

Initial Environmental Examination

Document stage: Draft for Consultation
Project Number: 43253-027
May 2018

IND: Karnataka Integrated Urban Water Management Investment Program (Tranche 2) – Replacement of Old Sewerage Pumping Mains for Mangalore City

Package No. 02MNG02

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

CURRENCY EQUIVALENTS

(As of 11 May 2018)

Currency unit	–	Indian rupee (₹)
₹1.00	=	\$0.0149
\$1.00	=	₹67.090

ABBREVIATIONS

ADB	–	Asian Development Bank
CTE	–	consent to establish
CTO	–	consent to operate
CGWB	–	Central Ground Water Board
DLIC	–	District Level Implementation Committee
DPR	–	detailed project report
EAC	–	Expert Appraisal Committee
EIA	–	environmental impact assessment
EMP	–	environmental management plan
GRC	–	grievance redress committee
H&S	–	health and safety
IEE	–	initial environmental examination
KIUWMIP	–	Karnataka Integrated Urban Water Management Investment Program
KSPCB	–	Karnataka State Pollution Control Board
KUDCEMP	–	Karnataka Urban Development and Coastal Environment Management Project
KUIDFC	–	Karnataka Urban Infrastructure Development and Finance Corporation
KUWSDB	–	Karnataka Urban Water Supply and Drainage Board
MCC	–	Mangalore City Corporation
MOEFCC	–	Ministry of Environment Forest and Climate Change
NGO	–	nongovernment organization
O&M	–	operations and maintenance
PIU	–	program implementation unit
PMDSC	–	project management, design and construction supervision consultant
PMU	–	program management unit
REA	–	rapid environmental assessment
RSPM	–	residual suspended particulate matter
SEIAA	–	State Environmental Impact Assessment Authority
SEMP	–	site environmental management plan
SEZ	–	special economic zone
SPS	–	Safeguard Policy Statement
STP	–	sewage treatment plant
UASB	–	up-flow anaerobic sludge blanket
ULB	–	urban local body

WEIGHTS AND MEASURES

dB	–	decibel
°C	–	degree Celsius
km	–	kilometer
lps	–	liter per second
m	–	meter
mbgl	–	meter below ground level
mm	–	millimeter
MLD	–	million liters per day
km ²	–	square kilometer
m ² /day	–	square meter per day

NOTE

In this report, "\$" refers to United States dollars.

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EXECUTIVE SUMMARY

The Asian Development Bank (ADB) funded Karnataka Integrated Urban Water Management Investment Program (KIUWMIP) aims to improve water resource management in urban areas in a holistic and sustainable manner consistent with the principles of integrated water resources management. Investment support will be provided to modernize and expand urban water supply and sanitation – while strengthening relevant institutions to enhance efficiency, productivity and sustainability in water use. Mangalore sewerage subproject is one of the subprojects proposed in Tranche 2.

Previously, Karnataka Urban Infrastructure Development and Finance Corporation (KUIDFC) implemented the ADB assisted Karnataka Urban Development and Coastal Environment Management Project (KUDCEMP), which initiated water supply and sewerage improvements in 10 coastal towns. However, owing to shortage of funds, the subprojects were not comprehensive enough to have full coverage and was limited to critical major works only. Hence, under the KIUWMIP, it is proposed to support four coastal towns (Kundapura, Mangalore, Puttur, and Udupi) to implement 24x7 water supply systems, besides sewerage improvements where required.

Mangalore City spreads around an area of 132.45 square kilometer (km²) and is located at 12°87'N latitude and 74°88'E longitude. The topography of the city is from plain to undulating with four hilly regions with natural valleys within the city. The city is characterized by undulating topography. Mangalore is situated on the west coast of India, and is bounded by the Arabian Sea to its west and the Western Ghats to its east. Mangalore is the largest urban center of coastal Karnataka and the fourth largest city in Karnataka in terms of area and population. Mangalore is located about 350 kilometers (km) west of the state capital, Bangalore.

Categorization. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in its Safeguard Policy Statement (SPS), 2009. The proposed projects are categorized as A, B, C or FI to determine the level of environmental assessment required. Mangalore sewerage subproject is classified as Environmental Category B as per ADB SPS, 2009 as no significant impacts are envisioned. Accordingly, this initial environmental examination (IEE) report has been prepared.

Subproject Scope. Under this subproject, it is proposed to replace existing sewage pumping mains, which are damaged, undersized and/or choked up in sewerage zones 3, 4, 6 and 7. Subproject included providing following sewage mains: (i) 7.65 km length 1,100 millimeter (mm) diameter sewer pumping main from Kudroli wet well no.3 to Kavoore sewage treatment plant (STP); (ii) 0.95 km length 900 mm diameter main from Kandathpalli wet well no.-4 to Kudroli wet well no. 3; (iii) 1.7 km length 450 mm diameter main from Mulihitilu wet well no.-6 to Ridge Manhole near Morgans gate; and (iv) 1.1 km length 450 mm diameter main from Jeppu Bappal wet well no. 7 to ridge manhole near Yekkur, inside old STP.

Implementation Arrangements. KUIDFC is the executing agency responsible for overall technical supervision and execution of all subprojects funded under the Investment Program. Implementation activities are overseen by program management unit (PMU) established in its head office at Bangalore in coordination with its regional office (RPMU) in Mangalore. PMU and RPMU are staffed with technical, administrative and financial officials, including safeguards specialists, to manage and monitor program implementation. The implementing agencies are the respective urban local bodies (ULBs). For this package, the implementing agency is Mangalore City Corporation (MCC). A program implementation unit (PIU) has been set up for implementation of day-to-day activities in the field. A consultant team, project management, design and

construction supervision consultant (PMDSCS), assists PMU, RPMU and all PIUs in subproject planning and management, assures technical quality of design and construction, designs the infrastructure, and supervises construction including conducting all safeguards tasks.

Description of the Environment. Subproject components are located in Mangalore urban area or in its immediate surroundings. Subproject sites are located in existing right of ways (ROW) of public roads, which are government-owned. There are no protected areas, wetlands, mangroves, or estuaries in or near the subproject location. There are no forest areas within or near Mangalore. Some road sections of the proposed pumping main alignments are very narrow and/or busy.

Potential Environmental Impacts. Subproject involves replacement of old and damaged sewage pumping mains, that carry sewage to sewage treatment plants (STPs) for treatment and disposal. Due to this rehabilitation nature of work, there are no notable impacts either due to location or design of the project. Pipelines will be laid along the public roads – along the vacant shoulders where available, or along the tarmac portion, where there is no vacant land. New pipeline will be mostly laid adjacent to the existing one which is currently in operation. Existing pipeline (of cast iron) will not be disturbed, and once the new line (of ductile iron) is laid, the old section will be isolated and new pipeline will be connected. The existing pipeline will then be left as is in the ground, by capping both ends. No disturbance to the existing sewerage system is, therefore, anticipated due to this approach. Adequate capacity of STP is already available, so the sewage conveyed by the pumping main will be treated and reused in industrial applications.

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

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

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

The stakeholders were involved in developing the IEE through discussions on-site and public consultation, after which views expressed were incorporated into the IEE and in the planning and

development of the subproject. The IEE will be made available at public locations in the city and will be disclosed to a wider audience via the ADB and KUIDFC websites. The consultation process will be continued and expanded during project implementation to ensure that stakeholders are fully engaged in the project and will have the opportunity to participate in its development and implementation.

Consultation, Disclosure and Grievance Redress. The stakeholders were involved in developing the IEE through discussions on-site and public consultation, after which views expressed were incorporated into the IEE and in the planning and development of the subproject. The IEE will be made available at public locations and will be disclosed to a wider audience via the ADB and KUIDFC websites. The consultation process will be continued and expanded during project implementation to ensure that stakeholders are fully engaged in the project and can participate in its development and implementation. A project-specific grievance redress mechanism is proposed and described in the IEE to ensure any public grievances are addressed quickly.

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

Permits and Clearances Required. Environmental Clearance requirement per Government of India Environmental Impact Assessment Notification is not applicable to this subproject. No environment-related statutory clearance or permissions required for this subproject.

Conclusions and Recommendations. The citizens of the Mangalore City will be the major beneficiaries of this subproject. The replacement of old sewerage pumping mains will improve the conveyance of sewage generated, avoiding the leaks and bypass to storm water drains. The most concrete net environmental benefits to the population will be positive and large as a result of improved: (i) sanitation and environmental health; and (ii) river water quality through the effective conveyance of sewage to proper treatment, etc.

Based on the findings of the IEE, there are no significant impacts and the classification of the subproject as Category “B” is confirmed. No further special study or detailed environmental impact assessment (EIA) needs to be under taken to comply with ADB SPS (2009).

I. INTRODUCTION

A. Background

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

2. The executing agency is the Karnataka Urban Infrastructure Development Finance Corporation (KUIDFC) and implementing agencies for the Investment Program will be respective urban local bodies (ULBs). Kundapura, Mangalore, Puttur, and Udupi are the four towns chosen to benefit from the Tranche 2 of the investment.

3. The expected outcome will be urban water resource management in four coastal towns (Kundapura, Mangalore, Puttur, and Udupi) improved. The outputs are (i) UWSS infrastructure expanded and upgraded; (ii) water resource planning, monitoring and service delivery improved; and (iii) project management capacity of KUIDFC and ULBs strengthened capacity. This initial environmental examination (IEE) is based on an assessment sewerage projects within the project area, i.e., Mangalore.

4. **Subproject Scope.** Under this subproject, it is proposed to replace existing sewage pumping mains, which are damaged, undersized and/or choked up in sewerage zones 3, 4, 6 and 7. Subproject included providing following sewage mains: (i) 7.65 kilometer (km) length 1,100 millimeter (mm) diameter sewer pumping main from Kudroli wet well no.-3 to Kavoov sewage treatment plant (STP); (ii) 0.95 km length 900 mm diameter main from Kandathpalli wet well no.-4 to Kudroli wet well no. 3; (iii) 1.7 km length 450 mm diameter main from Mulihitilu wet well no.-6 to Ridge Manhole near Morgans gate; and (iv) 1.1 km length 450 mm diameter main from Jeppu Bappal wet well no.7 to ridge manhole near Yekkur, inside old sewage treatment plant (STP).

B. Background of Initial Environmental Examination

5. **Categorization.** Asian Development Bank (ADB) requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in its Safeguard Policy Statement (SPS), 2009. The proposed projects are categorized as A, B, C or FI to determine the level of environmental assessment required.¹ Rapid environmental assessment using ADB's rapid environmental

¹ Per ADB SPS, the environmental categorization and level of environmental assessment required for each category are as follows: (i) **Category A:** A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment is required. (ii) **Category B:** A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible and, in most cases, mitigation measures can be designed more readily than for category A projects. An initial environmental examination is required. (iii) **Category C:** A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed. (iv) **Category FI:** A proposed project is classified as category FI if it involves investment of ADB funds to or through a financial intermediary

assessment (REA) checklist for Sewerage Scheme components were conducted, and results of the assessments show that Mangalore sewerage subproject is classified as Environmental Category B as per ADB SPS, 2009. Accordingly, this IEE report has been prepared.

C. Scope of Initial Environmental Examination

6. IEE is prepared based on detailed engineering design of the subproject. The IEE was based mainly on secondary sources [India Meteorological Department, Central Ground Water Board (CGWB), Census Department of India] of information and field reconnaissance surveys. No field monitoring (environmental) survey was conducted. Stakeholder consultation was an integral part of the IEE.

D. Report Structure

7. This IEE was prepared following KIUWMP's environmental assessment and review framework² and ADB SPS, 2009. It includes the following sections: (i) Introduction, (ii) Description of Program components, (iii) Policy and Legal Frame, (iv) Description of the environment, (v) Screening of potential environmental impacts and mitigation measures, (vi) Public consultation and information disclosure, (vii) Grievance Redress Mechanism, (viii) Environmental Management Plan, and (ix) Conclusion and Recommendations.

II. DESCRIPTION OF THE PROJECT COMPONENTS

8. Mangalore City spreads around an area of 132.45 square kilometer (km²) and is located at 12°87'N Latitude and 74°88'E Longitude. The topography of the city is from plain to undulating with four hilly regions with natural valleys within the city. The city is characterized by undulating topography. Mangalore is situated on the west coast of India, and is bounded by the Arabian Sea to its west and the Western Ghats to its east. Mangalore lies on the backwaters of the Netravati and Gurupura rivers. These rivers effectively encircle the city, with the Gurupura flowing around the north and the Netravti flowing around the south of the city. Mangalore is the Headquarters of Dakshina Kannada District. Mangalore is the largest urban center of coastal Karnataka and the fourth largest city in Karnataka in terms of area and population. Mangalore is located about 350 km west of the state capital, Bangalore. The municipality spreads in an area of 132.45 km² and is divided into 60 wards.

² The environmental assessment and review framework has been prepared in 2014 during KIUWMIP loan approval. This has been updated during Tranche 2 to include recent Government of India's environmental laws, rules and regulations and Tranche 2 project components.

A. Existing Sewerage System in Mangalore

9. The first sewerage system in Mangalore was built in 1961 and was designed for an ultimate flow of 27.04 million liters per day (MLD) estimated for a design population of 200,000 of the year 1991. This scheme was implemented by Public Health Department. The total area covered by the sewerage network is about 25 km² with two sewerage districts and seven zones. Total length of sewerage network constructed was about 250 km with pipe diameter varying from 150 mm to 600 mm with 7,000 manholes and eight wet wells-cum-pump houses. In 1974, Karnataka Urban Water Supply and Sewerage Board (KUWSDB) extended the sewerage networks within the existing 25 km² area by another 245 km with 8,000 units of manholes.

10. The second scheme was established in 2003 under the ADB funded Karnataka Urban Development and Coastal Environmental Management Project (KUDCEMP) and commissioned in 2007-2008 and the sewerage system was upgraded for an ultimate flow of 88.75 MLD for a design population of 624,432. Sewerage network extended to adjoining areas of old city and to other areas in Mangalore City Corporation (MCC) boundary covering 50.60 km². Overall 60% of Mangalore, 75.60 km², is covered with sewerage systems.

11. Mangalore city is divided into two parts as Surathkal and Mangalore, further subdivided into seven sewerage districts. Each district has one STP. The total length of sewerage network is about 360 km including 14,875 Manholes with pipe diameter varying from 150 mm to 900 mm, and 22 wetwells.

12. North District consists of 10 zones (complete Surathkal area) covers about 25 km². West district consists of 6 zones (city center of Mangalore) covers 30.82 km². South district consists of 3 zones (Jeppinamogaru, Bajal, Padil) covers 19.66 km². East district consists of 1 zone (Pachanady, Bondel and Shakatinagara) covers 18.78 km².

13. The salient features of the existing sewerage system are given in Table 1 below:

Table 1: Salient Features of Existing Sewerage System in Mangalore

Location	12°87'N Latitude 74°88'E Longitude
Area	132.45 km ²
Population 2011	488,487
Number of households	115,036
Road length	1,134 km
Projected population for the year 2016	554,183
Projected population for the year 2031	756,903
Projected population for the year 2046	1,033,778
Existing Underground Drainage (1961 Scheme) by Public Health Department	
Underground drainage Network	250 km (diameter varying from 150 mm to 750 mm) Sewers of stoneware pipes
Total Number of Manholes	8000
Total Number of Wet Wells	8
Total area covered	25 km ²
Designed Population	2,00,000 for the year 1991
Extension of Underground drainage system (1974) by KUWSDB and MCC	
Underground drainage Network	245 km
Total Number of Manholes	8000
Underground drainage system (2005) under KUDCEMP by KUIDFC	
No. of Sewerage Catchments	24
Underground drainage Network	360 km - diameter varying from 150 mm to 900 mm

Total Number of Manholes	14,815
Total Number of Wet Wells	22
Total Area Covered	70%
Designed Population	624,432
Capacity and Technology of STP	
• STP at Kavoor	43.5 MLD UASB
• STP at Pachanady	8.75 MLD ASP
• STP at Bajal	20 MLD ASP
• STP at Surathkal	16 MLD ASP
Total Number of House Service Connections	45,000

ASP = activated sludge process, km = kilometer, KUDCEMP = Karnataka Urban Development and Coastal Environment Management Project, KUIDFC = Karnataka Urban Infrastructure Development and Finance Corporation, KUWSDB = Karnataka Urban Water Supply and Drainage Board, MCC = Mangalore City Corporation, mm = millimeter, MLD = million liters per day, STP = sewage treatment plant, km² = square kilometer, UASB = up-flow anaerobic sludge blanket.

B. Project Need

14. A detailed assessment of the current situation was carried out zone wise, which concludes that the 1961 scheme using old sewage pumping mains of cast iron (CI) pipes from the following wet wells are not in good condition due to their leakage history: (i) Wet well no. 3 Kudroli to Kavoor STP; (ii) Wet well no. 4 Kandathpalli to Wet well no. 3 Kudroli under West Sewerage district; (iii) Wet well no. 6 Mulihitlu to Ridge Manhole; and (iv) Wet well no. 7 Jeppu Bappal to Ridge Manhole under South Sewerage district. Due to the existing pumping mains insufficient carrying capacity, sewage is not fully pumped to the STP – bypassing sewage to natural nalla near the wet well causing public nuisance in the process. Due to the inadequacy in the pumping mains carrying capacity and leakage, the replacement of old pumping mains is being proposed to prepare and enable the system to achieve sufficient carrying capacity until 2046.

15. The subproject covers Zone 3 and Zone 4 of west sewerage district and zone 6 and zone 7 of south sewerage district of Mangalore (Table 2). West sewerage districts covers 30.82 km² with 27 wards consists of Kudroli, Matadakani, Mannagudda, Gandhinagara, Lalbagh, Bejai, Anegundi, Kodialbail, Kadri, Urvaz, Kandathpalli, Old port area, Kavoor, Kottara, Ladyhill, Ashoknagara, Derebail, Bolor Konchady areas. South sewerage districts covers 19.66 km² with 18 wards consists of Mulihitlu, Mangaladevi Temple area, Hoigebazar, Bolar, Morgansgate, Mahakalipadpu, Valancia, Jeppu, Jeppinamogaru, Attavara, Sooterpete, Ekkur, Bendoor, Kankanady areas.

Table 2: Sewage District-Wise Details

Sewerage District Wise Details												
Sewerage District	Zones covered	Populations			Sewage Generation in MLD			Sewer Networks in KMs	Wet Wells	No of STP	Existing STP Capacity in MLD	Present sewage recived at STP in MLD
		2016	2031	2046	2016	2031	2046					
West	1,2,3,4,5 & 10	195842	276071	334754	31.4	42.91	51.86	445.39	9	1	43.5	20
South	6,7,8	85348	131418	167047	11.52	17.74	22.55	171.64	6	1	20	4
East	9	26598	55367	86586	4.17	8.14	12.43	62.77	3	1	8.75	4
North	1,2,4,5,6,7,8,9 & 10	59215	104797	145157	7.99	14.14	19.59	116.9	4	1	16.5	1

16. **In Zone-3 of West District.** As of 2016, zone-3 generates about 11.76 MLD, zone-4 about 2.0 MLD and zone-5 about 7.62 MLD of sewage. Wet well No-3 receives sewage from zone-4 and zone-5. A combined sewage of 21.38 MLD from zones 3,4 and 5 are conveyed to the Kavour STP. Given the existing Pumping Main originated from the 1961 scheme, it has been observed that the 750 mm dia CI pipe from Wet well 3 at Kudroli only conveys about 10 MLD to the Kavour STP (with a capacity of 43.5 MLD) despite the fact that sewage generated is at 21.38 MLD, leaving approximately 12 MLD of sewage bypassed to Natural Nalla near the Wet Well, which causes public nuisance. This is heavily due to leakages in the system. To address the problem and convey the full amount of sewage generated to the designated STP, the subproject proposed to replace 750 mm dia CI pipe to 1,100 mm dia DI K9 class pipe to convey peak sewage flow from Wet well-3 to 43.5 MLD STP at Kavour for 7.65 km.

17. **In Zone-4 of West District.** As of 2016, zones 4 and 5 generate 2 MLD and 7.62 MLD of sewage, respectively. Wet well No. 4 receives sewage from zones 4 and 5, leading to a combined sewage of 9.62 MLD being conveyed to Wetwell 3 from Wetwell 4. It has been observed that the existing 1961 scheme pumping main of 600 mm dia CI pipe from Wetwell 4 Kandathpalli to Wetwell 3 Kudroli in zone 4 only conveys about 4.5 MLD, despite a current amount of 9.62 MLD being generated by zones 4 and 5, due to leakage problems in the system. The remaining sewage amounting to approximately 5.5 MLD bypasses nalla near wet well, which causes public nuisance. To address the problem and fully convey generated sewage to its designated STP, the subproject proposed to replace 600 mm dia CI pipe to 900 mm dia DI K9 class pipe to convey peak sewage flow from Wet well-4 to Wet well-3 for 0.95 km.

18. **In Zone-6 of South District.** As of 2016, zone 6 generates sewage amounting to approximately 1.92 MLD with a population of 13,799. Wet well No-6 receives sewage from zone 6. Existing pumping main (1961 scheme) of 225 mm dia CI Pipe from Wet well 6 Mulihitlu to Ridge Manhole in zone 6 only conveys about 0.4 to 0.5 MLD to the STP due to leakage problems. It is, therefore, proposed to replace 225mm dia CI pipe to 450 mm dia DI K9 class pipe to convey peak sewage flow from Wet well-6 to Ridge Manhole near Morgansgate for 1.70 kms. From this ridge manhole, sewage flows by gravity to Wet well-8D of zone-8, then from wet well-8D through pumping to 20 MLD STP at Bajal. The pipe lines, wet wells and STP are in good condition which are constructed under KUDCEMP.

19. **In Zone-7 of South District.** As of 2016, Wet well No 7 receives zone 7 sewage amounting to 1.84 MLD from a population of 13,424. Existing pumping main of 450 mm dia CI pipe from wet well-7, JeppuBappal to Ridge Manhole (1961 scheme) in zone-7 only conveys about 0.60 MLD of sewage to its designated STP due to leakage problems in the system. It is, therefore, proposed to replace 450 mm dia CI pipe to 450 mm dia DI K9 class pipe to convey full quantity of sewage from Wet well-7 to ridge manhole for 0.95 kms. From this ridge manhole, sewage flows by gravity to Wet well-8D of zone-8, then from wet well-8D through pumping to 20 MLD STP at Bajal. The pipe lines, wet wells and STP are in good condition which were constructed under KUDCEMP. There is a conveyance gap of 2.76 MLD from zone 6 and 7. Zone 8 was commissioned in 2016 after remodelling under KUDCEMP. House service connections are under progress. This STP is sufficient to cater the sewage generation of west district till 2031. Total projected sewage generation from zone 8 is 7.76 MLD. Current sewage generation from zone 8 is at 3 MLD. After all zone 8 households have been connected, the balance of 4.76 MLD of sewage generated will be added bringing the total equivalent amount of sewage generated to 7.76 MLD as projected.

20. Table 3 below shows sewage generation and gap analysis.

Table 3: Sewage Generation and Conveying Capacity Analysis

Parameters	Present Status, 2016	Requirement/Demand			Gap
		2016	2031	2046	
Population covered under West Sewerage District (Zone 1+2+3+4+5)	1,95,842	1,95,842	2,76,070	3,34,754	No gap
Sewage Generation in MLD (west district)	31.40	31.40	42.91	51.86	Gap is in the conveyance of sewage from wet well to STP. There is no gap in treatment system Sewerage. 31.40 MLD sewage is generating in west district but receiving at STP is 20 MLD only. The gap of 11.40 MLD gap will be addressed by replacing pumping main from wet well to STP
Population covered under South Sewerage District (Zone 6+7+8)	85,348	85,348	1,31,418	1,67,047	No gap
Sewage Generation in MLD (South district)	11.52	11.52	17.74	22.55	Gap is in the conveyance of sewage from wet well to STP. There is no gap in treatment of sewerage. 11.52 MLD sewage is generating in south district but receiving at STP is 4 MLD only. Out of 7.52 MLD conveyance gap, 2.76 will be addressed by replacing pumping main from wet well to Ridge Manhole / STP (zone 6 and 7) Another 4.76 MLD sewage to be generated from zone-8 which was commissioned in 2016. House service connection under progress by MCC.

MCC = Mangalore City Corporation, MLD = million liters per day, STP = sewage treatment plant.

21. Existing sewage pumping mains at the following sections are in poor condition, and therefore proposed to replace under the project so that sewage generated in the area is fully conveyed to STP which will avoid bypassing of sewage to nala/drains.

- (i) **Pumping Mains from Wet Well No. 3 Kudroli to Kavour Sewage Treatment Plant.** 750 mm dia cast iron (CI) pipe – More than 40 years old pipe and bursting at few locations- which resulted in bypass of sewage to natural Nalla;
- (ii) **Wet Well 4 Kandathpalli to Wet Well No. 3 Kudroli.** 450 mm CI Pipe- More than 40 years old pipe and bursting at few locations- which resulted in bypass of sewage to natural Nalla;
- (iii) **Wet Well 6 Mulihitlu to Ridge Manhole.** More than 40 years old pipe and bursting at few locations- which resulted in bypass of sewage to natural Nalla; and
- (iv) **Wet Well 7 Jeppu Bappal to Ridge Manhole.** More than 40 years old pipe and bursting at few locations- which resulted in bypass of sewage to natural Nalla.

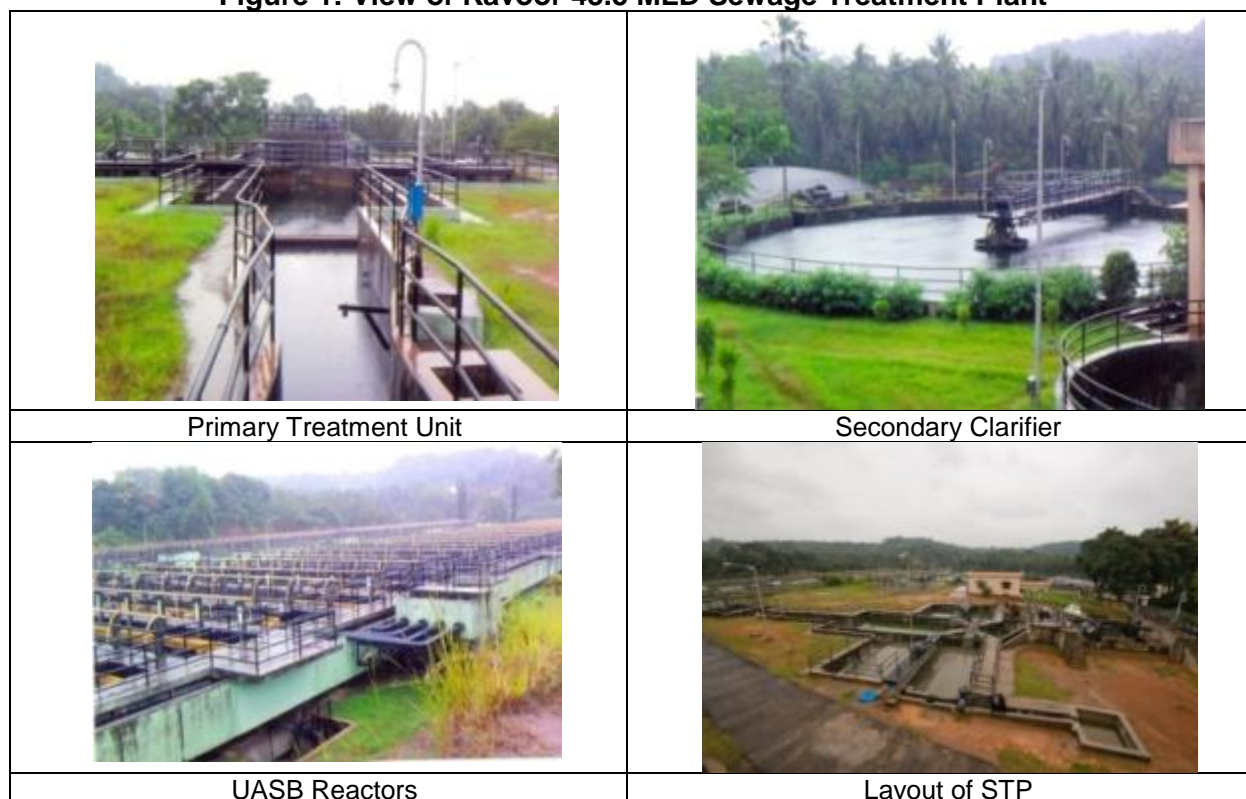
22. **Reasons of the Demand and Supply Gap.** The following are the main reasons for demand supply gap: (i) more than 40 years old system, (ii) pumping main pipes have outlived their design period life, (iii) pumping lines crossed their service life and causes bursting, and (iv) resource constraints for systematic up gradation of the system and insufficient carrying capacity.

23. **Existing Sewage Treatment Plant.** Sewage generated from zones 1, 2, 2A1, 2A2, 2A3, 2A4,3, 4, 5 and 10 is treated in existing STP at Kavoor of 43.5 MLD capacity (Table 4). Figure 1 shows the STP components. This STP was constructed for the designed population of 321,219 for the year 2026. The technology used in this STP is “Up-flow Anaerobic Sludge Blanket Reactor (UASB)”. The present sewage generation to this STP commanded area is 31.4 MLD. But at present receives only 20 MLD. This STP is sufficient to cater the sewage generation of west district till 2031. Therefore, the sub project does not include any components of STP.

24. The treated water from this STP is utilized by Mangalore Special Economic Zone (SEZ) Limited, for their Industrial purposes. The main components of existing STP have been constructed as mentioned in below:

Table 4: Components of 43.5 MLD Existing Sewage Treatment Plant at Kavoor

	Components	Quantity
1	Inlet chamber	1
2	Bar Screen- Mechanical Manual	2
3	Grit Chamber –Mechanical Manual	2
4	Parshall Flume	1
5	Division box	2
6	Collection Chamber	1
7	Distribution box	16
8	Up-flow Anaerobic Sludge Blanket Reactor	8
9	Pre-Aerator Tank	1
10	Aerator tank	2
11	Secondary settling tank	2
12	Chlorine contact chamber	1
13	Recirculation sump and pump house	1
14	Sludge thickener	1
15	Filtrate Supernatant and sump	1
16	Gas Holder	1
17	PMCC Building	1
18	New Sludge Drying beds	2
19	Manhole Chamber	1
20	Bleaching Powder Room	1
21	Laboratory cum office	1

Figure 1: View of Kavoor 43.5 MLD Sewage Treatment Plant

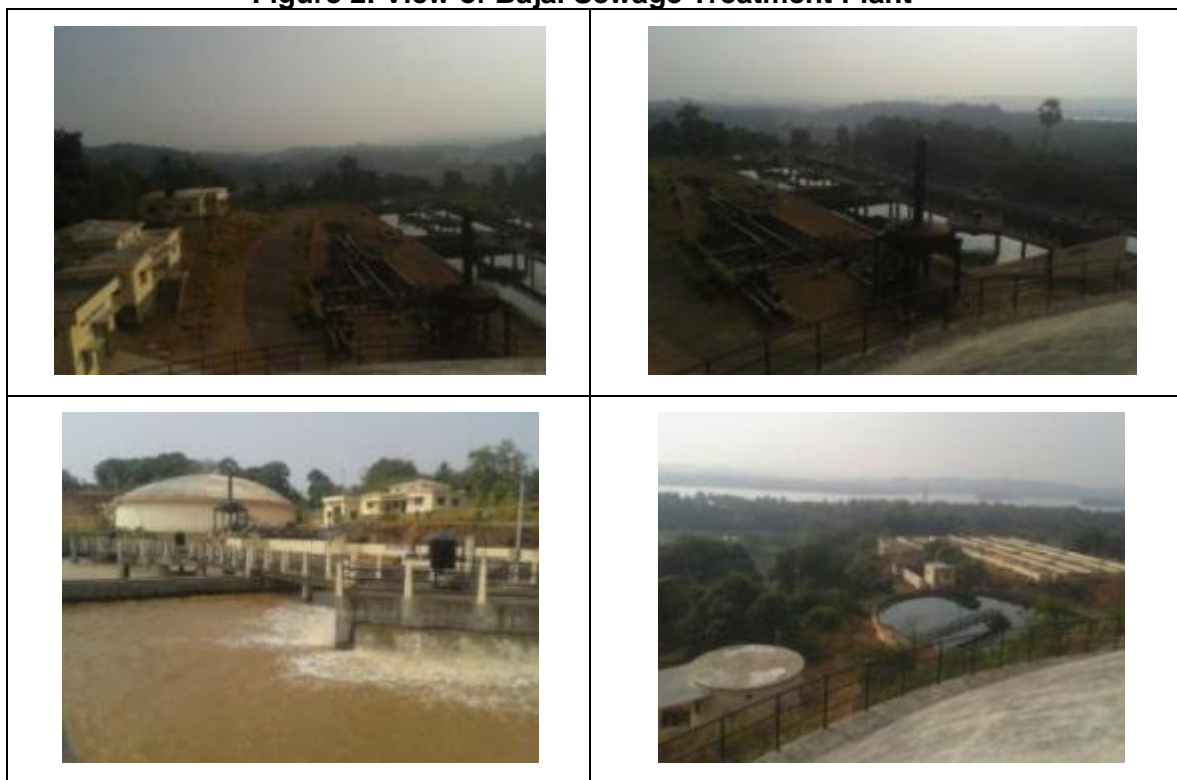
25. **Existing Sewage Treatment Plant at Bajal.** The Sewage generated from zones 6, 7, 8, 8E1, 8E2, 8E3 and 8D are treated in this STP. Capacity of this STP is 20 MLD and was constructed for the designed population of 112,922 for the year 2026. The technology used in Sewage Treatment Plant is “Extended Aeration Process”. Figure 2 shows the STP components. The present sewage generation of this STP command area is 11.52 MLD, which receives only 4 MLD at present. The 11.52 MLD sewage generation is from zone-6, 7 and 8. There is conveyance gap of 2.76 MLD from zone 6 and 7. Zone 8 was commissioned in 2016 after remodelling under KUDCEMP. House service connections are under progress. This STP is sufficient to cater the sewage generation of west district till 2031. The treated water from this STP is reutilized by Mangalore SEZ Limited, for their Industrial purpose. The main components of STP are presented in the below Table 5:

Table 5: Components of 20 MLD Existing Sewage Treatment Plant at Bajal

	Components	Quantity
1	Inlet chamber with odour removal unit	1
2	Bar Screen - Mechanical and Manual	1+1
3	Grit Chamber – Mechanical and Manual	1+1
4	Parshall Flume	1
5	Distribution box	1
6	Aeration tank	2
7	Secondary clarifier	1
8	Recirculation sump and pump house	1
9	Sludge thickener	1
10	Sludge storage tank	1
11	Gas Burner	1
12	Bleaching Powder Room	1

	Components	Quantity
13	Chlorine contact chamber	1
14	Sludge Drying beds	24
15	Filtrate Pump house	1
16	PMCC Building	1
17	Transformer yard	1
18	Laboratory cum office	1
19	Staff Quarters	2
20	Security room	1

Figure 2: View of Bajal Sewage Treatment Plant



26. From the above assessment it is clear that additional investment is needed for replacement of old sewerage pumping main of west and south district of Mangalore to address the conveyance gap, and to utilize the treatment capacity optimally.

