body staff will assist SPV focal points in project area for planning, implementation & monitoring of ESMP.

Key duties and function of the proposed cell would be:

ESMP planning, implementation and monitoring - Provide technical assistance in ESMP planning implementation & monitoring for each sub project activity.

Information/ Data Base Management - Manage comprehensive environmental & social information management system/data bases and documentation.

Training and Capacity building - Periodic workshops/ Meetings seminars on Social & Environment aspects; develop tailor made courses; organize basic /orientation training programs; organize documentation of staff experience on Social & Environmental issues/ solutions / lessons learned program ; develop environmental 'tool kits' for staff – CDs/ slides organize inter and intra states field visits; experience sharing program; organize study tours to provide exposure to the similar experience /best practices of the oversees etc. Enhancement of the staff capacity and their commitment are key pre-requisite for the effective implementation of project.

Awareness/ Sensitization - Develop/ Implement social & environmental awareness/ sensitization programs.

Inter-sectoral linkages and inter-agency coordination - Facilitate effective inter-sectoral linkages and inter-agency coordination among and between agencies and other key stakeholders involved in water sector management in relation to socio- environmental issues.

Grievance Redressal – Provide technical assistance to PIU related to grievance redressal mechanism to attend to any social and environmental grievances made by any person, community group.

Provide assistance for Project - Provide essential guidance and inputs related to Environmental & Social aspects for Next Phase.

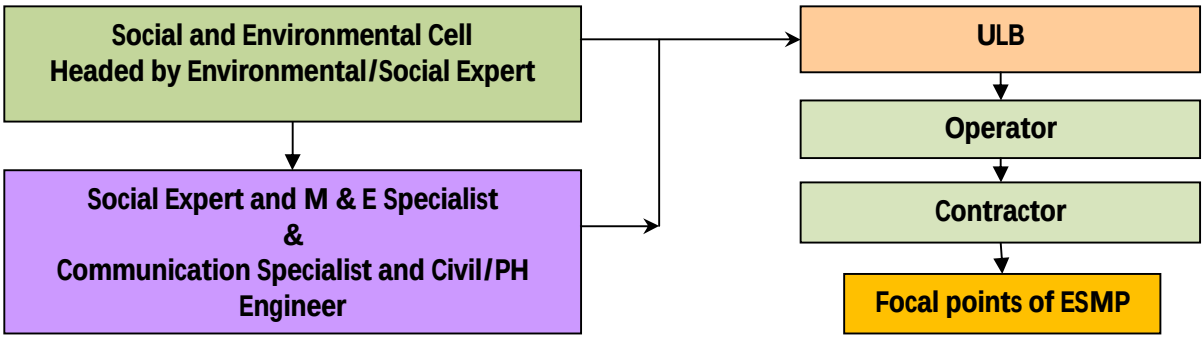


Figure 3.3: Environmental and Social Organizational Cell Structure

3.6.3 Legal Approvals / Clearances Required

The following are the various legal approvals and clearances on social and environmental aspects that the GOK may require before initiating site work.

Table 3.6: Legal Approvals and Clearances

Project Activity	Compliances/Clearances	Responsible Agency	
		Primary	Overall
Use of Diesel Generator sets at any stage during project cycle.	Consent from KSPCB under Air Act	Operator	SPV/PIU
Replacement of Old Pipe line, laying new pipe line, construction of WTP and Reservoirs	Approvals / authorization from State Forest Department in case of land appropriation of forest land (if any other than the identified proposed sites) and cutting of trees **Hubballi Dharwad: None as per the proposed design**	Operator	SPV/PIU
	Permissions from Railways for crossing railway lines **Hubballi Dharwad: Central Railway at locations Zone H 26 (Railway Area Bulk)**	SPV	SPV/PIU
	Permissions from PWD/NHAI/Local Authority for road cutting. **Hubballi Dharwad: NH 63 and 218 and SH 73 and 34(Ward no : 44,41,21, 18, 40, 17,21,36)**	SPV	SPV/PIU
	Permissions from Irrigation Department for drawing water from irrigation canals for water supply.	SPV	SPV/PIU
	Permission from Central Ground Water Board for withdrawing Ground Water (if required at any stage of project)	SPV	SPV/ULB
	Permission from Traffic Police Commissioner office for traffic management.	Contractor	SPV/PIU
Storage and Handling of Chlorine for Water Treatment	Permission from KSPCB under MS&H Rules, 1989 for Storage and Handling of Chlorine	ULB	SPV
Archeological Clearances	Permission from National Monuments Authorities to carry out augmentation works around heritage structures in the city	Operator	SPV

Chapter 4. Baseline Environmental and Social Profile

4.1 Environment Profile

An analysis of environmental characteristics and issues has been carried out for Project. The baseline environmental conditions are described in terms of Land Environment, Climate & Air Environment, Water Environment, Forest & Biodiversity and public health.

4.2 Land Environment

Land environment is described in terms of Geology, Topography, Soil and land use.

4.2.1 Geology and Topography

The study area falls in the western-ghat section (sahyadris) of the peninsula within the rugged foothills. An undulating central Pediplain and the eastern maiden is the prominent feature. It situated at an altitude of 753 m (N-W Dharwad Tk) to 558 mamsl.

4.2.2 Soil Characteristics

The lateritic brownish sandy soil occurs in the western region with 19.62-to 3.6-cm/hour rate of infiltration characteristic. The black cotton soil (BCS) in the eastern part having 2.0 to 5.0 metres thickness, are high humus and low phosphate content, with normal pH-value and very low infiltration characteristic. The Loamy to kankary soil are seen along the banks of river/stream courses.

4.2.3 Land Use

Land has remained as an important factor for economic activities in Project area. With the rising population, increasing pressures are being felt on the finite land resources, to meet the demands of food and fodder. The breakup of district land use pattern in 2008 can be categorized as cultivable, and uncultivable. Uncultivable land includes forest, pasture, fallow, and barren land.

The CDP for Hubballi-Dharwad has land use planning to the extent of 137.47 sq.km only for the year 2021. The details of the proposed Land use Pattern for Hubballi – Dharwad Cities for the year 2021 as per the CDP is as given in **Table -4.1**.

Table 4.1: Proposed Land use Pattern (2021)[4]

S. No	Land Use	Pattern Area (ha)	% of total area
1	Residential	5717	42
2	Commercial	835	6
3	Industrial	738	5
4	Public & Semi Public	2021	15
5	Park, Open Space and Play Ground	1431	10
6	Transportation	3005	22
	TOTAL	**13747**	**100**

[4]Table 1, Page No. 9, Project Report on KUWSIP-Up scaling 24x7 Water Supply, Hubballi-Dharwad

4.3 Climate and Air Environment

4.3.1 Climate and Rainfall

The twin cities of Hubballi - Dharwad enjoy pleasant moderate climate, without being subjected to the extremes of summer or winter. Summer sets in during the second half of February and lasts till the end of May. The average temperature during this period is around 35.9^{0}C. This season is marked by harsh Eastern winds, rising temperatures, whirlwinds and occasional thunderstorms accompanied by harsh showers.

The mean annual rainfall for the period 2001-2010 in the Dharwad district is 735mm. The mean pre monsoon rainfall is 146 mm, mean South West monsoon rainfall is around 468 mm and North East monsoon season is around 122 mm. Annual Normal rainfall of all the taluks are given in the **Table 4.2**. Annual rainfall during 2011 is 734mm in which 112 mm during pre-monsoon, 447mm during monsoon and 175mm during post monsoon (Table 4.2). Maximum annual rainfall of highest 1497mm is recorded during 2005 in Hubballi taluk. Overall rainfall distribution shows that northeast part is receiving lowest rainfall. Similarly southwest part is receiving highest rainfall.

Table 4.2: Rainfall Pattern in Hubballi-Dharwad

Station	Pre-Monsoon	South West-Monsoon	North East Monsoon	Annual
Dharwad	146	529	131	807
Hubballi	157	444	141	742
For District	146	468	122	735

[5] District Ground Water Brochure, Hubballi-Dharwad, 2012, Central Ground Water Board

4.3.2 Wind Speed and Direction

The predominant wind direction in Hubballi-Dharwad is from west to south-west in the monsoon season and from east to north east during winter seasons.

4.3.3 Air Quality

The Karnataka State Pollution Control Board (KSPCB) monitors ambient air quality in the State. The ambient air quality data was collected form Karnataka State Pollution Control Board (KSPCB) from April to December, 2013. The parameters wise air quality is summarized below.

SO_2 and NO_2: Both SO_2 and NO_2 concentration was observed within the limit in both cities which is shown in **Figure 4.1 & 4.2**.

Figure 4.1: SO2 and NO2 Concentration-Hubballi

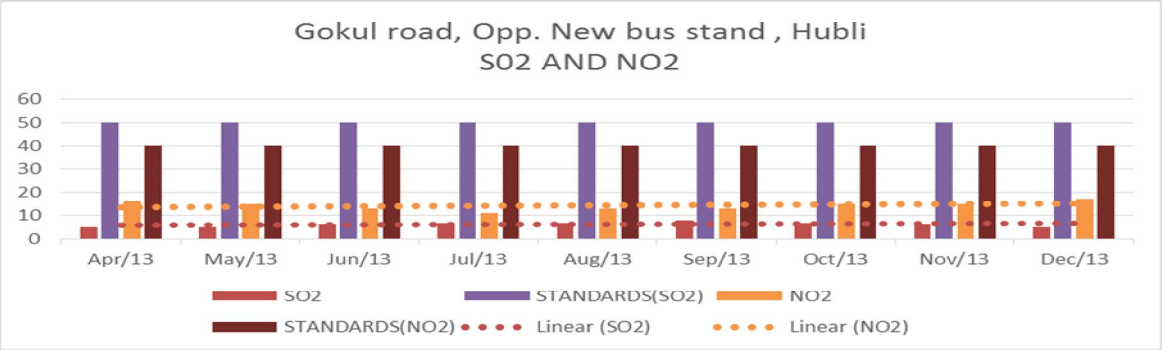
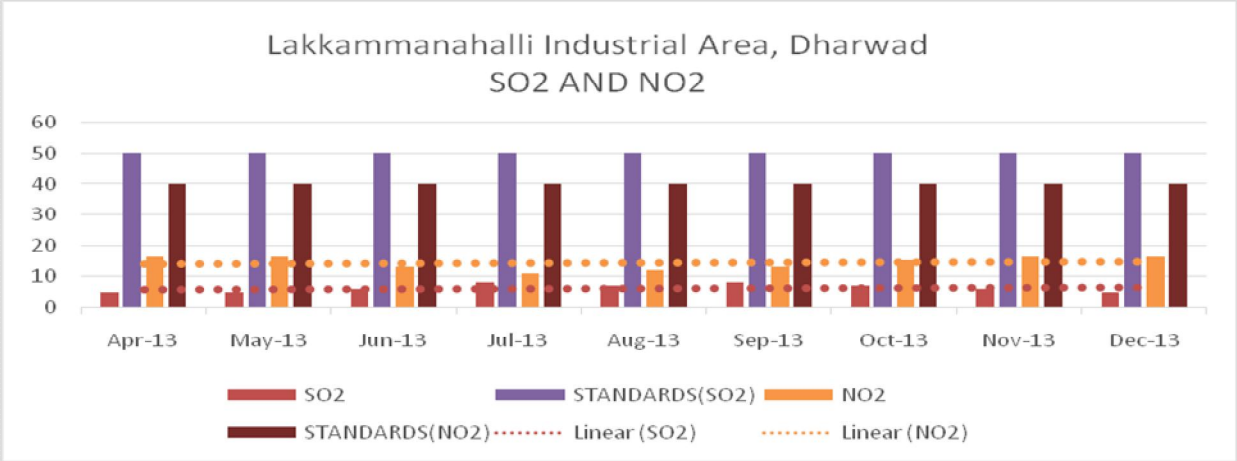
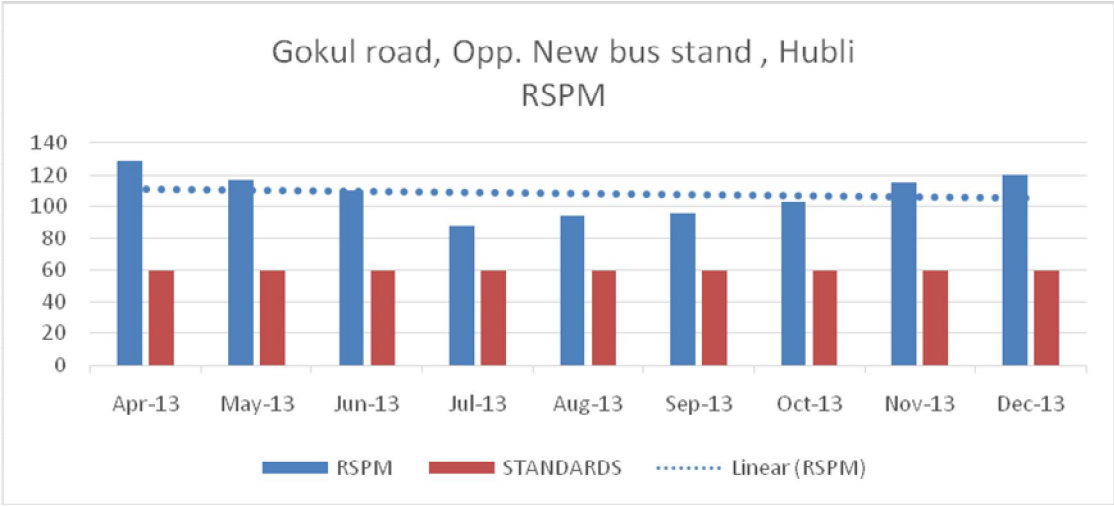


Figure 4.2: SO2 and NO2 Concentration - Dharwad



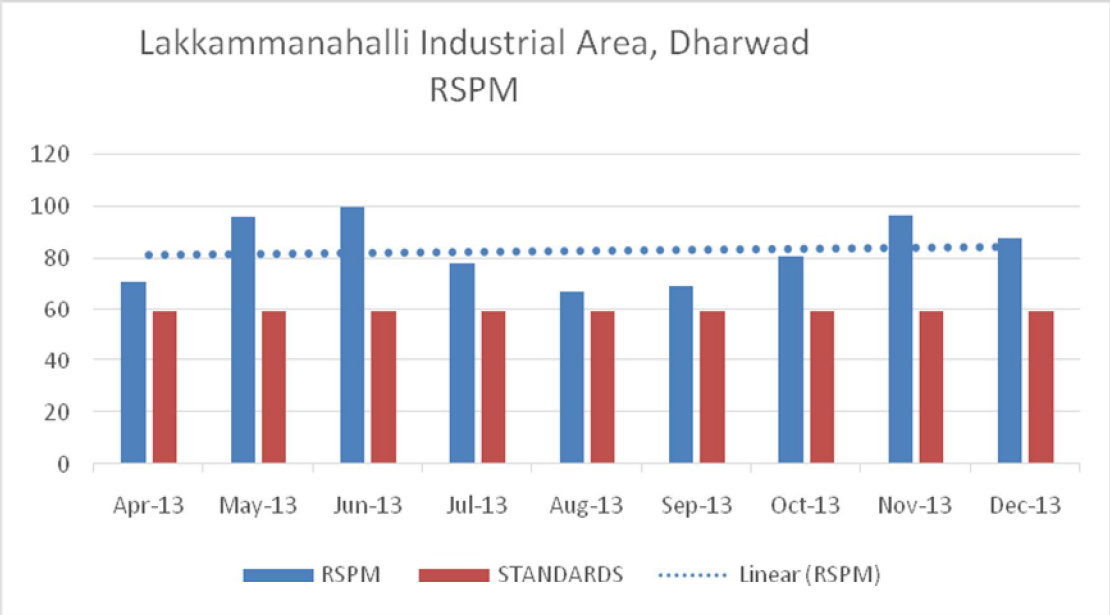
Particulate Matter ($PM_{2.5}$): The $PM_{2.5}$ was found above permissible limit (60 µg/m^3) in all months at Gokul Road, Opposite New Bus Stand, Hubballi. Highest $PM_{2.5}$ was observed in April while lowest in July, 2013 (**Figure 4.3).**

Figure 4.3: Particulate Matter2.5 Concentration-Hubballi



In Dharwad, $PM_{2.5}$ was also found above permissible limit (60 µg/m^3) in all months at Lakkammanahalli industrial area. Highest $PM_{2.5}$ was observed in June while lowest in August, 2013 (**Figure 4.4).**

Figure 4.4: Particulate Matter2.5 Concentration-Dharwad



The ambient air quality can be changed during construction phase due to movement of vehicles and construction activities.

4.4 Water Environment

Water environment of the study area is described in terms of surface & ground water resource and surface & ground water quality.

4.4.1 Surface Water Resources

There are no major rivers within Hubballi-Dharwad. River Malaprabha, the perennial river of the region and drinking water source of Hubballi-Dharwad, flows in the northern direction at about 25 kms from Dharwad city. In addition to the above, the cities have a number of tanks / lakes formed in shallow valley basins. The most prominent among them are the Unkal Lake in Hubballi and Kelegere in Dharwad.

Reservoir wise water availability assessment was carried out by TCE for water supply for the horizon year 2041, summarized below

Neeersagar Reservoir:

The Neersagar Dam constructed across Bedti nala is located in Kalaghatagi taluk of Dharwad district in Karnataka at latitude of 15019' 02" N & Longitude of 740 59' 23" E. It is constructed in the year 1955 mainly for providing drinking water to Hubballi- Dharwad twin cities. The reservoir is located at about 23 km from Hubballi and about 17 km from Dharwad. The Dam is of earth embankment type and has got a catchment area of about 181.08 Sq.Km with an annual average rainfall of 780 mm. The gross storage capacity of the Dam at FRL is 28.90 MCum and the dead storage capacity is 2.75 Mcum with a water spread area up to foreshore at FRL about 4.40 Sq.Km (440 Ha). The rainfall at source is generally sufficient to cater the requirements. However, for about three years in past

25 years, the rainfall was found to be less than adequate. The reservoir has dried up on three occasions during 1986-87 and 2002-2003 & 2004 due to insufficient rainfall

Malaprabha Reservoir

The reservoir was constructed in year 1972 by Irrigation Department, Government of Karnataka and the water supply scheme from this source was developed in the year 1983 and subsequently augmented in stages. The present capacity of water supply system is 73.8 MLD. The reservoir has an earthen embankment and the gross capacity of the reservoir is 1068 Mcum, the live capacity of the Reservoir is 972 million cubic meters.

4.4.2 Surface Water Quality

Surface water quality of project area is assessed based data from Regional Laboratory, Dharwad, State Pollution Control Board (SPCB). In 2012 & 2013**,** pH was found slightly acidic to alkaline in nature at all locations which varies 6.74 to 9.94 (**Table 4.3**). Highest pH was recorded at Kakti Pond (9.94) while lowest at Vishwakarma Temple. Turbidity was found beyond the permissible limit; biological oxygen demand was observed within the permissible limit at all locations except Angole Lake (near Vishwakarma temple), Beilary Nalla (at Kudachi Bridge and Sulebhavi).

Table 4.3: Surface Water Quality Status

District	Water Station	Sample Location	pH	DO	BOD
Dharwad	Angol Lake	Near Vishwakarma Temple	6.74	-	34.5
		Outlet of lake	6.81	0.9	3
	Kakti Pond	Kakti Pond near Culvert	9.94	-	8.9
	Kalmeshwar Tank	Kalmeshwar Temple	7.27	-	2
	Killa Lake	Opposite Hotel Vandhana Palace	8.39	-	2.76
		Near BUDA Oflice	8.34	-	2.04
	Rakkashopa Tank	Rakkashopa Tank	8.6	6.8	1
	Beilary Nalla	near Sulebhavi	7.47	-	33
		Kudachi Bridge	7.41	-	45
		near Alarwad Cross	7.61	-	24

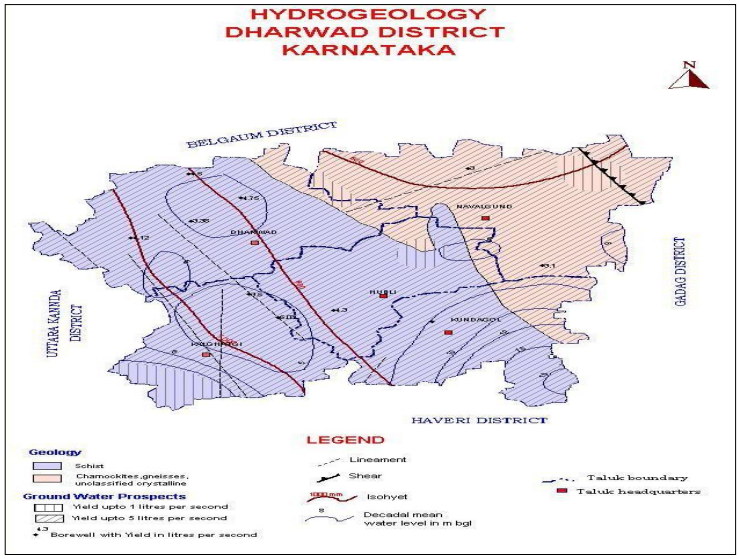
Source: Regional Laboratory, Dharwad, Karnataka State Pollution Control Board, 2012 &2013

Madhihal Nala in Dharwad receives wastewater from Gokul Industrial Estate. It is estimated that around 1.5 to 2 MLD of industrial waste is discharged into Madhihal Nala.

4.4.3 Hydrogeology & Ground Water Resources

Main rock formations in the area are the Gneissic-granites and Schists, the secondary structures like joints, fissures and faults present in them act as a porous media-the Aquifer. The lateritic layer overlying in moderate thickness and alluvium occurs along the riverbanks in less than 3.00 metres thickness acts as an aquifer locally. Ground water in the aquifer generally occurs under unconfined/phreatic and semi-confined conditions. The ground water development in the study area is given in **Figure 4.5.**

Figure 4.5: Hydrology



Source: Ground Water Brochure of Dharwad District, Karnataka (2012)

Depth to Water Level: Pre & Post Monsoon 2011, the depth to water levels was recorded in the range of 2.18 to 17.40 mbgl during May-2011 **(Figure 4.6)** and 1.28 to 19.10 mbgl during November 2011(**Figure 4.7**). The water level is deeper as between 10 to 20 mbgl in major part of Dharwad, Hubballi taluks.

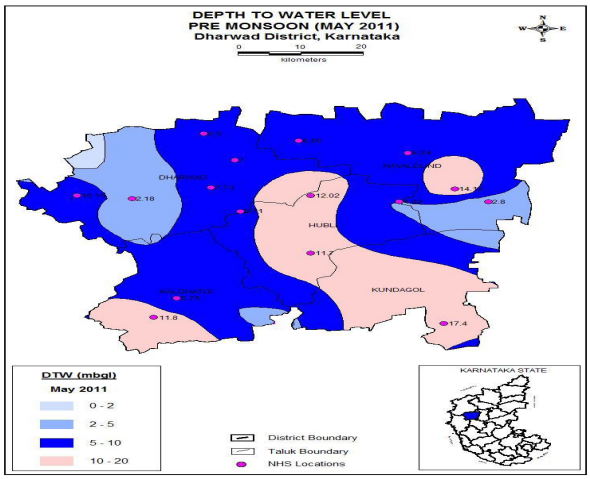


Figure 4.6: Pre-monsoon water level

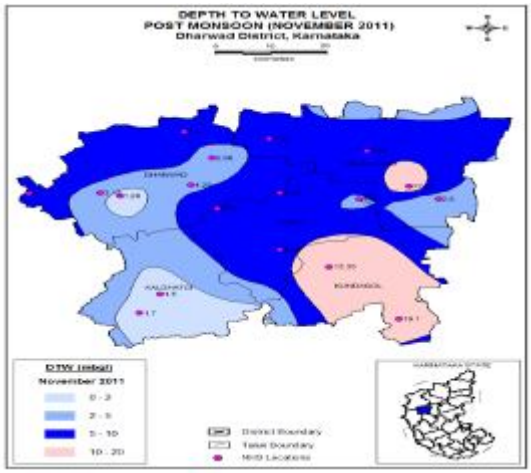


Figure 4.7: Post-monsoon water level

(*Source: Ground Water Brochure of Dharwad District, Karnataka, 2012)*

The water level fluctuation during May 2011 with respect to decadal mean water level shows that 75% of the wells rise in water level and only 25% wells shows fall in water level. The water level trend for the month May for the period of 2002 to 2011 shows a general rise of 0.018 to 1.748 m, with a few isolated pockets at falling (- fluctuation) trend in the order of 0.011 m.

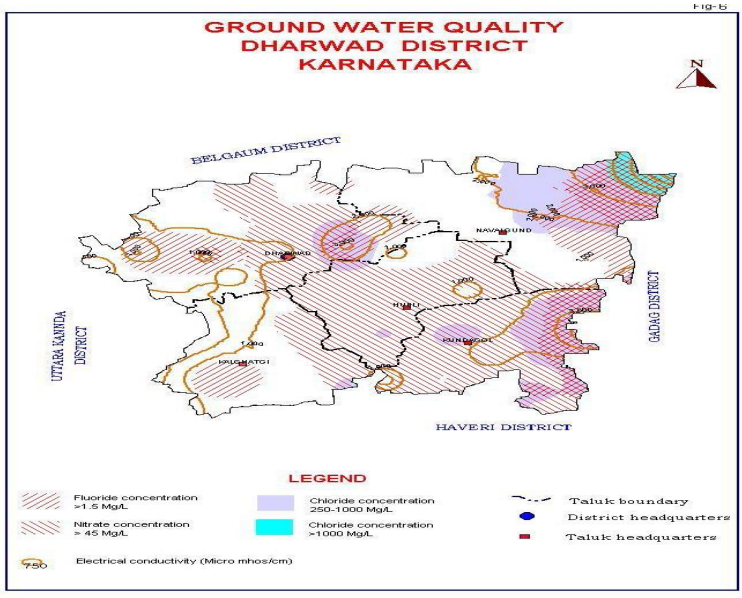
4.4.4 Ground Water Quality

The water in Phreatic aquifer zones found in potable form whereas it is alkaline to saline in the deeper zones, especially in the eastern part of Dharwad district. The electrical conductivity (EC) of waters observed in the range of 900 to1200 µm/cm, at places in Dharwad and Hubballi taluks is recorded between 4000 to>7500 at 25°C (**Figure 4.8**). The fluoride presence in some pockets of the central and eastern border areas noticed as around 1.5mg/l, is greater than the permissible limit, the rest of the area have acceptable limit of 0.2 to 1.0 mg/lit. The presence of chloride as high as >1000 mg/l in many parts of eastern region observed as in the area, is said to be due to the extensive use of chemical fertilizers in agricultural lands**.**

As per Central Ground Water Board, the ground water development found between 45 to 75% over the taluks, whereas the district average rate accounted for 55.60%. Since the water levels in the area as a whole has not shown any appreciable decline the district is categorized as "SAFE" category in terms of development. Due to significant decline in water levels an area of 50% in Dharwad taluk and 20% in Hubballi taluk as shown as semi critical.

As per Central Ground Water Board, the no. of Groundwater Monitoring Wells (as on 31st March 2011) is 25 Dug wells and 4 Piezometer. Pre-Monsoon depth to water level during May 2011 is 2.18-17.40 mbgl whereas during Post-Monsoon, the depth to water level during Nov 2011 is 1.28-15.35 mbgl. Long term water level trend in 10 years (2002-2011) shows 0.018-1.748 m/year rise & 0.011 m/year fall.

Figure 4.8: Ground water Quality Map of Dharwad District



(*Source: Ground Water Brochure of Dharwad District, Karnataka, 2013)*

4.5 Forest and Biodiversity Act

As per the Forest Survey of India, the land classified under forests is only 9.04% in entire district in 2011. Moderate dense forest cover is showing increasing trend from 2005-2007 in district (**Table 4.4)** while open forest is showing decreasing trend from 2005 to 2007 and further increased in 2011. The proposed project is rehabilitation and modernization of existing water supply

infrastructure which do not pass through any forest area. Therefore, there is no impact anticipated on forest land.

Table 4.4: Forest Cover in Project Area

District	Year	Geographical Area (GA)	Very Dense Forest	Moderate Dense Forest	Open Forest	Total	% of GA	Change	Scrub
Dharwad	2011	4260	0	232	153	385	9.04	2	5
	2007	4260	0	232	151	383	8.99	0	6
	2005	4260	0	223	164	387	9.08	0	50

Source: Forest Survey of India Report, 2007, 2009 & 2011

4.5.1 Protected Areas

There is one Blackbuck sanctuary in project area i.e. Ranebennuru Blackbuck Sanctuary in Hubbali-Dharwad located at a distance of 140 km from the city. The proposed project is rehabilitation and modernization of existing water supply infrastructure and project does not come under any protected areas. Therefore, no impact is anticipated due to proposed project.

The district has a rich variety of fauna. Wild animals commonly found are the leopard cat, jungle cat, toddy cat, Indian civet, striped hyena, small Indian mangoose, Indian jackal, wild dog, common porcupine, giant flying squirrel, wild pig etc. But these are confined to forest areas and agricultural lands, and are hardly found within the city.

4.6 Wetlands

Dharwad district shows the presence of 691 wetlands including 416 smaller than 2.25 ha (**Table 4.5** and shown in **Figure 4.9**). Total wetland area estimated was 3965 ha. The small wetlands contribute about 10 percent to the extent of wetlands, which is significant. In terms of extent, Tanks/Ponds (2250 ha) rank first accounting for about 57 percent of wetland area followed by River/Stream (660 ha) and Reservoirs/Barrages (568 ha). Seasonal change in open water extent shows a reduction of about 15 percent from post-monsoon (2603 ha) to 2075 ha in pre-monsoon. Aquatic vegetation has shown an increase of 2.3 times from post-monsoon (352 ha) to pre-monsoon (802 ha). Out of 2603 ha of open water, turbidity remained moderate comprising 1723 ha and 1398 ha in post- and pre-monsoon seasons respectively while highly turbid areas of open water were 880 ha and 677 ha. Notably, low turbidity has not been observed in both the seasons.

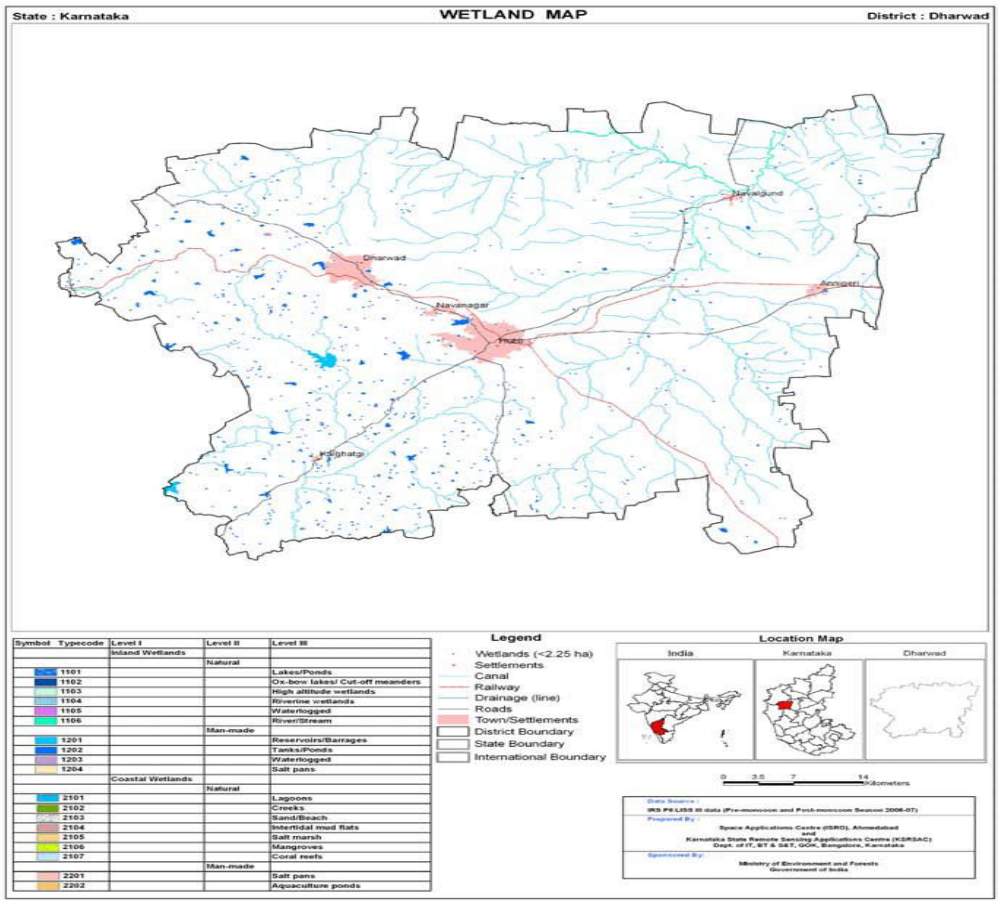
Table 4.5: Number and Types of Wetland in Hubballi-Dharwad

Sr. No.	Wet code	Wetland Category	No. of wetlands	Total Wetland area	% of wetland area	Open Water	
						Post-monsoon area	Pre-monsoon area
1	1106	River/Stream	7	660	16.65	660	578

2.	1201	Reservoirs/Barrages	3	568	14.33	458	360
3.	1202	Tanks/Ponds	256	2250	56.75	1455	1108
4.	1203	Waterlogged	9	71	1.79	30	29
Sub-Total			**275**	**3549**	**89.51**	**2603**	**2075**
Wetlands (<2.25 ha), mainly Tanks			**416**	**416**	**10.49**		
Total			**697**	**3965**	**100.0**	**2603**	**2075**

Source: National Wetland Atlas, Karnataka, 2010

Figure 4.9: Wetland Map of 2010 Hubballi-Dharwad



(Source: National Wetland Atlas, Karnataka, 2010)

4.7 Heritage

The list of monuments in Dharwad approved by ASI are the following :

Table 4.6: Heritage Structure

Name of the monument/site	Location	District
Two forts gates (inner & outer)	Dharwad	Dharwad
Chandramoulesvara temple	Unkal	Dharwad
Basavannadevi temple	Tambur	Dharwad

Source: State Environment Report, Karnataka, 2003

Chandramouleshwar Temple is very near to Unkal circle and Unkal Lake (on Old NH4 between Hubballi and Dharwad). It is on old Pune – Bangalore highway NH4, about 3 km north from Hubballi city centre.

