Report Data Sheet

Project Data

Client	:	Maharashtra Institution for Transformation (MITRA), Government of Maharashtra, 'Nirmal', 5th floor, Next to Inox cinema (CR2), Nariman Point, Mumbai – 400 021
Project	:	Consultancy Services for Re-Validation of Stormwater Drainage Master Plan & Preparation of Detailed Project Reports (DPRs) for Urban Flood Management in Kolhapur Municipal Corporation (KMC)
Document	:	Environment and Social Impact Assessment
Revision	:	R2
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Abbreviation

AAQS	Ambient Air Quality Standards
BOD	Biological Oxygen Demand
BSES	Bharat Stage Emission Standards
CEO	Chef Executive Officer
CHSP	Community Health and Safety Programme
CIB & RC	Central Insecticides Board and Registration Committees
COD	Chemical Oxygen Demand
CPCB	Central Pollution Control Board
CPHEEO	Central Public Health & Environmental Engineering Organisation
CPR	Community Property Resources
DMSC	Design Management and Supervision Consultants
DPR	Detailed project Report
DRR	Department of Revenue and Rehabilitation
E&S	Environment and Social
EB	Executive Body
EERU	Efficiency in Environmental resources Use
EG	Environmental Governance
EHS	Environment, Health and Safety
EIA	Environment Impact Assessment
EREEC	Enhancement of Resources for Environmental Conservation
ESCP	Environment and Social Commitment Plan
ESF	Environment and Social Framework
ESHS	Environment Social Health Safety
ESIA	Environmental and Social Impacts Assessment
ESMF	Environmental and Social Management Frame Work
ESMP	Environment and Social Management Plan
ESRC	Environment and Social Risk Classification
ESS	Environment and Social Stockholders
ESS	Environment and Social Standards
FB	Fire Bridge
FGD	Focus Group Discussion
GAP	Gender Action Plan
GBVAP	Gender Base Violence Action Plan
GM	Grievance Mechanism
GoI	Government of India
GoM	Government of Maharashtra
H&S	Health and Safety
IAS	Indian Administrivia Services
IECESD	Integration of Environmental Concerns in Economic and Social Development
IEEC	Independent External Evaluation Consultant
ILO	International Labour Organization
IPMP	Integrated Pest Management Plan
KMC	Kolhapur Municipal Corporation
LMF	Labour Management Framework
LMP	Labour management Procedure
LMP	Labor Management Plan
MC	Municipal Corporation
MITRA	Maharashtra Institution for Transformation

MKVDC	Maharashtra Krishna Valley Development Corporation
MOEFCC	Ministry of Environment, Forest and Climate Change
MoWCD	Ministry of Women and Child Development
MoWR	Ministry of Water Resources
MPCB	Maharashtra Pollution Control Board
MRDP	Maharashtra Resilience Development Program
MSDS	Material Safety Data Sheet
NAAQI	National Ambient Air Quality Index
NAAQS	National Ambient Air Quality Standards
NBS	Nature-Based Solutions
NBS	National Building Standards
NCSPS	National Conservation Strategy and Policy Statement
NDMA	National Disaster Management Authority
NEP	National Environmental Policy
NFP	National Forest Policy
NGO	Non-Government Organization
NPEW	National Policy for the Empowerment of Women
NTH	Non-title Holders
O&M	Operation and Militance
OHS	Occupation Health and Safety
OHSP	Occupation Health and Safety Policy
PDO	Project Development Objectives
PMTC	Project Management Technical Consultancy
PMTSC	Project Management and Technical Support Consultancy
PMU	Project Management Unit
PUI	Project Implementation Units
PWD	Public Work Department
R&R	Rehabilitation and Resettlement
RAP	Rehabilitation Action Plan
RCA	Root Cause Analysis
RCC	Regional Collaboration Centres
RF’s	Resettlement Framework
RP	Resettlement Plan
RPF	Resettlement Policy Framework
RPF	Resettlement Plan Framework
SC	Schedule Cast
SEA	Sexual Exploitation & Abuse
SEIAA	State Environment Impact Assessment Authority
SEP	Stakeholder Engagement Plan
SH	Sexual Harassment
SMKMC	Sangli-Miraj-Kupwad Municipal Corporation
SPCB	State Pollution Control Board
ST	Schedule Tribes
SWD	Strom Water Drain
TH	Title Holders
TOR	Terms of References
UFM	Urban Flood Management
ULB	Urban Local Bodies
WB	World Bank
WMP	Waste Management Plan

Team Involved in ESIA Study and Report Preparation:

Environmental and Social Impact Assessment (ESIA) consultants: The ESIA study has been carried out by Environmental and Social Team of PriMove Infrastructure Development Consultants Pvt. Ltd. as per the prescribed TOR of World bank. MITRA has contracted PriMove Infrastructure Development Consultants Pvt. Ltd. to prepare the Stormwater Drainage Master Plan & Preparation of Detailed Project Reports (DPR) for Urban Flood Management in Kolhapur and Sangli for **Component II - "Multi-hazard Resilience in Districts and Cities" and Sub-component 2.2** which includes activities related to "The Flood Risk and Associated Flood Mitigation Measures" in the Kolhapur Municipal Corporation Area in Kolhapur District.

ESIA is prepared meeting the requirements of the World Bank's Environmental and Social Framework (ESF), most particularly the Environmental and Social Standards (ESS), including the World Bank Group Environment, Health and Safety (EHS) Guidelines.

The Environmental and Social team comprised of Dr. Prajakta Kulkarni (Environment Safeguard Specialist – Sangli and Kolhapur), Mr. Nitin Shitole (Social Safeguard Specialist – Sangli and Kolhapur), Mr. Mahesh Kodgire (Social Safeguard Specialist - Sangli) and Mr. Sachin Hattalge (Social Safeguard Specialist – Kolhapur).

ESIA team is thankful for the time-to-time guidance is received from Experts and Team Leaders of World Bank and Environmental and Social Experts of MITRA. The report is prepared and submitted to the World Bank and MITRA for observations.

Executive Summary of ESIA

Project Background

Urban flooding is emerging as a frequent and damaging climate change-related hazard in Maharashtra, disrupting lives and economic activity in cities. Maharashtra has experienced a dramatic increase in climate-related challenges over the past 50 years, with droughts increasing seven-fold and floods six-fold..

Kolhapur city is located in the Panchganga River Basin which is upper Krishna sub-basin highly impacted with severe floods in 2005, 2019, and 2021 causing significant loss of life, damage to crops and infrastructure and strain on state resources. The 2019 floods were especially devastating, lasting over a week, and requiring INR 641 crore in compensation, while infrastructure restoration costs reached INR 800 crore annually. These events are exacerbated by factors like unplanned and unregulated urban development, insufficient or lacking storm water drainage, lack of adequate risk management capacities and encroachments on water bodies and flood zones.

Kolhapur City with total area of 69.018 sq.km is experiencing significant population growth and hence experienced a countable increase in the size of its settlement areas in flood-prone zones between 1985 and 2015. This has seriously increased the need of flood mitigation solutions through the development of strong and sustainable Storm Water Drainage (SWD) master plans, addressing the challenges of fluvial and pluvial flood risk management in Kolhapur City

MRDP Background

The Government of Maharashtra (GoM) recognizes the urgent need to address this issue and Maharashtra Resilience Development Program (MRDP) is designed to respond to this need. The proposed project aims to enhance resilient development in Maharashtra through climate-informed and integrated flood, drought, and landslide risk management by 2030. This entails strengthening institutional capacities for adaptive planning and mainstreaming integrated flood and multi-hazard mitigation and risk management; establishing a science-based decision-making system for planning investments, multi-hazard risk management, and emergency preparedness in Panchganga River basin; developing risk modelling and climate scenarios; and preparing a feasibility study and detailed project reports (DPRs) for long-term investments in water resource and flood risk management.

Project Development Objective (PDO)

The Project's Development Objectives are to: To strengthen multi-hazard climate and disaster risk management, and institutional capacity for Maharashtra's resilient development. For details, Please Refer Project Information Document (PIDDC00814).

Project Components

Component 2 and Sub-component 2.2 i.e., Urban Flood Control through SWD Works under MRDP related to design, construction and operation and maintenance (O&M) of flood control structures proposed to mitigate flood risks that are projected to increase due to climate change in Panchganga River basin and improve flood risk management through an optimal combination of grey, blue and green interventions. Total project cost is 60.14 million USD.

Sr. No.	Interventions	Activities Proposed	Dimensions / Area / Numbers	Location	Bidding Package
1	Desiltation of Nalla	Desilting of bottom silt deposited from SWD	18.475 Km	Gomati Nalla and Jayanti Nalla	
2	Desiltation of Lakes	Desilting of bottom silt deposited from Lakes	15 Ha	Kalamba Lake	
			0.32 Ha	Rajaram Lake	
			2.18 Ha	Sangeet Vibhag in Shivaji University	

Sr. No.	Interventions	Activities Proposed	Dimensions / Area / Numbers	Location	Bidding Package
			3.50 Ha	Bhasha Bhavan in Shivaji University	
			0.5 Ha	Existing Lake small lake near well in Shivaji University	
			2.6 Ha	Padtala	
3	Reconstruction of Nalla and RCC Channel Sections	Retaining Wall	23.5 km	Along the Nalla in KMC limits	
		Box drains and Open drains along with road side drains	37.16 km	In KMC Limits	
		RCC Channel	275 m	Kalamba Lake Outlet	
4	Culvert Upgradation	Demolition of inadequate culvert	135	In KMC Limits	
		Construction of new Culvert	135	In KMC Limits	
5	Earthen Nalla Bund and Cement Nalla Bind Construction				
		ENB near University Building	0.63 ha	Shivaji University	
		CNB near well	0.28 Ha		
		END on Nala near School of Nanoscience & technology at Rajaram lake	0.32 Ha		
6	Plantation	Plantation of indigenous Trees	100 Ha	Behind Kalamba Lake slopes on GP land	
			25 Ha	Shivaji University	
			9.079 km (39.84 Ha)	Nalla Park along Gomati Nalla and Jayanti Nalla	
7	Control Surface Runoff	Continuous Contour Trenching and Development of Dense Urban Forest	100 Ha	Behind Kalamba Lake slopes on GP land	
			25 Ha	Shivaji University	
		Loose Boulder Structure	-	Upstream of Kalamba Lake	
8	Construction of Sluice gates	Construction of precast sluice gate	4 Nos	Kalamba Lake Outlet	
9	Construction of Cement Check Dam	RCC Dam construction	L - 91 m, D - 4 m 1 No	Shivaji University	

Purpose and objectives of the ESIA

The Objective of the ESIA is to assess E&S risks and impacts of the SWD works mentioned in 1.1.2 proposed sub-project components and to develop and implement mitigation measures following a mitigation hierarchy. The other objectives of ESIA of the project are:

- A comprehensive description of the current natural environment and socio-economic conditions in the subproject area.
- Identification of potential impacts of the project on the natural environment and socioeconomic conditions of the population during its entire cycle i.e., from pre-construction

to construction and operation and maintenance. The ESIA concentrates on the analysis and scientific assessment of the physical, biological, and socioeconomic impacts of the subproject when it is implemented.

- Identifying the capacity constraints of the Implementing Agencies in respect of E&S management and propose commensurate capacity enhancement measures, among others.
- Providing recommendations that are technically feasible and culturally appropriate measures within legal and regulatory framework and World Bank ESF, towards effective management of adverse E&S impacts of the project on the natural environment and people during the pre-construction and construction phase.

Applicable Legal Regulatory Framework

The proposed Sub-Projects are being prepared and will be implemented in compliance with applicable environmental and social laws and regulations of the Government of India (GoI) and the Government of Maharashtra (GoM) and World Bank's Environment Social Framework (ESF). Environment Protection Act/ Rules 1986 and amendments, Water Prevention and Control of Pollution) Act, 1974, 1988, Air (Prevention and Control of Pollution) Act, 1981, 1987, The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013, Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 are key act/rules along with other relevant act as per the provision of Government of India & Maharashtra shall be applicable for the project.

As per the Ministry of Environment, Forests and Climate Change (MoEF&CC) of GoI's Environmental Impact Assessment (EIA) Notification 2006 and ammendments till date, Strom Water drain works does not require any EIA or approval from MoEF&CC[1].

Environmental and Social Baseline

The baseline study included analysis of various environmental parameters such as ambient air quality, ground water quality, Lake water quality, storm water drain/nalla water quality, river water quality, sediment quality of SWD bed and lakes to be desilted and ambient noise quality. Information on city biodiversity was obtained from secondary sources. Information on trees likely to be felled, utilities to be shifted, properties likely to be impacted was collected through primary study.

The contractor is requiring conducting baseline study during implementation of civil works as per environmental monitoring suggested in this ESIA Report.

Assessment of Impacts

This ESIA study carried out for the proposed Storm Water Drainage system in intervention areas under component 2.2 in KMC limits in terms of the potential environmental and social impacts that may occur as a result of the implementation of project. The anticipated environment and social impacts identified during construction phase which comprise of transitory/ insignificant increase in air and noise pollution, soil erosion, slight change in water quality near the construction area and these impacts are temporary and site and time specific in nature. The major impacts of the project are expected to be during the construction phase leading to air and noise quality deterioration, occupational, health and safety impacts to the works and local communities, utility shifting, desiltation, access to private properties, generation of construction debris through and excavation activities and disposal of excavated silt from the drains during operation phase respectively. The proposed storm water drainage in these areas will have a significant positive impact and mainly to address the problem of water logging, flooding, water stagnation/ odour and water borne diseases which in turn would strengthen public health, environmental enhancement of subproject area sanitation/ aesthetics and reduction in ground water contamination/ pollution.

The project mitigation measures have been developed for reducing and regulating the adverse impacts on the environment and social components induced by the project proposed. The policy,

[1] https://environmentclearance.nic.in/writereaddata/CompendiumofEIANotifications_Jan2021.pdf

legal and institutional framework under the ambit of which the ESIA was undertaken, is also detailed out in ESIA report. The Environmental Social Management Plan (ESMP) for the SWD works is developed, which elaborates on the mitigation measures, means of implementation for the proposed measures, monitoring strategy and the budgets pertaining to implementation of the proposed mitigation measures

Environmental and Social Management Plan

Non-permissible activities: A list of activities that are not permissible under the project have been identified. These include: Any activity located within a notified Eco Sensitive Zone (ESZ) and is prohibited from being implemented within an ESZ; Any activity that converts or leads to conversion and/or degradation of significant areas of critical natural habitats (areas officially protected) and/or other natural habitats (including wetlands of significance) and designated forest areas; Any activity that promotes or supports pesticides that are banned by the Government of India; Any activity that promote or support pesticides that are in WHO Classes Ia, Ib and II; Any activity that involves construction within 100 meters from an archaeological site/monument; Any activity that involves use of Asbestos Containing Materials (e.g., AC pipes for irrigation, AC sheets for roof); Any activity that violates the provisions of applicable National and State laws; Construction of any new irrigation reservoir dam; Construction of new canals, new branch canals and new off-take structures; Acquisition of private land on permanent basis.

Environmental and Social Management Plans **(ESMP):** The ESMPs for the project are the following:

- Project ESMP: Developed by the PMU with support from ESIA Consultant. Provides mitigation measures specific to each project activity. ESMP Includes the following:
  Activity specific ESMP; Waste Management Plan; Excavated material management plan; Vector, rodents and Snake Management Plan, Labor Influx and Construction Workers Camp Management plan; Management plan for Construction related issues.
- Contract Package ESMP: To be developed for each contract package by PIU with support from safeguard specialist at Project management Technical Consultant (PMTC).
- Contractor's ESMP: To be developed for each contract package within14 days of delivery of letter of acceptance by the Contractor with support from safeguard specialist at PMC. Provides action plan for implementation of mitigation measures including details of quantities, locations, tie-ups with third party entities, etc Includes implementation plans on the following critical issues: Waste Management; Labor Influx and Construction Workers Camp Management; Construction related issues.

Institutional Arrangement, Responsibilities and Capacity

The success of the ESMP implementation depends on the clear identification and allocation of responsibilities and functions, as well as the capability of the project management team in collaboration with other agencies, to take proper actions throughout the various stages of the proposed subproject activities.

The MRDP will establish a PMU at the MITRA to be responsible for day-today project implementation, coordination between all involved administrative and technical agencies, in managing and monitoring compliance with ESS and ESF requirements, including the implementation of the ESMP and other associated plans such as, LMP, SEP, GBV Action Plan (GBVAP), Resettlement Action Plans, etc.

The PIU will be responsible for overall planning and implementation of the entire project. The PIU and PMU will be staffed with the engagement of consultants, experts and various other categories of contractual staff to support the project.

PIU will ensure that the ESMP is followed during project implementation. The PMTC and Monitoring and Evaluation Agency to be engaged for the project. PMTC and M&E will have an experienced Senior Environmental Specialist and a Senior Social cum Gender Development Specialist. These Specialists will assist the PIU and PMU in implementing and monitoring environmental and social mitigation measures as per ESMP and in preparing periodic status reports.

Environmental and Social Monitoring Plan and Reporting

The project will take up monitoring and evaluation of the ESMP implementation at two levels as below:

- Monitoring and Evaluation of the ESMP implementation of the project as a whole: The application and effectiveness of ESMP elements including preparation of Contract Package ESMPs, preparation and implementation of Contractor's ESMPs, monitoring, capacity building and institutional arrangements will be monitored. For every contract under the project, statutory compliances of the contractor will be monitored. Mid-term and end-term audit of the environmental and social management aspects of the project will also be undertaken by engaging third party M&E agency.
- Monitoring of Mitigation Measures and Environmental Quality: This will monitor the effectiveness of implementation of the identified mitigation measures and the environmental quality parameters relevant to each project activity Locations where environmental quality monitoring is to be undertaken have been identified. The parameters to be monitored will include:
  - Environmental aspects: Water quality (Surface & Ground); Air quality; Noise levels around sensitive locations; Soil quality; Sediment quality; plant survival rate; Construction camp management; Waste management & debris removal; Site restoration.
  - Social aspects: Resettlement and compensation for acquisition; Livelihood restoration of PAFs / PAPs; Safety at work; Gender participation in works; Awareness program on HIV/AIDS.

The PMU through the PIU will monitor and report on implementation of the ESMP, with inputs from the Consultants that will be supervising the subprojects. The PMU Environmental and Social ESF Standards Officers will ensure that ESF standards monitoring is included in the Project's quarterly reports to the World Bank.

The PMU will notify the World Bank of any incident or accident related to the Project, which has, or is likely to have, a significant adverse effect on the environment, the targeted communities, the public or contracted workers and consultants including security incidents, sexual exploitation and abuse and sexual harassment (SEA/SH) among others, within 24 hours after learning of the incident or accident, followed by an initial report.

Capacity Building

The capacity building plan includes training for staff of PIU, PMTC, contractors, workers and officials of other relevant line departments on implementation of ESMP. In addition to training programs, exposure visits and demonstrations are planned. Topics of training, period and frequency of training is also described the capacity building plan.

Grievance Mechanism (GM)

A Grievance Mechanism (GM) is proposed as part of the Stakeholder Engagement Plan to meet the requirements of ESS10, which will provide a communication platform for hearing and addressing issues arising from project implementation within project communities. The goal is to promote a mutually constructive relationship and enhance the achievement of project development objectives. The GM is to ensure that complaints are directed and expeditiously addressed by the relevant agencies which are to enhance responsiveness and accountability. The GM is based on the principles of (a) fairness; (b) objectivity and independence; (c) simplicity and accessibility; (d) responsiveness and efficiency; (e) speed and proportionality; and (f) participatory and social inclusion.

Budget for ESMP Implementation

The cost of implementation of the ESMP has either been integrated into the main activity cost or has been provided for through a provisional sum in every contract package. The cost of human resources

and audit of the ESMP implementation has been separately ear-marked. In all, a sum of INR **118,19,21,529/-** has been provided for the ESMP implementation

ESIA and ESMP Report Structure:

- List of Abbreviations
- Executive Summary
- Chapter 1: Introduction
- Chapter 2: Brief Project Description
- Chapter 3: Legal and Regulatory Compliance
- Chapter 4: Environmental And Social Baseline
- Chapter 5: Analysis of Alternative
- Chapter-6: Potential Environmental and Social Impacts
- Chapter 7: Environmental and Social Management Plan (ESMP)
- Chapter 8: Environmental and Social Monitoring Plan
- Chapter 9: Stakeholder Consultation and Engagement
- Chapter 10: Capacity Building
- Chapter 11: Grievance Redressal Mechanism
- Chapter 12: Institutional Arrangement for Implementation of ESMP
- Chapter 13: Budget for ESMP Implementation

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Chapter 1 : Introduction

1.1 Project Description

Urban flooding is emerging as a frequent and damaging climate change-related hazard in Maharashtra, disrupting lives and economic activity in cities. Maharashtra has experienced a dramatic increase in climate-related challenges over the past 50 years, with droughts increasing seven-fold and floods six-fold. Many cities in Maharashtra increasingly face flood events due to unplanned and unregulated urban development, inadequate river management, insufficient or lacking storm water drainage, and encroachments on water bodies and flood zones.

Kolhapur city is located in the Panchganga River Basin which is upper Krishna sub-basin highly impacted with severe floods in 2005, 2019, and 2021 causing significant loss of life, damage to crops and infrastructure and strain on state resources. The 2019 floods were especially devastating, lasting over a week, and requiring INR 641 crore in compensation, while infrastructure restoration costs reached INR 800 crore annually. These events are exacerbated by factors like unplanned and unregulated urban development, insufficient or lacking storm water drainage, lack of adequate risk management capacities and encroachments on water bodies and flood zones.

Kolhapur City with total area of 69.018 sq.km is experiencing significant population growth and hence experienced a countable increase in the size of its settlement areas in flood-prone zones between 1985 and 2015. This has seriously increased the need of flood mitigation solutions through the development of strong and sustainable Storm Water Drainage (SWD) master plans, addressing the challenges of fluvial and pluvial flood risk management in Kolhapur City.

1.1.1 MRDP Background

Maharashtra as a frontrunner of India’s economic growth engine aspires to become a 1 trillion economy by 2027-28. As per the Government of India (GoI) Census and the Economic Survey of Maharashtra 2022–23, it is the second most populous state, third largest in area, third most urbanized in India and contributes to about 14 percent of the national nominal GDP.

Disaster risks are an increasing threat to Maharashtra's development due to the growing exposure, rising disruptions and losses across sectors. To effectively leverage its demographic and geographical profile Maharashtra needs to develop a robust, sustainable and resilient developmental plan to minimise, averse and mitigate extreme weather conditions that have become a major impediment to states developmental agenda. Estimates of losses to public and private properties stood over ₹4,000 crores ($53,88,00,000). Losses due to flooding in Kolhapur and Sangli were ₹700 crores. Electricity infrastructure worth ₹1,200 crores were damaged, while damage to roads and bridges was over ₹1,500 crores. Crops across 338,000 hectares were damaged in western Maharashtra and Konkan. Recent floods and landslides in Krishna Basin affected Sangli and Kolhapur district in 2019 and 2021. There is an urgent need to develop a comprehensive climate resilient infrastructure by upgrading the existing infrastructure through various intervention.

The Government of Maharashtra (GoM) recognizes the urgent need to address this issue and Maharashtra Resilience Development Program (MRDP) is designed to respond to this need. The proposed project aims to enhance resilient development in Maharashtra through climate-informed and integrated flood, drought, and landslide risk management. This entails strengthening institutional capacities for adaptive planning and mainstreaming integrated flood and multi-hazard mitigation and risk management; establishing a science-based decision-making system for planning investments, multi-hazard risk management, and emergency preparedness in Panchganga River basin; developing risk modelling and climate scenarios; and preparing a feasibility study and detailed project reports (DPRs) for long-term investments in water resource and flood risk management.

The development objective of MRDP is to enhance resilient development in Maharashtra through mitigating flood and developing state capacity for climate-informed disaster risk management by 2030. The multi-sectoral project activities toward an enhanced institutional capacity for climate-

informed and integrated risk management aim at reducing the loss of lives and economic damages from disasters in Maharashtra. It will improve climate resilience through feeding downscaled state-of-the-art climate models into decision-making systems for risk management.

1.1.2 Project Components

The Project has five components as given in **Table 1.1.**

Table 1-1: MRDP Project Components

Component	Name	Implementing Agency
Component 1	Climate Informed Flood Risk Management.	Maharashtra Krishna Valley Development Corporation (MKVDC)
Component 2	**Multi-hazard Resilience Building in Districts and Cities**	**Implementing Agency:** • **Kolhapur Municipal Corporation (KMC)** • **Department of Disaster Management, Relief, and Rehabilitation**
Subcomponent 2.1	Landslide risk mitigation in hotspots of selected districts using grey infrastructure where needed and nature-based solutions where possible, as well as landslide risk monitoring systems	
Subcomponent 2.2	**Urban flood risk mitigation, e.g., creating detailed risk assessments, high resolution maps, and resulting program of measures, including SWD and nature-based solutions in Kolhapur and Sangli-Miraj-Kupwad Municipal limits**	
Component 3	Upgrading Emergency Operations Capacities	Department of Revenue and Rehabilitation
Component 4	Private Capital Mobilisation for Risk Financing and Fiscal Resilience	Maharashtra Institution for Transformation (MITRA)
Component 5	Implementation Support and Knowledge Management	Maharashtra Institution for Transformation (MITRA)

Component 2 and Sub-component 2.2 i.e., Urban Flood Control through SWD Works under MRDP related to design, construction and operation and maintenance (O&M) of flood control structures proposed to mitigate flood risks that are projected to increase due to climate change in Panchganga River basin and improve flood risk management through an optimal combination of grey, blue and green interventions.

Based on the site situation assessment interventions are considered in SWD works are desilting of SWD, lakes, CNB, K. T. Weir; reconstruction/repairment/rehabilitation/widening/ upgrading of existing SWD and culverts wherever required; construction of RCC covered/uncovered SWD; road side pipe drains; new culverts; demolition of encroachment within earmarked green zones near nalas if necessary; utility Shifting at necessary locations; construction of retaining walls; tree removal; usage of construction equipment; procurement of construction raw materials; construction of sluice gates at uncontrolled existing outlets of Kalamba lake; earthen nalla bund; landscaping/ dense forest development at open and suitable spaces along the SWD and contour trenching and plantation for floodplain restoration.

1.2 Need of the Project

Several factors contribute to Kolhapur's flooding problem, including debris and waste blockages in drainage systems, unauthorized encroachments in flood-prone areas, unchecked vegetation growth obstructing water channels, and improper slopes that hinder efficient water flow. Additionally, the drains often remain clogged with waste and lack regular maintenance, exacerbating the flooding risk.

To address these challenges, a comprehensive drainage master plan is essential. This plan should prioritize infrastructure upgrades, including expanding the capacity of drainage systems and removing encroachments to restore natural watercourses.

It should also emphasize floodplain management by restricting construction in sensitive areas to minimize damage. Furthermore, integrated water management is crucial, particularly through better coordination of upstream and downstream dam operations to regulate water flows effectively. Regular maintenance of the drainage network, including cleaning drains to remove waste and debris and repairing damaged sections, is vital to ensure the system's efficiency.

Implementing a robust drainage master plan is critical for Kolhapur to mitigate flooding risks, protect lives, and minimize economic losses. By investing in sustainable stormwater infrastructure and adopting proactive measures, the city can enhance its resilience to floods while safeguarding its economic and cultural significance. This approach will not only secure Kolhapur's future but also reinforce its position as a thriving hub of tradition, agriculture, and industry.

1.3 Environmental and Social Impact Assessment (ESIA) Study of the Sub-Project

The Objective of the ESIA is to assess E&S risks and impacts of the SWD works mentioned in 1.1.2 proposed sub-project components and to develop and implement mitigation measures following a mitigation hierarchy. The other objectives of ESIA of the project are:

- As per the Ministry of Environment, Forests and Climate Change (MoEF&CC) of GoI's Environmental Impact Assessment (EIA) Notification 2006 and ammedments till date, storm water drain works does not require any EIA or approval from MoEF&CC[2].
- A comprehensive description of the current natural environment and socio-economic conditions in the subproject area.
- Identification of potential impacts of the project on the natural environment and socioeconomic conditions of the population during its entire cycle i.e., from pre-construction to construction and operation and maintenance. The ESIA concentrates on the analysis and scientific assessment of the physical, biological, and socioeconomic impacts of the subproject when it is implemented.
- Identifying the capacity constraints of the Implementing Agencies in respect of E&S management and propose commensurate capacity enhancement measures, among others.
- Providing recommendations that are technically feasible and culturally appropriate measures within legal and regulatory framework and World Bank ESF, towards effective management of adverse E&S impacts of the project on the natural environment and people during the pre-construction and construction phase.

1.4 Approach and Methodology

The approach adopted for conducting the environmental and social impact assessment for the proposed project was through

a) Review of interventions proposed in Anti Erosion measures, conformation of revenue records from the district administration and authorities for row details and ownership assessment to confirm if there are any associated facilities,
b) Site visits, and Environmental screening of proposed sub projects
c) Consultations with stakeholders,
d) Field surveys including household level census and socio-economic surveys through pre-tested questionnaires, and
e) Analysis of data and report compilation

The existing environmental and social conditions in and around the project area were analyzed, environmental and social impacts of project components and activities were assessed, and mitigation/ management measures were proposed.

The Baseline data were collected through site visits and on a sampling basis, interaction with local people and discussion with project authority, stakeholder consultation, collection of data from relevant project records, collected data from secondary sources and analysis. The studied parameters include pre-project Socio–economic status of the people of study area. The primary baseline information on different social and environmental components was collected through field survey. Field surveys were carried out to collect information on the major social and environmental

[2] https://environmentclearance.nic.in/writereaddata/CompendiumofEIANotifications_Jan2021.pdf

features such as human settlements, trees, water bodies, sensitive locations, etc. Literature and authentic records were consulted to study the Environment & Socio–Economic status concerning the study areas. Status of pre-project social and environmental conditions was considered in three aspects, i.e.,

a) Physical Environment,
b) Biological Environment and
c) Social Environment

The key assessment approach includes:

i. Identification and analysis of positive and negative environmental and social impacts – the significance of these impacts, which are to result from project interventions and associated facilities, if any.
ii. To adopt a mitigation hierarchy approach to the project's E&S risks, i.e.,
    a. anticipate and avoid risks and impacts;
    b. minimize or reduce risks and impacts to acceptable levels, if not avoidable;
    c. once risks and impacts have been minimized or reduced, mitigate; and
    d. where significant residual impacts remain, compensate for or offset them, by identifying technically and financially feasible and cost-effective mitigation/ management measures to minimize negative impacts and enhance positive impacts, including changes to engineering designs.
iii. To identify differentiated impacts on the disadvantaged or vulnerable and to identify differentiated measures to mitigate such impacts, wherever applicable
iv. Exploration of the opportunities for environmental and social enhancement.
v. Preparation of Environmental and Social Management Plan, as well as Resettlement Action Plan, for effective implementation of mitigation/ management measures at different stages of the project, i.e., pre-construction, construction and operation & maintenance
vi. Assessment of existing capacities and proposing commensurate measures to fill capacity gaps.

1.5 Structure of ESIA Report

- List of Abbreviations
- Executive Summary
- Chapter 1: Introduction
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- Chapter 4: Environmental And Social Baseline
- Chapter 5: Analysis of Alternative
- Chapter-6: Potential Environmental and Social Impacts
- Chapter 7: Environmental and Social Management Plan (ESMP)
- Chapter 8: Environmental and Social Monitoring Plan
- Chapter 9: Stakeholder Consultation and Engagement
- Chapter 10: Capacity Building
- Chapter 11: Grievance Redressal Mechanism
- Chapter 12: Institutional Arrangement for Implementation of ESMP
- Chapter 13: Budget for ESMP Implementation

Chapter 2 : Project Description

This chapter deals with the description of the existing conditions in the subproject areas within KMC area and proposed interventions in connection with Component 2.2 of MRDP.

The project focuses on flooding caused due to rains and inadequate drainage in the city. The methodology of finalization of interventions proposed ensures that all technical, environmental, and social requirements align with World Bank's ESSs and ESF requirements, making it a comprehensive and implementable flood management plan for KMC.

2.1 Project Location

The city of Kolhapur is located in southern Maharashtra in Krishna River Basin, on the banks of River Panchganga which is a tributary of Krishna River. The project development activities will be in the municipal limits of Kolhapur City. The area of interest considered for this project is the municipal corporation area of 69.018 sq. km along with a buffer amounting to a total area of 68.74 sq. km, where the drainage master plan needs to be developed. It lies between Latitude 15°73' to 17°11' and Longitude 73°75' to 74°70'. The Index Map of proposed project area is presented in the **Figure 2.1**.

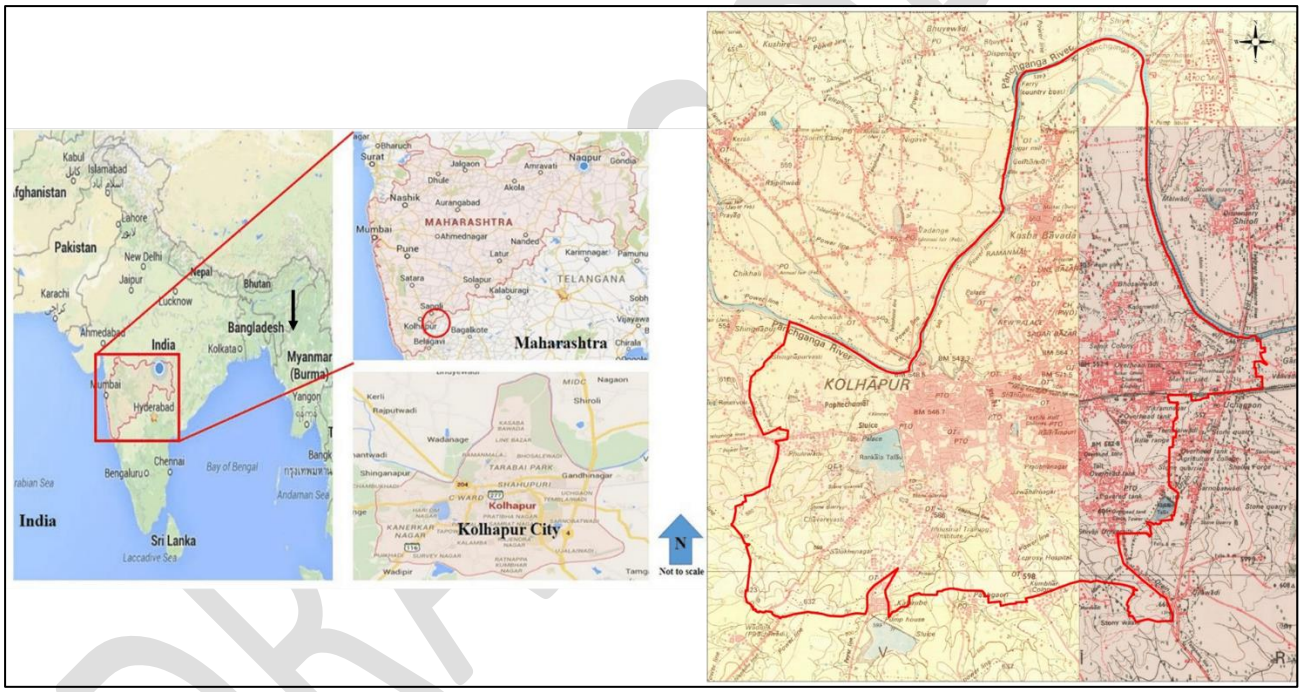


Figure 2-1: Project Location

2.2 Project Area Description

The KMC is located in southern Maharashtra in Krishna River Basin, on the banks of River Panchganga which is a tributary of Krishna River. The river Panchganga garlands the city in the north and forms the western, northern and Easter boundary of the city. In the south are Kalamba and Katyani hills that drain into the major natural streams (nalas) that pass through the city and join the Panchganga River.

Kolhapur is situated at 546-meter elevation from sea level and its proximity to the eastern slopes of the Sahyadri renders the greater part of the district almost immune from famine and even from scarcity. The topography of the city shows many undulations and the ground is generally sloping from south to north towards River Panchganga which flows along its northern and eastern boundary.