C. Description of the Subproject

27. The subproject covers west and south sewerage districts of Mangalore with a population of 281,190. West sewerage districts cover 30.82 km² with 27 wards consists Kudroli, Matadakani, Mannagudda, Gandhinagara, Lalbagh, Bejai, Anegundi, Kodialbail, Kadri, Urva, Kandathpalli, Old port area, Kavoor, Kottara, Ladyhill, Ashoknagara, Derebail, Bloor Konchady areas. South Sewerage districts covers 19.66 km² with 18 wards consists Mulihitlu, Mangaladevi Temple area, Hoigebazar, Bolar, Morgansgate, Mahakalipadpu, Valancia, Jeppu, Jeppinamogaru, Attavara, Sooterpete, Ekkur, Bendoor, Kankanady areas.

28. The proposed subproject includes of replacement of sewerage pumping mains from wet wells to the STP. Table 6 shows the nature and size of the various components of the subproject, based on the detailed engineering design of the subproject Figures 3 to 7 show location and alignment of proposed pumping mains.

Table 6: Proposed Subproject and Components

Infrastructure	Function	Description	Location
Pumping Mains	Convey the collected sewage from wet well to the STP	Replacement of old pumping main of total length 11.4 km with new mains of ductile iron pipes at following section: (i) from Kudroli wet well 3 to Kavoor STP: 7.65 km length and 1,100 mm) diameter (ii) from Kandathpalli wet well 4 to Kudroli wet well: 0.95 km length and 900 mm diameter (iii) From Mulihitlu wet well 6 to Ridge manhole near Morgans gate: 1.7 km length and 450 mm diameter (iv) from Jeppu Bappal wet well 7 to Ridge manhole near Yekkur, inside old STP: 1.1 km length and 450 mm diameter	New pumping mains will be laid along the public roads – in the vacant earthen shoulder where it is available, or in the tarmac portion, where there is no vacant land. New pipeline will be mostly laid adjacent to the existing ones which are currently in operation.

km = kilometer, mm = millimeter, STP = sewage treatment plant.

D. Implementation Schedule

29. The sewerage package for replacing of sewer pumping main is proposed to be completed in 30 months. Construction work is likely to start in December 2017 and completed by May-June 2020. The details of the same are given below:

Completion of detailed engineering design	January 2017
Approval of SAR	March 2017
Issuance of tender documents	June 2017
Contract award	December 2017
Commencement of contract	December 2017
Construction period	30 months

Figure 3: Key Plan Showing Pumping Main Alignments

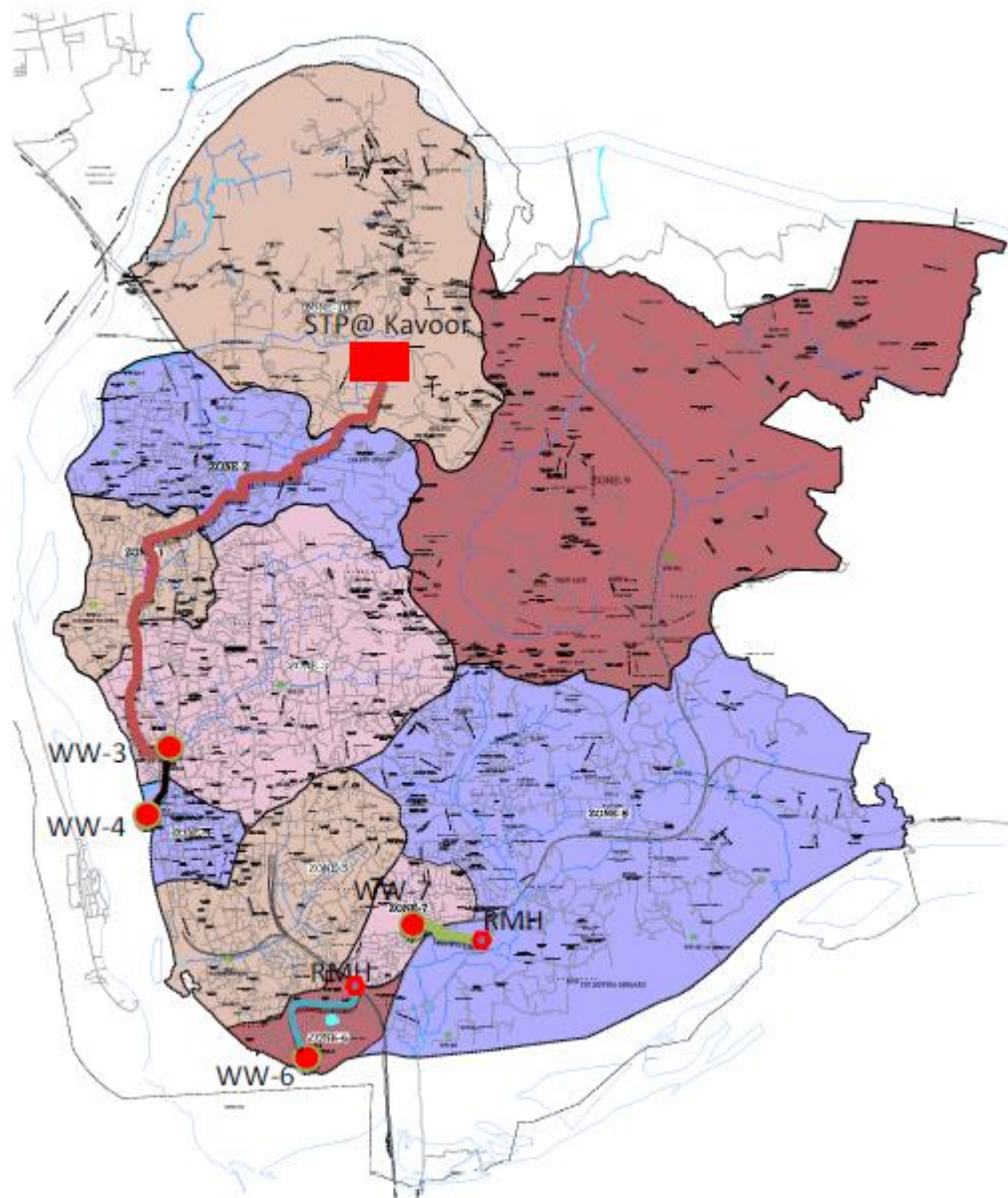
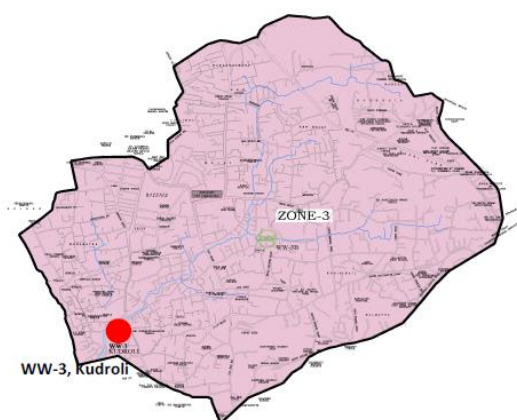


Figure 4: Pumping Main from Kudroli Wet Well No. 3 to Kavor 43.5 MLD Sewage Treatment Plant

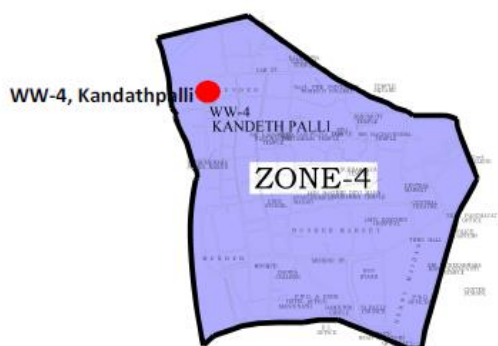


Zone-3 command area and Wet Well-3

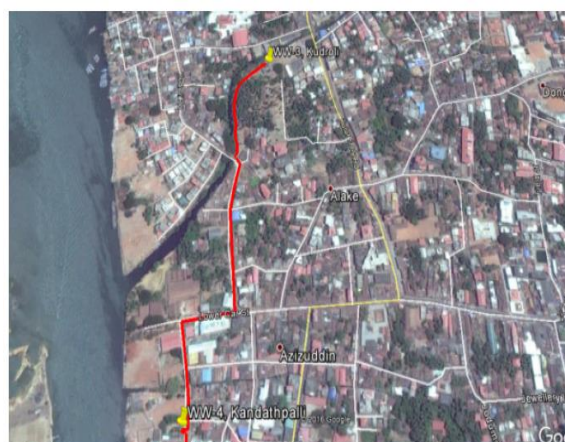


Alignment of Pumping Main shown on Google Earth

Figure 5: Pumping Main from Kandathpalli Wet Well No. 4 to Kudroli Wet Well No. 3

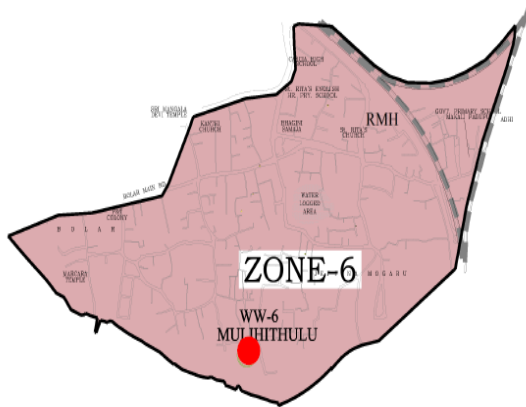


Zone-4 command area and wet well-4



Alignment of Pumping Main shown on Google Earth

Figure 6: Pumping Main from Mulihitlu Wet Well No. 6 to Ridge Manhole



Zone-6 command area and wet well-6



Alignment of Pumping Main shown on Google Earth

Figure 7: Pumping Main from JeppuBappal Wet Well No. 7 to Ridge Manhol



Zone-7 Command Area and Wet Well-7



Alignment of Pumping Main Shown on Google Earth

IV. POLICY AND LEGAL FRAMEWORK

A. ADB Safeguard Policy Statement, 2009

30. ADB SPS, 2009 requires the consideration of environmental issues in all aspects of the Bank's operations and requires environmental assessment of all project loans, programme loans, sector loans, sector development programme loans, financial intermediary loans and private sector investment operations.

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

- (i) Category A: A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment is required.
- (ii) Category B: A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible and, in most cases, mitigation measures can be designed more readily than for category A projects. An initial environmental examination is required.
- (iii) Category C: A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.
- (iv) Category FI: A proposed project is classified as category FI if it involves investment of ADB funds to or through a financial intermediary

32. The ADB Rapid Environmental Assessment Checklist (General) in <http://www.adb.org/documents/guidelines/environmentalassessment/eaguidelines002.asp> was used to screen the project for environmental impacts and to determine the environment category. The complete checklist is given in Appendix 1.

33. ADB has classed this subproject as Category B and following procedure for multitranchise financing facility (MFF) loans has determined that one IEE will be conducted for each subproject, with a subproject being the water supply or sewerage infrastructure improvements proposed in a subproject City.

34. **Environmental Management Plan.** An EMP which addresses the potential impacts and risks identified by the environmental assessment shall be prepared. The level of detail and complexity of the EMP and the priority of the identified measures and actions will be commensurate with the Project's impact and risks.

35. **Public Disclosure.** The IEE will be put in an accessible place (e.g., local government offices, libraries, community centers, etc.), and a summary translated into local language for the project affected people and other stakeholders. The following safeguard documents will be put up in ADB's website so that the affected people, other stakeholders, and the general public can provide meaningful inputs into the project design and implementation:

- (i) For environmental category A projects, a draft EIA report at least 120 days before Board consideration;
- (ii) Final or updated EIA and/or IEE upon receipt; and Environmental monitoring reports submitted by the program management unit (PMU) during project implementation upon receipt.

36. During the design, construction, and operation of the project the pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the **World bank Environmental, Health, and Safety (EHS) Guidelines -General EHS Guidelines: Occupational, Health and safety** ([www.ifc.org/ifcext/enviro.nsf/Content/ Environmental guidelines](http://www.ifc.org/ifcext/enviro.nsf/Content/Environmental%20guidelines)) and EHS Guidelines for water & sanitation will be followed (<http://www.ifc.org/wps/wcm/connect/e22c050048855ae0875cd76a6515bb18/Final%2B-%2BWater%2Band%2BSanitation.pdf?MOD=AJPERE>).

37. Employers and supervisors are obliged to implement all reasonable precautions to protect the health and safety of workers. Preventive and protective measures should be introduced according to the following order of priority:

- (i) Eliminating the hazard by removing the activity from the work process. Examples include substitution with less hazardous chemicals, using different manufacturing processes, etc;
- (ii) Controlling the hazard at its source through use of engineering controls. Examples include local exhaust ventilation, isolation rooms, machine guarding, acoustic insulating, etc;
- (iii) Minimizing the hazard through design of safe work systems and administrative or institutional control measures. Examples include job rotation, training safe work procedures, lock-out and tag-out, workplace monitoring, limiting exposure or work duration, etc.
- (iv) Providing appropriate personal protective equipment (PPE) in conjunction with training, use, and maintenance of the PPE; and
- (v) Comply with: Child Labour (Prohibition and Regulation) Amendment Act, 2016; Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 as amended from time to time from appropriate authorities; Trade Unions Act, 1926; The Building and Other Construction Workers (Regulation of Employment and conditions of Service Act) 1996 and the Cess Act of 1996; The Factories Act, 1948; and Prohibition of Employment as Manual Scavengers and Their Rehabilitation Act 2013.

38. Following requirements of ADB SPS, PMO and RPMOs shall apply pollution prevention and control technologies and practices consistent with international good practice. When the Government of India regulations differ from these levels and measures, PMO shall achieve whichever is more stringent. Appendix 2 and 3 provide applicable standards. If less stringent levels or measures are appropriate in view of specific subproject circumstances, PMO will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

B. Government Law and Policies

39. The Government of India EIA Notification of 2006 (replacing the EIA Notification of 1994), sets out the requirement for Environmental Assessment in India. This states that Environmental

Clearance is required for specified activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence. Projects are categorized as A or B depending on the scale of the project and the nature of its impacts.

40. Category A projects requires environmental clearance from the central Ministry of Environment, Forest and Climate Change (MOEFCC). The proponent is required to provide preliminary details of the project in the prescribed manner with all requisite details, after which an Expert Appraisal Committee (EAC) of the MOEFCC prepares comprehensive terms of reference (TOR) for the EIA study. On completion of the study and review of the report by the EAC, MOEFCC considers the recommendation of the EAC and provides the Environmental Clearance if appropriate.

41. Category B projects requires environmental clearance from the State Environment Impact Assessment Authority (SEIAA). The State level EAC categorizes the project as either B1 (requiring EIA study) or B2 (no EIA study), and prepares TOR for B1 projects within 60 days. On completion of the study and review of the report by the EAC, the SEIAA issues the EC based on the EAC recommendation. The Notification also provides that any project or activity classified as category B will be treated as category A if it is located in whole or in part within 10 km from the boundary of protected areas, notified areas or inter-state or international boundaries.

42. None of the components of this sewerage pumping main subproject in Mangalore falls under the ambit of the EIA Notification 2006, and, therefore EC is thus not required for the subproject.

43. **Environmental Rules, Laws, and Regulations.** Besides EIA Notification 2006, there are various other Acts, Rules, Policies and Regulations currently in force in India that deal with environmental issues that could apply to infrastructure development. Table 7 below presents a summary of environmental regulations and mandatory requirements applicable to the sub project.

Table 7: Applicable Environmental Regulations

Law	Description	Requirement
Environmental Impact Assessment (EIA) Notification	The EIA Notification of 2006, sets out the requirement for environmental assessment in India. This states that Environmental Clearance is required for certain defined activities /projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence. Projects are categorized as A or B depending on the scale of the project and the nature of its impacts. Categories A projects require Environmental Clearance from the Ministry of Environment, Forest and Climate Change (MOEFCC). Category B projects require Environmental Clearance from the State Environmental Impact Assessment Authority (SEIAA).	Subproject is not a listed activity in Schedule I of this notification and hence environmental clearance is not required
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments	Control of water pollution is achieved through administering conditions imposed in consent issued under provision of the Water (Prevention and Control of Pollution) Act of 1974. These conditions regulate the quality and quantity of effluent, the location of discharge and the frequency of monitoring of effluents. Any component of the Project having the potential to generate sewage or trade effluent will come under the purview of this Act, its rules and amendments. Such projects have to obtain consent to establish (CTE) under Section 25 of the Act from Karnataka State Pollution Control Board (KSPCB) before starting implementation and consent to operate (CTO) before commissioning. The Water Act also requires the occupier of such projects to take measures for abating the possible pollution of receiving water bodies.	Proposed replacement of old sewerage pumping main sub project does not require CTE and CTO under this Act. There is no construction of new sewage treatment plant (STP) and hence there is no need to obtain CTE/CTO from KSPCB. CTE/CTO is already obtained for existing STP which treats the sewage with tertiary treatment level and reused.
Air (Prevention and Control of Pollution) Act of 1981, Rules of 1982 and amendments.	The projects having potential to emit air pollutants into the atmosphere have to obtain CTE under Section 21 of the Air (Prevention and Control of Pollution) Act of 1981 from KSPCB before starting implementation and CTO before commissioning the project. The occupier of the project/facility has the responsibility to adopt necessary air pollution control measures for abating air pollution.	For the project, the following will require CTE and CTO from KSPCB: (i) diesel generators; (ii) wet mix plants; and (iii) stone crushers, if installed for construction. All relevant forms, prescribed fees and procedures to obtain the CTE and CTO can be found in the KSPCB website (www.kspcb.gov.in).
Environment (Protection) Act, 1986 and Central Pollution Control Board Environmental Standards.	Emissions and discharges from the facilities to be created or refurbished or augmented shall comply with the standards notified.	Appendix 2 provides applicable standards for ambient air quality and noise which should be followed during construction phase. Appendix 3 provides standards for discharge of effluents. Appendix 2 and 3 respectively also provides a comparison of national

Law	Description	Requirement
		standards and internationally recognized guidelines with respect to ambient air and noise, and effluent discharge. ADB SPS requires adoption of stringent values for project implementation.
Noise Pollution (Regulation and Control) Rules, 2000 amended up to 2010.	Rule 3 of the Act specifies ambient air quality standards in respect of noise for different areas/zones.	Appendix 2 provides applicable noise standards which should be followed during construction phase.
Ancient Monuments and Archaeological Sites and Remains Rules of 1959	The Rules designate areas within a radius of 100 meters (m) and 300 m from the “protected property” as “protected area” and “controlled area” respectively. No development activity (including mining operations and construction) is permitted in the “protected area” and all development activities likely to damage the protected property are not permitted in the “controlled area” without prior permission of the Archaeological Survey of India (ASI). Protected property includes the site, remains, and monuments protected by ASI or the State Department of Archaeology.	There are no protected monuments in or near subproject area in Mangalore. However, in case of chance finds, measures are suggested in environmental management plan (EMP) to take prompt action to ensure its removal or protection in situ.
Labor Laws	The contractor shall not make employment decisions based upon personal characteristics unrelated to job requirements. The contractor shall base the employment relationship upon equal opportunity and fair treatment and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment or retirement, and discipline. The contractor shall provide equal wages and benefits to men and women for work of equal value or type.	Appendix 4 provides applicable labor laws including amendments issued from time to time applicable to establishments engaged in construction of civil works.
Biodiversity Act of 2002	The Biodiversity Act 2002 primarily addresses access to genetic resources and associated knowledge by foreign individuals, institutions or companies, to ensure equitable sharing of benefits arising out of the use of these resources and knowledge to the country and the people.	Not applicable to Mangalore Sewerage Project as no mentioned activities are involved in the project
Ramsar Convention, 1971	The Ramsar Convention is an intergovernmental treaty that provides the framework for national action and international co-operation for the conservation and wise use of wetlands and their resources. India is one of the signatories to the treaty. The Ramsar convention made it mandatory for the signatory countries to include wetland conservation in their national land use plans.	Not applicable to Mangalore Sewerage Project as no wetlands presents in the project area.
Wildlife Protection Act, 1972	This overarching Act provides protection to wild animals, birds, plants and matters connected with habitat protection, processes to declare protected areas, regulation of wildlife trade, constitution of state and national board for	Not applicable to Mangalore Sewerage project as none of the project component will have any impact on wildlife or protected areas.

Law	Description	Requirement
	wildlife, zoo authority, tiger conservation authority, penalty clauses and other important regulations.	
Forest (Conservation) Act, 1980	The Forest (Conservation) Act prevents the use of forest land for non-forest uses without the clearance from Ministry of Environment, Forests and Climate Change (MOEFCC), Government. of India	Not applicable to Mangalore Sewerage Project as there is no forest area within or adjacent to the project area.
Indian Drinking Water Standards	Gives details of the permissible and desirable limits of various parameters in drinking water as per the Bureau of Indian Standards	http://cgwb.gov.in/documents/wq-standards.pdf
Karnataka Forest Act, 1963 and Karnataka Forest Rules, 1969	This Act makes the basis for declaration of Reserved Forests, constitution of village forest committees, management of reserved forests and penalties and procedures.	Not applicable to Mangalore Sewerage Project as there is no forest area within or adjacent to the project area.
Karnataka Preservation of Trees Act, 1976 and Karnataka Preservation of Trees Rules, 1977	This Act has put restriction on felling of trees in the State unless until permitted by the Tree Officer. Any person desiring to fell a tree shall apply in writing to the tree officer for permission in that behalf. It further defines clauses for planting adequate number of trees, planting in place of fallen/destroyed trees, preservation of trees and adoption of trees.	During the implementation of this project, no tree cutting is envisaged, hence not applicable to Mangalore Sewerage Project. However, during execution if any encountered shall follow the applicable norms.

V. DESCRIPTION OF THE ENVIRONMENT

A. Introduction

44. The subproject component of sewer pumping main laying is located in Mangalore city. The baseline environmental profile of the project area is presented in this section based on secondary information available. The base line environmental profile of the project area is broadly organized into three major environmental components; physical, ecological and social environment. The objective of preparation of baseline profile is to identify environmentally sensitive features of the project area that might be affected by the project activities.

45. Geographically, Mangalore city is located at a latitude of 12°87'N Latitude and 74°88'E Longitude. Mangalore is the Headquarters of Dakshina Kannada District. Mangalore is the largest urban center of coastal Karnataka and the fourth largest city in Karnataka in terms of area and population. Mangalore is located about 350 km west of the state capital, Bangalore. The city spreads in an area of 132.45 km² and is divided into 60 wards. The population in Mangalore according to the Census 2011 is 488,968.

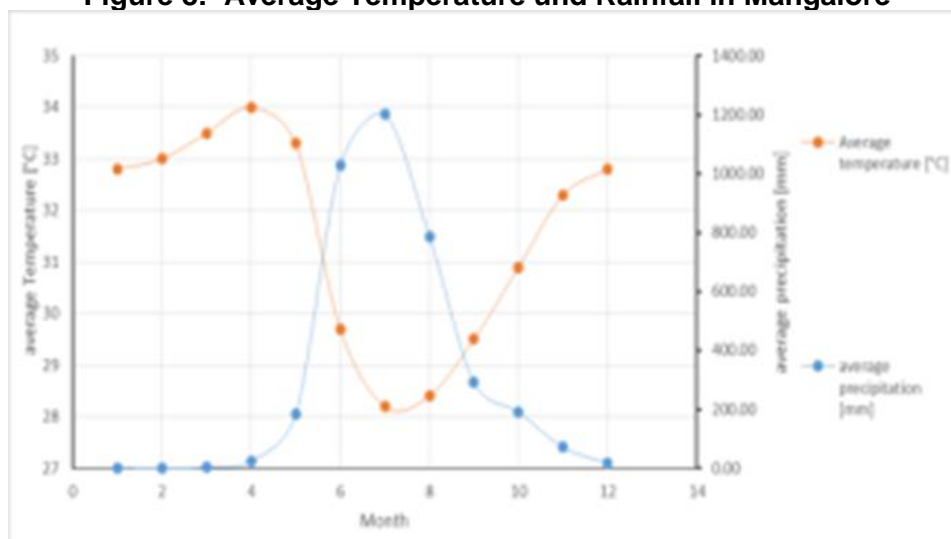
B. Physical Environment

1. Climate

46. The subproject has a tropical monsoon climate and is under the direct influence of the Arabian Sea branch of the southwest monsoon. It receives about 95% of its total annual rainfall within a period of about 6 months from May to October, while remaining extremely dry from December to March. The annual precipitation is 3,796.9 mm. Humidity is approximately 75% on average, and peaks during May, June and July. Monthly average temperature and rainfall in Mangalore is depicted in Figure 8 and data is provided in Table 8.

47. **Humidity.** The climate of the study area is marked by high humidity and oppressive weather in hot season. Morning monthly mean relative humidity ranges from 72% to as high as 95%. Comparatively, large variations in the evening relative humidity were observed across a year, ranging from 52% in December to 91% in July.

48. **Wind Speed and Wind Direction.** The winds are strong and mainly westerly and south-westerly in southwest monsoon months. For rest of the year, winds are mainly from north and east in the forenoons and westerly and north –westerly in afternoons. The maximum and minimum monthly mean wind speed recorded in the last decade was 8.5 km/h in February 1993 and 2.6 km/h in November 2001 respectively. The area also experiences high winds of more than 20 kilometers per hour (kmph) during the months of June, July and August but with low frequency. The winds in the range of 6 kmph to 11 kmph are more frequent during this period.

Figure 8: Average Temperature und Rainfall in Mangalore

Source: Climate data.org, 2015.

Table 8: Climate Data for Mangalore, India

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high °C	36.3	37.8	38.1	36.6	36.7	34.4	35.5	32.2	34.6	35	35.6	35.6	38.1
Average high °C	32.8	33	33.5	34	33.3	29.7	28.2	28.4	29.5	30.9	32.3	32.8	31.5
Average low °C	20.8	21.8	23.6	25	25.1	23.4	22.9	23	23.1	23.1	22.4	21.2	22.9
Record low °C	16.1	17.3	18.8	19.7	20.4	20.5	19.8	19.4	20.2	19.1	15.9	16.1	15.9
Average rainfall mm (inches)	1.1	0.2	2.9	24.4	183.2	1,027	1,200	787.3	292.1	190.8	70.9	16.4	3,796
Average rainy days	0.2	0	0.3	1.6	7	23.5	27.4	24.9	13.7	9.1	3.6	0.6	111.9
Average relative humidity (%)	62	66	68	71	71	87	89	88	85	79	73	65	75.3

°C = degree Celsius, mm = millimeter.

Source: India Meteorological Department.

2. Topography, Soil and Geology

49. Mangalore's topography is characterized by plain to undulating terrain with hilly regions and natural valleys within the city. Mangalore is situated on the west coast of India, and is bounded by the Arabian Sea to its west and the Western Ghats to its east. Also lies on the backwaters of the Netravati and Gurupura rivers.

50. The soil in the Dakshina Kannada district is mostly lateritic type, found distributed in the Pediplain area characterized by high iron and aluminum content. Lateritic soil is mostly red in color and yellow loamy, pale to bright red colors are also seen. Lateritic soil is suitable for paddy, sugarcane, areca nut (*Areca catechu*), cardamom and plantains. Loamy red soils are distributed in the lower reaches of valleys. Red lateritic soil is the most dominant soil type in the area. The

texture of the soil varies from fine to coarse. The soil in valleys and intermediate slopes is rich in loam whereas in upper slopes it is much coarse in nature. The soil responds well to irrigation and other soil - management practices. Silty and loamy soils are of transported origin and are found mostly along river banks and in valley plains. They have good infiltration capacity and are well-suited for agriculture due to their fertility.

3. Surface Water

51. Mangalore is situated on the west coast of India, and is bounded by the Arabian Sea to its west and the Western Ghats to its east. Mangalore lies on the backwaters of the Netravati and Gurupura rivers. These rivers effectively encircle the city, with Gurupura flowing around the north and the Netravti flowing around the south of the city. These rivers, like other of Dakshina Kannada district, flow westward and meet the Arabian Sea after a run varying from 50 km to 300 km. The rivers, generally originate at an elevation ranging from 400 m to 1,600 m above the mean sea level, close to the Western Ghats ridge, and have very steep gradient in the upper reaches and fairly steep in the middle reaches. It is only near the sea that they have relatively flat gradients and some sort of flood plain.

52. There are no major or medium irrigation projects in the district. One vented-dam has been built across the river Netravati at Tumbe near Mangalore, to cater to the drinking water need of Mangalore. Minor irrigation tanks and temporary *Mudkattas* are the other types of surface water utility structures. The seasonal and perennial springs are located in the foothills of hillocks and forests in the district. A thermal spring which is of very rare occurrence in south India has been found in the district. It is called as 'BendruTeertha" and located at Irde on Puttur-Panaje road at a distance of 13 km from Puttur, and about 60 km from Mangalore. The rock formations exposed in and around the spring are gneisses traversed by veins of quartz and pegmatite on the southern banks of Badantadka river.

4. Ground Water

53. Weathered and fractured gneiss, granite and schist are the major water bearing formations. Alluvial formation of limited thickness and aerial extent is found along the courses of major rivers. Groundwater occurs under phreatic (water table) condition in weathered zones of gneiss, schist and granite and under semi-confined to confined conditions in joints and fractures of these rocks at deeper levels. Weathered and fractured gneiss is the predominant aquifer found in the district followed by schistose and granitic aquifers, which occur as isolated patches in some taluks. The depth to water level during pre-monsoon (May 2006) ranged from 1.85 meter below ground level (mbgl) in Nelyadi to 15.17 mbgl in Bellare. During post-monsoon (Nov 2006) it ranged from 1.65 mbgl (Nelyadi) to 9.40 mbgl (Bellare). The seasonal fluctuation data reveals that 36.5% of the wells show rise while, 63.5% of the wells show a fall in water level. The rise in water level ranges from 0.15 m to 16.0 m while, the fall ranges from 0.65 m to 4.62 m. Analysis of the long-term water level trend in the last 10 years (1997-2006) reveals that 58% of the wells show a rise in water level ranging from 0.014 m to 0.12 m, whereas, the remaining wells show a fall in the range of 0.01m to 0.19 m. This means, little more than half of the total wells for which data have been analysed show a rise in the water level in the last decade. Bore wells drilled under Groundwater Exploration Program of CGWB ranged between 16 m and 200 m. These wells have yielded from less than 1 liter per second (lps) to 19.9 lps. Though the transmissivity ranged from 3–476 m²/day, it generally ranges from 3–20 m²/day. Good yield can be encountered by scientifically pin-pointing the bore well site. Groundwater quality is generally good and potable. The specific conductivity of ground water in the district varies from 70-140 micromhos/centimeter at 25°C. (CGWB, 2008).