A fort which was built in 1904over the area of about 76 acres is located on highway NH4, about 15km from Hubballi city centre. The famous Durgadevi temple is also situated in this area.

The district has a rich variety of fauna. Wild animals commonly found are the leopard cat, jungle cat, toddy cat, Indian civet, striped hyena, small Indian mangoose, Indian jackal, wild dog, common porcupine, giant flying squirrel, wild pig etc. But these are confined to forest areas and agricultural lands, and are hardly found within the city. The project activities are not expected to impact these structures. However, necessary approval shall be obtained from National Monuments Authority, for carrying out construction within 300 m of the monument. In addition construction activities need to consider precautionary measures to avoid damages of archaeological structures during excavation works and clearances from NMA.

4.8 Baseline Water Sample Survey

Quality of water supplied to consumers is very critical in assessing the impacts of proposed improvements under the project. The present practice of intermittent water supply to the project cities is expected to deliver bad quality of water due to systemic problems such as illegal connections, cross contamination due to soil, wastewater inflows and various other means adopted by the consumer to cope with the low pressure problems.

A reconnaissance survey of the entire supply and distribution system was carried out before finalising the number and locations of the samples in project city and the operation and flow sequence of the system was studied. Based on the survey, samples were collected at the following locations on 16th May, 2014 and bacteriological & physiochemical analysis was conducted to analyze water quality at supply end.

- Raw water from Dharwad , Malaprabha water supply scheme Jackwell at Saundatti
- Treated water from Dharwad, after clear water reservoir at WTP at Amminbhav
- Raw water from Hubballi , Neerasagar lake , Bharth Dommavadi
- Treated water from Hubballi , Neerasagar lake , Bharth Dommavadi
- Sixteen water samples from public Public Taps and locations are given below

S.No	Dharwad		Hubballi	
	Location	Ward no.	Location	Ward no.
1	Kelageri Area	1	Lingaraj Nagar	25
2	Hudco Colony	2	Shakti Colony	27
3	Kamalapura Area	5	Akashaya Colony	35
4	Kantioni Kumbhar Area	6	JP Nagar	40

5	Gollar Colony Area	7	Kalyani Nagar	48
6	Hosayallapura	11	Nekara Nagar	53
7	Jayanagar Janatha Colony	14	Akki Honda	57
8	CB Nagar	17	Janath Nagar	65

The water samples were analysed with National Drinking Water Standards (IS: 10500). The test results are at Annexure **VI.**

4.8.1 Water Quality at Source

Both raw and treated water samples were collected for quality assessment and results are given in **Table 4.7 & 4.8.**

Table 4.7: Raw and Treated Water Results (Physical and Chemical) Dharwad

S.no	Parameters	Result		Acceptable Limits as per IS 10500
		Raw water	Treated water	
1	Colour, Hazen Unit	<2.0	<2.0	Max.5
2	Odour	Agreeable	Agreeable	Agreebale
3	Taste	Agreeable	Agreeable	Agreebale
4	Turbidity ,NTU	8.7	1.4	Max.1
5	pH	8.15 @24 DEG C	7.88 @24 DEG C	6.50 TO 8.50
6	Total Dissolved Solids, mg/l	134	136	Max.500
7	Aluminium, mg/l	<0.01	0.13	Max. 0.03
8	Ammonia, mg/l	<0.05	<0.05	Max. 0.5
9	Anionic, mg/l	<0.2	<0.2	Max. 0.2
10	Barium, mg/l	<0.1	<0.1	Max. 0.7
11	Boron, mg/l	<0.1	<0.1	Max. 0.5
12	Calcium, mg/l	17.6	18.4	Max. 75
13	Chloramines, mg/l	<0.05	<0.05	Max. 4.0
14	Chlorides, mg/l	10.9	13.4	Max. 250
15	Copper, mg/l	<0.05	<0.05	Max. 0.05
16	Fluorides, mg/l	0.2	0.2	Max. 1.0
17	*Free Residual Chlorine,	0.005	0.6	Min. 0.2

S.no	Parameters	Result		Acceptable Limits as per IS 10500
		Raw water	Treated water	
	mg/l			
18	Iron, mg/l	0.2	0.2	Max. 0.3
19	Magnesium, mg/l	4.9	7.8	Max. 30
20	Manganese, mg/l	<0.1	<0.1	Max. 0.1
21	Nitrates, mg/l	0.3	0.3	Max. 45
22	PhenolicCompounds, mg/l	Absent	Absent	Max. 0.001
23	Selenium, mg/l	<0.01	<0.01	Max.0.01
24	Silver, mg/l	<0.01	<0.01	Max. 0.1
25	Sulphates, mg/l	6.5	6.9	Max. 200
26	Sulphide, mg/l	<0.05	<0.05	Max. 0.05
27	Total Alkalinity, mg/l	86	86	Max. 200
28	Zinc, mg/l	0.03	<0.01	Max. 5
29	Total Hardness, mg/l	64	78	Max. 200
30	Cadium, mg/l	< 0.003	< 0.003	Max 0.003
31	Cyanide, mg/l	Absent	Absent	Max 0.05
32	Lead, mg/l	<0.01	<0.01	Max 0.01
33	Mercury, mg/l	<0.001	<0.001	Max 0.001
34	Molybdenum, mg/l	<0.01	<0.01	Max 0.07
35	Nickel, mg/l	<0.01	<0.01	Max 0.02
36	Total Arsenic, mg/l	<0.01	<0.01	Max 0.01
37	Total Chromium, mg/l	<0.01	<0.01	Max 0.05

Microbiological tests

S. No	Parameters	Result		Acceptable Limits as per IS 10500
		Raw Water	Treated water	
1	Coliform Organisms/100 ml	Greater than 161	Less Than 1	Less Than 1
2	E.Coli Bacteria/100ml	Present	Absent	Absent

From the above Table 4.7, Turbidity was observed beyond the permissible limit in raw water sample (8.7 NTU) while low (1.4 NTU) in treated water sample. The pH was recorded well in all water samples and fit for drinking purpose. All heavy metals were found within the permissible limit in

both Raw and Treated water samples. Free residual chlorine was high in treated water which could be due to chlorination of water. Coliforms were found in both raw and treated water sample. E. Coli were also present in the raw water sample while absent in treated water sample.

Table 4.8: Raw and Treated Water Results (Physical and Chemical)-Hubballi

S.NO	Parameters	Result		AS per IS 10500 (2012)
		Raw water	Treated water	
1	Colour, Hazen Unit	<2.0	<2.0	Max.5
2	Odour	Agreeable	Agreeable	Agreeable
3	Taste	Agreeable	Agreeable	Agreeable
4	Turbidity ,NTU	1.6	1.7	Max.1
5	pH	8.42 @24 DEG C	7.84 @24 DEG C	6.50 TO 8.50
6	Total Dissolved Solids, mg/l	308	314	Max.500
7	Aluminium, mg/l	<0.01	0.05	Max. 0.03
8	Ammonia, mg/l	<0.05	<0.05	Max. 0.5
9	Anionic, mg/l	<0.2	<0.2	Max. 0.2
10	Barium, mg/l	<0.1	<0.1	Max. 0.7
11	Boron, mg/l	<0.1	<0.1	Max. 0.5
12	Calcium, mg/l	24.5	26.2	Max. 75
13	Chloramines, mg/l	<0.05	<0.05	Max. 4.0
14	Chlorides, mg/l	53.3	54.5	Max. 250
15	Copper, mg/l	<0.05	<0.05	Max. 0.05
16	Fluorides, mg/l	0.33	0.32	Max. 1.0
17	*Free Residual Chlorine, mg/l	0.005	0.6	Min. 0.2
18	Iron, mg/l	0.084	0.15	Max. 0.3
19	Magnesium, mg/l	18.9	18.9	Max. 30
W	Manganese, mg/l	<0.1	<0.1	Max. 0.1
21	Nitrates, mg/l	<0.1	1.0	Max. 45
22	Phenolic Compounds, mg/l	Absent	Absent	Max. 0.001
23	Selenium, mg/l	<0.01	<0.01	Max.0.01
24	Silver, mg/l	<0.01	<0.01	Max. 0.1
25	Sulphates, mg/l	12.7	13.5	Max. 200
26	Sulphide, mg/l	<0.05	<0.05	Max. 0.05
27	Total Alkalinity, mg/l	163.4	159.1	Max. 200
28	Zinc, mg/l	< 0.02	0.01	Max. 5
29	Total Hardness, mg/l	138.7	142.8	Max. 200
30	Cadium, mg/l	< 0.003	< 0.003	Max 0.003
31	Cyanide, mg/l	Absent	Absent	Max 0.05
32	Lead, mg/l	<0.01	<0.01	Max 0.01
33	Mercury, mg/l	<0.001	<0.001	Max 0.001
34	Molybdenum, mg/l	<0.01	<0.01	Max 0.07

S.NO	Parameters	Result		AS per IS 10500 (2012)
		Raw water	Treated water	
35	Nickel, mg/l	<0.01	<0.01	Max 0.02
36	Total Arsenic, mg/l	<0.01	<0.01	Max 0.01
37	Total Chromium, mg/l	<0.01	<0.01	Max 0.05

Microbiological tests

S. No	Parameters	Result		AS per IS 10500 (2012)
		Raw Water Sample	Treated Water Sample	
1	Coliform Organisms/100 ml	24	Less Than 1	Less Than 1
2	E.Coli Bacteria/100ml	Present	Absent	Absent

From the above Table 4.8, Turbidity was observed within the permissible limit (5 NTU) in both treated and raw water sample. The pH was recorded well in both raw and treated water sample and fit for drinking purpose. All heavy metals were found within the permissible limit in both Raw and Treated water samples. Free residual chlorine was also found within limit. Coliforms were found in raw water sample and less than 1 in treated water sample. Highest coliform numbers was counted in raw water sample as compare to treated water sample. E. Coli were also present in the raw water sample while absent in treated water sample.

4.8.2 Water Quality at Consumer End

Water quality sampling at consumer end was conducted and results are shown in **Fig 4.10** and given in **Table 4.9 and 4.10.**

In Dharwad, Residual Chlorine was observed high at all locations except Kelageri Area, Hosayallapura, Jayanagar Janatha Colony and CB Nagar. While in Hubballi, Residual Chlorine was also observed high except Shakti Colony which could be due to chlorination of water. E.coli were found less than 1CFU at all locations except Hosayallapura (80 CFU) water sample, Dharwad. It could be due to cross contamination of water.

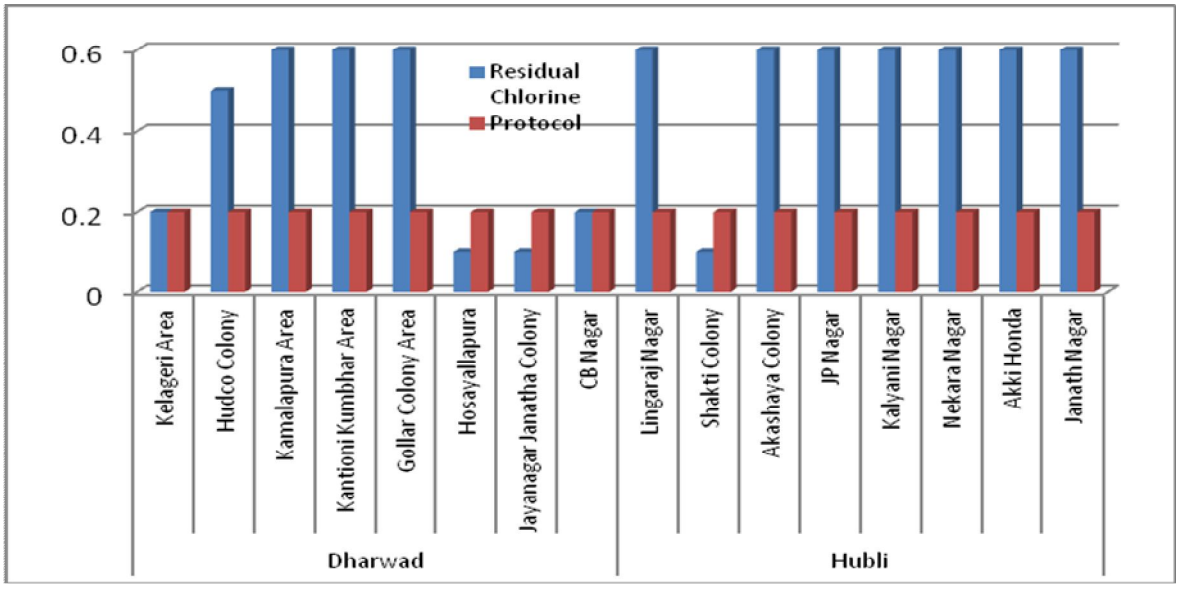


Figure 4.10: Residual Chlorine at Consumer End

Table 4.9: Water Quality at Consumers End (Tap Water) Dharwad

S.No	Location	Ward no.	Free Residual Chlorine		E.coli Bacteria/100ML	
			Result	Protocol	Result	Protocol
1	Kelageri Area	1	0.2	MIN 0.2	Less Than 1CFU	Absent
2	Hudco Colony	2	0.5	MIN 0.2	Less Than 1CFU	Absent
3	Kamalapura Area	5	0.6	MIN 0.2	Less Than 1CFU	Absent
4	Kantioni Kumbhar Area	6	0.6	MIN 0.2	Less Than 1CFU	Absent
5	Gollar Colony Area	7	0.6	MIN 0.2	Less Than 1CFU	Absent
6	Hosayallapura	11	0.1	MIN 0.2	80CFU	Absent
7	Jayanagar Janatha Colony	14	0.1	MIN 0.2	Less Than 1 CFU	Absent
8	CB Nagar	17	0.2	MIN 0.2	Less Than 1 CFU	Absent

Table 4.10: Water Quality at Consumers End (Tap Water) Hubballi

S.NO	Location	Ward no.	Free residual chlorine		E.coli bacteria/100ml	
			Result	Protocol	Result	Protocol
1	Lingaraj Nagar	25	0.6	Min 0.2	Less Than 1CFU	Absent
2	Shakti Colony	27	0.1	Min 0.2	Less Than 1CFU	Absent
3	Akashaya Colony	35	0.6	Min 0.2	Less Than 1CFU	Absent
4	JP Nagar	40	0.6	Min 0.2	Less Than 1CFU	Absent
5	Kalyani Nagar	48	0.6	Min 0.2	Less Than 1CFU	Absent
6	Nekara Nagar	53	0.6	Min 0.2	Less Than 1CFU	Absent
7	Akki Honda	57	0.6	Min 0.2	Less Than 1CFU	Absent
8	Janath Nagar	65	0.6	Min 0.2	Less Than 1CFU	Absent

4.8.3 Soil Quality

In order to assess possibility of cross contamination in the demonstration zones in the project city; soil samples were collected at the distribution network under the demo zone project KWASSIP and analyzed for its bacteriological and physiochemical characteristics.

Four soil samples along the distribution network were collected in Hubballi-Dharwad. Soil was red loamy and exhibits poor to medium porosity. All samples were found alkaline in nature. Nitrate levels in the samples were found high. High coliform counts were also recorded in the samples with fecal coliforms ranging from 5 to 20 colonies in plate count test. This indicates the potential of the soil to contaminate drinking water supplies.

4.9 Major findings from secondary data analysis

The issues identified from the secondary data are summarized below (**Table 4.11**).

Table 4.11: Major Social Issues/Findings based on Secondary Data Related to Proposed Project

Major Issues	Cause	Major findings in district
Water Supply infrastructure	Good Rainfall and Inadequate water storage infrastructure	Decreased Water supply and storage capacity
Changes in land use particularly	Forest cover is going to reduce	Forest Exists only 9.04% in project area
Limited availability of Surface Water	Lower forest cover, insufficient natural surface water resources, topography of the local area, lack of knowledge regarding water conservation. Insufficient of funds for care & maintenance of surface water resources,	Per Capita water supply is poor
Surface & Ground Water Quality	Madhihal Nala in Dharwad receives wastewater from Gokul Industrial Estate It is estimated that around 1.5 to 2 MLD of industrial waste is discharged into Madhihal Nala.	Surface and Ground water quality is of concern.
Ground Water Level	Increased withdrawal of ground water	Increased dependence on ground water resources due to limited availability of surface water

4.10 Social Profile

Social profile Hubballi-Dharwad City was analysed based on secondary source information primarily drawing from the *Census Report 2011*

4.10.1 Sex Ratio

Sex ratio (female population per 1,000 male population) of Hubballi Dharwad is 989 in 2011, which is higher than the district urban figure (952) and state urban average (963), census 2011. In 2001, the sex ratio of the city is 949.

4.10.2 Literacy Rate

In 2011, the literacy rate (percentage of literate population to the total population above six years of age) in the city is 77 percent. The literacy rate in Hubballi Dharwad City is higher than the district urban (71.21 percent), however lower than the state urban average (87.58 percent), census 2011. The male and female literacy rate is 80.7 percent and 73.3 percent, respectively. The high literacy rate in the city is attributed to large number of educational institutions.

Slum-

Of the total slum population, 85% are literates and the remaining 15% are illiterates where 45% are male and 55% are females

Source: MoUD; Report on Slum free city plan of action, Hubballi-Dharwad

4.10.3 Average Household Size

The total number of households in City according to the 2011 census were 2,00,418, with household size of 4.7. There has been decrease in household size from 5.1 in 2001 to 4.7 in 2011.

The total number of households in slums is 37319 according to 2011 census, with household size of 4.76.

4.10.4 Workforce Participation

Total work force participation rate of the town was 35 percent comprising of 171287 persons (census 2011). Total main workers were 155589 persons constituting 90.8 percent of the total work force. About 92.46 percent of main workers were engaged in other services, 2.99 percent main workers were engaged in agriculture sector and remaining 4.54 percent were engaged in house hold industries (census 2011).

4.10.5 Ward wise Analysis

Population: The total population of the city as per 2011 census is 943788. Population ranged from 6051 in ward number 49 to 31796 in ward number 54. Analysis of population distribution (ward wise) showed that ward numbers 54, 40, 43, 11, 51, 50 and 42, were most populated, while ward number 60, 59, 44, 39 and 25 were least populated.

Child Population: The child population [0-6 years] is reported to be 106031 comprising 11.23 percent of the total population. The child population in the wards is found to vary significantly. While ward 40 had highest number of children (3853i.e12 percent of total child population), ward 49 had least number of children (639 i.e. 10.56 percent of the total children population). The increase or decrease in the percentage of child population in the ward is a result of the number of households, the social composition of the population and so on.

Scheduled Caste Population: The percentage of the scheduled caste and schedule tribe population in the town is 9.83 percent and 3.63 percent respectively. The concentration of the scheduled caste and schedule tribe population is found to vary in the different wards in the city. While wards number 53, 54, 55 and 64 had minimal representation from the community, the highest concentration of population (more than 20 percent) is in ward numbers 50, 62, 48, 22, 57, 45, 16, 67 and 49.

Literate Population: The percentage of literate population to the total population is about 77 percent in the town. The male and female literates accounted for 80.7 percent and 73.3 percent respectively. Thus, there is significant variation among male and female literates. The percentage of literate population varied across the wards. The proportion of illiterate population varied from 12 percent to 38 percent. Wards with more that 25 percent population illiterate are 38,7,29,44,25,40,63,37,6,57,22,62,59,21,64,65,61,67, and 16.

4.10.6 Slum location, Spread & Details

Slum and squatter settlements in Hubballi-Dharwad are growing at alarming rates due to increased construction activities and industrial activities. The general composition of majority of slums comprises of scheduled tribes, scheduled caste, and other backward classes, forming the weaker section of the society.

Table 4.12: Physical location

Area (Sq. meters)						
	0 - 20000	20000 -	40000 - 60000	60000 -	80000 - 100000	Above 100000

		40000		80000		
No. of Slums	76	30	12	1	1	7

Whether slum is Located		
	Core	Fringe
No. of Slums	68	59

Physical location of slum								
	Along Nallah (Major Stormwater Drain)	Along Other Drains	Along Railway Line	Along Major Transport Alignment	Along River / Water Body Bank	On River/ Water Body Bed	Others (Hazardous or Objectionable)	Others (Non-Hazardous / Non - objectionable)
No. of Slums	20	17	18	29	3	2	3	35

Whether the Slum is prone to flooding due to rains				
	Not prone	Upto 15 days	15-30 Days	More than a Month
No. of Slums	113	11	3	0

Type of Area surrounding Slum					
	Residential	Industrial	Commercial	Institutional	Other
No. of Slums	98	5	11	0	13

Source: MoUD; Report on Slum free city plan of action, Dharwad

84% of the slums are on the sites of non-hazardous / non objectionable and remaining on the objectionable areas. Hence 16% of slums require special attention before undertaking any development, the beneficiaries cooperating and their livelihoods are of paramount importance.

Figure 4.11: Slum location

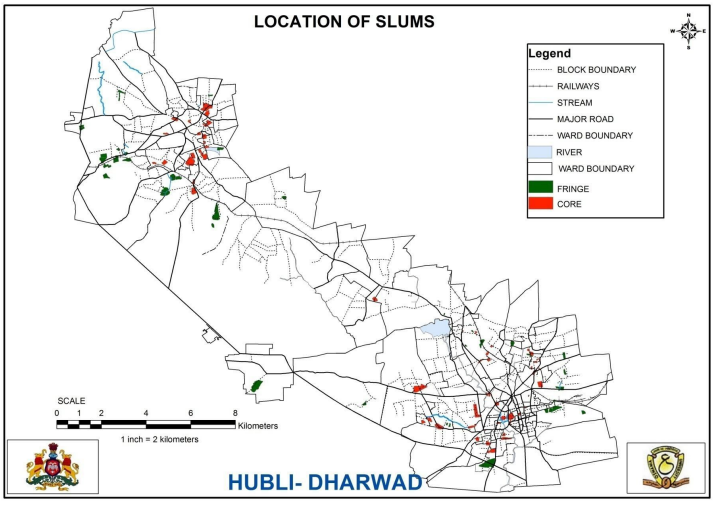
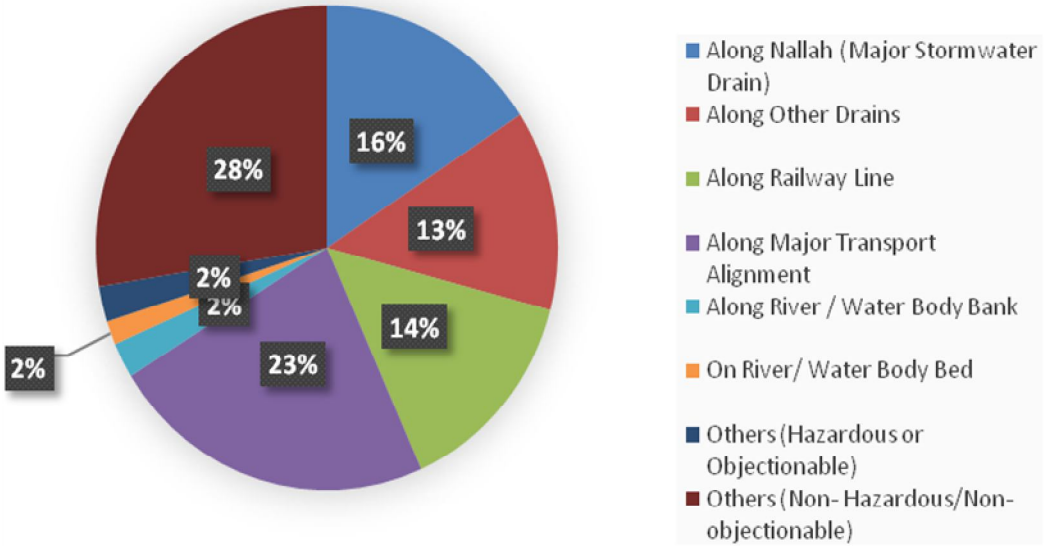


Figure 4.12: Distribution of Slums by Physical Location



4.11 Findings of the Primary Survey

City	Population	Total Households	Actual Sample Size	%
3.Hubballi-Dharwad	9,43,788	1,26,847	4803	3.8

The Communications and Social Intermediation Strategy (CSIS) study was undertaken in the Hubballi-Dharwad city by Samaj Vikas, a Development Support Organisation with a 3.8% sample size.

The household survey covered all wards and slum /non-slum households. The sample size for Hubballi-Dharwad has been as follows:

4.11.1 Socio economic features

The size of the family is proportional to the water quantity required for the family. Generally the larger the family the more the water required. The survey revealed that majority (84%) of the households in this city is nuclear families. However, In Hubballi-Dharwad 16% households are joint family.

The family size has a direct implication on number of water users. The survey thus focused on understanding the family size. Average family size is 4.8 in Hubballi-Dharwad.

Income and asset ownership are indicators which would, to some extent, indicate the households' capacity to spend and pay. The study has captured the economic and asset profile of the sampled households. The data indicates that 19% of slum households in Hubballi-Dharwad respectively, have an average monthly income of less than Rs. 5000. The non-slum households having an average monthly income of less than Rs. 5000/- are 12% in Hubballi-Dharwad . The slum households having an average monthly income of more than Rs. 20,000/- is 9% in Hubballi-Dharwad while the non-slum households having an average monthly income of more than Rs. 20,000/- are in Hubballi-Dharwad respectively.

Economic Profile

Income and asset ownership are indicators which would, to some extent, indicate the households' capacity to spend and pay. The study has captured the economic and asset profile of the sampled households. The data indicates that 19% of slum households in Hubballi-Dharwad respectively, have an average monthly income of less than Rs. 5000. The non-slum households having an average monthly income of less than Rs. 5000/- are 12% in Hubballi-Dharwad respectively. The slum households having an average monthly income of more than Rs. 20,000/- are 9% in Hubballi-Dharwad respectively while the non-slum households having an average monthly income of more than Rs. 20,000/- are in Hubballi-Dharwad is 25%. .

Educational profile indicates that majority of the male respondents are in the SSLS category. Professional comprised a small percentage.

Average HH Monthly Income Non Slum and Slum

Average HH Monthly Income - Non Slum and Slum		
	Hubballi-Dharwar	
Range	Non slum	Slum
	%	%
Less than Rs 5000	11.9	19.0
Rs 5000 - 10000	28.7	41.1
Rs 10000 - 20000	34.4	30.8
More than Rs 20000	24.9	9.1
Total	100	100

Earning HH Head and Education Level in Hubballi-Dharwar

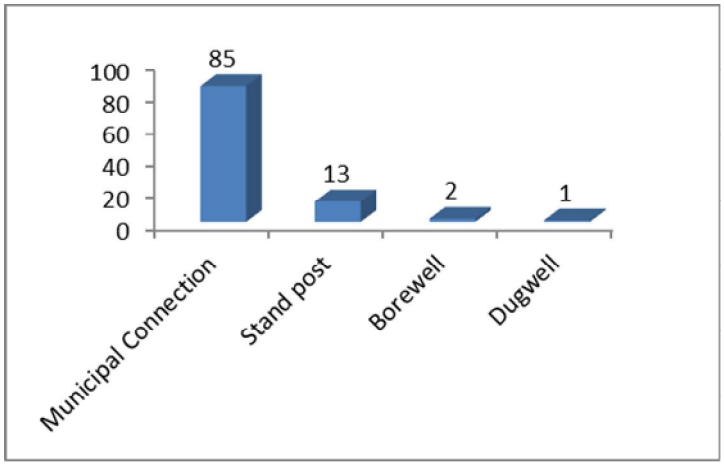
Earning HH Head and Education Level in Hubballi-Dharwar				
	Hubballi-Dharwar			
	Male		Female	
	Freq	%	Freq	%
Illiterate	459	12.8	146	37.6
1-9 Class	767	21.3	119	30.7
SSLC	796	22.1	54	13.9
PUC	376	10.5	25	6.4
Graduation	640	17.8	28	7.2
Post Graduation	162	4.5	1	0.3
Professional	202	5.6	7	1.8
Diploma	180	5.0	5	1.3
Others	15	0.4	3	0.8
Total	3597	100	388	100

4.11.2 Water Supply

Drinking Water Supply is a basic facility provided by the Municipal Corporation. The study collected information regarding water supply in the city; in both slum and non-slum households. 25% of the survey sample was slum households and the remaining were non-slum households. This

categorization helped in understanding the issues faced by the slum households. The figure shows that Municipal Household Connection is the major source of water supply in the city with 85% having the same. People do depend on other sources as well. In Hubballi-Dharwad, 13% households respectively use either stand posts or hand pumps for drinking water. 1% households use dug well (open well) water in Hubballi-Dharwad. However, in and Hubballi-Dharwad, 2% of slum households use bore well respectively.

Figure 4.13: Source of HH Water Supply



Frequency of water supply

Frequency of water supply is an issue considering in overall household management. As evident , frequency is not too bad with 58% receiving more than 4 times and 38% receiving more than 3 times.

Table 4.13: Frequency of Water Supply for HH Connection

No of times	% respondents
1	1
2	3
3	38
4 & above	58
Total	100

Hours of supply

Every urban household desires assured water supply at convenient timings. As reported by the users, Hubballi-Dharwad users report water supply ranging from 2 to 6 hours. 25% of the households report water supply up to two hours and the balance households report water supply from two to above four hours and above.

Table 4.14: Hours of supply

Hours of supply	
In hrs	% of households
1	7
2	18
3	49
4&above	26
Total	100

Per Capita Water Consumption in the ULBs

The field survey attempted to understand water consumption pattern in the ULB at the household level. There is no major difference in water use in demo zone and non-demo zone houses as seen from the data.

Table 4.15: Per Capita Water Consumption in Hubballi- Dharwad

Per Capita Water Consumption in Hubballi- Dharwad		
Consumption In Liters/capita /day	% of Respondents	
	Non Demo	Demo
Less than 40	13	5
40 - 70	49	48
70 - 100	28	35
100 - 135	7	8
Above 135	3	4
Total	100	100

The study also aimed at understanding water consumption in slum and non slum households.

Table 4.16: Per Capita Water Consumption in Hubballi-Dharwar

Per Capita Water Consumption in Hubballi-Dharwar (%HH)		
Consumption In Litres/capita /day	% of Respondents	
	Non Slum	Slum
Less than 40	11	15
40 - 70	48	51
70 - 100	29	26
100 - 135	8	5
Above 135	4	2
Total	100	100

Here also the consumption is 40-70 lpcd by majority of the households. However, the data clearly indicates that comparatively more number of slum households report water consumption. There is also a specific need of creating awareness among stakeholders on the fact that poor and slum use and can use water judiciously if better access to quality supply is provided to them.

User Adoptions

As the households are provided with irregular unassured water supply, some of them have adopted several means to tap water from their connections. The survey findings indicate that in Hubballi-Dharwar, 8% of the households having Municipal Household Connections resort to pit-tapping (dug pits) to get water and 7% use booster motor pumps as well.

Table 4.17: Methods Used to Get Water from HH Connections

Methods Used to Get Water from HH Connections

	% of Respondents
No of HH Connection Users	4058
No of HH having Pits Dug	313
No of HH Using Motor Pump	283
% HH having Pits Dug	8
% HH Using Motor Pump	7

This kind of supply is causing hardship to users, in particular to employed women and low income households. This unassured irregular supply at inconvenient timings propels users to look forward to safe and assured 24/7 water supply as in the demo zones.

Fetching Water

The study finds that each household on an average spends about half an hour to two hours to fetch water from stand post. This is primarily due to the fact that frequency of water supply is poor in the three cities. Women are the primary group (over 60%) who are engaged in fetching water. Menfolk also shoulder the responsibility to some extent. However, in Hubballi-Dharwar, in almost half of the households, fetching water is taken up by only one family member.

Table 4.18: HH Members involved in getting water from stand post

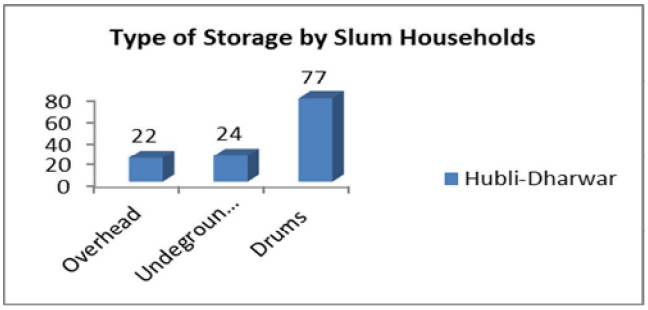
HH member involved in getting water from stand post % HH	
Family member fetching water	% of Respondents
Wife	49.2
Daughter	7.7
Daughter-in-law	4.6
Granddaughter	0
Head	18.5
Son	20
Others	0

.