KMC has total 77 wards and total ward wise population 5.49 Lakhs as per 2011 Census & present population is around 7.50 Lakhs. The KMC is covered by natural and manmade drains. Some streets have drains on both the sides and some streets have drains on one side and some streets do not

have any drains / gutters. The details of the existing SWD system – natural water ways are shown in the **Figure 2.2**.

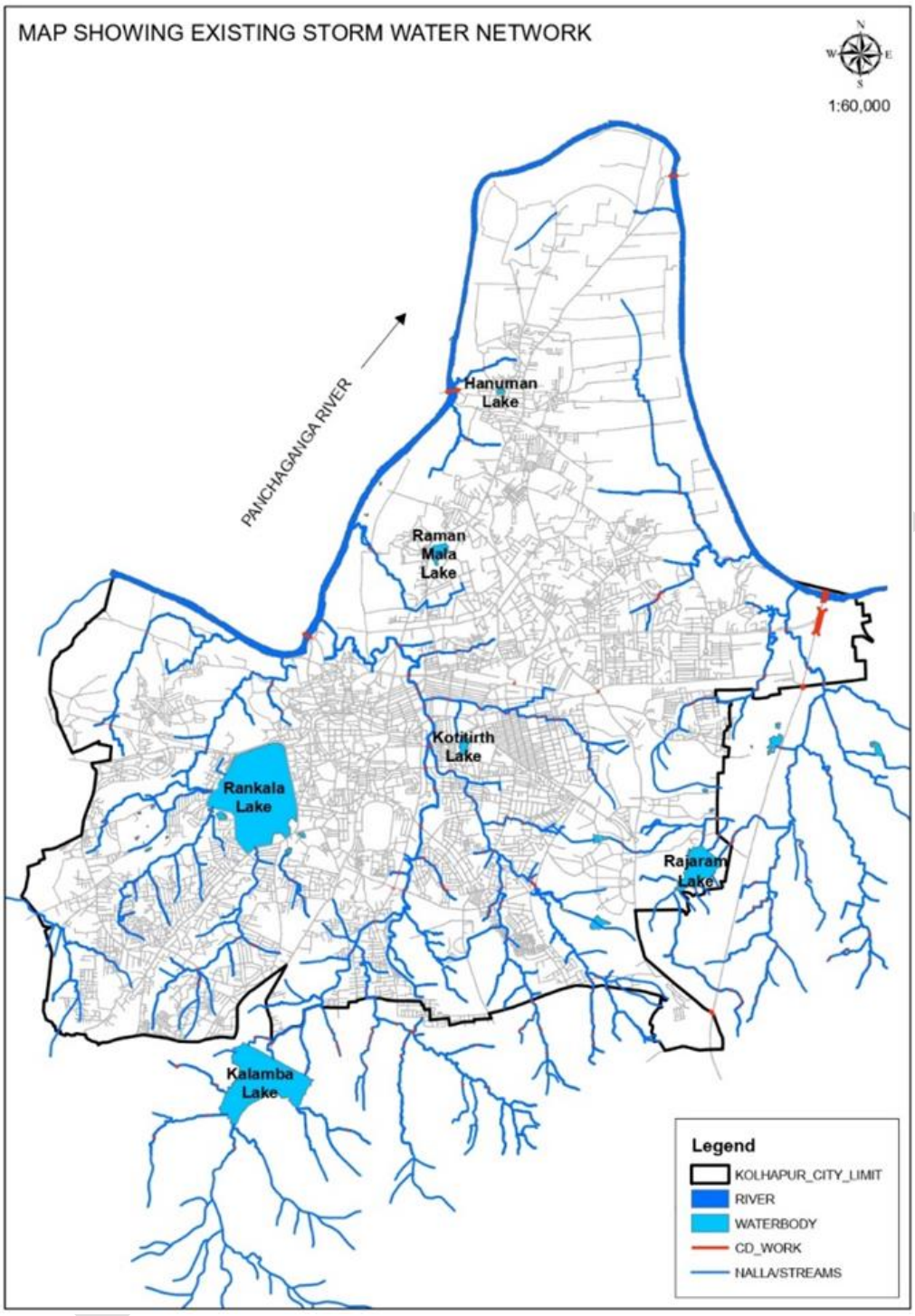


Figure 2-2: Existing SWD System

The total length of natural drains and nalla is about 105.323 km in KMC. The major SWD are Jayanti Nalla and Its Tributary Gomati Nalla flowing across the city. The storm water due to precipitation in the project area goes to the above water ways. Also, some water bodies (lakes) located in the project area like Kalamba Lake, Hanuman Lake, Raman Mala Lake, Rajaram Lake, Kotitirth Lake and Rankala Lake. The rain water that collected in and around these water bodies flow into these. Panchganga River flows along the western boundary and then northern boundary and then goes towards eastern boundary. All SWDs discharge the storm water in Panchganga River.

2.3 Proposed Interventions in Component 2.2

Various flood mitigation interventions, such as dense plantation, Earthen Nala Bunds, check dams, pond sites, Concrete Nala Bunds with gates, desilting of existing Lakes and contour trenching with plantation, are evaluated for their effectiveness in reducing flood risks. These interventions are assessed against baseline hydrological models to determine their impact and prioritization for implementation.

Additionally, policy measures such as **Rooftop Rainwater Harvesting (RWH) for government and institutional buildings, mandatory RWH implementation in residential areas, green building concepts, and modifications in building bylaws to include stormwater harvesting from high-intensity rainfall events** are proposed. Other structural and non-structural interventions, including **nala clearance certificates to prevent encroachments, recharge shafts at strategic locations, and a Flood Early Warning System**, are suggested to enhance flood resilience in the long term. The details of Sub-project activities / interventions are described in **Table 2.5**.

Table 2-1: Proposed Interventions in Component 2.2

Sr. No.	Interventions	Activities Proposed	Dimensions / Area / Numbers	Location	Bidding Package
1	Desiltation of Nalla	Desilting of bottom silt deposited from SWD	18.475 Km	Gomati Nalla and Jayanti Nalla	
2	Desiltation of Lakes	Desilting of bottom silt deposited from Lakes	15 Ha	Kalamba Lake	
			0.32 Ha	Rajaram Lake	
			2.18 Ha	Sangeet Vibhag in Shivaji University	
			3.50 Ha	Bhasha Bhavan in Shivaji University	
			0.5 Ha	Existing Lake small lake near well in Shivaji University	
			2.6 Ha	Padtala	
3	Reconstruction of Nalla and RCC Channel Sections	Retaining Wall	23.5 km	Along the Nalla in KMC limits	
		Box drains and Open drains along with road side drains	37.16 km	In KMC Limits	
		RCC Channel	275 m	Kalamba Lake Outlet	
4	Culvert Upgradation	Demolition of inadequate culvert	137	In KMC Limits	
		Construction of new Culvert	137	In KMC Limits	
		ENB near University Building	0.63 ha	Shivaji University	
		CNB near well	0.28 Ha		
		END on Nala near School of Nanoscience & technology at Rajaram lake	0.32 Ha		
6	Plantation	Plantation of indigenous Trees	100 Ha	Behind Kalamba Lake slopes on GP land	
			25 Ha	Shivaji University	
			9.079 km (39.84 Ha)	Nalla Park along Gomati Nalla and Jayanti Nalla	

Sr. No.	Interventions	Activities Proposed	Dimensions / Area / Numbers	Location	Bidding Package
7	Control Surface Runoff	Continuous Contour Trenching and Development of Dense Urban Forest	100 Ha	Behind Kalamba Lake slopes on GP land	
			25 Ha	Shivaji University	
		Loose Boulder Structure	-	Upstream of Kalamba Lake	
8	Construction of Sluice gates	Construction of precast sluice gate	4 Nos	Kalamba Lake Outlet	
9	Construction of Cement Check Dam	RCC Dam construction	L - 91 m, D - 4 m 1 No	Shivaji University	

Along with proposed interventions in Table 2.5, long term sustainable flood management plans like Equipment for the flood response cell at the ward office, Capacity building of Administration, Advocacy on policy - building codes, institutional rainwater harvesting, building byelaws and Capacity building of Stake holders are proposed.

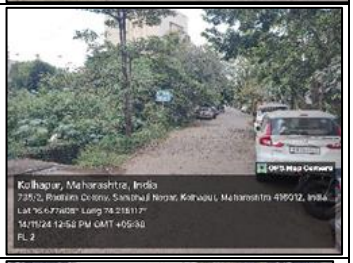
2.4 Technical Details of Interventions

2.4.1 Grey Infrastructure Within KMC Limits

2.4.1.1 Interventions at 29 Flooding Hotspots

Localized solutions are developed for 29 flooding hotspots, which include expansion of the drainage network in flood hotspot areas providing missing roadside drains, connecting existing drains, desilting nearby nalas, enhancing culvert capacities, and installing inlet arrangements to drains. These proposed solutions are proposed for adequacy with a 5-year return period, considering climate corrections. Below is a list of the flooding hotspots proposed activities.

Table 2-2: Proposed Interventions Flooding Hotspots

Sr. No.	Location Name	Basin Name	Reason for Flooding	Proposed Works	Photo
1	Devkar Panand Chowk	D	Inadequate waterway to carry runoff. Nalla converted in box drain with inadequate capacity.	1.Box drain - 2.0 X 2.0, L-235m both side 2.Road crossing duct 5.0x3.0, L-23m both side 3. Open Drain - 2 X 2.5, L-50 m	
2	Behind Nikam Park	D	Lack of storm water drains, Blockages of inlet gratings aty some location.	1.Open drain - 2.5 X 2, L-163	
3	Rajlaxmi Nagar	D	Silting of nalla, at D/S Drain water Blocked by K.T. Wear.	1.Box drain - 3 X 2 , L-245m 2.Nala desilting L-320m,Width 20m	

Sr. No.	Location Name	Basin Name	Reason for Flooding	Proposed Works	Photo
4	Prince Rajaram Colony	D	Silting of nalla.	1. Nala desilting, L - 410 M,Width 4m	
5	Dudhane Nala	D	Inadequate size of culverts, silting of nalla & RE wall damaged at some part.	1. Box Culvert - 3.5 X 2 2. Re Wall -L -1000m, ht- 4 m (3 m above GL + 1 m below GL) 3. Nala desilting, L-1190m upto river,Width 5m	
6	Parvati Multiplex	C	Inadequate waterway to carry runoff.	1. Box Drain - 1.20 X 1.20 , L-105M	
7	Bagal Chowk	C	Lack of storm water drains.	1. Box Drain - 2.5 X 1.50 , L-100M	
8	Parikh Pul Nala	C	Nalla converted in pipe drain with inadequate capacity, Silting of nalla.	1. Box Drain - 3.0 X 3.0 , L-75 2. Desilting-225M,Width 3m	
9	Parikh Pull	C	Inadequate waterway to carry runoff.	1. Box Drain - 2.0 X 1.5, L -125M (after bypass)	

Sr. No.	Location Name	Basin Name	Reason for Flooding	Proposed Works	Photo
10	Law College Chowk	C	Lack of inlet gratings, Silting of nalla.	1. Box Drain - 3.0 X 3.0 , L-100	
11	Janta Bazar Chowk	C	Lack of inlet gratings, Silting of nalla.	1. Box Drain - 4.0 X 3.0 , L-100	
12	Rajaram Puri 1st lane	C	Lack of storm water drains.	1. Box Drain, 3 X 3, L-150 M	
13	Mahadik Park Rajaram Rffal	C	Lack of storm water drains, Lack of inlet grating.	1. Desilting L-210 M, W-3 m	
14	Nala Enchroachment	C	..	1. Box Drain, 1 X 1, L-240 m	

Sr. No.	Location Name	Basin Name	Reason for Flooding	Proposed Works	Photo
15	Radhabai Shinde School	C	..	1. Box Drain, 2X1.5, L-140 m, both sides	
16	KSBP Chowk	C	Lack of proper inlet gratings.	MS gratings-300 M,220 M	
17	SSC Board, Niligiri Apartment	C	Lack of storm water drainage.	1. Box Drain 1.0 X 1.0, L-214 m	
18	Renuka Mata Mandir	C	Lack of storm water drains openings	1. MS Gratings - 10Nos	
19	Ravneshwar Mandir	C	Lack of storm water drains openings	1. Inlet Chamber 0.9 X 1.2 m, 1no 2. MS Gratings (throughout existing drain)	
20	Collector office to basant	C	Silting of drain, Lack of storm water drains openings.	Rect Open Drain 3 m X 1.5 m, L 200 m	

Sr. No.	Location Name	Basin Name	Reason for Flooding	Proposed Works	Photo
21	Patil wada	C	Silting of nalla, Lack of storm water drains.	Rect Open Drain 3 m X 3 m, L-100 m	
22	Shahapuri Gavat mandai	C	Lack of storm water drains openings, Silting of nalla.	1. Desilting L-100 M, W-5.5 m	
23	Muktasainik chowk to Patson	A	Nalla converted in box drain with inadequate capacity, nalla encroachment at some location, Silting of nalla.	1. Open drain - 2.0x2.0, L -200 M 2.Box Drain 2.5 X 2.0 L-160 M 3. Nala desilting -L-570 M, Width 3m	
24	IRB Godown	B	Nalla converted in box drain with inadequate capacity.	1. Culvert 2.5 X 2.5 m (15 m) 2. Box Drain 3 X 1.2 m - 171 m 3. Open Drain - 3 X 2 m - 31 m	
25	Pragati Society	B	Drain with inadequate capacity, nalla encroachment.	1. Open drain - 3 X 2 m, L-275 m X 2 nos	
26	Rasika hotel to Sapphire Path	A	Box drain with inadequate capacity, silting of nalla.	1. Open Drain - 2 X 2, L -475 m 2. Nala desilting, L - 300m, Width 5m	

Sr. No.	Location Name	Basin Name	Reason for Flooding	Proposed Works	Photo
27	Unik Park	A	Lack of storm water drains openings, drain with inadequate capacity, nalla encroachment at some location.	1. Box Drain - 2.5 X 2 , L -700 m	
28	Renuka Mata Mandir	A	Lack of storm water drains openings; Box drain with inadequate capacity.	1. Box Drain - 1.2 X 1.2 m, L- 200 (both side) 2. Box Culvert - 3.0 X 3.0, Road width 12m 3. SWD, Dia-900, L-40 (both side) 4. Open drain, 2.0 X 2.0m, L-510 m	
29	Trambak Nagar	A	Silting of drain, Drain with inadequate capacity.		

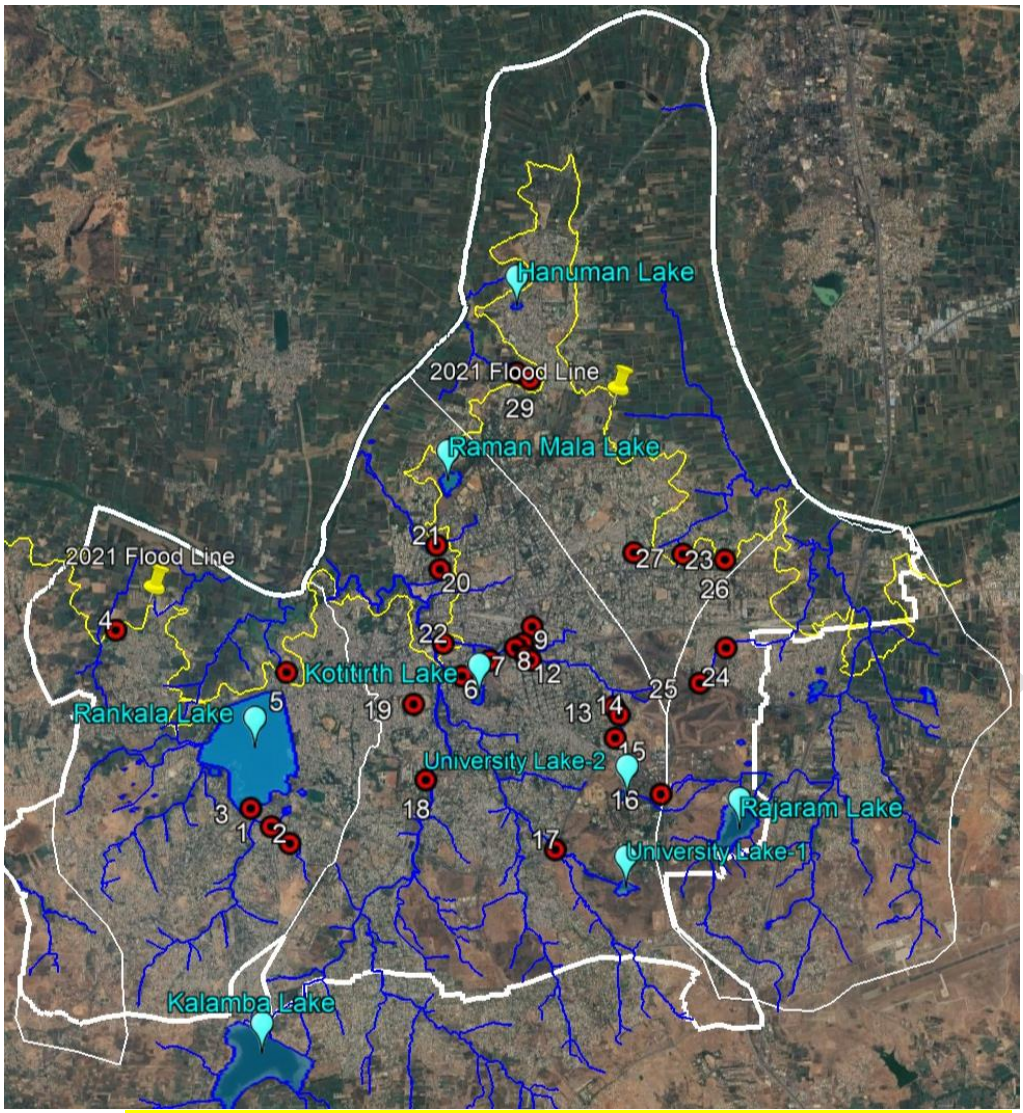
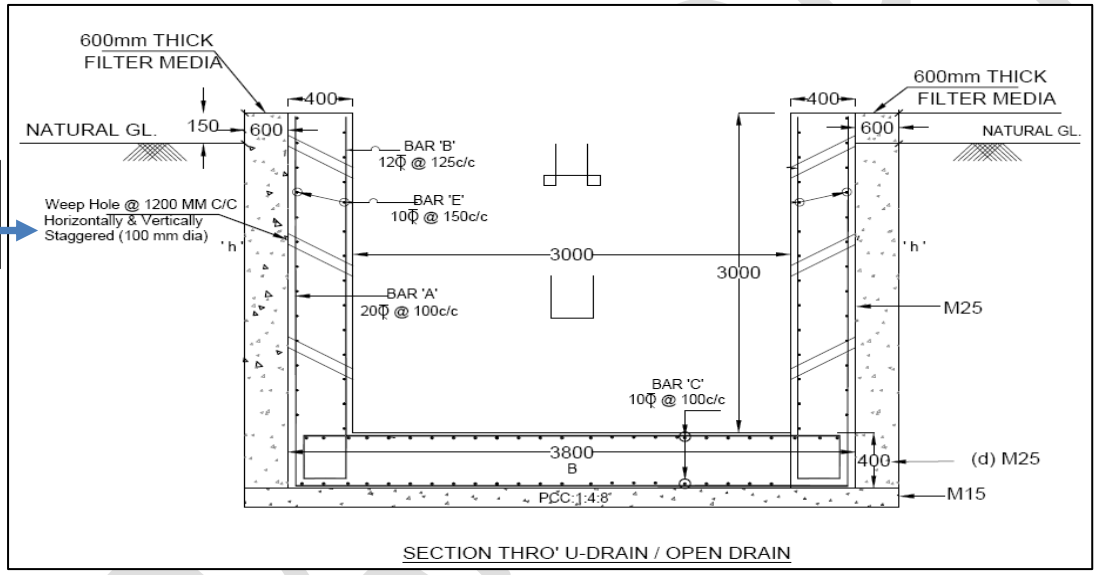


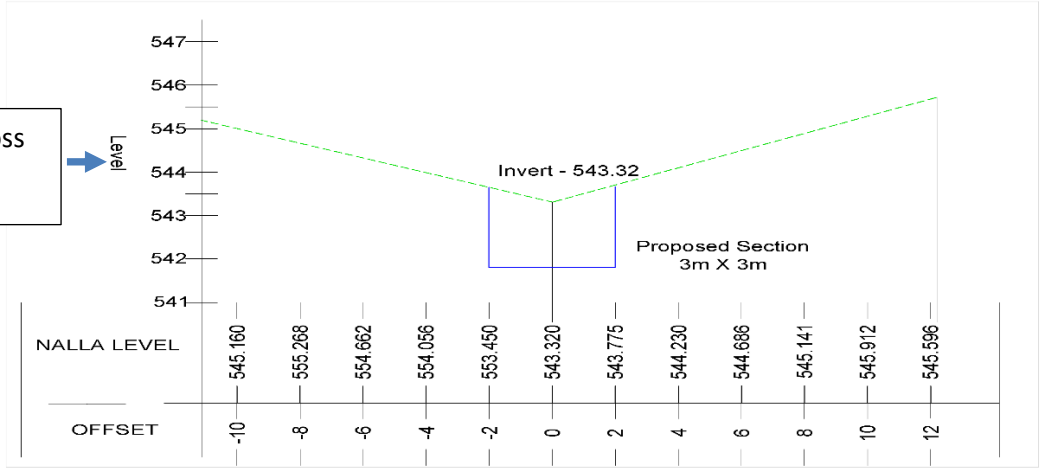
Figure 2-3: Location and Alignment Maps of Proposed SWD Flooding Hotspots

Sample interventions: - **PROPOSED OPEN DRAIN (3.0 X 3.0) OF FLOOD LOCATION AT PATIL WADA (FROM NODE J1017 TO 33)**

Proposed Cross Section



Existing Cross Section

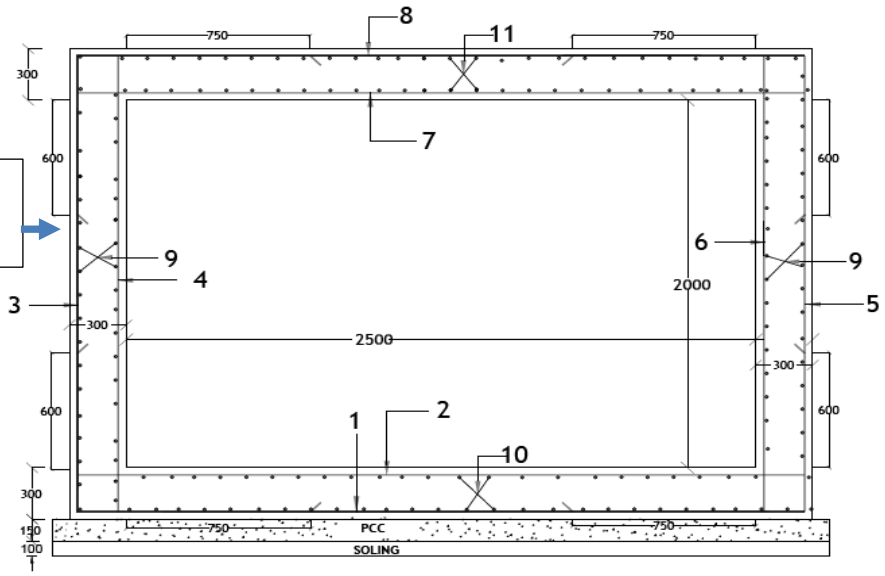


PROPOSED BOX DRAIN (2.5 X 2.0) & OPEN DRAIN (2.0 X2.0) OF FLOOD LOCATION AT MUKTASAINIK CHOWK TO PATSON

(FROM NODE J1206 TO 217)

Proposed
Cross Section

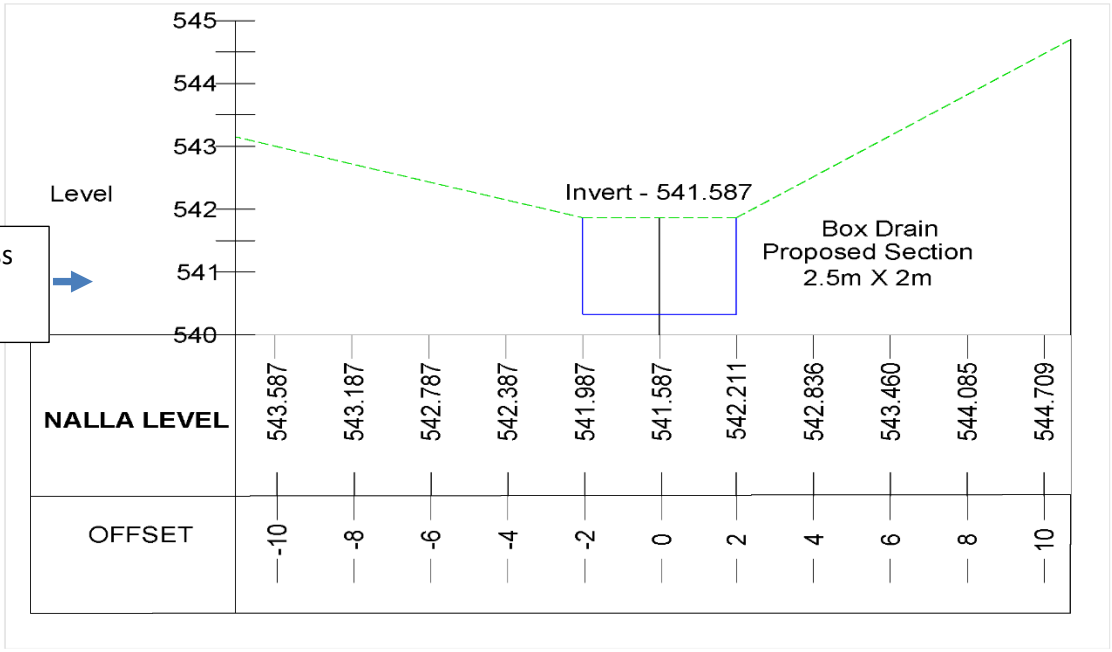
Construction Of Box Drain at
Unik Park &
Muktasainik Chowk to Patson
Size-(2.5 M X 2.0 M)



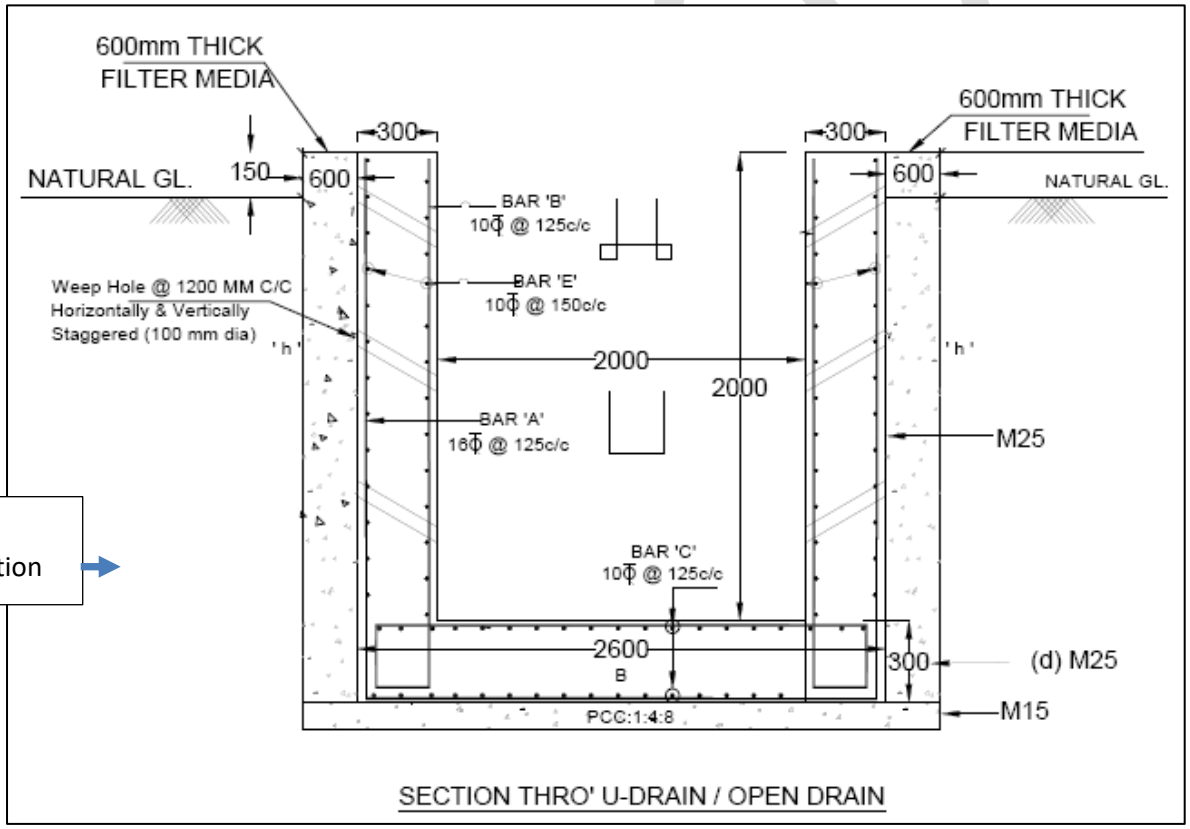
BAR BENDING SCHEDULE

BAR	SHAPE OF BAR	DIA OF BAR in 'mm'	SPACING in 'mm'
1		16	250
2		16	150
3		16	250
4		16	250
5		16	250
6		16	250
7		16	150
8		16	250
9		12	200
10		12	200
11		12	200

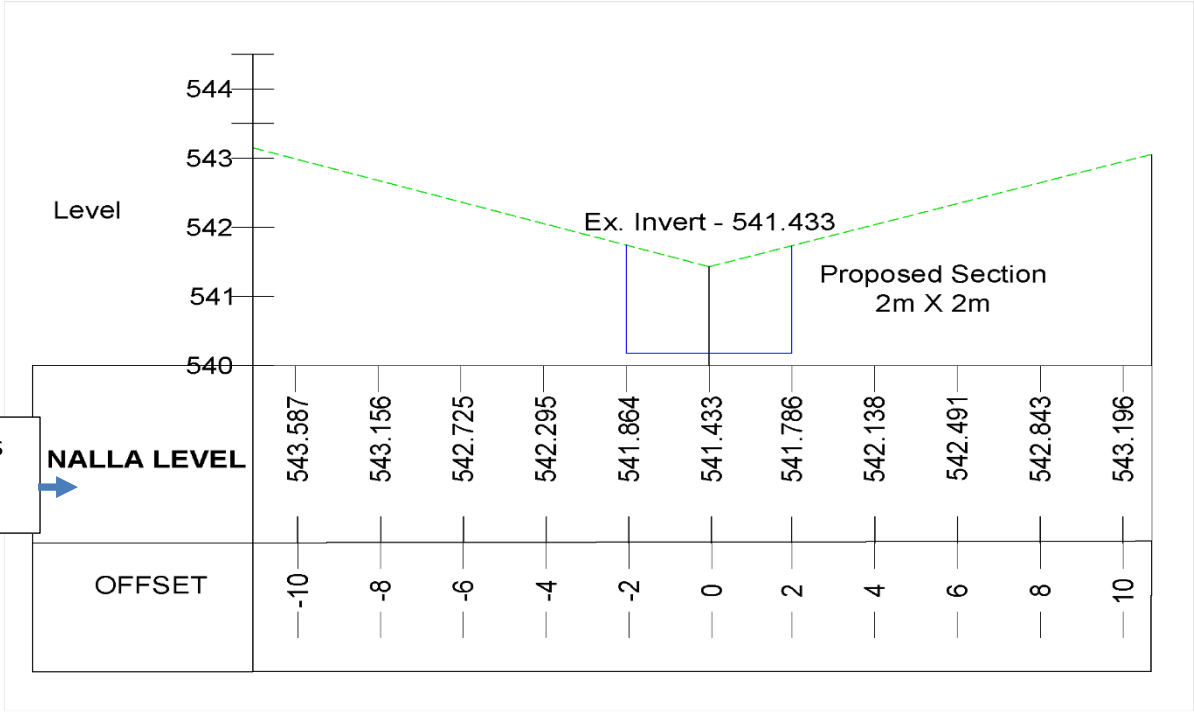
Existing Cross Section



Proposed Cross Section

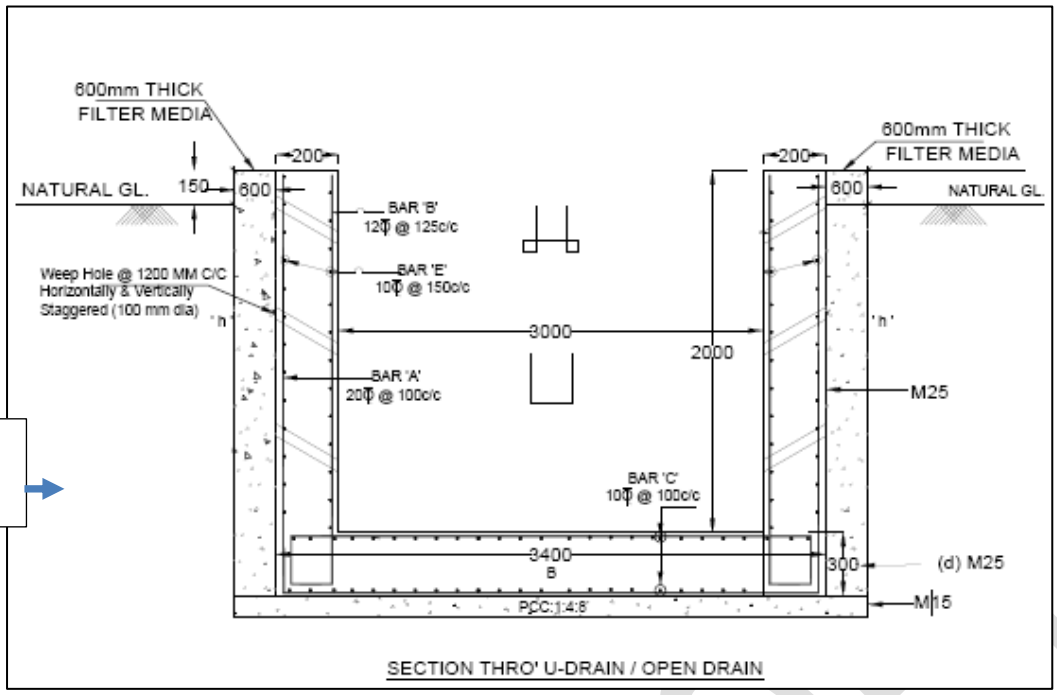


SECTION THRO' U-DRAIN / OPEN DRAIN

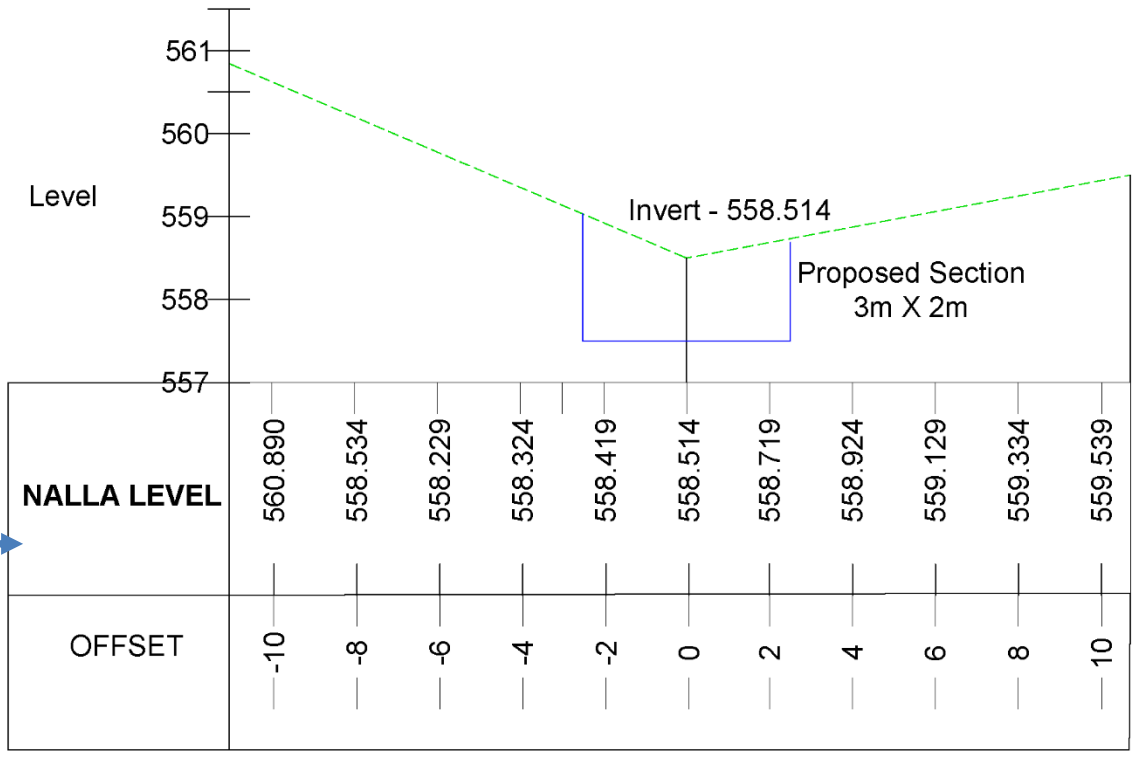


PROPOSED OPEN DRAIN (3.0 X2.0) OF FLOOD LOCATION AT PRAGATI SOCIETY (FROM NODE 195 TO 279)