5. Air Quality

54. The baseline air quality assessment for Mangalore city was carried out by Karnataka State Pollution Control Board under National Ambient Air Quality Monitoring Program (NAMP) covering three type of land uses - industrial area, mixed urban area and sensitive area. Monitoring of air quality was done twice a week for 24 hours at uniform intervals for residual suspended particulate matter (RSPM), sulphur dioxide (SO₂) and nitrogen dioxide (NO₂). The annual average values of 2015-2016 are given in Table 9.

Table 9: Ambient Air Quality in Mangalore
(Annual Average Values, 2015-2016)

Location	SO ₂ (µg/m ³)	NO ₂ (µg/m ³)	RSPM (µg/m ³)
Regional Office - Mangalore	8.0	9.5	35.0
NAAQ Standards	50.0	40.0	60.0

Source: KSPCB 2015-16.

55. The results of monitoring indicate that all monitored parameters are well within the stipulated National Ambient Air Quality Standards (Appendix 2).

C. Ecological Resources

56. **Forest.** The district of Dakshina Kannada is blessed with rich and diverse forests. Most of the forests in the Mangalore division lie on the western slopes of the Western Ghats and their foothills to a width of about 25 km in a continuous belt. Principal forest types of the area are evergreen, semi evergreen, moist deciduous and other forests. However, there are no forest areas in the subproject area, which is located within Mangalore urban area.

57. **Fisheries.** The wide varieties of fish species are found in Gurupur River, some of fresh water fishes are *Hyporanthous limbatus*, *Puntius Sp.*, *Labeo Sps.*, *Valamugil Sps.*, *Leiza Sps.* etc. There are number of Estuarine species like *Gerrus filamentus* (Whiptail-silver -biddy), *Gerrus oblongus* (Silver-biddy), *Terapon puta* (Small Scale Terapon), *Stolephorus indicus* (Indian anehovy), *Horabagrus brachysoma* (Gunther's catfish).³

D. Economic Development

1. Industry and Agriculture

58. Baikampady Industrial Estate is in Mangalore. The New Mangalore Port is India's seventh largest port, in terms of cargo handling. It handles 75 per cent of India's coffee exports and the bulk of its cashew nuts. The city's major enterprises include Mangalore Chemicals and Fertilizers Limited (MCF), Kudremukh Iron Ore Company Limited (KIOCL), Mangalore Refinery and Petrochemicals Limited (MRPL), BASF, Bharati Shipyard Limited and Total Oil India Limited (ELF Gas). The leaf spring industry has an important presence in Mangalore, with Canara Workshops Limited. and Lamina Suspension Products Limited. in the city. The Baikampady and Yeyyadi Industrial areas harbor several small-scale industries. Imports through Mangalore harbour include crude oil, edible oil, LPG, and timber. The city along with Tuticorin is also one of two points for import of wood to South India

³ Shashikala.K.B. April 200. *A survey on fish diversity in fresh water of Dakshina Kannada District*. Department of Applied Zoology, Mangalore University, Mangalagangothri.

59. Major information technology and outsourcing companies like Infosys, Cognizant Technology Solutions, Mphasis BPO, Thomson Reuters and Endurance International Group have their branches at Mangalore. Foreign IT companies such as Vecima Networks and Atlantic Data Bureau Services have established their offices in Mangalore. Plans to create three dedicated IT parks are underway, with two parks (Export Promotion Industrial park (EPIP) at Ganjimutt and SEZ near Mangalore University) currently under construction. A third IT SEZ is being proposed at Ganjimutt. Another IT SEZ, is under construction at Thumbe There is an IT Tech Park by the name Soorya Infra tech park situated in Mudipu. It is expected to have many IT companies in future.

60. Mangalore has a large Agriculture Produce Marketing Committee (APMC) yard that caters to the surrounding towns and villages. Due to good connectivity by roads and railway line with other parts of the region, it has become a focal point for trade and commerce.

2. Infrastructure

61. **Water Supply.** Currently water supply within Mangalore is intermittent and varies across the city. The reported duration and frequency is 8 hours every day. The current per capita volume made available to customers is 135 lpcd. Nethravathi River is the main source of water supply.

62. **Sewerage.** The first sewerage system was established in the year 1961 and was designed for an ultimate flow of 27.04 MLD estimated for a design population of 2,00,000 of the year 1991. This scheme was implemented by Public Health Department. The total area covered by the sewerage network is about 25 km² with two sewerage districts and seven zones. The total length of sewerage network constructed was about 250 km with pipe diameter varying from 150 mm to 600 mm with 7,000 manholes and eight wet wells-cum-pump houses. Later on from 1974 KUWSDB extended the sewerage networks within the existing 25 km² area by another 245 km with 8,000 manholes.

63. The second scheme was established in the year 2003 under KUDCEM Project and commissioned in the year 2007–2008 and the sewerage system was upgraded for an ultimate flow of 88.75 MLD for a design population of 624,432. Under KUDCEMP extension of sewerage network to adjoining areas of old city and extension to other areas in MCC boundary is made which covers about 50.60 km².

64. Overall 60% of the Mangalore about 75.60 km² is covered with sewerage systems. Balance about 40% is uncovered area in Mangalore. In the uncovered area only 40 km² sewerage systems can be provided. Another 15 km² are comes under Port area and Industrial area for which sewer systems cannot be provided.

65. Under KUDCEMP whole Mangalore city is considered in two parts as Surathkal and Mangalore and divided into Four sewerage Districts namely North District, East District, West District and South District. North District covers complete Surathkal area. Other three districts covers Mangalore area. Each district is having one Sewage Treatment Plant. The total length of sewerage network constructed was about 360Kms including 14,875 Manholes with pipe dia. varying from 150 mm to 900 mm , 20 new wetwells and 2 old wet wells were rehabilitated.

E. Economic Development

1. Demography

66. Mangalore is the largest urban center of coastal Karnataka and the fourth largest city in Karnataka in terms of area and population. Mangalore population is about 488,968 (2011 census). Per the census 2011, the sex ratio (female population per 1,000 of male population) is 1016. Mangalore has the highest literacy rate in Karnataka with 94.03%. The male literacy was 96.49%, while female literacy was 91.63%. About 8.5% population was under six years of age. The Human Development Index (HDI) of Mangalore city is 0.83. The Birth rate was 13.7%, while death rate and infant mortality rate were at 3.7% and 1.2%, respectively. According to the 2011 Census, 7,726 people reside in slums in Mangalore city, which is 1.55% of the total population. Table 10 shows the population growth of Mangalore from 1961 to 2011.

Table 10: Population Growth of Mangalore

Year	1961	1971	1981	1991	2001	2011
Population	1,70,253	2,15,122	2,73,304	3,06,078	3,99,465	4,88,968
Population growth rate per year (%)	-	2.63	2.70	1.19	3.05	2.24

Source: Census India, 2011.

2. History, Culture and Tourism

67. Mangalore City is well known for its Mangalore port on the Arabian Sea. Mangalore was ruled by several major powers, including the Kadambas, Alupas, Vijayanagar Empire, Keladi Nayaks and the Portuguese. The city was a source of contention between the British and the Mysore rulers, Hyder Ali and Tipu Sultan. Eventually annexed by the British in 1799, Mangalore remained part of the Madras Presidency until India's independence in 1947. The city was unified with the state of Mysore (now called *Karnataka*) in 1956.

68. Mangalore is the heart of a distinct metalinguistic—cultural region: South Canara, is the homeland of the Tulu-speaking people. In the third century BCE, the town formed part of the Maurya Empire, ruled by the Buddhist emperor, Ashoka of Magadha. From the third century CE to sixth century CE, the Kadamba dynasty, whose capital was based in Banavasi in North Canara, ruled over the entire Canara region as independent rulers. From the middle of the seventh century to the end of the 14th century, the South Canara region was ruled by its own native Alupa rulers. The Alupas ruled over the region as feudatories of major regional dynasties like the Chalukyas of Badami, Rashtrakutas of Manyakheta, Chalukyas of Kalyani, and Hoysalas of Dwarasamudra. During the reign of the Alupa king Kavi Alupendra (c.1110 – c.1160), the city was visited by the Tunisian Jewish merchant Abraham Ben Yiju, who travelled between the Middle East and India during the 12th century. The Moroccan traveller Ibn Battuta, who had visited the town in 1342, referred to it as *Manjarur*, and stated that the town was situated on a large estuary, called the "estuary of the wolf," and was the greatest estuary in the country of Malabar. By 1345, the Vijayanagara rulers brought the region under their control. During the Vijayanagara period (1345–1550), South Canara was divided into Mangalore and *Barkurrajyas* (provinces), and two governors were appointed to look after each of them from Mangalore and Barkur. But many times only one governor ruled over both Mangalore and *Barkurrajyas*, and when the authority passed into the hands of Keladi rulers (c. 1550–1763), they had a governor at Barkur alone. In 1448, Abdur Razzaq, the Persian ambassador of Sultan Shah Rukh of Samarkand, visited Mangalore, *en route* to the Vijayanagara court. The Italian traveller, Ludovico di Varthema, who visited India in 1506 says that he witnessed nearly sixty ships laden with rice ready for sail in the port of Mangalore.

69. Mangalore city is well known for tourist and the city has following locally important religious places.





- (i) **Mangaladevi Temple.** This city is called as Mangalore just because of this temple. It is situated 3 km. away from main City Bus stand. This temple was built by the Ballal family of Attavar in memory of a Princess of Kerala. This is an Archeological Survey of India (ASI) protected monument. However, none of subproject components are located in the 300 m regulated zone of ASI monument.
- (ii) **Kadri Manjunath Temple.** Kadri is another ancient historic spot in Mangalore. The Kadri Temple dating back to about 1068 A.D. with its nine tanks, its square temple, nestling at the foot of the highest hill, draws to Mangalore hundreds of visitors annually. The Lokeshwara bronze statue of the Kadri Manjunatha Temple is tipped to be the best bronze statue in India. On top of the hill King Kundavarma Bupendra built a mutt which came to be called 'Jogi Mutt'. There are some stone caves on top of the hill which are known as the caves of the Pandavas. It is situated 4 km. away from Nehru Maidan Bus Stand. The idol of Lord Manjunathaswamy of the temple is called as oldest of the South Indian Temples. The seven sacred ponds, Jogi Mutt and caves of Pandavas are the pilgrim attractions here.
- (iii) **St. Aloysius Church.** It is situated 1 km. away from Nehru Maidan Bus stand. The walls of the church are covered with the paintings of the artist Antony Moshaini of Italy. The Church was built in the year 1899-1900. St. Aloysius College Chapel, an architectural gem, comparable with the Sistine chapel in Rome, is situated on lighthouse hill. The special beauty of the chapel is the wonderful series of paintings that virtually cover every inch of the interior roof and walls executed by Bro. Moscheni trained in Italy.
- (iv) **Sultan Battery.** It is situated in Boloor 6 km. away from Mangalore City Bus Stand. It was built in Black Stones by Tipu Sulthan to prevent warships to enter Gurpurriver. Now the remaining part of the fort is called as Tippu's Well. It is today a deserted spot but its construction is bafflingly exquisite. Although it is a watchtower, it gives the impression of a miniature fortress with its arrangements for mounting cannons all-round. This is an ASI protected monument.
- (v) **Shri Sharavu.** Mangalore is known as a pilgrim center and boasts of many sacred temples like Sharavu, Kadri, Mangaladevi, Kudroli etc. Out of these Sri Sharavu Sharabeshwara - Sri Mahaganapathy Kshetra is an outstanding, pious center of great illustrious history of marathons 800 years
- (vi) **Kudroli Gokarnath Temple.** It is situated 3 km. away from main Nehru Maidan Bus Stand. Recently this temple has been renovated and now it is one of the tourist attraction places in Mangalore.

F. Environmental Settings of Investment Program Component Sites

70. The following tables show the environmental features of the subproject sites. There is neither protected monuments/places nor significant environmental sensitive feature in the proposed area. There are no environmentally-sensitive feature and no significant physical and cultural resources within or adjacent to the subproject sites. All the pumping main alignments along the public roads, where there is space along the ROW to lay the pipeline. There are no trees in the proposed pipeline alignment along the roads. Photographs of proposed pumping main alignments are provided in Table 11. The proposed components are not expected to cause any long term or major environmental impacts.

Table 11: Proposed Subproject Components and Site Setting







Subproject Component	Proposed Site Setting	Site Photograph
1. Laying of 7,650 m new Sewer Pumping Main of 1,100	There are no trees on this alignment.	Photos refer below

millimeters (mm) dia DI K9 Class Pipe from Kudroli wet well No-3 to Kavoor 43.5 million liters per day (MLD) sewage treatment plant (STP)		From Kudroli Wet Well No. 3, to Kavoor STP, all along road	
			
Gokarnanatha Temple Road (GT Road), Road width 4 meters (m) Dia of Pipe 1,100 mm dia DI K9 class Pipe		Jamia Masjid Raod , Road width 4 m Dia of Pipe 1,100 mm dia DI K9 class Pipe	
			
Jamia Masjid Raod , Road width 4 m Dia of Pipe 1,100 mm dia DI K9 class Pipe		Matadakani Road, Road width 4 m Dia of Pipe 1,100 mm dia DI K9 class Pipe	




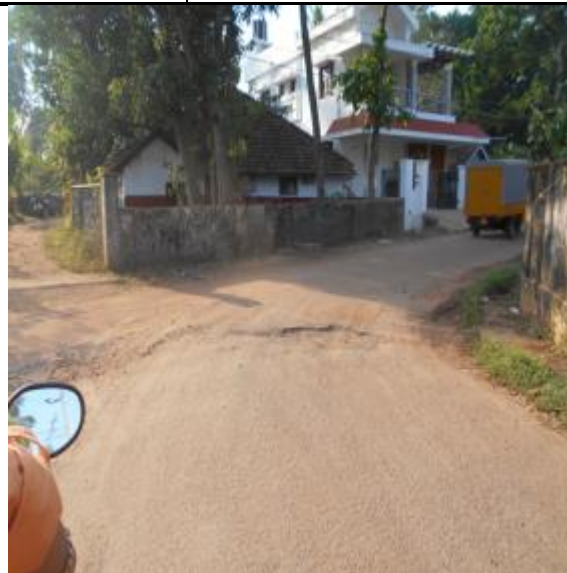
	
<p>Matadakani Road, Road width 4 m Dia of Pipe 1,100 mm dia DI K9 class Pipe</p>	<p>Matadakani Road, Road width 4 m Dia of Pipe 1,100 mm dia DI K9 class Pipe</p>
	
<p>Matadakani Road, Road width 7 m Dia of Pipe 1,100 mm dia DI K9 class Pipe</p>	<p>Urva Marigudi Temple Cross Road, Road width 4 m Dia of Pipe 1,100 mm dia DI K9 class Pipe</p>
	
<p>Urva Marigudi Temple Main Road, Road width 6 m Dia of Pipe 1,100 mm dia DI K9 class Pipe</p>	<p>Urva Marigudi Temple Main Road, Road width 6 m Dia of Pipe 1,100 mm dia DI K9 class Pipe</p>







	
<p>Urva Marigudi Temple Main Road, Road width 6 m Dia of Pipe 1,100 mm dia DI K9 class Pipe</p>	<p>Urva Marigudi Temple Main Road, Road width 6 m Dia of Pipe 1,100 mm dia DI K9 class Pipe</p>
	
<p>AshokNagara Main Road, Road width 3.8 m Dia of Pipe 1,100 mm dia DI K9 class Pipe</p>	<p>Kuntikan-Bajpe Road, Road width 10 m Dia of Pipe 1,100 mm dia DI K9 class Pipe</p>





	
<p>Kuntikan-Bajpe Road, Road width 10 m Dia of Pipe 1,100 mm dia DI K9 class Pipe</p>	<p>Kuntikan-Bajpe Road, Road width 10 m Dia of Pipe 1,100 mm dia DI K9 class Pipe</p>
	
<p>Kuntikan-Bajpe Road, Road width 10 m Dia of Pipe 1,100 mm dia DI K9 class Pipe</p>	<p>Kuntikan-Bajpe Road, Road width 8 m Dia of Pipe 1,100 mm dia DI K9 class Pipe</p>
	
<p>Kuntikan-Bajpe Road, Road width 7 m Dia of Pipe 1,100 mm dia DI K9 class Pipe</p>	<p>Kuntikan-Bajpe Road, Road width 7 m Dia of Pipe 1,100 mm dia DI K9 class Pipe</p>

					
Kuntikan-Bajpe Road, Road width 8 m Dia of Pipe 1,100 mm dia DI K9 class Pipe			Kuntikan-Bajpe Road, Road width 8 m Dia of Pipe 1,100 mm dia DI K9 class Pipe		
					
Kuntikan-Bajpe Road, Road width 8 m Dia of Pipe 1,100 mm dia DI K9 class Pipe			Kuntikan-Bajpe Road, Road width 8 m Dia of Pipe 1,100 mm dia DI K9 class Pipe		
					
Kuntikan-Bajpe Road, Road width 8 m Dia of Pipe 1,100 mm dia DI K9 class Pipe			Kuntikan-Bajpe Road, Road width 8 m Dia of Pipe 1,100 mm dia DI K9 class Pipe		
Subproject Component			Proposed Site Setting		
2. Laying of 950 m new Sewer Pumping Main of 900 mm dia DI K9 class pipe from Kandathpalli Wet Well No-4 to Kudroli Wet Well No-3.			Access road is not available but to be taken by the side of existing drain. There are no trees on this alignment. From Kandathpalli Wet Well No-4, to Wet Well No-3,		
			Site Photograph		
			Photos refer below		

	
Old Port Road, Road width 6 m Dia of Pipe 900 mm dia DI K9 class Pipe	Old Port Road, Road width 6 m Dia of Pipe 900 mm dia DI K9 class Pipe
	
Old Port Road, Road width 6 m Dia of Pipe 900 mm dia DI K9 class Pipe	Old Port Road, Road width 6 m Dia of Pipe 900 mm dia DI K9 class Pipe
	
Old Port–Kudroli Road, Road width 4.5 m Dia of Pipe 900 mm dia DI K9 class Pipe	Old Port–Kudroli Road, Road width 4.5 m Dia of Pipe 900 mm dia DI K9 class Pipe

		
Old Port-Kudroli Road, Road width 4.5 m Dia of Pipe 900 mm dia DI K9 class Pipe	Wet Well Layout, Dia of Pipe 900 mm dia DI K9 class Pipe	
Subproject Component	Proposed Site Setting	Site Photograph
3. Laying of 1700 m new Sewer Pumping Main of 450 mm dia DI K9 class pipe from Mulihitlu Wet Well No-6 to Ridge Manhole near Morgansgate.	There are no trees on this alignment. From Mulihitlu Wet Well No-6, to Ridge Manhole near Morgansgate all along road	Photos refer below
		
Mulihitlu Road, Road width 4.0 m Dia of Pipe 450 mm dia DI K9 class Pipe	Mulihitlu Road, Road width 4.0 m Dia of Pipe 450 mm dia DI K9 class Pipe	

	
Mulihitlu Road, Road width 4.0 m Dia of Pipe 450 mm dia DI K9 class Pipe	Mulihitlu Road, Road width 4.0 m Dia of Pipe 450 mm dia DI K9 class Pipe
	
Jeppu Market Road, Road width 6 m Dia of Pipe 450 mm dia DI K9 class Pipe	Jeppu Market Road, Road width 6 m Dia of Pipe 450 mm dia DI K9 class Pipe
	

Morgansgate Road, Road width 8 m Dia of Pipe 450 mm dia DI K9 class Pipe		Morgansgate Road, Road width 8 m Dia of Pipe 450 mm dia DI K9 class Pipe	
Subproject Component	Proposed Site Setting	Site Photograph	
4. Laying of 1,100 m new Sewer Pumping Main of 450 mm dia DI K9 class pipe from Jeppubappal Wet Well No-7 to Ridge Manhole inside premises of old STP at Ekkur	There are no trees on this alignment from Jeppu Bappal Wet Well No-7 to Ridge Manhole inside premises of old STP at Ekkur.	Photos refer below	
			
Wetwell-7, premises Dia of Pipe 450 mm dia DI K9 class Pipe	Nandigudda first cross road, road width 4 m Dia of Pipe 450 mm dia DI K9 class Pipe		
			
Nandigudda first cross road, road width 4 m Dia of Pipe 450 mm dia DI K9 class Pipe	MCC land road width 5 m Dia of Pipe 450 mm dia DI K9 class Pipe		
			
MCC land road width 5 m Dia of Pipe 450 mm dia DI K9 class Pipe	Railway Crossing at Sooterpete Dia of Pipe 450 mm dia DI K9 class Pipe		

	
<p>Kanakarabettu road, Road width 3.5 m Dia of Pipe 450 mm dia DI K9 class Pipe</p>	<p>Kanakarabettu road, Road width 3.5 m Dia of Pipe 450 mm dia DI K9 class Pipe</p>
	
<p>Kanakarabettu road, Road width 3.5 m Dia of Pipe 450 mm dia DI K9 class Pipe</p>	<p>Kanakarabettu road, Road width 3.5 m Dia of Pipe 450 mm dia DI K9 class Pipe</p>
	
<p>Kanakarabettu road, Road width 5 m Dia of Pipe 450 mm dia DI K9 class Pipe</p>	<p>Kanakarabettu road, Road width 5 m Dia of Pipe 450 mm dia DI K9 class Pipe</p>

Kanakarabettu road, Road width 5 m Dia of Pipe 450 mm dia DI K9 class Pipe	Kanakarabettu road, Road width 5 m Dia of Pipe 450 mm dia DI K9 class Pipe
Kanakarabettu road, Road width 5 m Dia of Pipe 450 mm dia DI K9 class Pipe	Kanakarabettu road, Road width 5 m Dia of Pipe 450 mm dia DI K9 class Pipe
Kanakarabettu road, Road width 5 m Dia of Pipe 450 mm dia DI K9 class Pipe	Ridge Manhole at Ekkur Dia of Pipe 450 mm dia DI K9 class Pipe

VII. SCREENING OF POTENTIAL ENVIRONMENT IMPACTS AND MITIGATION MEASURES

A. Overview

71. Potential environmental impacts of the proposed infrastructure components are presented in this section. Mitigation measures to minimize/ mitigate negative impacts, if any are recommended along with the agency responsible for implementation. Monitoring actions to be conducted during the implementation phase is also recommended.

72. As a general practice, an IEE should evaluate impacts due to the location, design, construction and operation of the project. Construction and operation are the two activities in which the project interacts physically with the environment, so they are the two activities during which the environmental impacts occur. In assessing the effects of these processes therefore, all potential impacts of the project should be identified, and mitigation is devised for any negative impacts. Following sections evaluate impacts of the proposed sewerage pumping main subproject in Mangalore to be funded under KIUWMIP Tranche 2.

- (i) **Location Impacts.** There are no environmentally-sensitive feature and no significant physical and cultural resources within or adjacent to the subproject sites. All the sewer pipelines are proposed along the roads, where there is space along the ROW to lay the pipeline. There are no trees in the alignment;
- (ii) **Design Impact.** Includes impacts arising from technology used and method for sewer pipelaying works;
- (iii) **Construction Impacts.** Includes impacts caused by site clearing, earthworks, machinery, vehicles and workers. Construction site impacts include erosion, dust, noise, traffic congestion and waste production; and
- (iv) **O&M Impacts.** Include impacts arising from the operation and maintenance activities of the infrastructure facility. These include routine management of operational waste streams and occupational health and safety issues.

73. The ADB Rapid Environmental Assessment Checklist (General) in <http://www.adb.org/documents/guidelines/environmentalassessment/eaguidelines002.asp> was used to screen the project for environmental impacts and to determine the scope of the IEE investigation. The complete checklist is given in Appendix 1.

B. Preconstruction Impacts

74. **Location.** These impacts are associated with planning particularly on the site selection. They include impacts due to encroaching on sensitive areas and impacts on the people who might lose their homes or livelihoods due to the development of the proposed site. In case of sewerage components, no significant impacts are anticipated since the laying of pumping main line will be along public roads only in an already built up area. There are no trees along the alignment, therefore no tree removal will be required.

75. Proposed subproject sites are carefully selected to avoid encroachment into sensitive areas and minimize the impacts on people livelihoods and homestead. In the case of this project (i) most of the individual elements are relatively small and involve straight forward construction and operation, so impacts will be mainly localized and not greatly significant; (ii) most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving excavation and earth movements; and (iii) being located in the urban areas, will not cause direct impact on biodiversity values.

76. **Utilities.** During the construction stage of underground pumping main line, utilities like telephone lines, electric poles and wires, water lines within the proposed subproject locations may require to be shifted in few cases which will be temporarily interfered due to the operation of construction machineries. While laying sewer pumping main in narrow roads with collapsible soil condition there may be chance of damage to the existing live gravity sewer line and manholes. For this, replacement of sewer line and manholes are also proposed in particular stretches.

77. Following Table 12 shows the utilities and existing infrastructure likely to be affected, and therefore is proposed for reconstruction under the project.

Table 12: Utilities Shifting

Existing Utilities to be Effected	Proposed Action	Quantity (km)
Existing water and sewer lines including house connections	All the damaged lines and connections will be reconstructed	9.10
Compound walls, culverts and drains	Reconstruction of Compound wall, culverts and drains	1.5
Electric poles, cables, etc.	Temporary shifting required for laying of Pipe line	-

78. To mitigate the adverse impacts due to relocation of the utilities, implementing agency will:

- (i) Conduct detailed site surveys with the construction drawings and discuss with the respective agencies during the construction phase before ground clearance;
- (ii) Require construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services. In case of disruption of water supply, alternative supply, through tankers, shall be provided;
- (iii) Prepare and implement utility management and contingency plan;
- (iv) Minimize duration of service disruptions as much as possible; and
- (v) Provide prior information to the effected households on nature, duration of disruptions and temporary remedies provided during the disruption, and reconstruction of damaged utilities.

79. As the works involves laying of sewer mains in public area, along the roads and other transport corridors, it requires permissions from various agencies (e.g., highways and railway authorities) for construction work. These clearances will be obtained prior to start of work. The list of clearances is required for subproject is given in Appendix 5.

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

- (i) The excavated soil should be removed from construction area at the earliest for beneficial reuse such as land raising / filling of excavated areas;

- (ii) Soil should be covered with tarpaulin sheets during the transportation; and
- (iii) Soil transportation should not be done during the peak hours and should be avoid narrow and heavy traffic routes and important religious or tourist sites.

81. Location for disposing the surplus soil/waste/debris to be identified in barren/unused public lands under the MCC. Contractor needs to identify these locations before starting the work at each site and include in the Construction Management plan.

82. **Setting Up Labor Camps.** Labor camps include accommodation for workers/laborers along with other basic amenities such as kitchen, potable water supply, sanitation (toilets, bathrooms, washing areas and water supply for such needs), first aid room as well as garbage collection and disposal facility. The roof height of the worker's and labor camp shall not be less than 3mt. from floor level to the lowest part of the roof. The camps shall be floored with concrete, shall be kept clean, and with proper cross ventilation, and the space provided shall be on the basis of one sq.mt per head or as per the relevant regulation, whichever is higher. Fire and electrical safety pre-cautions shall be adhered to. cooking, sanitation and washing areas shall be provided separately. The Contractor will maintain necessary living accommodation and ancillary facilities (including provision of clean fuel to prevent damage to forests and to prevent fuel wood cutting and burning by labor) in functional and hygienic manner. The site must be graded and rendered free from depressions such that water does not get stagnant anywhere. The entire boundary of the site should be fenced all around with barbed wire so as to prevent the trespassing of humans and animals.

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

84. For Mangalore subproject, the quarry material required will be sand and stone aggregate, and the nearest quarries are near Pane Mangalore and Modentar, Alankar for stone aggregate. These are existing quarries and are licensed by Mines and Geology Department. The material from the existing quarries will be adequate for the subproject construction, and therefore no new quarry sites will be developed for the purpose.

C. Design Impact

85. The proposed sewage pumping main will be developed within the city area where there are no sensitive natural habitats and the pipe line will be buried in the un-used vacant adjacent to the roads. It will be ensured that pipe alignment is chosen in such a manner that it does not pass over or below the water supply lines to avoid contamination. Necessary precaution will be taken for protection of pipe line in drain crossing and road crossing areas. Adequate protection measures will also be taken in water logged areas. No major impacts envisaged.

86. Measures such as the following are included in design to ensure that the system provides the benefits as intended:

- (i) Limit the pumping main depth where possible;

- (ii) Sewerage pumping main shall be laid away from water supply lines and drains (at least 1 m, wherever possible);
- (iii) all cases, the pumping main line should be laid deeper than the water pipeline (the difference between top of the sewer and bottom of water pipeline should be at least 300 mm);
- (iv) In unavoidable, where pumping main are to be laid close to storm water drains or canals or natural streams, appropriate pipe material shall be selected (stoneware pipes shall be avoided); and
- (v) Maximum depth of pumping main will be 2.5 m. Proper shoring arrangement will be considered during construction.

87. Since the subproject is only replacing the existing old pumping mains from the existing wet wells to STPs, no major design impacts anticipated. The subproject is designed in such a way that the existing services are not disturbed. New pipeline will be mostly laid adjacent to the existing one which is currently in operation. Existing pipeline (of cast iron) will not be disturbed, and once the new line (of ductile iron) is laid, old section will be isolated and new pipeline will be connected. The existing pipeline will then be left as it is in the ground, by capping both ends. No disturbance to the existing sewerage system anticipated due to this approach. Adequate capacity of STP is already available, so the sewage conveyed by the pumping main will be pumping and reused in industrial applications.

88. Adequate capacity of STPs are already available to meet the existing and projected future demand, and therefore no new or augmentation of treatment facility proposed under the subproject. Existing STPs are currently under-utilized due to low flow into STPs from the old and damaged pumping mains. The treated sewage from the existing STPs is being reused for industrial purposes in Mangalore SEZ. Appendix 6 shows the treated sewage quality monitoring results of STPs.

89. **Social and Cultural Resources – Chance Finds.** Any work involving ground disturbance can uncover and damage archaeological and historical remains. Subproject area is not a known area of archaeological potential, and therefore the risk is low. Nevertheless, construction contractor needs to follow these measures in conducting any excavation work:

- (i) Create awareness among the workers and supervisors about the chance finds during excavation work;
- (ii) Stop work immediately if any finds are suspected to allow further investigation; and
- (iii) Inform archaeological agencies promptly if a find is suspected and take any action they require to ensure its removal or protection in situ.

D. Construction Impacts

90. **Construction Method.** The project involves replacement of old pumping main with new sewer pumping main. Following Table 13 shows the details of construction activities involved in the subproject.

Table 13: Construction Activities for the Subproject

Component	Construction Method	Likely Waste Generated
Sewerage pumping main	<p>Trench will be excavated (either adjacent to the existing pumping main or in a new alignment where there is no vacant space to accommodate the new pumping main) for laying pipeline. The dimension of trench to be excavated are given below. Width of trench will range from 1.12 m to 1.81 m and depth from 1.72 m to 2.41 m.</p> <ul style="list-style-type: none"> (i) For 1100 mm dia sewer main: <ul style="list-style-type: none"> a. depth of trench – 2.41 m b. width of trench -- 1.81 m (ii) For 900 mm dia sewer main: <ul style="list-style-type: none"> a. depth - 2.20 m and width - 1.60 m (iii) For 450 mm dia sewer main: <ul style="list-style-type: none"> a. depth - 1.72 m and width -1.12 m <p>Trench will be excavated using backhoe and where ever not feasible will be done manually. Excavated soil will be placed along the trench. A bed of sand of 100 mm thick will be prepared at the bottom and pipes will be placed and joined. Excavated soil will be replaced and compacted. Where the pipes are laid in the roadway, handheld pneumatic drill will be used to break the road surface.</p> <p>Pumping main required to cross a national highway and a railway line (NH -66 crossing at Kuntikan and railway crossing at Sooterpete). Trenchless method using manual pipe Jacking method (thrust Boring) will be adopted for this so that it will not disturb the traffic movement.</p>	<p>~46,313 m³ of excavated soil is excavated; 78% will be utilized for refill; remaining soil (~10,130m³) need to be disposed off.</p>

dia = diameter, m³ = cubic meter, m = meter, mm = millimeter.

91. Subproject area is near to sea shore (about 3-4 km) comprising sandy soil and highwater table area. Provision has been made for well point type dewatering, sheet piling for shoring and strutting etc. precaution will be taken at the time of execution. Also, at a time, full road will not be excavated. Only one pipe length, i.e., 6 m to 10 m will be excavated, laying will be done for one length pipe and backfill the trench. Like this it will be continued in narrow roads. For laying of 1100 mm dia along Jamia Masjid road for about 500 m and along Ashoknagara road for about 400 m (these sections are very narrow), the required to be closed during execution. Also, for laying of 900 mm dia main in Kandathpalli, road section of about 250 m will be closed. Measures are provided in construction stage impacts to minimize the inconvenience.