Coping With Intermittent Supply

The intermittent supply with low frequency has compelled citizens to adopt coping mechanisms by creating household level storage. All types of households, across income ranges, in the three cities depend on storage facilities. It can be observed that more than 77% of households in slums in the Hubballi-Dharwad use drums, buckets and vessels for storing the water. Some of them do use overhead tanks and underground sumps as well for storage of water

Figure 4.14: Type of Storage by Slum Households



Water Quality

The survey collected users perceptions regarding water quality in demo zones and non-demo zones. Demo zone households reported no water quality problem. This is due to the fact that they receive safe 24/7 water supply. Only 13% households in Hubballi-Dharwad perceive water quality problems. The survey went further to understand type of problems perceived by the users. Out of 13% households, who reported water quality problems in Hubballi-Dharwad, 36% had reported taste followed by iron as a major problem.

The enquiry was furthered with type of home level treatment by users to make the water potable. This analysis is done on slum and non-slum households to understand variations in practices if any.

Household Level Water Treatment Practices

Though water quality is perceived as a problem by users, more than 50% households in both slum and non-slum areas do not take up any further treatment. Filtering by cloth is a common practice by more than 30% of the households in both slum and non-slum locations . use of Candle filters are used by about 10-20% of the households in slum and non slum areas. About 5 % households other electric/ non-electric purifiers for improving water quality. This is another reason for switching over to safe 24/7 water supply.

The survey listed the water treatment practices across social categories. It can be seen from the below table that 50% of the SC/ST households are not treating water at household level. Another 37% SC/ST households just filter by cloth and only 9% treat water using various means. The water treatment practices followed by other households from other social categories are not significantly different. This further strengthens the need for good quality water supply requiring no further treatment at household level. There is a need to create awareness among these households on safe water handling practices at household

Table 4.19: Social Category wise HH level water treatment practices

Social Category wise HH level water treatment practices (% HH)		
Type of Treatment	**% of Respondents**	
	SC/ST	Others
No further treatment	50	46
Filtration by cloth	37	32
Use candle filters	9	13

Boiling	0	1
Water purifiers & other gadget (electric)	2	5
Water purifiers & other gadget (non electric)	2	3
Others	0	0
Total	100	100

Reasons for not having house connections

The survey also aimed at understanding reasons for households not having municipal house service connection. The table 30 gives the Households' Source of Water Supply. According to this data 84.5% households have Municipal Household Connection. This means the remaining 15.5% households; both slum and non-slum have no Municipal Household Connection. The following table provides reasons as enumerated by these households for not having Municipal Household Connection.

Table 4.20: Reasons for not having HH Water Connection

Reasons for not having HH Water Connection		
Reasons	**% of Respondents**	
	Non Slum	Slum
Can't afford	75	31
No proper records	30	26
No distribution in the area	23	16
No pressure/technical not possible	63	28
Lengthy process getting one	62	25
Others	53	31
Total	306	157
Total No of Survey Households	3490	1313
% HH not having HH connections	**8.8**	**12.0**

The technical reasons such as low/no pressure are cited by 21% in Hubballi-Dharwad. Lengthy process for getting house service connection was reported as a reason by 20% households in Hubballi-Dharwad.

Affordability as an issue was raised by 20% in slum households in Hubballi-Dharwad.

Satisfaction Levels in Demo and Non-Demo Zones

The field survey aimed at understanding water supply services and also satisfaction level of domestic users. The data is segregated in users from demo zone and users from non-demo zone.

The below tables present the satisfaction levels in each of these areas. Some parameters vary due to the very nature and features of 24x7 water supply; these include, hours of supply, timing and access to water. In Demo zone areas of the city, every household is given water supply. It can be seen that there is extremely wide variation in satisfaction levels of demo zone and non-demo zone.

Satisfaction Levels in Demo Zones

Users of 24x7 water supply in demo zone expressed that they have received continuous water supply with adequate pressure where they are not required to store water. The below table shows that households in demo zone do receive good quality water. Further, grievance redressal and fault repair services are efficient and users are satisfied. The overall satisfaction level crosses 90% in Hubballi-Dharwad in demo zone. However, the picture is completely different in non-demo zone areas.

Table 4.21: Satisfaction Levels in Demo Zone (% HH)

	% of Respondents
Pressure of water supply	98
Quality of water supply	99
Access to water supply	98
Grievance redressal & Fault repair	98
Overall level of satisfaction	**97**

The findings indicate the situation is better as reported by users in Hubballi-Dharwad. This can be seen from the analysis satisfaction is 80% in Hubballi -Dharwad.

Table 4.22: Satisfaction Levels in Non Demo Zone Areas (% HH)

	% of Respondents
No. of hours of water supply	76
Pressure of water supply	84
Quality of water supply	87
Access to water supply	86
Grievance redressal & Fault repair	79
Timing of water supply from municipality	63
Overall level of satisfaction	**83**

Water Charges

Water Charges in Demo zone

In the demo zones, payments are made by households as per the metered readings. The findings are presented below

The data shows that about 20% of the users in Hubballi-Dharwad demonstration zone; both slum and non-sum receive a monthly bill in the range of Rs. 100 to Rs. 200/.The Municipal Corporations have provided subsidy for meter installation and connection to poor and slum households. As there is no subsidy on water charge payment, the water bills are based on usage. However about 81% of slum households in Hubballi-Dharwad respectively pay less than Rs. 100 a month. Further about 12% slum households in Hubballi-Dharwad pay less than Rs. 50 a month.

Willingness to Pay by Volumetric Billing

The study data indicates that above 56% of the non-slum households are willing to pay up to Rs. 250/- per month for 24/7 water supply. This was the response of the households when asked 'if the present water supply is improved to 24/7, then how much they would be willing to pay'. About 25% households in Hubballi-Dharwad are willing to pay as per meter (as peruse). The study further reveals that about 59% of the slum households are willing to pay Rs. 250 per month for 24/7 water supply. This indicates that the slum households which include poor suffer from the intermittent water supply and are willing to pay more for an assured safe 24/7 water supply.

Figure 4.15: Willingness to Pay by Non Slum HH

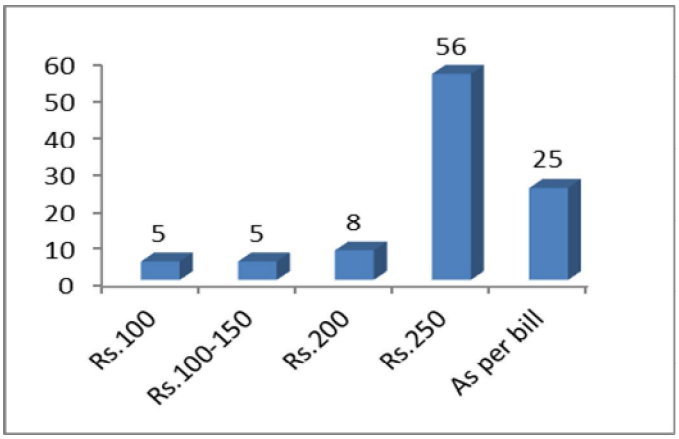
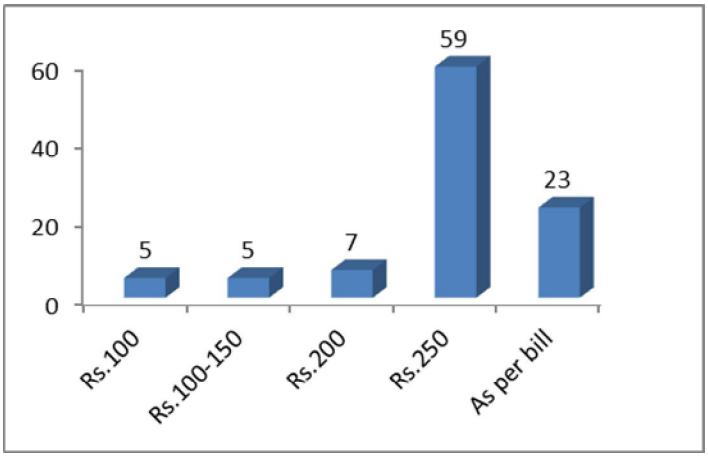


Figure 4.16: Willingness to Pay by Slum HH



The field survey reveals majority of the stand post users are willing to pay more for continuous water supply than the households with house service connections. The below table shows that households with house service connection (57%) are willing to pay up to Rs. 250/- per month,

whereas household using stand posts (50%) are willing to pay the same amount. This indicates that stand post users are put to hardship under intermittent water supply regime are craving for more assured and reliable water supply and area willing to pay more for the same.

Table 4.23: Willingness to Pay by Different Facility Users

Willingness To Pay by Different Facility Users (% HH)		
Cities	**% of Respondents**	
Monthly Water Charges	S pots	HH Connection
Rs 100	4	5
Rs 150	7	5
Rs 200	8	8
Rs 250	50	57
As per meter	32	25
Total	100	100

Table 4.24: Willingness to Pay across Income Categories

Willingness to Pay Across Income Categories[3] (% HH in non-slum areas– all cities together)								
Monthly Water Charges	Less than Rs 5000		Rs 5000 – 10000		Rs 10000 - 20000		More than Rs 20000	
	Non Slum	Slum	Non Slum	Slum	Non Slum	Slum	Non Slum	Slum
Rs 100	5	4	4	4	5	4	5	6
Rs 150	8	4	7	4	7	6	7	7
Rs 200	16	9	19	13	20	14	23	15
Rs 250	56	63	55	64	53	64	48	63
As per meter	16	19	15	15	16	30	17	10
Total	100	100	100	100	100	100	100	100

The above table reveals that there is willingness to pay for assured water supply across different income categories; both among slum and non-slum households. This indicates that citizens, irrespective of their income category are looking forward to having assured continuous water supply and are willing to pay more for this. It can also be seen that more number of slum households are willing to pay up to Rs. 250/- per month. This reminds us of the need for a project pro-poor policy to encourage such behavior among the poor and vulnerable and for making sure they access the services.

4.11.3 Health Profile

As per the household survey conducted for a sample size of 4041 households in Hubballi-Dharwad, around 80% of the respondents were aware of the water borne diseases such as typhoid, diarrhoea, gastroenteritis, cholera and others.

[3] Combined for Belagavi, Hubballi and Dharwad

Table 4.25: Knowledge of Water-borne diseases

Knowledge about Water-borne diseases	Percentage respondent
No	21.18
Yes	78.82

The monthly medical expenditure reported by the respondents ranged between Rs.20 to Rs.1200 per month, with more than 70% of the respondents spending between Rs.100-500 per month. During the last six months, the medical expenditure incurred by the respondents ranged between Rs.20 to Rs.35, 000.

Table 4.26: Average household Monthly Medical Expenditure

Range of Monthly expenditure	% of Respondents
Less than 0	3.49
0-100	9.34
100-1000	86.77
More than 1000	0.40

Incidence of gastroenteritis is significant followed by typhoid.

Table 4.27: Respondents Reporting Water Borne Diseases

Disease	% of Respondents
Typhoid	28.35
Diarrhoea	15.15
Gastroenteritis	43.11
Cholera	13.40

Around 65% of the respondents visited private health centers and the balance visited government health centers for treatment.

Table 4.28: Source of Medical treatment

Treatment Source	% of Respondents availing
Non-Government	86.92
Government Hospital	13.08

4.12 Conclusion

The base line socio economic profile of the project area does not indicate the presence any sensitive social and environmental features, which could be impacted due to the project activities. Hubballi-Dharwad, with its rich historic back ground has a few heritage structures. The project activities shall ensure that these structures are not impacted during the construction or operation phase of the project. Other than the above, the project is critical in improving the water supply service levels in Hubballi-Dharwad.

Chapter 5. Assessment of Environmental Impacts

5.1 Introduction

The proposed project will lead to several impacts on the environmental and socio-economic status of the project area. A good number of these impacts will be beneficial, especially the improvement of availability of potable water in city, reduction of water borne diseases, reduction in man- hours spent (especially women and children) in sourcing for water, and the establishment of an environmentally sound, safe and sustainable water sanitation system.

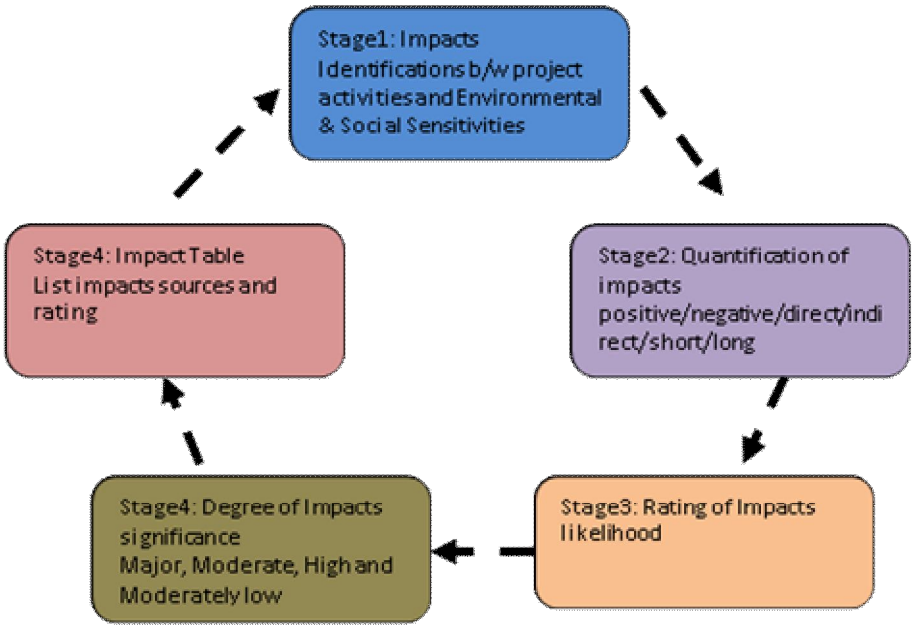
This chapter presents a summary of the identified potential beneficial and adverse impacts associated with the Hubballi-Dharwad water supply project. Identification of all potential environmental impacts due to project is an essential step of EIA. In case of water supply projects, impacts on biodiversity, air pollution, water pollution, waste management and social issues are significant.

5.2 Associated and Potential Environmental Impacts

For the identification and rating of key issues and impacts that are likely to occur during the phases of this project and the significance of the associated impacts, a "5-Step-Tool" was used.

5.2.1 Rating of Impacts

Five steps were followed sequentially in order to rate the impacts of the various activities of the project as shown below:



5.2.2 Associated and Potential Impact Determination

Activities during lying of new trunk main will involve excavation, transportation & lying of pipe and reinstating excavated farm land, road and stream sections. Replacement and strengthening of the feeder mains will include digging of roads in the areas where replacement and strengthening is planned and reinstating the roads and drains thus disturbed.

The alignment of the proposed new main transmission line are proposed in such a way that the main runs principally along public roads and that, there will be no land acquisition.

The project proposes dismantling of OHT/ELSR/GLSRs and construct new structures. It is proposed to dismantle overhead reservoirs and construct the new ones in its near vicinity. Extra care needs to be taken during the dismantling of the structures like caution board and prior information to nearby community. Dismantling and new construction may lead to air pollution and health & safety problems to nearby habitation. **It is strongly recommended during construction of both ELSR and GLSR a detailed geotechnical/ soil study should be carried out**.

An environment management plan or mitigation measures have been suggested in Chapter 7 and environmental code of practices are also prepared for this project.

Since the distribution network in the city is to be re-laid, extra precaution needs to be taken in areas which are congested. Proper barricading needs to be provided on such trenched. Proper "Caution" tapes and signboards need to be put in place in both local and English language to highlight the working area.

Barricading and proper signages should be placed in congested road and community. **It is recommended in congested community an alternate road or street should be taken for easy work and free movement of peoples.**

Before the work is undertaken in the city, a proper traffic flow management plan should be prepared and implemented to ensure that the public and good movement is not adversely effected due to the construction activity.

There should be proper parking facilities to the nearby houses, parks, playgrounds. Alternate lanes should be taken for pipelines so that access can be provided to residents. Start and end period date for the implementation and lying of pipeline work which is convenient way for traffic movement and it should be written in both local and English language.

5.2.3 Land Environment

The land environment will be impacted with activities during lying of new transmission main (Intake point of Renuka Sagar to Amminabhavi WTP, Neer Sagar Reservoir to Dhumwad GLR, A new line of 1168 mm diameter MS from Amminbhavi to Dharwad and new line of 1294 mm diameter MS from Amminbhavi to Hubballi) and clear water transmission lines will involve excavation of trenches, transportation & laying of pipe and reinstating excavated farm land, road and stream sections. Lying of mains will include also digging of roads in the areas where placement and strengthening is planned and reinstating the roads and drains thus disturbed. Activities wise impacts are summarized in **Table 5.1**. The width of the trench would depend on the pipeline diameter and in no

case would exceed 2.5 m. for the entire length of alignment. These earthwork activities will be localized and will have temporary impact on the topography of the area.

The alignment of the proposed new main transmission and clear water line is proposed in such a way that the main runs principally along public roads and that, there will be no land acquisition.

The construction of WTP, Clear water Storage and Clear water pump station at Amminbhavi will have localized impacts and also required 1.75 acres land (private land).

The project proposes dismantling of 25 ELSR/GLSRs/WTP and constructs 30 new structures. It is proposed to dismantle overhead reservoirs and construct the new ones in its near vicinity. Extra care needs to be taken during the dismantling of the structures which are near to habitation especially Ayodhya Nagar, Keshwapur, Karwar Road, DC Compound, Saraswatpur and Navnagar. Rehabilitation and New construction may lead to air pollution and health & safety problems to nearby habitation. An environment management plan or mitigation measures have been suggested in Chapter 7 and environmental code of practices are also prepared to minimize impacts.

Disposal of the excavated earth from the GLR and WTPs construction has to be done with precaution as it can contribute to localized impact on topography and may hinder natural drainage.

Since the distribution network (2100 km) in the city is to be re-laid, extra precaution needs to be taken in areas which are congested. Proper barricading needs to be provided on such trenched. Proper "Caution" tapes and signboards need to be put in place to highlight the trenching area. Trenchless technology should be used to lay pipelines near crossings and other roads of importance so that the traffic flow is not hampered due to the trench cutting for pipe laying.
Before the work is undertaken in the city, a proper traffic flow management plan should be prepared and implemented to ensure that the public and good movement is not adversely effected due to the construction activity.

Figure 5.1: Proposed Alignments

Soils

The impact on soil due to the project will be in terms of localized topsoil erosion along the alignment, due to construction activities. No quarries are envisaged in the project. Hence no impact on the soil is envisaged.

5.2.4 Water Environment

1. Water Availability

There are no major rivers or reservoirs in the near vicinity of the city other than present surface sources. This project may increase pressure on the available water sources. The present sources, Neerasagar Reservoir and Malaprabha Reservoir have been studied in detail to estimate the available quantity and dependability as a source for water supply to twin cities for the horizon year 2041.

In the absence of sufficient data such as inflows of Neersagar reservoir, simulation studies could not be carried out to work out the availability and dependability of the source. However based on the records of drawls from the reservoir for the water supply to Hubballi- Dharwad twin cities city for the past 10 years it was assessed that this source could yield 44 MLD (16 Mcum) at 100% dependability.

The balance requirement of 335 MLD (122.3 Mcum per year) out of 377 MLD has to be met by Renukasagar reservoir. This quantity is just 10.15% of the average catchment yield. Based on the catchment yield and the reservoir storage capacity of Renukasagar reservoir, this source is considered 100 % dependable for the supply of 335 MLD (122.3 Mcum per year) to Hubballi-Dharwad twin cities including enroute villages and Kundgol town and nearby industrial areas to meet water demand upto the year 2041.

Ground water source shall be treated as supplementary source in case of any emergency or till implementation of distribution system in the unserved areas.

*(Detailed water availability in these reservoirs is presented in **Annexure V**)*

1. Surface Water Quality

The proposed alignment of main passes along the roads which does not encroach / pollute any surface water bodies in the city. Hence no significant impacts are anticipated on the surface water quality due to the proposed alignment. But there are many ponds and Lake (Here Keri Tank, Dharwad, Sadhankheri Lake, Kelageri Lake, Navalur Lake,Rayapur Lake, Amargol Pond, Bhairkoppa Pond, Unkal Lake, Santosh Nagar Lake, Nagashetty Koppa Lake, Siddharooda matt lake, Topallgati lake, Murarji Nagar Pond, Chinnadakere Pond and Kempe kere) exist within the twin city which may be impacted due to distribution network. The sewerage system of city is very poor and STPs is being constructed in the twin city. Contribution of industrial waste to these surface water bodies is moderate. Madhihal Nala in Dharwad receives wastewater from Gokul Industrial Estate. While no information on the industrial waste generation is available from KSPCB, it is estimated that around 1.5 to 2 MLD of industrial waste is discharged into Madhihal Nala.

Activities involving replacement of existing distribution pipeline in the close proximity of households will have an adverse impact due to water logging and leakages. This impact is temporary and limited to the construction phase.

Improvement in the distribution system will not have any direct impact on the surface water quality. With the increase of population, the water demand would increase which in turn will lead to higher generation of sewage. As such proper sewerage system needs to be put in place along with the water supply scheme to ensure that the surface water quality is not adversely affected.

2. Ground Water Quality

Since alignment of the pipeline is on a fairly flat terrain, no activities of the project construction or operations are expected to interfere with the ground water characteristic of the region. Hence impacts on ground water quality are not anticipated. Improvement works in the distribution lines will not have any impact on the ground water quality during construction. Pre-monsoon water level ranged from 2.18 to 17.40 mbgl while in post-monsoon it ranged from 1.28 to 19.10 mbgl and is not susceptible to pollution due to construction of GLSR and WTP. Hence proper collection and disposal of sewage will be a critical factor to avoid pollution of the shallow ground water table.

Also, it is recommended that some water harvesting schemes be implemented in the city to recharge the depleting ground water.

5.2.5 Climatic and Air Environment

1. Impacts on Climate

No changes in climatic conditions are anticipated due to the project execution.

2. Air Quality

Suspended particulate matter and dust are major sources of air quality impacts during the excavation and construction process. As the project envisages lying of the pipeline in rigid road network, the impact of air pollution will not be very significant.

However, on site the impact on air quality due to the project is likely to be higher. Adequate dust suppression measures and protective measures to the work force will significantly reduce impacts. AWS (Automatic Weather Station) technique should be use for the monitoring of air pollution.

Considering the size of the pipe material being laid, transportation and lifting machinery will be required during the construction phase. The movement of these vehicles on these temporary roads will contribute to the deterioration of air quality.

No air quality impacts are anticipated during the operation phase of the project.

5.2.6 Noise Environment

1. Construction Phase: Movement of vehicles, transporting construction material and noise generating activities at the construction site, are major sources of noise pollution during construction. Material movement and associated laying work are primary noise generating activities on site and will be distributed over the entire construction period. Proper safety measures as mentioned in the management plan need to be adopted, to mitigate any adverse impact of the noise generated by such equipment.

Activities involving replacement of existing pipeline in the close proximity of households will have an adverse impact due to noise pollution. This impact is temporary and limited to the construction phase.

However, selection of construction equipment and timing of activities, as envisaged in the management plan, will mitigate the impact.

2. Operation Phase: Except during regular maintenance activities, no noise generating activities are envisaged during the project operation phase and hence no noise impacts are predicted then.

Ecological Resources

The project activity does not involve encroachment of sensitive environmental features or cutting of trees / vegetation. Hence no impacts are predicted on the ecological resources of the project area.

Archaeological / Cultural Properties

No structures of archaeological or historical importance lie along the main alignment route and hence there would be no impact on the Archaeological / Cultural properties. While in city, Fort, Chandramoulesvara temple and Basavannadevi temple are found as historical monuments under the central protection category. Construction activities around these structures need to include adequate precautionary measures and clearances from NMA.

Other Issues

It is understood that the right of way for the proposed alignment will be in understanding with landowners. The pipeline will be laid one meter below ground level and as such no existing activity will be affected.

5.3 Construction Phase Specific Impacts and their Rating

Impacts identified for various project activities are summarized in Table 5.1 below.

Table 5.1: Summary of Social and Environmental Impacts

Sr. No.	Project Activity	Environmental Impact
I.	**Construction Stage**	
1	Construction of new raw water transmission line of 1644 mm diameter MS from Saundatti to Amminbhavi WTP	• Increase dust levels in the area due to construction activities • Accumulation of construction waste • Increase water pollution during construction • Deterioration of water quality • Temporary Disruption of water supply • Damage to standing crops during break down of the transmission main or maintenance operations • Disruption of traffic due to movement of vehicles and equipments in Saundatti and Amminbhavi villages
2	Additional clear water storage of 43 ML is proposed at Amminbhavi	• Increase dust levels in the area due to construction activities • Accumulation of construction waste • Increase water pollution during construction

Sr. No.	Project Activity	Environmental Impact
		• Deterioration of water quality • Temporary Disruption of water supply • Disruption of traffic due to movement of vehicles and equipments in Amminbhavi village
3	A new Clearwater pump house to accommodate the additional pumps to cater to the additional capacity is proposed at Amminbhavi	• Increase dust levels in the area due to construction activities • Accumulation of construction waste • Deterioration of water quality • Temporary Disruption of water supply • Increase soil pollution
4	Laying of a new line of 1294 mm diameter MS from Amminbhavi to Hubballi	• Increase in Dust levels due to construction • Soil pollution or soil erosion • Increase noise levels due to excavation • Disruption of traffic flow during transportation of construction materials • Landscape degradation • Pressure on local resources • Accumulation of Excess Earth • Damage to standing crops during break down of the transmission main or maintenance operations • Unhygienic condition in construction camp • Emissions from use of construction equipments/DG sets for construction activities • Temporary Disruption of natural drainage pattern
5	Laying of a new line of 1168 mm diameter MS is proposed from Amminbhavi to Dharwad to cater to the additional future demand	
6	Construction of WTPs at Amminbhavi	• Increase dust or other gaseous (SO_2 & NO_2) levels due to the movement of construction vehicles and equipments • Increase health risk in nearby areas • Increase health risk in construction Labor • Accumulation of construction waste • Accumulation of earth material
7	Rehabilitation of existing WTPs	• No major impact anticipated
8	Laying of raw water gravity main from the reservoir to the pump house at Dhumwad of 1.4 km	• Disruption of traffic due to movement of vehicles and equipments in Dhumwad villages and NH-4 • Increase dust levels in the area due to construction activities

Sr. No.	Project Activity	Environmental Impact
		• Accumulation of construction waste • Increase water pollution during construction • Deterioration of water quality • Temporary Disruption of water supply
9	Laying of raw water rising main from the pump house to the WTP of length 2.225 kms	• Disruption of traffic due to movement of vehicles and equipments • Increase dust levels in the area due to construction activities • Accumulation of construction waste • Increase water pollution during construction • Deterioration of water quality • Temporary Disruption of water supply • Temporary Disruption of natural drainage pattern
10	Construction of new Clearwater reservoir of 4 ML and 5 ML	• Increase dust or other gaseous (SO_2 & NO_2) levels due to the movement of construction vehicles and equipments • Increase health risk in nearby areas • Increase health risk in construction Labor • Accumulation of construction waste • Accumulation of earth material
11	Laying of a clear water transmission (gravity) line of 813 HS exists towards Hubballi (from the Airport to Hosur)	• Disruption of traffic due to movement of vehicles and equipments in Airport Area • Increase dust levels in the area due to construction activities • Accumulation of construction waste • Increase water pollution during construction • Temporary Disruption of water supply • Temporary Disruption of natural drainage pattern
12	Dismantling of existing 25 Elevated/Ground Service Reservoir	• Increase in Dust Level due to dismantling • Increase health risk in nearby areas especially Ayodhya Nagar, Keshwapur, Karwar Road, DC Compound, Saraswatpur and Navnagar which are very congested areas in the city. • Accumulation of demolition waste • Increase health risk in Construction labor • Temporary disruption of water • Increase noise levels due to demolition and movement of vehicles • Temporary disruption of traffic due to

Sr. No.	Project Activity	Environmental Impact
		movement of vehicles especially DC Compound and Ayodhya Nagar • Disruption of water supply in the city
13	Construction of 15 new GLSRs and 15 new OHTs upto the year 2041	• Increase dust levels due to construction of reservoirs • Increase noise levels due to movement of heavy vehicles and construction equipments • Disruption of traffic due to movement of vehicles and equipments • Soil pollution due to leakages from vehicles and equipments • Accumulation of earth material • Increase health risk in nearby area • Increase occupational health risk of construction labours • Increase sanitation problems due to construction camp • Accumulation of construction waste • Impact on city drainage system
14	Laying of about 2100 km of distribution line	• Increase dust levels due to excavation of earth. • Increase noise levels due to movement of heavy vehicles • There may be cases of destruction of underlying cables(Telephones and internet) • Water pollution due to leakages or damages of existing distribution lines • Disruption of water supply to the consumers during implementation • Water conflicts due to shortage of water • Soil pollution due to leakages from vehicles and equipments • Soil erosion and accumulation of excavated materials • Increase occupational health risk of construction labors • Increase sanitation problems due to excavation • Increase risk on ground water contamination • Impact on city drainage system • There will be an increase in traffic congestion

Sr. No.	Project Activity	Environmental Impact
		on major roads and streets as a result of intermittent movement of equipment and materials. This will impact on travel time, and may result in negative perception about the project, amongst road users, residents and commercial establishments • If project implementation will require the procurement of more than one contractor, the possibility of conflicts and workplace violence occurring may arise. This may hinder or slow down project activities. Impediment to the work schedule will pose a negative social impact as successful project management and monitoring will be thwarted
15	Land Acquisition	• 1.75 Acres land is being acquired from private source
II	**Operation Stage**	
16	24X7 Continuous Supply of Water During Operation	• Operation Failure of Transmission Lines- due to mechanical failure or third party interference. • Bursting or breakage of distribution mains- as a result of increased pressure or aggressiveness of pumping. • Power outages, which may disrupt water supply. • Air quality impacts that would arise during the operation of the pumping stations would include emissions from generators • Generation of Additional Quantity of Wastewater from the Zones leading to contamination of surface / sub-surface sources • Deficiencies in Storage and Handling of Chlorine at the water treatment plant • Occurrence of chlorine intoxication if water is over chlorinated during treatment

5.3.1 Activity specific impacts in Sensitive Areas

While the phase specific impacts have been elaborated above, impacts of contraction will have specific and significant in sensitive locations – sensitivity being defined in terms of critical social, cultural, religious services with being delivered in those locations. Critical or sensitive locations

include hospitals and health units, schools and educational institutions, crematorium, historic and tourist locations, market place, major residential complexes and major road junctions. Some of the sensitive locations within Hubballi-Dharwad city and the type of impact envisaged have been indicated in the table below:

Table 5.2: Activity Specific Social Impacts in Sensitive Areas

Activity	Identified location which will be affected	Nature of impact
Laying of pipeline in institutional locations like schools	The city has numerous schools that provide students with quality education. To name a few: St. Joseph High School Karnataka High School Kendriya Vidyalya KPES English Medium School Chetan Public School Sacred Heart Convent School M.R. Sakhare School Lions English Medium Primary School The city is a prominent educational hub with 9 medical colleges, 5 pharmacy colleges, 2 polytechnic colleges, 7 law colleges, 8 management schools & other institutes. To name a few: Karnataka University University of Agricultural Sciences Karnataka State Law University	There will be disruption to the movement of vehicles and students / Teachers during construction phase. Increase in Dust levels due to earth work or replacement of pipe during construction phase. There will be noise pollution hampering classes and lectures during construction phase. Landscape degradation and uneven dug surface will have possibility of accidents during construction phase. Disruption of water supply to the consumers during implementation
Laying of pipeline near Hospitals and Medical Centers	The city has a number of Government and Private Hospitals recognized by government for Medical reimbursement which will be impacted to a significant extent.. To name a few: Karnataka Institute of Medical Sciences SDM College of Medical Sciences Vaatsalya Hospital Medical College & Hospital	Noise pollution during construction phase. The medical facility will face problems in terms of transportation of patients, visits by patient party and handling emergencies during construction phase. Disruption of water supply to hospitals during implementation
Laying of pipeline in Markets and Commercial Areas		Since there will be disruption to the movement of vehicles and pedestrian during construction phase. There is a possibility of commercial

		activities being affected due to non-commutable road conditions during construction phase. Vendors may have to shift locations which might affect their regular business during construction phase. Loss of livelihood and sales during construction phase.
Laying of pipeline through Intersections and Main City Roads, Narrow Lanes, Densely Populated areas	Hubballi-Dharwad is connected by roads to all major cities of Karnataka state & also to neighboring Maharashtra & A.P. The major road linkage is NH 4 connecting Pune & Bangalore which cuts through city. Other major roads are Sholapur/Bijapur road, Gadag road, Karwar road, Sulla road, Hallliyal road & Goa road. Hubballi lies on the "Golden Quadrilateral" super highways, NH 4. Asian highway cuts through Hubballi. It also lies on NH 63(Ankola-Gooty) & NH 218(Hubballi-Humnabad). All these highways connect Hubballi with major cities such as Bangalore, Pune, Hyderabad, Mumbai etc.	There will be disruption to the movement of vehicles and pedestrian during construction phase. Traffic congestions on major roads will lead to delay in commuting for regular commuters during construction phase. The problem will be pronounced if there are no route diversion possibilities.
Laying of pipeline in Tourist attractions and Historic Places	A wide variety of historical sites, temples and churches exist in and around the city, most notably the Chandramouleswara temple at Unkal, Dharawad fort, Mailaralinga temple(Vidyagiri), Jama Masjid, Malapur Masjid, Unka Hill(Northern part), All Saints Church, Basel Mission Church, Azad Park and others	Tourism will be affected temporarily because of disruptions in connectivity and commuting during construction phase.
Proposed ESR construction in commercial areas		Increase dust levels due to construction of reservoirs Increase noise levels due to movement of heavy vehicles and construction equipments during construction phase. There is a possibility of commercial activities being affected due to non-commutable road conditions during construction phase. Vendors may have to shift locations

		which might affect their regular business during construction phase. Loss of livelihood and sales during construction phase..