Proposed Cross Section



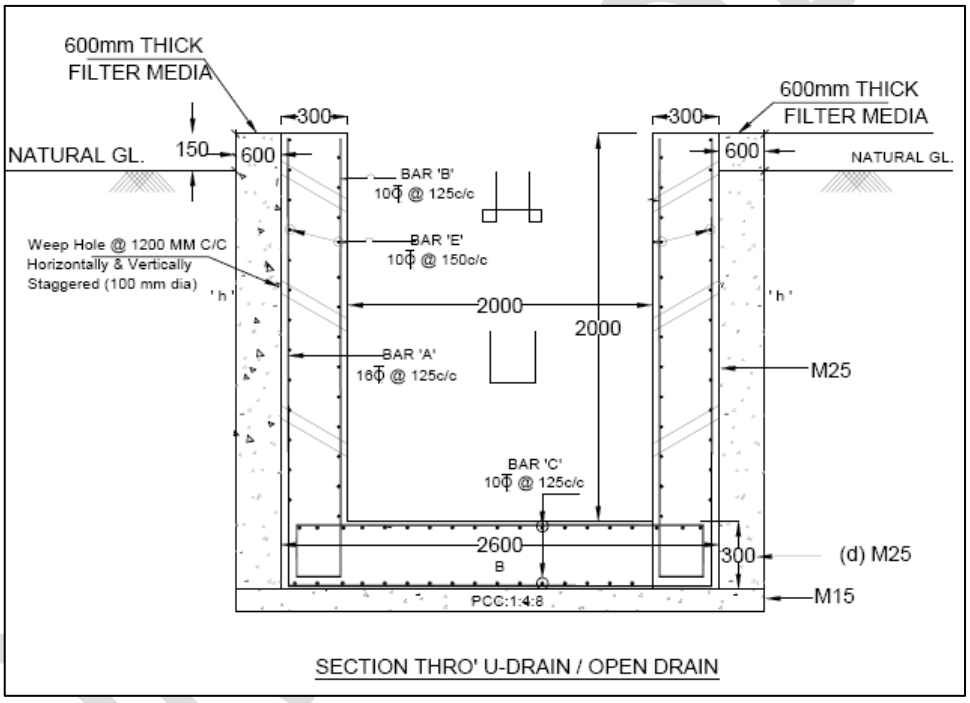
Existing Cross Section



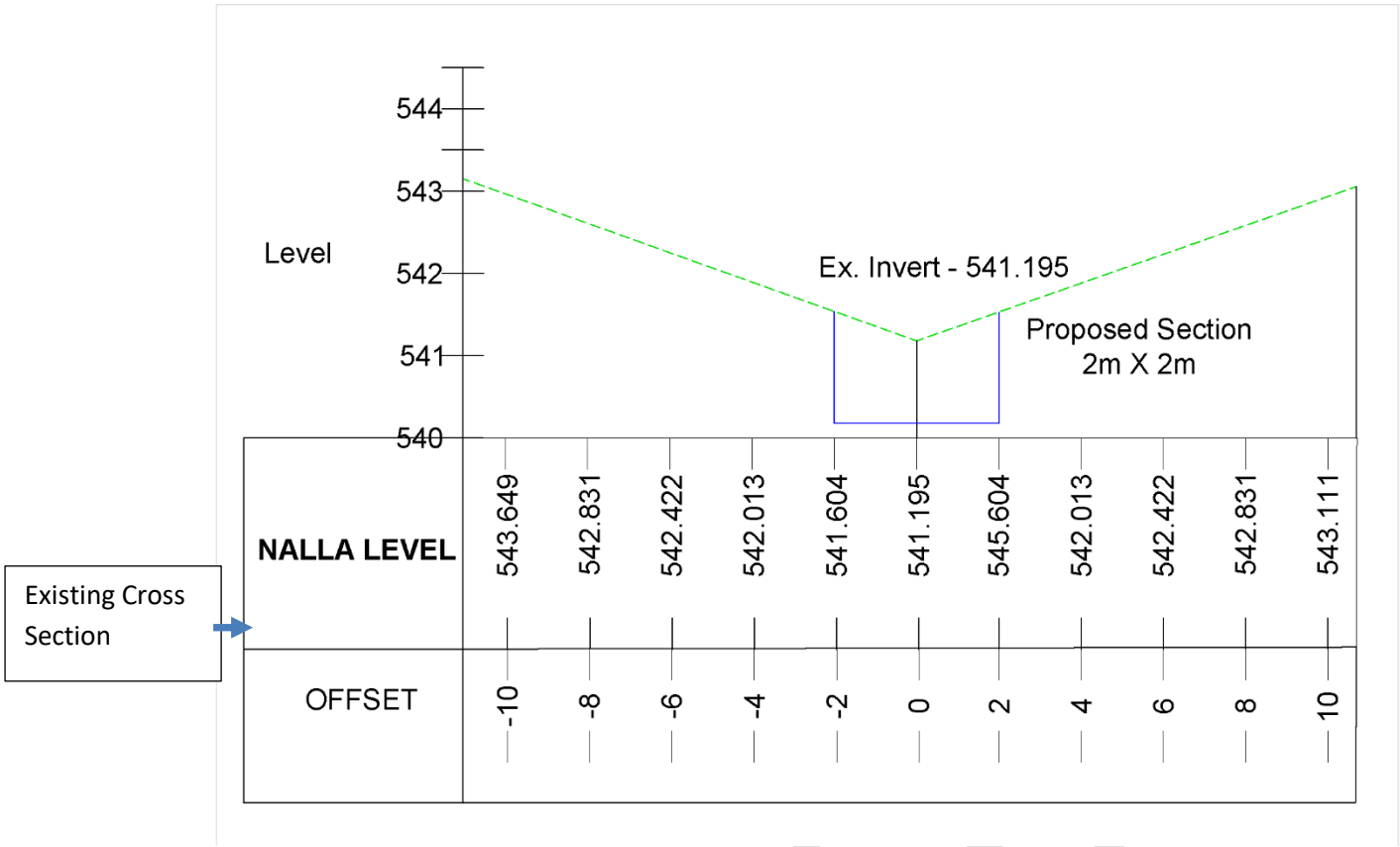
PROPOSED OPEN DRAIN (2.0 X2.0) OF FLOOD LOCATION

AT RASIKA HOTEL TO SAPPHIRE PATH
(FR OM NODE 97 TO 215)

Proposed Cross Section



SECTION THRO' U-DRAIN / OPEN DRAIN



2.4.1.2 Remodelling of Culverts

Over the years, inadequate culverts have been constructed without considering design rainfall intensities or the impact of climate change. These culverts become bottlenecks in the stream flow, causing water to back up and flood nearby areas. Many of these culverts are pipe drains with insufficient diameters, which trap floating debris and block water flow, leading to flooding. A total of 137 culverts along primary, secondary, and tertiary drains will be replaced with box culverts across the city and redesigned to enhance their hydraulic capacities. The criteria used to determine priority are inadequacy of existing culverts and location with culverts in populated areas over those in unbuildable flood zone areas. The following list provides the locations and the existing as well as proposed culvert sizes.

Table 2-3: Basinwise Culverts- Adequate & Inadequate

Sr. No.	Basin	Number of Culverts	No. of Adequate Culverts	No. of Inadequate Culverts - Proposed for Modification
1	A	37	10	27
2	B	21	14	7
3	C	114	62	52
4	D	68	23	45
5	E	12	6	6
Total		**252**	**115**	**137**

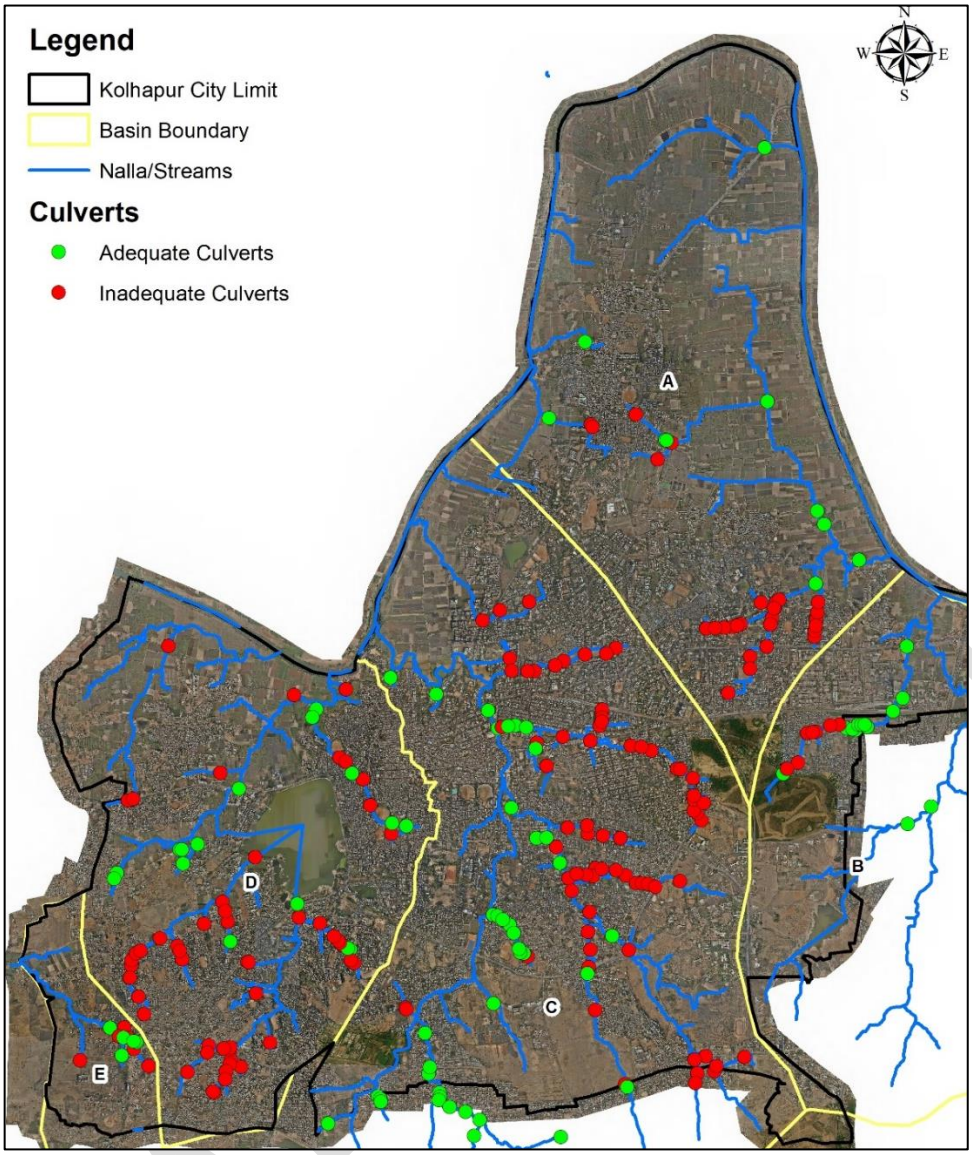


Figure 2-4: Basinwise Location Map of Proposed Culverts

2.4.1.3 Drain/Nalla Reconstruction and RCC Channel Section

From the modeling results, nala sections with inadequate capacities have been identified. Nala stretches that were inadequate to carry flood flows for a 5-year return period with the impact of climate change have been pinpointed. The nala stretches causing potential flooding in populated areas or on roads have been considered in study. 37.16 km of drains throughout KMC are proposed. Proposed retaining wall and Replacement of Damaged Drain Lines in Jayanti Nala is 9.5 km stretch of the main nala is designed for cross-section enhancement to increase its carrying capacity, addressing inadequacies observed during modeling.

A total of 6.62 km of damaged drain segments will be replaced with open constructed channels with retaining walls. New secondary and tertiary Roadside Drains of 2.4km in KMC are proposed to reduce flood risks.

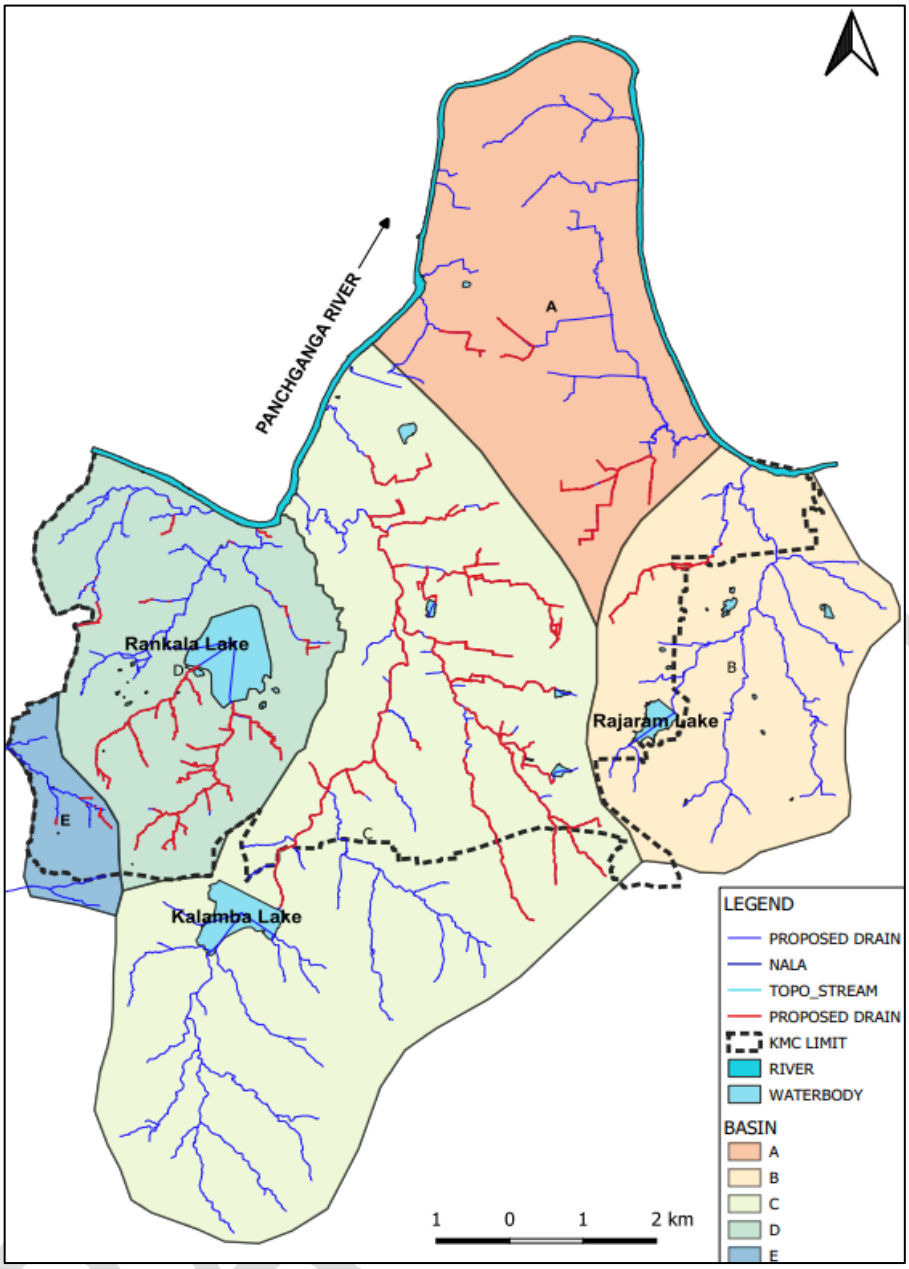


Figure 2-5: Alignment Map of Proposed Nalla Reconstruction

2.4.1.4 Drain/Nalla Retaining Wall

From the modeling results, nala sections with inadequate capacities have been identified. Nala stretches that were inadequate to carry flood flows for a 5-year return period with the impact of climate change have been pinpointed. Retaining walls are proposed in low-lying areas to minimize overtopping risks during heavy rainfall. To enhance the capacity of these nala stretches, appropriate widths have been proposed based on flood modeling. The construction of retaining walls on banks is proposed with enhanced nala cross-sections. The following table provides a list of locations where retaining walls are proposed. The total length of retaining wall 23.50 km have been proprosed.

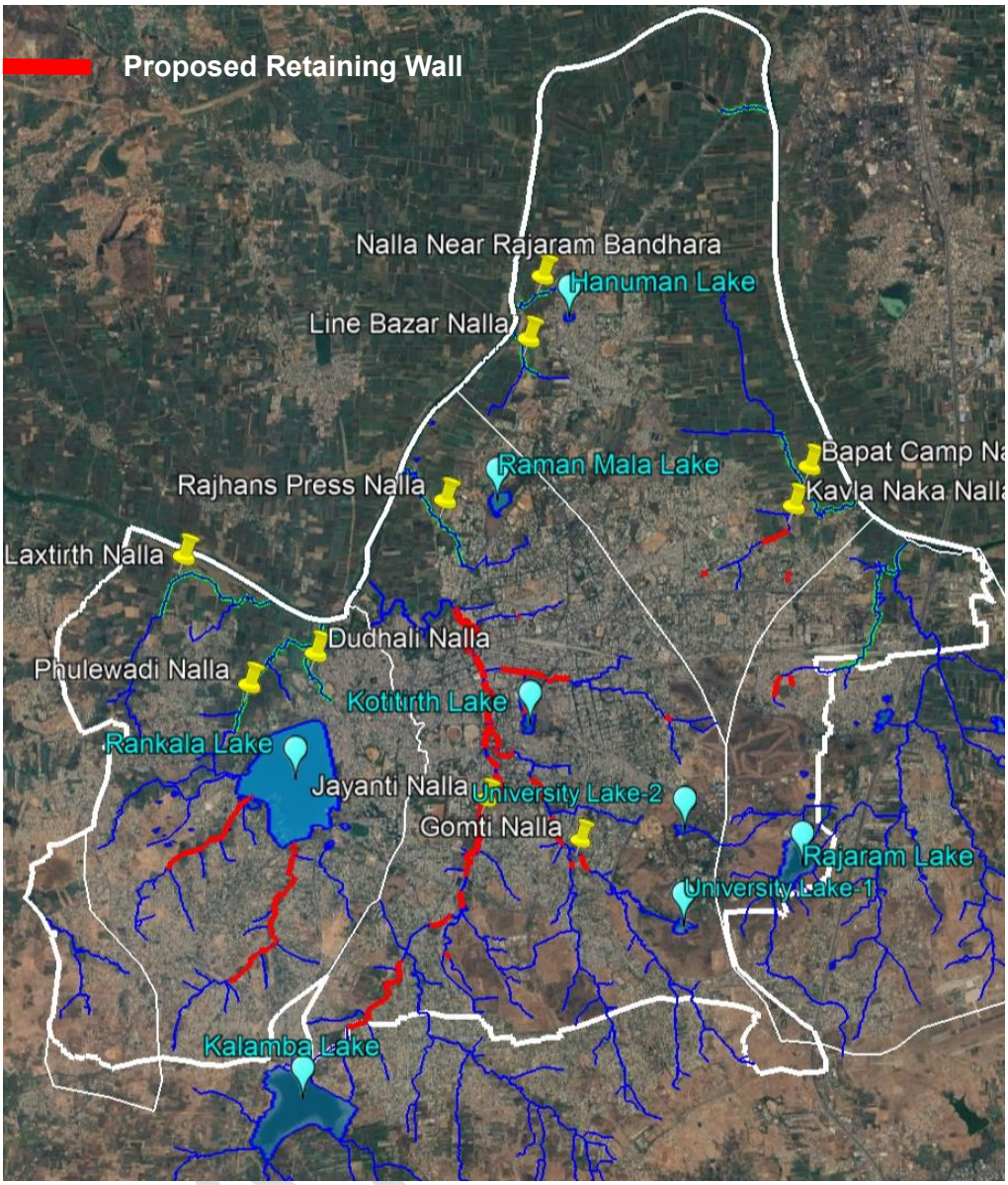


Figure 2-6: Alignment Map of Proposed Drain Retaining Wall

2.4.1.5 Drain/Nalla Desilting

Solid waste accumulation in the Nalas, flowing sewerage and inadequate culverts cause a lot of silt deposition in the natural nalas. In Kolhapur, nearly all the nalas have been silted up resulting in reduced flood carrying capacity of the nalas. It is proposed to desilt the nalas in each basin. Following table gives a basin wise summary of nala lengths to be desilted. Total desilted quantity is expected as 161138 CUM.

Table 2-4: Basin Wise Summary of Nala Lengths to be Desilted

Sr. No.	Name of Basin	Main Nallah	Nalla Length in City Limit (m)
1	A-Basin	Line Bazar	900
		Kasaba Bawada / Rajaram bandhara Nalla	560
		Rajaram Sugar Factory /Molasses Lake Nalla	1260
		Bapat Camp	2025
		Total- A Basin	**4745**
2	B-Basin	Vikram Nagar/Uchgaon/ Veet Bhati	2045
		Total- B Basin	**2045**
3	C-Basin	Jayanti Nalla	4590
		Rajhauns Press Nalla	1430
		Total- C Basin	**6020**
4	D-Basin	Laxtirth	2045
		Phulewadi	2305

Sr. No.	Name of Basin	Main Nallah	Nalla Length in City Limit (m)
		Total- D Basin	**4350**
5	E-Basin	Vasudev Nagar Nalla	1315
		Total- E Basin	**1315**
		Total –All Basins	**18475**

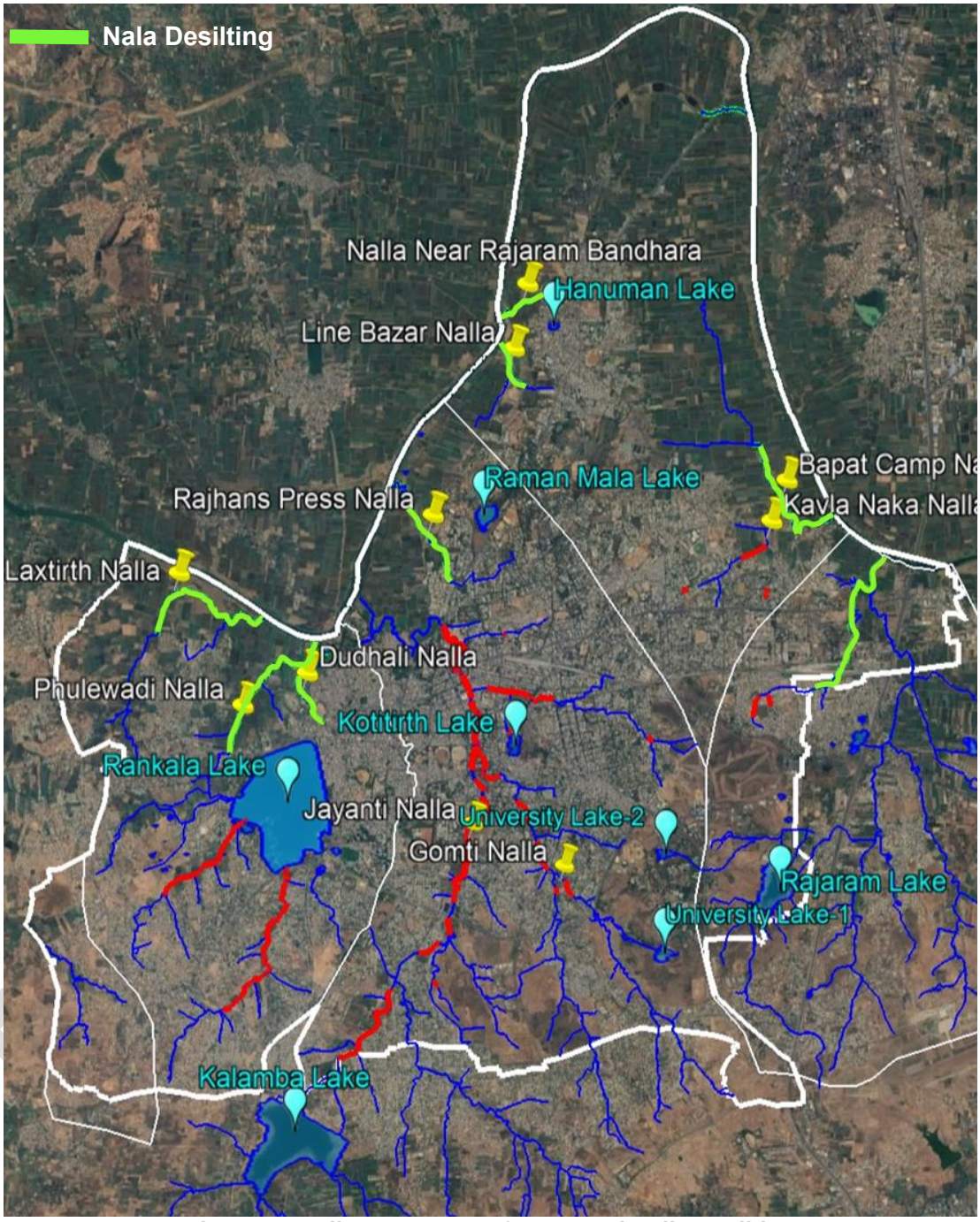


Figure 2-7: Alignment Map of Proposed Nalla Desilting

2.4.2 Blue Green Solutions within KMC Boundary

2.4.2.1 Green and Blue Interventions in Shivaji University Campus

The upsteam areas on Jayanti nala and Gomti nala – near the southern boundary of the city have large institutional campuses. The Shivaji University Campus, The Agriculture college Campus and Defense area have large tracts of open land which form the catchment of Jayanti and Gomti Nalas. Interventions are proposed to delay runoff from these rolling and barren lands by slowing down runoff, increasing ground water percolation and adopting soil and water conservation measures. Following treatments are proposed inside Shivaji University Campus

Table 2-5: Green and Blue Interventions in Shivaji University

Sr. No.	Interventions	Quantity	Unit
a	Continuous Contour Trench	25	Ha
b	Plantation	30000	Nos
d	Lake desilting at Sangeet vibhag	13080	Cum
e	Lake desilting at Bhasha Bhavan	21369	Cum
f	Earthen Nalla Bund at Shivaji University L-190 m, D - 5 m	1	No
g	Proposed desilting of Existing Lake near well	8750	Cum
h	Cement Check Dam near well at Shivaji University L - 91 m	1	No
i	Proposed Earthen Nala Bund on Nala near School of Nanoscience & technology at Rajaram lake L - 92 m, D - 4.9 m	1	No
j	Rajaram lake desilting	51121	Cum

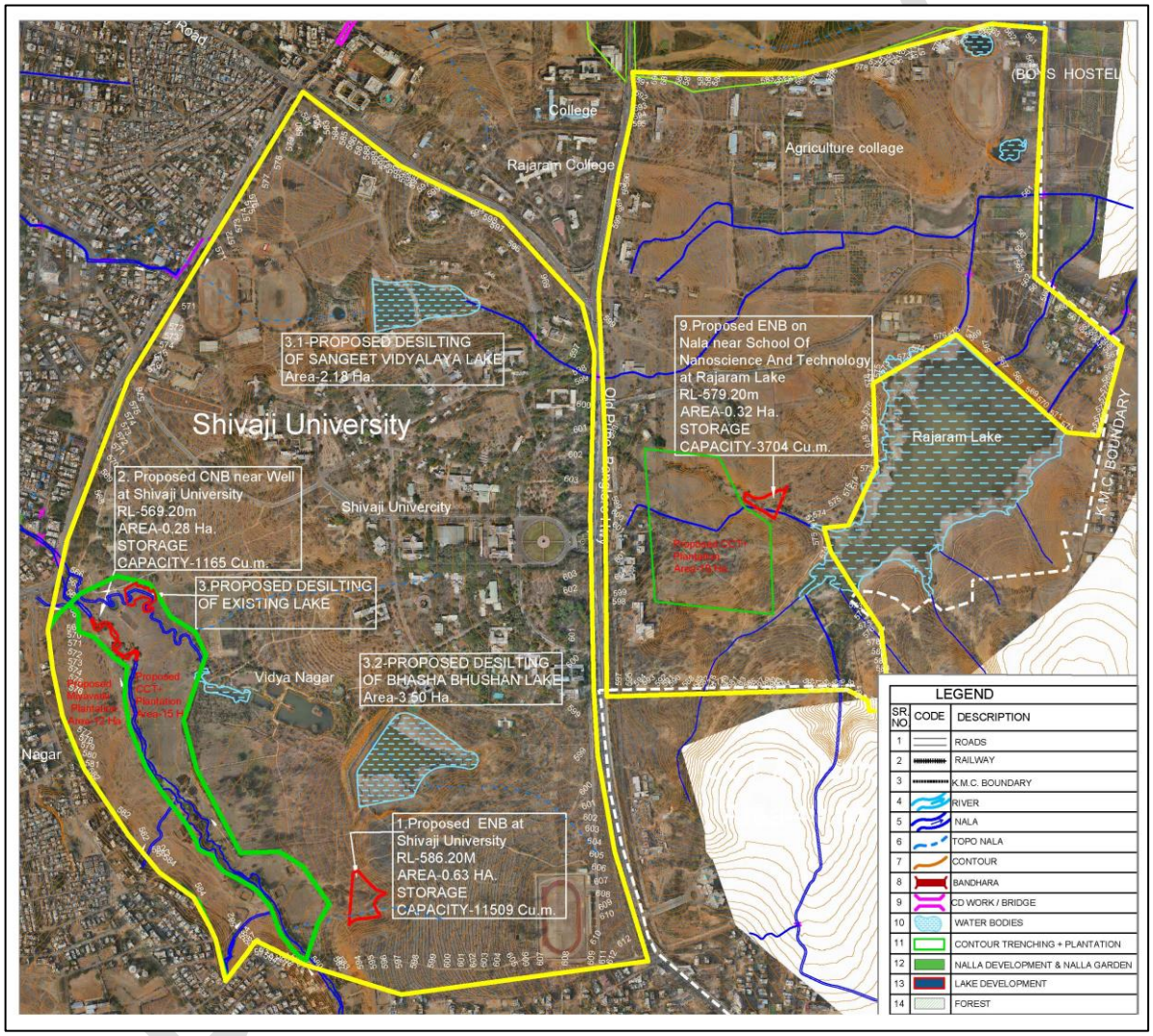


Figure 2-8: Green and Blue Interventions in Shivaji University

2.4.2.2 Development of Nala parks in the green reserved area of adjoining Nalas

Green reservations have been included in the city's Development Plan alongside the major Nalas. Currently, these areas are either overgrown with wild vegetation or have been encroached upon in some locations. There is a potential to develop these spaces as green buffers around the Nala. These areas can serve as green channels for Nala parks and act as buffers to absorb floodwaters. The Nala sections can be integrated with the green areas, protecting adjacent areas from encroachment and providing a green corridor through the city's core for citizens, while also serving as a flood absorption area. Following length of Nalas are proposed under this treatment. Details are shown on map.

Table 2-6: Parks around Gomati and Jayanti Nala

Sr. No.	Interventions	Quantity/ Size	Unit	Area
a	Gomti Nala - Nala Development	3123	Rmt	14.6 Ha
b	Jayanti Nala - Nala Development	5956	Rmt	25.24 Ha

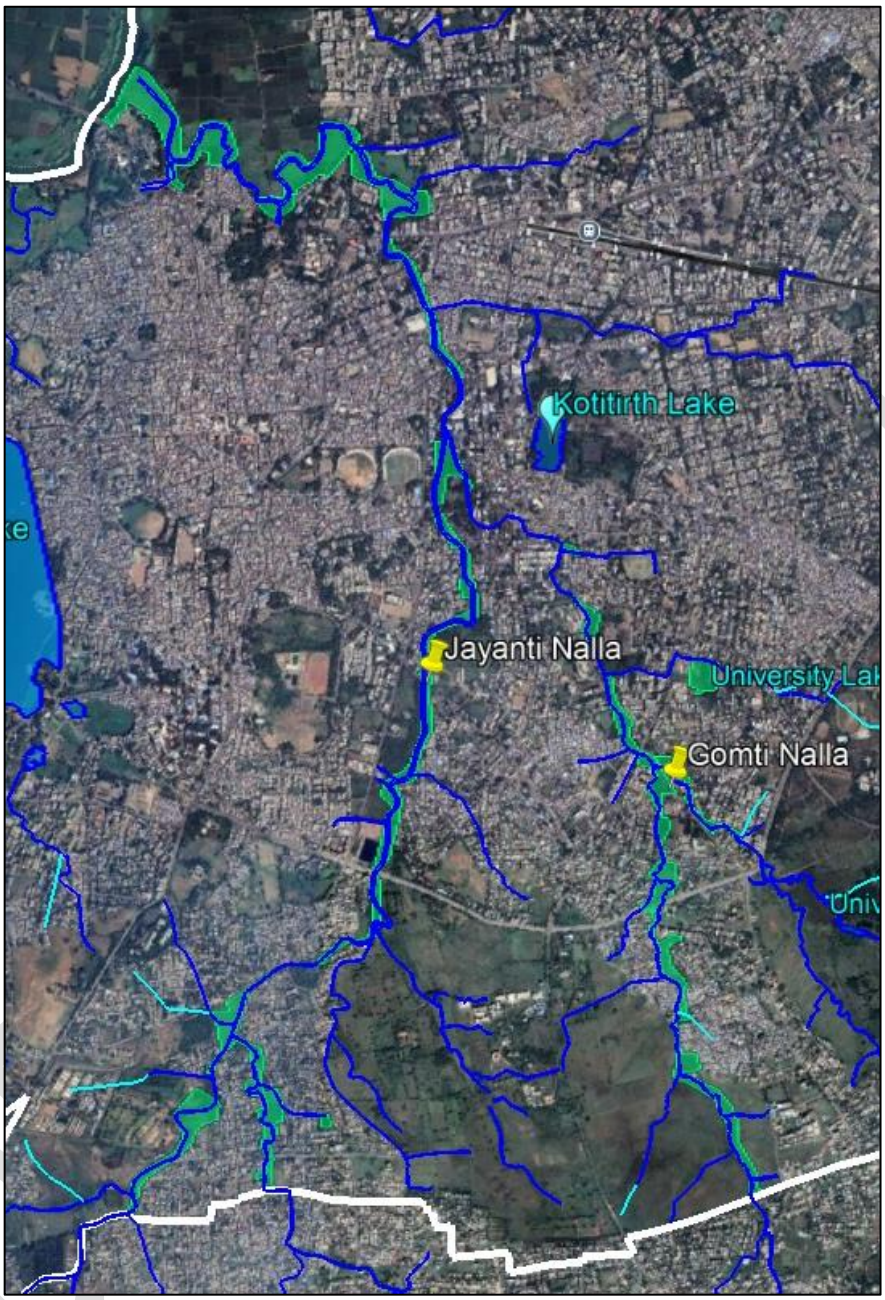


Figure 2-9: Alignment map of Nala Park and Nala Development

2.4.3 Blue Green Solutions Outside KMC Boundary

2.4.3.1 Kalamba Lake – As Flood Control Structure

Kalamba Lake is an artificial lake located on the southern boundary of Kolhapur Municipal Corporation. The lake used to serve as water source for the city. It still has a Jackwell and pumping arrangement to pump approximately 10 MLD of water for drinking.