92. Although construction of the pumping main line involves quite simple techniques of civil work, the invasive nature of excavation and the subproject locations in the built-up areas of Mangalore city, where there are a variety of human activities, will result to impacts to the environment and sensitive receptors such as residents, businesses, and the community in general. These anticipated impacts are temporary and for short duration. Physical impacts will be reduced by the method of working and scheduling of work, where by the project components will be: (i) constructed by small teams working at a time; (ii) work will be taken up in short stretches, pipes laid and immediately refilled to restore the road; and (iii) any excavation done near sensitive area like school, religious places and house will be protected as per standard construction practices. These are discussed in detail in the following sections.

93. While trenching at densely populated areas like market place or layouts, roads with heavy traffics additional care has to be taken. Hard barricade should be mandatorily provided along with

caution board and traffic diversion boards. Some of the densely populated area identified at Mangalore is Old Port Road, Jeppubappal to Suterpete, etc.

94. **Method Statement for Construction Works.** The method statement for pumping main line should be simple and explain the contractor's work process that is actually conducted on site, with safety and safeguard concerns. Method Statement is very important, particularly for pumping main line works along the roads. Method Statement can be prepared for each stretch (say 1 km)/specific site based on the project area. Method Statement should be in a table format with appended site layout map and cover the following:

- (i) Work description;
- (ii) No. of workers (skilled and unskilled);
- (iii) Details of Plant, equipment and machinery, vehicles;
- (iv) Work duration (total, and activity-wise, for example for pipe laying, from excavation to road resurfacing/ testing);
- (v) PPE (helmet, gloves, boots, etc) details for each type of work;
- (vi) Details of materials at each site (type and quantity);
- (vii) Risks/hazards associated with the work (for example, Trench excavation will have risks such as trench collapse, persons/vehicles falling into trench, structural risk to nearby buildings, damage to buildings, infrastructure etc);
- (viii) Construction waste/debris generated (details and quantity);
- (ix) Detail the sequence of work process (step-by-step) including specific details of each work;
- (x) Contractor's supervision and management arrangements for the work;
- (xi) Emergency: Designate (a) responsible person on site, and (b) first aider;
- (xii) Typical site layout plan including pipe trenching, placement of material, excavated earth, barricading, etc.;
- (xiii) The pipeline/sewers are to be laid along the roads, Roads are provided with side drains to carry rain water. The excavated soil, placed along the trench may get disturbed due to wind, rain water and the movement of workers, vehicles and pedestrians, and spill onto road way – disturbing road users, creating dust, road safety issues, etc, and also into nearby open drains. The following should be included in the site layout plan;
- (xiv) Provide barricading/security personnel at the site to prevent entry/trespassing of pedestrian/vehicles into the work zone;
- (xv) Location of temporary stockpiles and provision of bunds;
- (xvi) Separation of stockpiles areas with workers/vehicle movement paths to avoid disturbing the stockpiled soil;
- (xvii) Wetting of soil to arrest dust generation by sprinkling water; and
- (xviii) Waste/surplus soil and concrete debris utilization and disposal plan – indicate expected duration of temporary stockpiling along the trench at each site and identify final surplus soil utilization/disposal site in consultation with PIU.

95. The following should be included in the site layout plan:

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

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

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

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

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

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

98. **Noise Levels.** There are no hard soils in the subproject area and therefore activities like rock cutting/ blasting that generate high noise are not anticipated. Since the depth is within 2.5 m, there is no chances of hard stratum and does not require pneumatic drills, which shall create high noise during the activity. However, whenever the roadway, needs to be excavated using pneumatic drills shall be used to break open the road surface. Pneumatic drills typically generate an equitant noise of 82-98 decibels (dB), at 1 m distance from the activity. The sensitive receptors are the general population and sociocultural institutions in the area. Noise will be for a short term (about 2-3 days at each location) thus impact is minimal and short-term. The construction contractor will be required to:

- (i) Plan activities in consultation with the PIU so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance;
- (ii) Construction work shall be limited to day light hours (6 AM to 6 PM);
- (iii) Provide prior information to the local public about the work schedule;
- (iv) Ensure that there are no old and sensitive buildings that may come under risk due to the use of pneumatic drills; if there is risk, cut the rocks manually by chiselling;
- (v) Minimize noise from construction equipment/ pneumatic drills by using silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers the sound impact to surrounding sensitive receptor; and

- (vi) Maintain maximum sound levels not exceeding 80 dB when measured at a distance of 10 m or more from the vehicle/s.

99. **Surface Water Quality.** Mangalore topography is primarily with undulations; the town receives high rainfall. The southwest monsoon winds brings rainfall from May to October. Due to these reasons and also that excavation will not certainly be conducted during rains, there is no impact on drainage and surface water quality is envisaged. In unavoidable case of excavation during monsoons, there may be temporary impacts like flooding of construction sites, mixing of construction waste and material within the runoff, etc. This may lead to silting and blockage of drains and water bodies. These potential impacts are temporary and short-term duration only and to ensure these are mitigated, construction contractor will be required to:

- (i) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets;
- (ii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with Implementing Agency on designated disposal areas (Appendix 7);
- (iii) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies;
- (iv) Provide temporary bunds for stockpiles and materials; place storage areas for fuels and lubricants away from any drainage leading to water bodies. Storage structure should consider 110% capacity bund; and
- (v) Dispose any wastes generated by construction activities in designated sites.

100. **Ground Water.** Subproject activities do not interfere with groundwater regime, no groundwater abstraction proposed nor do the activities affect groundwater quality.

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

- (i) Prepare and implement Waste/Spoil Management Plan – it should present how the surplus waste generated will temporarily stocked at the site, transported and disposed properly;
- (ii) Avoid stockpiling of excess excavated soils as far as possible;
- (iii) Avoid disposal of any debris and waste soils in the forest areas and in or near water bodies/ rivers;
- (iv) Coordinate with PIU for beneficial uses of excess excavated soils or immediately dispose to designated areas;
- (v) Recover used oil and lubricants and reuse or remove from the sites;
- (vi) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
- (vii) Remove all wreckage, rubbish, or temporary structures which are no longer required; and
- (viii) Request PMU/ PMDCSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.

102. **Accessibility.** Transport infrastructure will be affected by the pumping main laying work, as in the narrower streets there is not enough space for excavated soil to be piled off the road. The road itself may also be excavated in places where there is no available land to locate pipes

alongside. Traffic will therefore be disrupted, and in some very narrow streets the whole road may need to be closed for short periods. For laying of 1100 mm dia along Jamia Masjid road for about 500 m and along Ashoknagara road for about 400 m (these sections are very narrow), the required to be closed during execution. Also, for laying of 900 mm dia main in Kandathpalli, road section of about 250 m will be closed. Pumping main required to cross a national highway and a railway line (NH-66 crossing at Kuntikan and railway crossing at Sooterpete).

Table 14: Pumping Main Alignment Roads and Construction Details

Road	Work Details
Jama Masjid Road	For 1100 mm dia sewer main: -Width of Road – 3.8 m to 10 m -Depth of laying pumping main – 2.41 m -Width of laying pumping main -- 1.81 m
Other roads	For 900 mm dia sewer main: -Width of Road – 4 m to 6 m -Depth of laying 2.20 m and width 1.60 m
	For 450 mm dia sewer main: -Width of Road – 3.5 m to 8 m -Depth of laying- 1.72 m and width -1.12 m

dia = diameter, m = meter, mm = millimeter.

103.. The construction contractor will be required to:

- (i) Plan pipeline work in consultation with the traffic police;
- (ii) Plan work such that trench excavation, pipe laying, and refilling including compacting, at a stretch is completed in a minimum possible time;
- (iii) Provide for immediate consolidation of backfilling material to desired compaction – this will allow immediate road restoration and therefore will minimise disturbance to the traffic movement;
- (iv) Do not close the road completely, ensure that work is conducted onto edge of the road; allow traffic to move on one line;
- (v) In unavoidable circumstances of road closure, provide alternative routes, and ensure that public is informed about such traffic diversions;
- (vi) Maintain safe pedestrian access at all times to the houses along the work site;
- (vii) At all work sites public information/caution boards shall be provided – information shall inter-alia include: project name, cost and schedule; executing agency and contractor details; nature and schedule of work at that road/locality; traffic diversion details, if any; entry restriction information; competent official's name and contact for public complaints;
- (viii) Prepare a Traffic Management Plan – a template is provided for reference at Appendix 8. The Traffic Management Plan should be part of the Construction Management Plan;
- (ix) The list of roads where the road will be closed (e.g., old port road) partially or completely during the construction time shall be informed to Traffic police and obtain permission prior to start of work;
- (x) In densely populated areas like market place or layouts, roads with heavy traffics additional care has to be taken. Hard barricades should be mandatorily provided along with caution board and traffic diversion boards. Some of the densely populated area identified in project area are Old Port Road, Jeppubappal to Suterpete; and
- (xi) Adopt trenchless method at highway and railway crossings to avoid large scale traffic disruptions.

104. **Impacts on Social Sensitive Areas.** Since the work is being conducted in an urban area, sensitive areas like schools, hospitals and religious center, the excavation of trenches and pumping main laying activity will create nuisance and health hazard to children and people with ailments. The measures suggested under various heads in this section will minimize the impact in general in all areas; however, special attention is necessary at these locations. Following measures shall be implemented in 250 m around the sensitive locations (schools, hospitals, and religious centers:

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

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

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

106. **Socioeconomic–Employment.** Manpower will be required during the 30-months construction stage. This can result to generation of contractual employment and increase in local revenue. Thus, potential impact is positive and long-term. The construction contractor will be required to employ local labor force to the maximum extent, if manpower is available.

107. **Occupational Health and Safety.** Workers need to be mindful of the occupational hazards which can arise from working in height and excavation works. Potential impacts are negative and long-term but reversible by mitigation measures. Subproject area is located in a coastal belt comprising sandy soil and highwater table area. Although the depth of excavation is limited to 2.6 m, there is a risk of collapse. There is a risk of working on operating sewage pumping mains, however, in this subproject it is proposed to lay a parallel pumping main, without disturbing

the existing in-operation pumping main. Once work is completed, and old structure will be isolated and blocked, and the new main will be connected and integrated into the system.

108. The construction contractor will be required to implement the following to eliminate any occupational health and safety risk:

- (i) Develop and implement site-specific Health and Safety (H&S) Plan which will include measures such as: (a) excluding public from the site, (b) ensuring all workers are provided with and use Personal Protective Equipment, (c) H&S Training⁴ for all site personnel, (d) documented procedures to be followed for all site activities, and (e) documentation of work-related accidents;
- (ii) All trenches deeper than 1 m (or less, if soil conditions are not appropriate) shall be protected against collapse to avoid safety risks to workers, public and nearby buildings/structures; provision has been made for well point type dewatering, sheet piling for shoring and strutting, etc., precaution shall be taken at the time of execution;
- (iii) Take all necessary precaution during isolation and blocking of existing pumping main, and connecting the new main to the existing system. Skilled supervision, appropriate apparatus and personal protection equipment (PPEs) must be used;
- (iv) Create awareness among all workers, supervisors and site engineers on potential hazard conditions and safety risks in working with existing/old sewer lines; working conditions may be hazardous with harmful gaseous emissions (hydrogen sulphide, carbon monoxide, methane, etc.) and oxygen deficiency;
- (v) Provide all necessary personnel protection equipment; including oxygen masks for emergency use;
- (vi) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site;
- (vii) Provide medical insurance coverage for workers;
- (viii) Secure all installations from unauthorized intrusion and accident risks;
- (ix) Provide supplies of potable drinking water;
- (x) Provide clean eating areas where workers are not exposed to hazardous or noxious substances;
- (xi) Provide H&S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;
- (xii) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;
- (xiii) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas;
- (xiv) Ensure moving equipment is outfitted with audible back-up alarms;
- (xv) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for

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

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;

- (xvi) Disallow worker exposure to noise level greater than 85 dB for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively; and
- (xvii) Overall, the contractor should comply with International Finance Corporation (IFC) EHS Guidelines on Occupational Health and Safety.

109. **Community Health and Safety.** Hazards posed to the public, specifically in high-pedestrian areas may include traffic accidents and vehicle collision with pedestrians. In most of the cases location of project sites are along the roadways, hence safety risk to community is to be considered. The pumping main line work may require only 1.5 m to 2.5 m deep trenches including in narrow streets; however, given the location in coastal area, unprotected trench excavation may endanger the stability of nearby buildings/structures. Potential impact is negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

- (i) All trenches deeper than 1 m (or less, if soil conditions are not appropriate) shall be protected against collapse to avoid safety risks to workers, public and nearby buildings/structures; provision has been made for well point type dewatering, sheet piling for shoring and strutting, etc., precaution shall be taken at the time of execution;
- (ii) Plan material and waste routes to avoid times of peak-pedestrian activities
- (iii) Liaise with implementing agency/Mangalore CC in identifying risk areas on route cards/maps;
- (iv) Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure;
- (v) Provide road signs and flag persons to warn of dangerous conditions, for all work sites along the roads; and
- (vi) Overall, the contractor should comply with IFS EHS Guidelines Community Health and Safety (this can be downloaded from <http://www1.ifc.org/wps/wcm/connect>).

110. **Work Camps.** Operation of work camps can cause temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants. Potential impacts are negative but short-term and reversible by mitigation measures. Provision of proper living facilities and basic amenities (water, sanitation, fire safety, health and safety, etc) shall be ensured. The construction contractor will be required to comply with the following. Overall, the contract should follow the IFC EHS guidelines specific to workers accommodation (this can be downloaded from http://www1.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/publications/publications_gpn_workers_accommodation).

- (i) Consult with PIU before locating workers camps/sheds, and construction plants as far as possible located within reasonable distance of work site;
- (ii) Minimize removal of vegetation and disallow cutting of trees;
- (iii) living facilities shall be built with adequate materials, and should be in good condition and free from rubbish and other refuse;
- (iv) The camp site should be adequately drained to avoid the accumulation of stagnant water;
- (v) Provide water and sanitation facilities; water, meeting Indian drinking water standards shall be provided, in adequate quantities (supply of 60- 80 LPCD); all

- water storage structures must be cleaned regularly and covered properly to avoid any contamination;
- (vi) Provide separate facilities for men and women; sanitary facilities shall be properly build and well maintained; toilet and bath facilities should be provided on basis of 1 per 15 or less persons;
 - (vii) Train employees in the storage and handling of materials which can potentially cause soil contamination;
 - (viii) Recover used oil and lubricants and reuse or remove from the site;
 - (ix) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
 - (x) Remove all wreckage, rubbish, or temporary structures which are no longer required; and
 - (xi) Report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.

E. Operation and Maintenance Impact

111. **Sewerage Pumping Main System.** The new sewerage pumping system will need regular maintenance during operation; with a few simple precautions this can also be conducted without major environmental impacts. The main requirement for maintenance of the new infrastructure will be for the detection and repair of leaks. The use of DI pipe for pumping main mean that pipeline breaks are very rare, and that leaks are mainly limited to joints between pipes. For any repairs, trenches will be dug around the faulty section and the leaking joint will be re-sealed, or the pipe will be removed and replaced. Necessary equipment to conduct routine maintenance and repair activities (removing blocks, overflows, etc.) is provided include the personal protection equipment for workers. Operation and maintenance guidelines (Appendix 9) will be followed during operation phase.

112. The new sewerage pumping mains will ensure proper collection domestic sewage produced by subproject area population and conveyance to the STPs. The existing STPs will treat the sewage collected. Adequate capacity of STPs are already available and functioning therefore negative impacts envisaged. From the existing STPs, the treated wastewater is being reused for industrial purposes, and there is no disposal into natural water bodies. No impacts therefore envisaged.

113. **Occupational Health and Safety.** There are no source of hazardous material that will discharge hazardous materials into the sewers, resulting in damage to sewer system and danger to workers. Waste water, other than municipal (i.e., industrial) entering the sewerage system shall meet the stipulated standards. No manual cleaning work will be conducted during the maintenance, appropriate apparatus, personal protection equipment and skilled and trained personnel will be used for operation and maintenance.

114. The provision of an improved sewerage system is expected to have indirect economic benefits from the expected improvement in the health, environment and economic well-being. The citizens of the Mangalore city will be the major beneficiaries of this subproject. The sewerage pumping system will remove the human waste from existing wet wells served by the network rapidly and treated to an acceptable standard. in addition to improved environmental conditions, the sub project will improve the overall health conditions of the town.

F. Cumulative Impacts

115. Cumulative impacts are those that result from the successive, incremental, and/or combined effects of a project or activity when added to other existing, planned, and/or reasonably anticipated future ones. The subproject is proposed to replace some sections of the existing sewage pumping mains, which are either not in good condition or do not have adequate capacity. This infrastructure will only improve the existing situation by providing seamless conveyance of sewage to STPs, and therefore no cumulative impacts anticipated. There is adequate treatment capacity to treat the generated sewage. During the construction work, dust pollution is anticipated from the subproject activities. This, combined with the other usual construction activities in urban areas, may increase the particulate matter concentration in ambient air. Dust control measures suggested in the EMP will minimize the dust generation from the subproject construction activities. Therefore, no significant impacts envisaged.

VIII. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Project Stakeholders

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

- (i) Residents, shopkeepers and businesspeople near the work sites;
- (ii) Public representatives and prominent citizens of the town;
- (iii) Mangalore City Corporation; and
- (iv) KUIDFC, Government of Karnataka.

117. Secondary stakeholders are:

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

B. Consultation and Disclosure Date

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

119. The public consultation workshop was conducted to discuss the proposed project and likely environmental issues and mitigation measures. Key stakeholders – public representatives, officials from various agencies, district level officers, from each project town, including Mangalore, were participated in the workshop on 6 December 2016 and 8 December 2016. Public consultation had been conducted extensively to assess the impact of proposed civil work on the livelihood of the people and also to update Resettlement Plan. The site verification reveals that, all the components of the sewerage system sub projects are either located on existing right of way of city roads or the open government land. Respective ward councillors were present in the public consultation process and supported the project by creating awareness about the

subprojects and requested the people to support the project during implementation. The people who participated in the public consultation expressed that the proposed civil work is useful to create healthy environment in the city and also promised that they will extend their support during construction work.

120. Issues Discussed in the Public Consultation. The subproject details have been provided in detail to the people who are involved in public consultation and also asked their suggestions and willingness to complete the proposed civil work. The participants expressed their willingness and support to complete the civil works. The details of various meetings held in Mangalore are provided in Appendix 10.

121. The inconvenience to approach the shops and residences during construction even after providing access by the contractor was explained to the participants and they expressed that they are willing to bare the inconvenience for a good cause. Suggestions received from the participants in the public consultation:

- (i) Maintaining access to shops by providing planks and leaving spaces to avoid disturbance to residents and businesses;
- (ii) Open pits to be guarded properly for safety reason, especially during day time working period, near road crossings, near school complex, etc.;
- (iii) Managing traffic flows as per the traffic management plan prepared by the contractor in coordination with local authorities and communities;
- (iv) Limiting period of time for open trenches;
- (v) Completing works quickly where large numbers of businesses are located;
- (vi) Avoiding full street closure to the extent possible;
- (vii) Providing employment opportunities to the displaced persons during construction works, especially vulnerable DPs, if necessary;
- (viii) Placing telephone hotlines on signs on visible areas to notify in case of emergency
- (ix) Making the community fully aware of the grievance redress mechanism;
- (x) Providing contact number of responsible persons in the RPMU and MCC offices; and
- (xi) Providing assistance to vendors and hawkers in shifting to alternative nearby locations and helping in the reinstallation of their businesses early.

C. Future Consultation and Disclosure

122. Executing agency and implementing agency shall extend and expand the consultation and disclosure process significantly during implementation of the Investment Program.

123. Consultation During Construction. Prior to start of construction, PIU will conduct meaningful⁵ consultations and information dissemination sessions at various places and solicit the help of the local community, leaders/prominent for the project work. Focus group meetings will be conducted to discuss and plan construction work (mainly pipeline work) with local communities to reduce disturbance and other impacts and regarding the project grievance redress mechanism. Project information and construction schedule will be provided to the public via mass media (newspapers, television, websites etc.). A constant communication will be established with

⁵ Meaningful consultation will: (i) be carried out on an ongoing basis throughout the project cycle; (ii) involve timely disclosure of relevant information. Affected peoples and stakeholders will have access to relevant project information prior to any decision-making that will affect them; (iii) be conducted free of intimidation or coercion; and (iv) be gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups.

the affected communities to redress the environmental issues likely to surface during construction phase. Contractor will provide prior public information (in Kannada and English) about the construction work in the area, once 7 days prior to the start of work and again a day before the start of work via pamphlets. At the work sites, public information boards will also be provided to disseminate project related information.

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

124. **Project disclosure.** Executive summary of the IEE will be translated in Kannada and made available at the offices of PMU, RPMU, PIU, and MCC and also displayed on their notice boards. Hard copies of the IEE will be accessible to citizens as a means to disclose the document and at the same time creating wider public awareness. Electronic version of the IEE in English and Executive Summary in Kannada will be placed in the official website of the KUIDFC after approval of the IEE by ADB. Stakeholders will also be made aware of grievance register and redress mechanism.

125. Public information campaigns to explain the project details to a wider population will be conducted. Public disclosure meetings will be conducted at key project stages to inform the public of progress and future. Prior to start of construction, the PIU will issue notification on the start date of implementation in local newspapers. A board showing the details of the project will be displayed at the construction sites for the information of public.

126. Local communities will be continuously consulted regarding location of construction camps, access and hauling routes and other likely disturbances during construction. The road closure together with the proposed detours will be communicated via advertising, pamphlets, radio broadcasts, road signage, etc.

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

127. Based on ADB requirements, the following will be posted on ADB website: (i) this IEE, upon finalization and approval of ADB; (ii) a new or updated IEE, if prepared, reflecting significant changes in the Project during implementation; (iii) corrective action plan prepared during Project implementation to address unanticipated environmental impacts and to rectify non-compliance to EMP provisions; and (iv) environmental monitoring reports (Appendix 11). Documents will also be available on the websites of KUIDFC and MCC.

IX. GRIEVANCE REDRESS MECHANISM

128. The grievance redress mechanism (GRM) for the subproject has been established in accordance with an official Memorandum issued upon the order of Joint Managing Director

KUIDFC Official Memorandum dated 28 June 2017. It has been established to receive, evaluate and address the concerns, complaints and grievances of the affected persons in relation to the project's social and environmental performances. The GRM aims to provide time bound action and transparent mechanisms to resolve social and environment concerns.

129. A project GRM will cover the project's towns for all kinds of grievances and will be regarded as an accessible and trusted platform for receiving and addressing project related complaints and grievances. The multi-tier GRM will have realistic time schedules and identify persons responsible to address grievances and deal directly with complainants to resolve their issues.

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

131. There will be multiple means of registering grievances and complaints by dropping grievance forms in complaint/ suggestion boxes at accessible locations, or through telephone hotlines, email, post or writing in a complaint registrar book in MCC's project office. There will be complaint registrar book and complaint boxes at construction site office to enable quick response of grievances/ complaints for urgent matters. The name, address and contact details of the persons with details of the complaint / grievance, location of problem area, date of receipt of complaint will be documented. The RPMU's Safeguards Officer will be responsible at the project level for timely resolution of the environmental and social safeguards issues and registration of grievances, and communication with the aggrieved persons.

A. Grievance Redressal Process

132. There will be several tiers for grievance redress process (Figure 9). Simple grievances for immediate redress will first be resolved at site by Contractor. If unaddressed for up to 7 days the complainants may go to PIU officer in MCC responsible for addressing resettlement/social issues. Resident engineer and the MCC will assist in resolving the issues. Name, designation and contact number of personnel responsible for grievance redress at MCC and RPMU, will be posted at Contractor's and PMDCSC's site office in full visibility of public. Grievances of immediate nature should be resolved at site/ within MCC/ PIU level within 15 days of registration of grievances.

133. All the Grievances that cannot be resolved at MCC/PIU within 15 days will be forwarded to the grievances redress committee (GRC) headed by Deputy Project Director, RPMU at Subdivision level who will review and resolve within 15 working days of grievance being registered with assistance of the concerned implementing agency/ULB personnel if required. The grievances of critical nature and those cannot be resolved at GRC level should be referred to District Level Implementation Committee (DLIC) set up at district level headed by Deputy Commissioner who will review the grievances and to be settled within 30 days. All documents related to grievances, follow up action taken to resolve along with explanatory note on nature, seriousness and time taken for grievance redress shall be prepared by RPMU Safeguards Officer and circulated to DLIC members at least a week prior to scheduled meeting. The decision taken at the DLIC level will be communicated to the complainant by SO RPMU through ULB/ PIU

134. For any issues that remain unresolved by the GRC it is referred to DLIC at the District Level, and if the decisions taken at such meetings are not acceptable, the complainants /displaced persons can approach the Court of Law as per Government of Karnataka legal procedure.

B. Grievance Redress Committee Composition and Selection of Members

135. The GRC for the project will be headed by: (1) Special Land Acquisition Officer/ Assistant Commissioner of the concerned sub-Division as Chairman of the sub Division with members as follows: (2) ULB Commissioners/ Chief Officer of the concerned ULB towns, (3) Deputy Project Director as member Secretary and Convener, (4) PMDCSC Engineer, (5) Affected Community member/NGO, and (6) SO RPMU KIUWMIP Mangalore member and will shoulder responsibility of keeping records of grievances/ complaints in details. Safeguards Officer will be responsible for coordinating with all GRC members and the displace persons for grievance redressal. The grievances of critical nature and those cannot be resolved at Divisional level should be referred to DLIC set up at District level they will determine the merit of each grievance and attempt to resolve the same within a month from the date of lodging of complaints. The decision of DLIC is final and cannot be contested in any other forum except in the Courts of Law.

136. The affected person can also use the ADB Accountability Mechanism through directly contact (in writing) to the Complaint Receiving Officer (CRO) at ADB headquarters or to ADB Indian Resident Mission (INRM). The complaint can be submitted in any of the official languages of ADB's DMCs. The ADB Accountability Mechanism information will include in the project information document (PID) to be distributed to the affected communities, as part of the project GRM.

137. **Recordkeeping.** Records of all grievances received, including contact details of complainant, date the complaint was received, nature of grievance, agreed corrective actions and the date these were effected and final outcome will be kept by PIU (with the support of PMDCSC) and submitted to PMU.

138. **Information Dissemination Methods of the Grievance Redress Mechanism.** The PIU, assisted by PMDCSC/ Public Communication, Awareness, Resettlement and Rehabilitation Consultant (PCARRC) will be responsible for information dissemination to affected persons and general public in the project area on grievance redress mechanism. Public awareness campaign will be conducted to ensure that awareness on the project and its grievance redress procedures is generated. The campaign will ensure that the poor, vulnerable and others are made aware of grievance redress procedures and entitlements per agreed entitlement matrix including. whom to contact and when, where/ how to register grievance, various stages of grievance redress process, time likely to be taken for redress of minor and major grievances, etc. Grievances received and responses provided will be documented and reported back to the affected persons. The number of grievances recorded and resolved and the outcomes will be displayed/disclosed in the PIU, offices, ULB notice boards and on the web, as well as reported in the semi-annual environmental and social monitoring reports to be submitted to ADB.

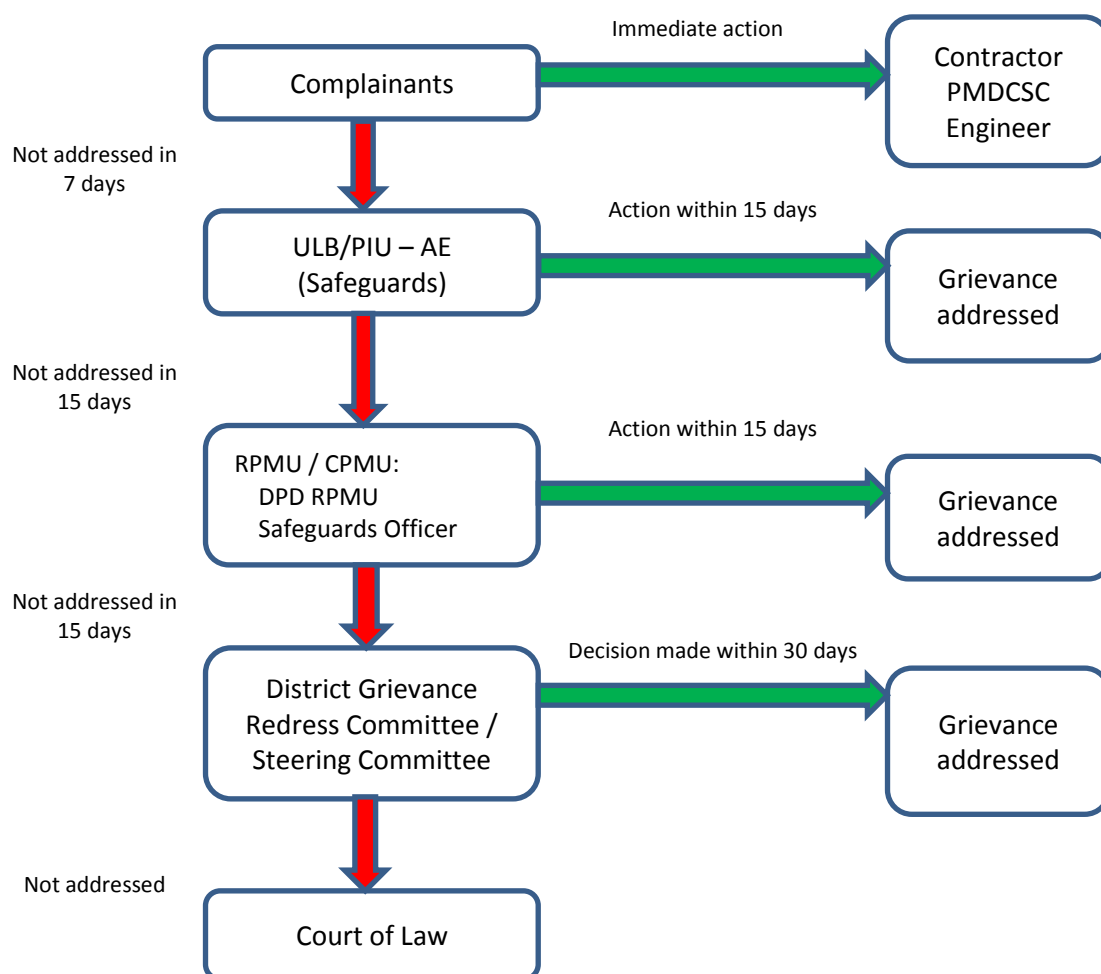
139. **Periodic Review and Documentation of Lessons Learned.** The PMU will periodically review the functioning of the GRM and record information on the effectiveness of the mechanism, especially on the PIU's ability to prevent and address grievances.

140. **Costs.** All costs involved in resolving the complaints (meetings, consultations, communication and reporting/information dissemination) will be borne by the respective PIU. Cost estimates for grievance redress are included in resettlement cost estimates.

141. **Country Legal Procedure.** An aggrieved person shall have access to the country's legal system at any stage, and accessing the country's legal system can run parallel to accessing the GRM and is not dependent on the negative outcome of the GRM.

142. **ADB's Accountability Mechanism.** In the event that the established GRM is not in a position to resolve the issue, the affected person can also use the ADB Accountability Mechanism through directly contacting (in writing) the CRO at ADB headquarters or the ADB India Resident Mission. The complaint can be submitted in any of the official languages of ADB's developing member countries. Before submitting a complaint to the Accountability Mechanism, it is recommended that affected people make a good faith effort to resolve their problems by working with the concerned ADB operations department (in this case, the resident mission). Only after doing that, and if they are still dissatisfied, they could approach the Accountability Mechanism. The ADB Accountability Mechanism information will be included in the project-relevant information to be distributed to the affected communities, as part of the project GRM.

Figure 9: Grievance Redress Process



AE = Assistant Engineer, CPMU = Central Program Management Unit, DPD = Deputy Project Director, PIU = Program Implementation Unit, PMDCSC = Program Management Design and Construction Supervision Consultant, RPMU = Regional Program Management Unit, ULB = urban local body.

X. ENVIRONMENTAL MANAGEMENT PLAN

A. Summary Environmental Impacts and Mitigation Measures

143. The purpose of the EMP is to ensure that the activities are undertaken in a responsible, non-detrimental manner with the objectives of: (i) providing a proactive, feasible, and practical working tool to enable the measurement and monitoring of environmental performance on-site; (ii) guiding and controlling the implementation of findings and recommendations of the environmental assessment conducted for the project; (iii) detailing specific actions deemed necessary to assist in mitigating the environmental impact of the project; and (iv) ensuring that safety recommendations are complied with.

144. The contractor will be required to submit to PIU, for review and approval, a site environmental management plan (SEMP) including: (i) proposed sites/locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following the approved EMP; and (iii) monitoring program as per SEMP. No works are allowed to commence prior to approval of SEMP.

145. A copy of the updated EMP/ SEMP must be kept on work sites at all times. The EMP will be included in the bid documents and will be further reviewed and updated during implementation. The EMP will be made binding on all contractors operating on the site and will be included in the contractual clauses. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance.

146. For civil works, the contractor will be required to: (i) establish an operational system for managing environmental impacts; (ii) carry out all of the monitoring and mitigation measures set forth in the EMP; and (iii) implement any corrective or preventative actions set out in safeguards monitoring reports that the employer will prepare from time to time to monitor implementation of this IEE and EMP. The contractor shall allocate a budget for compliance with these EMP measures, requirements and actions.