5.3.2 Determining the magnitude of impact

For the identification and rating of key issues and impacts the "5-Step-Tool" as adopted in the previous chapter on environmental impact involving the impact assessment matric has been adopted.

Impact Assessment Matrix

Likelihood	Negative Consequence				
	Hardly any	Little	Considerable	Great	Extreme
High	Moderate	Moderate	Major	Major	Major
Medium High	Minor	Moderate	Moderate	Major	Major
Medium	Minor	Minor	Moderate	Moderate	Major
Medium Low	Negligible	Minor	Minor	Moderate	Moderate
Low	Negligible	Negligible	Minor	Minor	Moderate

LOW	Consequences			High
Hardly any	Little	Considerable	Great	Extreme
Local, small-scale, easily reversible change on social characteristics or values of the communities of interest or communities can easily adapt or cope with change.	Short-term recoverable changes to social characteristics and values of the community of interest or community have substantial capacity to adapt and cope with change.	Medium-term recoverable changes to social characteristics and values of the communities of interest or community has some capacity to adapt and cope with change.	Long-term recoverable changes to social characteristics and values of the communities of interest or community have limited capacity to adapt and cope with change.	Irreversible changes to social characteristics and values of the communities of interest or community has no capacity to adapt and cope with change

Based on the above a conclusive rating has been done and presented below

Table 5.3: Rating of Environment Impacts

Project Phase	Sub-component	Potential Impact	Degree of Consequence	Rating
Pre - construction	Air	Fugitive dust and exhaust fumes from vehicles	Considerable	Moderate
	Soil	Soil compaction and soil structure changes due to influx and stationary positioning of heavy duty equipment and	Little	Minor

Project Phase	Sub-component	Potential Impact	Degree of Consequence	Rating
		vehicles		
		Leakages from stacked equipment and subsequent seeping through of contaminated soils and chemicals	Considerable	Moderate
	Noise	Increase above permissible noise level, (55Db in residential, 65 in commercial and 75 in industrial area) due to movement of vehicles, equipment and machines to the pumping stations	Considerable	Moderate
Construction	Ground water	Saltwater Intrusion	Considerable	Moderate
		Increase of groundwater vulnerability	Considerable	Moderate
		Introduction of turbid waste water into surface water during cleaning	Considerable	Moderate
	Air	Cement, dust (during demolition), other dusts, exhaust fumes, hazardous gases (NOx,CO, SOx, PM 2.5, PM10)	Considerable	Major
		Demolition works releasing asbestos dust into the atmosphere	Great	Major
		GHG Emissions	Considerable	Minor
	Water quality / hydrology	Contamination from (oils, fuel, chemicals substances etc.)	Great	Moderate
		Contamination by human faecal wastes	Considerable	Moderate
		Water contamination by sediments	Considerable	Moderate
	Soil / Geology	Creation of pathways for contaminants as a result of borehole/well drilling	Considerable	Moderate
		Loss or compaction of top soil due to movement of heavy vehicles and equipment	Considerable	Moderate
		Contamination of soil by oil spills, fuel etc.	Considerable	Minor
	Noise	Extensive noise pollution as a result of on-going construction works.	Considerable	Moderate
	Waste	Social and health concerns arising due to poor waste management practices	Considerable	Moderate

Project Phase	Sub-component	Potential Impact	Degree of Consequence	Rating
	Traffic	Increase in travel time due to works.	Considerable	Moderate
Post Construction	Air	Exhaust fumes from equipment and diesel generator plant.	Little	Minor
	Soil	Groundwater contamination from accidental spills.	Considerable	Moderate
	Noise	Nuisance due to increase in noise levels	Little	Negligible
	Water quality and hydrology	Cross Contamination/ Leakages	Considerable	Moderate

5.4 Conclusion

The implementation of project implementation will create pressure on current water resource. The present water supply sources of twin city are Neerasagar Reservoir (44 MLD) and Malaprabha Reservoir (335 MLD). Malaprabha reservoir is more reliable source of drinking water supply for the city which covers 99% drinking water demand of twin city. Ground water source shall be treated as supplementary source in case of any emergency or till implementation of distribution system in the un-served areas.

The alignment of the proposed new main transmission and clear water line pass public roads and that, there will be no land acquisition while construction of WTP involves land acquisition. Activities during lying of new transmission mains and clear water transmission lines will involve excavation of trenches, transportation and also digging of roads which may affect traffic. Construction of WTP/OHT/GLSR, demolition of OHT/GLSR and laying of distribution network have localized impacts which may affect air quality, water quality, noise levels and traffic of area. There are some historical places exist within the city and need an extra attention during implementation of activity.

Chapter 6. Stakeholders Consultations

Consultation with relevant stakeholders had been an important component of the social and environmental baseline assessment and to obtain the perceptions and views of the stakeholders on social and environmental concerns pertaining to the local areas. The objective of stakeholder consultation was to identify environmental & social issues, impacts, and options to minimize potential negative impacts. The views held by the stakeholders were analyzed and are presented in this section.

Stakeholders were consulted through primary household survey (Demo and Non Demo zone) and discussions with concerned line department which were organized by City Corporation Hubballi-Dharwad and Karnataka Urban Infrastructure Development & Finance Corporation, Communication strategy and Safeguard strategy

6.1 Major Findings from Stakeholders Consultation

The methodology followed in focus group discussion and stakeholder consultation workshop is given below.

- Inviting the key stakeholders to the workshops
- Motivating and encouraging interactions and deliberations on pertinent issues
- Eliciting feedback and responses from the participants and recording them
- Identification of ways and means to identify Environmental & Social issues, options & resolve conflicts, if any, between stakeholder groups.
- Consultations at the demo and non-demo level were carried out through a checklist.

The key issues that were revealed are as follows:

Water woes are prevalent among all cross sections of inhabitants

- There is a pressing demand which is also well visualized during our site visit and interaction for the 24*7 water supply especially in this hard terrain area.
- In non-demo zones water availability is touching a minimal low frequency of daily supply.
- Generally one water tanker is pressed in service daily but is unable to meet the needs of the users. Cut across all the non-demo zones the willingness to pay was largely evident and even the demand to be covered under the scheme. Lot of in community fights take place for getting water from the tanker /few taps in the locality. They have to compromise on all hygiene requirements and thus the health status in this area is low.

Discussions on gender related issues

At the outset it was deemed necessary to understand the prevalent gender issues in the project cities. A series of stakeholder consultation in different project cities have been conducted at this stage of social assessment to find out women's concerns regarding the 24x7 water supply project to be taken up. The consultation was carried out in local language to establish the comfort level. Consultation team in different project cities was present to initiate this process where their primary role was to facilitate discussions and analysis with the women. Initial selection of women's groups for consultation was done in a manner that they represented women from demo zones, non-demozones. Gender consultations during DPR stage must cover various age groups, economic backgrounds, tribal and religious backgrounds.

In the detailed project design stage for the subprojects, more of gender consultations is needed to be carried out. Women stakeholders of various categories, including women office bearers in local bodies and line agencies, self-help groups, women headed households, NGO representatives, working women and teachers of local schools / colleges may be considered for gender consultation and situational analyses. A gender checklist would be prepared. The checklist needs to emphasize on women's economic pursuits (for example, if they were involved in wage labor or self-employed), availability of education and health services, accessibility to water and sanitation facilities and their activities including performing daily chores following activity clock – time spent on productive, reproductive and community work, etc.

- Cut across all boundaries when it comes to women they are always on the lower bar of the ladder. They are the givers so they use minimum water irrespective of its negative impact.
- In the 24*7 supply demo zones the women members were hassle free from fetching and storing water.
- In the non-demo zones the women are most of the time involved in fetching water and storing it. Women are unable to timely go out to work and many a times lose their jobs because of this.
- They are experiencing a lot of physical discomfort in fetching water from far/near sources.
- The spurt of water borne diseases is affecting their health and they have to spend both time and money in tending to those who are ill in the family.
- Personal hygiene becomes difficult to practice when each and every drop of water counts.
- Adding on to all the other woes is the community fights which occur due to lack of water. Many a times it takes a violent turn with the male members getting involved as well.

(The detailed stakeholder consultation is provided in Annexure III)

6.2 CSIS Stakeholders Consultation

This was arranged in coordination with Municipal Corporation. The list of invitees included users from the demonstration zones, representatives of various institutions such as educational institutions, Lions Club, Rotary Club, Resident Welfare Associations, student groups, Local NGOs, eminent persons like teachers, professors, former corporators, Industry Leaders, academicians, professional such as architects, entrepreneurs, media representative and officials of Municipal Corporation, Water Board, Operator, etc. The session was open to share their concerns, opinion, feedback and suggestions. Key points raised were:

· The participants wanted to know more about stakeholders. The Joint Commissioner explained categories of stakeholders.

· Participants also sought clarity on role of Samaj Vikas. It was informed that it is a study agency hired for developing a Communication and social Intermediation Strategy based on field study and interactions for short duration of four months. The proposed plan of engaging local NGOs for this purpose during implementation by the City Corporation was also informed along with important role played by NGOs in demonstration zone.

· Role of private agencies was another question raised. Details of that proposed institutional arrangement for up-scaling 24x7 water supply in the city was explained to the participants. It was clarified that no private investment is envisaged for this work and City Corporation, state government and KUIDFC will provide the funding. Professional services for installation, operation and maintenance of the system will be hired as performance based management

contract. Terms of performance based management contract were explained to the participants. The hiring will be done through open and transparent bidding process.

· The citizen recommended formation of an Inter-departmental Coordination Committee or a nodal agency to oversee implementation in the city. The need of avoiding citizen inconvenience was put forth by the participants. Many departments such as telephone electricity, etc are required to be made part of the proposed committee.

· The NGO representatives put forth the need of improving the new connection procedures including simplification. It was expressed that new connections need to be given within a week's time.

· Issue of stand posts and shared connection was discussed. Shared connections were explained by the officials. Success of this in demo zone was explained.

· Participants voiced their concerns of water quality in non-demo zone and requested the City Corporation to improve the water supply to that of demo zones.

· Existence of unauthorized connections due to higher water supply tariff (in select area Ward No. 6) was raised by an NGO representative. Hence, the need of subsidizing water tariff was the need. The officials explained the experience of demo zone and the water tariff reduction achieved in demo zone through volumetric billing.

· The Municipal Commissioner informed the participants about the city level water supply status and issues. He explained about water losses ranging froJm 50 to 60%, old pipelines network in twin cities, and increased population from 3 lakhs to 11 lakhs. He promised the citizens of the commitment of improving water supply situation in Municipal areas and also dialogue in subsequent stages of implementation.

6.3 Conclusion

The Stakeholder Consultations revealed that there is clear support for the project and people are in fact impatient for the arrival of 24x7 water. The stakeholders are aware of the benefits of continuous water supply specifically health benefits to the family. Women, who play a key role in ensuring water for the family, are eagerly waiting for this project. In addition to health benefits, they indicated that time saved can be used for economic and social activities. The environmental aspects may be included during communication campaigns to increase awareness among stakeholders.

Chapter 7. Social Impact And Mitigation Measures

7.1 Introduction

The proposed project will generate some social impacts in the project area. A good number of these impacts will be beneficial, especially the improvement of availability of potable water in city, reduction of water borne diseases, reduction in man- hours spent (especially women and children) in sourcing for water, and the establishment of an environmentally sound, safe and sustainable water sanitation system. However there will be some negative impacts in the project which although will be in the form of temporary inconveniences, will have to be mitigated.

Social Impact are social ramifications and it is imperative that decision-makers understand the consequences of their decisions before they act and people get negatively affected Social assessment helps to make the project responsive to social development concerns.

This social impact assessment has been undertaken to ensure *social sustainability relating to equity, empowerment and security.*

In simple words, social impact component seeks to understand the community as it is now as understood from the baseline, and seeks to determine:

- What will change as a result of this project?
- What social implications will it have as a result of these changes?
- How can those social impacts be assessed?
- What can be done to reduce the impacts of this project?
- What can be done to maximise the benefits of this project?

This chapter presents a summary of the identified potential impacts associated with the Hubballi-Dharwad water supply project in the social domain.

7.2 Social set up of ESR sites

As evident from the design, major components of WS Project will be constructed within the existing component locations as there will be alterations and rehabilitations of the existing structures. However construction of the ESR will involve dismantling of the existing structures and constructing new structures. The locational features of the proposed ESR have been provided below.

A. Gouri Shankar Nagar:

Proposed ESR is near old railway station. The surrounding of site is vacant. There is no flora and fauna concentration in the site. There are sparse settlements in proximity to proposed ESR. The proposed site has boundary walls hence no direct impact to the residential area.

B. FCI, Bommapur:

Proposed ESR is near Mantur road. The surrounding is mainly vacant land. There is no flora and fauna concentration in the site. There are sparse settlements and railway tracks near the proposed ESR. The existing area of ESR has complete boundary wall and restricted from public.

C. Bidnal:

Proposed ESR is near KEB substation. The surrounding of site is vacant. There is no flora and fauna concentration in the site. There are sparse settlements in close proximity to proposed ESR. Private property to be procured.

D. APMC, Amargol:

Proposed ESR is near FCI godown. The surroundings mainly consist of government headquarters. Procurement is under process. There is no flora and fauna concentration in the site. The site has dense settlements in close proximity to proposed ESR. The area is well protected with boundary walls, hence no impacts to the local residents.

E. Tarihal:

Proposed ESR is present to north of NH-4 bypass, near Nandi Badawane. The surrounding of site is vacant. There is no flora and fauna concentration in the site. There are sparse settlements in close proximity to proposed ESR. Private property to be procured. The area is under well protected boundary, hence no impacts on the local residents.

F. Gokul Village:

Proposed ESR is near Murarji Nagar behind KEC forest lands. The surrounding of site is vacant. There is no flora and fauna concentration in the site. The existing area of ESR has complete boundary wall and restricted from public.

G. Buddha Vihar:

Proposed ESR is near Buddha Vihar Temple. There is no flora and fauna concentration near the site. There are sparse settlements in close proximity to proposed ESR.

H. Udaygiri:

Proposed ESR is near Sattur KHB Colony road. The surrounding of site is vacant. There is no flora and fauna concentration in the site. The PS is located within 2-3 km and the area is well protected with boundary walls, hence no impacts to the local residents

I. Navalur:

Proposed ESR is near Ashraya Plot on hillock. The site has dense settlements in close proximity to proposed ESR. There is no flora and fauna concentration in the site. The area is under well protected boundary, hence no impacts on the local residents.

J. Nehru Nagar:

Proposed ESR is near Tapovan, Dharwad. The surrounding of site is vacant. There are sparse settlements in close proximity to proposed ESR. There is no flora and fauna concentration near the site.

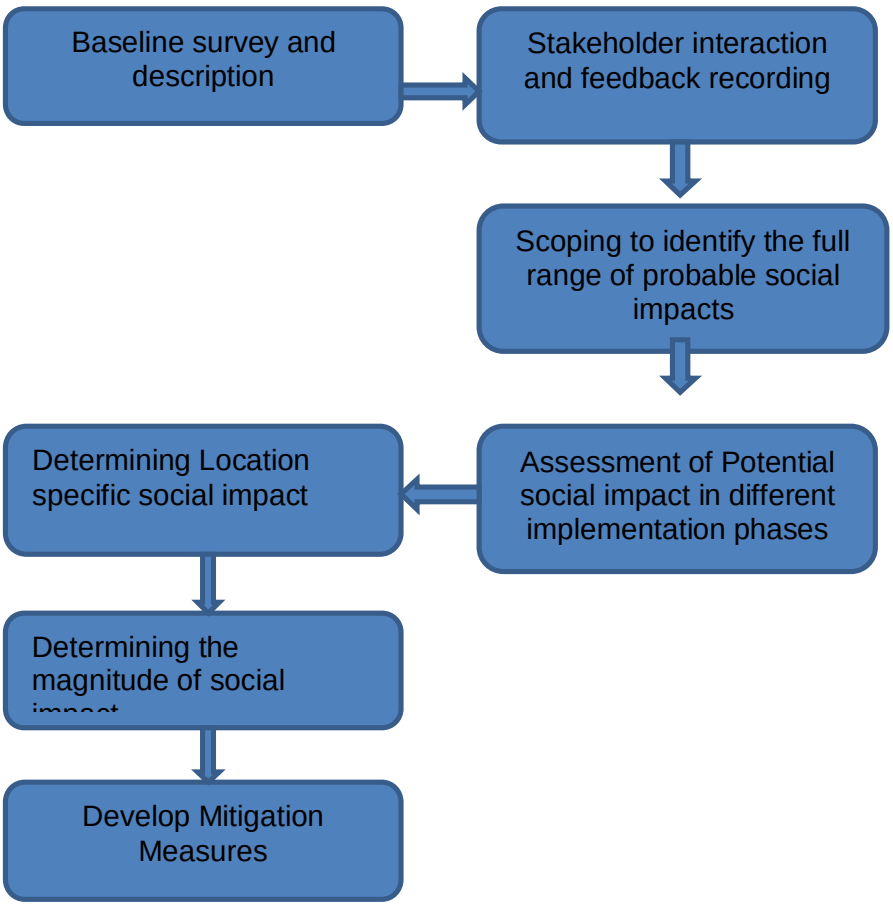
Table 7.1: Proposed Required - LAND DETAILS – Hubballi-Dharwad

Sl. No	Area	ESR/ GLSR/ OHT	LAND OWNERSHIP	AREA REQUIRED (sqm)	Remarks
1.	Gouri Shankar Nagar, Hubballi	GLSR	Sunil D. Kothari	50m X 50m	To be acquired
2.	FCI, Bommapur, Mantur Road, Hubballi	OHT	Commissioner, HDMC	50m X 100m	Land is available
3.	Bidnal, Haliyal Road, Hubballi	OHT	Private	50m X 50m	To be acquired
4.	APMC, Amargol, Near FCI Godown, Hubballi	OHT & GLSR	APMC Land available	100m X100m	Govt land
5.	Tarihal, Hubballi	GLSR	Micro finish valves Pvt. Partner Director T. V. Vikamashi	60m X 60m	To be acquired
6.	Gokul Village, Hubballi	OHT	Commissioner, HDUDA	50m X 50m	Land is available
7.	Buddha Vihar , Hubballi	GLSR	Commissioner, HDMC	50m X 50m	Land is available
8.	Udaygiri, Dharwad	GLSR	Commissioner, HDMC	50m X 50m	Land is available
9.	Navalur, Dharwad	GLSR	Commissioner, HDMC	50m X 50m	Land is available
10.	Nehru Nagar, Near Tapovan, Dharwad	OHT	KIADB Land	50m X 50m	To be acquired

*(Detailed policies for land acquisition is provided in **Annexure II**)*

7.3 Process for Social Impact Assessment

The Social impact assessment and mitigation process is a multi-stage progression involving participative and technical approaches. The process has been presented below.



7.3.1 Baseline Survey and Stakeholder Feedback

The detailed baseline analysis has been presented in chapter 4. The total population of HDMC is 9, 43,788 as per the census 2011. The population density for the city in 2011 is 9831 persons per sq. km. There are altogether 127 slums, out of which 68 slums which are located in the core area are characterized by closely bound clusters and 59 are in fringe areas. Sample survey shows that Municipal Household Connection is the major source of water supply in the city with 85% having the same. People do depend on other sources as well. In Hubballi-Dharwad, 13% households respectively use either stand posts or hand pumps for drinking water and 1% households use dug well (open well) water in Hubballi-Dharwad. However, in and Hubballi-Dharwad, 2% of slum households use bore well respectively. Hubballi-Dharwad users report water supply ranging from 2 to 6 hours. 25% of the households report water supply up to two hours and the balance households report water supply from two to above four hours and above. Every urban household desires assured water supply at convenient timings and are ready to pay for it.

Stakeholder interactions revealed the limited water supply situation and its mitigation through water tanker coupled with low maintenance of existing infrastructure in non-demo zones. Women are worst affected as this kind of supply is causing hardship to users, in particular to employed women and low-income households. This unassured irregular supply at inconvenient timings propels users to look forward to safe and assured 24/7 water supply as in the demo zones.

Prevalence of water borne diseases arising out of unhygienic conditions was mentioned by participants in stakeholders consultations. On the other hand demo zones depict a picture of positivity where consumers are satisfied with the services in terms of quantity and quality. Disease incidence is low.

Hence the water supply project will induce a major positive impact touching upon the quality of life of people and in addressing the Millennium Development Goals.

However along with the overarching positive impact of improvement in quality of life, a full range of other social impacts – negative and positive – needs to be determined which will call for focused intervention. This has been attempted in the following section.

For the identification and rating of key issues and impacts the "5-Step-Tool" as adopted in the previous chapter on environmental impact involving the impact assessment matrix has been adopted.

7.3.2 Scoping to identify full range of social impacts

The potential social impacts associated with any construction activity are as follows

i) Negative perception about the project

In general construction of physical infrastructure aimed at improved service delivery although welcome in a big way, yet it associates apprehensions which may disrupt their daily life. People anticipate disruptions in service and commuting problems during the construction phase which is in one way true. People envisage damage of the existing pipelines during construction disrupting service. Hubballi-Dharwad is already impacted by heavy traffic jams. Further increase in traffic congestions as a result of movement of equipment and materials along the road and streets where works will be conducted is envisaged.

ii) Impact on human health

One of the potential impacts of the proposed sub-projects will be on the air quality due to the dust generated during excavation and tunneling. The amount of dust generated will depend upon the level of digging and the prevailing weather conditions. Based on past experience, the air pollution due to entrainment of fugitive emission is marginal in nature and is observed up to a distance of 100 to 200 m from the point of entrainment. Thus, it is expected to lead to marginal impact on ambient air quality. No major health related issues due to air pollution during construction phase of the proposed project are anticipated.

iii) Traffic Congestion

The construction activities could lead to inconvenience to public during sewer lying along thick commercial areas and narrow streets, or where public facilities are located. This could lead to inconvenience to access business, residential and other immediate facilities for the public and impact on livelihood due to loss of access to business. Resident may not be able to take out their vehicles from their house premises and space for parking may also be reduced. However, such impacts are likely to last for a short duration only.

iv) Impact on livelihood

The excavation and alignment of pipeline work will lead to road blockage and as a result the commercial establishments and vendors will have some inconvenience in operating their business on daily basis. But loss of livelihood is not expected. The vendors can move to nearby places as and when required. Thus, overall no loss of livelihood is anticipated. As per anecdotal evidence gathered during field visit, most shop-owners and mobile vendors are welcoming the water supply project implementation as they see a direct benefit of improved living and working conditions. They are aware of, and prepared to face temporary inconveniences caused by construction if the project is implemented in a timely manner.

v) Increased employment potential

About 100 persons are likely to be employed during construction phase. Some of the locals will also get employment. This will marginally improve the employment scenario during project construction phase.

vi) Impact on existing utility services

The road opening activities may damage the underground water pipelines or electricity poles in the vicinity of the site for the proposed sub-projects. This will lead to water supply interruptions, disruption in electricity supply and will involve expensive repair costs. Hence, it is recommended that adequate precautions be taken during construction phase to minimize such impacts.

vii) Safety hazards

There are potential hazards like falling in the trenches and excavated area for the workers as well as for the pedestrians. Safety equipment for workers has been recommended as a part of the DPR. It is also recommended that construction sites be properly fenced with appropriate signage.

viii) Elevated Noise Levels

Increased noise pollution from construction equipment will disturb residences, and especially schools and institutions in area. For elderly and students, noise is disturbing and affects their comfort. This could be a problem especially in sensitive areas like schools and hospitals located in vicinity of the construction sites. The severity of such impacts is expected to be low/marginal.

ix) Failure to Restore Temporary Construction Sites

Excessive debris, trash or construction remnants (e.g. dirt piles) would create problems related to drainage, unhygienic conditions and poor aesthetics.

7.4 Potential Social Impacts in different implementation phases

Social impacts are linked with different phases of implementation and thus such impacts during pre-construction, construction and operation were identified. Operationally there will be minimal social impacts and these can be addressed through good management practice and good local communication by the Executing Agency. The construction phase impinges the maximum primarily because of the multiplicity of activities at different project sites linked with different components like

- Laying of pipe
- Rehabilitation of Existing WTP

- Dismantling of existing Elevated Service Reservoir
- Construction of new overhead reservoirs
- Relaying of complete Water Distribution Network

The local community is directly impacted due to the high influx of construction workers for extended periods of time and also due to access issues, dust, noise, increased traffic on site. On the other hand from workers perspective occupational hazards are significant during this stage where women especially remain vulnerable from security, privacy and health and hygiene aspects.

The implementation phase specific impacts with special reference to varied construction activities have been identified below:

Table 7.2: Summary of Social and Environmental Impacts

Pre-construction phase		
Social Impacts		
Positive	1	The project will undertake a stakeholders/public consultation exercise to sensitize the inhabitants of Hubballi-Dharwad on the social safeguards components of the project. The public consultation process is seen to be a positive impact, as it will form a basis for project concept decision-making and implementation.
	2	The implementing agency (KUIDFC/ULB) may also help establish project supervision committees at the community levels to enable participation, monitoring and evaluation when rehabilitation works commence.
Negative	1	Land acquisition is an inevitable activity in the preconstruction stage. While govt. to Govt. Transfers involve official notifications and subsequent transfer, acquiring private land calls for compliance with the Land Acquisition and Rehabilitation and Resettlement Act 2013. Land acquisition as a process is lengthy involving a series of stages from identification of Project Affected Persons to preparation of RP and its implementation. This often comes with hitches between the PAP and the donor and delays.
	2	Considering that Hubballi-Dharwad is already impacted by heavy traffic jams, further increase in traffic congestions as a result of movement of equipment and materials along the road and streets where works will be conducted is envisaged. This will impact on travel time, and may result in negative perception about the project, amongst residents and road users. It will also disrupt movement of inhabitants to places of work, business and schools, resulting in loss in man-hours. Traffic in city is already heavy and will be highly affected by this.
	3	Noise from heavy-duty project vehicles and equipment may exceed the MOEF/CPCB acceptable noise level limits, resulting in nuisance particularly in sensitive areas .
	4	Properties may be accidentally damaged or destroyed during the movement of heavy duty vehicles and equipment
	5	Accidents involving vehicles or pedestrians are likely to occur during vehicle and equipment movement to pumping stations/Water Treatment Plant and work areas within the city.
Occupational Health and Safety		
Positive	1	During the pre-construction phase, Occupational Health and Safety (OHS) awareness programs will be conducted. Awareness programs and

Pre-construction phase		
		interactive sessions will benefit primarily the contractors' personnel, ULB and KUIDFC staff. Guidelines on safe practices and safe behavior's will be made available to these groups in order to minimize the occurrence of occupational incidents or accidents in the course of implementing project activities. This is especially in the areas where major construction works will take place.
Negative	2	During the pre-construction phase air pollution from exhaust fumes of vehicles and equipment moving to the pumping stations and work areas may occur. This will pose an occupational health risk (*respiratory infections and diseases*), especially for people living in and carrying out activities around the neighborhood's and also, personnel conveying equipment to the construction site
	3	Exposure to noise pollution, injuries and accidents during movement of equipment to the work areas.
Construction Phase		
Social Impacts		
Positive	1	Employment of skilled and unskilled labor will be promoted. Artisans and professionals from the Hubballi-Dharwad will be provided contractual employment during this phase. This will help promote community goodwill.
	2	Engagement of local people will instill in them a sense of ownership which will help sustain the project in the long run. The entire Hubballi Dharwad town would be geared towards an improved quality.
Negative	1	Laying of pipe • Increase dust levels due to excavation of earth may cause respiratory problems and overall nuisance . • Increased noise levels due to movement of heavy vehicles will cause inconvenience and also hamper work in sensitive locations • There may be cases of destruction of underlying cables (Telephones and internet) • There may be cases of destruction of underlying existing water supply line which leads to leakages and shortage of water nearby locality. • Damage to standing crops during break down of the transmission main or maintenance operations will decrease income of the land owning farmers • Accumulation of Excess Earth will cause inconvenience in commuting and health problems through air pollution. • Disruption of traffic flow in the roads. • Disruption of Utilities such as electricity, telephone and other services. • Water conflicts due to shortage of water
	2	Rehabilitation of existing WTPs in terms of the alum dosing plant, laboratory up-gradation etc. • Noise pollution causing inconvenience • Contamination of water leading to water borne diseases

Pre-construction phase		
	3	Construction of WTPs at Amminbhavi • Increase dust or other gaseous (SO_2 & NO_2) levels due to the movement of construction vehicles and equipment impacting human health Increase health risk in construction Labor
	4	Dismantling of existing 25 Elevated Service Reservoir (Ayodhya Nagar GLSR; N. R. Betta (old GLSR); Keshwapur OHT; Bhairidevarkoppa OHT; Karwar Road OHT after 2031); Nekar Nagar OHT (after 2021); Saraswatpur GLSR; D C Compound 2.5 ML GLSR 9. D C Compound 3 ML GLSR; Gulganjikoppa GLSR; Madarmadi GLSR; Rayapur GLSR; Rayapur Village GLSR; Rajatgiri OHT; D C Compound OHT; Saraswatpur OHT; Mrutyunjay Nagar; Navalur OHT; Sattur OHT; Suthgatti OHT; Navnagar GLSR; Gamangatti OHT; Amargol OHT; Tadsinkoppa OHT 1; Tadsinkoppa OHT 2) • Increase in Dust Level due to dismantling causing air pollution directly causing respiratory problems • Accumulation of demolition waste causing inconvenience and health problems. • Increased health risk in Construction labor • Temporary disruption of water • Increase noise levels due to demolition and movement of vehicles causing inconvenience particularly in sensitive zones • Temporary disruption of traffic due to movement of vehicles
	5	Construction of new overhead and ground reservoirs • Increase dust levels due to construction of reservoirs causing air pollution directly causing respiratory problems • Increase noise levels due to movement of heavy vehicles and construction equipment causing inconvenience particularly in sensitive zones • Accumulation of construction waste causing inconvenience and health problems. • Increase risk on ground water contamination causing water borne diseases • Impact on city drainage system causing diseases
Occupational Health and Safety		
Negative impacts related to occupational health and safety	1	In the course of rehabilitation works, there would be a moderate to severe likelihood of the occurrence of workplace hazards. Activities such as removal and replacement of pipes, trench digging, mechanical, structural works and electrical installations could predispose personnel to hazards. "**Unsafe behaviors**" and **"unsafe conditions"** will pose a serious occupational health and safety risk. Hazardous conditions or practices likely to impact on occupational health and safety will include: a) Works involving removal and replacement of transmission and

Pre-construction phase		
		distribution pipes (collapse) b) Works involving valve replacement and installation of valve chambers. c) Conveying and lifting of heavy equipment (transformers, generators) d) Works at heights (i.e. rehabilitation of elevated tanks) e) Use and exposure to hazardous energy f) Water treatment upgrades g) Electrical installations etc. h) Demolition works
Operation and Maintenance Phase		
Social Impacts		
Positive	1	Improvement in overall water supply and sanitation services for Hubballi-Dharwad
	2	There will be job creation and employment. For instance, more workers may be employed in water supply department as managers, Technicians etc.
	3	Surge in improved health, standard of living; personal and infrastructural hygiene is envisaged as there would be an availability of flowing water in households and public places (Markets, motor parks).
	4	Services delivered by commercial establishments *(restaurants),* hospitals, businesses etc. will be enhanced directly and indirectly
	5	The upgrades in the pumping stations and entire water supply and sanitation system will make it suitable for educational tours, (for example university students studying in the fields of water engineering, etc.)
Negative	1	Operation Failure of Transmission Lines- due to mechanical failure or third party interference disrupting water supply.
	2	Bursting or breakage of distribution mains- as a result of increased pressure or aggressiveness of pumping.
	3	Power outages, which may disrupt water supply
	4	Air quality impacts that would arise during the operation of the pumping stations would include emissions from generators. This will cause respiratory problems.
	5	Generation of Additional Quantity of Wastewater from the Zones leading to contamination of surface / sub-surface sources and leading to borne diseases
	6	Occurrence of chlorine intoxication if water is over chlorinated during treatment leading to morbidity.