The lake is strategically located at the foot of the hills in south of the city. The most prominent water stream – Jayanti Nala originates in these hills. The lake is formed by an earth Dam which is 1146 m long. The dam has two spillways that drain into what may be termed as the origin of Jayanti Nala within the city. Jayanti Nala flows through the heart of the city and effective channelization of flood water through this nala will have major impact on flood protection in the core city area. The salient features of Kalamba lake and its earthen dam are given below;

Table 2-7: Measurements of Kalamba Lake (Current)

Sr. No.	Type	Earthen Dam
1	Capacity	2.758 MCuM
2	Spread of reservoir	63.13 ha
3	Top of Dam	600.00 M
4	FSL	597.1 M
5	HFL	598.00 M
6	Bottom of Tank	586.74M
7	Length of waste weir	91.4 M
8	Max daily Drawl possible from Gravity outlet	2 MGD

Following enhancements are proposed for Kalamba lake;

Table 2-8: Intervetions Details Proposed at Lake Details

Sr. No.	Interventions Details Proposed at Lake Details	Quantity	Unit
1	**Kalamba Lake**		
a	Lake desilting	2,31,512	Cum in 15 Ha
b	Sluice gates	Existing 4, Proposed 4	Nos
	RCC channel	275 (8m wide and 2m deep)	m
2	Padtala Desilting	25813	Cum in 2.6 Ha

1. Desilting of the lake to enhance storage capacity.
    - Hydrographic surveys are carried out in the lake to measure its depth profile using Sonar waves. Based on the bed levels and design bed levels, an estimate of silt accumulation is calculated and dislting of the lake is proposed.
    - The silt removed will be analysed in laboratory for its quality and nutrient contents and then as per suitability will be given to farmers in nearby are for application on fields.
    - A total of 2,31,512 Cum of Silt is proposed to be removed.

The enhanced capacity of Kalmaba lake will serve as buffer to hold intense rainfall events and reduce peak discharge in downstream nala.

2. The Kalamba reservoir has gravity outlets for supply to water supply scheme. The maximum possile drawl from these outet is 2 MGD. The Kalamba reservoir has been provided with two overflow weirs. One of the weirs has 5 openings with gates.
    - To enhance the flood buffer capacity of Kalmaba reservoir, it is proposed to increase the depth of this spillway, allowing the lake water to be drained to a total depth of 2 meters.
    - The upstream area of this gate will be excavated to channelize the flow into the gate. On the downstream side, a concrete channel with a width of 8 meters and a depth of 2 meters, including energy dissipation arrangements, is proposed to extend up to the downstream culvert, directing the overflow into Jayanti Nala.
    - The gates will be operated to maintain the water level at 2 meters below the Full Supply Level (FSL) to provide buffer storage during the monsoon.

- Towards the end of the monsoon, the gates will be closed to top up the reservoir for use throughout the year. This spillway operation will significantly impact the flood flow in Jayanti Nala.
- The following graphs illustrate the flow in Jayanti Nala with and without flood control at Kalamba Lake, showing a significant reduction in peak discharge with water level maintained at 2 m below FSL.

Figure 2-10: Location Map of Kalamba Lake Sluice Gate

Figure 2-11: Kalamba Lake Proposed Sluice Gate

2.4.3.2 Green Interventions in upstream catchments of Kalamba Lake

The Upstream catchment of Kalamba lake is in neighboring Kalamba Gram panchayat. The hilly region in this catchment area is undergoing rapid developments with new roads and housing

development as well as commercial plotting coming up. As per site visits carred out and study of land ownership in this rea, certain government lands like Gairan, Social forestry lataion plots have been identified. It is proposed that these areas be covered with interventions for soil and water conservation and plantation.

The interventions can be implemented by KMC in coordination with Soild and Water conservation department. Following interevntions are panned;

Table 2-9: Green Interventions in Upsteam Catchment of Kalamba Lake

Sr. No.	Blue/Green Solutions Outside KMC limit in Kalamba GP Over Gairan and Social forestry areas	Quantity	Unit
1	Continuous Contour Trench	100	Ha
2	Plantations	120000	Nos
3	Loose Boulder Structures	3667	Cum

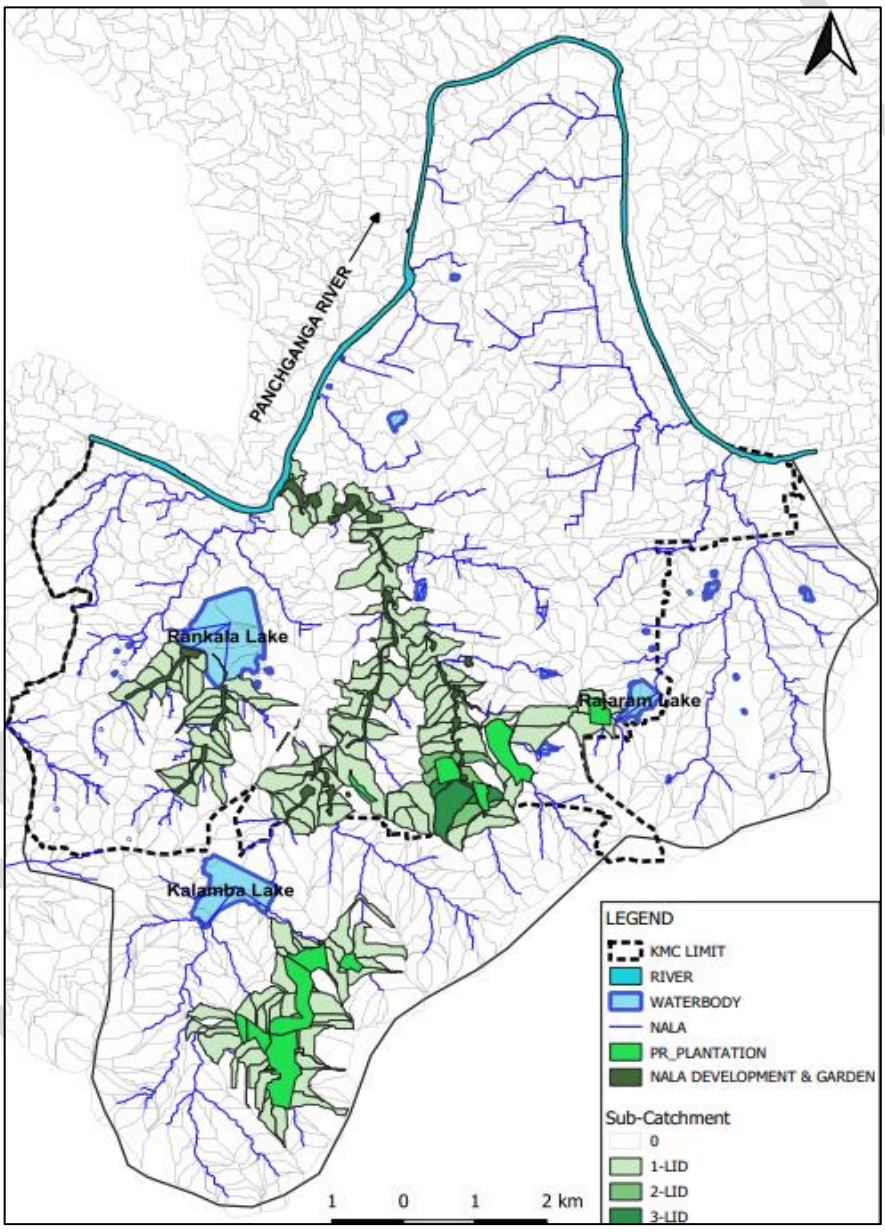


Figure 2-12: Green Interventions in upstream catchments of Kalamba Lake (Outside KMC Limits)

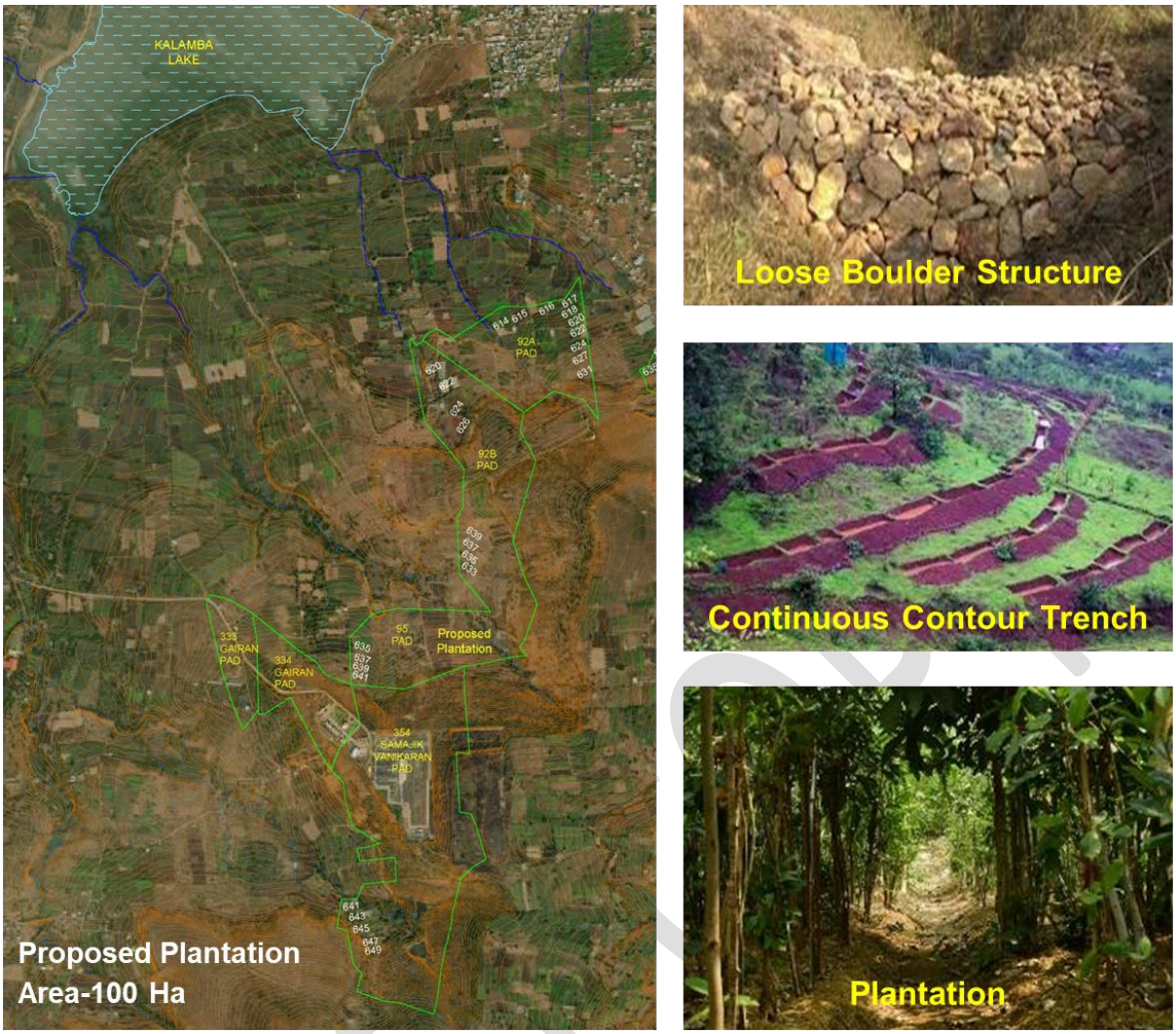


Figure 2-13: Green Interventions in upstream catchments of Kalamba Lake (Outside KMC Limits)

2.4.4 Long Term Institutional Flood Management Strategies

2.4.4.1 Roof Top Rainwater Harvesting to All KMC Buildings and Other Government Building

To enhance water conservation and mitigate urban flooding, all buildings under the Kolhapur Municipal Corporation (KMC), along with other government establishments, should implement mandatory rooftop rainwater harvesting systems. These systems will collect and store rainwater for various non-potable uses such as irrigation, sanitation, and groundwater recharge. Implementation of these systems will reduce surface runoff during heavy rainfall events, thereby alleviating the burden on the existing stormwater drainage network. A structured policy framework should ensure periodic inspection, maintenance, and efficiency assessment of these harvesting units. Public awareness campaigns should be initiated to highlight the importance of water conservation through rooftop harvesting. Government offices can serve as model establishments, demonstrating the efficacy of such initiatives. Proper guidelines can be developed regarding filtration and storage to ensure optimal utilization of rainwater. This initiative will lead to reduced flood risks, enhanced groundwater recharge, and improved sustainability in the region.

2.4.4.2 Roof Top Rainwater Harvesting Policy for Major Institutions in the City

A robust policy framework should be introduced to mandate rooftop rainwater harvesting systems in major institutional buildings, such as schools, colleges, hospitals, and commercial complexes, within Kolhapur. These establishments occupy large roof areas, providing substantial potential for rainwater collection. The stored water can be utilized for various non-potable purposes, reducing reliance on municipal water supply and aiding in flood mitigation. Strict regulatory enforcement

should be implemented to ensure compliance, with penalties for non-adherence and incentives for early adoption. Technical guidelines should be developed to standardize the design, installation, and maintenance of rainwater harvesting structures. Institutions should be encouraged to incorporate groundwater recharge mechanisms to enhance local water table levels. Awareness programs and training workshops can be conducted to educate stakeholders on the benefits and maintenance of rainwater harvesting systems. Periodic audits and inspections should be carried out to assess the effectiveness of installed systems. Collaboration with private firms and research institutions can facilitate technological advancements in rainwater harvesting techniques. Rainwater harvesting policies should be linked with building permit approvals to ensure systematic implementation. By integrating this policy, the city can achieve significant water conservation, mitigate flood risks, and promote long-term sustainability.

2.4.4.3 Roof Top Rainwater Harvesting Policy for Individual Houses, Bungalows, and Residential Societies

To promote decentralized rainwater management, a policy should be enacted to mandate rooftop rainwater harvesting systems for individual houses, bungalows, and residential societies. Homeowners should be encouraged to install simple and cost-effective rainwater harvesting structures to capture runoff from rooftops.

This harvested water can be used for gardening, washing, and other non-drinking purposes, as also for ground water recharge, thereby reducing dependency on municipal water supply and acting as flood management intervention.

A structured incentive program, including property tax rebates and subsidies, should be introduced to facilitate widespread adoption. Technical guidelines and support should be provided to homeowners for efficient implementation. Municipal bodies should conduct awareness drives and workshops to educate residents on the importance of rainwater harvesting. Proper integration of filtration mechanisms will ensure water quality maintenance. Rainwater storage tanks or percolation pits should be incorporated to recharge groundwater. Regular inspections and compliance checks should be conducted to assess functionality. Rainwater harvesting should be included as a prerequisite for new housing developments. The adoption of this policy will not only enhance flood resilience but also contribute to water conservation and climate adaptation in urban areas.

2.4.4.4 Nalla Clearance Certificate for Building Permission to Avoid Encroachments

To prevent encroachments on natural drainage channels and mitigate urban flooding, a Nalla Clearance Certificate should be made mandatory before granting building permissions in the Kolhapur region. This certificate will ensure that new constructions do not obstruct natural drainage paths or reduce the carrying capacity of stormwater channels. A systematic survey of existing nallas and their floodplain zones should be conducted, and a digital mapping system should be implemented to track encroachments. Strict penalties should be imposed on unauthorized constructions over nallas. The clearance certificate process should involve hydrological assessments and expert verification to prevent future flooding risks. Awareness campaigns should educate citizens and developers about the risks of obstructing drainage channels. Existing encroachments should be systematically removed, and alternative rehabilitation measures should be explored. A grievance redressal mechanism should be introduced to address concerns related to drainage and encroachments. Effective implementation of this policy will help in flood prevention, ensure smooth drainage of stormwater, and maintain ecological balance.

2.4.4.5 Modifications in Building Byelaws to Include Harvesting of Runoff from Maximum Rainfall of 30-Min Duration with a 2-Year Return Period

To enhance urban flood resilience, modifications in building byelaws should mandate the inclusion of rainwater harvesting systems capable of capturing runoff from a 30-minute maximum rainfall event with a 2-year return period. This requirement will ensure that structures are equipped to manage peak stormwater runoff efficiently, reducing the load on the city's drainage system. The policy should provide clear design specifications for storage capacities, recharge pits, and runoff disposal methods. Compliance should be linked with building permit approvals, ensuring proper integration

into new constructions. Existing structures should be incentivized to retrofit rainwater harvesting systems to meet these standards. Smart monitoring mechanisms, such as water level sensors, should be promoted to enhance operational efficiency. Public awareness programs should educate builders, architects, and citizens on the benefits of stormwater management. Integrating green infrastructure, such as bioswales and permeable pavements, should be encouraged alongside runoff harvesting. Periodic audits and inspections should be mandated to assess compliance and efficiency. By enforcing these modifications, the city can significantly reduce urban flooding risks, improve groundwater recharge, and enhance climate resilience.

2.4.4.6 Green Building Concept Implementation

The adoption of the Green Building Concept should be encouraged across all new constructions in the Kolhapur city to promote sustainability and environmental conservation. Green buildings incorporate energy-efficient designs, rainwater harvesting, natural ventilation, solar energy utilization, and wastewater recycling systems, leading to reduced ecological footprints. The municipal corporation should introduce incentives such as property tax rebates and fast-track approvals for buildings that meet green certification criteria. Regulatory guidelines should be established for developers, outlining key sustainability measures to be incorporated. Rooftop solar panels, vertical gardens, and permeable pavements should be promoted as standard components of green buildings. Rainwater harvesting should be integrated with landscape irrigation and flushing systems. Awareness campaigns should educate architects and builders on green construction practices. A certification system can be introduced to recognize and reward eco-friendly buildings. Regular audits should be conducted to ensure compliance and effectiveness. The integration of green buildings will significantly contribute to energy conservation, flood mitigation, and long-term urban sustainability.

2.5 Proposed Utility Shifting and Tree Cutting

2.5.1 Utility Shifting

In the proposed project utility shifting is expected during SWD works at proposed sub-project activity locations. The details are collected after site visit at each intervention i.e. sub-project location. The list of utilities needs to be shifted prior to construction activity is listed in **Table 2.15**.

Table 2-10: List of utilities shifting details

Sr. No.	Utility Details	Numbers Getting Impacted
1	Electric Pole	34 Nos
	Access Roads	
2	Transformer	9 Nos
3	UG Water Supply Line	186 mt
4	Electrical cable	114 mt
5	Optical Fibre	50 mt
6	Fuse Box	02 Nos
7	Gas Pipeline	52 mt

Contractor has to take prior permission for shifting of utilities or working near utilities listed from concerned departments.

2.5.2 Tree Cutting Details

A total of 25 trees of various sizes, at intervention locations at 29 flooding hotspots and proposed CD works will be cut down due to the project construction activities. The presence of Gulmohor trees has been recorded as the highest among other trees in project areas. None of these trees are of threatened status. The details of trees species and their presence in project area is given below in table to be felled in proposed sub projects.

Table 2-11: Distribution of Tree Species to be Felled in Project Area

Tree Species Common Name	Tree Species Botanical Name	Nos
Coconut	Cocos nucifera	3
Betelnut	Areca catechu	2

Tree Species Common Name	Tree Species Botanical Name	Nos
Gulmohar	Royal poinciana	6
Badam tree	Terminalia catappa	1
Saptaparni	Alstonia scholaris	1
Karanj	Pongamia pinnata	1
kapok Tree	Ceiba pentandra	1
Pimpal	Ficus religiosa	1
Rain Tree	Samanea saman	1
Bakul	Mimusops elengi	1
Nilgiri	Eucalyptus globulus	2
Neem	Azadiracta indica	1
Vilayati Chinch	Pithecellobium dulce	1
Babhul	Vachellia Nilotica	3

2.6 Resource requirements

Labour: The subproject will be implemented under variation of contracts. Both skilled and unskilled workers will be appointed throughout the construction period of 36 months. Overall, about 210 workers will be required, out of which 80% of workers from nearby communities mostly un-skilled or semi-skilled labour and 20% of other workers, skilled, technical etc. from outside the district but available within the state.

Construction Material Requirement: The major construction material with quantity is given in **Table 2-17**. Source of Construction Materials: Construction materials such as sand will be identified by respective contractors from recognised vendors after prior discussion with KMC officials.

Table 2-12: Construction Materials

Items	Unit	Quantity	Construction Works	Source
Steel	Metric Ton	9,175	Retaining wall, Box culvert, drain, slab culvert, Sluice gate,	Local Authorized Agency in consultation with KMC
Concrete- M15, M20, M30	Cubic meter	1,00,535	Footing, PCC, Slab, Stem	
Granular Sub base (GSB)	Cubic meter	31,145	Road reinstatement	
Dense Bituminous Macadam (DBM)	Cubic meter	9,981	Road reinstatement	
Bituminous Concrete (BC)	Cubic meter	5327	Road reinstatement	
Wet Mix Macadam (WMM)	Cubic meter	17675	Road reinstatement	

Earthworks: Approximated excavated earthwork quantity from bank trimming is given in **Table 2-18**. The excavated soils from the existing riverbanks will be reused as filling material toward countryside as per requirement.

Table 2-13: Approximated Earthworks Quantity

Earthworks	Volume	Remarks
Excavations	6,26,329.61 Cum	Will be reused in backfilling in countryside

Use of Water and Energy: The water will be required mainly for drinking and domestic purposes and construction works. The water will be sourced from KMC water supply.

Energy will be used for the camps and construction works in the project area. The contractor will avoid using fuel wood for cooking purposes in labour camps. The energy required for the

construction works is conventional source from MSEDCL. Vehicles will use diesel or petrol supplied by the contractor from outside the project area.

Subproject Implementation Schedule: Construction works will be completed in 36 months' time considering the working season. The Bar chart is enclosed as **Annexure 2.1 for Better Clarity**.

Consultancy Services for Re-Validation of Stormwater Drainage Master Plan and Preparation of Detailed Project Reports (DPRs) for Urban Flood Management in Kolhapur

IMPLEMENTATION PLAN

STORM WATER MANAGEMENT

IMPLEMENTATION PLAN

Sr. No.	Component	Qty	unit	Amount
I	Grey Infrastructure - Within KMC limits			
1	Flooding Hot spot locations	29	Nos	36,64,60,033.02
2	Culverts			
	A basin	27	Nos	12,30,09,056.54
	B basin	7	Nos	3,52,97,682.60
	C basin	52	Nos	31,11,44,737.01
	D basin	45	Nos	17,86,77,035.89
	E basin	6	Nos	2,32,52,719.84
3	Retaining Wall at Inadequate Sections	17	Km	1,93,73,80,266.31
4	Working Survey			13,85,393.88
5	Geo-technical Investigation			43,40,400.00
6	Electical & Utility Shifting for Culverts & Flooding locations	LS		4,50,95,042.90
7	Material Testing			58,23,831.50
			Total Amount - Grey Infrastructure	3,03,18,66,299.49
II	Blue/Green Solutions -			
1	Lake and Nala desilting			
a	Kalamba Lake desilting	231512	Cum	17,57,53,667.54
b	Sluice gates and RCC channel at Kalamba lake	275	m	5,53,29,290.80
2	Desilting of Padtala	65000	Cum	5,32,43,468.20
3	Nala desilting	161138	Cum	12,21,58,400.00
			Total Amount for Lake and Nala Desilting	40,64,84,826.54
2	Shenda Park - Within KMC limit			
a	Continuous Contour Trench	21	Ha	7,51,067.10
b	Plantation	25200	Nos	16,66,980.00
c	Miyawaki Plantation	25	Ha	41,25,00,000.00
d	Earthen Nala Bund at Agrifarm behind Rajashri Chatrapati Shahu Maharaj Govt. Medical College (L-144, D-6.8m)	1	Nos	2,75,79,485.53
e	Proposed New Earthen Nala Bund at West Side Nala (L-136 m, D-3.5 m)	1	Nos	77,62,400.00
f	Reconstrcution of Existing Earthen Nala Bund at West Side Nala (L-136 m, D-6m)	1	Nos	85,53,600.00
			Total for Shenda Park	45,88,13,532.63
3	Shivaji University -Within KMC limit			
a	Continuous Contour Trench	25	Ha	8,94,127.50
b	Plantation	30000	Nos	19,84,500.00
d	Lake desilting at Sangeet vibhag	13080	Cum	1,10,39,800.00
e	Lake desilting at Bhasha Bhavan	21369	Cum	1,82,47,900.00
f	Earthen Nalla Bund at Shivaji University L-190 m, D - 5 m	1	No	1,07,91,000.00
g	Proposed desilting of Existing lake near Well	8750	Cum	77,56,400.00
h	Cement Check Dam near well at Shivaji University L - 91 m, D - 4 m	1	No	1,87,78,400.00
i	Proposed Earthen Nala Bund on Nala near School of Nanoscience & technology at Rajaram lake L - 92 m, D - 4.9 m	1	No	50,70,200.00
j	Rajaram lake desilting	51121	Cum	4,00,41,900.00
			Total for Shivaji University	11,46,04,227.50
4	Development of Nala Park/green area around nalas			
a	Gomti Nala - Nala Development	3123	Rmt	10,62,29,700.00
b	Jayanti Nala - Nala Development	5956	Rmt	17,20,51,000.00
			Total in Nala Development	27,82,80,700.00
5	Institutional Rain Water Harvesting	120	Nos	1,34,09,124.00
			Total Amount for Components for BGGI Within KMC Limit (A)	4,30,34,58,710.16
B	Non-Structural Interventions			
1	Equipment for the flood response cell at the ward office			1,70,65,500.00
2	Capacity building of Administration			1,31,47,500.00
3	Advocacy on policy - building codes, building byelaws			98,00,000.00
4	Capacity building of Stake holders			1,04,82,000.00
			Total Amount for Non-Structural Interventions (B)	5,04,95,000.00
			Total Amount for Components Within KMC limits (A+B)	4,35,39,53,710.16
C	Blue/Green Solutions -			
	Outside KMC limit			
1	Continuous Contour Trench	100	Ha	35,76,510.00
2	Plantations	120000	Nos	79,38,000.00
3	Loose Boulder Structure	3667	Cum	75,25,514.00
			Total Amount for Blue/Green Solutions Outside KMC Limit ('C)	1,90,40,024.00
			Net Amount	4,37,29,93,734.16

Implementation schedule (month columns of the chart):

April'25	May'25	June'25	July'25	August'25	September'25	October'25	November'25	December'25	January'26	February'26	March'26	April'26	May'26	June'26	July'26	August'26	September'26
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

October'26	November'26	December'26	January'27	February'27	March'27	April'27	May'27	June'27	July'27	August'27	September'27	October'27	November'27	December'27	January'28	February'28	March'28
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36

2.7 Aspect Impact Analysis

The proposed project is intended for better management of the hydrological situation and management of storm water, improvement of drainage and to prevent flooding in the low-lying areas of the project area. However, the developmental activities which may be considered under the project both during under construction and operational phases may have some temporary or negligible impacts on various components of the environment. **Table 2.19** explained the major aspects and its impacts on concerned environment features.

Table 2-14: Aspect Impact Analysis

Aspects / Project Activities	Components of Environment and Social															
	Land	Air		Water		Biodiversity		Social and Aesthetic						Waste Management		
	Soil	Air Quality	Noise	Surface Water	Ground Water	Terrestrial	Aquatic	Resettlement & Land acquisition	Road and Traffic issues	Occupational Health and safety	Any damage to Public & Sensitive property	Employment	Aesthetics	Construction and Demolition Waste	Domestic Waste	Sediment/Silt Waste from Lakes and SWDs
Preconstruction and Construction Phase																
Site Clearing	Y	Y	Y	Y	Y	Y					Y			Y		
Excavation & Filling Operations	Y	Y	Y		Y	Y	Y	Y			Y			Y		
Silt Removal and Disposal		Y	Y	Y	Y		Y		Y	Y		Y	Y			Y
Demolition of Dilapidated Structures		Y	Y				Y	Y	Y	Y	Y			Y		
Construction Civil Works	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y		
Construction Camps		Y	Y		Y	Y	Y	Y	Y	Y	Y		Y		Y	
Tree Cutting	Y	Y				Y	Y				Y		Y			
Utility Shifting	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y		Y	Y		
Transportation of Construction Materials		Y	Y						Y				Y			
Storage of Construction Material	Y	Y											Y			
Operation Phase																
SWD system Maintenance	Y	Y	Y	Y										Y		
Maintenance Silt removal		Y	Y	Y	Y		Y		Y	Y		Y	Y			Y
Green buffer zones Maintenance	Y					Y						Y	Y			

2.8 Avoidance principles for impacts anticipated

Avoidance of Non-Permissible Activities: The project will not support following activities which may have severe, irreversible, long-term, adverse environmental impacts.

1. List of Non-permissible Activities / Project Financing Limitations of World Bank[3];
2. Any activity located within a notified Eco Sensitive Zone (ESZ) and is prohibited from being implemented within an ESZ;
3. Any activity that converts or leads to conversion and/or degradation of significant areas of critical natural habitats (areas officially protected) and/or other natural habitats (including wetlands of significance) and designated forest areas;
4. Avoidance of tree cutting to the possible extent with locational and design alternatives during design stage;
5. Avoidance of major settlement removal due to green field alignment of drains during design stage;
6. Any activity that promotes or supports pesticides that are banned by the Government of India[4];
7. Any activity that promotes or support pesticides that are in Classes Ia, Ib and II of the WHO classified pesticides by hazard[5];
8. Any activity that involves construction within 300 meters from an archaeological site/monument.
9. Any activity that violates the provisions of applicable National and State laws;
10. Construction of any new irrigation reservoir dam;
11. Construction of new canals, new branch canals and new offtake structures.

2.9 E&S Factors integrated into the subproject design

Integrating environmental and social factors into stormwater drain intervention design involves considering ecological impacts, community needs, and sustainable practices. There are many design considerations taken for the project such as:

- Design of storm water drains considering the peak run-off and discharge capacity of drains.
- Proposed Embankment, Retention wall, sluice gate to be designed as per Seismic activity of the area
- Using natural slope to the extent possible so that Minimal intervention to the natural contour
- Combining traditional grey infrastructure with green infrastructure elements (combination of blue green grey infrstructure) creates a more resilient and multifunctional system.
- Consideration of Nature-Based Solutions to manage stormwater offers numerous environmental and social benefits.
- Management of catchment area with plantation etc.
- Box culverts and drains are environmentally friendly, as they are made of concrete, which is a durable and recyclable material.
- The use of precast drains will significantly reduce environment and social risk duing construction activities. Also, will provide additional safety during construction.
- Horizontal Directional Drilling method is the most commonly recognised trenchless utilities method recommended as a preferred construction method in this project. HDD method offers less disturbance on traffic, the public, business activities and neighbourhood, lower restoration cost, less noise, dust and minimum import/export of the construction materials. In addition, HDD method can drill through congested utilities areas with minimum cutting and shorter time.
- Avoiding the interventions near to the Eco sensitive areas and ASI / Heritage structures

2.10 Project Beneficiaries

[3] https://www.ifc.org/en/what-we-do/sector-expertise/sustainability/ifc-exclusion-list-2007

[4] For list of pesticides banned in India, refer to: http://cibrc.nic.in/ibr2012.doc

[5] For list of pesticides in WHO classes Ia, Ib and II, refer to: http://www.who.int/ipcs/publications/pesticides_hazard_2009.pdf

The urban population in Kolhapur is divided into 77 Municipal Wards. According to Census 2011 figures Kolhapur city has a population of 5, 49,236 out of which 280,366 are males and 268,870 are females thus the Average Sex Ratio of Kolhapur is 959 will have access to improved urban living conditions and service delivery through interventions to improve storm water drainage infrastructure, neighbourhood upgrading, and local institutional capacity. They will not only benefit from improved flood resilience, reducing the risks of property and livelihood loss, contamination and deterioration of quality of life, but also improved productivity and access to services during flood emergency. Special attention will be given to the needs of disadvantaged groups, women, and children under the flood resilience Programs.

The government at the local and state level will directly benefit from the project's capacity building and technical assistance investments for improved storm water drainage network, flood-resilient spatial planning, permitting, revenue generation, and O&M. This will include beneficiaries from Municipal Corporation, Public Works Department, Fire Brigade, Disaster Management Authority, Department of Revenue and Rehabilitation etc. The estimated number of government beneficiaries is a) Department of Public Works: 20 b) Fire Brigade, Disaster Management Authority Department: 8 c) Health Department: 20 d) Water Supply Department: 15 e) Electricity Board: 10 f) Education Department: 10 g) Transport Department: 5 and h) Department of Public Relation: 2 who will benefit directly from trainings and improved administrative processes, additional data availability, and from being directly involved with implementation of project activities and related on-the-job learning.

The other beneficiary group is Developers and Builders, Business Trade Association, Entrepreneurs, Shop Owners, Hawkers, Societies, Residents, etc. These are people from communities who are directly affected due to flood and subsequent losses of life, land, assets, livelihoods, etc. And these include all sections of society and the vulnerable population, including women, men, elderly persons (above 60 years), pregnant women, children, persons with disabilities, sexual minorities, religious minorities, etc.

Through the project works and maintenance activities, the project intends to use labour-intensive approaches that will maximize the number of temporary jobs, providing needed livelihood support.

In terms of beneficiaries, it is estimated that at least 241,217 will directly benefit from avoided flooding and the neighbourhood upgrading activities and remaining 308,019 will indirectly benefit from the project (ref. Data from KMC). This is calculated based on the current population numbers for the targeted areas and estimations, population of directly affected 33 Wards. This population is expected to either directly or indirectly benefit from the flood interventions and the neighbourhood upgrading interventions in their communities either through reduced flood situation, better accessibility to roads and other services and also the community upgrading infrastructure.

Based on these assumptions, the number of beneficiaries has been estimated to be 44% of the total population in the flood impacted zone which is around 241,217 people. It is noted that this number does not account for other beneficiaries. For instance, the frequent and widespread flooding in these areas with inaccessible roads may cause disruption of markets and other activities affecting visitors from outside these communities.

2.11 Project Cost

Total project cost is 60.14 million USD, of which ___ Million USD (___%) will be financed by the World Bank and remaining ___ Million USD (30%) by Govt. of Maharashtra towards the implementation of Component 2.2. Entire project will be implemented over a period of 36 Months, starting from financial year 2025 to 2028

Chapter 3 : Administrative and Legal (Regulatory) Framework

This section explains the national and state administrative and legal (regulatory) requirements under different acts / rules and policies for E&S aspects. It also identifies the requirement of permits / licenses in the sub-project under different rules /regulation as different stages of the project period. Further, an outline of the World Bank Environmental and Social Management Framework (ESF) has been presented. Different acts / policies and its implications / applicability to the subproject activities of component 2.2, is detailed out in the sections below.

3.1 Applicable National and State Policies and Regulations

3.1.1 Environmental Regulatory Framework

The Environment Regulatory Framework as per National and State Policies and Regulations given in **Table 3.1** explained key legal and policy provisions of GoI, GoM and international conventions applicable to the subproject activities. While the key policies and regulations are mentioned in Table 3.1, the entire legal and regulatory framework is given in the ESMF.

As per the Ministry of Environment, Forests and Climate Change (MoEF&CC) of GoI's Environmental Impact Assessment (EIA) Notification 2006 and ammedments till date, storm water drain works does not require any EIA or approval from MoEF&CC[6].

3.1.2 Social Regulatory Framework

The applicable Social Regulatory Framework as per National and State Policies and Regulations given in **Table 3.2** explained key legal and policy provisions of GoI, GoM. While the key policies and regulations are mentioned in Table 3.2, the entire legal and regulatory framework is given in the ESMF.

3.1.3 International Labour Conventions and Key Statutory Clearances for Construction

The international labour conventions applicable to the subproject activities is explained in **Table 3.3**. India has ratified six out of the eight core/fundamental International Labour Organization (ILO) Conventions. Key Statutory Clearances for Construction are provided in the **Table 3.4**.