147. Tables 15 to 17 shows the potential adverse environmental impacts, proposed mitigation measures, responsible parties, and estimated cost of implementation. This EMP will be included in the bid documents and will be further reviewed and updated during implementation. Table 18 shows the Environmental Monitoring Plan to be implemented during project implementation and operation.

Table 15: Environmental Management Plan for Anticipated Impacts – Pre-Construction

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Fund
Submission of updated Environmental Management Plan (EMP)/Site Environmental Plan (SEP); EMP implementation and reporting	Unsatisfactory compliance to EMP	<ul style="list-style-type: none"> • Appoint Safeguards (Environment, Health and Safety) Engineer to ensure EMP implementation • Submission of updated EMP/ SEMP • Timely submission monthly of monitoring reports including documentary evidence on EMP implementation such as photographs 	Contractor	<ul style="list-style-type: none"> • Mobilization of EHS engineer • Submission of SEMP prior to start of works • Submission of monthly reports 	Contractor cost
Utilities	Disturbance/ damage to existing utilities on the sites (Telephone lines, electric poles and wires, water lines within proposed project sites)	<ul style="list-style-type: none"> • Conduct detailed site surveys with the construction drawings and discuss with the respective agencies during the construction phase before ground clearance; and • Require construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services. In case of disruption of water supply, alternative supply, through tankers, shall be provided. • Prepare and implement utility management and contingency plan • Minimize duration of service disruptions as much as possible • Provide prior information to the effected households on nature, duration of disruptions and temporary remedies provided during the disruption, and reconstruction of damaged utilities 	Program Implementation Unit/Consultant Team- Project Management, Design and Construction Supervision Consultant (PMD CSC)	Review and check the inclusion/provision in detailed project report (DPR) as appropriate	Part of project cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Fund
Social and Cultural Resources – Chance finds	Ground disturbance can uncover and damage archaeological and historical remains	<ul style="list-style-type: none"> • Create awareness among the workers and supervisors about the chance finds during excavation work • Stop work immediately if any finds are suspected to allow further investigation • Inform archaeological agencies promptly if a find is suspected, and take any action they require to ensure its removal or protection in situ. 	Construction Contractor and PMDCSC	Measures in place for chance finds	No cost required.
Design	Sewer Pumping Main – contamination to water supply or water bodies, leak, block or overflow	<ul style="list-style-type: none"> • Limit the pumping main line depth within 2.5 m depth. • Pumping main lines shall be laid away from water supply lines and drains (at least 1 m, wherever possible); • In all cases, the pumping main line should be laid deeper than the water pipeline (the difference between top of the pumping main line and bottom of water pipeline should be at least 300 mm) • In unavoidable, where pumping main lines are to be laid close to storm water drains or canals or natural streams, appropriate pipe material shall be selected (stoneware pipes shall be avoided) 	PIU/Consultant Team- PMDCSC	Review and check the inclusion/ provision in DPR as appropriate	Part of project cost

Table 16: Environmental Management Plan for Anticipated Impacts–Construction

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Fund
Construction Impacts	<ul style="list-style-type: none"> • Impacts due to excess excavated earth, excess construction materials, solid waste etc.; and • Occupational hazards which can occur to workers and public during work. 	<p>Prepare and submit a Method Statement for pumping main pipeline works in a table format with appended site layout map and cover the following:</p> <ul style="list-style-type: none"> • Work description; No. of workers (skilled and unskilled); Details of Plant, equipment and machinery, vehicles; • Work duration (total, and activity-wise, for example for pipe laying, from excavation to road resurfacing/testing); • Personal Protection Equipment (PPE) (helmet, gloves, boots, etc.) details for each type of work; • Details of materials at each site (type and quantity); • Risks/ hazards associated with the work (for example, Trench excavation will have risks such as trench collapse, persons/vehicles falling into trench, structural risk to nearby buildings, damage to buildings, infrastructure etc.); • Construction waste/debris generated (details and quantity); • Detail the sequence of work process (step-by-step) including specific details of each work; • Contractor's supervision and management arrangements for the work; • Emergency: Designate (i) responsible person on site, and (ii) first aider; and • Typical site layout plan including pipe trenching, placement of material, excavated earth, barricading, etc. <p>The pumping main line are to be laid along the roads, Roads are provided with side drains to carry rain water. The excavated soil, placed along the trench may get disturbed due to wind, rain water and the movement of workers, vehicles and pedestrians, and spill onto road way – disturbing</p>	Construction Contractor	<ul style="list-style-type: none"> • Site inspection and record verification; • Site specific Occupational Health and Safety (OHS) plan; • Spoil and waste management plan; and • Complaints from sensitive receptors and public. 	Good construction practice to be followed by contractor – no additional costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Fund
		<p>road users, creating dust, road safety issues, etc., and also into nearby open drains. The following should be included in the site layout plan:</p> <ul style="list-style-type: none"> • Provide barricading/security personnel at the site to prevent entry/trespassing of pedestrian/vehicles into the work zone; • Location of temporary stockpiles and provision of bunds; • Separation of stockpiles areas with workers/vehicle movement paths to avoid disturbing the stockpiled soil; • Wetting of soil to arrest dust generation by sprinkling water; and • Waste/ surplus soil utilization and disposal plan – indicate expected duration of temporary stockpiling along the trench at each site and identify final surplus soil utilization/disposal site in consultation with program implementation unit (PIU). 			
Utilities	Disturbance/ damage to existing utilities on the sites (Telephone lines, electric poles and wires, water lines within proposed project sites)	<ul style="list-style-type: none"> • Prepare and implement utility management and contingency plan; • Minimize duration of service disruptions as much as possible; and • Provide prior information to the effected households on nature, duration of disruptions and temporary remedies provided during the disruption, and reconstruction of damaged utilities. 	PIU	Review and check the inclusions/ provisions in the detailed project report (DPR) as appropriate	Part of project cost
		<ul style="list-style-type: none"> • Prepare a contingency plan to include actions to be done in case of unintentional interruption of services; • Conduct detailed site surveys with the construction drawings and discuss with the respective agencies during the construction phase before ground clearance; and 	Construction Contractor	Utility Contingency Plan	Part of project cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Fund
		<ul style="list-style-type: none"> In case of disruption of water supply, alternative supply through tankers, shall be provided; water may be made available by the Mangalore City Corporation, but it will be the responsibility of contractor to supply to affected people. 			
Construction work camps, stockpile areas, storage areas, and disposal areas	Disruption to traffic flow and sensitive areas and receptors	<ul style="list-style-type: none"> Prioritize areas within or nearest possible vacant space in the subproject location; Construction work camps shall be located at least 200 m from residential areas; Do not consider residential areas; for stockpiling the waste/surplus soil; and Material stockpiles shall be protected by bunds during the monsoon to arrest the silt laden runoff into drains. 	Construction Contractor	<p>List of selected sites for construction work camp, storage area and disposal area.</p> <p>Complaints from sensitive receptors</p>	Good construction practice to be followed by contractor –no additional costs
Source of construction materials	Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution	<ul style="list-style-type: none"> Contractor should obtain material from existing mines approved/licensed by Mines and Geology Department/ Revenue Department; Verify suitability of all material sources and obtain approval of implementing agency; No new quarry sites shall be developed for the subproject purpose; and Submit a monthly statement of construction material procured indicating material type, source and quantity. 	Construction Contractor	Check Sources and approval	Good construction practice to be followed by contractor –no additional costs
Air quality	Dust and emissions from construction activity may degrade the air quality	<ul style="list-style-type: none"> Consult with PIU on the designated areas for stockpiling of clay, soils, gravel, and other construction materials; Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather; Bring materials (aggregates, sand, etc. gravel) as and when required; Use tarpaulins to cover sand and other loose material when transported by vehicles; 	Construction Contractor	Site observations Informal Ambient air quality monitoring (4 locations, frequency – quarterly - 4 times a year, 9 times in 24 months, parameters - SPM, RSPM, SOx, NOx)	Good construction practice to be followed by contractor Contractor's cost – air quality monitoring (4 locations x 9 samples in construction x

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Fund
		<ul style="list-style-type: none"> • Clean wheels and undercarriage of vehicles prior to leaving construction site; • Fit all heavy equipment and machinery with air pollution control devices which are operating correctly; ensure valid Pollution Under Control (PUC) Certificates for all vehicles and equipment used in the construction activity; and • Carry out air quality monitoring. 			5000 = INR 1,80,000)
Noise Level	High noisy construction activities may have adverse impacts on sensitive receptors and structures	<ul style="list-style-type: none"> • Plan activities in consultation with the PIU so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance; • Construction work shall be limited to day light hours (6 AM to 6 PM) for all the works located within the town; Provide prior information to the local public about the work schedule; • Ensure that there are no old and sensitive buildings that may come under risk due to the use of pneumatic drills; if there is risk, cut the rocks manually by chiselling; • Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers the sound impact to surrounding sensitive receptor; and • Maintain maximum sound levels not exceeding 80 decibels (dB) when measured at a distance of 10 m or more from the vehicles 	Construction Contractor	Complaints from sensitive receptors Site observations Ambient noise monitoring (day and night time / 24 hours monitoring at 4 locations, frequency – quarterly - 4 times a year, 9 times in 24 months)	Good construction practice to be followed by contractor Contractor's cost – noise level monitoring (4 locations x 9 samples in construction x 2500 = ₹90.000)
Water Quality	Impacts on surface drainage and water quality due to contaminated runoff from construction areas in monsoon	<ul style="list-style-type: none"> • Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets; • Stockpiles shall be provided with temporary bunds; • Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, 	Construction Contractor	Site observations	Good construction practice to be followed by contractor –no additional costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Fund
		<p>consult with Implementing Agency on designated disposal areas;</p> <ul style="list-style-type: none"> • Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies; • Place storage areas for fuels and lubricants away from any drainage leading to water bodies. Storage structure should consider 110% capacity bund; and • Dispose any wastes generated by construction activities in designated sites. 			
Landscape and aesthetics	Impacts on landscape and aesthetics due to construction activity	<ul style="list-style-type: none"> • Prepare and implement Waste Management Plan – it should present how the surplus waste generated will temporarily stocked at the site, transported and disposed properly; • Avoid stockpiling of excess excavated soils as far as possible; • Avoid disposal of any debris and waste soils in the forest areas and in or near water bodies/rivers; • Coordinate with PIU for beneficial uses of excess excavated soils or immediately dispose to designated areas; • Recover used oil and lubricants and reuse or remove from the sites; • Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; • Remove all wreckage, rubbish, or temporary structures which are no longer required; and • Request program management unit (PMU)/ project management, design and construction supervision consultant (PMDSC) to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work. 	Construction Contractor	Work site inspection Complaints from public	Good construction practice to be followed by contractor – no additional costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Fund
Construction works	Hindrances to traffic movement / accessibility	<ul style="list-style-type: none"> • Plan pipeline work in consultation with the traffic police • Plan work such that trench excavation, pipe laying, and refilling including compacting, at a stretch is completed in a minimum possible time; • Provide for immediate consolidation of backfilling material to desired compaction – this will allow immediate road restoration and therefore will minimise disturbance to the traffic movement; • Do not close the road completely, ensure that work is conducted onto edge of the road; allow traffic to move on one line; • In unavoidable circumstances of road closure, provide alternative routes, and ensure that public is informed about such traffic diversions; • Maintain safe pedestrian access at all times to the houses along the work site • At all work sites public information/caution boards shall be provided – information shall inter-alia include: project name, cost and schedule; executing agency and contractor details; nature and schedule of work at that road/locality; traffic diversion details, if any; entry restriction information; competent official's name and contact for public complaints. • Prepare a Traffic Management Plan – a template is provided for reference at Appendix 8. The Traffic Management Plan should be part of the Construction Management Plan. • The list of roads where the road will be closed (e.g., old port road) partially or completely during the construction time shall be informed to Traffic police and obtain permission prior to start of work. • In densely populated areas like market place or layouts, roads with heavy traffics additional care 	Construction Contractor	Work Program Review	Good construction practice to be followed

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Fund
		<p>has to be taken. Hard barricades should be mandatorily provided along with caution board and traffic diversion boards. Some of the densely populated area identified in project area are Old Port Road, Jeppubappal to Suterpete</p> <ul style="list-style-type: none"> • Adopt trenchless method at highway and railway crossings to avoid large scale traffic disruptions 			
Nuisance/ disturbance to sensitive areas	Schools, hospitals and religious places) due construction work in the proximity (within 250 m of such place)	<ul style="list-style-type: none"> • No material should be stocked in this area; material shall be brought to the site as and when required • Conduct work manually with small group of workers and less noise; minimize use of equipment and vehicles • No work should be conducted near the religious places during religious congregations • Material transport to the site should be arranged considering school timings; material should be in place before school starts; • Notify concerned schools, hospitals, etc. 2 weeks prior to the work; conduct a 30 minutes awareness program at on nature of work, likely disturbances and risks and construction work, mitigation measures in place, entry restrictions and dos and don'ts Implement all measures suggested elsewhere in this report – dust and noise control, public safety, traffic management, strictly at the sites. 	Construction Contractor	Complaints from sensitive receptors Work program	Good construction practice to be followed by contractor – no additional costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Fund
Socio-Economic-Livelihood Impediment of access to houses and business	Impediment of access to houses and business	<ul style="list-style-type: none"> • Leave space for access between mounds of excavated soil • Provide wooden planks/footbridges for pedestrians and metal sheets for vehicles to allow access across trenches to premises where required • Consult affected business people to inform them in advance when work will occur • Address livelihood issues, if any; implement the Resettlement Plan to address these issues • Provide sign/caution/warning boards at work site indicating work schedule and traffic information; prevent public entry into work sites through barricading and security; and • Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints. • Prepare a Traffic Management Plan – a template is provided for reference at Appendix 8. The site-specific traffic management plan should be part of the Construction Management Plan. 	Construction Contractor	<ul style="list-style-type: none"> • Number of walkways, wooden planks and foot bridges; • Complaints from public; • Spoil Management Plan; and • Traffic Management plan. 	Good construction practice to be followed by contractor – no additional costs
Socio-Economic Employment	Impact on local employment generation	Employ local labor force to the maximum extent, if manpower is available	Construction Contractor	Employment Records Compliance to labor laws	NA
Occupational Health and Safety	Workers occupational health and safety	<ul style="list-style-type: none"> • Develop and implement site-specific Health and Safety (H&S) Plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment (PPE); (c) H&S Training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents; • All trenches deeper than 1 m (or less, if soil conditions are not appropriate) shall be protected 	Construction Contractor	Site specific OHS Equipped first aid station Potable water supply and clean eating area. PPE and medical insurance	Good construction practice to be followed by contractor – no additional costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Fund
		<p>against collapse to avoid safety risks to workers, public and nearby buildings/structures; provision has been made for well point type dewatering, sheet piling for shoring and strutting etc., precaution shall be taken at the time of execution;</p> <ul style="list-style-type: none"> • Take all necessary precaution during isolation and blocking of existing pumping main and connecting the new main to the existing system. Skilled supervision, appropriate apparatus and PPEs must be used; • Create awareness among all workers, supervisors and site engineers on potential hazard conditions and safety risks in working with existing/old sewer lines; working conditions may be hazardous with harmful gaseous emissions (hydrogen sulphide, carbon monoxide, methane, etc.) and oxygen deficiency; • Provide all necessary personnel protection equipment; including oxygen masks for emergency use; • Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site; • Provide medical insurance coverage for workers; • Secure all installations from unauthorized intrusion and accident risks; • Provide supplies of potable drinking water; • Provide clean eating areas where workers are not exposed to hazardous or noxious substances; • Provide H & S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; 			

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Fund
		<ul style="list-style-type: none"> • Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted; • Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; • Ensure moving equipment is outfitted with audible back-up alarms; • Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. • Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; • Disallow worker exposure to noise level greater than 85 dB for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively; and • Overall, the contractor should comply with IFC EHS Guidelines on Occupational Health and Safety (this can be downloaded from http://www1.ifc.org/wps/wcm/connect/9aef2880488559a983acd36a6515bb18/2%2BOccupational%2BHealth%2Band%2BSafety.pdf?MOD=AJPERES). 			
Community Health and Safety	Danger due to deep excavations, hindrance to traffic and chances of accident,	<ul style="list-style-type: none"> • All trenches deeper than 1 m (or less, if soil conditions are not appropriate) shall be protected against collapse to avoid safety risks to workers, public and nearby buildings/structures; provision has been made for well point type dewatering, sheet piling for shoring and strutting etc., 	Construction Contractor	<ul style="list-style-type: none"> • Traffic Management Plan • Complaints from public 	Good construction practice to be followed by contractor – no additional costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Fund
		<p>precaution shall be taken at the time of execution;</p> <ul style="list-style-type: none"> • Plan material and waste routes to avoid times of peak-pedestrian activities; • Liaise with implementing agency/Mangalore CC in identifying risk areas on route cards/ maps; identify buildings at risk prior to start of excavation work and take necessary precautions for safe conduct of work; • Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure; • Provide road signs and flag persons to warn of dangerous conditions, for all the sites along the roads; and • Overall, the contractor should comply with IFC EHS Guidelines Community Health and Safety (this can be downloaded from http://www1.ifc.org/wps/wcm/connect/dd673400488559ae83c4d36a6515bb18/3%2BCommunity%2BHealth%2BAnd%2BSafety.pdf?MOD=AJPERES). 			
Worker Camps	Temporary worker camps	<p>The contractor should establish and operate the temporary worker camps in compliance with IFC EHS Guidelines specific to workers accommodation (this can be downloaded from http://www1.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/publications/publications_gpn_workers_accommodation), including the following:</p> <ul style="list-style-type: none"> • Consult with PIU before locating workers camps/sheds, and construction plants; as far as possible located within reasonable distance of work site; • Minimize removal of vegetation and disallow cutting of trees; 	Construction Contractor	<p>List of selected sites. Written consent of land owner</p> <p>Waste Management plan</p>	Good construction practice to be followed by contractor – no additional costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Fund
		<ul style="list-style-type: none"> • Living facilities shall be built with adequate materials, should be in good condition and free from rubbish and other refuse; • The camp site should be adequately drained to avoid the accumulation of stagnant water; • Provide water and sanitation facilities; water, meeting Indian drinking water standards shall be provided, in adequate quantities (supply of 60-80 lpcd); all water storage structures must be cleaned regularly and covered properly to avoid any contamination; • Provide separate facilities for men and women; sanitary facilities shall be properly build and well maintained; toilet and bath facilities should be provided on basis of 1 per 15 or less persons; • Train employees in the storage and handling of materials which can potentially cause soil contamination; • Recover used oil and lubricants and reuse or remove from the site; • Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; • Remove all wreckage, rubbish, or temporary structures which are no longer required; and • Report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work. 			

Table 17: Environmental Management Plan for Anticipated Impacts – Operation and Maintenance

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Fund
Sewer Pumping Main	General maintenance and repair work of pumping main line	Follow standard procedures as prescribed by operation and maintenance (O&M) Manual	Mangalore City Corporation (MCC)	O&M Manual, Inspection of site and record	Part of project O&M cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Fund
	system (nuisance and disturbance to people, disruption services etc.)	<ul style="list-style-type: none"> • Ensure that all necessary equipment and tools are available for regular maintenance, especially for Sewer Pumping Main; • Implement all necessary mitigation measures suggested during construction (to avoid disturbance and inconvenience to people, business and traffic); and • Ensure operation and maintenance of Sewer Pumping Main as per the standard operating procedures to avoid, over flows, blockages, etc. and immediately conducting the maintenance work in case of such occurrences. 			

Table 18: Environmental Monitoring Plan

Sample	Site/s	Responsibility	Parameter to monitor	Frequency	Who	Cost (₹)
Construction Phase						
Ambient air quality and noise	4 points (shall be selected during construction)	Contractor	<ul style="list-style-type: none"> • SPM, RSPM, SOx, NOx • Day and night time noise (dBA) • Monitoring method as prescribed by Central Pollution Control Board 	Once before start of construction Quarterly (yearly 4-times) during construction period of 30 months – 10 times	Contractor	₹5,000 per sample – sum ₹200,000 for 40 samples
Noise Level	4 points (shall be selected during construction)	Contractor	<ul style="list-style-type: none"> • Noise level 	Once before start of construction Quarterly (yearly 4-times) during construction period of 30 months – 10 times	Contractor	₹2,500 per sample – sum ₹100,000 for 40 samples

dBA = A-weighted decibel, ₹ = Indian rupee, NOx = Nitrogen Oxide, RSPM = Respirable Suspended Particulate Matter, SOx = Sulphur Oxide, SPM = Suspended Particulate Matter.

B. Institutional Arrangements

148. **Executing Agency.** KUIDFC is the executing agency responsible for the overall technical supervision and execution of all subprojects funded under the Investment Program. Implementation activities is overseen by PMU established in its head office at Bangalore exclusively for KIUWMIP. PMU is supported by RPMU established in Mangalore headed by Deputy Project Director, to support and monitor implementation in PIUs of Tranche 2 program towns. PMU and RPMU are staffed with technical, administrative and financial officials, including safeguards specialists, to manage and monitor program implementation.

149. **Implementing Agency.** The implementing agencies are the respective ULBs, in this case Mangalore City Corporation (MCC). PIUs are set up in each program ULB for implementation of day-to-day activities in the field.

150. Other than the above institutional setup, District Level Implementation Committee (DLIC) will be set up in each district to monitor implementation of subprojects and institutional reforms. The DLIC shall consist of Deputy Commissioner of District, Deputy Project Director, RPMU, Municipal Commissioners/ Chief Officers of ULB and PMDCSC.

151. **Safeguards Implementation.** The SCMU will ensure that all subprojects comply with environmental safeguards. In each regional office in Mangalore and Davangere, a Safeguards Officer will assist in and coordinate safeguard tasks. For enhancing the monitoring role of environmental safeguards, KUIDFC will consider assigning the environmental officers at the regional officers in implementation stage. In each PIU, an Assistant Engineer (safeguards) will coordinate the safeguard tasks at PIU/town level. For Tranche 2, PIUs are established at Kundapura, Mangalore, Puttur and Udupi. The PMDCSC will assist PMU and PIUs in the implementation of the entire investment program including compliance with the environmental assessment and resettlement framework (EARF) and resettlement framework. The PMDCSC is stationed in Mangalore with the field teams in each of the PIUs. PMDCSC team includes an Environmental Specialist and a Social Development Specialist to prepare, implement and monitor all safeguard activities and ensure safeguards compliance. At the civil works stage, Contractor staff will include Safeguards / Environment, Health and Safety (EHS) engineer to supervise and report on EMP implementation.

152. The responsibility fulfilling environmental requirements of Government of India/ Government of Karnataka and conducting required level of environmental assessment as per ADB guidelines lies with the PIUs/implementing agency, i.e. MCC. Consultant Team will assist the MCC in this regard.

153. The mitigation measures identified through IEEs and EMP will be incorporated into the Investment Program implementation cycle. Mitigation measures, which are to be implemented by the Contractor, shall form part of the Contract Documents. The other mitigation measures will be implemented by the implementing agency/PIU/PMU as specified in the IEE. During the construction phase, PIU with the support of consultant team will monitor the implementation of the EMP and report to the PMU. Implementation of EMP and other environmental related measures and the results of environmental monitoring conducted during implementation will be reported to ADB through semi-annual Environmental Monitoring Reports. These will also be made available on executing agency (KUIDFC) website for wider public access.

154. **Consultant Support.** A consultant team (Project Management, Design and Supervision Consultant), based in Mangalore and with field teams in tranche 2 programs towns will assist PIUs, RPMU and PMU in day-to-day implementation of the investment program. PMDCSC will be involved in all activities including in project planning, preparation, design of subproject and cost estimates, co-ordination, procurement, technical guidance, construction supervision, contract management, safeguards implementation and monitoring, capacity development and training etc., PMDCSC includes an Environmental Specialist consultant to implement the subprojects in compliance with EARF, and will be responsible for all safeguards tasks – preparation, implementation, monitoring and reporting. In each program town, a field team of PMDCSC will be mobilized and will include an Environmental Engineer for day-to-day implementation and monitoring of EMP implementation, and also to assist Environmental Specialist of PMDCSC.

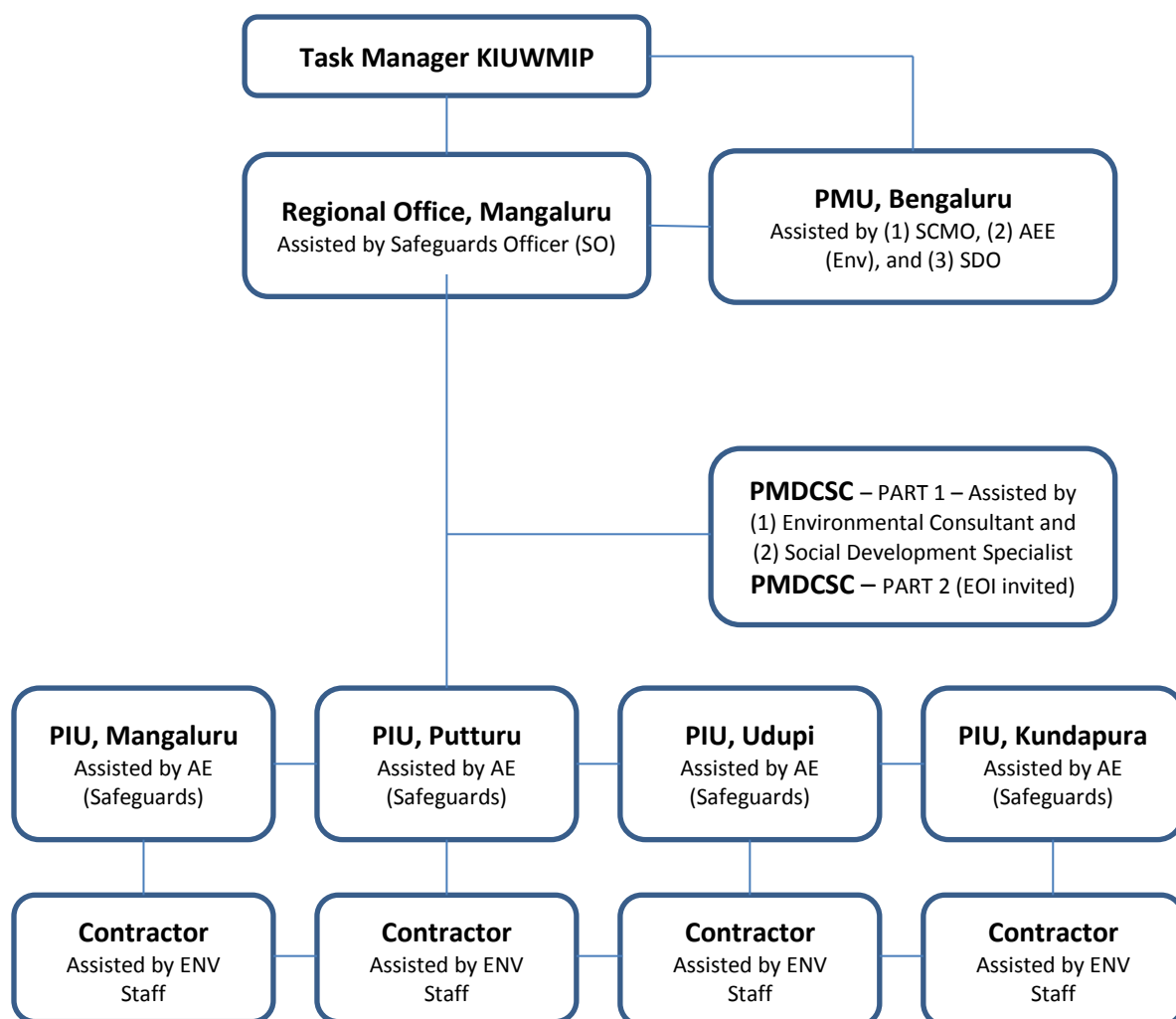
155. **Contractor:** The contractor shall appoint one Safeguards (EHS) Engineer who will be responsible on a day-to-day basis for i) ensuring implementation of EMP ii) Coordinating the CSS and environment specialists (all levels) iii) community liaison, consultation with interested / affected parties and grievance redressal and iv) reporting.

156. KUIDFC will ensure that bidding and contract documents include specific provisions requiring contractors to comply with all: (i) applicable labor laws and core labor standards on (a) prohibition of child labor as defined in national legislation for construction and maintenance

activities, on (b) equal pay for equal work of equal value regardless of gender, ethnicity or caste, and on (c) elimination of forced labor; and (ii) the requirement to disseminate information on sexually transmitted diseases including HIV/AIDS to employees and local communities surrounding the project sites.

157. Figure 10 and Table 19 summarize the institutional responsibility of environmental safeguards at all stages of the project.

Figure 1: Environmental Safeguard Implementation Arrangements



AE = Assistant Engineer, AEE = Assistant Executive Engineer, ENV = environment, EOI = expression of interest, KIUWMIP = Karnataka Integrated Urban Water Management Investment Program, PIU = program implementation unit, PMDCSC = Project Management Design and Construction Supervision Consultant, SCMO = safeguards and community mobilizer officer, SDO = Social Development Officer.

Table 19: Institutional Roles and Responsibilities

Responsible Agency	Responsibility		
	Pre-Construction Stage	Construction Stage	Post-Construction
Task Manager	(i) Review rapid environmental assessment (REA) checklists and assign categorization based on ADB Safeguard Policy Statement (SPS); (ii) Review and approve environmental impact assessment (EIA)/initial environmental examination (IEE); (iii) Submit EIA/IEE to ADB for approval and disclosure in ADB website; (iv) Ensure approved IEEs are disclosed in Karnataka Urban Infrastructure Development Finance Corporation (KUIDFC) website and summary posted in public areas accessible and understandable by local people; (v) Ensure environmental management plans (EMPs) are included in the bid	(i) Task Manager is responsible for over-all environmental safeguards compliance of the project; (ii) Review and submit to ADB semi-annual monitoring reports; (iii) Review and submit Corrective Action Plans to ADB; (iv) Organize capacity building programs on environmental safeguards; (v) Coordinate with national and state level government agencies; and (vi) Assist in addressing any grievances brought about through the grievance redress mechanism in a timely manner as per the IEEs.	Compliance monitoring to review the environmental performance of project component, if required and as specified in EMP.
Assistant Executive Engineer (Environment)	documents and contracts; (vi) Organize an orientation workshop for Program Management Unit (PMU), urban local bodies (ULBs)/City Municipal Councils (CMCs), and all staff involved in the project implementation on (a) ADB SPS, (b) Government of India national, state, and local environmental laws and regulations, (c) core labor standards, (d) Occupational health and safety (OHS), (e) EMP implementation especially spoil management, working in congested areas, public relations and ongoing consultations, grievance redress, etc; (vii) Assist in addressing any grievances brought about through the Grievance Redress Mechanism in a timely manner as per the IEEs; (viii) Organize an induction course for the training of contractors preparing them on EMP implementation, environmental monitoring requirements related to mitigation measures; and	(i) Assist in the preparation of semi-annual monitoring reports; (ii) Monitor and ensure compliance of EMPs as well as any other environmental provisions and conditions; (iii) If necessary prepare Corrective Action Plan and ensure implementation of corrective actions to ensure no environmental impacts; (iv) Organize capacity building programs on environmental safeguards at regional / divisional level (v) Coordinate with regional level government agencies; (vi) Assist in addressing any grievances brought about through the Grievance Redress Mechanism in a timely manner as per the IEEs; (vii) Assist in overseeing implementation of the EMP during construction including environmental, health and safety monitoring of contractors; and (viii) Coordinate with the General Manager,	Compliance (Appendix 10) to review the environmental performance of project component, if required and as specified in EMP.