7.5 Conclusion and Way Forward towards Mitigation

Hubballi-Dharwad is not located near any eco-sensitive area. The construction of proposed units will have environmental impact on the adjoining settlement in terms of dust and noise during construction. Soil pollution and impact on water quality and hydrology will be marginal and temporary. The impact on the air quality due to the operation of construction machineries in the site is found to be considerable due to digging of trenches and demolition activities. The negative impacts that are likely due to construction activities in narrow and congested roads need critical attention. For mitigation of these impacts following measures are suggested: Compliance with Air Act 1981 and Noise Rules, EP Act 1986 will be mandatory for contractors. There will be no significant adverse impacts in terms of flooding, gas emission, waste discharge, health risks etc. Hence no Environmental Clearances are required for the project.

Chapter 8. Environmental Mitigation and Management Plan

8.1 Introduction

The Environmental Management Plan and Social management Plan details out impacts due to project activities at different phases of the project. Both EMP also details the mitigation/ enhancement measures which will be required over and above the project design. Implementation schedule for each of the suggested measures along with the primary responsibility for implementation is also incorporated in the EMP . This chapter also includes the Monitoring Plan as well as the Institutional Arrangement in implementing EMP.

8.2 Environmental mitigation measure

The mitigation measures in the different environmental domain are presented as below:

AIR	• Dust suppression should be instituted, using water tankers mounted on tractors and sprinklers for dust control. • Vehicles transporting construction materials prone to fugitive dust emissions should be covered. • Trucks carrying sand should have tarpaulin sheets to cover bed and sides of trucks. • Idling of delivery trucks or other equipment should not be permitted during loading and unloading • All construction vehicles should comply with emission standards and
LAND	The solid waste generated during the construction phase is usually Excavated earth material and Construction debris. Excavated earth material should be reused for backfilling between foundations; to fill up the low-lying areas with consultation local municipal body and whereas, topsoil will be reused for Landscaping/Greenbelt development purpose.
WATER	• Construction equipment requiring minimum water for cooling and operation for optimum effectiveness should be chosen. • Appropriate sanitation facilities, septic tank and soak pits should be provided for the workers onsite and offsite to reduce impact on water resources • Discharge of construction wastes to surface water bodies or ground water should not be allowed during construction. • During Construction period in rainy season, the water quality is likely to be affected due to the construction work and loosening of topsoil. This is likely to increase the suspended solids in the run – off during heavy precipitation. In order to reduce the impact on water quality, temporary sedimentation
NOISE	• Restriction on the usage of noise generating activities, and traffic movement in the Residential areas during night to avoid high noise avoiding sleep disturbance to residents during the construction phase. • Generator sets should be provided with noise shields around them. • Vehicles used for transportation of construction material should be well maintained. • The workers operating high noise machinery or operating near it should be provided with adequate personal protective equipment including ear plugs.

8.3 Environmental Management Plan

The Environmental management Plan provides the road map for managing adverse environmental impacts arising from the implementation of such a project. The detailed plan has been provided in the following table.

Table 8.1: Environmental Management Plan (EMP) for Components proposed Project

Sr. No	Project Activities	Impacts	Mitigation Measures	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(4)	(5)	(6)
Design Phase					
1.	Awareness generation and people's confidence building Seeking participation of stakeholders Designing the project keeping in view the social, environmental and technical features	• People apprehension of the project • People's fear on loss of land and property • People's threat of inconvenience	➢ Meetings with stakeholders ➢ Loud speaker announcements on upcoming project seeking participation of people ➢ Insertions in cable TV on upcoming project and its benefits ➢ Hoardings indicating the temporary nature of inconvenience ➢ Design of socially acceptable, environmentally sensitive and technically feasible project engaging a team of consultants	ULB	ULB
Construction /Transition Phase					
2.	Replacement of existing PSC pipe and laying of new pipe	• Disruption of water supply to the consumers during implementation • Water conflicts due to shortage of water • Unhygienic condition in construction camp • Increase Health problems among labourers and Populace in general.	➢ Alternate supply arrangements such as supply through tankers should be provided. ➢ Awareness generation indicting temporary nature of disruption –targeting awareness more toward women who are the household water managers. ➢ Install speed breaker and sign ages near settlements ➢ Prepare traffic management plan. and prior intimation of the construction schedule to the people in the areas of construction. ➢ crossings/ bridges to avoid accidents and other construction hazards ➢ Provide safety measures (mask, gloves, hat etc.) to minimize exposure ➢ Provide sirens in vehicles to avoid any collision with human/animals ➢ Child labour must be strictly prohibited ➢ Provision of temporary ➢ Ensure implementation of Construction Camp Plan (ECOP) for labour camps ➢ Ensure implementation of Health & Safety Management Plan (ECOP) for public and workers safety	Contractor & Operator	ULB/SPV

Sr. No	Project Activities	Impacts	Mitigation Measures	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(4)	(5)	(6)
3.	Construction of WTP	• Noise pollution • Increase health risk in nearby areas • Increase health risk in construction Labour	• Limit hours of operation in populated areas • Use of barriers to reduce noise pollution • Plants, machinery and equipment may be handled in such a way so as to minimize generation of dust. • Dump solid waste in specified place to minimize contamination of water • Organize awareness programs on environmental resource management • Child labour must be strictly prohibited • Ensure implementation of Construction Camp Plan (ECOP,) for labour camps • Ensure implementation of Health & Safety Management Plan (ECOP 10,) for public and workers safety • Preparation of traffic diversion plans and prior intimation of the construction schedule to the people in the areas of construction • Provision of temporary crossings/ bridges to avoid accidents and other construction hazards • Using low noise generating equipment such as pneumatic hammers / drills, provision of encasings around generators and avoiding construction during nights	Contractor & Operator	ULB/SPV
4.	Rehabilitation of existing WTPs	• Noise pollution • Increase health risk in nearby areas • Occupational Hazard leading to Health risk in construction Labour	• Ensure implementation of Health & Safety Management Plan (ECOP) for public and workers safety.	Contractor & Operator	ULB/SPV
5.	Dismantling of existing Elevated Service Reservoir	• Accumulation of demolition waste • Increase health risk in Construction labour • Temporary disruption of water • Increase noise levels due to demolition and movement of vehicles • Temporary disruption of traffic due to	• Limit hours of operation in populated areas • Prepare traffic management plan • Provide safety measures (mask, gloves, hat etc.) to minimize exposure • Child labour must be strictly prohibited • Ensure implementation of Health & Safety Management Plan (ECOP) for public and workers	Contractor & Operator	ULB/SPV

Sr. No	Project Activities	Impacts	Mitigation Measures	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(4)	(5)	(6)
		movement of vehicles	safety. • Ensure implementation of Cultural Properties Plan (ECOP,) if any cultural property is being impacted due to interventions • Preparation of traffic diversion plans and prior intimation of the construction schedule to the people in the areas of construction • First aid facilities to be provided at the construction camps. Any case of disease outbreak may be immediately subjected to medical treatment. Mosquito repellent to be provided to the labours such as odomas, coil and sprays. The camps to maintain cleanliness and hygienic condition. • Provision of scaffolding. • There should be proper covering of excavated or dismantled material while transportation of these waste materials		
6.	Construction of new overhead reservoirs	• Increase noise levels due to movement of heavy vehicles and construction equipment • Disruption of traffic due to movement of vehicles and equipments • Increase health risk in nearby area • Increase occupational health risk of construction labourers • Increase sanitation problems due to construction camp • Accumulation of construction waste	• Limit hours of operation in populated areas • Cross contamination of water should be avoided • Prepare traffic management plan • Preparation of traffic diversion plans and prior intimation of the construction schedule to the people in the areas of construction • Provide safety measures (mask, gloves, hat etc.) to minimize exposure • Organize awareness programs on environmental resource management • Child labour must be strictly prohibited • Ensure implementation of Health & Safety Management Plan for public and workers safety. • Ensure implementation of Cultural Properties Plan (ECOP) if any cultural property is being impacted due to interventions • Ensure implementation of Construction Camp Plan (ECOP) for labour camps	Contractor & Operator	ULB/SPV

Sr. No	Project Activities	Impacts	Mitigation Measures	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(4)	(5)	(6)
7.	Laying of pipeline and construction of ESR in sensitive locations like schools, hospitals, religious, cultural and tourist locations	• Increase noise levels due to movement of heavy vehicles and construction equipment • There will be disruption to the movement of vehicles • Increase in Dust levels due to earth work or replacement of pipe • There will be noise pollution hampering classes and lectures. • Landscape degradation and uneven dug surface will have possibility of accidents. • Disruption of water supply to the consumers during implementation	• Priority work planning in sensitive location • Limit hours of operation in sensitive zones during peak service hours. • Hospitals need special planning for emergency management • Laying of pipeline in alternate street, if possible, to avoid traffic disruptions and commuting problems • Install speed breaker and signages near settlements • Hoardings and signboards intimating the temporary nature of inconvenience • Construction activities to be scheduled carefully to minimize the impact of noise from construction machinery during school hours. • Barricades, temporary noise control measures and dust suppression measures through watering	Contractor & Operator	ULB/SPV
8.	Laying of pipeline and construction of ESR in commercial areas	• Loss of livelihood for vendors • Limited access to small shop and low sales	• Adequate provision for space shall be left so that the pedestrians have access to shops and local service providers • Immediate cleaning up of debris as part of planned process • Alternative livelihood planning to compensate or the temporary loss of livelihood	Contractor & Operator	ULB/SPV

9.	Construction of any nature and in any location	• Safety hazards and accidents
		• Occupational Hazards in all construction sites including health impacts due to absence of proper housing and sanitation facilities in labour camps
			• Fencing of the excavation site and providing proper caution sign boards
			• Protective measures to workers as per occupational and safety norms
			• Develop women sensitive work conditions with toilets blocks catering to women's needs
			• Include creches in worksites.
			• Develop and implement site-specific Health and Safety (H&S) Plan which will include measures such as:
			  • *excluding public from the site;*
			  • *ensuring all workers are provided with and use Personal Protective Equipment (PPE);*
			  • *health and safety Training for all site personnel;*
				Contractor & Operator	ULB/SPV

Sr. No	Project Activities	Impacts	Mitigation Measures	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(4)	(5)	(6)
			• *documented procedures to be followed for all site activities; and* • *documentation of work-related accidents;* • *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; • Training of workers on safety and health and set down rules and regulations of all new workers at the site, personal protective protection and preventing injuring to fellow workers. • 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; and		
10.	Focus on cultural properties	• Access to any of the cultural properties is severed during construction;	• Immediately after completion of construction, the Contractor will affect clearance of the precincts of cultural properties. • Access needs to be restored at the Contractor's cost.		
Operations/Sustaining Phase					

Sr. No	Project Activities	Impacts	Mitigation Measures	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(4)	(5)	(6)
11.	24X7 Continuous Supply of Water During Operation	• Disruption in water supply leading to inadequacy • Generation of Additional Quantity of Wastewater from the Zones leading to contamination of surface / sub-surface sources • Flooding of Low Lying Areas due to overflow of storm water drains • Occurrence of chlorine intoxication if water is over chlorinated during treatment	• Ensure alternate drinking water supply through tankers. In case of Contamination and/or shortage of Water • Involve ward level women's groups like SHGs and Neighbourhood Groups in monitoring. • Measures for water removal though pumping in case of flooding • Ensure implementation of Health & Safety Management Plan (ECOP for public and workers safety. • Ensure implementation of water quality Management (Eco for better water quality • Create awareness on precautions/preventive measures to be taken up in case of over chlorination.	Operator	ULB/SPV

8.4 Environmental Monitoring Plan

The monitoring programme is devised to ensure that the envisaged purpose of the project is achieved and results in the desired benefit to the target population. To ensure the effective implementation of the ESMP, it is essential that an effective monitoring programme be designed and carried out. Broad objectives of the monitoring programme are:

- To evaluate the performance of mitigation measures proposed in the ESMP
- To suggest improvements in the management plans, if required
- To satisfy the statutory and community obligations
- To provide feedback on adequacy of Environmental Impact Assessment

8.4.1 Monitoring Indicators

The monitoring programme contains monitoring plan for all performance indicators, reporting formats and necessary budgetary provisions. Physical, biological and environmental management components identified as of particular significance in affecting the environment at critical locations have been suggested as Performance Indicators (PIs); The Performance Indicators shall be evaluated under three heads as:

- Environmental condition indicators to determine efficacy of environmental management measures in control of air, noise, water and soil pollution;
- Environmental management indicators to determine compliance with the suggested environmental management measures.
- Operational performance indicators have also been devised to determine efficacy and utility of the mitigation/ enhancement designs proposed.

Table 8.2: Environmental Monitoring Indicators

S. No.	Indicator	Details	Stage	Responsibility
A.	**Environmental Condition Indicators and Monitoring Plan**			
1.	Air Quality	The parameters to be monitored, frequency and duration of monitoring as well as the locations to be monitored will be as per the Monitoring Plan prepared (Refer Table 8.4)	Construction	Contractor under the monitoring of PIU
2	Noise Levels		Construction	Contractor under the monitoring of PIU
3	Water Quality		Pre-construction, Construction and Operation	Contractor under the monitoring of PIU
B.	**Environmental Management Indicators and Monitoring Plan**			
1.	Construction Camps	Location of construction camps have to be identified and parameters indicative of environment. In the area has to be reported	Pre-construction	PIU
2.	Tree Cutting (if any)	Progress of tree removal marked for cutting is to be reported	Pre-construction	Forest Department to PIU
3.	Soil Erosion	Visual Monitoring and operation inspection	Construction &Operation	PIU

For each of the environmental condition indicator, the monitoring plan specifies the parameters to be monitored; location of the monitoring sites; frequency and duration of monitoring. The monitoring plan also specifies the applicable standards, implementation and supervising responsibilities. The monitoring plan for environmental condition indicators of the project in construction and operation stages is presented in **Table 8.3.**

Table 8.3: Environmental Monitoring Plan

Attribute	Project Stage	Parameters	Special Guidance	Standards	Frequency	Duration	Location	Responsibility
Air Quality	Construction	All parameters as per National Ambient Air Quality Standards, 2009 like PM_{10}, $PM_{2.5,}$ SOx, NOx	High volume sampler to be located 50m from the plant in the Downwind direction. Use method specified by CPCB	Air (prevention and Control of Pollution) Rules, 2009	Quarterly in a Year	24 hours	Near the Construction area such as sensitive locations like Schools, Hospitals, Water bodies, etc	Operator
Surface Water	Construction	All Parameters as per drinking water standards (BIS:10500) and WHO guidelines	Grab sample collected from source and Analyze as per standards	National Drinking Water Standards (IS:10500} and Inland surface water (IS:2296), 1982	Daily	Grab as per the contract	Surface and Ground Water Sources	Contractor
	Operation							ULB
Noise	Construction	Noise level on Db (A) scale	Equivalent noise levels using a meter	Noise Rule, 2000	Quarterly in a year	Leq in dB (A) fir day and night time	Construction site, Hot mix or batching plant	Contractor

Monitoring and evaluation is primarily required to ensure proper and timely implementation of mitigation measures identified in the planning stage, based on the ESMP. Monitoring at regular intervals during implementation and for a specified period in the post implementation stages is necessary to identify and implement any change / improvement needed in the execution of the activity or in the mitigation measures.

A monitoring and evaluation cell to be created at State level (KUIDFC) under the supervision of an official familiar with environmental issues of the proposed scheme. In specific situations, one may consider appointing external agencies to carry out the monitoring and evaluation activities and report to the supervising official (EE/AE of KUIDFC/Engineers of ULB). The indicators to be monitored can be framed from the ESMP taking into consideration the activities involved.

The feedback received from monitoring and evaluation cell will be discussed with the implementing officials and the contractor and corrective actions will be taken, where necessary. The ESMP requires detailed supervision, monitoring and evaluation of the impact of the project on the environment.

8.5 Capacity Building and Training

The KUIDFC/ULB currently has limited capacity for environmental management. The training and capacity building program developed for the project aims at building environmental awareness and environmental management capacity in the project administration structure as well as in the intended target communities.

The training programs for the staff in the project agencies at various levels as well as for the communities will be organized. Both KUIDFC and ULB to work in the project will require capacity building for survey, design, preparation of designs, drawings and cost estimates for the water supply and sanitation schemes by using computer-oriented tools.

8.5.1 Objectives

The capacity building for environment management shall be integrated with overall capacity building component of the project with the following objectives:

- To build and strengthen the capability of urban water and sanitation agency/institutions (KUIDFC and ULB) and other partners (NGOs, Contractors and Supporting Organisations) to integrate sound environmental management in water and sanitation services.
- To orient the service delivery of staff and Welfare association representatives to the requirements of the projects' Environmental Management Framework.
- Systematic capacity building initiatives shall be introduced only after the completion of training needs assessment.
- The training shall be of plummet mode. All the trained staff and other shall in turn conduct further trainings at State, District and community levels for improved service delivery.

8.5.2 Training Approach

A specific training program for the key officials of the project, focused on the procedural and technical aspects of environmental assessment and management shall be developed. This training would be mandatory for the ULB Staff and Contractors personnel. The project shall fulfil (a) short-

term training on ESMP application in planning and implementing of schemes under the proposed project to all stakeholders concerned including the potential beneficiary communities (b) water quality monitoring and conservation training to Department of urban Development and regulating authorities (ULB). The training shall involve initial orientation, main training program and livener training programs. The main and livener training programs shall be for duration of 2-3 days each, whereas the initial orientation workshop shall be of duration of one day.

8.5.3 Training Resources

Some specialized institutions identified for training are:

- Karnataka Urban Water Supply & Drainage Board
- Department of Environment and Ecology, Karnataka
- Environment Management and Policy Research Institute, Bangalore
- Central Ground Water Board
- Karnataka Pollution Control Board

8.5.4 Training Programs

The various training programmes along with the details are presented in the **Table 8.5** below.

Table 8.4: Training Programs

Sl.	Trainings	Purpose of the Training	Participants	Schedule	Course content
1.	Introduction to Environmental Management in Proposed Project including ESMP	➢ Procedural & technical aspects of Environmental Assessment. ➢ To equip with knowledge and skills necessary for undertaking environmental appraisal as per the requirements of the ESMP. ➢ To undertake periodic supervision of environmental performance of schemes ➢ To prepare for planning and monitoring implementation of environmental mitigation measures identified through the appraisal process. ➢ To equip with skills necessary for water quality testing using the field testing kits under the Community	Personnel from KUIDFC, ULB, Operator	➢ Orientation Workshop – 1 day ➢ Detail training with regards to the environmental and social management plan-2	Environment aspects pertaining to sustainability of water sources, water quality, protection of sources and Environmental appraisal. Water quality monitoring, prevention of pollution & surveillance.
2.	Environmental Awareness and Sensitization	To build awareness on safe drinking water, water conservation, environmental sanitation and personal hygiene.	Personnel of ULB, Welfare Associations and NGOs	One day workshop at the community level.	-
3.	Orienting for planning, design and implementation of project interventions including environmental issues/safeguard	➢ To create awareness among the implementation agencies as well as the monitoring units so as to have in depth understanding of the interventions being implemented under the proposed project. ➢ The orientation shall educate the agencies with regards to the environmental issues / safeguard to be taken into consideration during the implementation of the	KUIDFC, ULB, Operator, Contractor	3 day workshop – First day induction program, and next 2 days in detail training with regards to the environmental issues/safeguards.	

Sl.	Trainings	Purpose of the Training	Participants	Schedule	Course content
		proposed interventions.			
4.	Orientation for Water Quality monitoring	To build awareness on water quality monitoring amongst implementation agencies.	ULB, Operator staff, Lab staff, Community, NGOs	One day training at the community level.	

Cost Estimates for EMP

The environmental budget is estimated for the various environmental management measures in the ESMP, summarized in **Table 8.6**

Table 8.5: Cost Estimates for EMP

Component	Stage	Item	Sampling Locations	Frequency	Unit	Quantity	Unit Cost (INR)/sample	Total Cost (INR)
Mitigation Cost								
Air	Construction Phase	Dust Management with sprinkling of Water	Laying/replacement of mains and distribution pipeline	One time	Km	2210	11,000.00	24,310,000.00
	Construction Phase	Dust Management with sprinkling of Water	Dismantling of existing Elevated Service Reservoir	One time	Number	25	11,000.00	275,000.00
Safety hazards to workers and residents	Construction Phase	Putting fences or other barricades to demarcate the area	At construction site during pipe laying Cost of barricading/ wire 100 kgs @Rs 600 per Kg = Rs 60,000/- Labour required for this work 4 nos @ 200/- = Rs 800/- per day=8000 (the same material will be reused)	Regular	KM	10	68,000.00	680,000.00
Monitoring Cost								
Air	Construction Phase	Monitoring at construction sites	Laying/replacement of mains (4 Nos.), Dismantling of existing reservoirs (25 Nos.) and proposed reservoirs (30 Nos. (15 GLSR and 15 OHT)	Quarterly	Number (59)	236	7,500.00	1,770,000.00
	Operation	(if DG sets use as power backup)	WTP/Pumping Station	Quarterly	Number (5)	20	4,000.00	80,000.00
Water (Surface and Ground)	Construction Phase	From the Ground Water/Surface water bodies of the Construction Site	From Intake point (2 Nos.), WTP (2 Nos.) and Sensitive Locations (8) Nos.	Quarterly	Number (71)	284	6,000.00	1,704,000.00
	Operation	At least one sample at each stage of supply consumer point and public tap	From Intake point (2 Nos.), WTP (2 Nos.), Public Tap (10 Nos.), and Consumer point (67 Nos.@1 sample from each municipal ward)	Daily	Number (81)	81	6,000.00	486,000.00
Noise	Construction Phase	Construction Site	Laying/replacement of mains (4 Nos.), Dismantling of existing reservoirs (25 Nos.) and proposed reservoirs (30 Nos. (15 GLSR and 15 OHT)	Quarterly	Number (59)	236	1,000.00	236,000.00
	Operation	(if DG sets use as power backup)	WTP/Pumping Station	Quarterly	Number (5)	20	1,000.00	20,000.00
					Sub-Total		**47,500.00**	**29,561,000.00**
Environmental Audit						2	500,000.00	1,000,000.00
Preparation of specific environment related community awareness materials						LS	200,000.00	200,000.00

Component	Stage	Item	Sampling Locations	Frequency	Unit	Quantity	Unit Cost (INR)/sample	Total Cost (INR)
Trainings @2 Training/year						6	100,000.00	600,000.00
Internal Supervision/Year						7	200,000.00	1,400,000.00
					Sub-Total			**3,200,000.00**
					Contingencies@5%			1,638,050.00
					Grand Total			**34,399,050.00**

Chater 9: Social Mitigation & Management Plan

9.1 Resettlement and Rehabilitation Issues

A standalone document, Resettlement Policy Framework (RPF) has been prepared that consists resettlement planning and entitlement provisions. The RPF outlines the principles and approaches to be followed in minimising and mitigating the adverse social and economic impacts due to the project. The Resettlement Plan of RPF spells out the actions / tasks required to involve the community, and reduce adverse impacts on PAPs/PAFs at various stages of project along with the agency (agencies) responsible for these actions / tasks and their time frame.

9.2 Social Mitigation Plan

Social impact assessment is not just to forecast impacts - it should identify means to mitigate adverse impacts. This includes the possibility of avoiding the impact by not considering the project at all, if the felt impact is likely to be too severe. Alternately if the predicted impact is minimal and can be managed, mitigation measures must be put in place. This could be in the form of:

Modification of the specific event in the project;

Operation and redesign of the project or policy;

Compensation for the impact by providing substitute facilities, resources and opportunities.

Ideally, mitigation measures should be built into the selected alternative, but it is appropriate to identify mitigation measures even if they are not immediately adopted or if they would be the responsibility of another person or government unit. Ideally effort should be to avoid all adverse impacts. The Social management plan presents the possible social impacts arising from the commissioning of such a project along with the mitigation measures and institutional responsibility in accomplishing it.

Based on the measures the Social Mitigation Plan has been presented as follows:

Table 9.1: Social Mitigation Plan (SMP) for the proposed Project

Sr. No	Project Activities	Impacts	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(5)	(6)
1	Awareness generation and people's confidence building seeking participation of stakeholders Designing the project keeping in view the social, environmental and technical features	People apprehension of the project People's fear on loss of land and property People's threat of inconvenience	ULB	ULB
2.	Special focus on cultural property	Disturbance from construction works to the cultural and religious sites, and contractors lack of knowledge on cultural issues cause social disturbances.		
3.	Replacement of existing PSC pipe and laying of new pipe	Disruption of water supply to the consumers during implementation	Contractor	Operator
		Water conflicts due to shortage of water	Contractor	Operator
		Unhygienic condition in construction camp	Contractor	Operator
		Increase Health problems among laboueres and Populace in general.	Contractor	Operator
5.	Rehabilitation of existing WTPs	Noise pollution Increase health risk in nearby areas Occupational Hazard leading to Health risk in construction Labour	Contractor	Operator

Sr. No	Project Activities	Impacts	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(5)	(6)
6.	Dismantling of existing Elevated Service Reservoir	Increase in Dust Level due to dismantling Accumulation of demolition waste Increase health risk in Construction labour Temporary disruption of water Increase noise levels due to demolition and movement of vehicles Temporary disruption of traffic due to movement of vehicles	Contractor	Operator
7.	Construction of new reservoirs	Increase dust levels due to construction of reservoirs Increase noise levels due to movement of heavy vehicles and construction equipments Disruption of traffic due to movement of vehicles and equipments Increase health risk in nearby area Increase occupational health risk of construction labours Increase sanitation problems due to construction camp Accumulation of construction waste	Contractor	Operator
8.	Laying of pipeline and construction of ESR in sensitive locations like schools, hospitals, religious,cultural and tourist locations	Increase dust levels due to construction of reservoirs Increase noise levels due to movement of heavy vehicles and construction equipment There will be disruption to the movement of vehicles and students / Teachers. Increase in Dust levels due to earth work or replacement of pipe	Contractor	Operator

Sr. No	Project Activities	Impacts	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(5)	(6)
		There will be noise pollution hampering classes and lectures. Landscape degradation and uneven dug surface will have possibility of accidents. Disruption of water supply to the consumers during implementation		
9.	Laying of pipeline and construction of ESR in commercial areas	Increase dust levels due to construction of reservoirs Increase noise levels due to movement of heavy vehicles and construction equipment Loss of livelihood for vendors Limited access to small shop and low sales	Contractor	Operator
10	Construction of new WTPs, resorvoirs, etc	Loss of land and properties Temporary loss of livelihood Access constraints during construction and other impacts (Refer Table 9.2 for entitlements for the impacts).	ULB/PIU	KUIDFC
11	Construction camps	Safety hazards and accidents Occupational Hazards in all construction sites including health impacts due to absence of proper housing and sanitation facilities in labour camps	Contractor	Operator

Sr. No	Project Activities	Impacts	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(5)	(6)
12.	24X7 Continuous Supply of Water During Operation	Operation Failure of Transmission Lines- due to mechanical failure or third party interference. Bursting or breakage of distribution mains- as a result of increased pressure or aggressiveness of pumping leading to flooding and water scarcity. Power outages, which may disrupt water supply. Air quality impacts that would arise during the operation of the pumping stations would include emissions from generators Generation of Additional Quantity of Wastewater from the Zones leading to contamination of surface / sub-surface sources Flooding of Low Lying Areas due to overflow of storm water drains Deficiencies in Storage and Handling of Chlorine at the water treatment plant Occurrence of chlorine intoxication if water is over chlorinated during treatment	Operator/ ULB	ULB/SPV
13	Focus on cultural properties	Access to any of the cultural properties is severed during construction;		
14	Land Requirements	Out of total 33600 sq mts, 25000 sq mts belongs to Government. Balance 8600 sq mts will be attempted to be acquired through direct	ULB/SPV	KUIDFC

Sr. No	Project Activities	Impacts	Site Responsibility	Supervision Responsibility
(1)	(2)	(3)	(5)	(6)
		purchase. (For entitlements, refer Table 9.2)		

Table 9.2 : Entitlement Matrix

Sl No	Impact Category	Unit of Entitlement	Details of Entitlements	Remarks
Loss of Assets - Titleholders				
1	Loss of private land	Land owner(s) Individual/Household	As per provisions of RFCTLARR Act, 2013; or direct purchase. Amount equivalent to current stamp duty and registration charges on compensation amount for replacement of lost assets. In case of land owners become marginal farmers, landless or those who are already marginal, the following entitlement shall be provided: (a) Subsistence allowance of Rs 40,000/- (b) Assistance of Rs 1,00,000/- for creating Income Generating Assets and (c) the Training Assistance	
2	Loss of structure (Residential or Commercial or Res-cum-Commercial)	Owner/Family	Replacement cost determined on the basis of R&BD current Schedule Rates and without depreciation and other provisions prescribed in RFCTLARR Act 2013; or direct purchase Shifting allowance as per provisions of RFCTLARR Act, 2013 Subsistence allowance of Rs 40,000 if the structure is lost completely (RFCTLARR Act 2013) Resettlement allowance of Rs 50,000 if the structure is lost completely (RFCTLARR Act 2013) Additional 25% structure compensation for partially affected structures towards reconstruction of affected	

			structures. In case more than 25% of house is affected and unviable for retaining, full compensation will be paid. Right to salvage materials from affected land or structure	
Loss of Assets - Non Titleholders				
3	Encroachers - Unauthorized occupation of government lands by encroachments	Affected Person (Individual/Family)	Assistance amount equivalent for impacted structures at replacement cost determined on the basis of R&BD Schedule of Rates as on date without depreciation Encroachers shall be given advance notice of 2 months in which to remove assets	
4	Squatters residing on public/government lands for residential or commercial or for both purposes	Affected person (Individual/Family)	Assistance amount equivalent for impacted structures at replacement cost determined on the basis of R&BD Schedule of Rates as on date without depreciation Shifting Allowance as per provisions under RFCTLARR Act, 2013 Subsistence allowance of Rs 40,000 if the structure is lost completely (RFCTLARR Act 2013) Resettlement allowance of Rs 50,000 if the structure is lost completely (RFCTLARR Act 2013) Two months advance notice to remove assets	
Loss of livelihood – Title and Non-Titleholders				
5	Loss of livelihood – title holders and commercial	(Individual/Family)	One time grant of Rs 25,000 (value prescribed under	• For commercial squatters, the eligibility will

	squatters		RFCTLARR Act 2013) Training assistance	become from the date of Census survey
6	Forseeable and unforeseen impacts* likely during the construction stage	Owner, affected person	Payment of damages if any to structures Temporary access would be provided, where necessary.	• Such as temporary impacts on structures, temporary disruption to access or passage, particularly in congested slums if the option of mobile units is not used;
7	Temporary loss of income of mobile kiosks, if any; and	Kiosk owner	Two months advance notice to vacate the area	
Vulnerable people				
8	Vulnerable persons		Assistance to include in government welfare schemes if not included, if eligible as per Government criteria; and One time lump sum assistance Rs 20,000. Additional benefits to SC and ST as per the provisions of RFCTLARR Act 2013.	
9	Women		In case of extending any productive asset, joint ownership in the name of husband and wife will be offered in case of non - women headed households. While disbursing the entitlements, women will be given the first priority to receive the entitlement benefits over other entitled persons.	

10	Loss of or impact on any Common or cultural Property Resource such as shrine, temple, mosque, handpump, shed, etc.	Community, Village/ Ward	Resources such as cultural properties and community assets shall be conserved (by means of special protection, relocation, replacement, etc.) in consultation with the community.	
11	Unforeseen impacts		Any unforeseen impacts shall be documented and mitigated in accordance with the principles and objectives of the Policy	

3 Consultations Strategy and Participation Framework

To ensure peoples' participation in the planning phase and aiming at promotion of public understanding and fruitful solutions of developmental problems such as local needs of drinking water and problem and prospects of resettlement, various sections of project affected persons and other stakeholders will be engaged in various consultation throughout the project planning and implementation.

Public participation, consultation and information dissemination in a project begins with initial Social assessment activities during the initial phases of project preparation. Public consultation activities and information dissemination to PAPs and local authorities continues as the project preparation activities proceed in a project. Through respective local governments and civil society, PAPs are regularly provided with information on the project and the resettlement process prior to and during the project preparation and implementation stage.

The information dissemination and consultation with PAPs during project preparation should include but not limited to the following:

- project description and its likely impacts
- objective and contents of the surveys
- general provisions of compensation policy
- mechanisms and procedures for public participation and consultation
- resettlement options (reorganization on remaining land, relocation to a fully developed resettlement site, or cash compensation)
- grievance redress procedures and its effectiveness
- tentative implementation schedule
- roles and responsibilities of the sub-project proponents and local authorities
- feedback on the income generation activities and effectiveness
- feedback regarding relocation site(s)
- preferences for the mode of compensation for affected fixed assets (i.e., cash

or land-for-land)

A detailed consultation and communication plan shall be developed for each sub-project as part of the RAP. This framework shall be a sub-set of the overall communication strategy of the project. Some of the methods that can be used for the purpose of communication will include provisions of information boards, pamphlets distribution, wall paintings, drum beating, organizing meetings with key informants and village committees and opinion gathering through post cards, phones and SMSes. Certain per centage of the project cost will be allocated for preparation and implementation of communication strategy.

It is good practice to document details of all public meetings held with people and local government officials with dates, location and the information provided and the major emerging issues. It is recommended that RAP and other documents include this list, as an attachment. Where public announcements are made, the details, together with a copy of the text of the announcements should be provided in the documents.