[6] https://environmentclearance.nic.in/writereaddata/CompendiumofEIANotifications_Jan2021.pdf

Table 3-1: Applicable Environmental Acts and Policies and Notifications of GoI and GoM

Sr. No.	Acts and Policies and Notifications of GoI and GoM	Key Requirements	Type of Permit	Concerned Authority	Stage of Applicability	Responsibilities
1.	Water Prevention and Control of Pollution) Act, 1974, 1988	To provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water.	Consent to Establish (CtE) Consent to Operate (CtO)	MPCB	Before Construction Activity Start.	Contractor.
2.	Air (Prevention and Control of Pollution) Act, 1981, 1987	To prevent, control and abatement of air pollution activities.	Consent to Establish (CtE) Consent to Operate (CtO)	MPCB	Before Construction Activity Start	Contractor
3.	Environmental (Protection) Act, 1986 amended 1991	To protect and improve overall Environment		MoEF&CC, GoI DoE, CPCB, MPCB	Throughout the project cycle	All agencies including Contractor
4.	Noise Pollution (Regulation and Control Act 1990) and rules 2000 and amendment till date	Ambient Noise Standards for different areas and zones (Contractor has to comply with the standard limits during implementation)	No permits issued under this act	MPCB	During Implementation	Contractor
5.	Hazardous Waste Management Rules, 2016	Provides procedures for spent oil, used engine oil, gear oil, sludges handling, storage and disposal facility (TSDF)	Requires Pollution Control Board's consent for handling hazardous waste.	CPCB and MPCB	Before Implementation	Contractor
6.	Construction and Demolition Waste Management Rules, 2016	To manage construction waste resulting from construction, remodeling, repair and demolition of any civil structure.	No authorization is to be obtained	MPCB, Local Bodies	During Implementation	Contractor
7.	Solid Waste Management Rules, 2016	Generated weed waste and kitchen waste from camp site shall be stored separately and dispose of as per the directions of the local body from time to time. No waste shall be thrown, burn or buried on streets, open public spaces or in the drain or water bodies.	Obtaining authorization under solid waste management rules for handling and disposal of waste generated.	MPCB	Before Implementation	Contractor and PIU
8.	Central Vehicle Act 1988 Central Motor Vehicle Rules 1989	To minimize the road accidents, penalizing the guilty, provision of compensation to victim and family and check vehicular air and noise pollution.	No permit issued under this Act; however, the contractor has to ensure proper license, PUC, permits as required	District / Regional Transport Officer	During Implementation	Contractor

Sr. No.	Acts and Policies and Notifications of GoI and GoM	Key Requirements	Type of Permit	Concerned Authority	Stage of Applicability	Responsibilities
9.	Notification for use of fly ash, 2003 and subsequent amendment, 2016	Presence of TPPs within 300 km radius of proposed project activities are observed. Project activity involves construction activity like PCC lining, rehabilitation of regulating structure, flood wall construction.	No permit issued under this Act; however, the PIU has to explore possibility of fly ash use in civil work	MoEFCC	Designing Stage	Contractor and PIU
10.	Maharashtra Felling of Trees (Regulation) Act of 1964	Conservation of forest and controlled felling of trees	Tree cutting Permission from Garden Department of KMC	KMC	Before Implementation	KMC
11.	Ancient Monuments and Archeological Sites and Remains (Amendment and Validation) Act, 2010	Conservation of cultural and historical remains; if any such archaeological wealth found during implementation of project activities specially during	No permit issued under this Act; however, the contractor shall inform respective department if any such archaeological wealth found	Archaeological Survey of India (ASI)	During Implementation ESMPs of the project works include procedures for dealing with chance finds.	Contractor
12.	Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996	To regulate the employment and conditions of service of buildings and other construction workers and to provide for their safety, health and welfare measures and for other matters connected therewith or incidental thereto.	Obtaining Laborer License	Chief Labour Commissioner, GOM	Before commencement of civil work	Contractor
13.	Plastic Waste Management Rules, 2016	To manage the plastic waste generated during project implementation (Plastic waste need to collected separately and disposed)	No Authorization is to be obtained	MPCB	During Implementation	Contractor
14.	Insecticides Act, 1968, Rule 1971	Use of registered and recommended insecticides and non-use of banned insecticides. Insecticides that are banned and restricted in India will not be promoted as part of the project activities	No permit issued under this Act; however, the PIU has to ensure non-use of banned pesticides	Central Insecticides Board and Registration Committees (CIB & RC)	During Construction and Operation	Contractor and PIU

Table 3-2: Applicable Social Policies and Notifications of GoI and GoM

Sr. No.	Acts and Policies and Notifications of GoI and GoM	Key Requirements	Type of Permit	Concerned Authority	Stage of Applicability	Responsibilities
1.	Contract Labour (Regulation and Abolition) Act, 1970;	The Act is applicable to the establishments or Contractor of principal employer if they employ 20 or more contract labour. The Act provides for certain welfare measures to be provided by the Contractor to contract labour	Contractor to obtain a Certificate of Registration as the principal employer and License	Chief Labour Commissioner, Government of Maharashtra.	Before Implementation	Contractor
2.	Public Liability and Insurance Act 1991	Protection from liability arising due to accidents from handling of hazardous chemicals	Contractor of project should take out Insurance policies providing for contracts of insurance so as he is insured against liability to give relief, before handling any such hazardous material	District Collector	Before Implementation	PIU/PMU
3.	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	No permit issued under this Act; however, contractor has to ensure that no construction workers are paid not less than the prescribed minimum wage	Chief Labour Commissioner, Government of Maharashtra.	During implementation of Civil work	Contractor
4.	Equal Remuneration Act, 1979	The Act provides for payment of equal wages for work of equal nature to Male and Female workers and not for making discrimination against Female employees in the matters of transfers, training and promotions etc	No permit issued under this Act; however, contractor has to ensure that equal wages are provided for work of equal nature to Male and Female	Chief Labour Commissioner, Government of Maharashtra.	During implementation	Contractor
5.	The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013	The act provides for a transparent process and fair compensation in land acquisition for public purpose and provides for rehabilitation and resettlement of land owners and those affected by land acquisition.	No permit issued under this Act; however, POU and PMU has to ensure that compensations provided for loss of properties as per	Revenue Department/ District Administration Stage wise notification as per Act	During implementation	PIU and PMU

Sr. No.	Acts and Policies and Notifications of GoI and GoM	Key Requirements	Type of Permit	Concerned Authority	Stage of Applicability	Responsibilities
			R&R action plan			
6.	Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996	It regulates the employment and conditions of service of building and other construction workers and provides for their safety, health, and welfare	No permit issued under this Act; however, contractor has to provide EHS requirements to workers	Chief Labour Commissioner, Government of Maharashtra.	During construction work .	Contractor
7.	Workmen Compensation Act, 1923	The Act provides for compensation in case of injury by accident arising out of and during the course of employment	No permit issued under this Act; however, contractor has to record all cases of accidents and provide compensation	Commissioner for Workmen's Compensation	During Implementation	Contractor
8.	The Inter-State Migrant Workmen (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). Certain facilities such as housing, medical aid, traveling expenses from home up to the establishment and back, etc. to be provided to inter- state migrant workmen	Contractor shall register with Labour Department	Chief Labour Commissioner, Government of Maharashtra.	Before Implementation	Contractor
9.	The Child Labour (Prohibition & Regulation) Amendment Act, 2016	The Act prohibits employment of children below 14 and 15 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.	No permit issued under this Act, however the contractor has to ensure non-employment of child labour	Chief Labour Commissioner, Government of Maharashtra.	During Implementation	Contractor
10.	Sexual Harassment of Women at the Workplace (Prevention, Prohibition and Redressal) Act, 2013 (POSH Act)	It mandates every organization having more than ten employees to constitute an Internal Complaints Committee (ICC) in the prescribed manner to receive and address the complaints of any sort of sexual harassment from women in a time-bound and extremely confidential manner	No permit issued under this Act; however, the contractor has to ensure no sexual harassment of woman at work place	District Officer (District Magistrate or Additional District Magistrate)	During Implementation	Contractor
11.	Maharashtra State Right to Public Services Act, 2025	The Act provides that the citizens shall be provided services by the State	No permit issued under this Act,	The Maharashtra State Commission	During Implementation.	Contractor.

Sr. No.	Acts and Policies and Notifications of GoI and GoM	Key Requirements	Type of Permit	Concerned Authority	Stage of Applicability	Responsibilities
		Government in a transparent, efficient and time bound manner. Citizens can get complete information regarding which services are available under this Act by accessing either the mobile app 'RTS Maharashtra' or 'Aaple Sarkar Web Portal'.	however, the contractor has to provide public services during construction.	for Right to Services.		
12.	Maharashtra State Water Policy, 2019.	The policy provides a framework for water resources planning, development, management, and governance in Maharashtra. It contains principles, objectives, strategies, and action points for various aspects of water resources such as irrigation, drinking water supply, hydropower generation, flood control, drought mitigation, environmental protection, participatory management, institutional reforms, and legal aspects.	The contractor has to arrange drinking water in case of disturbances of drinking water supply pipe lines during construction.	Maharashtra Water Resources Regulatory Authority.	During Implementation.	Contractor.
13.	Maharashtra Urban Mobility Policy, 2023.	Applicable to all urban areas of the state, the policy envisions transport modes which are safe, reliable, sustainable and accessible for citizen from all walks of life. Additionally, focusing on women's safety.	The contractor and respective PIU has to provide safe and reliable mobility during construction and operation.	Urban Development Department.	During Implementation.	Contractor and PIU.
14.	Govt. of Maharashtra's Resolution about Direct Purchase of Land through Negotiations, 2015	The state revenue department notified fresh guidelines to allow direct purchase of land, arguing that the new Land Act did not bar such private purchase. Maharashtra's new direct purchase model offers at least 25 per cent higher compensation than the amount provided under the Land Act. Under the direct purchase route, the state government has said that a land owner can opt for a one-time compensation.	PIU can go into negotiations for Direct Purchase of land to avoid lengthy and time-consuming land acquisition process.	Maharashtra Revenue Department and Municipal Corporation Urban Development Department.	Pre-construction.	Revenue Dept. and UD Department of KMC.
15.	Right to Information Act, 2005.	The Act provides for setting out the practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every	KMC is responsible for provide information related with the project to the citizens.	Public Authority (a body of Government or "instrumentality of State")	Through out the project.	PIU KMC.

Sr. No.	Acts and Policies and Notifications of GoI and GoM	Key Requirements	Type of Permit	Concerned Authority	Stage of Applicability	Responsibilities
		public authority, the Constitution of a Central Information Commission and State Information Commission and for matter connected therewith or incidental thereto.				

Table 3-3: International Labour Law Conventions

Sr. No.	International Labour Law Convention	Key Requirements	Concerned Authority	Stage of Applicability	Responsibilities
1.	Forced Labour Convention, 1930 (No. 29),	Prohibits all forms of forced or compulsory labour, which is defined as "all work or service which is exacted from any person under the menace of any penalty and for which the said person has not offered him voluntarily." The convention also requires that the illegal extraction of forced or compulsory labour is punishable as a penal offence and that ratifying states ensure that the relevant penalties imposed by law are adequate and strictly enforced.	Chief labour Commissioner	During Implementation	Applicable to all implementing agencies
2.	Equal Remuneration Convention, 1951 (No. 100)	Lays out the principles for equal remuneration for work of equal value and addresses gender discrimination	Chief labour Commissioner	During Implementation	Applicable to all implementing agencies
3.	Discrimination (Employment and Occupation) Convention, 1958 (No. 111),	Prohibits all discrimination and exclusion on any basis including of race or color, sex, religion, political opinion, national or social origin in employment and repeal legislation that is not based on equal opportunities	Chief labour Commissioner	During Implementation	Applicable to all implementing agencies

3.2 Key Statutory Clearances for Construction

Certain permissions, clearances and authorizations need to be obtained from competent authorities during the design and construction phase of sub-projects. This will depend mainly on the area, type, size and scope of the sub-project in question. The key statutory permits that may be required are summarized below in **Table 3.4**.

Table 3-4: List of Statutory Clearances and Requirements

Sr. No.	Clearance/ Authorization	Relevant Act	Competent Authority	Responsibility		When required
				Implementation	Supervision	
1	Tree Cutting Permission	Maharashtra Felling of Trees (Regulation) Act of 1964	KMC Garden Department	Contractor	PIU	Before Construction
2	Consent to Establish and Consent to Operate under Air, Water & Environment Act and noise rules	For establishment of Construction Camp.	MPCB	Contractor	PIU	Before Construction

Sr. No.	Clearance/ Authorization	Relevant Act	Competent Authority	Responsibility		When required
				Implementation	Supervision	
3	Management of C&D Waste	Provision for collection and disposal of Construction & Demolition (C&D) Waste as per C&D Waste Management Rules, 2016	MPCB	Contractor	PIU	Before Construction
4	Management of MSW	SWM rules 2016	MPCB KMC	Contractor	PIU	Before Construction
5	Desilting, Disposal of excess silt	SWM rules 2016	MPCB KMC	Contractor	PIU	Before Construction
6	Location/ layout of workers camp, equipment and storage yards	Environment Protection Act, 1986 and Manufacturing, Storage and Import of Hazardous Chemicals Rules, 1989	MPCB	Contractor	PIU	Before Construction
7	Applicable for health and safety issues of labours	Provision of Building & other construction workers (Regulation of Employment and condition of service) Act 1996	State Labour Department	Contractor	PIU	Before Construction
8	Discharges from Labour Camp	Water (Prevention and Control of Pollution) Act, 1974	MPCB	Contractor	PIU	Before Construction
9	Pollution Under Control certificate for vehicles	Central Motor Vehicle Act 1988	Transport Department	Contractor	PIU	During the project implementation for all vehicles engaged at sites
10	Employing Labour/ Workers Labour License	The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act 1996	Labour Commissioner	Contractor	PIU	Immediately after award of contract, and to be renewed regularly till completion of works
11	Fire Safety Clearance	National Building Code Maharashtra Fire Prevention and Life Safety Act, 2006	Maharashtra Fire Services Department	Contractor	PIU	Immediately after award of contract
12	Electrical Safety	Indian Electricity Act, 1910 re- enacted in 2003. Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2010	Chief Electrical Inspector	Contractor	PIU	Immediately after award of contract
13	Temporary traffic diversion measures	-	Traffic Control Department	Contractor	PIU	Immediately after award of contract

The construction activities under the project are along existing drainages, roads, lakes, within municipal corporation limits in urban areas. These are considerably medium types of works to be built by local/ national contractors. As per the existing practices in Maharashtra, mostly the labour will be local, and some will be migrants. There will be batching plants, crushing plants, etc., for the construction of these works. There will not be much extraction of groundwater for construction use; mostly tanker water from Municipal Corporation will be used for these works. Where groundwater is used, permissions required for extraction of groundwater will be obtained.

3.3 Applicability of World Bank ESS

This section highlights the World Bank ESS and their applicability to the project. The objective of these ESS is to prevent and mitigate undue harm to people and their environment in the development process. These policies provide guidelines for Bank and borrower in the identification, preparation, and implementation of programs and projects. They also provide a platform for the participation of stakeholders in project design. In essence, the ESS ensure that E&S issues are evaluated in decision making, help reduce and manage the risks associated with the project and provide a mechanism for consultation and disclosure of information. The World Bank's ESSs applicable to project activities are summarized in **Table 3.5**.

Table 3-5: World Bank ESS

Environment & Social Standard	Objective(s) of the ESS	Relevance
ESS1: Assessment and Management of Environmental and Social Risks and Impacts	• Identify, assess, evaluate, and manage environment and social risks and impacts. • Adopt a mitigation hierarchy principle • Adopt differentiated measures so that adverse impacts do not fall disproportionately on the disadvantaged or vulnerable. • Utilize national environmental and social institutions, systems, laws, regulations and procedures where appropriate. • Promote improved environmental and social performance in ways which recognize and enhance Borrower capacity.	**This standard is relevant;** the ESMF study is undertaken as per the provisions of ESS1. The study reveals that various types of E&S risks under ESS 2, 3, 4, 5, are 10 are likely during construction and operation.
ESS2: Labour and Working Conditions	• Promote safety and health at work. • Promote fair treatment, non-discrimination, and equal opportunity for project workers. • Protect project workers, with emphasis on vulnerable workers. • Prevent the use of all forms of forced labor and child labor. • Support principles of freedom of association and collective bargaining of project workers. • Provide project workers with accessible means to raise workplace concerns.	**This standard is relevant** as the project is going to work with different kinds of labour of all categories, direct, indirect, contract, primary, etc., at different levels, and labour influx related risks are likely.
ESS3: Resource Efficiency and Pollution Prevention and Management	• Promote the sustainable use of resources, including energy, water and raw materials • Avoid or minimize adverse impacts on human health and the environment caused by pollution from project activities • Avoid or minimize project-related emissions of short and long-lived climate pollutants • Avoid or minimize the generation of hazardous and non-hazardous waste. • Minimize and manage the risks and impacts associated with pesticide use	**This standard is relevant,** given the opportunities to promote the efficiency of resource use and prevent pollution from activities to be financed under the project.
ESS4: Community Health and Safety	• Anticipate or avoid adverse impacts on the health and safety of project-affected communities during the project life-cycle. • Promote quality, safety and climate change considerations in infrastructure design and construction • Avoid or minimize community exposure to project- related traffic and road safety risks, diseases and hazardous materials, and have in place effective measures to address emergency events.	**This standard is relevant,** as there are communities in the vicinity/ surroundings of sub-project locations, and appropriate management measures would be required.

Environment & Social Standard	Objective(s) of the ESS	Relevance
	• Ensure that the safeguarding of personnel and property is carried out in a manner that avoids or minimizes risks to the project-affected communities	
ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	• Avoid or minimize involuntary resettlement by exploring project design alternatives. • Avoid forced eviction • Mitigate unavoidable adverse impacts from land acquisition or restrictions on land use through timely compensation for loss of assets at replacement cost and assisting displaced persons in their efforts to improve, or at least restore, livelihoods and living standards. • Improve living conditions of poor or vulnerable persons who are physically displaced. • Appropriate disclosure of information, meaningful consultation, and informed participation during • resettlement activities	**This standard is relevant**, as the project may need to acquire private land for the construction of some of the proposed sub-projects. The government land that is proposed to be used for sub-projects has encroachments and squatters, impacting livelihoods.
ESS7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	•	There are no Indigenous People in the project area, therefore ESS7 has not been applicable.
ESS8: Cultural Heritage	• To protect cultural heritage from the adverse impacts of project activities and support its preservation. • To address cultural heritage as an integral aspect of sustainable development. • To promote meaningful consultation with stakeholders regarding cultural heritage.	**This standard is not relevant** However, given the vast geographical area of the municipal corporation across which sub- projects would be located, there is a possibility of cultural heritage related concerns, including chance finds, coming-up in the case of certain sub-projects under the proposed operation.
ESS10: Stakeholder Engagement and Information Disclosure	• Establish a systematic approach to stakeholder engagement that helps Borrowers identify stakeholders and maintain a constructive relationship with them • Assess stakeholder interest and support for the project and enable stakeholders' views to be taken into account in project design • Promote and provide means for effective and inclusive engagement with project-affected parties throughout the project life-cycle • Ensure that appropriate project information is disclosed to stakeholders in a timely, understandable, accessible and appropriate manner	**This standard is relevant**, as stakeholders need to be consulted throughout the project preparation and implementation period and also duly informed through disclosure of project related information.

The World Bank Group's General Environment, Health and Safety (EHS) Guidelines, 2007 set out international good practice related to EHS, which the project should follow regarding assessment of potential impacts and applicable standards and management measures, performance indicators, and monitoring guidelines. In particular, the guidance in Section 4 on Construction and Decommissioning will be applicable to this project. When national requirements differ from the standards and measures set out in these guidelines, then MRDP will need to ensure that it achieves whichever is more stringent.

3.3 Environmental Standards & Guidelines

Project involves various activities, which may interfere with various environmental components. Thus, it is required to control those activities so as the concentration of pollutant in environment should not exceeds its assimilation capacity. CPCB has issued some standards for disposal of effluents and quality of surface water body which should be referred and adhered to with regards to prescribed discharge standards at any point of time. India does not have any standard yet for disposal of dredged material, thus standards issued by other renowned bodies are referred. Suggested list of standards is listed below and given in detail at **Annexure 3.1**.

- National Ambient Air Quality Standards, CPCB, 2009
- Ambient Air Quality Standards in Respect to Noise, CPCB, 2000
- Noise standard for the construction vehicle, CPCB, 2000
- Bharat Stage Emission Standards (BSES) for Construction Equipment Vehicles, CPCB, 2017
- Classification of Surface water Bodies on basis of Quality (Source: Guidelines for Water Quality Management-CPCB, 2008)
- Sediment Quality, USEPA
- Water Quality Standards
- General standards for discharge of environmental pollutants, CPCB, 1989
- Criteria for harmful bottom sediments (Source: Assessment of the Environmental Impact of Port Development, United Nations, New York, 1992)
- Approximate Quantity of Suspended Sediments Generated by Dredging or Dumping Operations (Source: Assessment of the Environmental Impact of Port Development, United Nations, New York, 1992)
- The World Bank Group's General Environment, Health and Safety (EHS) Guidelines, 2007
- GIIPs for camp design and management, for Workers' accommodation: processes and standards guidance note by IFC and the EBRD.
- IFC Environmental, Health, and Safety Guidelines for Water and Sanitation, 2007

Chapter 4 : Project Environmental and Social Baseline

This chapter provides a baseline E&S condition in the project areas based upon the secondary data obtained from authentic sources and primary data collected from site surveys and environmental monitoring.

A comprehensive understanding of the physical, chemical, and biological environment provides the foundation to a well-executed Environmental Assessment. The detailed baseline characterization is used as input to model possible project impacts, which allows specialists to provide timely input to project designs to reduce potentially adverse environmental impacts. This in turn produces a more socially and environmentally sustainable project and enhances the efficiency of the project permitting process.

4.1 E&S Data Collection

The primary baseline information on different social and environmental components are collected through field survey. Field surveys are carried out at project interventions and major flooding hotspots to collect information on the major social and environmental features such as human settlements, trees within RoW of the SWDs, Lakes/waterbodies, sensitive locations, air, water, noise, soil quality, solid waste management etc. Further primary surveys and sample collection for the environmental components, such as air, surface water, noise and soil characteristics that are critical in the context of the sub-project are carried out during the study period.

Sampling stations are strategically located in and around the proposed subproject sites. Soil & Water samples are collected as per recommended procedure. Suitable equipment is used to record Air quality and Noise level at site / near to site. Literature and authentic records are consulted to study the Environment & Socio–Economic status concerning the study areas. Status of pre-project social and environmental conditions are considered in three aspects, i.e., (1) physical environment, (2) biological environment and (3) social environment.

4.2 History of Floods

The recent flood events in 2005, 2006, 2019, and 2021 have served as a wake-up call for authorities to implement urgent measures to address fluvial and pluvial flooding. These events have resulted in significant loss of human life, extensive damage to properties and agriculture, and an unavoidable economic burden. Additionally, the social and environmental impacts of these floods remain incalculable.

4.1.1 Historical Details of Water Level Rise

The details of water level rise and areas of inundation where flooding becomes severe and poses high flood risk is described in this section. Historical flood levels are studied with the help of details provided in KMC records. The **Figure 4.1** below shows the flood water levels of the Panchganga River at the Rajaram Weir in Kolhapur in 2005, 2019 and 2021. The flooding records from 1988 to 2023 are described in **Table 4.1**. The flood levels for flood management set by KMC are;

- **The Warning Level** is 542.07 m, indicating the river is close to flooding.
- The **Danger Level** is 543.30 m, where flooding becomes severe and poses a risk to nearby areas. Year 1989 the water level reached at 545.61 m and year 2005 the river level was 545.27 m.
- In **2019** the river reached a level of 547.13 m. In **2021**, the river reached a record high level of 547.33 m, marking an extreme flood event.

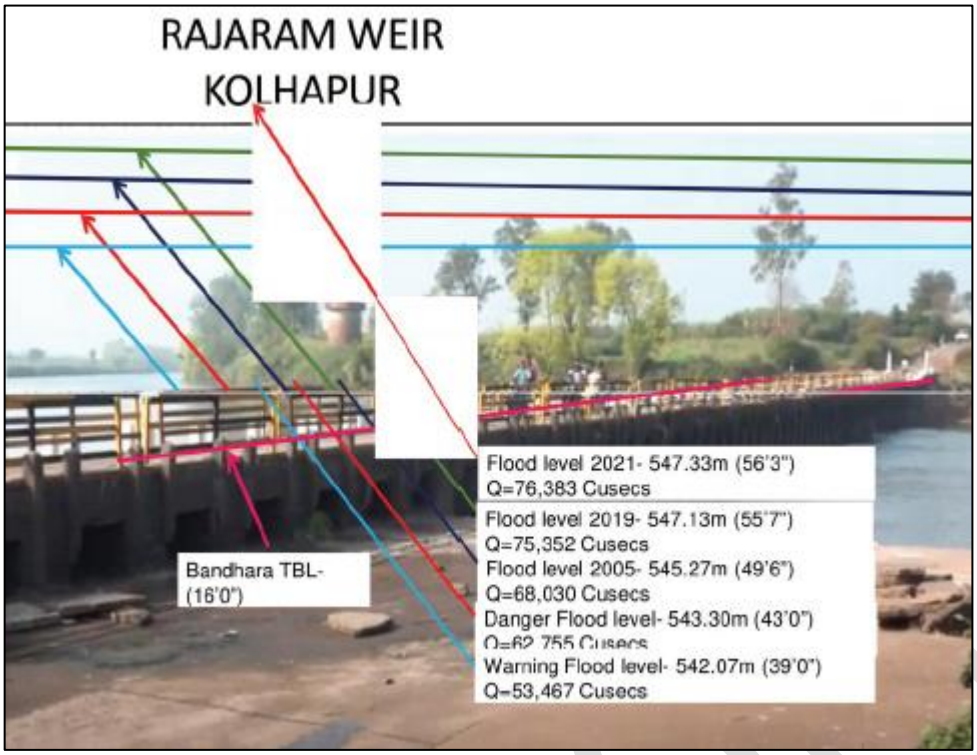


Figure 4-1: Water level details- 2019 & 2021 flooding

Table 4-1: Observed Maximum Water levels of Panchganaga River at Rajaram K.T. weir Gauge station.

Date	Water Level (feet)	Water Level (meter)	Date	Water Level (feet)	Water Level (meter)
20-07-1988	43'6"	543.45	02-07-2007	43'4"	543.39
27-07-1989	50'6"	545.61	13-08-2008	43'9"	543.49
19-08-1990	43'2"	543.34	18-07-2009	46'5"	542.51
24-07-1991	44'10"	543.85	02-08-2010	41'2"	542.68
21-07-1992	37'6"	541.32	09-05-2011	41'6"	542.84
13-07-1993	42'2"	543.04	02-08-2012	33'4"	540.35
15-07-1994	44'8"	544.41	27-07-2013	41'6"	542.84
22-07-1995	37'8"	541.37	25-07-2014	39'2"	542.12
02-08-1997	44'2"	543.65	25-06-2015	32'2"	540.29
10-07-1999	37'4"	541.57	13-07-2016	46'2"	544.26
23-07-1999	44'4"	543.73	27-07-2017	41'11"	542.96
14-07-2000	39'7"	542.55	19-07-2018	44'5"	543.72
11-07-2001	37'5"	541.59	07-08-2019	55'7"	547.63
14-08-2002	30'6"	539.42	07-08-2020	44'10"	543.85
15-08-2003	30'6"	539.42	24/07/2021 (3:00 AM)	56'3"	547.83

Date	Water Level (feet)	Water Level (meter)
27-07-2005	49'6"	545.27
12-08-2006	45'10"	544.16

Date	Water Level (feet)	Water Level (meter)
13-08-2022	41'8"	542.84
28-07-2023	41'8"	542.84

Figure 4-2: Water level at Panchganaga River at Rajaram K.T. weir Gauge station

4.1.2 Areas of Inundation

List of extreme floods affected areas in 2021 due to water level rise is described in **Table 4.2.**

Table 4-2: Areas of Inundation in KMC

Flood Level	Locations
43 feet	Suttarwad
45 feet	Old Shiva Naka, near the Odia (drainage), Reliance Mall back lane, Kumbhar Galli, Kamgar Chaal, Kanda Bata Market, Shahupuri Konda
45 feet 5 inches	Venus Corner, Venus Talkies to Ice Factory Road, Naik Mala, Polo Ground
47 feet 2 inches	Panchganga Hospital, Jamdar Club, Shukrawar Peth (West side)
47 feet 2 inches	Ideal Colony, Laxtirth Vasahat, Suttar Mala (Laxtirth Vasahat), Shingapur Sasta Bhandar (cheap goods market)
47 feet 4 inches	Shahupuri Kumbhar Galli (Shahupuri), Mukt Sainik Vasahat, Kate Mala, Yashoda Park, Malaygiri Apartment, Jadhav Wadi, Babat Camp, Kapur Vasahat
47 feet 5 inches	Renukamandir, Gunjan Hotel, Trimboli Nagar, Renuk Nagar, Ghadge Gruhayog & Renukamandir back lane, Mali Mala, Medical College Bawda, Ulpe Mala, Raman Mala, Javdekar building, Naik Mala, Palace back lanes, Rajhans Printing press, Haripuja Puran, ➢ Trikani Bagh to Mahaveer College road, Closed. ➢ KV Park, Dipti Park, Diamond Hospital, Antarang Hospital, Khanwilkar Petrol pump to Zilla Parishad Office Road, ➢ Zilla Parishad Office to Mahaveer College (via Patlacha Wada) road, ➢ Basant Bajar to Zilla Parishad Office Road ➢ Basant Bahar to Collector's Office Road closed. ➢ Bhalji Pendarkar Hall Premises (Mahavir Garden South Side) ➢ Dasara Chowk to Venus Corner Road Closed. ➢ Durga Temple (Laxmi's residence)
47 feet 7 inches	Subhash Road (titan showroom to ford corner) road blocked.
47 feet 8 inches	Pinak, Suncity, Mali mala, mahaveer college Pidhadis, Polo ground,Jaavdekar Apartments, Dream World's back side.
48 feet	➢ Mukt Sainik rickshaw stop to Malaygiri road closed, ➢ Kaate mala to Sapphire Park Road closed, ➢ Menon bungalow to Shelake So Nagarasevak house front road closed.
47 feet 5 inches	Wilson Pool to Venus Corner Road closed, ➢ Lakshmipuri to Naik & Naik company road closed, ➢ Grass market street's west side under water
48 feet 8 inches	Shankaracharya math, Panchganga training (Jamdar club to Panchganga hospital road's west side is fully under water), ➢ Usha Talkies (B News to Venus Corner Road closed)

Flood Level	Locations
49 feet 11 inches	Ghodekawadi, Open Military Settlement east side, MSEB, Bapte Camp, Kadamwadi Ganesh Park
51 feet	Dudhali (Kolhapur Orthopaedic Center, Maharana Pratap High School, Utarishwar grass market, Dudhali ground area)
51 feet 8 inches	Kolhapur Kaman to toll gate road closed
53 feet	Basant Bahar to District Collector's office east side under water (District Collector's office backside is Umed Puri)
56 feet 3 inches	District Collector's office, approximately 3 to 4 feet water; District Collector's office front part (Nagala Park) was flooded

The Flood situation of Kolhapur city is shown below in the following **Figure 4-3 and Figure 4-4.**

Figure 4-3: Image of 2019 Flood in Kolhapur City

Figure 4-4: Image of 2021 Flood in Kolhapur City

4.1.3 Flood Line Mapping

The KMC authorities demarcated **red and yellow flood lines** to identify areas prone to flooding and mitigate future risks. The **red flood line** represents the maximum extent of flooding observed during the 2019 disaster, highlighting zones of severe inundation. The **Yellow flood line**, on the other hand, marks areas with moderate flood risk, often affected by high rainfall or backwater effects. These demarcations serve as critical tools for urban planning, disaster management, and evacuation strategies.

They guide infrastructure development, ensuring new constructions are kept out of high-risk zones. Additionally, they help in zoning regulations, improving community resilience against floods. These efforts emphasize the need for sustainable development and effective water resource management to safeguard lives and property in Kolhapur. The flood lines are shown in the **Figure 4-5**, below.

In the **Figure 4.5,** flood line of year 2021 is marked showing highest flood impact till date. It confers that the encroachment, illegal construction within red line and blue line, contributed into area inundation due to flood water.

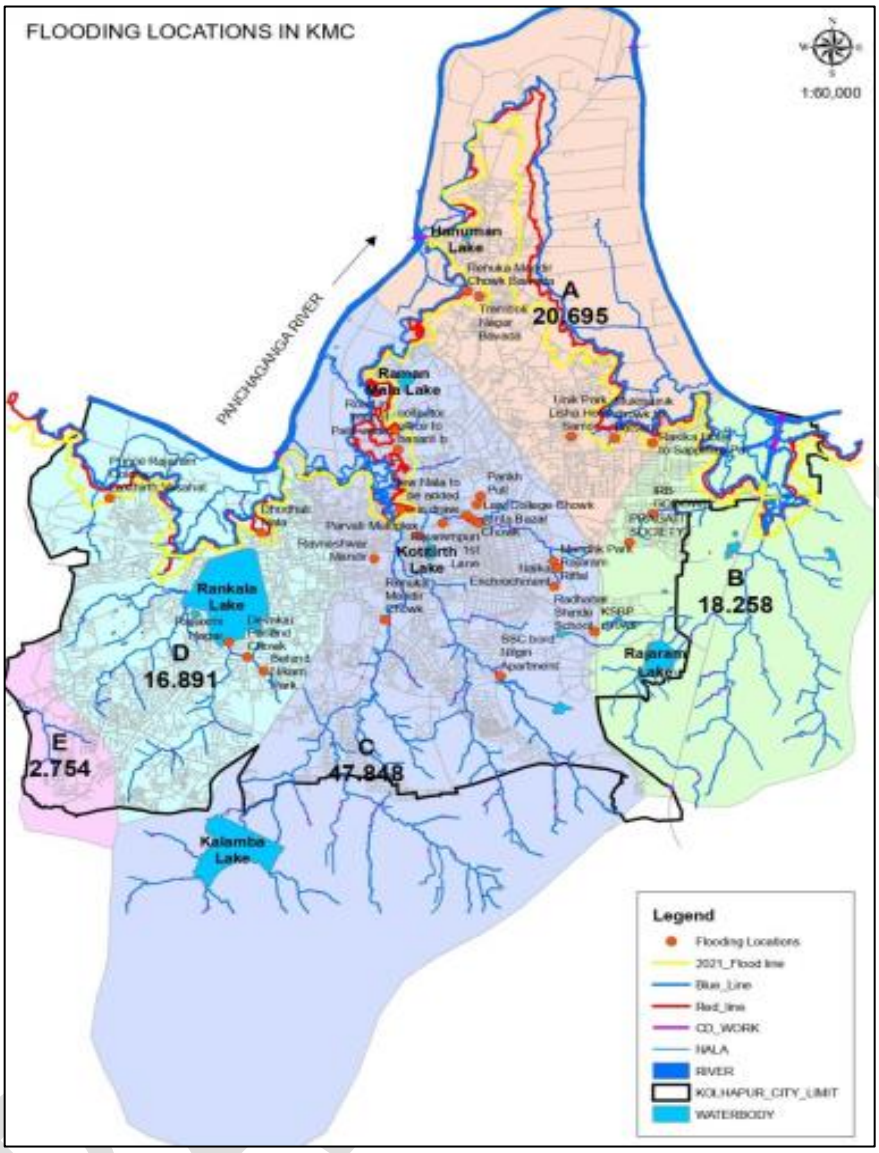


Figure 4-5: Map Showing Flood Lines Along the Panchganga River

4.1.4 Analysis by Expert Study Committee 2019

The flooding in Kolhapur and its surrounding regions is primarily caused by topographical constraints that slow down the dissipation of floodwaters beyond Sangli, creating a bottleneck effect and leading to prolonged inundation upstream. Tributaries like Warna and Panchganga face backwater effects due to simultaneous flooding in the Krishna River, preventing them from draining their waters, which results in overflow onto their floodplains. Heavy rainfall in these tributaries during Krishna's flooding period exacerbates the situation, increasing water levels and causing further inundation. The meandering course of the Krishna River creates large floodplains, slowing water movement and submerging vast areas with stagnant water for extended periods. These meanders delay flood dissipation and sometimes force water to bypass them, creating new pathways that disrupt land use and increase erosion.