Responsible Agency	Responsibility		
	Pre-Construction Stage	Construction Stage	Post-Construction
	<p>taking immediate actions to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation;</p> <p>(ix) Ensure compliance with all government rules and regulations regarding site and environmental clearances as well as any other environmental requirements;</p> <p>(x) Assist PMU, Program Implementation Units (PIUs), and project nongovernment organizations (NGOs) to document and develop good practice construction guidelines to assist the contractors in implementing the provisions of IEE; and</p> <p>(xi) Assist in the review of the contractors' implementation plans to ensure compliance with the IEE.</p>	<p>environmental Experts, ULBs/CMCs, NGOs, consultants and contractors on mitigation measures involving the community and affected persons and ensure that environmental concerns and suggestions are incorporated and implemented.</p>	
Safeguards Officer	<p>(i) Coordinate public consultation and information disclosure;</p> <p>(ii) Liaise with local offices of regulatory agencies in obtaining clearances/ approvals;</p> <p>(iii) Assist PMU for clearances obtained at state level;</p> <p>(iv) Review and approve contractors' updated EMPs;</p> <p>(v) Take necessary action for obtaining rights of way;</p> <p>(vi) Inform affected persons on: (a) project cut-off date; (b) public notice for schedule of land acquisition / occupation; (c) entitlement matrix; and (d) compensation packages against different categories of loss and tentative schedule of land clearing / acquisition for starts of civil works activities; and</p> <p>(vii) Coordinate valuation of assets such as land, trees of various species, etc.</p>	<p>(i) Oversee day-to-day implementation of EMP by contractors, including compliance with all government rules and regulations;</p> <p>(ii) Ensure continuous public consultation and awareness;</p> <p>(iii) Coordinate grievance redress process and ensure timely actions by all parties; and</p> <p>(iv) Review monthly contractors' EMP monitoring reports.</p>	<p>(i) Review and forward quarterly monitoring reports to PMU;</p> <p>(ii) Inform PMU of unanticipated impacts and formulate corrective action plan;</p> <p>(iii) Recommend issuance of work - construction work completion certification of the contractor upon verification of satisfactory post-construction clean-up;</p> <p>(iv) Take corrective actions when necessary to ensure no adverse impacts; and</p> <p>(v) Submit monthly social and environmental monitoring reports to PMU.</p>
Mangalore City Corporation (MCC)/PIU	<p>(i) Conduct initial environmental assessment for proposed project using REA checklists and submit to PMU;</p>	<p>(i) Ensure EMP implementation is included in measuring works carried out by the contractors and certifying payments;</p>	<p>(i) Conducting environmental monitoring, as specified in the EMP; and</p>

Responsible Agency	Responsibility		
	Pre-Construction Stage	Construction Stage	Post-Construction
	(ii) Prepare EIA/IEE based on categorization and submit to PMU for approval; (iii) Ensure IEE is included in bid documents and contract agreements. Ensure cost of EMP implementation is provided; (iv) Disclose approved EIAs/IEEs; (v) Obtain all necessary clearances, permits, consents, NOCs, etc. Ensure compliance to the provisions and conditions; (vi) EMP implementation regarding sites for disposal of wastes, camps, storage areas, quarry sites, etc.; and (vii) Ensure contractors undergo EMP implementation orientation prior to start of civil works.	(ii) Ensure Corrective Action Plan is implemented; (iii) Conduct public awareness campaigns and participation programs; (iv) Prepare monthly reports; and (v) Address any grievances brought about through the Grievance Redress Mechanism in a timely manner as per the IEEs.	(ii) Issuance of clearance for contractor's post-construction activities as specified in the EMP.
Consultant Environment Specialist at MCC/PIU level Construction Consultant Specialist at MCC/PIU level	(i) Assist ULBs/CMCs in preparation of REA checklists and EIAs/IEEs; (ii) Assist ULBs/CMCs in obtaining all necessary clearances, permits, consents, NOCs, etc. Ensure provisions and conditions are incorporated in the IEE and detailed design documents; (iii) Assist in ensuring IEE is included in bid documents and contract agreements. Assist in determining adequacy of cost for EMP implementation. (iv) Assist in addressing any concern related to IEE and EMP. (v) Assist in summarizing IEE and translating to language understood by local people.	(i) Monitor EMP implementation (ii) Recommend corrective action measures for non-compliance by contractors (iii) Assist in the review of monitoring reports submitted by contractors (iv) Assist in the preparation of monthly reports (vi) Assist in addressing any grievances brought about through the Grievance Redress Mechanism in a timely manner as per the IEEs	(i) Assist in the inspection and verification of contractor's post-construction activities.
Contractors	(i) Ensure EMP implementation cost is included in the methodology. (ii) Undergo EMP implementation orientation prior to award of contract (iii) Provide EMP implementation orientation to all workers prior to deployment to worksites (iv) Seek approval for camp sites and sources of materials.	(i) Implement EMP. (ii) Implement corrective actions if necessary. (iii) Prepare and submit monitoring reports including pictures to MCC (iv) Comply with all applicable legislation, is conversant with the requirements of the EMP; (v) Brief his staff, employees, and laborer about the requirements of	(i) Ensure EMP post-construction requirements are satisfactorily complied (ii) Request certification from ULBs/CMCs

Responsible Agency	Responsibility		
	Pre-Construction Stage	Construction Stage	Post-Construction
	<p>(v) Ensure copy of IEE is available at worksites. Summary of IEE is translated to language understood by workers and posted at visible places at all times.</p>	<p>the EMP and provide environmental awareness training to staff, employees, and laborers; (vi) Ensure any sub-contractors/ suppliers who are utilized within the context of the contract comply with all requirements of the EMP. The Contractor will be held responsible for non-compliance on their behalf; (vii) Bear the costs of any damages/compensation resulting from non-adherence to the EMP or written site instructions; (viii) Ensure that ULBs/CMCs and PMDCSC are timely informed of any foreseeable activities related to EMP implementation. (vi) Address any grievances brought about through the Grievance Redress Mechanism in a timely manner as per the IEEs</p>	

Table 20: Activity and Responsibility – Safeguard Implementation

Investment Program Phase	Activity	Details	Responsible Agency
Pre-construction phase	Investment Program Categorization	Conduct rapid environmental assessment (REA) for each subcomponent using REA checklists	Urban Local Body (ULB)
		Reviewing the REA and assigning Investment Program category (A/B/C) based on Karnataka Integrated Urban Water Management Investment Program (KIUWMIP) Environmental Assessment Guidelines and ADB Guidelines	Project Management Unit (PMU)
	Conducting executing agency	Conducting Initial Environmental Examination (IEE)/Environmental Impact Assessment (EIA) based on the Investment Program categorization Conducting public Consultation and information disclosure Preparation of IEE/EIA	Investment Program Consultants
	Investment program clearances	Fulfilling Government of India/Government of Karnataka requirement such as clearances from other Government Agencies (Appendix 5)	ULB
	Review of EIA/IEE	Reviewing the EIA/IEE Reports to ensure compliance of the report as per ADB Guidelines and approval of the same	PMU
	Disclosure of EIA/IEE	Information disclosure – IEE/EIA reports should be made available to the public, and on request IEE/EIA also made available.	ULB
	Incorporation of mitigation measures into Investment Program design	Incorporation of necessary mitigation measures identified in IEE/EIA in Investment Program design and in contract documents.	Investment Program Consultants
	Review of design documents	Review of design and contractual documents for compliance of mitigation measures	PMU
Construction Phase	Implementation of mitigation measures	Implementation of necessary mitigation measures	Contractor
	Environmental Monitoring	Environmental monitoring as specified in monitoring plan during construction stage; monitoring of implementation of mitigation measures	Investment Program Consultants
	Preparation of progress reports	Preparation of monthly progress reports to be submitted to PMU including a section on implementation of the mitigation measures	Investment Program Consultants
	Review of progress reports	PMU to review the progress reports, consolidate and send to ADB review	PMU
Operation Stage	Environmental Monitoring	Conducting environmental monitoring, as specified in the environmental monitoring plan.	ULB
	Compliance Monitoring	Compliance monitoring to review the environmental performance of sub-project component, if required and as specified in monitoring plan	Karnataka State Pollution Control Board (KSPCB)

C. Training Needs

158. The following Table 21 presents the outline of capacity building program to ensure EMP implementation. The estimated cost (under PMU cost) is (excluding trainings of contractors which will be part of EMP implementation cost during construction) to be covered by the project's capacity building program. The detailed cost and specific modules will be customized for the available skill set after assessing the capabilities of the target participants and the requirements of the project.

Table 21: Outline of Capacity Building Program

Description	Target Participants	Estimate Lump Sum (₹)	Cost and Source of Funds
1. Introduction and sensitization to environment issues (1 day) - ADB Safeguards Policy Statement (SPS) - Government of India and Karnataka applicable safeguard laws, regulations and policies including but not limited to core labor standards, occupational health and safety (OHS), etc. - Incorporation of environmental management plan (EMP) into the project design and contracts - Monitoring, reporting and corrective action planning	All staff and consultants involved in the project	10,000	Project Management Unit (PMU) cost
2. EMP implementation (3 days) - Roles and responsibilities - OHS planning and implementation - Wastes management (water, hazardous, solid, excess construction materials, spoils, etc.) - Working in congested areas, - Public relations - Consultations - Grievance redress - Monitoring and corrective action planning - Reporting and disclosure - Post-construction planning	All staff and consultants involved in the project All contractors prior to award of contract	25,000	PMU cost
3. Plans and Protocols (3 days) - Construction site standard operating procedures (SOP) - Site-specific EMP - Traffic management plan - Spoils management plan - Waste management plan - Chance find protocol - O&M plans - Post-construction plan	All staff and consultants involved in the project All contractors prior to award of contract or during mobilization stage.	25,000 25,000	PMU cost Contractors cost as compliance to contract provisions on EMP implementation (refer to EMP tables)
4. Experiences and best practices sharing - Experiences on EMP implementation - Issues and challenges - Best practices followed	All staff and consultants involved in the project All contractors All NGOs	25,000	PMU Cost
5. Contractors Orientation to Workers on EMP implementation (OHS, core labor laws, spoils management, etc.)	All workers (including manual	10,000	Contractors cost as compliance to contract

Description	Target Participants	Estimate Lump Sum (₹)	Cost and Source of Funds
	laborers) of the contractor prior to dispatch to worksite		provisions on EMP implementation (refer to EMP tables)
Total cost for Capacity Building Program on EMP Implementation		1,200,000	

PMU Fund: ₹ 85,000

Contractor Cost ₹ 35,000

Total cost for Capacity Building Program ₹120,000

D. Monitoring and Reporting

159. Prior to commencement of the work, the contractor will submit a compliance report to MCC ensuring that all identified pre-construction environmental impact mitigation measures as detailed in the EMP will be undertaken. MCC with the assistance of the consultant environment specialist will review the report and thereafter PMU will allow commencement of works.

160. During construction, results from internal monitoring by the contractor will be reflected in their weekly EMP implementation reports to the PMDCSC. These weekly reports will be retained in PMDCSC office for reference. PMDCSC will review and advise contractors for corrective actions if necessary. Monthly report summarizing compliance and corrective measures taken will be prepared by PMDCSC to be reviewed and endorsed by MCC to PMU.

161. Based on monthly reports and measurements, PMU will draft, review, and submit to ADB, 6-monthly (twice a year) EMP implementation progress report (Appendix 11). Once concurrence from the ADB is received the report will be disclosed in the Project website.

162. ADB will review project performance against the KUIDFC's commitments as agreed in the legal documents. The extent of ADB's monitoring and supervision activities will be commensurate with the project's risks and impacts. Monitoring and supervising of social and environmental safeguards will be integrated into the project performance management system. Monitoring and reporting format is attached as Appendix 11.

163. ADB's monitoring and supervision activities are carried out on an on-going basis until a Project Completion Report (PCR) is issued. ADB issues a PCR within 1-2 years after the project is physically completed and in operation.

E. Environmental Management Plan Implementation Cost

164. Most of the mitigation measures require the contractors to adopt good site practice, which should be part of their normal procedures already, so there are unlikely to be major costs associated with compliance. Regardless of this, any costs of mitigation by the construction contractors or consultants are included in the budgets for the civil works and do not need to be estimated separately here. Mitigation that is the responsibility of MCC will be provided as part of their management of the project, so this also does not need to be duplicated here. Cost for the capacity building program is included as part of the project. The EMP cost includes the cost for monitoring, capacity building, workers facility, barricades, safety measures etc. In addition to this, hard barricades need to be provided at the work sites to prevent any entry of the public or animals into the worksite and to prevent any possible accidents. All monitoring

during construction phase will be done from National Accreditation Board listed laboratory. Following Table 22 presents the environmental management cost of the subproject

Table 22: Cost Estimates to Implement the Environmental Management Plan

No.	Particulars	Stages	Unit	Quantity	Rate	Cost (₹)	Costs Covered By
A	Implementation Staff						
1	Environment, Health, and Safety (EHS) Engineer	Construction	Per month	30	30,000	900,000	Civil works contract
B.	Monitoring Measures						
1	Air quality monitoring (Quarterly - 10 Times in 30 months, at 4 locations)	Construction	Per location	40	5000	200,000	Civil works contract
2	Noise levels monitoring (Quarterly - 10 Times in 30 months, at 4 locations)	Construction	Per location	40	2500	100,000	Civil works contract
					Sub Total	300,000	
C	Capacity Building						
1	Introduction and sensitization to environment issues	Pre-construction	lump sum			10,000	PMU
2	Environmental Management Plan (EMP) implementation	Construction	lump sum			25,000	PMU
3	Plans and Protocols	Construction	lump sum			25,000	PMU
			lump sum			25,000	Civil works contract
4	Experiences and best practices sharing	Construction/ Post-Construction	lump sum			25,000	PMU
5	Contractors Orientation to Workers on EMP implementation	Prior to dispatch to worksite	Lump sum			10,000	Civil works contract
	Subtotal (B)					120,000	
D	Civil Works						
1	Construction of shelters for workers.	Construction	Lump sum			4,00,000	Civil works contract
2	Providing Water Supply Facility for the workers	Construction	Lump sum			1,00,000	Civil works contract
3	Providing Sanitation Facility for the workers	Construction	Lump sum			1,00,000	Civil works contract

No.	Particulars	Stages	Unit	Quantity	Rate	Cost (₹)	Costs Covered By
4	Barricades at the worksite (MS Sheet of 20 gauge of size 5 x 3 meters, having vertical support by MS flat (65 x 65 x 6 mm) along the sides and at 1.5 m and 3.5m, horizontal support by MS flat (65 x 65 x 6 mm) along the sides and at the center, supported by 50mm MS hollow pipes of 4 m height at the ends and at the center.	Construction	Per unit	32	15,000	480000	Civil works contract
5	Retro reflectorized Traffic Signs as per IRC: 67, M 15 grade, 80 x 60 mm rectangular; fixed over Aluminium sheeting supported on MS angle iron.	Construction	Per unit	8	3000	24000	Civil works contract
5	Retro reflectorized Traffic Signs as per IRC:67, M 15 grade, 60 x 60 mm square; fixed over Aluminium sheeting supported on MS angle iron.	Construction	Per unit	8	2500	20000	Civil works contract
	Sub Total (C)					524,000	
	Total (A+B+C+D)					1,844,000	

XI. CONCLUSION AND RECOMMENDATIONS

165. The process described in this document has assessed the environmental impacts of all elements of the infrastructure proposed under the Mangalore Sewerage Pumping Main Subproject. All potential impacts were identified in relation to pre-construction, construction, and operation phases. Planning principles and design considerations have been reviewed and incorporated into the site planning process whenever possible. Subproject is unlikely to have any significant impacts in relation to design or location.

166. The subproject components are located in the Mangalore urban area. No private land required for this subproject. There are no environmentally-sensitive areas such as protected areas, wetlands, mangroves, or estuaries in or near the subproject locations. All the sites – pumping main alignments, are along the public roads within the ROW. As the work is related to replacement of existing and functional sewage pumping main, there is risk of disrupting the sewerage services and resulting overflow of raw sewage. Therefore, measures such as laying a parallel new pumping main without disturbing the existing pumping main has been considered.

This will avoid both service disruptions and risk of working with the sewer line under operation. The new line will be laid adjacent to the existing one, and once the work is completed, the old line will be isolated, and blocked, and the new one will be connected to the system and operated. The old main will be capped from both ends and will be left as it is in the ground.

167. No significant impacts are anticipated whether due to location or design of the subproject as the sites are selected and fixed ensuring components are not located in environmentally-sensitive areas. However due to the project sites being in urban areas and nature of open cut method for sewer laying works, unavoidable impacts include (i) health and safety hazards to workers and road users during construction and operation; (ii) noise and dust from construction activities; (iii) increased road traffic due to interference of construction activities; and (iv) soil erosion/ silt runoff from construction waste soils. These impacts during construction and operation can be mitigated through good construction and operations and maintenance (O&M) practices. In the operational phase, pumping mains will operate with routine maintenance, which should not affect the environment. Facilities will need to be repaired periodically, but environmental impacts will be much less than during construction period as the work will be affecting small areas only.

168. Environmental monitoring protocols will be implemented during construction and operation to ensure compliance and the protection of environmental integrity. Observations on- and off-site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be reported to PMU. Regular and periodic surveys will be conducted to monitor the expected improvements in the quality of domestic water at intake, reservoirs and consumer levels to safeguard the health of the population.

169. The public participation processes undertaken during project design ensured stakeholders are engaged during the preparation of the IEE. The planned information disclosure measures and process for carrying out consultation with affected people will facilitate their participation during project implementation.

170. The project's grievance redressal mechanism will provide the citizens with a platform for redressal of their grievances, and describes the informal and formal channels, time frame, and mechanisms for resolving complaints about environmental performance. The EMP will assist the PMU, PIU, PMDCSC and contractors in mitigating the environmental impacts, and guide them in the environmentally sound execution of the proposed project. The EMP will also ensure efficient lines of communication between the implementing agency, project management unit, and contractors.

171. The citizens of Mangalore will be the major beneficiaries of this subproject. The new sewerage pumping mains will ensure proper conveyance of human waste from pumping stations to STP to treat to an acceptable standard. Subproject will avoid leakages and overflowing of sewage mains, and will avoid pollution of natural water bodies.

172. The Mangalore Sewerage Pumping Main subproject is unlikely to cause significant adverse impacts. The potential impacts that are associated with design, construction, and operation can be mitigated to standard levels without difficulty through proper engineering design and the incorporation or application of recommended mitigation measures and procedures.

173. Based on the findings of the IEE, the classification of the Project as Category "B" is confirmed, and no further special study or detailed EIA needs to be undertaken to comply with ADB SPS, 2009. This IEE is prepared based on detailed engineering design and needs to be

updated in future (during design validation, preconstruction and construction phases) for changes in project components, design locations or construction processes.

RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST

Replacement of Old Sewerage Pumping Main Subproject in Mangalore City

Country / Project Title:

IND: Karnataka Integrated Urban Water Management Investment Program Tranche 2- Mangalore city Sewerage Subproject

Sector /Division

Sewerage System

A. Screening Questions for Impact Categorization

Check the appropriate box (e.g. ☒) by double-clicking the box and selecting 'checked' in default value)

Screening Questions	Yes/No	Remarks
A. Project Siting		
Is the project area...		
• Densely populated?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Subproject activities extend to the selected few roads in the City including the few densely populated areas. There are no major negative impacts envisaged, because sewer pumping main lines will be alongside the existing roads and can be constructed without causing disturbance to, houses, and commercial establishments. In narrow streets, disruption to road users is likely, and measure like best activity scheduling, alternative routes, prior information to road users, houses and shops will minimize the impact to acceptable levels.
• Heavy with development activities?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Mangalore is a developing town; urban expansion is considerable
• Adjacent to or within any environmentally sensitive areas?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	None
• Cultural heritage site	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	None
• Protected Area	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	None
• Wetland	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	None
• Mangrove	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	None
• Estuarine	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	None
• Buffer zone of protected area	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
• Special area for protecting biodiversity	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	None
• Bay	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	None
▪ impairment of historical/cultural monuments/areas and loss/damage to these sites?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	There are no such areas near the subproject sites

<ul style="list-style-type: none"> interference with other utilities and blocking of access to buildings; nuisance to neighbouring areas due to noise, smell, and influx of insects, rodents, etc.? 	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	No blocking/interference with other utilities expected; subproject include sewer pumping main; necessary measures are included for smooth operation and maintenance
<ul style="list-style-type: none"> Dislocation or involuntary resettlement of people? 	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	There may also be temporary disturbance to business and squatters/vendors during construction.
<ul style="list-style-type: none"> Impairment of downstream water quality due to inadequate sewage treatment or release of untreated sewage? 	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Adequate sewage treatment capacity facility is already implemented and running successfully with tertiary treatment and reuse of treated water is in progress.
<ul style="list-style-type: none"> Overflows and flooding of neighbouring properties with raw sewage? 	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Sewerage system has been designed considering the population growth. It has been designed to accommodate sewage until year 2046. Design considers standard peak factors and therefore no such impact envisaged.
<ul style="list-style-type: none"> Environmental pollution due to inadequate sludge disposal or industrial waste discharges illegally disposed in sewers? 	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Proper treatment facilities are provided and safe guard measures are recommended.
<ul style="list-style-type: none"> Noise and vibration due to blasting and other civil works? 	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	No blasting activities envisaged. Temporary nuisance/disturbance due to construction activities will be minimized with appropriate mitigation measures.
<ul style="list-style-type: none"> Discharge of hazardous materials into sewers, resulting in damage to sewer system and danger to workers? 	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	There are no sources of hazardous material that will find its way into the sewers. Wastewater other than municipal, i.e. industrial, entering the sewerage system must meet the stipulated, and therefore it is unlikely that problematic waste will be discharged into the sewers (Appendix 3).
<ul style="list-style-type: none"> Inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances, and protect facilities? 	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Buffer zone planned in and around Sewage Treatment Plant.
<ul style="list-style-type: none"> Social conflicts between construction workers from other areas and community workers 	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Provision added to employ at least 50% or maximum extent of people from the local project area.
<ul style="list-style-type: none"> Road blocking and temporary flooding due to land excavation during the rainy season? 	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	All necessary precautions will be taken to prevent flooding during construction; flooding is unlikely as work will be mostly be conducted during dry season.
<ul style="list-style-type: none"> Noise and dust from construction activities? 	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	No major noise generating activities like rock blasting is envisaged. Dust will be temporary and will be controlled with proper measures.
<ul style="list-style-type: none"> Traffic disturbances due to construction material transport and wastes? 	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Proper planning, such as selection of routes and scheduling to avoid peak traffic hours, will be carried out in consultation with concerned authorities
<ul style="list-style-type: none"> Temporary silt runoff due to construction? 	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Natural gradient with gentle sloping topography prevail in the city and so no such impact envisaged
<ul style="list-style-type: none"> Hazards to public health due to overflow flooding, and groundwater pollution due to failure of sewerage system? 	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	A chance of failure of sewerage system is very remote; proper design and standard operating procedures will be followed in O&M; necessary

		equipment and training to workers will be provided
<ul style="list-style-type: none"> ▪ Deterioration of water quality due to inadequate sludge disposal or direct discharge of untreated sewage water? 	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	The STP design include adequate sludge treatment facilities with sludge drying beds
<ul style="list-style-type: none"> ▪ Contamination of surface and ground waters due to sludge disposal on land? 	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Presently the STP has adequate sludge treatment facilities and the dried sludge is being utilized as manure
<ul style="list-style-type: none"> ▪ Health and safety hazards to workers from toxic gases and hazardous materials which may be contained in confined areas, sewage flow and exposure to pathogens in untreated sewage and unsterilized sludge? 	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	All necessary health and safety training and necessary personal protection equipment will be given to workers and staff during operation of sewerage system
<ul style="list-style-type: none"> ▪ Large population increase during project construction and operation that causes increased burden on social infrastructure (such as sanitation system)? 	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	No such impact anticipated; local communities in the vicinity of the project would be employed as much as possible.
<ul style="list-style-type: none"> ▪ Social conflicts between construction workers from other areas and community workers? 	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	No such impact anticipated; local communities in the vicinity of the project would be employed as much as possible.
<ul style="list-style-type: none"> ▪ Risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation? 	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Not applicable. Construction/operation will not involve use of explosives and chemicals.
<ul style="list-style-type: none"> ▪ Community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning? 	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Operational area will be clearly demarcated and access will be controlled. Only worker and project concerned members will be allowed to visit the construction sites with Personnel Protective Equipment (PPE).

A Checklist for Preliminary Climate Risk Screening

Country/Project Title: India/ Karnataka Integrated Urban Water Management Investment Program

Sector: Urban Development

Subsector: Waste water (Replacement of Old Sewerage Pumping Main)

Division/Department: Urban Development

Screening Questions		Score	Remarks ⁶
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?	0	
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	0	
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s)?	0	
Performance of project outputs	Would weather/climate conditions and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	0	

Note: Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response will be categorized as high risk project.

Result of Initial Screening (Low, Medium, High): Low_

Other

Comments: _____

Prepared by:

Karnataka Urban Infrastructure Development and Finance Corporation, Government of Karnataka

⁶ If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

Applicable Ambient Air and Noise Quality Standards

Table 1: Applicable Ambient Air Quality Standards

Parameter	Location ^a	Applicable Standards Per ADB SPS ^e (µg/m ³)
PM ₁₀	Industrial Residential, Rural and Other Areas	20 (Annual) ^c 50 (24-hr) ^c
	Sensitive Area	20 (Annual) ^c 50 (24-hr) ^c
PM ₂₅	Industrial Residential, Rural and Other Areas	10 (Annual) ^c 25 (24-hr) ^c
	Sensitive Area	10 (Annual) ^c 25 (24-hr) ^c
SO ₂	Industrial Residential, Rural and Other Areas	50 (Annual) ^b 20 (24-hr) ^c 500 (10-min) ^c
	Sensitive Area	20 (Annual) ^b 20 (24-hr) ^c 500 (10-min) ^c
NO ₂	Industrial Residential, Rural and Other Areas	40 (Annual) ^b 80 (24-hr) ^b 200 (1-hr) ^c
	Sensitive Area	30 (Annual) ^b 80 (24-hr) ^b 200 (1-hr) ^c
CO	Industrial Residential, Rural and Other Areas	2,000 (8-hr) ^b 4,000 (1-hr) ^b 100,000 (15-min) ^d
	Sensitive Area	2,000 (8-hr) ^b 4,000 (1-hr) ^b 100,000 (15-min) ^d
Ozone (O ₃)	Industrial Residential, Rural and Other Areas	100 (8-hr) ^b 180 (1-hr) ^b
	Sensitive Area	100 (8-hr) ^b 180 (1-hr) ^b
Lead (Pb)	Industrial, Residential, Rural and Other Areas	0.5 (Annual) ^b 1.0 (24-hr) ^b
	Sensitive Area	0.5 (Annual) ^b 1.0 (24-hr) ^b
Ammonia (NH ₃)	Industrial Residential, Rural and Other Areas	100 (Annual) ^b 400 (24-hr) ^b
	Sensitive Area	100 (Annual) ^b 400 (24-hr) ^b
Benzene (C ₆ H ₆)	Industrial Residential, Rural and Other Areas	5 (Annual) ^b
	Sensitive Area	5 (Annual) ^b
Benzo(o)pyrene (BaP) particulate phase only	Industrial Residential, Rural and Other Areas	0.001 (Annual) ^b
	Sensitive Area	0.001 (Annual) ^b
Arsenic (As)	Industrial Residential, Rural and Other Areas	0.006 (Annual) ^b
	Sensitive Area	0.006 (Annual) ^b
Nickel (Ni)	Industrial Residential, Rural and Other Areas	0.02 (Annual) ^b
	Sensitive Area	0.02 (Annual) ^b

^a Sensitive area refers to such areas notified by the India Central Government.

^b Notification by Ministry of Environment and Forests, Government of India Environment (Protection) Seventh Amendment Rules, 2009

^c WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide. *Global update 2005*. WHO. 2006

^d Air Quality Guidelines for Europe Second Edition. WHO 2000.

^e Per ADB SPS, the government shall achieve whichever of the ambient air quality standards is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the executing agency of the government will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

Table 2: Applicable Ambient Noise Standards

Receptor/ Source	Applicable Standards Per ADB SPS ^c (dBA)	
	Day time	Night time
Industrial area	70 ^b	70 ^b
Commercial area	65 ^a	55 ^a
Residential Area	55 ^a	45 ^a
Silent Zone	50 ^a	40 ^a

^a Noise Pollution (Regulation and Control) Rules, 2002 as amended up to 2010.

^b Guidelines for Community Noise. WHO. 1999

^c Per ADB SPS, the government shall achieve whichever of the ambient air quality standards is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the executing agency of the government will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

APPLICABLE STANDARDS FOR DISCHARGE OF ENVIRONMENTAL POLLUTANTS (EFFLUENT)

Pollutants	Units	Applicable Standard per ADB SPS ^{a, b, c}
pH	pH	6 – 9 ^b
BOD	mg/l	20 ^a
COD	mg/l	125 ^b
Total nitrogen	mg/l	10 ^b
Total phosphorus	mg/l	2 ^b
Oil and grease	mg/l	10 ^b
Total suspended solids	mg/l	<50 ^a
Total coliform bacteria	MPN b / 100 ml	400a ^b

^a Environment (Protection) Amendment Rules, 2017

^b Health-based guideline values

^c Per ADB SPS, the government shall achieve whichever of the ambient air quality standards is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the executing agency of the government will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

SALIENT FEATURES OF MAJOR LABOR LAWS

Including Amendments Issued from Time to Time Applicable to Establishments Engaged in Construction of Civil Works

- (i) Workmen Compensation Act, 1923 - The Act provides for compensation in case of injury by accident arising out of and during the course of employment.
- (ii) Payment of Gratuity Act, 1972 - Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years' service or more or on death at the rate of 15 days wages for every completed year of service. The Act is applicable to all establishments employing 10 or more employees.
- (iii) Employees' PF and Miscellaneous Provisions Act, 1952 - The Act provides for monthly contributions by the employer plus workers @10 % or 8.33 %. The benefits payable under the Act are:
 - (a) Pension or family pension on retirement or death as the case may be;
 - (b) deposit linked insurance on the death in harness of the worker;
 - (c) payment of PF accumulation on retirement/death etc.
- (iv) Maternity Benefit Act, 1951 - The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage etc.
- (v) Contract Labor (Regulation and Abolition) Act, 1970 - The Act provides for certain welfare measures to be provided by the Contractor to contract labor and in case the Contractor fails to provide, the same are required to be provided by the Principal Employer by Law. The principal employer is required to take Certificate of Registration and the Contractor is required to take a License from the designated Officer. The Act is applicable to the establishments or Contractor of principal employer if they employ 20 or more contract labor.
- (vi) Minimum Wages Act, 1948 - The employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the Act if the employment is a scheduled employment. Construction of Buildings, Roads, Runways are scheduled employment.
- (vii) Payment of Wages Act, 1936 - It 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.
- (viii) 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 in the matters of transfers, training and promotions etc.
- (ix) Payment of Bonus Act, 1965 - The Act is applicable to all establishments employing 20 or more workmen. The Act provides for payments of annual bonus subject to a minimum of 8.33% of wages and maximum of 20 % of wages to employees drawing ₹3,500/- per month or less. The bonus to be paid to employees getting ₹2,500/- per month or above up to ₹3,500/- per month shall be worked out by taking wages as ₹2,500/- per month only. The Act does not apply to certain establishments. The newly set up establishments are exempted for five years in certain circumstances. Some of the State Governments have reduced the employment size from 20 to 10 for the purpose of applicability of the Act.
- (x) 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.
- (xi) Industrial Employment (Standing Orders) Act, 1946 - It is applicable to all establishments employing 100 or more workmen (employment size reduced by some of the States and Central Government to 50). The Act provides for laying down rules governing the conditions of employment by the employer on matters provided in the Act and get the same certified by the designated Authority.
 - (xii) Trade Unions Act, 1926 - The Act lays down the procedure for registration of trade unions of workmen and employees. The trade unions registered under the Act have been given certain immunities from civil and criminal liabilities.
 - (xiii) 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.
 - (xiv) Inter-State Migrant Workmen's (Regulation of Employment and Conditions of Service) Act, 1979 - The Act is applicable to an establishment which employs 5 or more inter-state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another state). The inter-state migrant workmen, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, traveling expenses from home up to the establishment and back, etc.