9.4 Grievance Redress Mechanism

The GRC will be constituted by the Project Authority with the aim to settle as many disputes as possible on LA and R&R through consultations and negotiations. There will be one GRC for each city. The GRC will comprise five members headed by a retired Magistrate. Other members of the GRC will include a retired ULB Officer, Social Development Officer, representative of PAPs and ULB Chairman/ or his/her nominee (Elected Head of Corporation/ULB) of the concerned city. Grievances of PAPs in writing will be brought to GRC for redressal by the RAP implementation agency. While the GRC is in place, in general all the grievances in first go will be reviewed and attempted to be addressed by the field level officer – JE/AE/anyother designated officer. All the unresolved and major ones will only be escalated to the level of GRC. The RAP implementation agency will provide all necessary help to PAPs in presenting his/her case before the GRC. The GRC will respond to the grievance within 15 days. The GRC will normally meet once in two months but may meet more frequently, if the situation so demands. A time period of 30 days will be available for redressing the grievance of PAPs. The decision of the GRC will not be binding to PAPs. This means the decision of the GRC does not debar PAPs taking recourse to court of law, if he/she so desires. Broad functions of GRC are as under:

- Record the grievances of PAPs, categorize and prioritize them and provide solution to their grievances related to resettlement and rehabilitation assistance.
- The GRC may undertake site visit, ask for relevant information from Project Authority and other government and non-government agencies, etc in order to resolve the grievances of PAPs.
- Fix a time frame within the stipulated time period of 30 days for resolving the grievance.
- Inform PAPs through implementation agency about the status of their case and their decision to PAPs and Project Authority for compliance.

The GRC will be constituted within 3 months by an executive order from competent authority from the date of mobilization of RAP implementation agency. The RRO will persuade the matter with assistance from implementation agency in identifying the suitable persons from

the nearby area for the constitution of GRC. Secretarial assistance will be provided by the PIU as and when required.

9.5 Monitoring and Evaluation (M&E) at Project and Sub-project Level

M&E would be carried out for regular assessment of both process followed and progress of the RAP implementation. The Resettlement Action Plan will contain indicators and benchmarks for achievement of the objectives under the resettlement programme. These indicators and benchmarks will be of three kinds:

i) Input indicators, indicating project inputs, expenditures, staff deployment, etc.
ii) Output indicators, indicating results in terms of numbers of affected persons compensated and resettled, training held, assistance disbursed, etc,
iii) Impact indicators, related to the longer-term effect of the project on people's lives.

The benchmarks and indicators will be limited in number, and combine quantitative and qualitative types of data. Some of these indicators may include, percentage of PAPs actually paid compensation before any loss of assets; percentage of PAPs whose incomes after resettlement are better than, or at least same as before resettlement; percentage grievances resolved; and/or percentage of cases to court. The first two types of indicators, related to process and immediate outputs and results, will be monitored to inform project management about progress and results, and to adjust the work programme where necessary if delays or problems arise. The results of this monitoring will be summarized in reports which will be submitted to the PMU/World Bank on a regular basis. Provision will be made for participatory monitoring involving the project affected persons and beneficiaries of the resettlement programme in assessing results and impacts. Depending on the need, for participatory monitoring, options like joint monitoring teams with PAPs representatives; forming village/community teams for their own review and sharing their observations with the PIU; joint reviews of the implementation, etc will be attempted.

The internal monitoring will be carried out by the KUIDFC/PMU. The Project Authority will engage services of an external agency (third party), which will undertake independent concurrent impact evaluations at least twice during the project implementation period. Such independent evaluation will focus on assessing whether the overall objectives of the project have been met and will use the defined impact indicators as a basis for evaluation. Specifically, the evaluation will assess: (i) The level of success (including the constraints and barriers) in land acquisition programme, resettlement plan, and income recovery of the PAPs after they have been displaced from the project affected area, and, (ii) the types of complaints/ grievances and the success of the handling of grievance and public complaints towards the construction of project's infra-structures, means of redress for assets and lands and the amount of compensation, resettlement, and other forms of complaints.

Annexure I: Analysis of Alternatives (Technology & Site)

Since the proposed project is effectively an on-going modernization and rehabilitation of existing urban water supply infrastructure in the city, there is a limited scope for considering alternatives to achieve intended development objectives. One alternative considered, but rejected was to create new water supply infrastructure in the targeted areas. This would lead to major social and environmental impacts considering the baseline situation in the project areas. Instead, interventions focused on rehabilitation and modernization of existing water supply infrastructure would have limited impacts only. Various alternatives to the project are discussed in the sections below.

Option 1 - Increasing water supply efficiency and sufficiency by acquiring land

A positive alternative towards achieving efficient and sustainable water supply for the current and estimated projected population would be to acquire land for the construction of new pumping stations, Water treatment plant and new pipeline distribution to support the existing ones. This will provide new areas for water optimization and enhance pumping capacity and output especially in the new receiving areas. The option will encourage excavation of trenches, lying of new pipes etc.

Constraints

- High costs required for purchase of lands
- Availability of land required for establishment of a new water supply network.
- Heavy financial requirements for building new structures; purchase of additional piping materials; excavating new trenches; purchase and installation of mechanical and electrical equipment etc.
- Amount of power and energy required to pump water from new pumping stations

Option 2 - Alternatives to pipeline routes

This option will require the acquisition of new Right –of –Ways (ROWs), whereas in the proposed project most of the ROW is in existence and will only be upgraded.

Constraints

- Most neighborhoods and communities within the project area are already built up. Creation of new ROW will require removal of existing structures and displacement of people and movable property i.e. market tables etc.

Pipe Laying Alternatives

Several alternatives to lying of pipes within the project area exist. They include:

- Excavating old pipes and installing new pipes in the old pipeline routes by trench digging
- Abandon old pipes in the existing network and install new pipes parallel to the network
- Installing new pipes in a new pipeline route by trench digging

Option 1-Excavating old pipes and installing new pipes in the old pipeline routes by trench digging

This would involve the excavation of old pipes, which pass through the old pipeline network. Hubballi-Dharwad is a city, which is currently undergoing rapid infrastructural expansion, most especially with regard to its road network. Currently, a huge percentage of the old water pipeline network sits under newly expanded avenues and roads, pursuing this project implementation option would therefore mean a pseudo-destruction of parts of newly constructed roads, and reconstructing after new pipes are laid.

Option 2- Abandon old pipes in the existing network and install new pipes in a parallel position.

A modification of *Option 1* would be to leave the existing pipeline as it is, especially networks consisting of asbestos pipes *(in order to minimize the complexity of excavation and management of disused asbestos material)*. New pipes could be laid parallel to the abandoned old network, thereby maintaining the same network channel but encouraging supply through new safer pipe-type alternatives e.g. PVC.

Option 3- Installing new pipes in a new water pipeline route by trench digging

This involves the installation of new pipes in a new pipeline route by digging trenches all along the newly proposed pipeline route. It is not necessarily the cheapest of all the options and it may have considerable short-term negative socio-economic impacts such as involuntary resettlement *(in unplanned areas)*, temporary loss of income due to lost man-hours, lack of access to business space (in cases where business premises are affected by the need to resettle). It also creates local employment opportunities, as trench digging will require the engagement of local labor.

Option 4- Horizontal/Vertical Directional drilling (trenchless pipe lying)

This option minimizes environmental disruption by installing pipes along surface bore paths. This can be achieved by exploiting new pipeline routes (expanded network) and through exploiting old pipeline routes (existing network). For instance, rather than removing or demolishing structures on the Right-of-Way, drainages, concrete walkways etc. could be drilled in order to lay new pipes. This will reduced the occurrence of compensation for displaced persons. However there is the likelihood of affecting the foundation of existing structures.

Advantages:

- Cost: Substantial cost savings are possible. However, even when trenchless methods are more expensive, such technology may be the best alternative because of other considerations discussed below.
- Environmental effects: Less soil is disturbed so impacts on adjacent organisms and water bodies can be reduced significantly.
- Disruption: Traffic delays are reduced or eliminated, as is heavy truck traffic associated with culvert excavation deep below the roadway.
- Speed of installation: Construction often takes less time, regardless of the road fill depth.
- Safety: Many safety concerns associated with steep-excavation slopes, work inside trench boxes, and worker exposure to traffic may be eliminated or reduced.
- Less engineering: Less surveying, fewer design calculations, and fewer drawings and specifications may be required.
- Fewer unknowns: Minimal ground disturbance results in fewer contingencies associated with subsurface conditions with pipe lining options

Disadvantages:

- Cost: Where placement is shallow and traffic is not a major constraint, excavation is usually more cost effective.
- Level of engineering difficulty: Specialized expertise in related technologies and the impact on subsurface site conditions is required.
- Decreased flow capacity: Practices such as lining pipes with thick structural sections reduce pipe openings, decreasing the pipe's flow capacity.
- Grade or alignment corrections: Effecting necessary changes to the existing grade and alignment are not always possible.
- Shorter design life: Rehabilitation techniques such as spot repair or grouting have a shorter design life than new pipe installation.

Susceptible to fire damage: Forest engineers found that culverts lined with plastic or replaced with

corrugated polyethylene pipe were damaged severely when subjected to wildfires. Fire caused the plastic to burn or melt from one-half to the complete culvert length. Engineers should be aware of this potential for fire damage

Option 6 - Do Nothing

A No Project scenario was also considered but rejected, as there is a dire need to improve water supply service delivery and increase water availability to ensure minimum water requirement, as well as reform the water resources management to meet the demands of a fast growing population. This has been incorporated as its own project sub-component. Analysis of the no project versus with project scenario is presented in Table:

Analysis of No Project versus With Project Scenario

No Project Scenario	With Project Scenario
– Existing inefficient system will continue with environmental & social problems. – No new technologies use – Inefficient & unsustainable Water Resource Management – Unsafe water supply structures – Limited knowledgebase – Poor Water Quality – Unbalance water supply	– Improved, sustainable & efficient water delivery system (24x7) – Improved knowledgebase for implementing efficient water resource management system – Short term environmental impact during construction may take place but risk factor will reduce and better water management system will emerge – Possible increase in miss use of water and wastewater, but mitigated through awareness – Improve water quality – Safer water supply can be achieved.

The “do-nothing” option would involve maintaining the status quo. This would mean that no further rehabilitation and expansion of the existing network in the area would be undertaken, excluding water works and routine pipeline maintenance.

It will also mean that the current predominant practices in obtaining water supply in the two zones will be maintained. These include:

- Rainwater harvesting
- Surface water harvesting

The Preferred Option

There preferred option would be to apply alternatives as they best fit into the engineering designs and implementation of tasks in order to achieve the objectives of the project. The project involves a multi-disciplinary approach and therefore will require a combination and interplay of best practices as the need arises.

The type and range of alternatives which may be considered include:

a. Demand alternatives (e.g. using energy more efficiently rather than building more alternative generating capacity)

b. Input or supply alternatives (e.g. use of waste drainage water)

c. Activity alternatives (e.g. providing public transport rather than increasing road capacity)

d. Location alternatives (e.g. location of field crusher etc.)

e. Process alternatives (e.g. use of waste minimizing and energy efficient and efficient process technologies, use of optimum chemicals)

Alternatives available in site activities should be analyzed on the basis of:

a. Impact of each alternative

b. Mitigation measures for each alternative

During execution of the project, construction equipments, machinery and plants are likely to cause adverse impact on the environment. The impact can be due to the emissions, dust, noise and oil spills that concern the safety and health of the workers, surrounding settlements and environment as a whole. Impacts of construction activities can be reduce through good construction practices. An environment and Social Management Plan (Chapter 8) are prepared for the project. An environmental and social cell is also proposed at KUIDFC level which will assist local body to sustainable implementation of ESMP during planning, construction and operation phase.

Annexure II: Key Tenets of the NRRP 2007 and Land Acquisition and R&R Act 2013

Sl. No.	Policy Principles	NRRP (2007)	New LAA (2013)	Remarks
1	Involuntary resettlement should be avoided whenever feasible, if unavoidable it should be minimized	✓	✓	LAA is applicable wherever private land is to be acquired by Government for public purpose.
2	A Resettlement Plan should be prepared wherever resettlement is envisaged	✓	✓	According to the NRRP, RP should be prepared when it involves resettlement of more than 400 families (roughly about 2,000 persons) in plain areas and 200 families (roughly about 1000 people) in hilly areas, Desert Development Programme (DDP) blocks, areas mentioned in Schedule V and Schedule VI of the Constitution of India. New LAA states to prepare a SIA.
3	Affected people are to be identified and recorded as early as possible to establish their eligibility, through a census, which serves as a cut-off date, and prevents subsequent influx of Encroachers.	✓	✓	LAA provides for every affected person to receive a notification prior to acquisition and for a hearing in case of any objection. Acquisition under the Act is permitted within one year from the date of declaration of intent to acquire, failing which, the process has to start again. LAA does not regard non-titleholders as APs.
4	Detailed socio-economic surveys should be conducted to analyse impacts and Affected Persons (APs) should be classified under different categories	✓	✓	NRRP predefines the broad categories of APs and compensation packages for them. This compensation does not take into account the varying open market rates and local conditions in different urban and rural areas across the country. New LAA predefines specific land value estimation process and also compensation packages.
6	Losses of APs should be estimated on case-by-case basis	✗	✓	Broad categories of PAPs and compensation for each are predefined in the NRRP. The New LAA, however, differentiates the losses due to land acquisition in rural and urban areas.
7	All PAPs should be provided with better standard of living and absence of a formal title to land is not a bar to entitlements	✓	✓	NRRP indicates provisions for better living standard for PAPs. However, it does not provide scope for dealing with finer issues of resettlement because of predefined categories and compensation packages. Compensating PAPs without having formal title to land is also not clearly mentioned. New LAA considers this as important.
8	All Project Affected Families (PAFs) should be	✗	✓	Under NRRP “project affected family” means a family/person whose place of residence or

	compensated based on losses incurred			other properties or source of livelihood are substantially affected by the process of acquisition of land for the project and who has been residing continuously for a period of not less than three years preceding the date of declaration of the affected zone or practicing any trade, occupation or vocation continuously for a period of not less than three years in the affected zone, preceding the date of declaration of the affected zone. NRRP extends benefits based on the above mentioned definition. Loss of livelihoods of any PAF has to be compensated as per New LAA.
9	PAPs if non-titleholders	✗	✗	LAA does not recognize any PAPs other than titleholders. NRRP, though not clearly, but has the provision of benefits for PAPs residing for consecutive three years in the affected zone, as mentioned previously. New LAA also does not clearly say anything about non-titleholders entitlements for R&R assistances.
10	All PAPs should be compensated at replacement cost for lost assets, including transaction and transition costs	✗	✓	The NRRP's concept of replacement cost is not clearly defined. However, the NRRP does consider various compensation packages to substitute the losses of PAPs. New LAA predefines specific land value estimation process and also compensation packages.
11	Wherever feasible land-for- land option should be provided for acquired land	✓	✓	For, socially disadvantaged groups like SC / ST, the New LAA provides for this entitlement.
12	Land allotted should be in the joint name of husband and wife if families are affected	✓	✗	Only NRRP opines for it.
13	Vulnerable PAPs should be identified and provided with special assistance	✓	✗	NRRP clubs vulnerable PAPs including BPL persons, landless, elderly, physically challenged, widow, unmarried girls, orphans, SCs, STs and other minorities and provisions of benefits have been considered for them.
14	Social networks and cultural links should be preserved. Common property resources should be replaced	✓	✗	Only NRRP recommends this.
15	PAPs are to be assisted to integrate economically and socially into host communities	✓	✗	Only NRRP recommends this.

16	Each involuntary resettlement is conceived and executed as part of a development project or program with time-bound action plan	✓	✓	LAA does not provide for resettlement. However, it specifies the time limit for acquisition, though the project / program for which it is conceived need not necessarily be time-bound. New LAA considers involuntary resettlement for land acquisition for public purpose not only to be executed as part of development project but also significantly as State Government's responsibility.
17	The Affected Persons are to be fully informed and closely consulted	✓	✓	LAA recognizes only titleholders, who are to be notified prior to acquisition. New LAA considers public disclosure as important but not necessarily for non-titleholders.
18	Organization and management of RP activities should be carried out through proper institutional structures and efficiently monitored	✓	✗	Under NRRP, a National Monitoring Commission is proposed to be set-up, which shall be chaired by the Secretary, Department of Land Resources, under the Ministry of Rural Development and comprise seven other Secretaries.
19	Provisions for grievance redressal procedures	✓	✓	Under NRRP, Grievances Redressal Cell will be set-up under the Commissioner, Resettlement. LAA, previous and new, provide for a hearing of objections filed by PAPs
20	All costs should be borne by requiring body and shall be a part of project cost	✓	✗	The New LAA says that all costs should be borne by the requiring body but not as part of project cost.

Annexure III: Stakeholder Consultation and Focus Group Discussion

Consultation with relevant stakeholders had been an important component of the social and environmental assessment exercise to obtain the perceptions and views of the stakeholders on social and environmental concerns pertaining to the local areas. The objective of stakeholder consultation was to identify environmental & social issues, impacts, and options to minimize potential negative impacts. The views held by the stakeholders were analyzed and are presented in this chapter.

Stakeholders were consulted through primary household survey (Demo and Non Demo zone) and discussions with concerned line department which were organized by City Corporation Hubballi-Dharwad and Karnataka Urban Infrastructure Development & Finance Corporation.

The discussions were carried out on 3rd to 7th February, 2014 under the chairmanship of Managing Director, KUIDFC and which was attended by various senior officials of different departments including local Member of Parliament and Member of Assembly, Karnataka.

The methodology followed in focus group discussion and stakeholder consultation workshop is given below

- Inviting the key stakeholders to the workshops
- Motivating and encouraging interactions and deliberations on pertinent issues
- Eliciting feedback and responses from the participants and recording them
- Identification of ways and means to identify Environmental & Social issues, options & resolve conflicts, if any, between stakeholder groups.
- Consultations at the demo and non-demo level were carried out through a checklist.

Major findings from Stakeholders Consultation

The stakeholder consultation was conducted with various groups involving officials, professionals and city population from various areas of the project towns. The in-depth discussion on various water supply and related subjects brought forth some key issues which are as mentioned below

1	**Meeting with ULB officials:**	
	Participants:	Mr. R. Chowdhary (IAS) Municipal Commissioner, Er. M.K. Managond – Assistant Engineer (KUIDFC), Consultant (IPE Global Private Limited)
	Date:	5th& 6th February, 2014
	Venue:	Office of the Municipal Commissioner
	Discussion	Er. M.K. Managond (AE KUIDFC) informed that for 24*7 extension coverage most of the land requirement issues have been resolved either through dialogue or choosing alternative available nearby land. At present ward allocation process is in transit between the water board and corporation. According to him also users were satisfied in the demo zones and there was a pressing need from the non-demo zones. Mr. R. Chowdhary (IAS) Municipal commissioner was well conversant with the water issues of Hubballi -Dharwad. According to him people's eagerness to avail 24*7 water supply must be addressed within the stipulated time frame and more in depth stakeholder consultations at various levels were required to capture all the issues. The finding would leverage policy decisions and would be dove tailed in framing successful implementation strategies.
2	**Site Visits**	

	Agenda	– Inspection of Sites for GLSR &	
	Participants	– Officials from Municipal Corporation Hubballi – Dharwad& KUIDFC – Consultant (IPE Global Private Limited)	
	Venue : Gauri Shankar: Old Railways GLSR present Nagar near location **Date:** 5th February, 2014 **Issues Discussed**		
	Venue : FCI BommapurMantur Road: Government land **Date:** 5th February, 2014 **Issues Discussed**		
	Venue :Bidnal, Haliyal: Road Open lands (Agriculture) exist near the Electrical Substation. **Date:** 5th February, 2014 **Issues Discussed**		
	Venue :Tarihal: Elevated land /hillock present to the North of the NH-4 bypass. Near Nandi Badawane **Date:** 5th February, 2014 **Issues Discussed**		
	Venue :Gokul Village: Near Murarji Nagar behind KEC forest land available. Also HDUDA plot with defunct sump/GLSR present. **Date:** 5th February, 2014 **Issues Discussed**		
	Venue : Udaygiri, Dharwad: Existing GLSRs present in the identified area **Date:** 5th February, 2014 **Issues Discussed**		

	Venue : Navalur: Next to Ashraya Plot on Hillock **Date:** 5th February, 2014 **Issues Discussed**	 
	Venue : Nehru Nagar, near Tapovan: Near Star factory, under jurisdiction of Court – Alternate Site in second image **Date:** 5th February, 2014 **Issues Discussed**	 
3	**Interaction with Community**	
	Purpose	Community Development & their needs
	Participants:	– Various respondents from different community – Consultant (IPE Global Private Limited)
	Date:	5th February, 2014
	Venue:	Navloor -Non Demo Zone
	Discussion  	This Aashray colony has 80 households. The houses have been provided to the community members under the Rajiv Gandhi AavasYojna. Electricity is yet to be made available to the dwellers. The state of drainage is pathetic and to add on to this is there water woes. Very limited supply of water is provided by the water board and that too it is very hard water. Bore wells are built at intervals but the maintenance is very poor. The community pools in to get repairs done on and off but major repairs are costly affair and not affordable. Due to poor upkeep of these bore wells a lot of water is wasted as well. The houses are built in a scattered manner on an overarching hilly terrain. It becomes a herculean task especially for women to go down to the nearby village and then climb up all the way carrying one/two pails of drinking water for the family. Many of them have complained of back/leg pain/swelling because of this regular up/down hill climb a number of times every day. There is a pressing demand which is also well visualized during our site visit and interaction for the 24*7 water supply especially in this hard terrain area.
	Participants	– Various respondents from different community – Consultant (IPE Global Private Limited)
	Date:	5th February, 2014
	Venue:	Navaluragasihosayellasu - Demo Zone

	Discussion  	Most male members in this community are daily wage earners. Initially when the 24*7 water supply scheme was introduced they faced some teething problem in timely payment of the water tariff. Now they have evolved their own strategy of savings on a daily /weekly basis to be able to pay the tariff monthly and generally on time. Water is top on their priority and they want to avoid disconnection. The Customer care personnel have established a good /healthy rapport which was very evident during our interaction. Disconnections are very rare and only when the user has not paid the tariff even once since the time of water connection. This is a boon for these daily wage earners as their monthly income is dependent a number of times on work availability/payment flow etc. The tariff receipts provided have water conservation liners /customer care contact/numbers etc. printed .This is very useful /informative. In the chain of water provision they are only responsible for implementation and maintenance .The rest still rests with the Government and in a phased manner a lot of responsibilities in this chain would be handed over to the local elected representatives as envisaged in the project document .The water quality is checked twice a week and the users were satisfied with it and incidences of water borne diseases were un reported. Thus it goes needless to say that priced essential commodity like water is also accepted by the community if it is judiciously priced and the quality and quantity of supply is maintained as per customer satisfaction.
	Participants	– Various respondents from different community – Consultant (IPE Global Private Limited)
	Date:	6th February, 2014
	Venue:	Gandhi Ekta Colony-Non Demo Zone
	Discussion 	The majority of respondents in this locality with water availability touching a minimal low frequency of daily supply. Generally one water tanker is pressed in service daily but is unable to meet the needs of the users. Cut across all the non-demo zones the willingness to pay was largely evident and even the demand to be covered under the scheme. Lot of in community fights take place for getting water from the tanker /few taps in the locality. Women are unable to timely go out to work and many a times lose their jobs because of this. Even elderly /physically challenged members in the household have to pitch in to fetch water. Due to current deficit of water in non-demo zones, women complaint that they were unable to maintain their personal hygiene because of water scarcity especially during

		menstruations.
	Participants	– Various respondents from different community – Consultant (IPE Global Private Limited)
	Date:	6th February, 2014
	Venue:	Sonia /Rajiv Gandhi Aavasiya Colony-Non Demo Zone
	Discussion 	This is a very densely populated colony with almost 1500 households. Most of the bore wells are redundant due to poor upkeep. The nearest approachable bore well is almost at a distance of about 1.5 km. The queue is long and it's mostly women filling water. Even school going children are pulled out frequently to fetch water rather than attending school. The water is not sufficient and not fit for drinking. Tankers are supplying rationed drinking water------- 4 /5 pots per house hold irrespective of the number of members. It has been observed that their condition in summers with the limited water is very miserable. Most of them get heat stroke /fall prey to dehydration/urinary tract problems etc. So is the case of bathing and washing utensils. They have to compromise on all hygiene requirements and thus the health status in this area is low. Cut across all boundaries when it comes to women they are always on the lower bar of the ladder. They are the givers so they use minimum water irrespective of its negative impact.
	Participants	– Various respondents from different community – Consultant (IPE Global Private Limited)
	Date:	6th February, 2014
	Venue:	Shiv Shankar Colony- Non Demo Zone
	Discussion 	The findings in this colony falls on the samechequered pattern of the above. Their water woes are similar even though the socio economic status of the dwellers is slightly above that of the above colony. Most of the male members are gainfully employed as drivers of bus/truck/taxi /auto etc.

Annexure IV: Ward Wise Population

Existing Ward Details – Hubballi-Dharwad

Dharwad (Ward No.1-22)	Area (Sq.km)	Hubballi (Ward No.23-67)	Area (Sq.km)
1	5.64	23	21.14
2	1.61	24	5.62
3	7.95	25	0.69
4	1.85	26	1.65
5	2.43	27	1.74
6	1.93	28	0.40
7	1.57	29	3.98
8	1.81	30	2.10
9	1.73	31	0.32
10	2.28	32	0.72
11	0.14	33	1.01
12	0.42	34	6.86
13	0.93	35	7.28
14	2.38	36	15.93
15	0.63	37	4.16
16	0.60	38	2.77
17	13.32	39	0.69
18	8.34	40	0.26
19	7.38	41	0.21
20	5.12	42	0.37
21	16.66	43	0.60
22	11.40	44	0.90
Sub-Total (A)	**96.14**	45	0.33
		46	1.18
		47	3.81
		48	1.79
		49	2.51
		50	0.16
		51	0.19
		52	0.20
		53	0.10
		54	0.14
		55	0.15
		56	0.21
		57	0.15
		58	0.14
		59	0.23
		60	0.51
		61	0.33
		62	1.96
		63	1.05
		64	0.28
		65	0.74
		66	0.36
		67	10.25
		Sub-Total(B)	**106.14**
		HDMC Area (A+B)	**202.28**

(Source: Hubballi-Dharwad Municipal Corporation, ULB records)
(Ward Wise Population Projections is presented below)

Ward No.	Households	Population
0001	3712	16491
0002	2896	11961
0003	3430	16638
0004	3019	14447
0005	2485	12331
0006	2263	11287
0007	2999	14806
0008	2697	13128
0009	2404	10942
0010	2545	12367
0011	1970	10986
0012	2158	9816
0013	2465	10379
0014	3396	13576
0015	2261	11007
0016	2254	11358
0017	4044	17015
0018	3585	16325
0019	2641	11161
0020	3781	17258
0021	2357	12060
0022	4847	22926
0023	3257	14821
0024	3489	15627
0025	5035	22232
0026	2584	11585
0027	2605	11782
0028	2948	12892
0029	3677	16998
0030	4131	19036
0031	3364	14816
0032	2599	12081
0033	3516	14957
0034	2338	9796
0035	4949	21697
0036	4286	18993
0037	4419	19530
0038	3266	14967
0039	3671	18885
0040	6890	31796
0041	2668	12657
0042	2264	11509
0043	1836	9289
0044	2562	13551

Ward No.	Households	Population
0045	2113	10145
0046	1870	8193
0047	2612	11953
0048	4033	18258
0049	1330	6051
0050	3939	19572
0051	2112	10345
0052	2117	9999
0053	2304	11138
0054	2064	11273
0055	2104	10934
0056	2126	10324
0057	2674	13876
0058	2158	10767
0059	2629	14946
0060	2207	10974
0061	2330	11662
0062	2206	11072
0063	3207	15338
0064	2774	15579
0065	4600	23409
0066	3105	14326
0067	3241	15892

Annexure V: Proposed Water Supply System

GENERAL

It is proposed to upscale the existing system with required modifications and additions as necessary for the successful implementation of the 24x7 water supply system to the cover the entire project area.

The system is designed for the year 2041. However the phase wise implementation of the proposed works are also worked out so as to reduce the wokrs and the capital investment at the start of the project.

Based on the past failure history of NWSS an interlinking arrangement between NWSS and MWSS is proposed for Hubballi such that water can be fed from MWSS to the zones normally fed by NWSS. It is porposed to vary the operation of the system such that additional flow and quantity of treated water is made available from MWSS to cater to the additional load in the absense of NWSS. Hence the clear water transmission system for Hubballi is proposed to be designed to cater to this condition.

WATER POLICY IN KARNATAKA

Objective

• Provide drinking water at the rate of 55 litres per person per day in the rural areas, 70 litres per person per day in towns and 100 litres per person per day in the city municipal council areas and 135 litres per person per day in city corporation areas.
• Improve performance of all water resource projects.
• Provide a legislative, administrative and infrastructural environment, which will ensure fair, just and equitable distribution and utilization of the water resources of the State to benefit all the people of the State.

Allocation priorities

In planning and operation of water resources projects, water allocation priorities are broadly as follows:

• Drinking water
• Irrigation
• Hydropower
• Aquaculture
• Agro industries
• Non-Agricultural Industries
• Navigation and other uses

Private Sector Participation

- Private sector participation are encouraged in various aspects of planning, investigation, design, construction, development and management of water resources projects for diverse uses, wherever feasible.
- Depending upon specific situation, to bring in various combinations of private sector participation, in building, owning, operation, leasing and transferring of water resources facilities.

Water Rates:

Water rates for various uses to be revised in a phased manner and fixed so as to cover at least the operation and maintenance charges of providing services.

Monitoring:
Close monitoring of planning, execution and performance of water resources projects to be undertaken to identify bottlenecks and to obviate time and cost overruns.

Action plan:
- Make water accounting and audit mandatory.
- Mobilize community and stakeholder participation through Users Organizations, empower them, provide training, technical support and create public awareness.

DRINKING WATER AND SANITATION POLICY IN KARNATAKA

Objective:
- Ensure universal coverage of water and sanitation services that people want and are willing to pay for
- Ensure a minimum level of service to all citizens

Institutional arrangements:
- Policy formulation
- Encouraging the use of public private partnerships as well as private sector participation to achieve the sector goals.
- Ensuring co-ordination and collaboration among the various agencies both at the policy and operational level through the establishment of appropriate committees and agencies.

Tariff:
The longer-term objective is to establish an appropriate cost recovery mechanism through adequate tariff to ensure that revenue cover operation and maintenance costs, debt service plus a reasonable return on capital. In the medium term, however, subsidies to be continued to the needed and to be focused in areas such as pockets and communities of extreme poverty and investments with large-scale externalities like wastewater treatment. Tariff need to be structured in a manner so that excessive consumption and wastage of water is discouraged. Achieve 100% metering and volumetric pricing based on long run marginal costs.

Private Sector Participation
To improve efficiency in service provision, continuously update technology and ultimately bring in private investment into sector, the GOK to actively encourage private sector participation.

SOURCE STUDIES

Background
The increase in the concentration of human activities intensifies the competition for all types of sources among the most vital of which is water. Water has become a very important commodity for the growth of the towns/cities. The major water related problems of rapidly growing towns/cities are; a) the need for dependable supplies of potable water, b) severe and growing sanitation problems including pollution of streams, lakes, estuaries and ground water from domestic and industrial sewage and solid wastes, and c) depletion of ground water aquifers caused by reduction of infiltration and over pumping of aquifers.

Identification of feasible and perennial source is imperative to meet the ever-increasing demand owing to increasing population and improved standards of living. The problem of source identification becomes easier in respect of cities/towns situated in the proximity of any perennial source. Where there are no such facilities and where it has to depend upon seasonal monsoon rainfall only, it becomes rather difficult to cope up with the needs. Therefore, in locations where there is no scope for surface water identification then efforts becomes absolutely necessary to conserve the available water and depend on ground water. Source of water will be either surface or sub-surface provided it should be perennial besides technically and economically feasible. City Municipal Corporation, Town / City Municipal Council (CMC/TMC) or any independent authority constituted for this purpose is responsible for providing safe drinking water of adequate quantity to the people of the city. The major objective of such authorities is to plan well ahead and identify additional sources of water to meet ever-increasing demand owing to increased population and also for stepping up per capita supply.

The Hubballi-Dharwad Municipal Corporation is the second largest corporation in Karnataka State. The Corporation was established in the year 1962. It is a very important junction in respect of both railways as well as highways. It is located on Pune-Bangalore National Highway-4 at about 405 Km from Bangalore. Dharwad is situated between 15° 19' N and 15° 41' N longitude and between 75° 15' E and 75° 36' E latitude.Where as, Hubballi is situated between 15° 11' N and 15° 31' N longitude and between 75° 01' E and 75° 28' E latitude .The average annual rainfall in Hubballi City is about 700 mm and that in Dharwad is about 880 mm. The average altitude of Hubballi is 627.97 m above Mean Sea Level and Dharwad is about 696.97 m above Mean Sea Level. Hubballi is mainly an industrial, commercial and educational center whereas Dharwad is mainly an educational center. The population of the twin cities as per 2001 census is 7.86 lakhs and the present population is about 9.4 lakhs and in an area of 202.28 Sq.Kms comprising 45 villages and large number of extensions spread in all the directions of the city. Out of 202.28 sq.kms, fully developed or buit up area of the city is approximately 72.78 Sq.kms. Kundgol is a town located 10 km from Hubballi is also being supplied from Hubballi-Dharward water supply system as bulk consumer. The present population of Kundgol town is about 18, 500. The population of the Hubballi-Dharwad cities and Kundgol town is expected to reach 14,14,776 by the year 2031 and 16,51,827 by the year 2041 as per population projections. The present treated water requirement for twin cities and Kundgol town is 166 MLD. This demand is expected to reach 228 MLD by the year 2031 and 289 MLD by the year 2041. The present supply capacity is about 115 Mld (41 MLD + 74 Mld) from surface sources and about 8 Mld from ground water source. There is a need for augmentation of present water supply system to take care of immediate as well as future water demand of the city. Considering transmission and treatment plant losses of 5% the raw water requirement to meet the water demand by the year 2041 is 312 MLD (114 Mcum per year). In addition to city requirement, bulk raw water is also being supplied to the enroute 8 villages between Saundatti and Amminbhavi from existing Malaprabha Water Supply Scheme (MWSS). The enroute village population will be 1,31,092 by the year 2041 and the raw water requirement is 9 MLD. The total raw water requirement of City, nearby Industrial areas, Kundgol town and enroute villages is 377 MLD (138 M cum per year) by the year 2041.