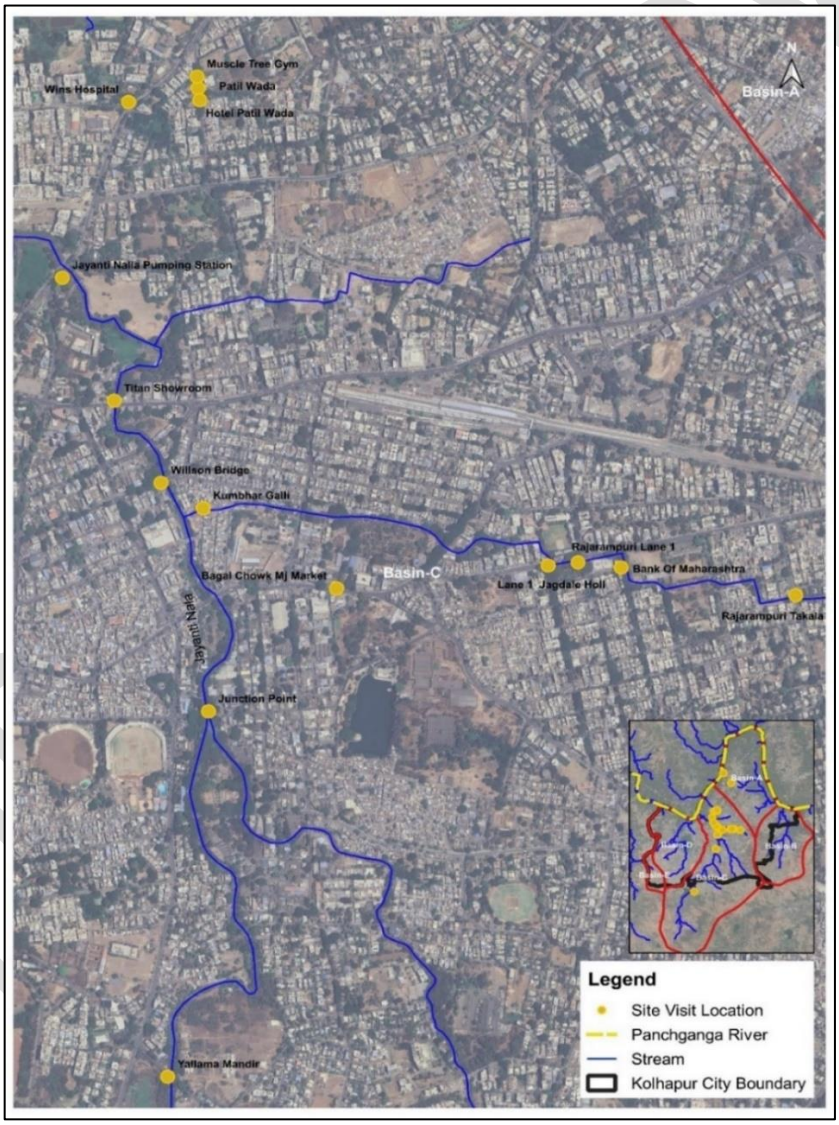
The combination of backwater effects, simultaneous rainfall, and floodplain dynamics leads to higher flood levels and long-term inundation near confluences such as Kolhapur, Sangli, and Kurundwad. Additionally, the slow movement of water through these floodplains damages agricultural lands, infrastructure, and settlements. Effective mitigation measures could include enhancing river capacity, managing floodplains, regulating tributary flows, and exploring engineering solutions for problematic meanders. Integrated watershed management is essential to coordinate upstream and

downstream flood mitigation efforts. Together, these measures could reduce the flooding impact and protect the region from recurring inundation.

4.3 Field Visits Observations at Major Flooding Locations

Site visit has been carried out primarily focuses on assessing Basin-C, with additional observations in parts of Basin-A. Basin-C is a critical area for flood management due to its vulnerability to overflow from the Panchganga River and Kalamba Lake in the Jayanti and Gomati Nallas. Some of measure issues are insufficient drain inlet points across the city, limiting stormwater capture, and elevation differences in roads, which lead to water stagnation and localized flooding.

The visit aims to evaluate the condition of these drainage systems, present status from E&S perspective and topography, identify problem areas, and understand contributing factors like sedimentation, obstructions, and inadequate infrastructure. The **Figure 4.6** below highlights the specific locations covered in the assessment. Some important locations are summarised in the **Table 4.3**.



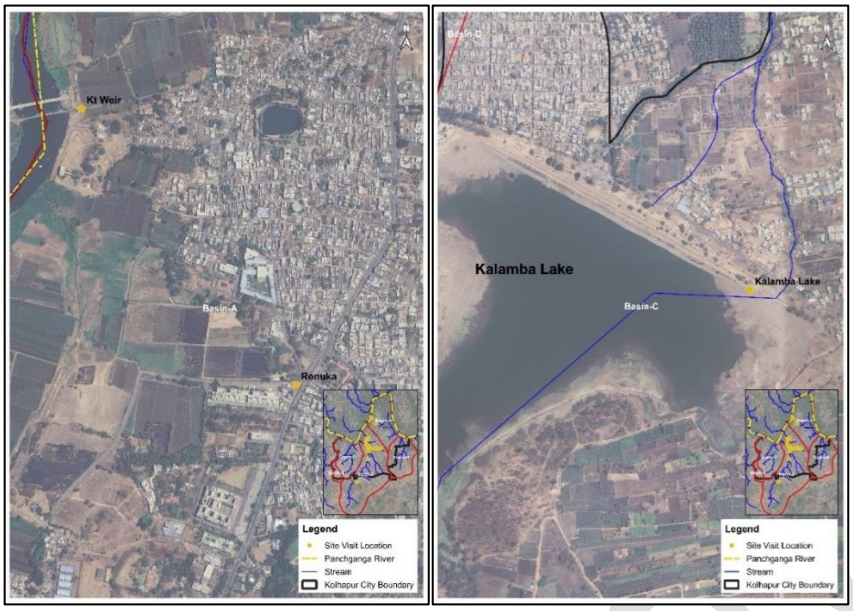
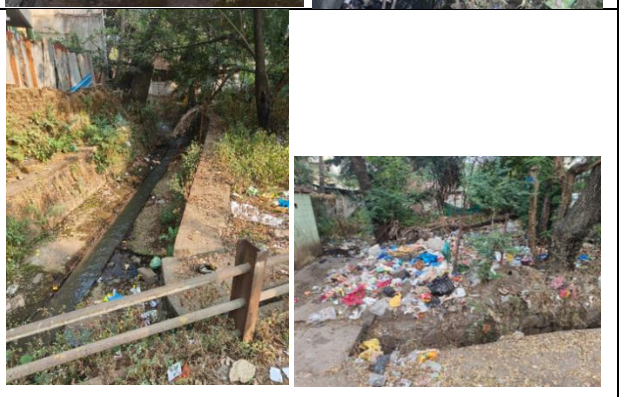
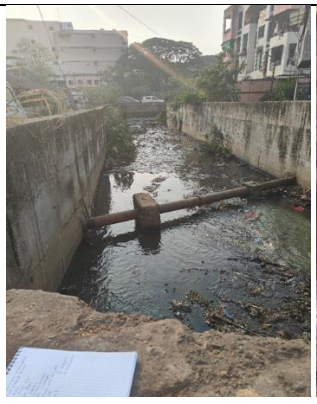


Figure 4-6: Site Visit Locations

Table 4-3: Observations diring Site Visit at Major Flood Prone Area

Sr. No.	Major Hotspot Locations	GPS Location	Cause/Description	Images
1	Renuka Hotel (Near Bawda Chowk)	16.730291° 74.241733°	• A constructed drain with poor water quality owing to solid waste disposal and inadequate drain inlets. • This area requires both inlet redesign and periodic maintenance to improve performance	
2	Rajaram nala next to Tararani Vidhyapith	16.698085° 74.243679°	• A constructed drain with choked culverts due to solid waste deposition. • Residential structures on both side of nala, the waste from these residents are through in the nala, solid waste • The insufficient drain inlet capacity contributes to frequent waterlogging and hinders effective stormwater management.	

Sr. No.	Major Hotspot Locations	GPS Location	Cause/Description	Images
3	Rajarampuri (Lane no 1)	74.248, 16.697	• The semi-constructed drain experiences severe pollution from solid waste, residential sewerage, and septic tank connections. • Choked stormwater inlets further aggravate flooding potential in the area. • There are many commercial structures having basement. • It is observed that waste of slaughterhouse and other is thrown into the nala	 
4	Janata Bajar Chawk	16.698436° 74.242141°	• Two sub nalas are connecting (confluence) in this area therefore there is issue of flood water. There are commercial shops constructed on the nala. • The semi-constructed drain experiences severe pollution from solid waste, residential sewerage, and septic tank connections. • Choked stormwater inlets further aggravate flooding potential in the area.	
5	Shaupuri no 5 and 6 (Gavat Mandai)	16.699617° 74.232627°	• At this location, Rajaram nala connecting (Confluence) Jayanti nala. • The main issue is the crossing drain line due to which waste is get stuck and create hygienical issues. • The local people requested to raise the Hight of sewage drain line. • This natural drain junction is affected by sedimentation caused by side-bank erosion. • The poor water quality stems from	 

Sr. No.	Major Hotspot Locations	GPS Location	Cause/Description	Images
			solid waste and sewage discharge, requiring both structural and environmental remediation.	
6	Jayanti Nala Behind Venus Talkies	16.701147° 74.231078°	• This area is vulnerable and every year affected due to the flood as well nala overflow. There are many commercial as well residential structures affected due to the flood for longer than 20 to 30 days (Ref. 2019 flood). • Venus talkies chowk is the low-lying area therefore water logging remains longer period. Sutar Wada close from Venus chowk is the first location of the flood (Ref. KMC information). • Sewer network is passing through • Illegal Solid waste dumping is observed from uplands and deposition is observed which is affecting storm water flow • Silt deposition is observed	
7	Nagala Park	16.704923° 74.229132°	• Nagala Park is the vulnerable area and every year get affected. There are many newly constructed residential apartments on the bank of Panchganga. • The drain is earthen and soil erosion is observed because of no embankment • Sewage is getting mixed	

Sr. No.	Major Hotspot Locations	GPS Location	Cause/Description	Images
			• Solid waste dumping is observed	
8	Muscle Tree Gym (Near Hotel Patil Wada)	16.711049° 74.232222°	• A natural drain with significant vegetation growth along its course. • Water quality is severely impacted by solid waste and sewage inflow. • The excessive vegetation further restricts flow capacity.	 
9	Kumbhar Galli	16.699227° 74.221847°	• The semi-constructed drain has a damaged bottom and Vegetation growth in the middle and along its sides. • Water quality issues arise from solid waste, direct sewerage connections, and residential septic tank overflows	
10	Bagal Chowk MJ Market	16.698033° 74.238215°	• Drain Type: Semi-constructed drain. • Significant vegetation growth along the side banks of the drain, obstructing proper water flow. • The water quality is severely impacted due to the accumulation of solid waste and connections to the sewage system, leading to contamination. • The culvert is damaged, reducing the drain's capacity and potentially contributing to further flooding and water stagnation. • Flash Flooding because of inadequate Inlet problem	 

4.4 Project Influence Area (PIA)

The project will support SWD infrastructure construction confined at the existing SWD system within KMC limits. In perspective of the ESIA study of the proposed project, the direct impact area has been considered within design periphery of each proposed subprojects activity where drainage network will be implemented. The Project Influence Area (PIA) area has been considered as 100 meters radius from the proposed sub-project activity.

4.5 Land Use Land Cover of KMC

The Land Use Land Cover Map (LULC) of the year 2022 was downloaded from Bhuvan official site for the study area are shown below. As seen from the map, the share of each land use is summarized in the **Table 4.4** that follows and the LULC Map shown in **Figure 4.7**.

Table 4-4: LULC Classification of KMC

Land Use Type	Area (sq km)	Area (%)
Agriculture	24.30	35.35%
Built-up	33.16	48.24%
Industrial Area	0.46	0.67%
Road	3.98	5.79%
Waste lands	4.59	6.68%
Waterbodies	2.25	3.27%
Total	**68.74**	**100%**

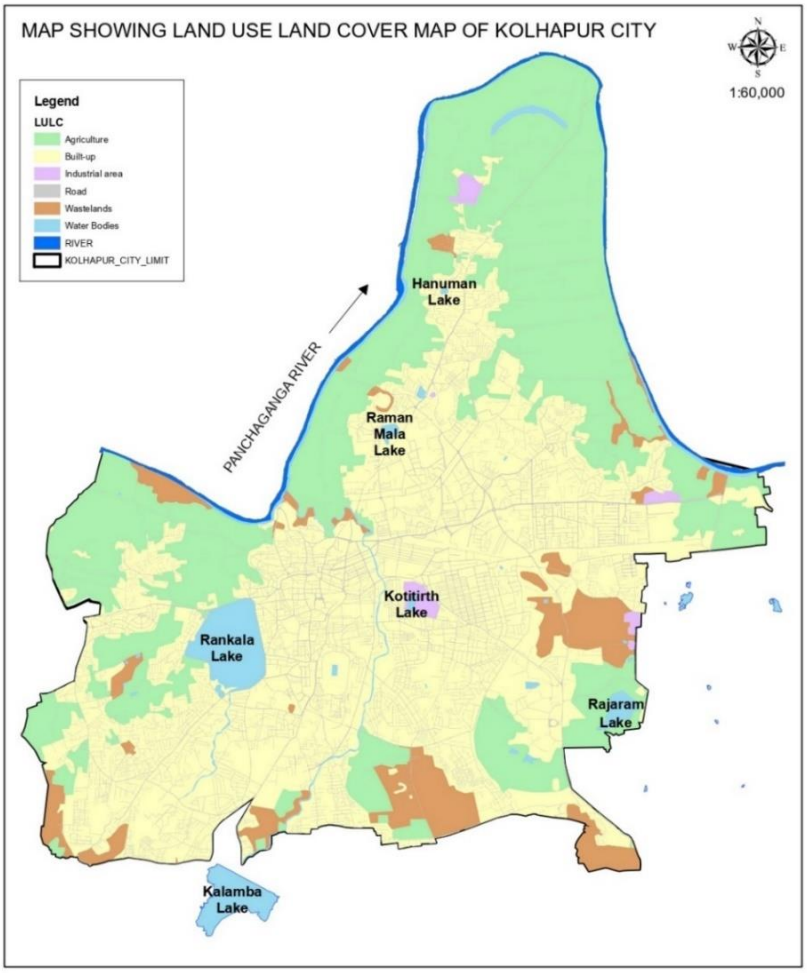


Figure 4-7: LULC Map of Kolhapur Municipal Corporation

4.6 Waste Management in Kolhapur City

4.1.5 Management of Desilted Material in Kolhapur City[7]

It is noted during meeting with KMC officials that presently the silt removed from lakes and SWD channels during maintenance activity in KMC, is being disposed on the designated silt disposal ground within KMC boundary. The location is shown in the **Figure 4.8.** The desilted material is being used by the local farmers for agriculture activity. Also, at some extent it is reused as fill materials, aggregates, embankment construction, road construction etc., to minimize the disposable quantity.

In the proposed project additional desilting is proposed to increase the depth and carrying capacity of SWD channels and lakes will leads into generation of huge quantum of desilted materials and thus systematic disposal is suggested. Also, contractor has to check the capacity of silt disposal site to cater the additional silt from lakes and SWDs.

Figure 4-8: Silt Disposal Ground within KMC Boundary

[7] Source: KMC

4.1.6 Management of Municipal Solid Waste in Kolhapur City[8]

Zoom Bio-Fertilizer Private Limited (ZBPL), a Special Purpose Vehicle (SPV) of Zoom Developers, has set up one Municipal Solid Waste (MSW) processing plant in Kolhapur, Maharashtra in collaboration with KMC. The Zoom Project is spread over an area of 67 sq. km. The municipal solid waste generated in the city is collected and sent to the Zoom biofertilizers where it is treated further. The current information about the MSW production in the city is collected from KMC as well as by visiting the Zoom fertilizer project site. The removed solid waste from SWDs will be sent to Zoom Project for its management.

It is noted that no separate construction and demolition (C&D) waste treatment facility is available in the Kolhapur city. Currently the C&D waste is reused at maximum extent for levelling, road constriction and rest is being sent to Zoom site for its disposal.

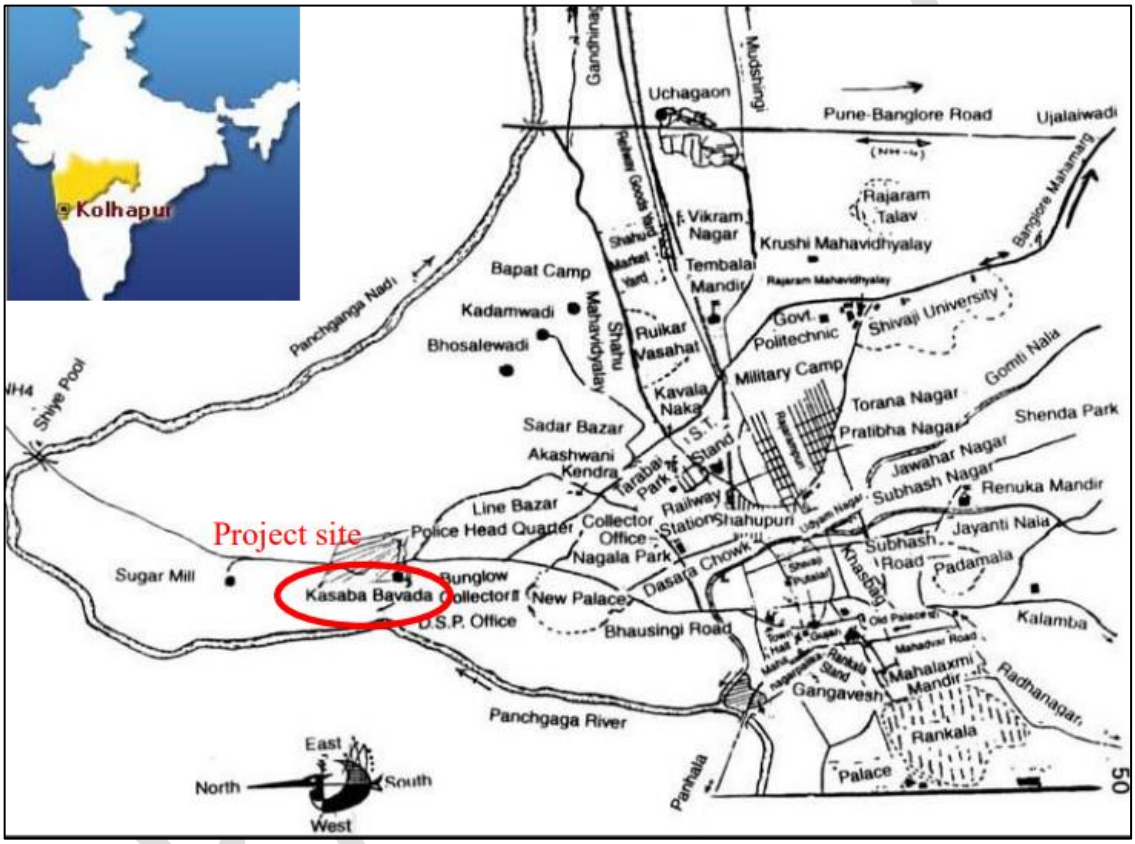


Figure 4-9: Location Map of Zoom Project in Kolhapur City

Figure 4-10: Aerial View of Zoom Project in Kolhapur City

[8] Source: KMC

4.1.7 Management of Domestic Sewage in Kolhapur City[9]

During discussion with KMC officials it is noted that in Kolhapur city, two Sewage Treatment Plants are under operation. One STP is in Kasaba Bawda having a designed capacity of 76 MLD and other one is at Dudhali with a designed capacity of 17 MLD. The third STP development in the city is under construction.

The treated water is discharged to the Panchganga river by gravity through an underground pipeline network. In addition, currently up to 40 KLD septage is co-treated daily at both the sewage treatment plants. It is observed that on an average daily 83 MLD of treated waste water (TWW) is generated and the quality results from the on-site monitoring system shows that it is fit for reuse. Currently, 4% (3 KLD) of the total treated wastewater is generated reused for dousing fire, site dusting at SWM site and for road median watering. The treated sewage water from STP in Kolhapur city can be reused for construction purpose.

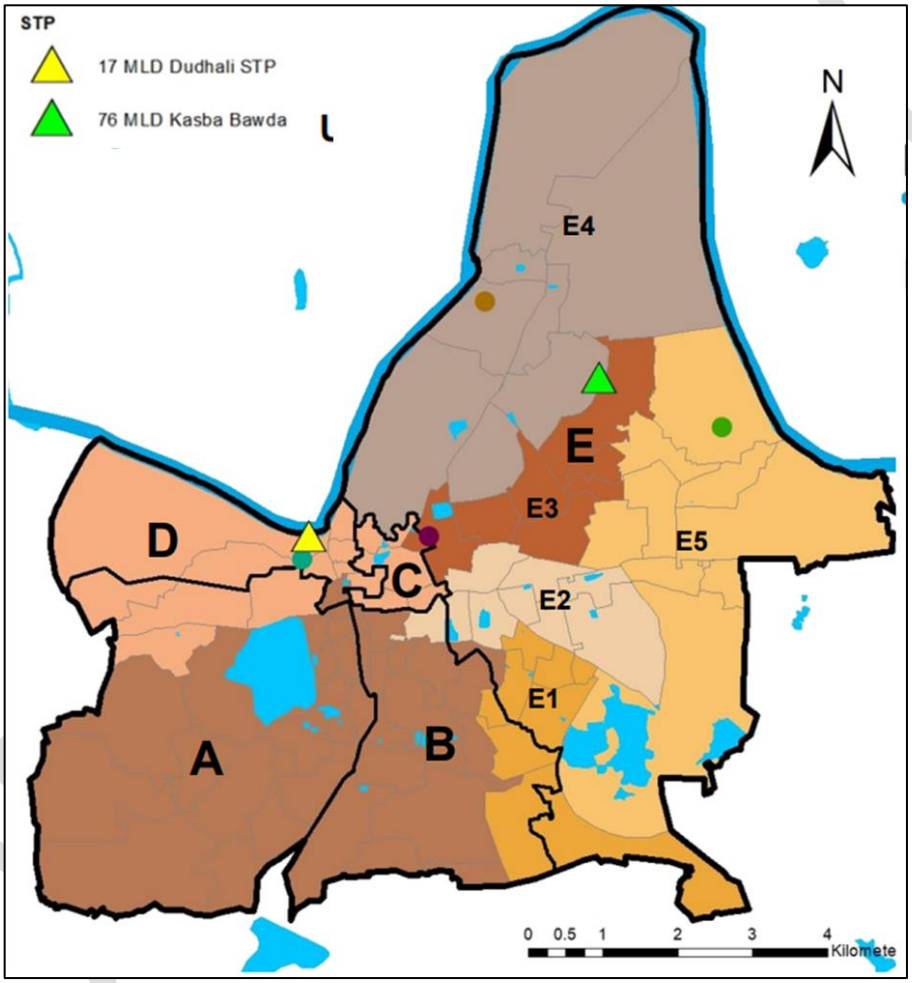


Figure 4-11: Aerial View of Zoom Project in Kolhapur City

4.7 Physical Environment

Physical environment study includes topography, terrain, climate, seismicity and hydrogeology of the project area.

4.6.1 Physiography[10]

The physiography of the Project district is characterized by a distinct division between the western hilly region, part of the Sahyadri range, and the eastern plain area, with the majority of the district falling under the Deccan Plateau, featuring primarily basaltic rock formations and black cotton soil in

[9] Source: KMC

[10] Central Ground Water Board, Kolhapur, 2022

the east and laterite soil in the west; the main rivers in the region include the Krishna, Värna, Panchganga, Dudhganga, Vedganga, and Hiranyakeshi, all originating from the Sahyadri range.

Key features of Kolhapur's physiography:

- **Western Ghats dominance:** The western part of the district is dominated by the Sahyadri mountain range, creating a hilly topography with steep slopes and dense forests.
- **Deccan Plateau:** The eastern part of the district is mostly flat terrain, constituting part of the Deccan Plateau.
- **Basaltic rock formations:** The majority of the district is composed of basaltic rocks, which contribute to the black cotton soil prevalent in the eastern plains.
- **Laterite soil:** The western hilly region is characterized by laterite soil due to weathering of the basaltic rocks.
- **River systems:** The major rivers in Kolhapur, including the Panchganga, Dudhganga, and Vedganga, flow eastwards from the Sahyadri range, providing irrigation and water sources.

Important points to consider:

- **Elevation variation:** The elevation varies significantly from the high peaks of the Sahyadri in the west to the relatively lower plains in the east.
- **Rainfall pattern:** Due to the influence of the Western Ghats, the western part receives significantly higher rainfall compared to the eastern region.
- **Drainage pattern:** The rivers in Kolhapur generally have a dendritic drainage pattern.

4.6.2 Agroclimatic Zone[11]

The Maharashtra state is divided nine agro-climatic zones those are as fallows Central Plateau zone, Central Vidharbha zone, Eastern Vidharbha zone, North Konkan coastal zone, Scarcity zone, South Konkan coastal zone, Sub Montane zone, Western Ghat zone, and Western Maharashtra plain zone. The map of Agroclimatic zones in Maharashtra is shown in **Figure 4.8**. The Project is planned in Transition Zone-1/ Sub Montane Zone. The Agroclimatic zones of the project district is shown in the below **Table 4.5**.

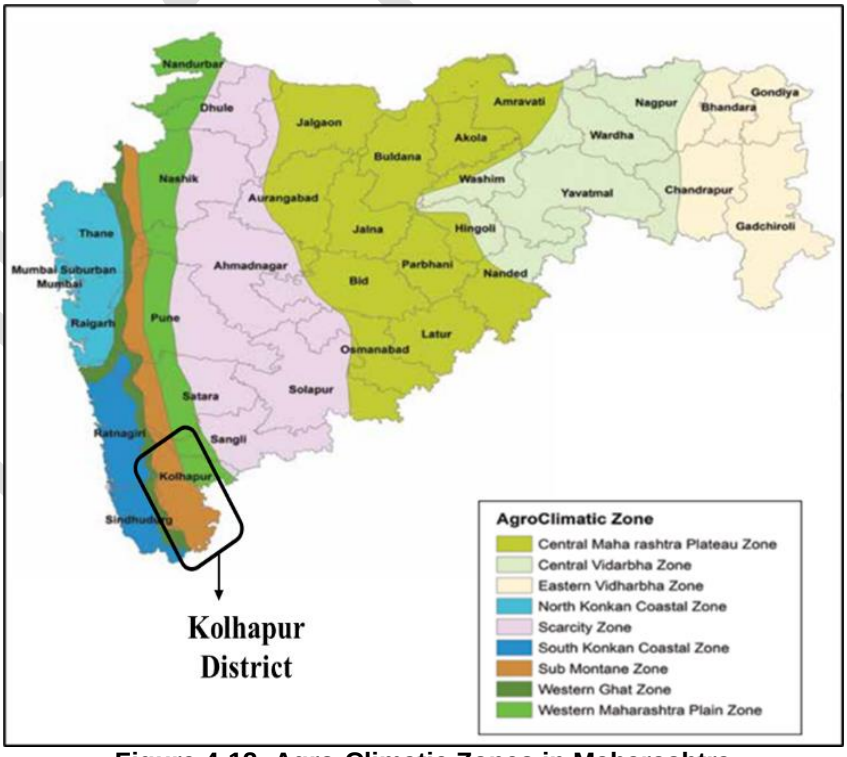


Figure 4-12: Agro-Climatic Zones in Maharashtra

[11] Dairying in Maharashtra report 2015

Table 4-5: District by Agroclimatic Zone and Main Crops Grown

Sr. No.	Agroclimatic Zone	Project Districts	Main Crops
1.	Western Ghat Zone/Ghat Zone	Kolhapur	Paddy, Ragi, Jowar, Pulses, Groundnut, Sugarcane, Mango, Cashewnut
2.	Transition Zone-1/ Sub Montane Zone	Kolhapur	Kharif cereals, Groundnut, Sugarcane, Mango, Grapes Guava, Banana, Cashewnut
3.	Transition Zone- 2/ Western Maharashtra Plain Zone	Kolhapur	Jowar, Bajra, Groundnut, wheat, Sugarcane, Pulses.

4.6.3 Geology and Geomorphology[12]

The major portion of district is covered by Basaltic lava flows of upper Cretaceous to lower Eocene age. These flows are part of the plateau Basalt of the Peninsular India, and believed to have been extruded by fissure type of Volcanoes.

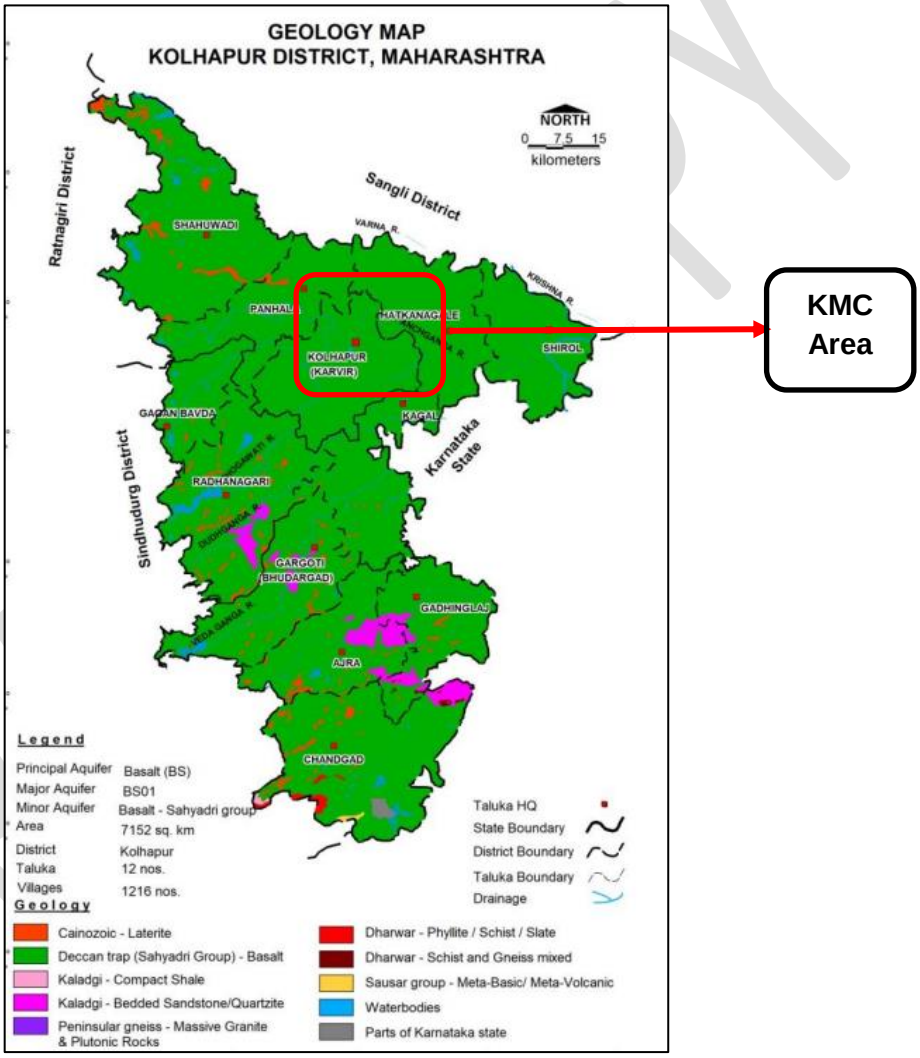


Figure 4-13: Geology Map of the Kolhapur District and Location of KMC

Geomorphology depicts that Sahyadri hills are forming the most prominent feature along its western administrative boundary of Kolhapur District. The Central portion by the district, the hill range exhibit a similar form and possess the same height but they have a SW-NE trend and they extend to a length of about 24 kms. The southern hill range viz the Kagal range and Bhudargad range maintain the same trend SW-NE.

Broadly, the district has three major characteristic land forms (1) the hill, ghats and plateau (2) the foot hill zones (3) the plains. The geomorphological map of Kolhapur District is shown in **Figure 4.10.**

[12] Central Ground Water Board, Kolhapur, 2022

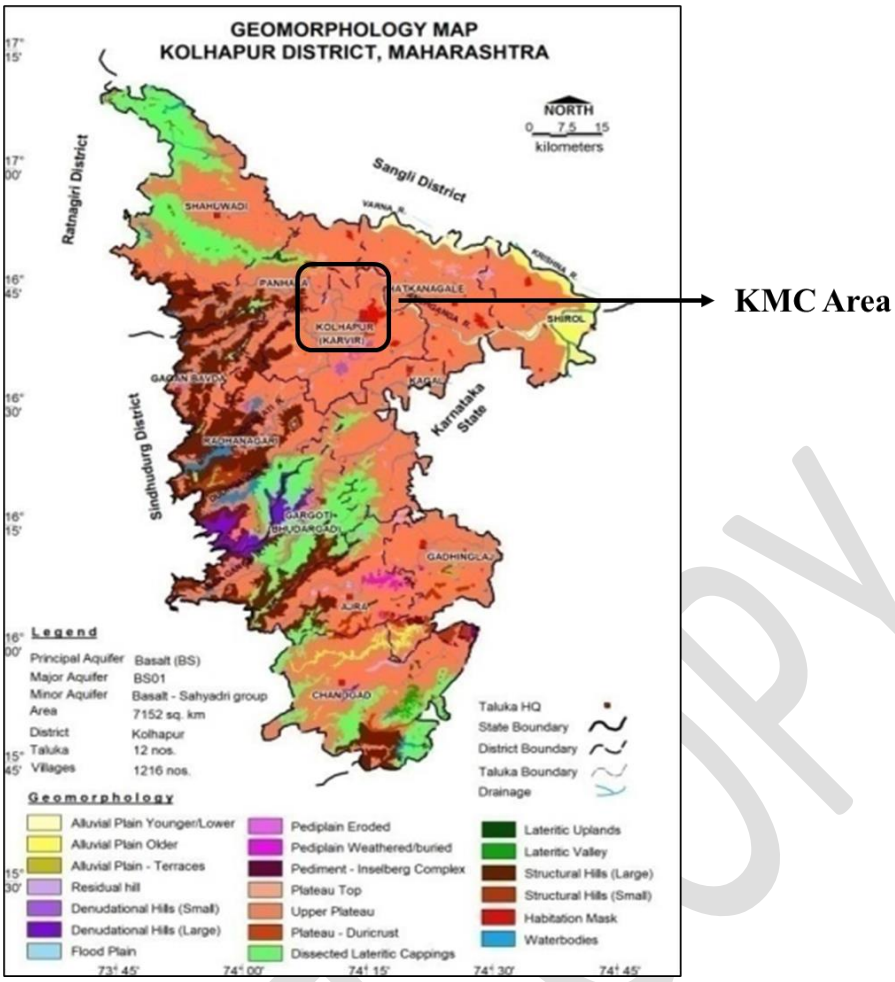


Figure 4-14: Geomorphology Map of the Kolhapur District and Location of KMC

From the topographic point of view the project city (KMC Bounadry) presents a typical rolling topography, full of ups and downs. The city is located on high ground on the banks of Panchganga river. The district has general slope from hills in the south to the Panchaganga river which flanks the western, northern and eastern sides of the city. The topographical map of the Kolhapur city shown in **Figure 4.15**.