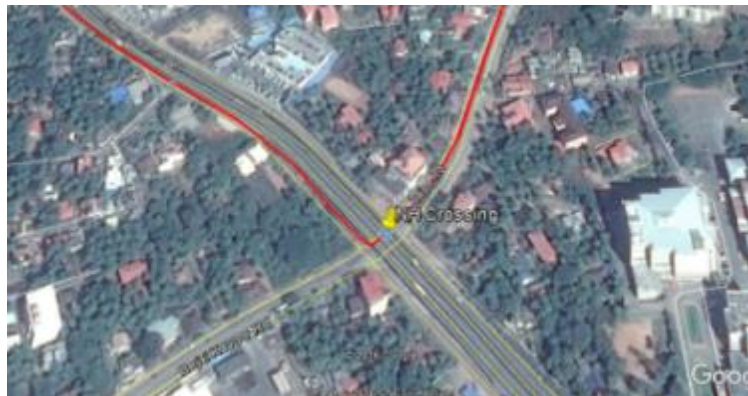
The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and the Cess Act of 1996 - All the establishments who carry on any building or other construction work and employ 10 or more workers are covered under this Act. All such establishments are required to pay Cess at rate not exceeding 2% of the cost of construction as may be notified by the Government. The employer of the establishment is required to provide 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. The employer to whom the Act applies has to obtain a registration certificate from the Registering Officer appointed by the Government

LIST OF CLEARANCE REQUIRED

No	Permission	Replacement of Old Sewer Pumping Main
1	KSPCB	NA
2	National Highways/Public Works Department	Clearance required, - under process
3	Railway	Clearance required – under process
4	Utilities (BESCOM, BSNL)	Clearance required
5	Labor License	License required
6	Forest	NA

	Size of Pipe (mm)	Ref. of MH/WW	Location of Crossing	Remarks
1	1100	WW-3, Kudroli To STP at Kavoor	NH-66, at Kuntikan Junction	NH Crossing
2	450	WW-7, JeppuBappal to RMH at Ekkur	Near Sooterpete railway level Crossing	Railway Track Crossing



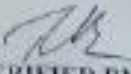
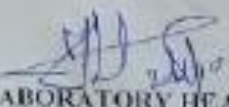
Edappally Panvel Highway-66 Crossing near Kuntikan



Mangalore –Mumbai Railway Crossing near Sooterpete



**LABORATORY ANALYSIS REPORT FOR TREATED SEWAGE EFFLUENT FROM KSPCB
FOR SEWAGE TREATMENT PLANTS AT MANGALORE**

 KARNATAKA STATE POLLUTION CONTROL BOARD No 10 B, Industrial Area Bailkumady, Mangalore 575011 Ph.No: 0824-2408420 An ISO 9001:2008 Certified Laboratory. PCB/RO(MNG)/TSE-556/2016-17/R No :301 Date: 24/10/16				
<u>ANALYSIS REPORT OF WATER QUALITY</u>				
<u>REGIONAL LABORATORY</u>				
NAME OF THE INDUSTRY:		M/s Coramandala Infrastructure P Ltd, @Enalmar behind Bajal Church, (MCC STP at Jeppu, Mangaluru.)		
SAMPLE COLLECTED BY :		AEO, Mangaluru.		
DATE OF COLLECTION :		09.09.2016.		
DATE OF RECEIPT :		13.09.2016.		
SAMPLE NO & PARTICULARS OF SAMPLE COLLECTED:		Treated Sewage Effluent (556)		
Sl No.	Parameters Analysed	Unit	Standard	Result Sample No.556
1	pH	pH unit	6.5-9.0	7.6
2	Suspended Solids	mg/L	20	22
3	BOD (3 days @ 27°C)	mg/L	10	10
4	COD	mg/L	50	69
5	Ammonical Nitrogen (as N)	mg/L	5	BDL
6	TKN	mg/L	10	BDL
INFERENCE		Conforming.		
Note: 1. The above results pertain only to the sample tested. 2. The method of analysis is as per the Standard Method for the examination of Water and Waste Water, and Indian Standard Publication. 3. ND: Not detected. 4. BDL: Below detection limit.				
 ANALYSED BY KSPCB/TEL/FO/OI		 VERIFIED BY VALID FROM 27/07/2012 RV-01		 LABORATORY HEAD

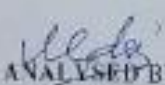
KARNATAKA STATE POLLUTION CONTROL BOARD
 No 10 B, Industrial Area-Balarampur, Mangalore-575011 Ph No: 0824-2408420
 An ISO 9001:2008 Certified Laboratory
 PCB/RO(MNG)/TSE-471/2016-17/R No:262 Date: 15/9/16


ANALYSIS REPORT OF WATER QUALITY
REGIONAL LABORATORY


NAME OF THE INDUSTRY		M/s Coramandala Infrastructure P Ltd. (@Enalmar behind Bajal Church, (MCC STP at Bejei Jeppinamogaru, Mangaluru.)		
SAMPLE COLLECTED BY:		AEO, Mangaluru.		
DATE OF COLLECTION:		19.08.2016		
DATE OF RECEIPT:		20.08.2016		
SAMPLE NO & PARTICULARS OF SAMPLE COLLECTED:		Treated Sewage Effluent (471)		
Sl No.	Parameters Analysed	Unit	Standard	Result Sample No.471
1	pH	pH unit	6.5-9.0	8
2	Suspended Solids	mg/L	20	16
3	BOD (3 days @ 27 ⁰ C)	mg/L	10	2
4	COD	mg/L	50	39
5	Ammoniacal Nitrogen (as N)	mg/L	5	BDL
6	TKN	mg/L	10	BDL

INFERENCE	Conforming
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Note: 1. The above results pertain only to the sample tested.
 2. The method of analysis is as per the Standard Method for the examination of Water and Waste Water, and Indian Standard Publication.
 3. ND: Not detected
 4. BDL: Below detection limit

ANALYSED BY  KSPCB/CEL/FO/01

VERIFIED BY  VALID FROM 27/07/2012 RV-01

LABORATORY HEAD 




KARNATAKA STATE POLLUTION CONTROL BOARD
 No 10 B, Industrial Area Baikampady Mangalore 575011 Ph No: 0824-2408420
 An ISO 9001:2008 Certified Laboratory
 PCB/RO(MNG)/TSE-471/2016-17/R No :262 Date: 15/9/16

ANALYSIS REPORT OF WATER QUALITY
REGIONAL LABORATORY

NAME OF THE INDUSTRY		M/s Coramandala Infrastructure P Ltd, @Enalmar behind Bajal Church, (MCC STP at Bejer Jeppinamogaru, Mangaluru.)		
SAMPLE COLLECTED BY		AEO, Mangaluru.		
DATE OF COLLECTION :		19.08.2016		
DATE OF RECEIPT :		20.08.2016		
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INFERENCE	Conforming
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Note: 1. The above results pertain only to the sample tested.
 2. The method of analysis is as per the Standard Method for the examination of Water and Waste Water, and Indian Standard Publication.
 3. ND: Not detected.
 4. BDL: Below detection limit

 ANALYSED BY
 KSPCB/CEL/FG/01
  VERIFIED BY
 VALID FROM 27/03/2012 RV-01
  LABORATORY HEAD

SAMPLE OUTLINE SPOILS (CONSTRUCTION WASTE) MANAGEMENT PLAN

- The Spoil Management Plan should be site specific and be part of the monthly Construction Management Plan.
- The contractor, in consultation with the PIU, has to find out appropriate location/s for the disposal of the excess soil generated. The spoils should be deposited only at these sites.
- Further precautions need to be taken in case of the contaminated spoils
- The vehicle carrying the spoil should be covered properly.
- The spoils generating from each site should be removed on the same day or immediately after the work is complete. The site / road should be restored to the original condition.

I. Spoils information

The spoil information contains the details like a) The type / material, b) Potential contamination by that type, c) Expected volume (site / component specific), d) Spoil Classification etc.

II. Spoils management

The Spoil Management section gives the details of a) Transportation of spoil b) disposal site details c) Precautions taken d) Volume of contaminated spoil, if present, d) Suggested reuse of disposal of the spoil

III. Documentation

The volume of spoil generated (site specific, date wise), site disposed, reuse / disposal details should be documented properly.

TRAFFIC MANAGEMENT PLAN

A. Principles for Traffic Management Plan around the Sewer Pumping Main Construction Sites

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

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

B. Operating Policies for Traffic Management Plan

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

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

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

C. Analyze the Impact Due to Street Closure

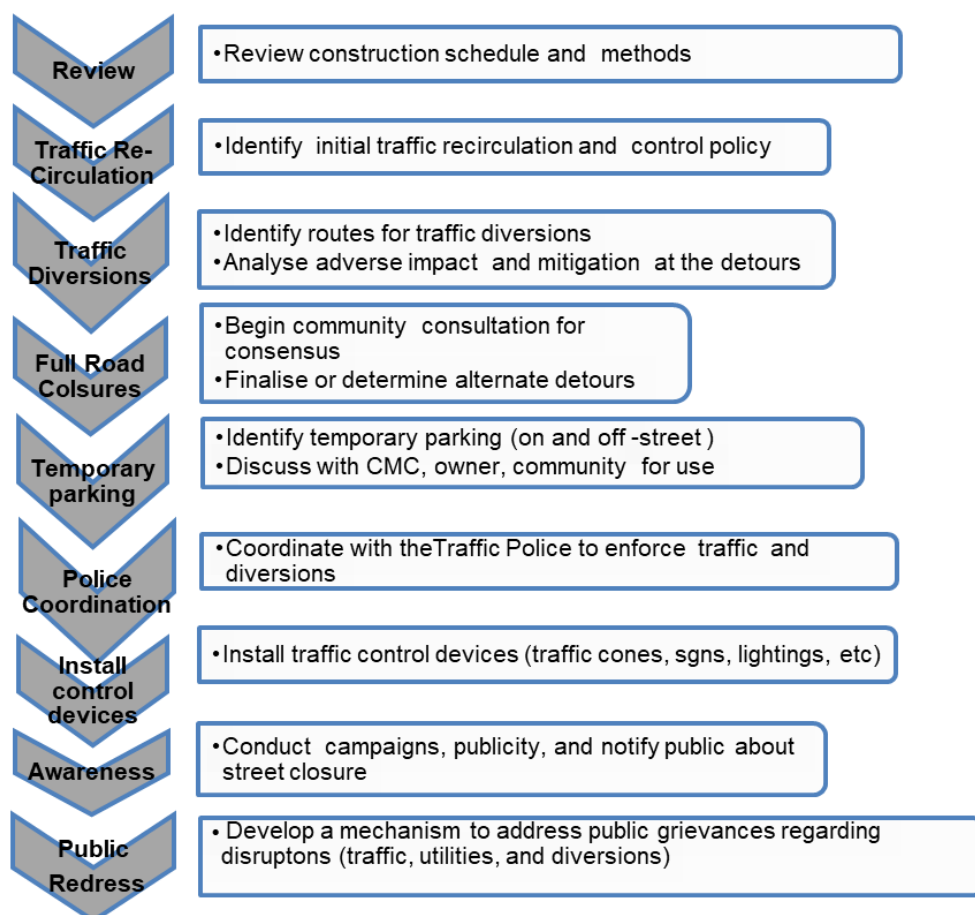
4. Apart from the capacity analysis, a final decision to close a particular street and divert the traffic should involve the following steps:

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

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

5. If full road-closure of certain streets within the area is not feasible due to inadequate capacity of the Detour Street or public opposition, the full closure can be restricted to weekends with the construction commencing on Saturday night and ending on Monday morning prior to the morning peak period.

Figure A9.1: Policy Steps for the Traffic Management Plan



D. Public Awareness and Notifications

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

7. The awareness campaign and the prior notification for the public will be a continuous activity which the project will carry out to compensate for the above delays and minimize public claims as result of these problems. These activities will take place sufficiently in advance of the time when the roadblocks or traffic diversions take place at the particular streets. The reason for this is to allow sufficient time for the public and residents to understand the changes to their travel plans. The project will notify the public about the roadblocks and traffic diversion through public notices, ward level meetings and city level meeting with the elected representatives.

8. The PIU will also conduct an awareness campaign to educate the public about the following issues:

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

9. It may be necessary to conduct the awareness programs/campaigns on road safety during construction.

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

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

E. Install Traffic Control Devices at the Work Zones and Traffic Diversion Routes

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

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

12. Procedures for installing traffic control devices at any work zone vary, depending on road configuration, location of the work, construction activity, duration, traffic speed and volume, and pedestrian traffic. Work will take place along major roads, and the minor internal roads. As such, the traffic volume and road geometry vary. The main roads carry considerable traffic; internal roads in the new city areas are wide but in old city roads very narrow and carry considerable traffic. However, regardless of where the construction takes place, all the work zones should be cordoned off, and traffic shifted away at least with traffic cones, barricades, and temporary signs (temporary “STOP” and “GO”).

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

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

14. The work zone should take into consideration the space required for a buffer zone between the workers and the traffic (lateral and longitudinal) and the transition space required for delineation, as applicable. For the works, a 30 cm clearance between the traffic and the temporary STOP and GO signs should be provided. In addition, at least 60 cm is necessary to install the temporary traffic signs and cones.

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

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

Figure A8.2 and A8.3: Work on Shoulder or Parking Lane and Shoulder or Parking Lane Closed on Divided Road)

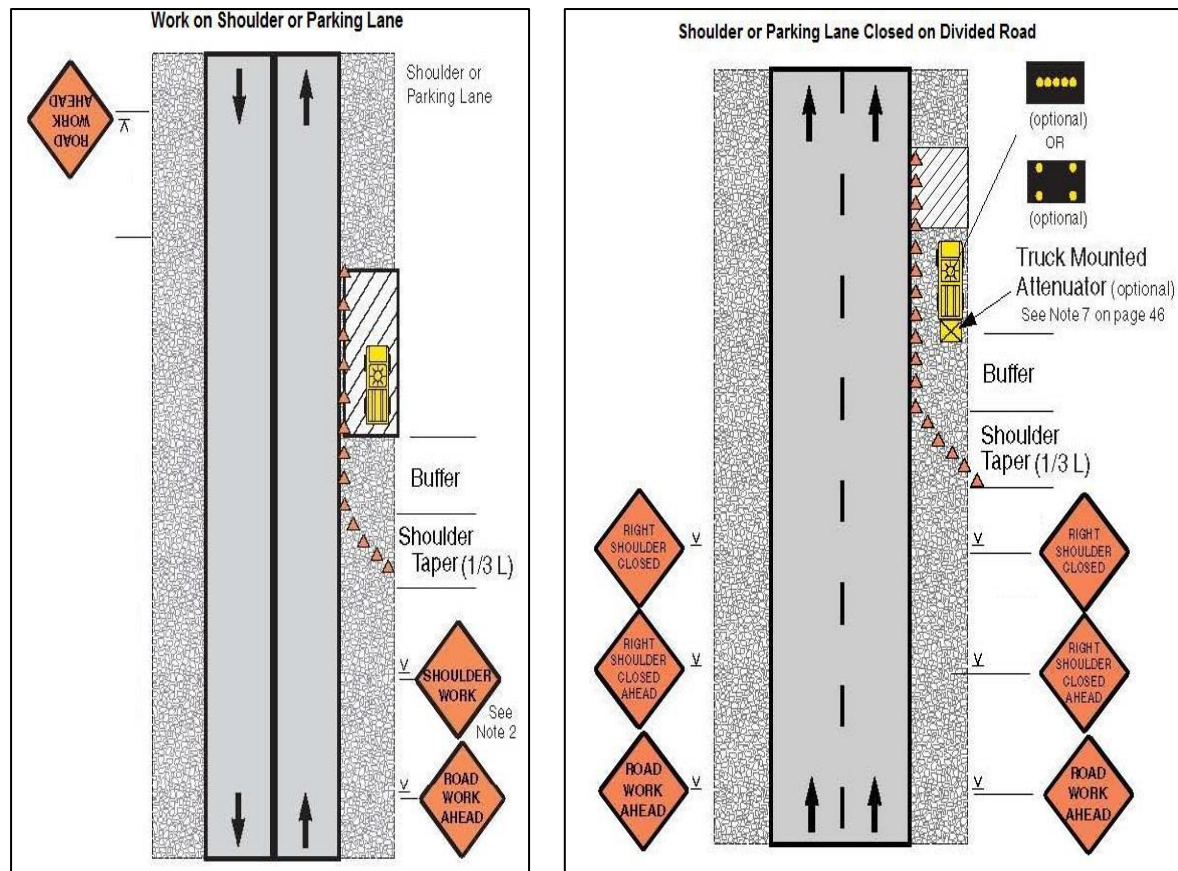


Figure A8.4 and A8.5: Work in Travel Lane and Lane Closure on Road with Low Volume

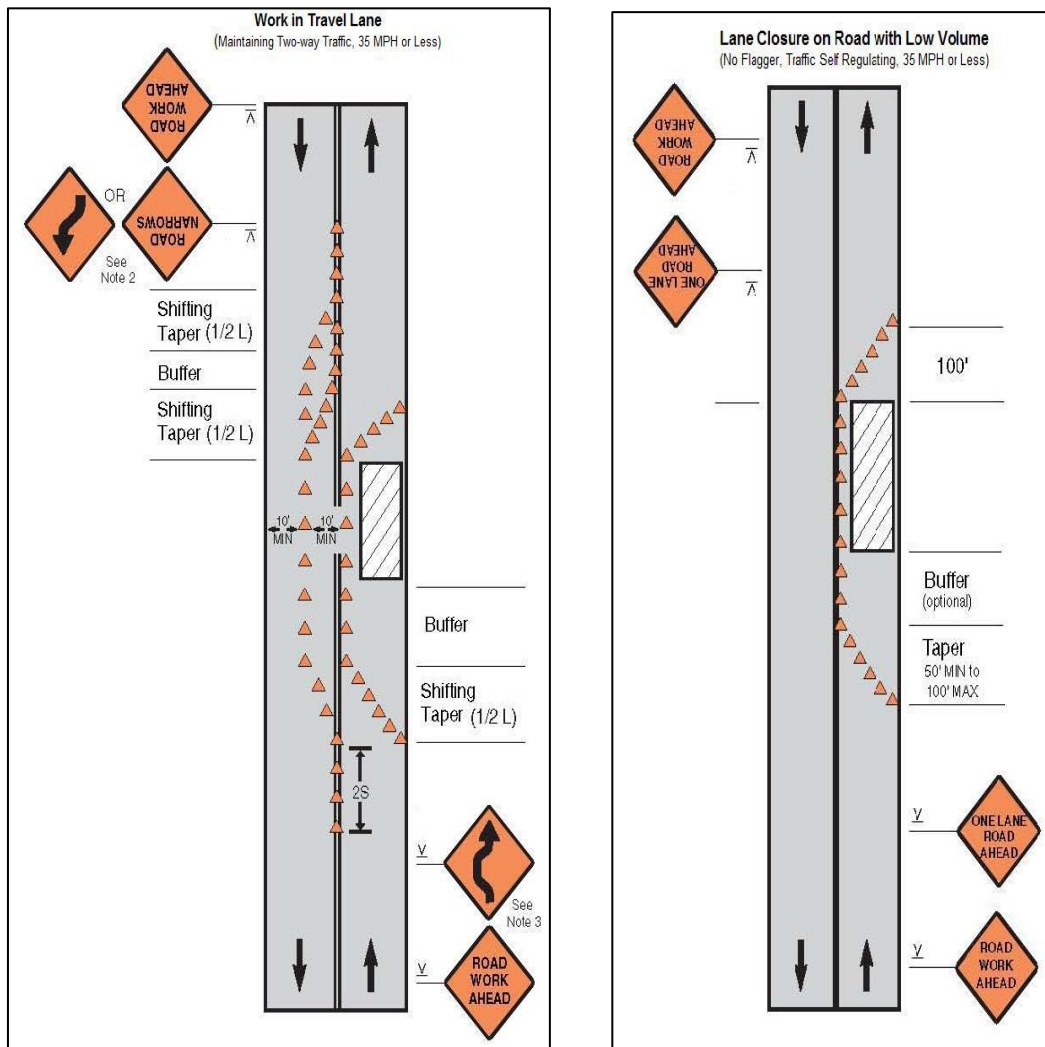


Figure A8.6 & A8.7: Lane Closure on a two-line road with low volume (with yield sign) and Lane closure on a two-line road with low volume (one flagger operation)

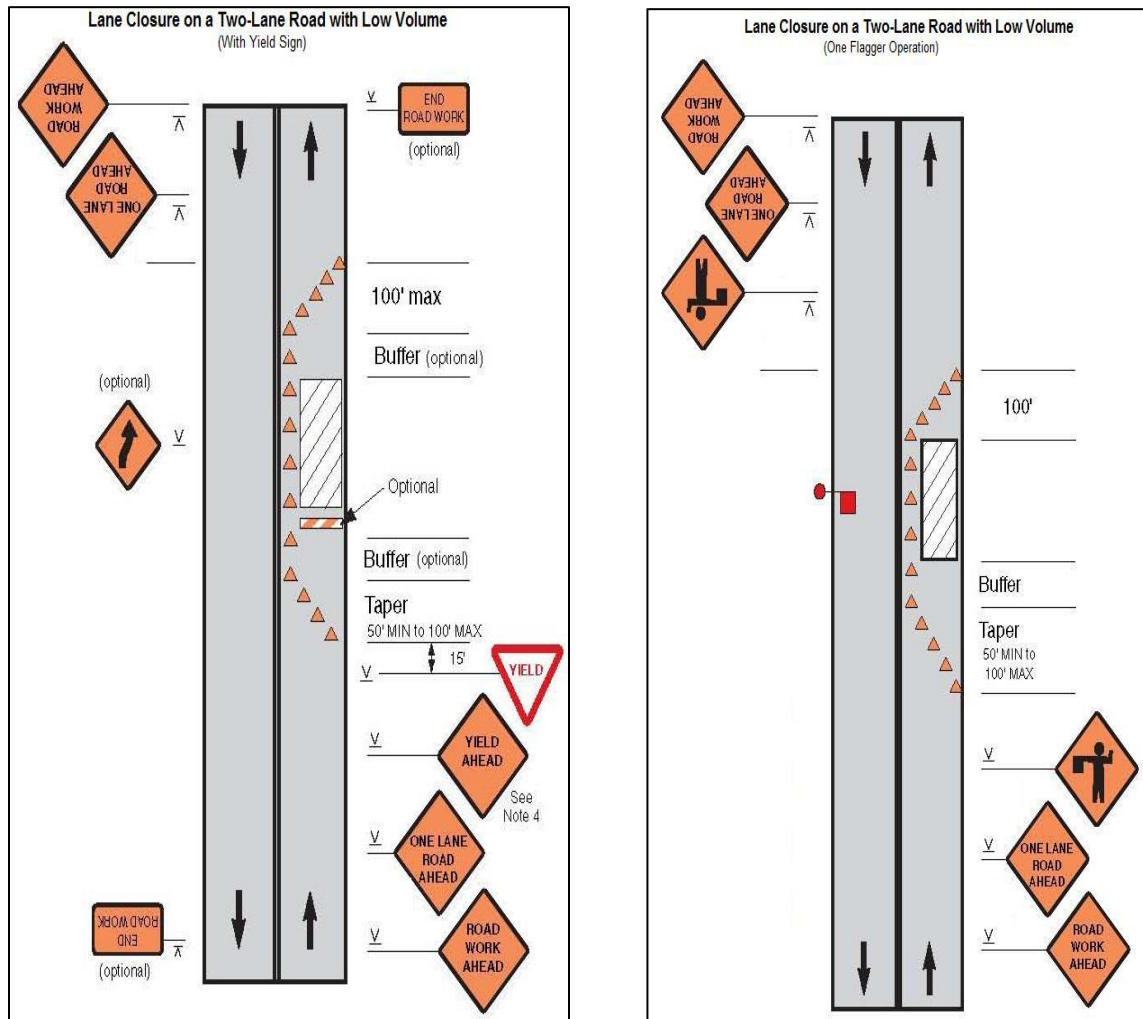


Figure A8.8 and A8.9: Lane closure on a two-lane road (two flagger operation) & Lane closure on a four-lane undivided Road

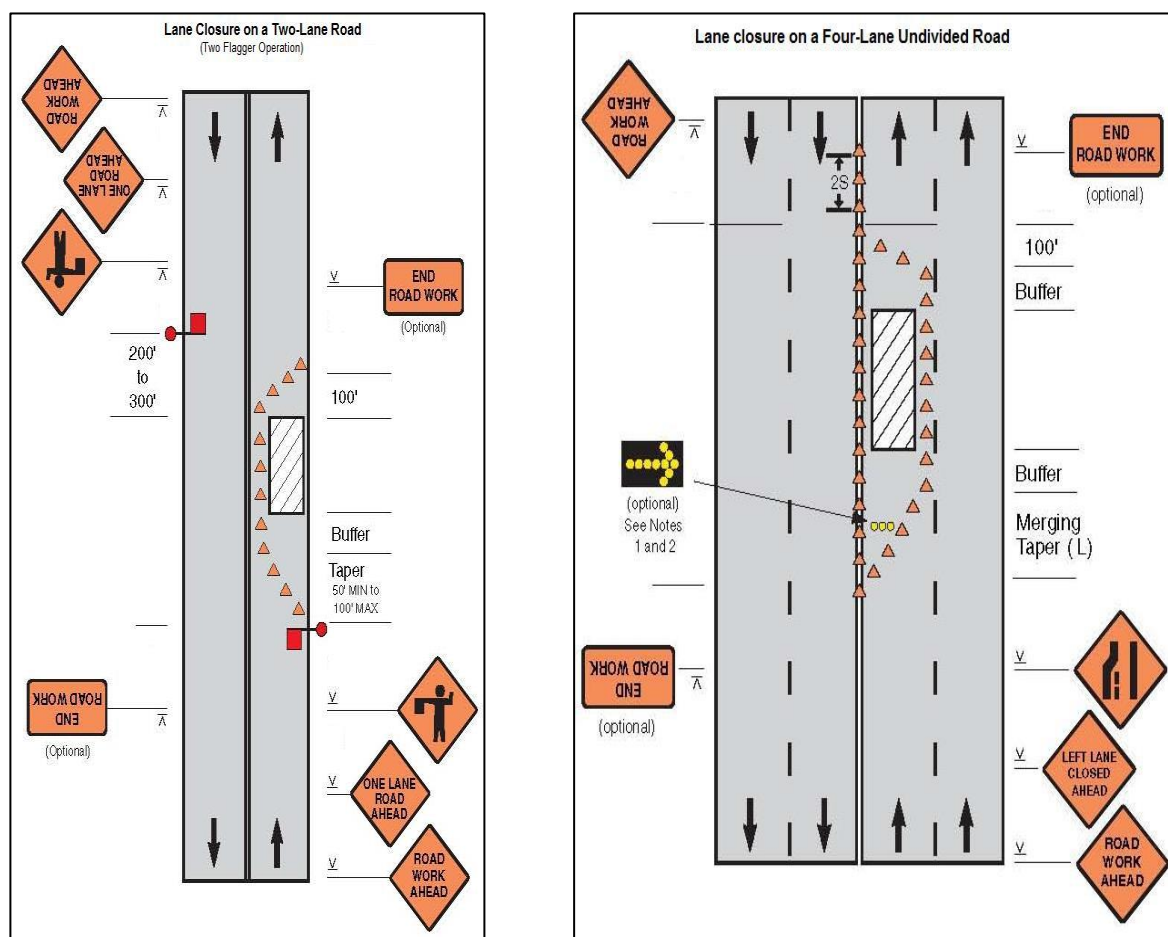


Figure A8.10 and A8.11: Lane closure on divided roadway & Half road closure on multi-lane roadway

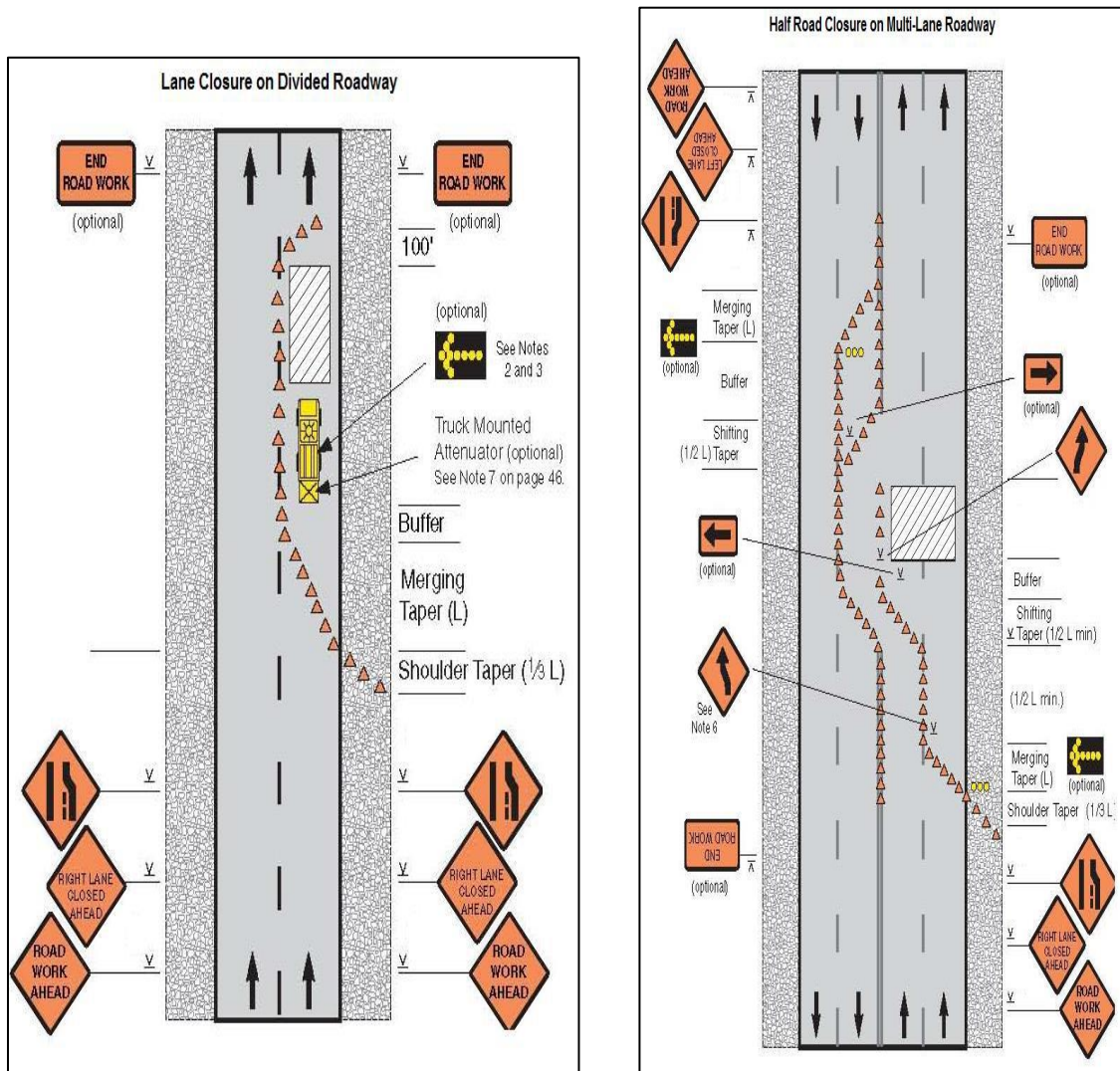
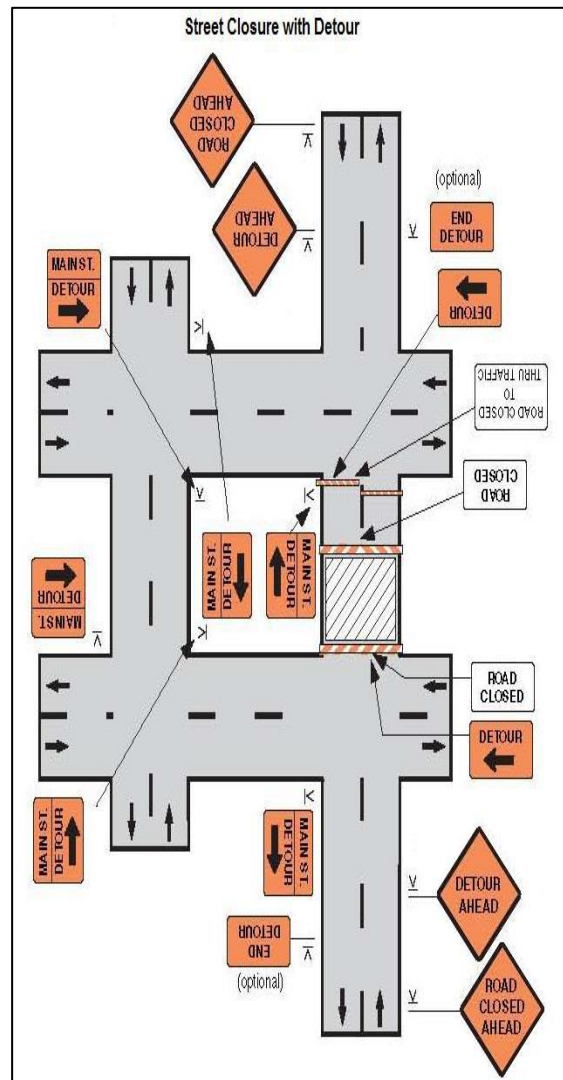


Figure A8.12: Street closure with detour



OPERATION AND MAINTENANCE GUIDELINES

1. Replacement of Old Sewer Pumping Main

Quality maintenance shall be the most important step in smooth functioning of the proposed sewers. This includes the optimum use of labor, equipment and material to keep the system in good condition. The following sessions deals with methods of sewer cleaning, staff pattern, organisational set-up for proposed sewerage system and the duties, powers and responsibilities of the staff dealing with proposed system for the town. The following recommendations are made for the smooth maintenance of the sewerage system in the town.

General

Quality maintenance of sewerage system consists of the optimum use of labor, equipment and materials to keep the system in good condition, so that it can accomplish efficiently its intended purpose of collection and transportation of wastewater to the treatment plant.

Types of Maintenance

There are two types of maintenance of a sewerage system - preventive and emergency. It is necessary that preventive or routine maintenance are to be carried out to prevent any breakdown of the system and to avoid emergency situations like clogged pumping main line, over flowing manholes or backing up of sewage into a house or structural failure of the system. Preventive maintenance is more economical and provides for reliability in operations of the sewer facilities. Emergency repairs, which would be rare if proper maintenance is carried out. Proper inspection and preventive maintenance is a necessity.