PRESENT WATER SOURCE

At present water supply to Hubballi-Dharwad twin cities is from:

1) **Ground Water Source:** 1596 working out of 1814 Borewells drilled at different locations in and around the city with power pumps or hand pumps.
2) **Surface Source:** Two water sources viz. (i) Neersagar reservoir and (ii) Renukasagar (Malaprabha) reservoir.

GROUND WATER SOURCE

Some of the areas of the city are supplied with ground water through borewells. 1596 borewells out of 1814 are functioning fitted with hand pumps or power pumps. 1047 out of 1596 are fitted with power pumps of capacities between 1 HP and 12 HP. The approximate yield from these bore wells fitted with power pumps is 8 MLD

DETAILS OF BOREWELLS IN HUBBALLI-DHARWAD CITIES

BOREWELL WITH HAND PUMPS			
SL NO	**PART**	**TOTAL**	**WORKING**
1	Hubballi	444	361
2	Dharwad	237	188
TOTAL		**681**	**549**
BOREWELL WITH POWER PUMPS			
SL NO	**PART**	**TOTAL**	**WORKING**
1	Hubballi	812	755
2	Dharwad	321	292
TOTAL		**1133**	**1047**

Source: Status report of water supply in Hubballi-Dharwad as on July 2010 by KUWS&DB

The quality of ground water is meeting the permissible CPHEEO drinking water standards.The ground water source shall be considered for as supplementary source. Ground water table shall be recharged using rainwater harvesting methods and this source could be used when there is an emergency and shortage of surface water due to bad monsoons.

SURFACE WATER SOURCE

There are no major rivers or reservoirs in the near vicinity of the city other than present surface sources. The present sources, a) Neersagar reservoir and b) Renukasagar (Malaprabha) reservoir have been studied to estimate available quantity and dependability as a source for water supply to city for the horizon year 2041

Neersagar Reservoir

The Neersagar Dam constructed across Bedti nala is located in Kalaghatagi taluk of Dharwad district in Karnataka at latitude of 15019' 02" N & Longitude of 740 59' 23" E. It is constructed in the year 1955 mainly for providing drinking water to Hubballi- Dharwad twin cities. The reservoir is located at about 23 km from Hubballi and about 17 km from Dharwad.

The Dam is of earth embankment type and has got a catchment area of about 181.08 Sq.Km with an annual average rainfall of 780 mm. The gross storage capacity of the Dam at FRL is 28.90 MCum and the dead storage capacity is 2.75 Mcum with a water spread area up to foreshore at FRL about 4.40 Sq.Km (440 Ha). The salient features of the Neersagar Reservoir have been presented in table below. Area capacity details of reservoir have been presented in table given below. The rainfall at source is generally sufficient to cater the requirements. However, for about three years in past 25 years, the rainfall was found to be less than adequate. The reservoir has dried up on three occasions during 1986-87 and 2002-2003 & 2004 due to insufficient rainfall.

The Neersagar water supply scheme was commissioned in 2 stages (4 MGD+ 5 MGD) in the years 1956 & 1969 to provide drinking water to Hubballi- Dharwad twin cities. The reservoir contemplates utilization of 21.96 MCum to meet drinking water needs of the twin cities excluding the losses due to reservoir evaporation. This Dam was originally constructed by minor Irrigation and Public Health Engineering Department and later handed over to the Karnataka Urban Water Supply and Drainage Board for operation and maintenance.

SALIENT FEATURES OF NEERSAGA R RESERVOIR

I	**GENERAL**	
1	Name of the project	Neersagar Reservoir
2	Name of the River	Bedti Nala
3	Location of Dam	Latitude : 15^0 19' 02" N Longitude : 74^0 59' 23" E Dhumwad village, Kalghatgi Taluk, Dharwad District
4	Purpose	Drinking purpose
5	Means of Access	Deviation road from Dharwad – Kalghatgi road Distance - 3.60 km
II	**GEOPHYSICAL FEATURES**	
1	Catchment Area	181.08 Sq KM
2	Mean annual rainfall	780 mm
3	Yield at dam site	28.90 Mcum
4	Utilisation (excluding lake losses)	21.96 Mcum
5	Evaporation losses	6.94 Mcum
6	Total utilisation	28.90 Mcum
III	**RESERVIOR**	
1	Gross storage capacity	28.90 Mcum
2	Dead storage capacity	2.75 Mcum
3	Live storage capacity	26.15 Mcum
4	Lowest river bed level	571.42 Mtr
5	Full reservoir level	590.70 Mtr
6	Deepest foundation level	565.09 Mtr
7	Maximum water level	592.53 Mtr
8	Crest level	590.70 Mtr
9	Minimum drawdown level	580.94 Mtr
10	Sill level of outlets	1) 580.94 Mtr, 2) 585.36 Mtr 3) 589.17 Mtr
11	Top of dam	594.66 Mtr
12	Water spread area	440 Ha (1087 Acres)
13	Maximum flood discharge	1048 Cumecs
IV	**DAM**	
1	Type of dam	Earthen Dam
2	Length of dam	1356.36 Mtrs.
3	Maximum height of dam above deepest foundation	29.56 Mtr
4	Height above lowest river bed level	23.24Mtrs
V	**SPILLWAY LOCATED ON RIGHT FLANK**	
1	Type of spillway crest profile	Broad Crested type Clear Overflow Waste Weir
2	Crest level	590.70 Mtr
3	Length of spillway	244 Mtr (112 mtr on the right and 50 mtr on the left with 0.60 m height fixed MS gates and central 82 mtr with wooden flash boards)

4	Head over crest	1.83 Mtr (Max. flood height)
VI	**EARTHEN DAM**	
1	Crest length of dam	1356.36 Mtrs.
2	Slope of dam	i) U/S Slope : 3:1 ii) D/S Slope : 3:1 with 4.57 mtr wide berms at El 590.10 mtr & El 585.52 mtr along the D/S slope
3	Top width of dam	6.10 Mtrs
4	Type of section	Zoned Earth Dam
VII	**SUBMERSION**	
	Total area of submergence at FRL	440 Ha (1087 Acres)

AREA-CAPACITY DETAILS OF NEERASAGAR RESERVOIR

REDUCED LEVEL (m)	CAPACITY (MCUM)	WATER SPREAD (M Sq.m)
580.95	2.75	0.29
581.25	3.09	1.11
581.56	3.43	1.11
581.86	3.85	1.39
582.17	4.28	1.39
582.47	4.70	1.39
582.78	5.13	1.39
583.08	5.62	1.63
583.39	6.12	1.63
583.69	6.61	1.63
584.00	7.11	1.63
584.30	7.79	2.25
584.61	8.48	2.25
584.91	9.17	2.25
585.22	9.85	2.25
585.52	10.69	2.74
585.83	11.53	2.74
586.13	12.36	2.74
586.44	13.20	2.74
586.74	14.22	3.34
587.04	15.12	2.97
587.35	16.08	3.16
587.65	17.05	3.16
587.96	18.14	3.58
588.26	19.23	3.58
588.57	20.32	3.58
588.87	21.41	3.58
589.18	22.61	3.95
589.48	23.79	3.86
589.79	24.71	3.02
590.09	26.22	4.97
590.40	27.57	4.41
590.70	28.91	4.41

In the absence of sufficient data such as inflows into Neerasagar reservoir, pan evaporation and abstractions from the reservoir, simulation studies could not be carried out to work out the availability and dependability of the source. However based on the records of reservoir levels it is noticed that in last six years it has overflowed in each year. Based on the Water treatment plant production of water it is assessed that this source could yield 44 MLD (16 Mcum per year) of water during normal rain fall seasons.

Malaprabha Reservoir

Renukasagar reservoir was created by constructing a masonry dam across river Malaprabha near Saundatti and it is located at about 60 km from Hubballi and 43 km from Dharwad. The reservoir was constructed in year 1972 by Irrigation Department, Government of Karnataka and the water supply scheme from this source was developed in the year 1983 and subsequently augmented in stages. The present capacity of water supply system is 73.8 MLD. The reservoir has an earthen embankment and the gross capacity of the reservoir is 1068 Mcum, the live capacity of the Reservoir is 972 million cubic meters. The salient features of the Renukasagar Reservoir have been presented in table below. Area capacity details of reservoir have been presented in table below.

The MWSS Stage III (Phase I) works in under progress and is due for commissioning in this year. This would augment the supply by another 68 MLD making it a total of 141.8 MLD

Renukasagar Reservoir is also nearby. Karnataka Neeravari Nigam Limited has done simulation studies for reservoir operation with irrigation demands and demands for water supply and industries. Water demand for irrigating 1.76 lakh Ha area and about 800 water supply has been considered. Simulation studies have been carried out from 1980 to 2008-09. The simulation study results show that irrigation demands are met with 76% dependability and the water supply demands are met with 100% dependability.

SALIENT FEATURES OF RENUKASAGAR RESERVOIR

NAME OF PROJECT	RENUKASAGAR RESERVOIR
RIVER BASIN	Krishna
NAME OF STREAM/ SUB-BASIN	Malaprabha
LOCATION	
a. Nearby village/town b. Taluk c. District d. latitude e. Longitude	Navilutheertha Saundatti Belgavi 150 - 49' - 0" N 750 - 6' - 0" E
CATCHMENT AREA (SQ.KM)	2564
YIELD (TMC)	42.57 (1205.47 Mcum)
STORAGE (TMC)	
a. Gross b. Live c. Dead	37.73 (1068.42 Mcum) 29.32 (830.27 Mcum) 8.41 (238.15 Mcum)
IRRIGABLE AREA	218191 Ha
DAM	
a. Type b. Height (Mtrs) c. Length (Mtrs)	Masonry 154.53 40.23

d. MWL (Mtrs)	633.83
e. FRL (Mtrs)	633.83
f. MDDL (Mtrs)	623.93
g. Top level of Reservoir (Mtrs)	637.19
h. Irrigation sluice level (Mtrs)	619.35
i. River sluice level (Mtrs)	612.03
SPILLWAY	
a. Location	Central
b. Length (Mtrs)	85.34
c. Flood Lift (Mtrs)	12.19
d. Discharging capacity (Cumecs)	5236
e. Gates	4 (15.24m x 12.19m) radial gates
f. Crest level (Mtrs)	621.79

AREA-CAPACITY DETAILS OF RENUKASAGAR RESERVOIR

REDUCE LEVEL (m)	WATER SPREAD AREA (M Sq.m)	CAPACITY (Mcum)
609.60	1.17	1.66
611.12	2.53	4.48
612.65	5.22	10.39
614.17	**7.82**	20.33
615.70	11.45	35.01
617.22	13.58	54.08
618.74	20.45	81.43
620.27	24.95	115.97
621.79	31.33	158.75
623.32	38.87	212.14
624.84	47.16	277.61
626.36	64.17	362.20
627.89	75.03	468.18
629.41	86.34	591.04
630.94	98.65	732.13
631.24	102.56	762.80
631.55	106.57	794.67
631.85	110.59	827.77
632.16	112.28	861.73
632.46	119.13	905.36
632.76	121.53	933.68
633.07	123.94	971.09
633.37	126.33	1009.23
633.68	128.95	1048.14
633.98	131.41	1087.82

SUMMARY OF SIMULATION STUDIES

In the absence of sufficient data such as inflows of Neersagar reservoir, simulation studies could not be carried out to work out the availability and dependability of the source. However based on the records of drawls from the reservoir for the water supply to Hubballi- Dharwad twin cities city for

the past 10 years it is assessed that this source could yield 44 MLD (16 Mcum) at 100% dependability.

The balance requirement of 335 MLD (122.3 Mcum per year) out of 377 MLD has to be met by Renukasagar reservoir. This quantity is just 10.15% of the average catchment yield. Supply for Drinking water gets top priority as per National water policy and if situation demands irrigation releases may be curtailed. Based on the catchment yield and the reservoir storage capacity of Renukasagar reservoir, this source is considered 100 % dependable for the supply of 335 MLD (122.3 Mcum per year) to Hubballi-Dharwad twin cities including enroute villages and Kundgol town and nearby industrial areas to meet water demand upto the year 2041.

Ground water source shall be treated as supplementary source in case of any emergency or till implementation of distribution system in the un served areas.

PROPOSED WATER SUPPLY SCHEME

The proposed water supply schemes would be from the following two Surface sources.

Neersagar Water Supply Scheme (NWSS)

The source studies of this scheme indicates that this source is 100% reliable for the present installed capacity of 43.33 MLD of water. Hence further augmentation from this source is not proposed and this scheme would continue to operate at its present design capacity until the end of the design period. NWSS, due to the proximity of this source and due to the fact that the clear water transmission of this scheme (to Hubballi) is by gravity, it would have a low O&M cost. This scheme is proposed to be integrated into the proposed system with some rehabilitation and upgradation.

Based on the past history of this source the source has dried up on two occasions, once in 1986-87 and again from 2002 to 2004 during which period water could not be supplied from the above source. Keeping this in mind it is proposed to make suitable interlinking of its clearwater transmission network with the other scheme (MWSS) such that the zones normally fed by NWSS may be fed by MWSS. This condition is discussed in detail futher in this chapter.

The following are the component wise observations of this scheme.

- The system in general is a very old scheme commissioned in 1955
- The jackwell has been recently rehabilitated and is in a good condition
- The raw water gravity main from the reservoir to the pump house at Dhumwad of 1.4 km length (750 CI) is very old and has exceeded its design life and hence a new line has been proposed
- The pump house at Dhumwad is in a good condition and new pumps have been installed in 2010. Two new pumps of 302 lps (2W) and 147 m head have been already been installed and installation of a new standby pump is under progress.
- The raw water rising main from the pump house to the WTP of length 6.7 kms comprises of 4.443 kms of new 762 mm diameter MS line and the balance 2.225 kms comprises of the old 675 HS line laid in 1955. Hence it is proposed to replace the balance length of 2.225 kms with 762 mm diameter MS.
- The WTP also has been rehabilitated recently and is in an average condition. Minor rehabilitation is proposed on the WTP.
- Clearwater reservoir of 4 ML and 5 ML exists which are over 40 years old and in a average to poor condition. It is porposed to construct a new reservoir and discard the old one.
- Further to this a clear water transmission (gravity) line of 660 HS exists towards Hubballi. Of this a small stretch of new line has been laid within Hubballi (from the Airport to Hosur) of 660 mm diameter MS. It is proposed to replace the old line with 813 mm diameter MS upto the airport.

- Another clear water transmission (Pumping) line of 450 mm diameter CI exists towards Dharwad which is being discarded.

DETAILS OF NEERSAGAR WATER SUPPLY SCHEME – PROPOSED

SL NO	COMPONENT	DETAILS	REMARKS
1	Jackwell at Neersagar Reservoir	--	Existing
2	Raw water transmission (gravity) Main- 1.4 Km	**864** mm MS	Proposed
3	Raw water pumping station at Dhumwad	43.33 MLD	Existing
4	Raw water transmission (pumping) main – 4.447 / 6.7 kms	762 mm MS	Existing
5	Raw water transmission (pumping) main – 2.257 / 6.7 kms	762 mm MS	Proposed
6	WTP at Kanvihonnapur	41.17 MLD	Existing
7	Clear Water Reservoir	**6.2** ML	Proposed
8	Clear water transmission main	813 mm MS	Proposed
9	Service reservoirs and Distribution Network	---	Existing & Proposed

Malaprabha Water Supply Scheme (MWSS)

The above scheme is planned to be integrated into the proposed system which minor rehabiltation and augmentation. Based on the source studies this source is proposed for augmentation to meet the future demands.

Also considering the fact that NWSS had become inoperational due to insufficient water in the reservoir on two occassions, MWSS is proposed to cater to the needs of the city in the event of failure of NWSS. The following are the component wise observations of this scheme.

Observations:

- The jackwell cum pump house at Saundatti is a new structure and is in a good condition and is capable of housing eight deep well turbine pumps. Hence it is planned to integrate this into the proposed system and no additional jackwell or pump house is required until 2041. However pumps will have to be added /changed accordingly.
- The details of mechanical and electrical parts rehabilitation is being dealt in the respective chapters.
- Two raw water transmission (pumping) lines (30 kms) of 965 mm and 1168 mm diameters MS exists which were laid in 2004 and 2011 respectively. These lines are in a good condition and proposed to be retained and integrated into the proposed system.
- A new raw water transmission line of 1644 mm diameter MS from Saundatti to Amminbhavi WTP is proposed to cater to the additional and future raw water requirement.
- Two WTP's of 63.74 MLD and 58.73 MLD commissioned in 2004 and 2011 exist at Amminbhavi which are in a good condition and have been integrated into the proposed system.
- New WTPs of a total capacity of 186.73 MLD is proposed at Amminbhavi to cater to the additional and future clear water requirements over the design period.
- Clearwater reservoir of 3.632 ML exists at Amminbhavi which is in an average condition and is planned to be integrated into the proposed system after rehabilitation.
- Additional clear water storage of 43 ML is proposed at Amminbhavi over the design period.
- Clearwater pump house exists at Amminbhavi which is in an average condition and is planned to be integrated into the proposed system after rehabilitation.

- A new Clearwater pump house to accommodate the additional pumps to cater to the additional capacity is proposed at Amminbhavi.
- A 1168 mm diameter MS line of 23 kms laid in 2004 conveys clear water to Hubballi. This line is proposed to be integrated into the proposed system.
- A new line of 1294 mm diameter MS is proposed from Amminbhavi to Hubballi to cater to the additional future demand.
- A 813 & 750 mm diameter MS & CI line of 10.5 & 2 kms laid in 1996 & 1983 respectively conveys Clearwater to Dharwad. The MS line is proposed to be integrated into the proposed system.
- A new line of 1168 mm diameter MS is proposed from Amminbhavi to Dharwad to cater to the additional future demand.

DETAILS OF MALAPRABHA WATER SUPPLY SCHEME – PROPOSED

SL NO	TYPE	DETAILS	REMARKS
1	Jackwell cum pump house at Saundatti	---	Existing
2	Raw water transmission (pumping) Main from Saundatti to Amminbhavi - 30 Km	965 mm diameter MS	Existing
3	Raw water transmission (pumping) Main from Saundatti to Amminbhavi - 30 Km	1168 mm diameter MS	Existing
4	Raw water transmission (pumping) Main from Saundatti to Amminbhavi - 30 Km	1644 mm diameter MS	Proposed
5	WTP at Amminbhavi (MWSS – EIWSS)	63.74 MLD	Existing
6	WTP at Amminbhavi (MWSS – Stage III : Phase 1)	58.73 MLD	Existing
7	WTP at Amminbhavi (MWSS – Stage III : Phase 2)	58.73 MLD	Proposed
8	WTP at Amminbhavi (MWSS – Stage IV : Phase 1)	64 MLD	Proposed
9	WTP at Amminbhavi (MWSS – Stage IV : Phase 2)	64 MLD	Proposed
10	Clearwater pump house at Amminbhavi	---	Existing
11	Clearwater pump house at Amminbhavi	---	Proposed
12	Clear water transmission main to Hubballi	1168 mm diameter MS	Existing
13	Clear water transmission main to Hubballi	1294 mm diameter MS	Proposed
14	Clear water transmission main to Dharwad	813 mm diameter MS	Existing
15	Clear water transmission main to Dharwad	1168 mm diameter MS	Proposed
16	Service Reservoirs and Distribution Network	---	Existing & Proposed

RAW WATER TRANSMISSION MAINS

NWSS

The proposed raw water transmission system from Neersagar to Kanvihonnapur consists of a 864 mm diameter MS gravity main of 1.4 km length upto Dhumwad pumping station and further a 762 mm diameter MS rising main (4.443 / 6.7 kms existing) upto Kanvihonnapur WTP of 6.7 km length.

MWSS

The proposed raw water transmission system from Malaprabha to Amminbhavi WTP would comprise of two existing (pumping) lines (30 kms) of 965 mm and 1168 mm diameters MS and one proposed new line of 1644 mm diameter MS.

Inventory of Proposed Raw Water Transmission System

The diameter wise lengths of the proposed raw water transmission system is presented in table below

DETAILS OF EXISTING AND PRPOSED RAW WATER TRANSMISSION MAINS

SR. NO	DIAMETER (MM)	MATERIAL	LENGTH (M)		
			EXISTING	PROPOSED	TOTAL
1.	762	MS	4450	2226	6676
2.	864		0	1450	1450
3.	965		28872	0	28872
4.	1168		28854	0	28854
5.	1644		0	28865	28865
TOTAL			**62175**	**32542**	**94717**

Annexure VI: Water Quality Test Results

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OHSAS 18001 : 2007 & ISO 9001 : 2008

JAS-ANZ

Cert. No. RO91/JA/1111
Cert. No.: RO91/JA/IC/1111

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TEST REPORT

Page : 1 of 1

Report No. : ED/2014/05/0424	Report Date : 19/05/2014
Issued to : IPE Global Private Limited IPE Global House, B 84, Defence Colony, New Delhi, DELHI - 110024.	Customer Reference : Data Sheet, Dated: 15/05/2014
	Date of Receipt : 16/05/2014
	Date of Start of Test : 17/05/2014
Sample Nature/ Name : Tap Water	Date of Completion of Test : 19/05/2014
	Job Order No. : ED/2014/05/0424
	Sample Particulars : Tap Water from Dharwad, Ward No.6 (Kantioni Kumbar Area), Date of Sampling: 15/05/2014
Sample Condition : Satisfactory	

Sl. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits as per IS: 10500-2012	Test Method
1	Free Residual Chlorine, mg/L	0.6	Min.0.2	Min.1.0	IS: 3025 (P 26)
	MICROBIOLOGICAL TESTS:				
2	Description	Colourless and clear transparent liquid filled in sterilised bottle.			
3	E. coli Bacteria/ml	Less than 1 CFU	Absent	–	IS: 5887 (Part I) 1976

ANALYST

AUTHORIZED SIGNATORY

NOTE : 1. The result listed refer only to the tested samples & applicable parameters. Endorsement of products is neither inferred nor implied. 2. Samples will be destroyed after 15 days from the date of issue of test certificate unless otherwise specified. 3. This report is not to be reproduced wholly or in part & cannot be used as an evidence in the Court of law & should not be used in any advertising media without our special permission in writing. 4. Sample(s) not drawn by us unless otherwise stated. 5. Total liability of our laboratory is limited to the invoice amount. Any dispute arising out of this report is subject to Bangalore Jurisdiction only.

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TEST REPORT

Report No. : ED/2014/05/0425	**Report Date** : 19/05/2014
Issued to : IPE Global Private Limited IPE Global House, B 84, Defence Colony, New Delhi, DELHI - 110024.	**Customer Reference :** Data Sheet, Dated: 15/05/2014 **Date of Receipt** : 16/05/2014 **Date of Start of Test** : 17/05/2014 **Date of Completion of Test** : 19/05/2014 **Job Order No.** : ED/2014/05/0425
Sample Nature/ Name : Tap Water	**Sample Particulars** : Tap Water from Dharwad, Ward No.5 (Kamalapura Area), Date of Sampling; 15/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits as per IS: 10500-2012	Test Method
1	Free Residual Chlorine, mg/L	0.6	Min.0.2	Min.1.0	IS: 3025 (P 26)
	MICROBIOLOGICAL TESTS:				
2	Description	Colourless and clear transparent liquid filled in sterilised bottle.			
3	E. coli Bacteria/ml	Less than 1 CFU	Absent	--	IS: 5887 (Part I) 1976

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TEST REPORT

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Report No. : ED/2014/05/0426	Report Date : 19/05/2014
Issued to : IPE Global Private Limited IPE Global House, B 84, Defence Colony, New Delhi, DELHI - 110024.	Customer Reference : Data Sheet, Dated: 15/05/2014
	Date of Receipt : 16/05/2014
	Date of Start of Test : 17/05/2014
	Date of Completion of Test : 19/05/2014
Sample Nature/ Name : Tap Water	Job Order No. : ED/2014/05/0426
	Sample Particulars : Tap Water from Dharwad, Ward No.11, 24/7 (Hosayallapura), Date of Sampling; 15/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits as per IS: 10500-2012	Test Method
1	Free Residual Chlorine, mg/L	0.1	Min.0.2	Min.1.0	IS: 3025 (P 26)
	MICROBIOLOGICAL TESTS:				
2	Description	Colourless and transparent liquid with few sediments filled in sterilised bottle.			
3	E. coli Bacteria/ml	80 CFU	Absent	--	IS: 5887 (Part I) 1976

ANALYST

AUTHORIZED SIGNATORY

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TEST REPORT

Report No. : ED/2014/05/0427	**Report Date** : 19/05/2014
Issued to : IPE Global Private Limited IPE Global House, B 84, Defence Colony, New Delhi, DELHI - 110024.	**Customer Reference** : Data Sheet, Dated: 15/05/2014
	Date of Receipt : 16/05/2014
	Date of Start of Test : 17/05/2014
	Date of Completion of Test : 19/05/2014
	Job Order No. : ED/2014/05/0427
Sample Nature/ Name : Tap Water	**Sample Particulars** : Tap Water from Dharwad, Ward No.14 (Jayanagara Janatha Coloni), DOS: 15/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits as per IS: 10500-2012	Test Method
1	Free Residual Chlorine, mg/L	0.1	Min.0.2	Min.1.0	IS: 3025 (P 26)
	MICROBIOLOGICAL TESTS:				
2	Description	Colourless and transparent liquid with few sediments filled in sterilised bottle.			
3	E. coli Bacteria	Less than 1 CFU	Absent	–	IS: 5887 (Part I) 1976

ANALYST

AUTHORIZED SIGNATORY

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Format No. BTH/QF/164

BANGALORE TEST HOUSE

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TEST REPORT

Page : 1 of 1

Report No. : ED/2014/05/0428	**Report Date** : 19/05/2014
Issued to : IPE Global Private Limited IPE Global House, B 84, Defence Colony, New Delhi, DELHI - 110024.	**Customer Reference** : Data Sheet, Dated: 15/05/2014
	Date of Receipt : 16/05/2014
	Date of Start of Test : 17/05/2014
Sample Nature/ Name : Tap Water	**Date of Completion of Test** : 19/05/2014
	Job Order No. : ED/2014/05/0428
	Sample Particulars : Tap Water from Dharwad, Ward No.2 (Huduco Colony), Date of Sampling; 15/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits as per IS: 10500-2012	Test Method
1	Free Residual Chlorine, mg/L	0.5	Min.0.2	Min.1.0	IS: 3025 (P 26)
	MICROBIOLOGICAL TESTS:				
2	Description	Colourless and transparent liquid with few sediments filled in sterilised bottle.			
3	E. coli Bacteria/ml	Less than 1 CFU	Absent	--	IS: 5887 (Part I) 1976

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TEST REPORT

Report No. : ED/2014/05/0429	**Report Date** : 19/05/2014
Issued to : IPE Global Private Limited IPE Global House, B 84, Defence Colony, New Delhi, DELHI - 110024.	**Customer Reference** : Data Sheet, Dated: 15/05/2014
	Date of Receipt : 16/05/2014
	Date of Start of Test : 17/05/2014
	Date of Completion of Test : 19/05/2014
	Job Order No. : ED/2014/05/0429
Sample Nature/ Name : Tap Water	**Sample Particulars** : Tap Water from Dharwad, Ward No.01 (Kelageri Area), Date of Sampling; 15/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits as per IS: 10500-2012	Test Method
1	Free Residual Chlorine, mg/L	0.2	Min.0.2	Min.1.0	IS: 3025 (P 26)
	MICROBIOLOGICAL TESTS:				
2	Description	Colourless and transparent liquid with few sediments filled in sterilised bottle.			
3	E. coli Bacteria/ml	Less than 1 CFU	Absent	--	IS: 5887 (Part I) 1976

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TEST REPORT

Report No. : ED/2014/05/0430	**Report Date** : 19/05/2014
Issued to : **IPE Global Private Limited** **IPE Global House, B 84,** **Defence Colony, New Delhi,** **DELHI - 110024.**	**Customer Reference** : Data Sheet, Dated: 15/05/2014 **Date of Receipt** : 16/05/2014 **Date of Start of Test** : 17/05/2014 **Date of Completion of Test** : 19/05/2014 **Job Order No.** : ED/2014/05/0430
Sample Nature/ Name : Tap Water	**Sample Particulars** : Tap Water from Dharwad,Ward No.7 (Gollar Colony Area), Date of Sampling; 15/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits as per IS: 10500-2012	Test Method
1	Free Residual Chlorine, mg/L	0.6	Min.0.2	Min.1.0	IS: 3025 (P 26)
	MICROBIOLOGICAL TESTS:				
2	Description	Colourless and transparent liquid with few sediments filled in sterilised bottle.			
3	E. coli Bacteria/ml	Less than 1 CFU	Absent	--	IS: 5887 (Part I) 1976

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TEST REPORT

Report No. : ED/2014/05/0431	**Report Date** : 19/05/2014
Issued to : IPE Global Private Limited IPE Global House, B 84, Defence Colony, New Delhi, DELHI - 110024.	**Customer Reference** : Data Sheet, Dated: 15/05/2014
	Date of Receipt : 16/05/2014
	Date of Start of Test : 17/05/2014
	Date of Completion of Test : 19/05/2014
Sample Nature/ Name : Tap Water	**Job Order No.** : ED/2014/05/0431
	Sample Particulars : Tap Water from Dharwad, Ward No.17 (CB Nagar), Date of Sampling; 15/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits as per IS: 10500-2012	Test Method
1	Free Residual Chlorine, mg/L	0.2	Min.0.2	Min.1.0	IS: 3025 (P 26)
	MICROBIOLOGICAL TESTS:				
2	Description	Colourless and clear transparent liquid filled in sterilised bottle.			
3	E. coli Bacteria/ml	Less than 1 CFU	Absent	--	IS: 5887 (Part I) 1976

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TEST REPORT

Report No. : ED/2014/05/0422	**Report Date** : 23/05/2014
Issued to : **IPE Global Private Limited** **IPE Global House, B 84,** **Defence Colony, New Delhi,** **DELHI - 110024.**	**Customer Reference** : Data Sheet, Dated: 15/05/2014
	Date of Receipt : 16/05/2014
	Date of Start of Test : 17/05/2014
	Date of Completion of Test : 23/05/2014
	Job Order No. : ED/2014/05/0422
Sample Nature/ Name : Raw Water	**Sample Particulars** : Water from Dharwad, Malaprabha Water Supply Scheme Jackwell at Saundatti, DOS: 15/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits As per IS: 10500-2012	Protocol
	Table 1: Organoleptic and Physical Parameter				
1	Colour, Hazen units	< 2.0	Max.5	Max.15	IS: 3025 (P 4)
2	Odour	Agreeable	Agreeable	--	IS: 3025 (P 5)
3	Taste	Not Agreeable	Agreeable	Agreeable	IS: 3025 (P 7&8)
4	Turbidity, NTU	8.7	Max.1	Max.5	IS: 3025 (P 10)
5	pH	8.15 @ 24 deg C	6.50 to 8.50	No relaxation	IS: 3025 (P 11)
6	Total Dissolved solids, mg/L	134.0	Max.500	Max.2000	IS: 3025 (P 16)
	Table 2: General Parameters				
7	Aluminium, as Al, mg/L	< 0.01	Max.0.03	Max.0.2	IS: 3025 (P 55)
8	Ammonia, as NH3, mg/L	< 0.05	Max.0.5	No relaxation	IS: 3025 (P 34)
9	Anionic Detergents, as MBAS, mg/L	< 0.2	Max.0.2	Max.1.0	Annex K of IS: 13428
10	Barium, as Ba, mg/L	< 0.1	Max.0.7	No relaxation	IS: 15302
11	Boron, as B, mg/L	< 0.1	Max.0.5	Max.1.0	IS: 3025 (P 57)
12	Calcium, as Ca, mg/L	17.6	Max.75	Max.200	IS: 3025 (P 40)
13	Chloramines, as Cl2, mg/L	< 0.05	Max.4.0	No relaxation	IS: 3025 (P 26)
14	Chlorides, as Cl, mg/L	10.9	Max.250	Max.1000	AN-S-003
15	Copper, as Cu, mg/L	< 0.05	Max.0.05	Max.1.5	IS: 3025 (P 42)
16	Fluorides, as F, mg/L	0.2	Max.1.0	Max.1.5	AN-S-003
17	*Free Residual Chlorine, mg/L	< 0.05	Min.0.2	Min.1.0	IS: 3025 (P 26)
18	Iron, as Fe, mg/L	0.2	Max.0.3	No relaxation	IS: 3025 (P 53)
19	Magnesium, as Mg, mg/L	4.9	Max.30	Max.100	IS: 3025 (P 46)

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	Date of Receipt : 16/05/2014
	Date of Start of Test : 17/05/2014
	Date of Completion of Test : 23/05/2014
	Job Order No. : ED/2014/05/0422
Sample Nature/ Name : Raw Water	**Sample Particulars** : Water from Dharwad, Malaprabha Water Supply Scheme Jackwell at Saundatti, DOS: 15/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits As per IS: 10500-2012	Protocol
20	Manganese, as Mn, mg/L	< 0.1	Max.0.1	Max.0.3	IS: 3025 (P 59)
21	Nitrates, as NO3, mg/L	0.3	Max.45	No relaxation	AN-S-003
22	Phenolic compounds, as C6H5OH, mg/L	Absent	Max.0.001	Max.0.002	IS: 3025 (P 43)
23	Selenium, as Se, mg/L	< 0.01	Max.0.01	No relaxation	IS: 3025 (P 56)
24	Silver, as Ag, mg/L	< 0.01	Max.0.1	No relaxation	Annex J of IS: 13428
25	Sulphates, as SO4, mg/L	6.5	Max.200	Max.400	AN-S-003
26	Sulphide, as H2S, mg/L	< 0.05	Max.0.05	No relaxation	IS: 3025 (P 29)
27	Total Alkalinity, as CaCO3, mg/L	86.0	Max.200	Max.600	IS: 3025 (P 23)
28	Zinc, as Zn, mg/L	0.03	Max.5	Max.15	IS: 3025 (P 49)
29	Total Hardness, as CaCO3, mg/L	64.0	Max.200	Max.600	IS: 3025 (P 21)
	Table 3: Toxic Substances				
30	Cadmium, as Cd, mg/L	< 0.003	Max.0.003	No relaxation	IS: 3025 (P 41)
31	Cyanide, as CN, mg/L	Absent	Max.0.05	No relaxation	APHA
32	Lead, as Pb, mg/L	< 0.01	Max.0.01	No relaxation	IS: 3025 (P 47)
33	Mercury, as Hg, mg/L	< 0.001	Max.0.001	No relaxation	IS: 3025 (P 48)
34	Molybdenum, as Mo, mg/L	< 0.01	Max.0.07	No relaxation	By GFAAS
35	Nickel, as Ni, mg/L	< 0.01	Max.0.02	No relaxation	IS: 3025 (P 54)
36	Total Arsenic, as As, mg/L	< 0.01	Max.0.01	Max.0.05	IS: 3025 (P 37)
37	Total Chromium, as Cr, mg/L	< 0.01	Max.0.05	No relaxation	IS: 3025 (P 52)
38	* Applicable for Chlorinated water				

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TEST REPORT

Report No. : ED/2014/05/0422	Report Date : 23/05/2014
Issued to : IPE Global Private Limited IPE Global House, B 84, Defence Colony, New Delhi, DELHI - 110024.	Customer Reference : Data Sheet, Dated: 15/05/2014
	Date of Receipt : 16/05/2014
	Date of Start of Test : 17/05/2014
Sample Nature/ Name : Raw Water	Date of Completion of Test : 23/05/2014
	Job Order No. : ED/2014/05/0422
	Sample Particulars : Water from Dharwad, Malaprabha Water Supply Scheme Jackwell at Saundatti, DOS: 15/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits As per IS: 10500-2012	Protocol
MICROBIOLOGICAL TESTS:					
	Description	Almost colourless turbid liquid with sediments filled in sterilised bottle.			
1	Coliform organisms/100ml	Greater than 161	Less than 1	--	IS: 1622 - 1981
2	E. coli Bacteria/100ml	Present	Absent	--	IS: 1622 - 1981

Remarks : The sample does not conform to IS: 10500-2012 for Chemical/Microbiological tests in the above respect.
The sample is unfit for drinking in the above respect.