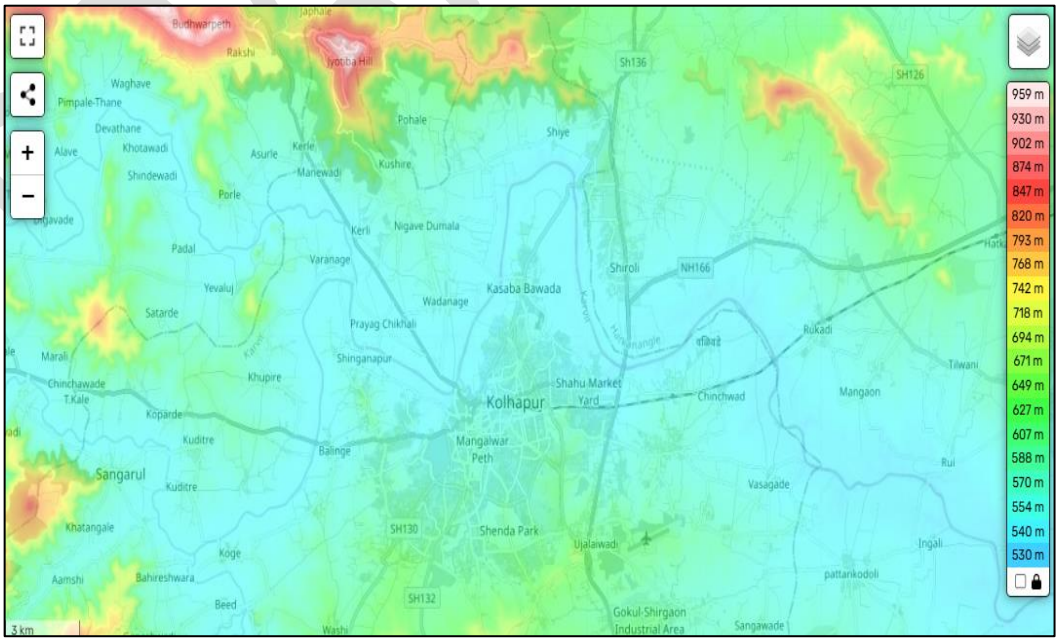


Figure 4-15: Topographic Profile of the Kolhapur City

The highest point of 2025 ft (618 M.) is found near the Kolhapur-Belgaum Road, not far away from the Rajaram tank in the south-east in the southwest corner of the city. The height of 600 m. is reached

near Kalamba village. From the line formed by joining these two high points the altitude goes on decreasing towards north, as is evident from the direction of the stream's tributary to the Panchganga River. The slope is steep till one reaches Rankala tank, Padmala pool and the foot of the Tembalai hill However it is generally low to the north of these places. The 549-meter contour line sends a wedge in the bend of the river, it is on this low sloping, uneven land that the city is located.

4.6.4 Soil Map

The Hydrological Soil Group (HSG) data was received from NBSS & LUP Nagpur for the watershed area of the basin that covers Clay and Loam soils. These soils have a very slow rate of water transmission. The HSG map of the study area is shown below.

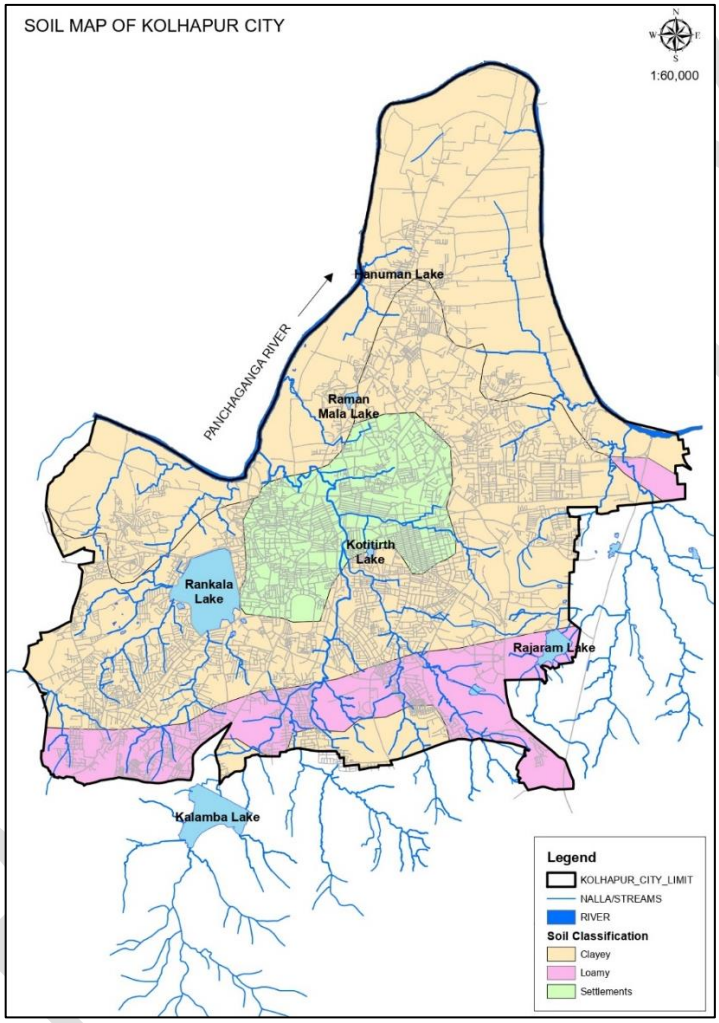


Figure 4-16: Soil Map of the Kolhapur City

4.6.5 Hydrogeology[13]

In the Basaltic Terrain, in parts of Kolhapur district, the ground water occurs under unconfined conditions in the phreatic zone up to the depth of 15.00 m in the weathered zone, joints and fractures in the massive units, and weathered vesicular units. The water bearing strata below the red bole and massive units exhibits mild confined conditions as observed in the borewells tapping deeper aquifers. In the laterites plateaus, the ground water occurs down to a depth of 15.00 to 20.00 m. bgl under un-confined conditions. The wells of these areas show rapid decline in water level during post monsoon period and practically go dry in peak summer, due to lateral movement at lithomargic/lateritic contact and spring discharge is noticed.

4.6.5.1 Ground Water Level Scenario

[13] CGWB, Kolhapur 2022

The CGWB periodically monitors 36 National Hydrograph Network Stations (NHNS) in Kolhapur district, four times a year i.e. January, May, August and November.

Depth to Water Level: Depth to water level varies with in the district depending upon hydrogeological framework, level of ground water development and topography of the area. It also varies with time. The general rise during monsoon and decline after monsoon till the next monsoon is witnessed in the region. The water level data of 36 National Hydrograph Network monitoring Stations (NHNS) established by CGWB have been analyzed to depict the ground water level during pre monsoon and post monsoon 2022.

Pre monsoon Depth to Water Level (May-2022): Pre monsoon depth to water level map has been prepared using the NHNS water level data of May-2022 and is presented as Figure 3. The Premonsoon depth to water level ranges from 0.00 to 16.28 m. bgl. The depth to water level ranges between 5 to 10 m. bgl. in major part of the district. The water levels of 2.0 to 5.0 m. bgl is observed as elongated patch in the central part of the district. The deeper water levels of more than 10.00 m bgl are observed in the northern and southern part of the district. Spatial variation of pree monsoon depth to water level is shown in **Figure 4.17.**

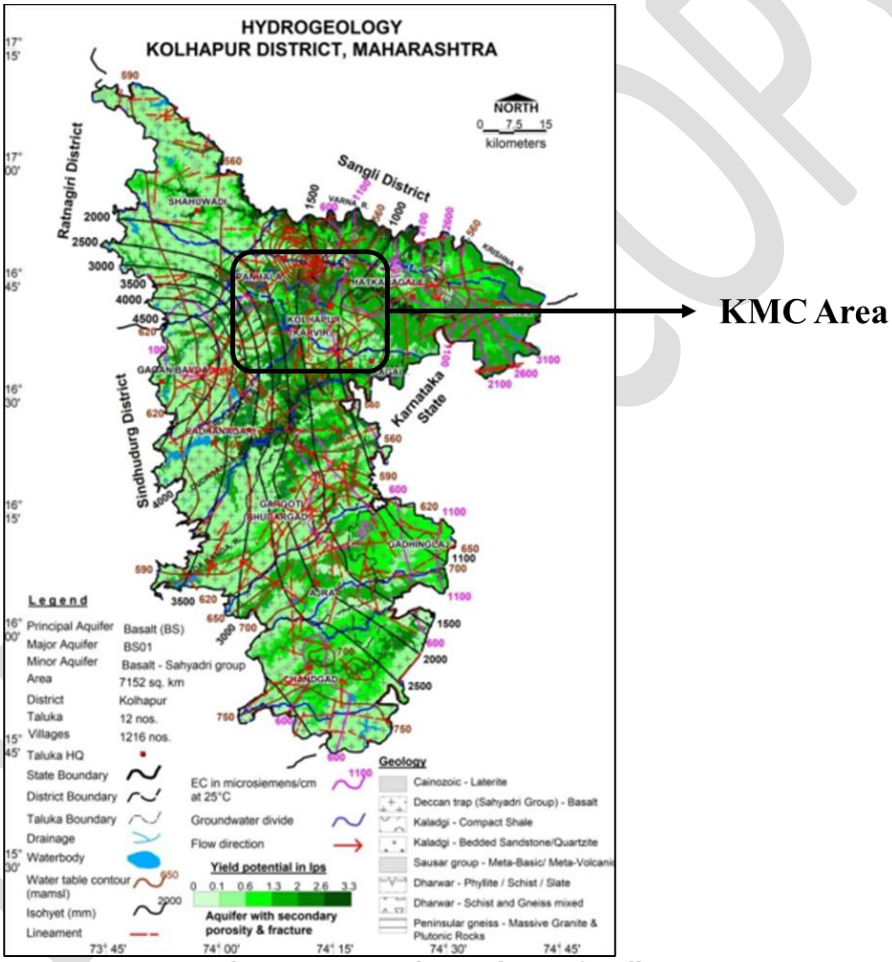


Figure 4-17: Hydrogeology of Kolhapur

Post monsoon Depth to Water Level (Nov-2022): Post monsoon depth to water level map has been prepared based on Nov 2011 water level data. The post monsoon water level ranges from 0.3 to 9.6 m bgl. The water levels of 2 to 5m bgl is observed in major part of the district.
The shallow water level of less than 2.0m. bgl occur as scattered patches in northern and south eastern parts of the district. The deeper water levels of 5 to 10 m bgl are observed in eastern parts of the district. Spatial variation of post monsoon depth to water level is shown in **Figure 4.18**.

Water Level Fluctuation (May-Nov 2022): The difference between pre monsoon and post monsoon water level is taken as fluctuation, which assumes significance for ground water recharge, estimates. The difference between pre monsoon and post monsoon water level is the seasonal fluctuation, which may vary due to excess or deficit rainfall during that particular year. The fluctuation is less

than 2.0m bgl. in almost entire district except in a few isolated patches where the fluctuation is more than 2.0m. The water level fluctuation is depicted in **Figure 4.19.**

4.6.5.2 Water Table Elevation

Water Table Elevation range 500 m amsl to 750 m amsl. The entire district is mainly drained by Panchganga River which is the tributary of Krishna River, the general slope is eastwards. Groundwater movement is from NE to E with elevation from 590 m to 560 m amsl. Groundwater movement along Bhogwati river is from W to E with elevation from 690 m to 520 m amsl. Along Dudhganga river in Western part of the district, the Groundwater movement is from W to E with elevation from 590 m to 560 m amsl. Along Veda Ganga River Groundwater movement is from SW to N with elevation from 590m to 560mamsl. It has been observed that the groundwater flow direction follows the drainage and topography of the area. This indicates the topographic control for the groundwater movement.

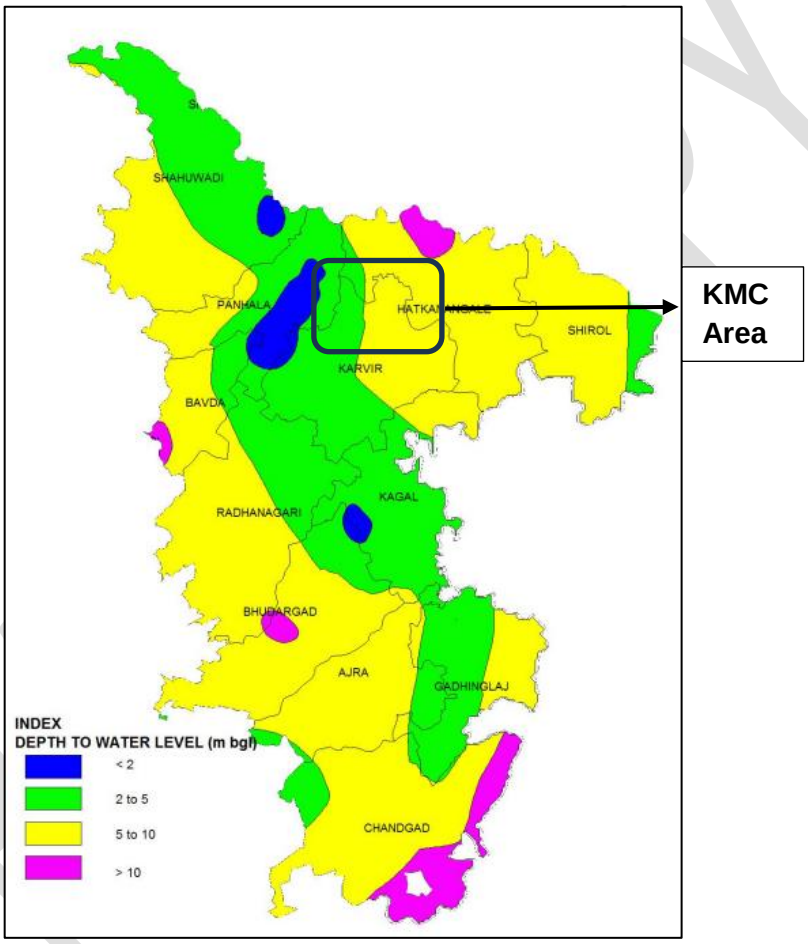


Figure 4-18: Premonsoon depth to water level (May 2022)

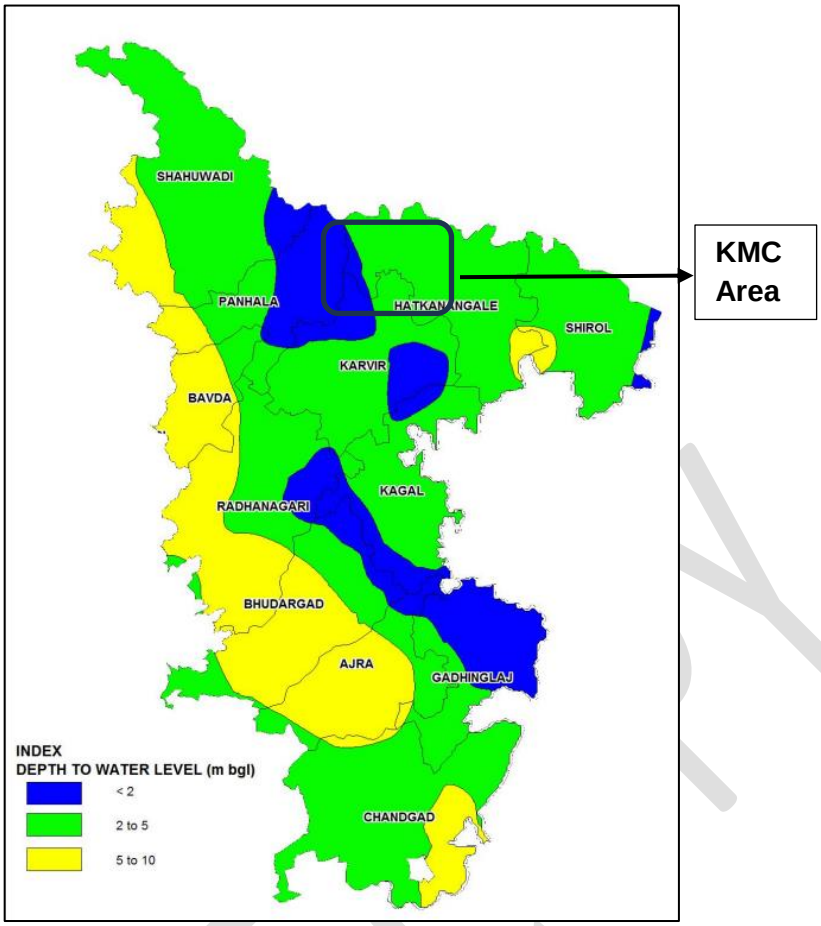


Figure 4-19: Postmonsoon depth to water level (Nov 2022)

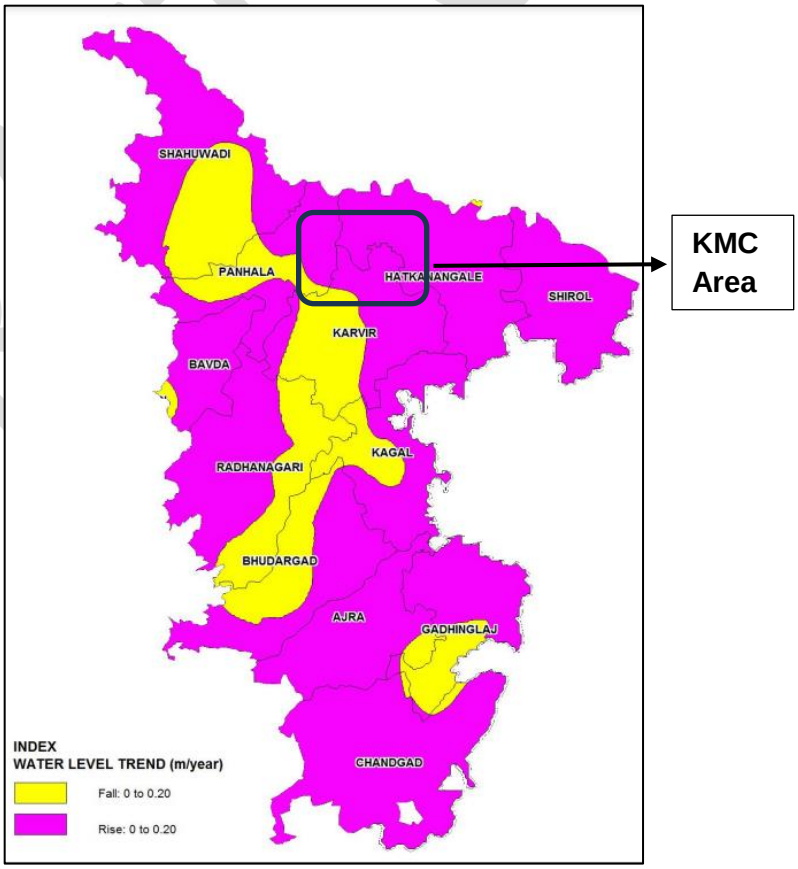


Figure 4-20: Water Level Fluctuation (May to Nov 2022)

4.6.6 Aquifer details / Ground Water Availability[14]

Aquifer Characteristic of Kolhapur district is shown in **Table 4-6.** Deccan Trap Basaltic Formation is the major aquifer in the district. Weathered/Fractured Basalt and Jointed / Fractured Basalt are the water bearing formations in Basalt of Kolhapur District. Yield of Aquifer –I is 5-160 m3/day, Aquifer-II is 0.1-3.3 LPS.

Depth of occurrence and fractured/granular rock thickness of Aquifer-I and Aquifer-II is shown in **Figure 4.21 and 4.22,** respectively. Depth of occurrence of Aquifer –I Basalt (Weathered /Fractured Basalt) are 8 to 30 m while depth of occurrence of Aquifer-II Basalt (Jointed & Fractured Basalt) is 25 to 180 m. Yield Potential of Aquifer-I (Weathered /Fractured Basalt) and Aquifer-II (Basalt) is shown in **Figure 4.23 and 4.24**.

Table 4-6: Aquifer Characteristics of Kolhapur District

Sr. No.	Major Aquifer	Basalt (deccan Traps)	
1.	Type of Aquifer	Aquifer-I	Aquifer-II
2.	Formation	Weathered/Fractured Basalt	Jointed / Fractured Basalt
3.	Depth of Occurrence (m bgl)	8 to 30	25 to 180
4.	SWL (m bgl)	1 to 15	9 to 85
5.	Weathered, Jointed / Fractured rocks thickness (m)	5 to 20	0.5 to 3
6.	Fractured zones encountered (mbgl)	4 to 30	25 to 180
7.	Yield	5 –160 m3/day	0.1 –3.3 lps
8.	Sustainability	1 to 4 hrs	0.5 to 3 hrs
9.	Transmissivity(m2/day)	-	-
10.	Specific Yield/ Storativity (Sy/S)	-	-
11.	Suitability for drinking/ irrigation	Suitable for both	In major part of the district ground water is potable and its quality is well within permissible limit except Fluoride contamination

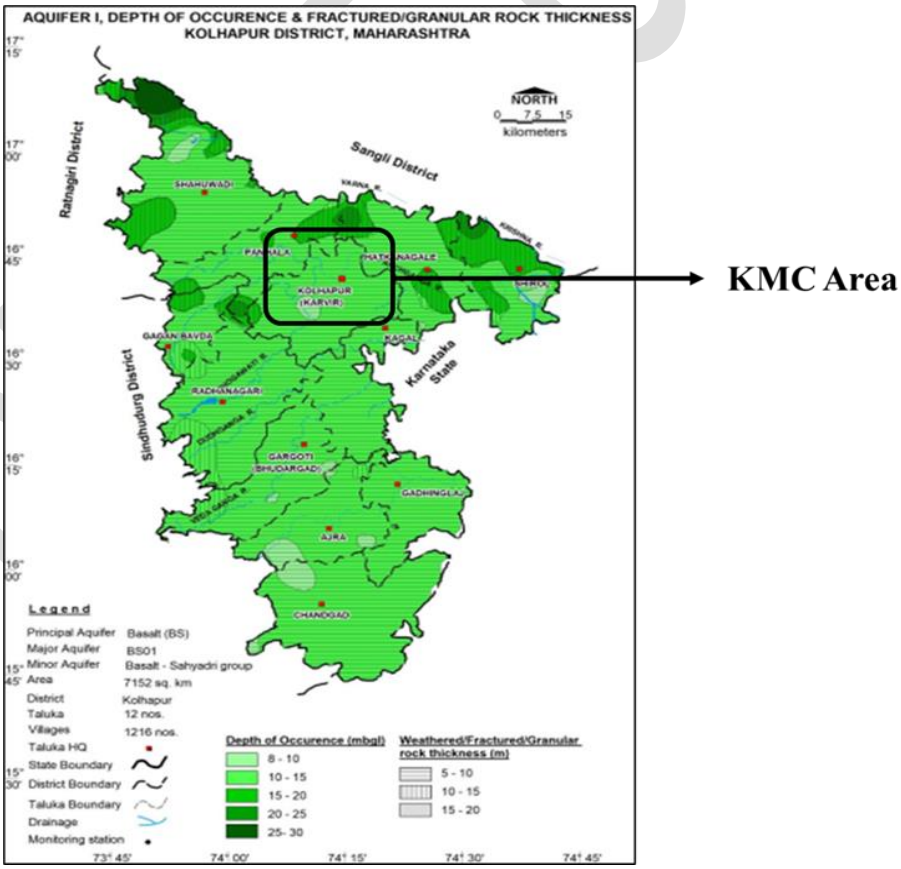


Figure 4-21: Depth of Occurrence and fractured/granular rock thickness of Aquifer-I

[14] CGWB, Kolhapur, 2022

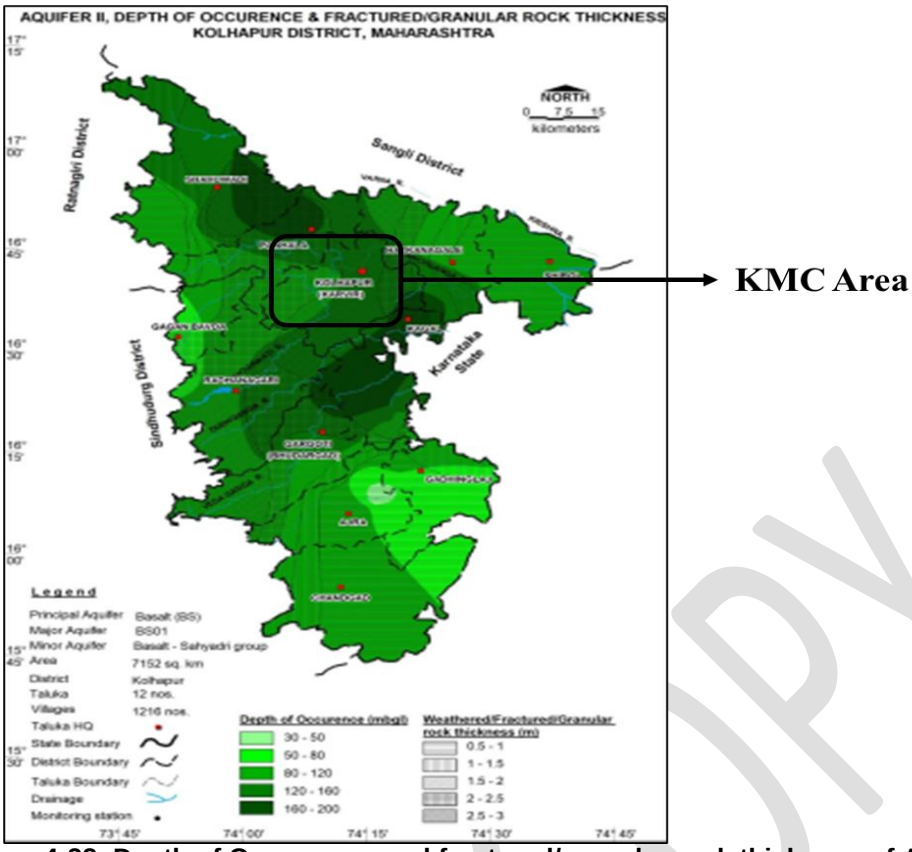


Figure 4-22: Depth of Occurrence and fractured/granular rock thickness of Aquifer-II

4.6.6.1 Ground Water Availability

During pre-monsoon, rise in water level trend has been recorded at 55 stations and ranges from 0.0009m/year Hindgaon, Chandgad block) to 0.7585 m/year Surute. Chandgad block) while falling trend was observed in 79 stations varying from 0.0004 (Pimpalthane, Panhala block) to 1.21 m/year (Adkur, Chandgad block). Major Area showing rising trend upto 0.20 m/yr (53%) **Figure 4.23**.

During post monsoon, rise in water level trend has been recorded at 43 stations and it ranges between 0.0006 m/year (Harur, Ajra block) to 0.56m/year (Panhala, Panhala block) while falling trend was observed in 91 stations varying from 0.0003 (Chipari, Shirol Block) to 0.87 m/year (Adkur, Chandgad block). Major Area showing rising trend upto 0.20 m/yr (58%) **Figure 4.24**.

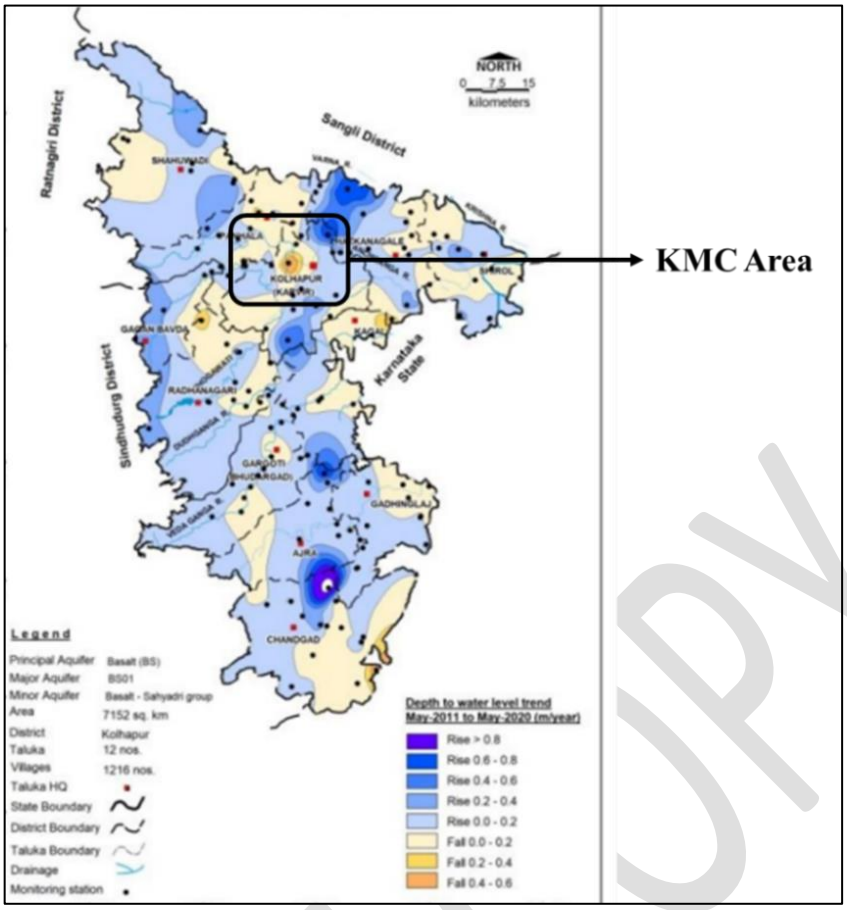


Figure 4-23: Pre-Monsoon Ground Water Avialbility

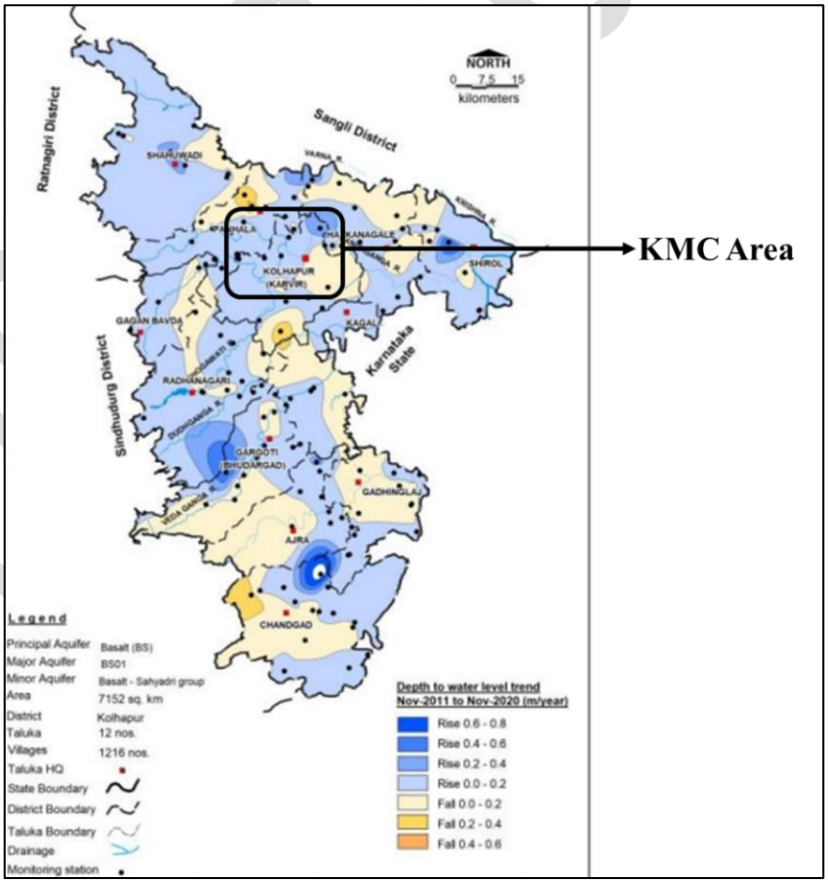


Figure 4-24: Post-Monsoon Ground Water Avialbility

4.6.7 Earthquake Zone[15]

According to the Global Seismic Hazards Assessment Program (GSHAP) data, the State of Maharashtra falls in a region of moderate to high seismic hazards. As per the 2002 Bureau of Indian Standards (BIS) map, the KMC city falls in Zone III. The seismic map of Maharashtra showing KMC area is shown in following **Figure 4-25**.

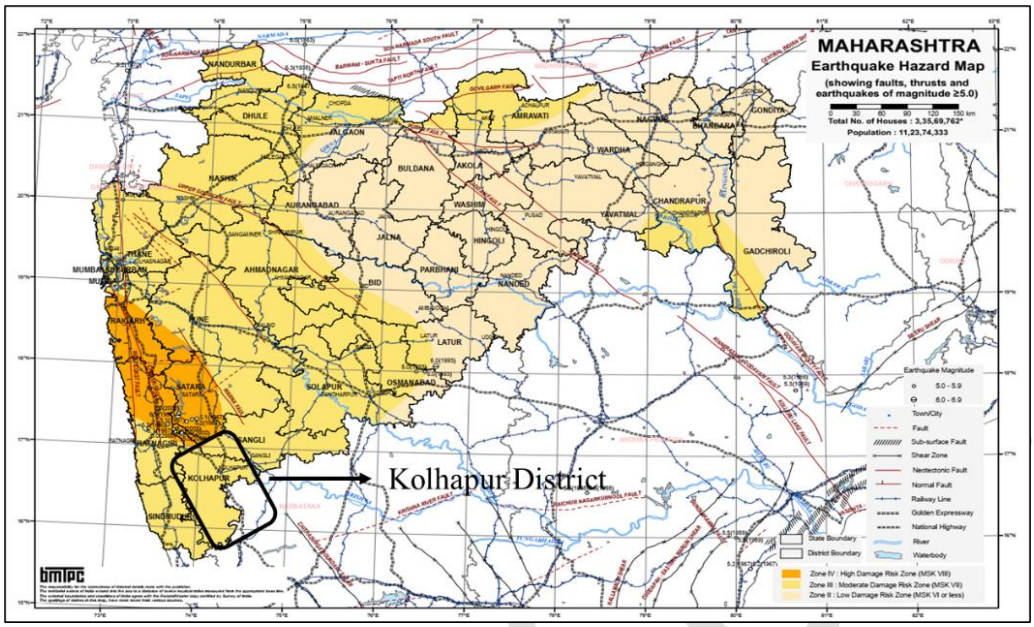


Figure 4-25: Seismic Map of Maharashtra Showing Kolhapur District

4.6.8 Meteorology (30 Years Historical)[16]

Physio-graphically, the State is broadly divided into five regions, viz (i) Konkan Region (in the West), (ii) Uttara Madhya Maharashtra (in the North), (iii) Dakshin Madhya Maharashtra (in the South), (iv) Marathwada (in the Center), (V) Vidharbh (in the East). The proposed project location is coming in Dakshin Madhya Maharashtra. All the physical features are discussed in subsequent sections. Simulated historical climate & weather data for 30 years period (1995 to 2025) of Kolhapur City is explained in the subsequent sections.

4.6.8.1 Climate

The climate of Kolhapur is characterized by Warm and humid monsoon, dry and coldest winters to hot and humid summers. The general climate is tropical. Kolhapur experiences three principal seasons; summer (March to June), rainy Season (June to October) and winter (December to February). In the winter season, from December to February the general dry and January being a coldest month. In summer months, March to June, the general flow of hot winds. The direction of winds mostly south westerly, the season is named as South west Monsoon season. Between these two principal seasons are the transition seasons of hot weather April and May and retreating Monsoon months for June and October.

Since the agriculture is the largest consumer of water, agricultural activities are linked with three principal cropping seasons with corresponding meteorological seasons, i.e., (a) Summer corresponding with pre-Kharif or Boro cultivation; (b) Monsoon with Kharif; and (c) Retreating Monsoon with Rabi.

4.6.8.2 Temperature

The 30 years data depict that the maximum mean temperature ranges between 26^0C to 36^0C. The minimum mean temperature ranges between 16^0C to 23^0C.

[15] BMPTC, Maharashtra Earthquake Hazard Map
[16] Meteoblue

Maximum temperature records depict that April and May are generally the hottest months with 40^{0}C temperature and December and January are the coldest month with 12^{0}C to 17^{0}C temperatures.