The primary effort of the staff is to maintain sewers free flowing and unobstructed. The sewer system with its components properly designed and installed is handed over to the person in charge of maintenance who assumes the responsibility to make it function satisfactorily for the benefit of the community. One should have sufficient experience of the system to enable him to perform his task efficiently with an understanding and appreciation of the problems that may arise during maintenance. One has not only to be a technical man but has also to deal with human relations in order to be successful in his work. Service training shall be imparted to the maintenance personnel to improve upon the methods adopted based on the latest trends. Failure to develop a better understanding of human relations and also lack of development of the concept of service to the community generally results in the maintenance part becoming unpopular. The general public is also to be made aware of do's and don'ts to help in keeping the sewers free flowing and unobstructed. Steps to be taken for operation and maintenance of the sewerage network detailed in this section are aimed at:

- Regular maintenance of the system for proper functioning;
- Preventing any breakdown of the system;
- Emergency operations to deal with clogged pumping main line or overflowing manholes;
- Preventing backflow of sewage into residences; and
- Preventing structural failure of the system.

Institutional Structure

A separate Operations and Maintenance Wing is proposed for an effective maintenance of sewerage system. A sewer maintenance crew comprising of a gang leader and four workers shall be set up in each sector comprising 20 km of Sewer Pumping Main for regular cleaning

and maintenance of the pumping main line. There will be three such crews under one sewer inspectors. The supervisors report to the Junior Engineer who in turn reports to Assistant Executive Engineer. The Junior Engineer, Sewerage Inspectors and the crew can look after the sewerage, drainage and other solid waste management activities in the town. The Crew works as per the instructions of the supervisors. The supervisors hold the charge of the particular sectors or districts under their jurisdiction and will follow up the works like cleaning of sewers. They shall be assigned the work to take care of the sewerage network and the sewage treatment plant proposed. Care should however be taken to ensure that the debris, brickbats, mortar, etc. is removed immediately after the repair work. A record of daily works done by the sewer maintenance team has to be maintained in a logbook in order to identify the chronic trouble spots, take extra care of these spots and necessary remedial action.

The following list gives the duties that are to be performed for proper sewer maintenance:

- Inspection of sewers, sewer appurtenances etc.;
- Cleaning of sewers and sewer appurtenances;
- Checking manhole conditions for deposition of silt etc.;
- Replacing broken manhole covers.;
- Raising the manhole cover for the construction of culverts, resurfacing etc.
- Approval of sewer connection applications and executing connections
- Maintaining records of sewers including:
 - Permanent construction;
 - Daily operation and maintenance report;
 - Complaints register;
 - Stock of equipment;
- Disposal of silt, garbage removed after cleaning sewer, manholes and treatment plants;
- Removal of debris, brickbats etc. after any repair work;
- Identifying locations where regular maintenance is needed (problem areas) in sewers;
- Ensuring work is carried out correctly and safely with due regards to health and safety regulations;
- Adopting preventive maintenance within the sub division as a whole; and
- Conducting periodic staff meeting and record of the proceedings.

Sewer Cleaning Equipment and Procedures

General Practice

In addition to the routine sewer cleaning equipment such as pick-axes, manhole guards, tripod stands, danger flags, lanterns, batteries, safety lamps, lead acetate paper, silt drums, ropes, iron hooks, handcarts, plunger rods, observation rods, shovels, etc., a Pull through Disc with Rope, Jetting Machine (Velocity Cleaners) and Hand Operated Winching Machine are also recommended for effective maintenance.

- For small diameters (150 to 400 mm dia), Jetting machines are used.
- For larger diameters (400 to 1100 mm dia), bucket cleaning equipment is used.
- For larger diameters (Above 1100 mm dia), manual de-silting of sewers is practiced.

Manual Cleaning

In manual cleaning method, the silt is collected manually from manholes and large sewers where man- entry is possible. This is however a very slow and risky operation. Proper artificial ventilation and adequate safety precautions are required before the men enter the sewers. The depth of most of the sewers, are considerable in some cases; the velocity can also be expected to be low leading to generation of gases. All personnel entering the manhole should have proper safety equipment. There should be forced ventilation by using air blowers on manholes upstream of the concerned length. All such personnel should use safety harness fastened at the other end and another crew member should monitor crew who has entered the manhole.

Passing Rope Knots and Discs

In this method of sewer cleaning, solid split bamboos are passed through sewers from one manhole to the other to create a link. Ropes are attached to this link and a rope link is created between two manholes. A wooden disc with rubber gasket ring or a series of knots of rope are formed and pulled through the sewer to and from. The inside of the sewer (sewer fabric) gets scrubbed due to this procedure and dislocates the encrusted silt. The freed silt flows away downstream and in this way the sewer can be cleaned from upstream to downstream. This method is labor intensive and hence expensive. Further such vigorous scrubbing sometimes breaks the joints and damages the sewer fabric. This method is therefore no longer adopted in modern sewer maintenance practices.

Bucket Cleaning Equipment

In the method of utilizing the bucket cleaning equipment, two winches are installed on two manholes. A rope link is established. A bucket is attached to the rope and pulled from one end to the other. The silt deposited in the sewer is collected in the bucket and is taken out from a manhole. This method can cause damage to manholes and sewer fabric due to heavy pulling if not done properly.

Jetting & Suction Equipment

Jetting and suction equipment is mounted on a truck chassis. Water is stored in a tank (usually 6000 lit capacity) mounted on the truck. This water is jetted in the pumping main line using a high-pressure pump and a nozzle system. Fine jets with high velocity are generated. On the forward and the backward pass of the jet, the deposited silt is loosened and gets washed down and is collected in the downstream manhole. From this manhole, it is sucked out in a slurry form to a silt tank mounted on the chassis. Various sizes of jets and suction can be used to clean various diameter sewers. The Indian equipment available is usually effective for sewer up to 300mm diameter and can be used up to 450 mm diameter with some modifications. For larger diameter sewers, imported heavy-duty suction and jetting machines can be used. In the latest sewer maintenance programs, these machines are preferred by all and could be conveniently used.

Hand Operated Winch Machine

This is used to clean sewer pipes larger than 300 mm. diameter which are blocked to a significant extent.

Safety & Precautions

Adequate safety measures and precautions are most important while maintaining the sewer systems. These precautions should necessarily comprise of:

- Ventilating pumping main line by opening two or three manholes on both sides of working pumping main line for about one hour;
- Using gas masks while entering the pumping main line;
- Placing at least two helpers at the top and sending signals at every few minutes to the person in the manhole;
- Testing manhole rungs or steps for structural safety before using;
- Lowering all the tools to the workman in bucket and ensuring that no tools are located near the manhole edge that could fall in to the manhole and injure the workman;
- Using lighting equipment that are explosion and fire proof;
- Adequate and easily readable warning signs to the traffic well ahead of the work area;
- Posting flagman at the two ends of the working pumping main line to avoid traffic jams;
- Avoiding infections by using rubber gloves, gum boots, separate cloths while working; and
- By keeping records of injury with description of accident, corrective actions taken and the accident analysis.

In addition to the above, an up-to-date record of maps and profiles have to be maintained duly incorporating any changes made, if any, during construction and repair works. This will help in proper maintenance of the system.

C. Sewerage Treatment Plants

The following sessions covers the routine operation and maintenance plans for the STP. The exact method and nature of operation may vary / differ with respect to the model and specification of the machinery and equipment. Therefore, manufacture's manual and hand book should be referred before finalizing these operation and maintenance plans. The operator shall carry out preventive, routing maintenance and break down maintenance operations for proper upkeep of plant in accordance with good operating practices.

1. Daily

A. Sewage Pumping station & Sewage Treatment Plant

- (i) Operate the centrifuge for sludge drying and treat incoming sewage at prescribed standards through optimal dosing;
- (ii) Carrying out daily cleaning of grit channels and removal of screenings and disposal of floating matter in grit dewatered sludge out of premises;
- (iii) Cleaning of the overflow weirs and weekly scarping of the floor and walls of the lauder;
- (iv) Carrying out continuous flow measurements of treated & untreated sewage and recording the same;
- (v) Checking the operation, correcting defects related to calibration and setting, minor repairs and proper up keeping such as cleaning for Screens/ Grit Channels, Moving parts of screens and grit removal equipment, Blowers /Agitators / Pumps/ Agitators /Return Sludge pumps/ Chemical mixer/Centrifuge/Decanter, Stuffing box, Bearings,

Balancing on Decanter, Chemical dosing and mixing, Motor contact tightness, Cable insulation near the lugs, Panel breaker and starter, contacts of relay and circuit breaker, Setting of over current relay, no-volt coil and tripping mechanism, transformer sub-station, Ground Operated dis-connectors, radiators and earth pit;

- (vi) Providing security for facilities and system at all times;
- (vii) Ensure continuous power supply, provide necessary power back up; and
- (viii) Ensure the smooth flow into the treatment plant.

B. Daily Reports

- (i) Daily summary of Operations at Pumping Stations: A daily report providing information at each pumping station, on the hours of pumping quantity of sewage pumped and energy consumed during the day; and
- (ii) Daily summary of Operations at Sewage Treatment Plant – A daily report of operation of the diffuses, agitators, decanter and other equipment at the sewage treatment plants providing information on the quantity of sewage treated, hours of operation of equipment, energy consumed and use of chemicals.

2. Monthly

A. Pumping Machinery and Treatment Plant Equipment

- (i) Checking for damaged pipes, fittings and valves for suction and delivery pipes and replacing / repairing them as required;
- (ii) Checking pump impellers, body, bearings shafts column pipes and repairing / replacing them if required;
- (iii) Checking of motors, starters, circuit breakers, capacitors, vanes and/or gears of agitators, transformers, blowers, decanters, diffusers, chlorinator, chemical dosing equipment and centrifuge, and repairing / replacing as required;
- (iv) Calibration, minor repairs and up keeping of Sewerage level indicators in wet well, manholes, wet well interiors and Lighting arrestors; and
- (v) Checking the operation, correcting defects attending to calibration and setting, minor repairs and proper up keeping such as Screen and Grit channels, Chain in mechanically operated components, screen performance, transformer, Oil in transformer, relay alarm circuit, load and voltage.

3. Quarterly

A. Pumping Station Complex

- (i) Checking the pipes and repair /replacing damaged pipes, fittings and valves as required; and
- (ii) Checking the level indicator, lighting conductor etc and replacing / repairing if required.

B. Pumping Machinery and Treatment Plant Equipment

- (i) Cleaning and maintaining all rising mains/sewers in the plant area.
- (ii) Checking the operation, correcting defects attending to calibration and setting, minor repairs and proper up keeping such as transformer bushing and dehydrating breathers.
- (iii) Collecting samples of influent and effluent and analyzing them daily to determine the quality of sewage and performance of the treatment plant
- (iv) Checking of the walkways for corrosion
- (v) Conducting Safety audit on routine basis.

C. Quarterly Reports

- (i) Sewage Quality Monitoring – A quarterly report monitoring the quality of raw and treated sewage through the analysis of samples (Inlet and outlet water quality for Bio-Chemical Oxygen Demand (BOD)/COD/TSS/TKN / TN, TP, Colour etc,)
- (ii) Testing of the Parameters like testing for MLSS etc. on quarterly basis.

4. Half Yearly

A. Pumping Station Complex

- (i) De-silting of wet well and disposing silt.
- (ii) Pumping Machinery and Treatment Plant Equipment
- (iii) Dewatering and de-silting of sludge sump, chlorination tank, chemical dosing tanks and disposal of silt.

B. Pumping Station Complex, Wet well, Buildings and other Civil Structures

- (i) Checking the roof and walls for water proofing.
- (ii) Checking the operation, correcting defects attending to calibration and setting, minor repairs and proper up keeping such as pumps, blowers, agitators, compressor, decanters, centrifuge, gland of stuffing box, gland bolts, gland packing, alignment of pump aerator and drive, oil lubricating bearings, tripping elements for motor protection, contact points and fuse ratings.

5. Annual

A. Pumping Station and Treatment Complex

- (i) Checking the ladders and repairs / replacing as required.
- (ii) Checking for Leakages in structures, ladders, railings, structural damages to the wet and dry well and overflow drain.
- (iii) Checking the operation, correcting defects attending to calibration and setting, minor repairs and proper up keeping such as paint screens, grit removal mechanism, scrapers, motor pipes, valves, fittings agitators, inlet / outlet weirs.
- (iv) Carry out routine maintenance and minor repairs including cleaning, repair to plaster doors, windows and painting.

6. Contingency

The contractor need to prepare contingency plans in respect of responses to natural disasters, periods of power failure, storm water inflow into sewers during monsoon, de-silting of units of treatment plants, constraint operations or other similar emergencies to maintain the quality of treated sewage.

7. Energy Audit

The Operator shall take all necessary measures to minimize the power consumption in carrying out its operations. The energy audit operations shall include, but not be limited to the following.

- (i) Reducing electricity consumption by regulating pumping through suitable modifications to the operating schedules.
- (ii) Installing more efficient pumping equipment and following better maintenance practices for electrical installation.

DETAILS OF THE STAKEHOLDER/PUBLIC CONSULTATION MEETING

Date: 06.12.2016 and 08.12.2016

Public consultation had been conducted extensively to assess the impact of proposed civil work on the livelihood of the people and also to update Resettlement Plan (RP). The site verification reveals that, all the components of the sewerage system sub projects are either located on existing right of way of city roads or the open govt land. Proposed pumping alignment having road width above 5 meters and the photographs of the proposed pumping main alignments are attached. Respective Ward Councillors were present in the public consultation process and supported the project by creating awareness about the subprojects and requested the people to support the project during implementation. The people who participated in the public consultation expressed that the proposed civil work is useful to create healthy environment in the city and also promised that they will extend their support during construction work.

Issues discussed in the Public Consultation:

- The subproject details have been provided in detail to the people who are involved in public consultation and also asked their suggestions and willingness to complete the proposed civil work. The participants expressed their willingness and support to complete the civil works.
- The inconvenience to approach the shops and residences during construction even after providing access by the contractor was explained to the participants and they expressed that they are willing to bare the inconvenience for a good cause.
- Suggestions received from the participants in the public consultation:
 - (i) Maintaining access to shops by providing planks and leaving spaces to avoid disturbance to residents and businesses;
 - (ii) Open pits to be guarded properly for safety reason, especially during day time working period, near road crossings, near school complex, etc;
 - (iii) Managing traffic flows as per the traffic management plan prepared by the contractor in coordination with local authorities and communities;
 - (iv) Limiting period of time for open trenches;
 - (v) Completing works quickly where large numbers of businesses are located;
 - (vi) Avoiding full street closure to the extent possible;
 - (vii) Providing employment opportunities to the displaced persons during construction works, especially vulnerable displaced persons, if necessary;
 - (viii) Placing telephone hotlines on signs on visible areas to notify in case of emergency;
 - (ix) Making the community fully aware of the grievance redress mechanism,
 - (x) Providing contact number of responsible persons in the RPMU and ULB offices; and
 - (xi) Providing assistance to vendors and hawkers in shifting to alternative nearby locations and helping in the reinstallation of their businesses early.

The details of public consultation are as follows:

Name of the Ward: Hoigebazar, Bolar
 Name of the Councilor: Mrs. Kavitha
 Area: Mulihithlu

	Name and Address of the Person Consulted	Contact No.	Present Condition of UGD System	What Improvement is Required in the Present Condition	Contacted Person is the Beneficiary of the Proposed Project Yes/ No	Proposed Project Cause Any Social Issue? Yes/ No (If Yes, provide details)	Suggestions for the Proposed Project
1	Mr. Yathish Shetty S/o Shashindra Shetty Door No 22-7-1061 Mulihithlu Mangalore- 575001	7026696920	Over flow due to insufficient carrying capacity of pumping main, sewerage bypassed to natural Nala.	Replacement of old pumping mains with sufficient carrying capacity	Yes	No	Pipe laying civil work need to be completed as an earliest and access to shops and houses to be provided during construction.
2	Amitha K Sanil S/o KarunakarSanil Door No 22-7-987 Mulihithlu Mangalore- 575001	9242855917	Over flow due to insufficient carrying capacity of pumping main, sewerage bypassed to natural Nala.	Replacement of old pumping mains with sufficient carrying capacity	Yes	No	Pipe laying civil work need to be completed as an earliest and access to shops and houses to be provided during construction.
3	Mrs. Vani W/o MadhavaShrimatha Door No 22-7-1061/5 Mulihithlu Mangalore	9986864998	Over flow due to insufficient carrying capacity of pumping main, sewerage bypassed to natural Nala.	Replacement of old pumping mains with sufficient carrying capacity	Yes	No	Pipe laying civil work need to be completed as an earliest and access to shops and houses to be provided during construction.
4	Mr.H Sheena Shetty S/o Madarappa Shetty D. N 22-7-1061/3 Mulihithlu Mangalore	9141614488	Over flow due to insufficient carrying capacity of pumping main, sewerage bypassed to natural Nala.	Replacement of old pumping mains with sufficient carrying capacity	Yes	No	Pipe laying civil work need to be completed as an earliest and access to shops and houses to be provided during construction.

	Name and Address of the Person Consulted	Contact No.	Present Condition of UGD System	What Improvement is Required in the Present Condition	Contacted Person is the Beneficiary of the Proposed Project Yes/ No	Proposed Project Cause Any Social Issue? Yes/ No (If Yes, provide details)	Suggestions for the Proposed Project
5	Mrs.Umavathi W/o Shashindra Shetty D. No 22-7-989 Mulihithlu Mangalore	9591063388	Over flow due to insufficient carrying capacity of pumping main, sewerage bypassed to natural Nala.	Replacement of old pumping mains with sufficient carrying capacity	Yes	No	Pipe laying civil work need to be completed as an earliest and access to shops and houses to be provided during construction.
6	Mrs. Hema W/o Bhaskar Shetty D. No 22-7-1061/8 Mulihithlu Mangalore	9845869521	Over flow due to insufficient carrying capacity of pumping main, sewerage bypassed to natural Nala.	Replacement of old pumping mains with sufficient carrying capacity	Yes	No	Pipe laying civil work need to be completed as an earliest and access to shops and houses to be provided during construction.

Name of the Ward: Bolar, Emmekere, Level, Morgansgate, Mahakalipadpu
 Name of the Councilor: Mrs. Rathikala
 Area: Morgansgate

	Name and Address of the Person Consulted	Contact No.	Present Condition of UGD System	What Improvement is Required in the Present Condition	Contacted Person is the Beneficiary of the Proposed Project Yes/ No	Proposed Project Cause Any Social Issue? Yes/ No (If Yes, provide details)	Suggestions for the Proposed Project
1	Sri. Bhagavathi Co-operative Bank Morgan's gate Mangalore	7760328964	Over flow due to insufficient carrying capacity of pumping main, sewerage bypassed to natural Nala.	Replacement of old pumping mains with sufficient carrying capacity	Yes	No	Pipe laying civil work need to be completed as an earliest and access to shops and houses to be provided during construction.
2	Mr. Suresh S/o Manjanna Shreya Medicals Morgansgate Mangalore	9035423679	Over flow due to insufficient carrying capacity of pumping main, sewerage bypassed to natural Nala.	Replacement of old pumping mains with sufficient carrying capacity	Yes	No	Pipe laying civil work need to be completed as an earliest and access to shops and houses to be provided during construction.
3	Mr. Vinodh Shetty S/o Sadashiva Shetty Siddi canteen Morgansgate Mangalore	7259892378	Over flow due to insufficient carrying capacity of pumping main, sewerage bypassed to natural Nala.	Replacement of old pumping mains with sufficient carrying capacity	Yes	No	Pipe laying civil work need to be completed as an earliest and access to shops and houses to be provided during construction.
4	Mr. Devadas Shetty S/o Sheenappa Shetty Morgansgate Mangalore	9449894578	Over flow due to insufficient carrying capacity of pumping main, sewerage bypassed to natural Nala.	Replacement of old pumping mains with sufficient carrying capacity	Yes	No	Pipe laying civil work need to be completed as an earliest and access to shops and houses to be provided during construction.
5	Mr. Abdulla S/o Late Y Musthaf K. Mohammed and Co. Plywood shop	9980246367	Over flow due to insufficient carrying capacity	Replacement of old pumping mains with	Yes	No	Pipe laying civil work need to be completed as an earliest and

	Name and Address of the Person Consulted	Contact No.	Present Condition of UGD System	What Improvement is Required in the Present Condition	Contacted Person is the Beneficiary of the Proposed Project Yes/ No	Proposed Project Cause Any Social Issue? Yes/ No (If Yes, provide details)	Suggestions for the Proposed Project
	Morgansgate Mangalore		of pumping main, sewerage bypassed to natural Nala.	sufficient carrying capacity			access to shops and houses to be provided during construction.

Name of the Ward: Derebail-3 (South), Daddalkad
 Name of the Councilor: Mr. Rajaneesh
 Area: Derebail- Daddalakadu

	Name and Address of the Person Consulted	Contact No.	Present Condition of UGD System	What Improvement is Required in the Present Condition	Contacted Person is the Beneficiary of the Proposed Project Yes/ No	Proposed Project Cause Any Social Issue? Yes/ No (If Yes, provide details)	Suggestions for the Proposed Project
1	Mr. Dasharath S/o Late Mudara D. No 1-8-534 Derebail- Daddalakadmangalore	9901638209	Over flow due to insufficient carrying capacity of pumping main, sewerage bypassed to natural Nala.	Replacement of old pumping mains with sufficient carrying capacity	Yes	No	Pipe laying civil work need to be completed as an earliest and access to shops and houses to be provided during construction.
2	Mr. Justin D'Souza W/o Late D'Souza Philip D. No 1-9-535 DerebailDaddalkadu Mangalore	0824- 2458048	Over flow due to insufficient carrying capacity of pumping main, sewerage bypassed to natural Nala.	Replacement of old pumping mains with sufficient carrying capacity	Yes	No	Pipe laying civil work need to be completed as an earliest and access to shops and houses to be provided during construction.

Name of the Ward: Derebail-5 (North East)
 Name of the Councilor: Radhakrishna
 Area: Urva Market

	Name and Address of the Person Consulted	Contact No.	Present Condition of UGD System	What Improvement is Required in the Present Condition	Contacted Person is the Beneficiary of the Proposed Project Yes/ No	Proposed Project Cause Any Social Issue? Yes/ No (If Yes, provide details)	Suggestions for the Proposed Project
1	Mr. Radhakrishna Councilor, Ward No 26 Derebail North East Mangalore	9845054799	Over flow due to insufficient carrying capacity of pumping main, sewerage bypassed to natural Nala.	Replacement of old pumping mains with sufficient carrying capacity	Yes	No	Pipe laying civil work need to be completed as an earliest and access to shops and houses to be provided during construction.
2	Mr. Nagesh S/o Narayan Souza ChikenUrva Market Mangalore	9972022381	Over flow due to insufficient carrying capacity of pumping main, sewerage bypassed to natural Nala.	Replacement of old pumping mains with sufficient carrying capacity	Yes	No	Pipe laying civil work need to be completed as an earliest and access to shops and houses to be provided during construction.

Name of the Ward: Mannagudda
 Name of the Councilor: JayanthiAchar
 Area: Mannagudda, Matadakani Junction

	Name and Address of the Person Consulted	Contact No.	Present Condition of UGD System	What Improvement is Required in the Present Condition	Contacted Person is the Beneficiary of the Proposed Project Yes/ No	Proposed Project Cause Any Social Issue? Yes/ No (If Yes, provide details)	Suggestions for the Proposed Project
1	Mrs. JayanthiAchar W/o Harish Achar Councilor Ward No 28 Mannagudda Mangalore	7760054523	Over flow due to insufficient carrying capacity of pumping main, sewerage bypassed to natural Nala.	Replacement of old pumping mains with sufficient carrying capacity	Yes	No	Pipe laying civil work need to be completed as an earliest and access to shops and houses to be provided during construction.
2	Mr. V. Hari Kamath Matadakani Main Road Mangalore	-	Over flow due to insufficient carrying capacity of pumping main, sewerage bypassed to natural Nala.	Replacement of old pumping mains with sufficient carrying capacity	Yes	No	Pipe laying civil work need to be completed as an earliest and access to shops and houses to be provided during construction.

Name of the Ward: Kudroli

Name of the Councilor: Mr. Abdul Azeez

Area: Bokkapatna

	Name and Address of the Person Consulted	Contact No.	Present Condition of UGD System	What Improvement is Required in the Present Condition	Contacted Person is the Beneficiary of the Proposed Project Yes/ No	Proposed Project Cause Any Social Issue? Yes/ No (If Yes, provide details)	Suggestions for the Proposed Project
1	Mr. M Abdul Azeez Councilor Ward No 43 Kudroli Ward Mangalore	9845337500	Over flow due to insufficient carrying capacity of pumping main, sewerage bypassed to natural Nala.	Replacement of old pumping mains with sufficient carrying capacity	Yes	No	Pipe laying civil work need to be completed as an earliest and access to shops and houses to be provided during construction.
2	Mr. Dinakar S/o DoomannaMariamma cycle shop BokkapatnaMatadakani Road Mangalore	9980185556	Over flow due to insufficient carrying capacity of pumping main, sewerage bypassed to natural Nala.	Replacement of old pumping mains with sufficient carrying capacity	Yes	No	Pipe laying civil work need to be completed as an earliest and access to shops and houses to be provided during construction.

Snapshots of Public Consultation



Public Consultation Conducted Along with the Ward Councilor Mrs. Kavitha in Mulihithlu Area



Public Consultation Conducted Along with Ward Councilor Mrs. Rathikala in Morgansgate



Public Consultation Conducted Along with Ward Councilor Mr. Rajaneesh at Urvastore-Daddalkad Road



Public Consultation Conducted Along with Ward Councilor Mrs. JayanthiAchar at Matadakani Road



Public Consultation Conducted Along with Ward Councilor Mr. Abdul Azeez at Kandathpalli



Public Consultation along with Ward Councilor Mr. Radhakrishna near Urva Market



MONITORING AND REPORTING FORMATS

Sample Semi-Annual Environmental Monitoring Report Format

I. INTRODUCTION

- (i) Overall project description and objectives;
- (ii) Environmental category as per ADB Safeguard Policy Statement, 2009;
- (iii) Environmental category of each subproject as per national laws and regulations;
- (iv) Project Safeguards Team;

Name	Designation/Office	Email Address	Contact Number
1. Program Management Unit			
2. Program Implementation Units			
3. Consultants			

- (v) Overall project and sub-project progress and status; and
- (vi) Description of subprojects (package-wise) and status of implementation (preliminary, detailed design, on-going construction, completed, and/or O&M stage).

Package Number	Components/List of Works	Status of Implementation (Preliminary Design/Detailed Design/On-going Construction/Completed/O&M)	Contract Status (specify if under bidding or contract awarded)	If On-going Construction	
				%Physical Progress	Expected Completion Date

^a If on-going construction, include %physical progress and expected date of completion.

II. COMPLIANCE STATUS WITH NATIONAL/STATE/LOCAL STATUTORY ENVIRONMENTAL REQUIREMENTS

- Identify the role/s of Safeguards Team including schedule of on-site verification of reports submitted by consultants and contractors.
- For each package, provide name/s and contact details of contractor/s' nodal person/s for environmental safeguards.
- Include as appendix all supporting documents including **signed** monthly environmental site inspection reports prepared by consultants and/or contractors.
- With reference to approved EMP/site-specific EMP/construction EMP, complete the table below
- Provide the monitoring results as per the parameters outlined in the approved EMP (or site-specific EMP/construction EMP when applicable).
- In addition to the table on EMP implementation, the main text of the report should discuss in details the following items:
 - (i) **Grievance Redress Mechanism.** Provide information on establishment of grievance redress mechanism and capacity of grievance redress committee to address project-related issues/complaints. Include as appendix Notification of the GRM (town-wise if applicable).
 - (ii) **Complaints Received during the Reporting Period.** Provide information on number, nature, and resolution of complaints received during reporting period. Attach records as per GRM in the approved IEE. Identify safeguards team member/s involved in the GRM process. Attach minutes of meetings (ensure English translation is provided).
 - (a) Confirm if any dust was noted to escape the site boundaries and identify dust suppression techniques followed for site/s;
 - (b) Identify muddy water was escaping site boundaries or muddy tracks were seen on adjacent roads;
 - (c) Identify type of erosion and sediment control measures installed on site/s, condition of erosion and sediment control measures including if these were intact following heavy rain;
 - (d) Identify designated areas for concrete works, chemical storage, construction materials, and refueling. Attach photographs of each area;
 - (e) Confirm spill kits on site and site procedure for handling emergencies;
 - (f) Identify any chemical stored on site and provide information on storage condition. Attach photograph;
 - (g) Describe management of stockpiles (construction materials, excavated soils, spoils, etc.). Provide photographs;
 - (h) Describe management of solid and liquid wastes on-site (quantity generated, transport, storage and disposal). Provide photographs;
 - (i) Provide information on barricades, signages, and on-site boards. Provide photographs;
 - (j) Provide information; and
 - (k) Checking if there are any activities being under taken out of working hours and how that is being managed.

Summary of Environmental Monitoring Activities (for the Reporting Period)

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

^a Attach Laboratory Results and Sampling Map/Locations.

Overall Compliance with CEMP/ EMP

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

CEMP = construction environmental management plan, EMP = environmental management plan.

V. APPROACH AND METHODOLOGY FOR ENVIRONMENTAL MONITORING OF THE PROJECT

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

VI. MONITORING OF ENVIRONMENTAL IMPACTS ON PROJECT SURROUNDINGS (AMBIENT AIR, WATER QUALITY AND NOISE LEVELS)

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

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

Air Quality Results

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

Site No.	Date of Testing	Site Location	Parameters (Monitoring Results)		
			PM10 µg/m3	SO2 µg/m3	NO2 µg/m3

Water Quality Results

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

Site No.	Date of Sampling	Site Location	Parameters (Monitoring Results)					
			pH	Conductivity µS/cm	BOD mg/L	TSS mg/L	TN mg/L	TP mg/L

Noise Quality Results

Site No.	Date of Testing	Site Location	LA _{eq} (dBA) (Government Standard)	
			Day Time	Night Time

Site No.	Date of Testing	Site Location	LA _{eq} (dBA) (Monitoring Results)	
			Day Time	Night Time

VII. SUMMARY OF KEY ISSUES AND REMEDIAL ACTIONS

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

VIII. APPENDIXES

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

Sample Environmental Site Inspection Report

Project Name _____
Contract Number _____

NAME: _____ DATE: _____

TITLE: _____ DMA: _____

LOCATION: _____ GROUP: _____

WEATHER CONDITION: _____

INITIAL _____ SITE _____ CONDITION: _____

CONCLUDING SITE CONDITION:

Satisfactory _____ Unsatisfactory _____ Incident _____ Resolved _____
Unresolved _____

INCIDENT:

Nature of incident: _____

Intervention Steps: _____

Incident Issues

Resolution

Project Activity Stage	Survey	
	Design	
	Implementation	
	Pre-Commissioning	
	Guarantee Period	

Inspection

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

Site Restored to Original Condition Yes ☐ No ☐

Signature _____

Sign off

Name _____
Position _____

Name _____
Position _____

Inspection

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

Site Restored to Original Condition Yes

☐
☐

Signature

Sign off

Name

Position

Name

Position

Sample Checklist for Construction Safety

	Safety Issues	Yes	No	Non-Compliance	Corrective Action	Penalty	Remarks
1	Appointment of qualified construction safety officers						
2	Approval for construction safety management plan by the SC						
3	Approval for traffic management/control plan in accordance with IRC: SP: 55-2001						
4	Maintenance of the existing road stretches handed over to the contractor.						
5	Provision of temporary traffic barriers/barricades/caution tapes in construction zones						
6	Provision of traffic signboards						
7	Provision for flags and warning lights						
9	Providing plastic crash barrier						
10	Provision of adequate staging, form work, and access (ladders with handrail) for works at a height of more than 3 m						
11	Provision of adequate shoring/ bracing/ barricading/lighting for all deep excavations of more than 3 m depth.						
12	Demarcations (fencing, guarding, and watching) at construction sites						
13	Provision for sufficient lighting, especially for nighttime work						
14	Arrangements for controlled access and entry to construction zones						
15	Safety arrangements for road users/ pedestrians						
16	Arrangements for detouring traffic to alternate facilities						
17	Regular inspection of work zone traffic control devices by authorized contractor personnel						
18	Construction workers' safety - Provision of						

	Safety Issues	Yes	No	Non-Compliance	Corrective Action	Penalty	Remarks
	personnel protective equipment						
19	A. Helmets						
	B. Safety shoes						
	C. Dust masks						
	D. Hand gloves						
	E. Safety belts						
	F. Reflective jackets						
	G. Earplugs for labor						
20	Workers employed on bituminous works, stone crushers, concrete batching plants, etc. provided with protective goggles, gloves, gumboots, etc.						
21	Workers engaged in welding work shall be provided with welder protective shields						
22	All vehicles are provided with reverse horns.						
23	All scaffolds, ladders, and other safety devices shall be maintained in safe and sound condition.						
24	Regular health check-up for labor/ contractor's personnel						
25	Ensuring sanitary conditions and all waste disposal procedures and methods in the camps.						
26	The contractor shall provide adequate circuit for traffic flow around construction areas, control speed of construction vehicles through road safety and training of drivers, provide adequate signage, barriers, and flag persons for traffic control						
27	Provision of insurance coverage for the contractor's personnel						

Contractor

Consultant