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TEST REPORT

Report No. : ED/2014/05/0423	**Report Date** : 22/05/2014
Issued to : **IPE Global Private Limited** **IPE Global House, B 84,** **Defence Colony, New Delhi,** **DELHI - 110024.**	**Customer Reference** : Data Sheet, Dated: 15/05/2014
	Date of Receipt : 16/05/2014
	Date of Start of Test : 17/05/2014
	Date of Completion of Test : 22/05/2014
Sample Nature/ Name : Treated Water	**Job Order No.** : ED/2014/05/0423
	Sample Particulars : Treated Water from Dharwad, After Clear Reservoir at WTP at Amminbhavi, DOS; 15/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits As per IS: 10500-2012	Protocol
	Table 1: Organoleptic and Physical Parameter				
1	Colour, Hazen units	< 2.0	Max.5	Max.15	IS: 3025 (P 4)
2	Odour	Agreeable	Agreeable	--	IS: 3025 (P 5)
3	Taste	Agreeable	Agreeable	Agreeable	IS: 3025 (P 7&8)
4	Turbidity, NTU	1.4	Max.1	Max.5	IS: 3025 (P 10)
5	pH	7.88 @ 24 deg C	6.50 to 8.50	No relaxation	IS: 3025 (P 11)
6	Total Dissolved solids, mg/L	136.0	Max.500	Max.2000	IS: 3025 (P 16)
	Table 2: General Parameters				
7	Aluminium, as Al, mg/L	0.13	Max.0.03	Max.0.2	IS: 3025 (P 55)
8	Ammonia, as NH3, mg/L	< 0.05	Max.0.5	No relaxation	IS: 3025 (P 34)
9	Anionic Detergents, as MBAS, mg/L	< 0.2	Max.0.2	Max.1.0	Annex K of IS: 13428
10	Barium, as Ba, mg/L	< 0.1	Max.0.7	No relaxation	IS: 15302
11	Boron, as B, mg/L	< 0.1	Max.0.5	Max.1.0	IS: 3025 (P 57)
12	Calcium, as Ca, mg/L	18.4	Max.75	Max.200	IS: 3025 (P 40)
13	Chloramines, as Cl2, mg/L	< 0.05	Max.4.0	No relaxation	IS: 3025 (P 26)
14	Chlorides, as Cl, mg/L	13.4	Max.250	Max.1000	AN-S-003
15	Copper, as Cu, mg/L	< 0.05	Max.0.05	Max.1.5	IS: 3025 (P 42)
16	Fluorides, as F, mg/L	0.2	Max.1.0	Max.1.5	AN-S-003
17	*Free Residual Chlorine, mg/L	0.6	Min.0.2	Min.1.0	IS: 3025 (P 26)
18	Iron, as Fe, mg/L	0.2	Max.0.3	No relaxation	IS: 3025 (P 53)
19	Magnesium, as Mg, mg/L	7.8	Max.30	Max.100	IS: 3025 (P 46)

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TEST REPORT

Report No. : ED/2014/05/0423	**Report Date** : 22/05/2014
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	Date of Receipt : 16/05/2014
	Date of Start of Test : 17/05/2014
	Date of Completion of Test : 22/05/2014
	Job Order No. : ED/2014/05/0423
Sample Nature/ Name : Treated Water	**Sample Particulars** : Treated Water from Dharwad, After Clear Reservoir at WTP at Amminbhavi, DOS; 15/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits As per IS: 10500-2012	Protocol
20	Manganese, as Mn, mg/L	< 0.1	Max.0.1	Max.0.3	IS: 3025 (P 59)
21	Nitrates, as NO3, mg/L	0.3	Max.45	No relaxation	AN-S-003
22	Phenolic compounds, as C6H5OH, mg/L	Absent	Max.0.001	Max.0.002	IS: 3025 (P 43)
23	Selenium, as Se, mg/L	< 0.01	Max.0.01	No relaxation	IS: 3025 (P 56)
24	Silver, as Ag, mg/L	< 0.01	Max.0.1	No relaxation	Annex J of IS: 13428
25	Sulphates, as SO4, mg/L	6.9	Max.200	Max.400	AN-S-003
26	Sulphide, as H2S, mg/L	< 0.05	Max.0.05	No relaxation	IS: 3025 (P 29)
27	Total Alkalinity, as CaCO3, mg/L	86.0	Max.200	Max.600	IS: 3025 (P 23)
28	Zinc, as Zn, mg/L	< 0.01	Max.5	Max.15	IS: 3025 (P 49)
29	Total Hardness, as CaCO3, mg/L	78.0	Max.200	Max.600	IS: 3025 (P 21)
	Table 3: Toxic Substances				
30	Cadmium, as Cd, mg/L	< 0.003	Max.0.003	No relaxation	IS: 3025 (P 41)
31	Cyanide, as CN, mg/L	Absent	Max.0.05	No relaxation	APHA
32	Lead, as Pb, mg/L	< 0.01	Max.0.01	No relaxation	IS: 3025 (P 47)
33	Mercury, as Hg, mg/L	< 0.001	Max.0.001	No relaxation	IS: 3025 (P 48)
34	Molybdenum, as Mo, mg/L	< 0.01	Max.0.07	No relaxation	By GFAAS
35	Nickel, as Ni, mg/L	< 0.01	Max.0.02	No relaxation	IS: 3025 (P 54)
36	Total Arsenic, as As, mg/L	< 0.01	Max.0.01	Max.0.05	IS: 3025 (P 37)
37	Total Chromium, as Cr, mg/L	< 0.01	Max.0.05	No relaxation	IS: 3025 (P 52)
38	* Applicable for Chlorinated water				

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TEST REPORT

Report No. : ED/2014/05/0423	Report Date : 22/05/2014
Issued to : IPE Global Private Limited IPE Global House, B 84, Defence Colony, New Delhi, DELHI - 110024.	Customer Reference : Data Sheet, Dated: 15/05/2014
	Date of Receipt : 16/05/2014
	Date of Start of Test : 17/05/2014
	Date of Completion of Test : 22/05/2014
Sample Nature/ Name : Treated Water	Job Order No. : ED/2014/05/0423
	Sample Particulars : Treated Water from Dharwad, After Clear Reservoir at WTP at Amminbhavi, DOS; 15/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits As per IS: 10500-2012	Protocol
MICROBIOLOGICAL TESTS:					
	Description	Colourless and clear transparent liquid filled in sterilised bottle.			
1	Coliform organisms/100ml	Less than 1	Less than 1	--	IS: 1622 - 1981
2	E. coli Bacteria/100ml	Absent	Absent	--	IS: 1622 - 1981

Remarks : The sample conforms to IS: 10500-2012 for Chemical/Microbiological tests in the above respect.
The sample is fit for drinking in the above respect.

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TEST REPORT

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Report No. : ED/2014/05/0432		**Report Date**	: 21/05/2014
Issued to : IPE Global Private Limited IPE Global House, B 84, Defence Colony, New Delhi, DELHI - 110024.		**Customer Reference**	: Data Sheet, Dated: 15/05/2014
		Date of Receipt	: 17/05/2014
		Date of Start of Test	: 19/05/2014
Sample Nature/ Name	: Tap Water	**Date of Completion of Test**	: 21/05/2014
		Job Order No.	: ED/2014/05/0432
		Sample Particulars	: Tap Water from Hubli, Ward No.27, Shakti Colony, Date of Sampling: 15/05/2014
Sample Condition	: Satisfactory		

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits as per IS: 10500-2012	Test Method
1	Free Residual Chlorine, mg/L	0.1	Min.0.2	Min.1.0	IS: 3025 (P 26)
	MICROBIOLOGICAL TESTS:				
2	Description	Colourless and transparent liquid with sediments filled in sterilised bottle.			
3	E. coli Bacteria/ml	Less than 1 CFU	Absent	–	IS: 5887 (Part I) 1976

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Report No. : ED/2014/05/0433	**Report Date** : 21/05/2014
Issued to : IPE Global Private Limited IPE Global House, B 84, Defence Colony, New Delhi, DELHI - 110024.	**Customer Reference** : Data Sheet, Dated: 15/05/2014
	Date of Receipt : 17/05/2014
	Date of Start of Test : 19/05/2014
	Date of Completion of Test : 21/05/2014
	Job Order No. : ED/2014/05/0433
Sample Nature/ Name : Tap Water	**Sample Particulars** : Tap Water from Hubli, Ward No.25, Lingaraj Nagar, Date of Sampling: 15/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits as per IS: 10500-2012	Test Method
1	Free Residual Chlorine, mg/L	0.6	Min.0.2	Min.1.0	IS: 3025 (P 26)
	MICROBIOLOGICAL TESTS:				
2	Description	Colourless and transparent liquid with sediments filled in sterilised bottle.			
3	E. coli Bacteria/ml	Less than 1 CFU	Absent	--	IS: 5887 (Part I) 1976

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Report No. : ED/2014/05/0434	**Report Date** : 21/05/2014
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	Date of Receipt : 17/05/2014
	Date of Start of Test : 19/05/2014
	Date of Completion of Test : 21/05/2014
	Job Order No. : ED/2014/05/0434
Sample Nature/ Name : Tap Water	**Sample Particulars** : Tap Water from Hubli, Ward No.35, Akashaya Colony, Lakshmi Nagar, DOS: 15/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits as per IS: 10500-2012	Test Method
1	Free Residual Chlorine, mg/L	0.6	Min.0.2	Min.1.0	IS: 3025 (P 26)
	MICROBIOLOGICAL TESTS:				
2	Description	Colourless and clear transparent liquid filled in sterilised bottle.			
3	E. coli Bacteria	Less than 1 CFU	Absent	--	IS: 5887 (Part I) 1976

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Report No. : ED/2014/05/0435	**Report Date** : 21/05/2014
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	Date of Receipt : 17/05/2014
	Date of Start of Test : 19/05/2014
	Date of Completion of Test : 21/05/2014
Sample Nature/ Name : Tap Water	**Job Order No.** : ED/2014/05/0435
	Sample Particulars : Tap Water from Hubli, Ward No.40, JP Nagar, Date of Sampling: 15/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits as per IS: 10500-2012	Test Method
1	Free Residual Chlorine, mg/L	0.6	Min.0.2	Min.1.0	IS: 3025 (P 26)
	MICROBIOLOGICAL TESTS:				
2	Description	Colourless and clear transparent liquid filled in sterilised bottle.			
3	E. coli Bacteria/ml	Less than 1 CFU	Absent	--	IS: 5887 (Part I) 1976

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Report No. : ED/2014/05/0436	**Report Date** : 21/05/2014
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	Date of Receipt : 17/05/2014
	Date of Start of Test : 19/05/2014
	Date of Completion of Test : 21/05/2014
Sample Nature/ Name : Tap Water	**Job Order No.** : ED/2014/05/0436
	Sample Particulars : Tap Water from Hubli, Ward No.53, Nekara Nagar, Date of Sampling: 15/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits as per IS: 10500-2012	Test Method
1	Free Residual Chlorine, mg/L	0.6	Min.0.2	Min.1.0	IS: 3025 (P 26)
	MICROBIOLOGICAL TESTS:				
2	Description	Colourless and clear transparent liquid filled in sterilised bottle.			
3	E. coli Bacteria/ml	Less than 1 CFU	Absent	--	IS: 5887 (Part I) 1976

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Report No. : ED/2014/05/0437	**Report Date** : 21/05/2014
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	Date of Receipt : 17/05/2014
	Date of Start of Test : 19/05/2014
	Date of Completion of Test : 21/05/2014
Sample Nature/ Name : Tap Water	**Job Order No.** : ED/2014/05/0437
	Sample Particulars : Tap Water from Hubli, Ward No.65, Janath Nagar, Date of Sampling: 15/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits as per IS: 10500-2012	Test Method
1	Free Residual Chlorine, mg/L	0.6	Min.0.2	Min.1.0	IS: 3025 (P 26)
	MICROBIOLOGICAL TESTS:				
2	Description	Colourless and transparent liquid with sediments filled in sterilised bottle.			
3	E. coli Bacteria/ml	Less than 1 CFU	Absent	--	IS: 5887 (Part I) 1976

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TEST REPORT

Report No. : ED/2014/05/0438	Report Date : 21/05/2014
Issued to : IPE Global Private Limited IPE Global House, B 84, Defence Colony, New Delhi, DELHI - 110024.	Customer Reference: Data Sheet, Dated: 15/05/2014
	Date of Receipt : 17/05/2014
	Date of Start of Test : 19/05/2014
Sample Nature/ Name : Tap Water	Date of Completion of Test : 21/05/2014
	Job Order No. : ED/2014/05/0438
	Sample Particulars : Tap Water from Hubli, Ward No.57, Akki Honda, Date of Sampling: 15/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits as per IS: 10500-2012	Test Method
1	Free Residual Chlorine, mg/L	0.6	Min.0.2	Min.1.0	IS: 3025 (P 26)
	MICROBIOLOGICAL TESTS:				
2	Description	Colourless and clear transparent liquid filled in sterilised bottle.			
3	E. coli Bacteria/ml	Less than 1 CFU	Absent	--	IS: 5887 (Part I) 1976

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TEST REPORT

Report No. : ED/2014/05/0439	**Report Date** : 21/05/2014
Issued to : IPE Global Private Limited IPE Global House, B 84, Defence Colony, New Delhi, DELHI - 110024.	**Customer Reference:** Data Sheet, Dated: 15/05/2014
	Date of Receipt : 17/05/2014
	Date of Start of Test : 19/05/2014
	Date of Completion of Test : 21/05/2014
	Job Order No. : ED/2014/05/0439
Sample Nature/ Name : Tap Water	**Sample Particulars** : Tap Water from Hubli, Ward No.48, Kalyani Nagar, Date of Sampling: 15/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits as per IS: 10500-2012	Test Method
1	Free Residual Chlorine, mg/L	0.6	Min.0.2	Min.1.0	IS: 3025 (P 26)
	MICROBIOLOGICAL TESTS:				
2	Description	Colourless liquid with few sediments filled in sterilised bottle.			
3	E. coli Bacteria/ml	Less than 1 CFU	Absent	–	IS: 5887 (Part I) 1976

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TEST REPORT

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Report No. : ED/2014/05/0432	**Report Date** : 21/05/2014
Issued to : IPE Global Private Limited IPE Global House, B 84, Defence Colony, New Delhi, DELHI - 110024.	**Customer Reference** : Data Sheet, Dated: 15/05/2014
	Date of Receipt : 17/05/2014
	Date of Start of Test : 19/05/2014
	Date of Completion of Test : 21/05/2014
	Job Order No. : ED/2014/05/0432
Sample Nature/ Name : Tap Water	**Sample Particulars** : Tap Water from Hubli, Ward No.27, Shakti Colony, Date of Sampling: 15/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits as per IS: 10500-2012	Test Method
1	Free Residual Chlorine, mg/L	0.1	Min.0.2	Min.1.0	IS: 3025 (P 26)
	MICROBIOLOGICAL TESTS:				
2	Description	Colourless and transparent liquid with sediments filled in sterilised bottle.			
3	E. coli Bacteria/ml	Less than 1 CFU	Absent	--	IS: 5887 (Part I) 1976

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Report No. : ED/2014/05/0433	Report Date : 21/05/2014
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	Date of Receipt : 17/05/2014
	Date of Start of Test : 19/05/2014
Sample Nature/ Name : Tap Water	Date of Completion of Test : 21/05/2014
	Job Order No. : ED/2014/05/0433
	Sample Particulars : Tap Water from Hubli, Ward No.25, Lingaraj Nagar, Date of Sampling: 15/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits as per IS: 10500-2012	Test Method
1	Free Residual Chlorine, mg/L	0.6	Min.0.2	Min.1.0	IS: 3025 (P 26)
	MICROBIOLOGICAL TESTS:				
2	Description	Colourless and transparent liquid with sediments filled in sterilised bottle.			
3	E. coli Bacteria/ml	Less than 1 CFU	Absent	--	IS: 5887 (Part I) 1976

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TEST REPORT

Report No. : ED/2014/05/0504	**Report Date** : 26/05/2014
Issued to : IPE Global Private Limited IPE Global House, B 84, Defence Colony, New Delhi, DELHI - 110024.	**Customer Reference** : Data Sheet, Dated: 16/05/2014
	Date of Receipt : 19/05/2014
	Date of Start of Test : 20/05/2014
	Date of Completion of Test : 26/05/2014
Sample Nature/ Name : Treated Water	**Job Order No.** : ED/2014/05/0504
	Sample Particulars : Treated Water from Hubli, Neerasagara Lake, Bharth Dommavadi, DOS: 16/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits As per IS: 10500-2012	Protocol
	Table 1: Organoleptic and Physical Parameter				
1	Colour, Hazen units	< 2.0	Max.5	Max.15	IS: 3025 (P 4)
2	Odour	Agreeable	Agreeable	--	IS: 3025 (P 5)
3	Taste	Agreeable	Agreeable	Agreeable	IS: 3025 (P 7&8)
4	Turbidity, NTU	1.7	Max.1	Max.5	IS: 3025 (P 10)
5	pH	7.84 @ 24 deg C	6.50 to 8.50	No relaxation	IS: 3025 (P 11)
6	Total Dissolved solids, mg/L	314.0	Max.500	Max.2000	IS: 3025 (P 16)
	Table 2: General Parameters				
7	Aluminium, as Al, mg/L	0.05	Max.0.03	Max.0.2	IS: 3025 (P 55)
8	Ammonia, as NH3, mg/L	< 0.05	Max.0.5	No relaxation	IS: 3025 (P 34)
9	Anionic Detergents, as MBAS, mg/L	< 0.2	Max.0.2	Max.1.0	Annex K of IS: 13428
10	Barium, as Ba, mg/L	< 0.1	Max.0.7	No relaxation	IS: 15302
11	Boron, as B, mg/L	< 0.1	Max.0.5	Max.1.0	IS: 3025 (P 57)
12	Calcium, as Ca, mg/L	26.2	Max.75	Max.200	IS: 3025 (P 40)
13	Chloramines, as Cl2, mg/L	< 0.05	Max.4.0	No relaxation	IS: 3025 (P 26)
14	Chlorides, as Cl, mg/L	54.5	Max.250	Max.1000	AN-S-003
15	Copper, as Cu, mg/L	< 0.05	Max.0.05	Max.1.5	IS: 3025 (P 42)
16	Fluorides, as F, mg/L	0.32	Max.1.0	Max.1.5	AN-S-003
17	*Free Residual Chlorine, mg/L	0.6	Min.0.2	Min.1.0	IS: 3025 (P 26)
18	Iron, as Fe, mg/L	0.15	Max.0.3	No relaxation	IS: 3025 (P 53)
19	Magnesium, as Mg, mg/L	18.9	Max.30	Max.100	IS: 3025 (P 46)

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Format No. BTH/QF/164

OHSAS 18001 : 2007 & ISO 9001 : 2008

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Cert. No. RQ91/JA/1111
Cert. No.: RO91/JA/IC/1111

TEST REPORT

Report No. : ED/2014/05/0504	Report Date : 26/05/2014
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	Date of Receipt : 19/05/2014
	Date of Start of Test : 20/05/2014
	Date of Completion of Test : 26/05/2014
Sample Nature/ Name : Treated Water	Job Order No. : ED/2014/05/0504
	Sample Particulars : Treated Water from Hubli, Neerasagara Lake, Bharth Dommavadi, DOS: 16/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits As per IS: 10500-2012	Protocol
20	Manganese, as Mn, mg/L	< 0.1	Max.0.1	Max.0.3	IS: 3025 (P 59)
21	Nitrates, as NO3, mg/L	1.0	Max.45	No relaxation	AN-S-003
22	Phenolic compounds, as C6H5OH, mg/L	Absent	Max.0.001	Max.0.002	IS: 3025 (P 43)
23	Selenium, as Se, mg/L	< 0.01	Max.0.01	No relaxation	IS: 3025 (P 56)
24	Silver, as Ag, mg/L	< 0.01	Max.0.1	No relaxation	Annex J of IS: 13428
25	Sulphates, as SO4, mg/L	13.5	Max.200	Max.400	AN-S-003
26	Sulphide, as H2S, mg/L	< 0.05	Max.0.05	No relaxation	IS: 3025 (P 29)
27	Total Alkalinity, as CaCO3, mg/L	159.1	Max.200	Max.600	IS: 3025 (P 23)
28	Zinc, as Zn, mg/L	0.015	Max.5	Max.15	IS: 3025 (P 49)
29	Total Hardness, as CaCO3, mg/L	142.8	Max.200	Max.600	IS: 3025 (P 21)
	Table 3: Toxic Substances				
30	Cadmium, as Cd, mg/L	< 0.003	Max.0.003	No relaxation	IS: 3025 (P 41)
31	Cyanide, as CN, mg/L	Absent	Max.0.05	No relaxation	APHA
32	Lead, as Pb, mg/L	< 0.01	Max.0.01	No relaxation	IS: 3025 (P 47)
33	Mercury, as Hg, mg/L	< 0.001	Max.0.001	No relaxation	IS: 3025 (P 48)
34	Molybdenum, as Mo, mg/L	< 0.01	Max.0.07	No relaxation	By GFAAS
35	Nickel, as Ni, mg/L	< 0.01	Max.0.02	No relaxation	IS: 3025 (P 54)
36	Total Arsenic, as As, mg/L	< 0.01	Max.0.01	Max.0.05	IS: 3025 (P 37)
37	Total Chromium, as Cr, mg/L	< 0.01	Max.0.05	No relaxation	IS: 3025 (P 52)
38	* Applicable for Chlorinated water				

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Format No. BTH/QF/104

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OHSAS 18001 : 2007 & ISO 9001 : 2008
JAS-ANZ

Cert. No. RQ91/JA/1111
Cert. No.: RO91/JA/IC/1111

TEST REPORT

Report No. : ED/2014/05/0504	Report Date : 26/05/2014
Issued to : IPE Global Private Limited IPE Global House, B 84, Defence Colony, New Delhi, DELHI - 110024.	Customer Reference : Data Sheet, Dated: 16/05/2014
	Date of Receipt : 19/05/2014
	Date of Start of Test : 20/05/2014
Sample Nature/ Name : Treated Water	Date of Completion of Test : 26/05/2014
	Job Order No. : ED/2014/05/0504
	Sample Particulars : Treated Water from Hubli, Neerasagara Lake, Bharth Dommavadi, DOS: 16/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits As per IS: 10500-2012	Protocol
MICROBIOLOGICAL TESTS:					
	Description	Colourless and clear transparent liquid filled in sterilised bottle.			
1	Coliform organisms/100ml	Less than 1	Less than 1	--	IS: 1622 - 1981
2	E. coli Bacteria/100ml	Absent	Absent	--	IS: 1622 - 1981

Remarks : The sample conforms to IS: 10500-2012 for Chemical/Microbiological tests in the above respect.
The sample is fit for drinking in the above respect.

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TEST REPORT

Report No. : ED/2014/05/0503	**Report Date** : 31/05/2014
Issued to : IPE Global Private Limited IPE Global House, B 84, Defence Colony, New Delhi, DELHI - 110024.	**Customer Reference** : Data Sheet, Dated: 16/05/2014
	Date of Receipt : 19/05/2014
	Date of Start of Test : 20/05/2014
	Date of Completion of Test : 31/05/2014
Sample Nature/ Name : Raw Water	**Job Order No.** : ED/2014/05/0503
	Sample Particulars : Raw Water from Hubli, Neerasagara Lake, Bharth Dommavadi, DOS: 16/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits as per IS: 10500-2012	Protocol
	Table 1: Organoleptic and Physical Parameter				
1	Colour, Hazen units	< 2.0	Max.5	Max.15	IS: 3025 (P 4)
2	Odour	Agreeable	Agreeable	--	IS: 3025 (P 5)
3	Taste	Agreeable	Agreeable	Agreeable	IS: 3025 (P 7&8)
4	Turbidity, NTU	1.6	Max.1	Max.5	IS: 3025 (P 10)
5	pH	8.42 @ 24 deg C	6.50 to 8.50	No relaxation	IS: 3025 (P 11)
6	Total Dissolved solids, mg/L	308.0	Max.500	Max.2000	IS: 3025 (P 16)
	Table 2: General Parameters				
7	Aluminium, as Al, mg/L	< 0.01	Max.0.03	Max.0.2	IS: 3025 (P 55)
8	Ammonia, as NH3, mg/L	< 0.05	Max.0.5	No relaxation	IS: 3025 (P 34)
9	Anionic Detergents, as MBAS, mg/L	< 0.2	Max.0.2	Max.1.0	Annex K of IS: 13428
10	Barium, as Ba, mg/L	< 0.1	Max.0.7	No relaxation	IS: 15302
11	Boron, as B, mg/L	< 0.1	Max.0.5	Max.1.0	IS: 3025 (P 57)
12	Calcium, as Ca, mg/L	24.5	Max.75	Max.200	IS: 3025 (P 40)
13	Chloramines, as Cl2, mg/L	< 0.05	Max.4.0	No relaxation	IS: 3025 (P 26)
14	Chlorides, as Cl, mg/L	53.3	Max.250	Max.1000	AN-S-003
15	Copper, as Cu, mg/L	< 0.05	Max.0.05	Max.1.5	IS: 3025 (P 42)
16	Fluorides, as F, mg/L	0.33	Max.1.0	Max.1.5	AN-S-003
17	*Free Residual Chlorine, mg/L	< 0.05	Min.0.2	Min.1.0	IS: 3025 (P 26)
18	Iron, as Fe, mg/L	0.084	Max.0.3	No relaxation	IS: 3025 (P 53)
19	Magnesium, as Mg, mg/L	18.9	Max.30	Max.100	IS: 3025 (P 46)

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Format No. BTH/QF/164

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Cert. No. RQ91/JA/1111
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TEST REPORT

Report No. : ED/2014/05/0503	**Report Date** : 31/05/2014
Issued to : IPE Global Private Limited **IPE Global House, B 84,** **Defence Colony, New Delhi,** **DELHI - 110024.**	**Customer Reference:** Data Sheet, Dated: 16/05/2014
	Date of Receipt : 19/05/2014
	Date of Start of Test : 20/05/2014
	Date of Completion of Test : 31/05/2014
Sample Nature/ Name : Raw Water	**Job Order No.** : ED/2014/05/0503
	Sample Particulars : Raw Water from Hubli, Neerasagara Lake, Bharth Dommavadi, DOS: 16/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits as per IS: 10500-2012	Protocol
20	Manganese, as Mn, mg/L	< 0.1	Max.0.1	Max.0.3	IS: 3025 (P 59)
21	Nitrates, as NO3, mg/L	< 0.1	Max.45	No relaxation	AN-S-003
22	Phenolic compounds, as C6H5OH, mg/L	Absent	Max.0.001	Max.0.002	IS: 3025 (P 43)
23	Selenium, as Se, mg/L	< 0.01	Max.0.01	No relaxation	IS: 3025 (P 56)
24	Silver, as Ag, mg/L	< 0.01	Max.0.1	No relaxation	Annex J of IS: 13428
25	Sulphates, as SO4, mg/L	12.7	Max.200	Max.400	AN-S-003
26	Sulphide, as H2S, mg/L	< 0.05	Max.0.05	No relaxation	IS: 3025 (P 29)
27	Total Alkalinity, as CaCO3, mg/L	163.4	Max.200	Max.600	IS: 3025 (P 23)
28	Zinc, as Zn, mg/L	0.02	Max.5	Max.15	IS: 3025 (P 49)
29	Total Hardness, as CaCO3, mg/L	138.7	Max.200	Max.600	IS: 3025 (P 21)
	Table 3: Toxic Substances				
30	Cadmium, as Cd, mg/L	< 0.003	Max.0.003	No relaxation	IS: 3025 (P 41)
31	Cyanide, as CN, mg/L	Absent	Max.0.05	No relaxation	APHA
32	Lead, as Pb, mg/L	< 0.01	Max.0.01	No relaxation	IS: 3025 (P 47)
33	Mercury, as Hg, mg/L	< 0.001	Max.0.001	No relaxation	IS: 3025 (P 48)
34	Molybdenum, as Mo, mg/L	< 0.01	Max.0.07	No relaxation	By GFAAS
35	Nickel, as Ni, mg/L	< 0.01	Max.0.02	No relaxation	IS: 3025 (P 54)
36	Total Arsenic, as As, mg/L	< 0.01	Max.0.01	Max.0.05	IS: 3025 (P 37)
37	Total Chromium, as Cr, mg/L	< 0.01	Max.0.05	No relaxation	IS: 3025 (P 52)
38	* Applicable for Chlorinated water				

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TEST REPORT

Report No. : ED/2014/05/0503	**Report Date** : 31/05/2014
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	Date of Receipt : 19/05/2014
	Date of Start of Test : 20/05/2014
	Date of Completion of Test : 31/05/2014
Sample Nature/ Name : Raw Water	**Job Order No.** : ED/2014/05/0503
	Sample Particulars : Raw Water from Hubli, Neerasagara Lake, Bharth Dommavadi, DOS: 16/05/2014
Sample Condition : Satisfactory	

SL. No.	PARAMETERS	Results	Acceptable Limits as per IS: 10500-2012	Permissible Limits as per IS: 10500-2012	Protocol
MICROBIOLOGICAL TESTS:					
	Description	Almost colourless liquid with sediments filled in plastic can.			
1	Coliform organisms/100ml	24	Less than 1	--	IS: 1622 - 1981
2	E. coli Bacteria/100ml	Present	Absent	--	IS: 1622 - 1981

Remarks : The sample does not conform to IS: 10500-2012 for Microbiological tests in the above respect.
The sample is unfit for drinking in the above respect.

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