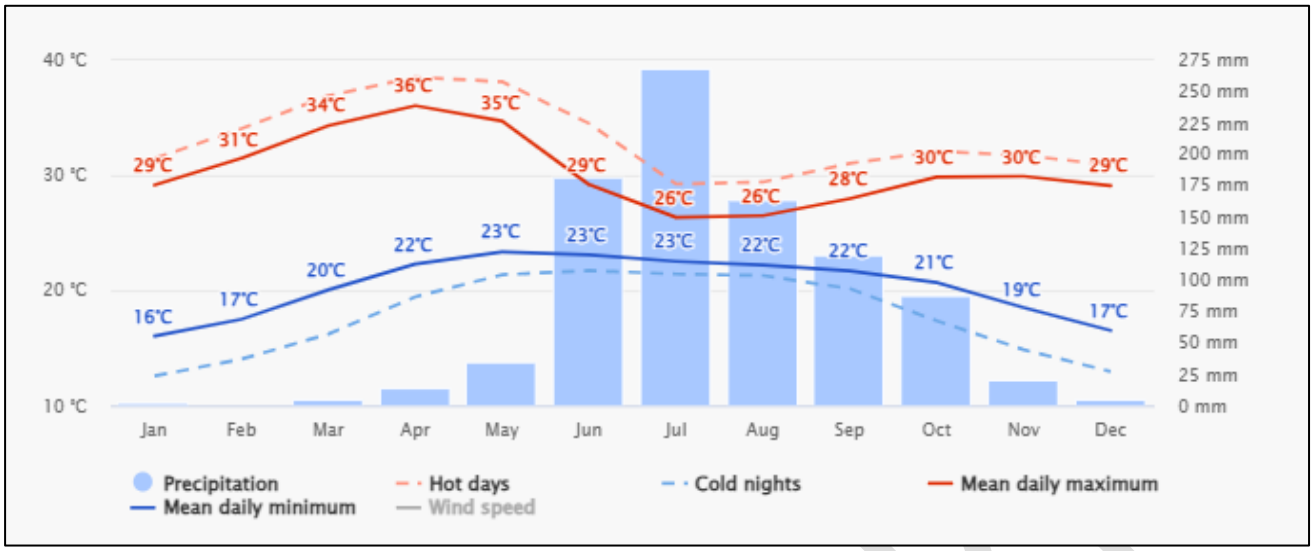


Figure 4-26: Average Temperatures and Precipitation of Kolhapur City

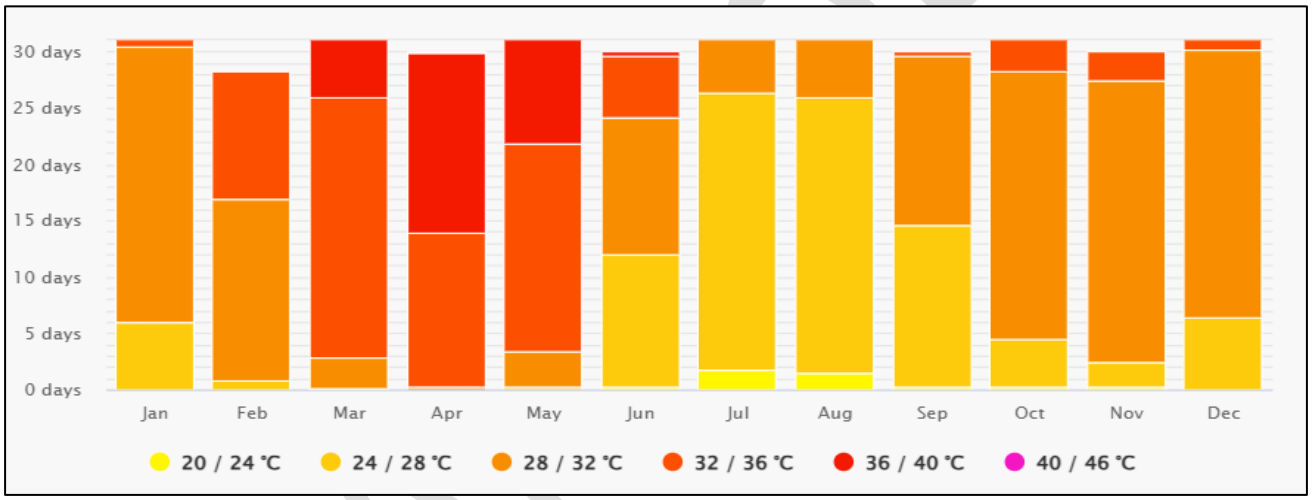
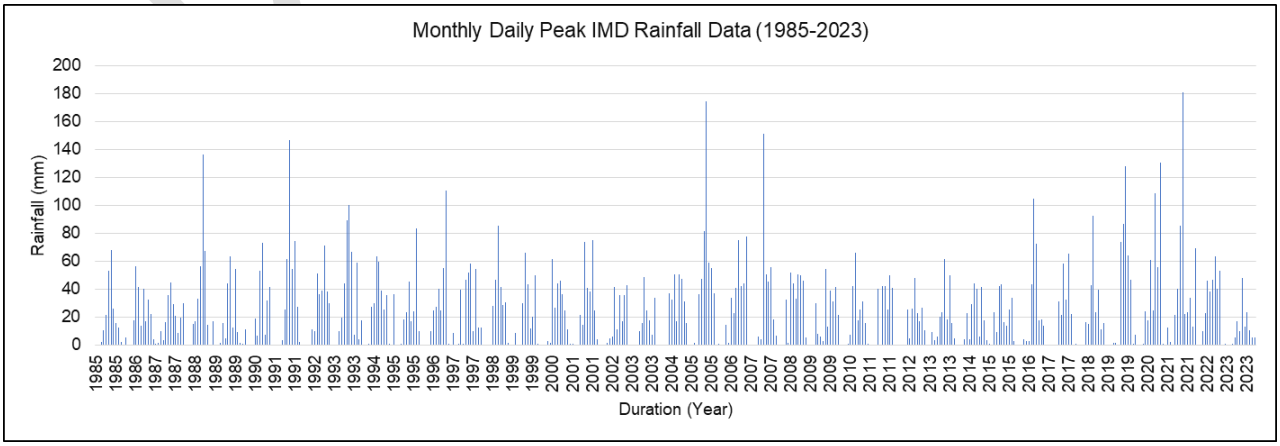


Figure 4-27: Maximum Temperatures in Kolhapur City

4.6.8.3 Precipitation / Rainfall[17]

The India Meteorological Department (IMD) is the primary agency responsible for providing weather-related information, including rainfall data and forecasts, for India. The observed rainfall data is collected from the IMD station at Kolhapur. In this study, 39 years (1985 -2023) of historical observed rainfall data is used and shown below.



[17] IMD

Figure 4-28: Monthly daily Peak rainfall data from 1985 to 2023 for Kolhapur

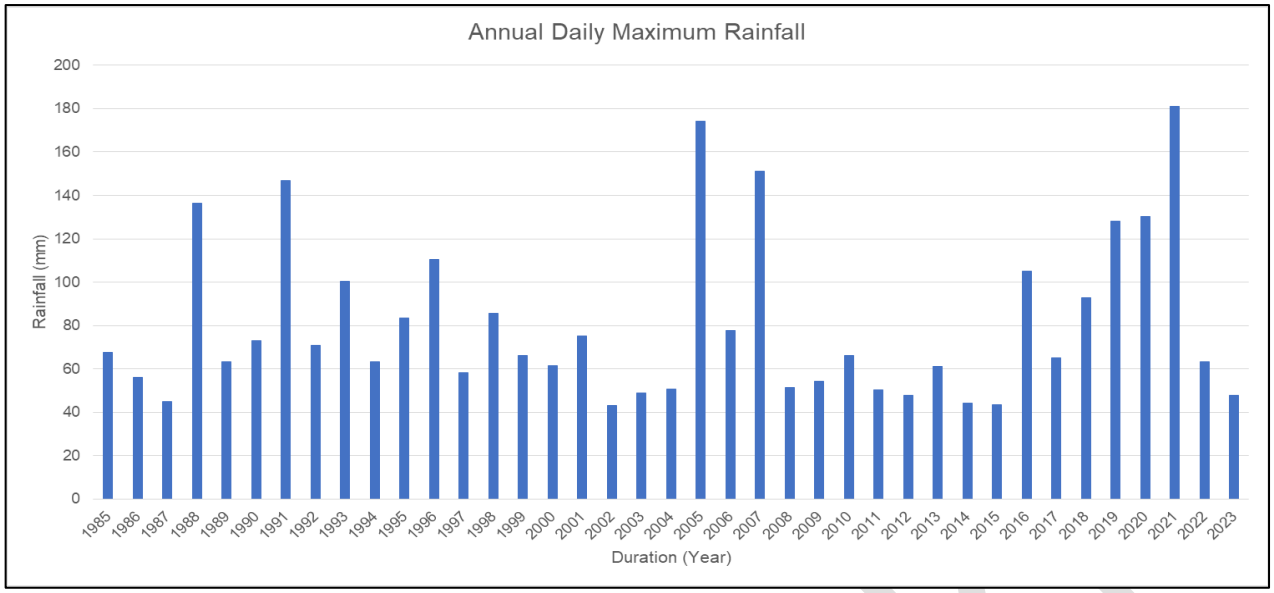


Figure 4-29: Annual daily maximum rainfall data from 1985 to 2023 for Kolhapur

From the Past 39 years of rainfall data, the peak rainfall in a day observed in Kolhapur city is 181 mm and this occurred in 2021. The average annual rainfall of the Kolhapur region is 1031.77 mm. The region experiences most of its rainfall during the monsoon season, particularly from June to September.

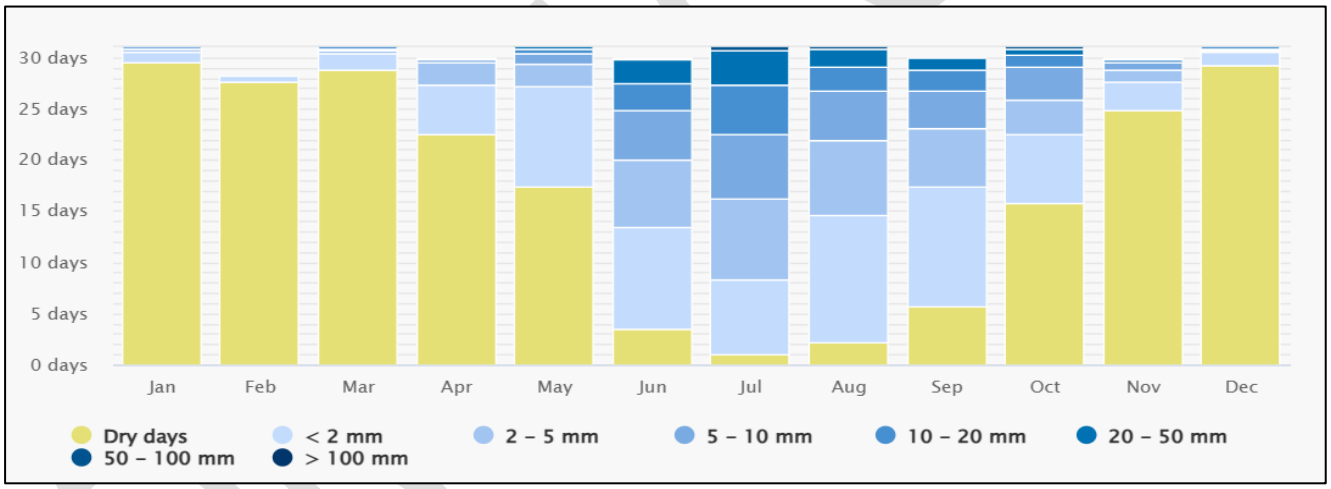


Figure 4-30: Precipitation Diagrame of Kolhapur City

4.6.8.4 Relative Humidity[18]

The average Relative Humidity of Kolhapur is around 72% although it varies from around 54% during Winter (February) to 91% during the Monsoon (August). The most humid month of the year is August with humidity varies from 73.6% to 98.7%. The least humid month is of the year is February, with humidity varies from 25.1% to 88.2%. The **Table 4.7** below shows the minimum, maximum and average % Relative Humidity over the year in Kolhapur.

Table 4-7: Average Annual Relative Humidity of Kolhapur

Sr. No.	Parameter	Relative Humidity, %			
		Maximum	Minimum	Average	Standard Deviation
1.	January	27.0	94.0	64.1	± 16.6
2.	February	25.1	88.2	54.0	± 15.8
3.	March	25.6	94.3	58.7	± 18.3
4.	April	22.1	88.7	58.6	± 17.7

[18] Indian climate

Sr. No.	Parameter	Relative Humidity, %			
		Maximum	Minimum	Average	Standard Deviation
5.	May	28.7	90.9	67.6	± 16.1
6.	June	55.1	98.4	87.4	± 7.9
7.	July	73.7	98.9	91.2	± 5.4
8.	August	73.6	98.7	91.5	± 5.4
9.	September	53.5	98.0	83.2	± 10.4
10.	October	35.0	95.2	70.6	± 15.0
11.	November	36.9	94.1	66.2	± 14.2
12.	December	36.1	95.0	67.4	± 14.5

The graph shows below in **Figure 4.31**, the minimum, maximum and average % Relative Humidity by month in Kolhapur.

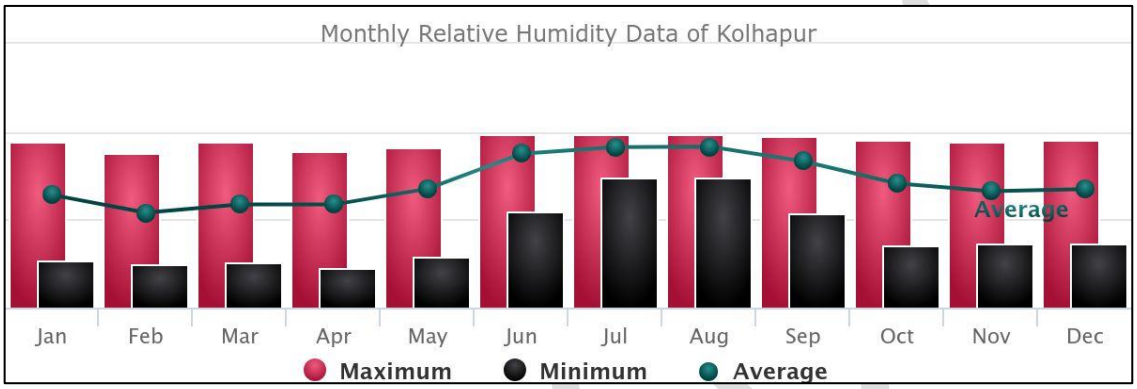


Figure 4-31: Average Annual Relative Humidity of Kolhapur

4.6.8.5 Wind

The diagram for Kolhapur shows maximum wind speed i.e. 20-30 km/h (steady strong winds) in the months of June, July and August. However, rest of the months has maximum wind speed is 10-20 km/h (calm winds). The graph of the wind speed shown in the **Figure 4.32** below.

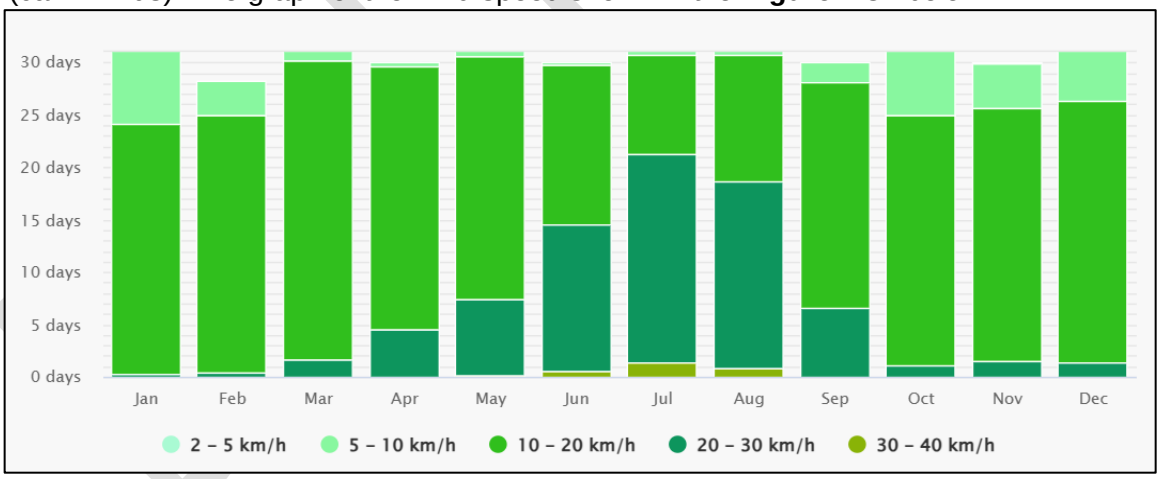


Figure 4-32: Annual Average wind speed of Kolhapur

The wind rose for Kolhapur shows wind direction is dominantly from west. The wind rose diagram of the Kolhapur shown in **Figure 4.33** below.

Figure 4-33: Wind Rose Diagram of Kolhapur

4.6.9 Climate Change (45 Years)[19]

The effects of climate change are already well visible by increasing air temperatures, melting glaciers and decreasing polar ice caps, rising sea levels, increasing desertification, as well as by more frequent extreme weather events such as heat waves, droughts, floods and storms. Climate change has already affected the region of Kolhapur during the past 45 years. On the following diagrams, as per source used is ERA5, the fifth generation ECMWF atmospheric reanalysis of the global climate, covering the time range from 1979 to 2024, with a spatial resolution of 30 km.

4.6.9.1 Yearly Temperature Change in Kolhapur

The graph shows an estimate of the mean annual temperature for the larger region of Kolhapur. The dashed blue line is the linear climate change trend and is going up from left to right, the temperature trend is positive and it is getting warmer in Kolhapur due to climate change.
In the lower part the graph shows the so-called warming stripes. Each coloured stripe represents the average temperature for a year - blue for colder and red for warmer years.

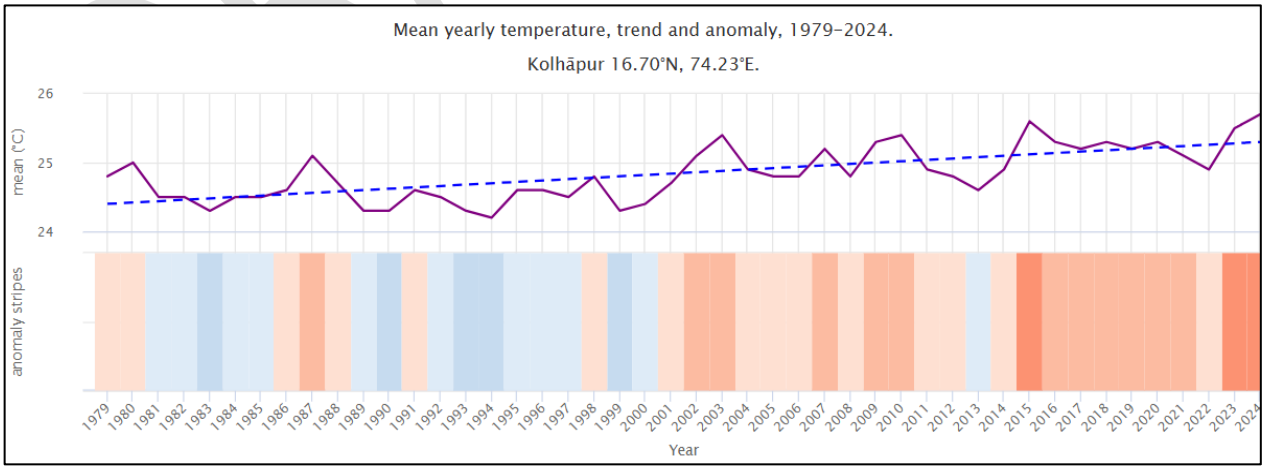


Figure 4-34: Yearly Temperature Change in Kolhapur

4.6.9.2 Yearly Precipitation Change in Kolhapur

[19] Meteoblue

The graph shows an estimate of mean total precipitation for the larger region of Kolhapur. The dashed blue line is the linear climate change trend going up from left to right, the precipitation trend is positive and it is getting wetter in Kolhapur due to climate change. In the lower part the graph shows the precipitation stripes. Each coloured stripe represents the total precipitation of a year - green for wetter and brown for drier years.

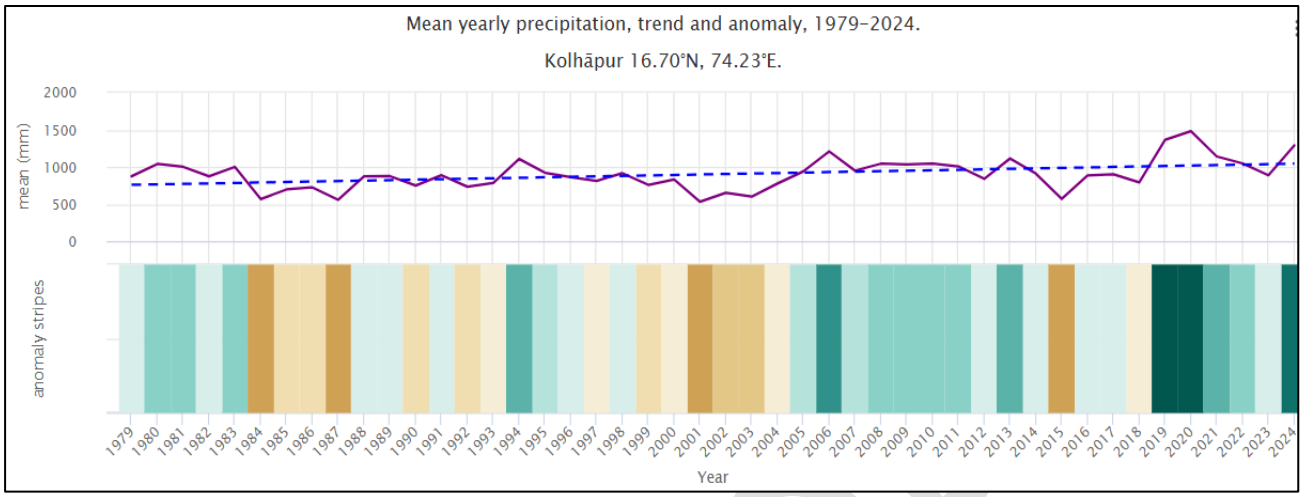


Figure 4-35: Yearly Precipitation Change in Kolhapur

4.6.9.3 Monthly Anomalies of Temperature and Precipitation - Climate Change Kolhapur

The graph shows the temperature anomaly for every month since 1979 up to now. The anomaly tells you by how much it was warmer or colder than the 30-year climate mean of 1980-2010. Thus, red months were warmer and blue months were colder than normal. In most locations, increase of warmer months over the years, which reflects the global warming associated with climate change.

The lower graph shows the precipitation anomaly for every month since 1979 up to now. The anomaly tells if a month had more or less precipitation than the 30-year climate mean of 1980-2010. Thus, green months were wetter and brown months were drier than normal.

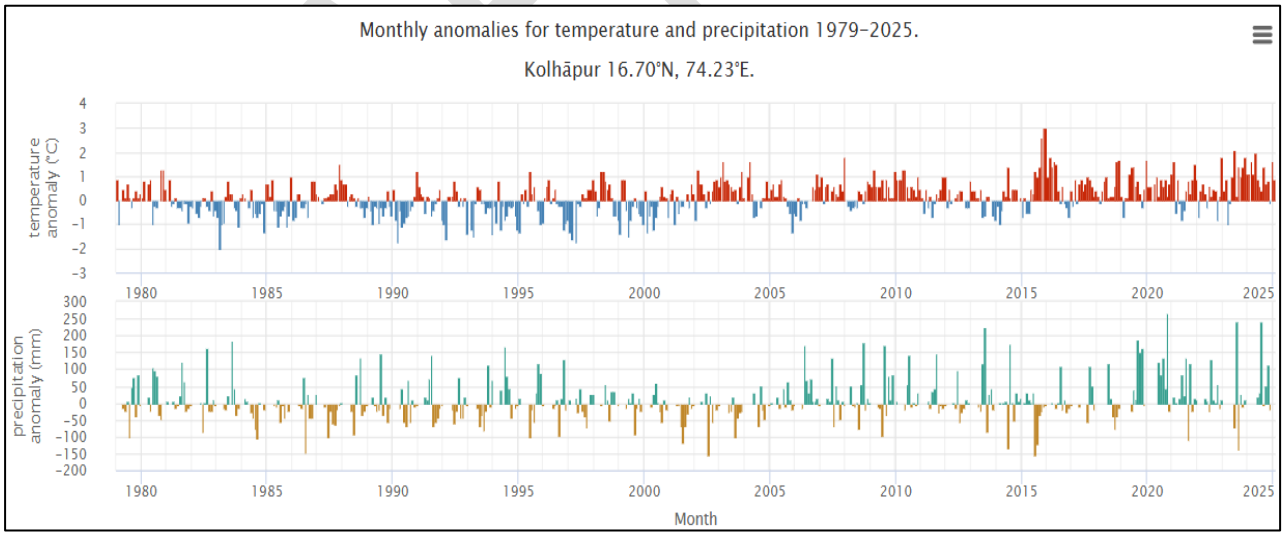


Figure 4-36: Climate Change in Kolhapur

4.6.10 Major Water Bodies

4.6.10.1 Panchganga River

The eastern edge of the Sahyadri hills is home to the Panchganga river basin. Situated at latitudes 15°43' and 17°17' north, it lies in Maharashtra's Kolhapur district's northern region. It is made up of five streams that go northeast, including Bhogavati (83 km), Dhamani (41 km), Tulsi (30 km), Kumbi (48 km) and Kasari (69 km). The Bhogawati River is renamed Panchganga from Prayag Chikhali.

The river flows and meets the Krishna River at Narsinhwadi, Tal: Shirol, Dist: Kolhapur. There are 174 villages, 2 municipal towns (Ichalkarnji and Kurundwad), and one city (Kolhapur) on the river's bank. The salient features of the Panchganga river are given the below **Table 4.8**. Also, the watershed area for Panchganga basin is shown in the **Figure 4.37**.

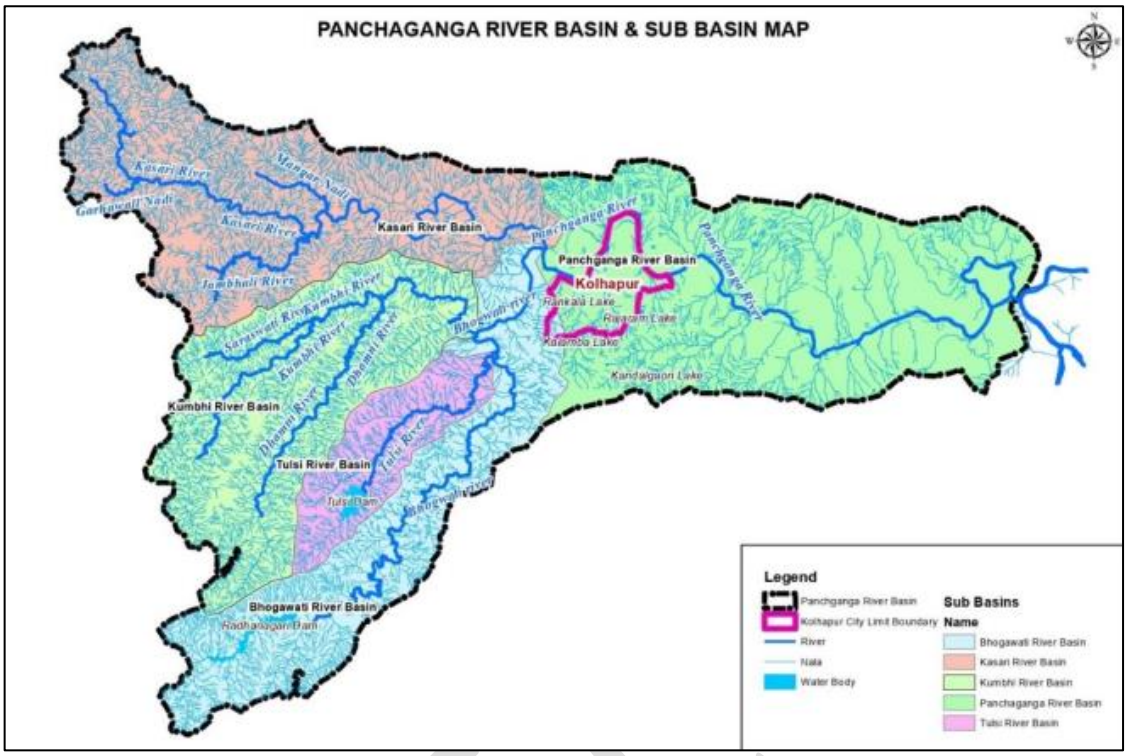


Figure 4-37: Panchganga River Basin Map and Position of KMC- Drainage & Sub-Basin

Table 4-8: Salient features of the Panchganga River

Sr. No.	Description	Quantity
1.	East-West Length of River	108 Km
2.	North-South Length of River	67 Km
3.	Total Area	2730.40 sq. m
4.	Average width	110 m
5.	Average Minimum Depth	3 m
6.	Average Maximum Depth	14 m
7.	Average Rainfall	2501.9 mm
8.	Average Min. Temperature	28℃ to 1.2℃
9.	Average Max. Temperature	14℃ to 22℃

4.6.10.2 Lakes

Kolhapur City features six major lakes as detailed in Table No. 3.6, covering approximately 3% of the city's total area. These lakes serve as vital resources for various activities, including water supply, fishing, irrigation, and recreation. Additionally, Kolhapur is home to other notable lakes, such as Lasktirth, New Palace Lake, and two lakes within the Shivaji University campus. The **Table 4.9**, below describe the major water bodies under Kolhapur Municipal Corporation.

Table 4-9: Details of the Major Water Bodies under KMC

Sr No	Name of lake	Latitude	Longitude	Max. Depth (Meters)	Area (sq.m)
1	Rankala	16°41'18.32"N	74°12'41.70"E	30	1065623.305
2	Kalamaba	16°39'20.19"N	74°12'44.89"E	14	615278.805
3	Kotitirth	16°41'39.00"N	74°14'12.65"E	60	24727.569
4	Hanuman	16°44'9.69"N	74°14'27.82"E	3	6694.426
5	Rajaram	16°40'46.96"N	74°15'58.04"E	11	183657.367
6	Raman Mala	16°43'1.88"N	74°13'59.94"E	4	41448.875

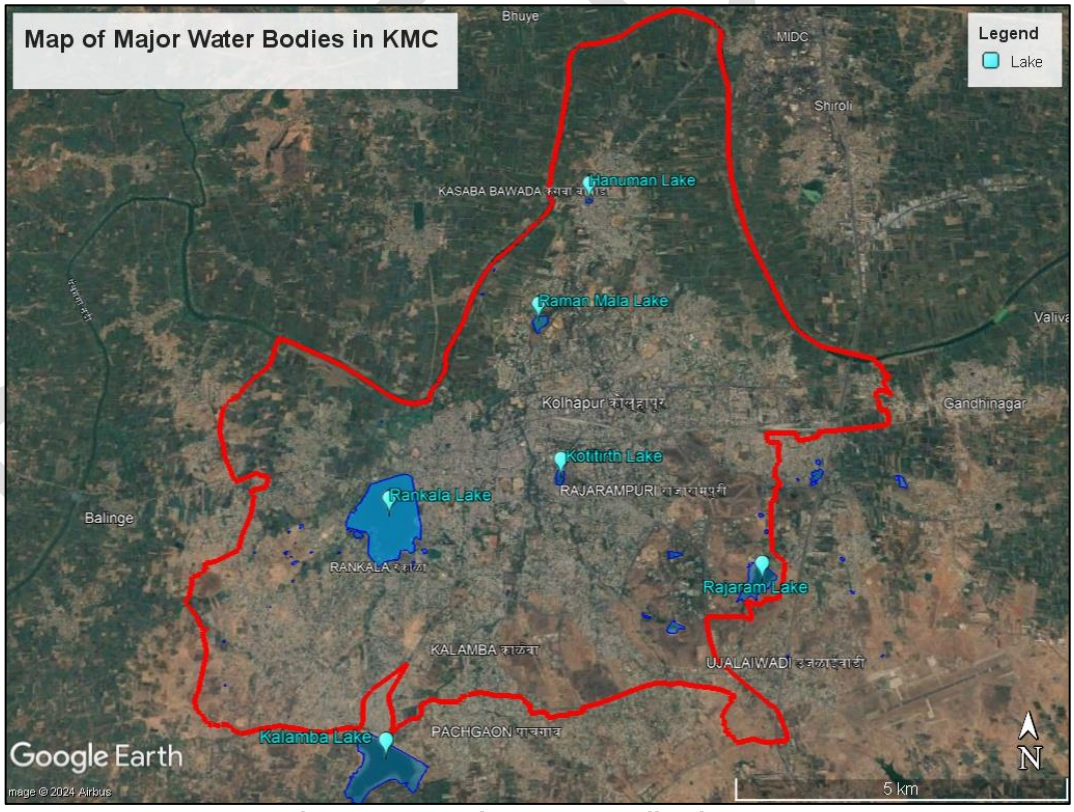


Figure 4-38: Major Water Bodies in KMC

4.6.11 Watershed Boundary of the Panchganga River

The watershed boundary is a critical factor in stormwater management for Kolhapur city as it defines the natural catchment area, determining how and where rainwater flows.

Understanding this boundary helps in identifying sources of runoff, assessing flood-prone areas, and planning drainage systems effectively. It ensures that stormwater interventions, such as retention basins, channels, and infiltration zones, align with natural hydrological patterns. Accurate delineation of the watershed boundary supports sustainable water resource management and mitigates the risk of urban flooding. It also aids in integrating upstream and downstream impacts, ensuring a holistic approach to stormwater management. For Kolhapur, with its terrain and monsoon intensity, this knowledge is indispensable for a resilient infrastructure plan.

In this study, the watershed boundary is extracted by using USGS SRTM 30m Res. DEM data. The delineated watershed up to Kolhapur MC is shown in the **Figure 4.39** below.

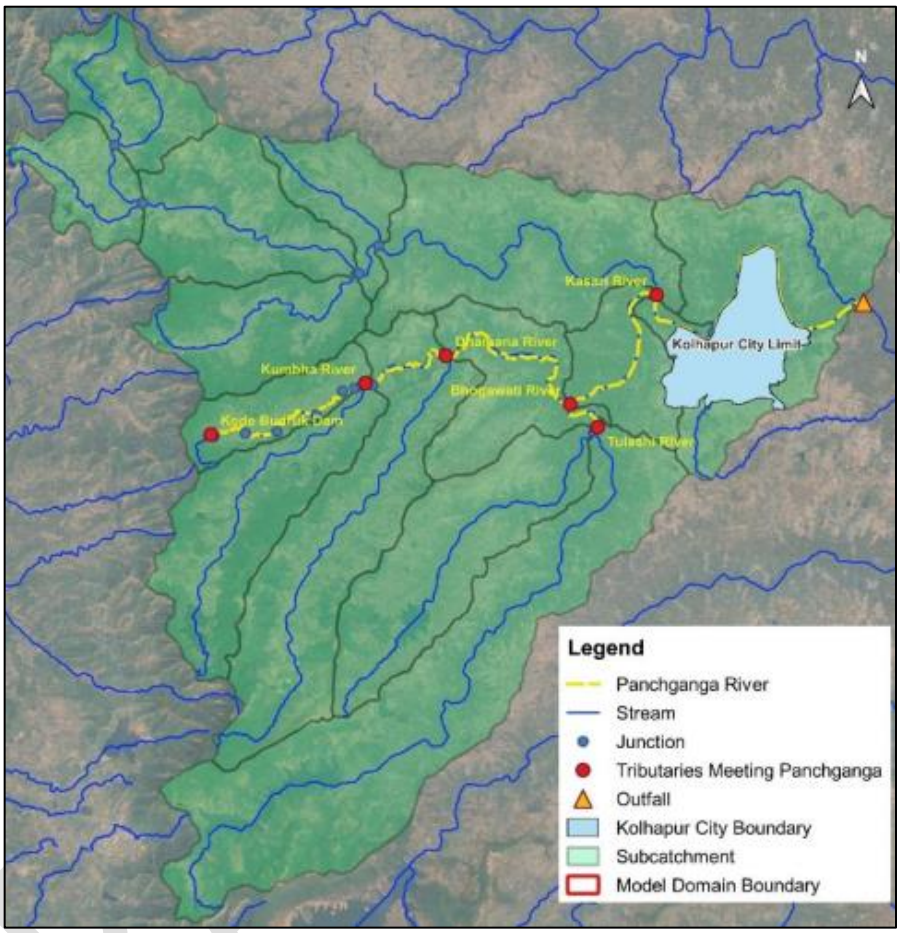


Figure 4-39: Watershed Delineation of the Panchganga Upper sub-basin

4.6.11.1 Slope Profile

The watershed delineation tool directly determines slope based on the DEM and the streams paths generated. The generated watershed slope map is shown below **Figure 4.40**. The Kolhapur MC area slope variation is 2 to 47.23 %.

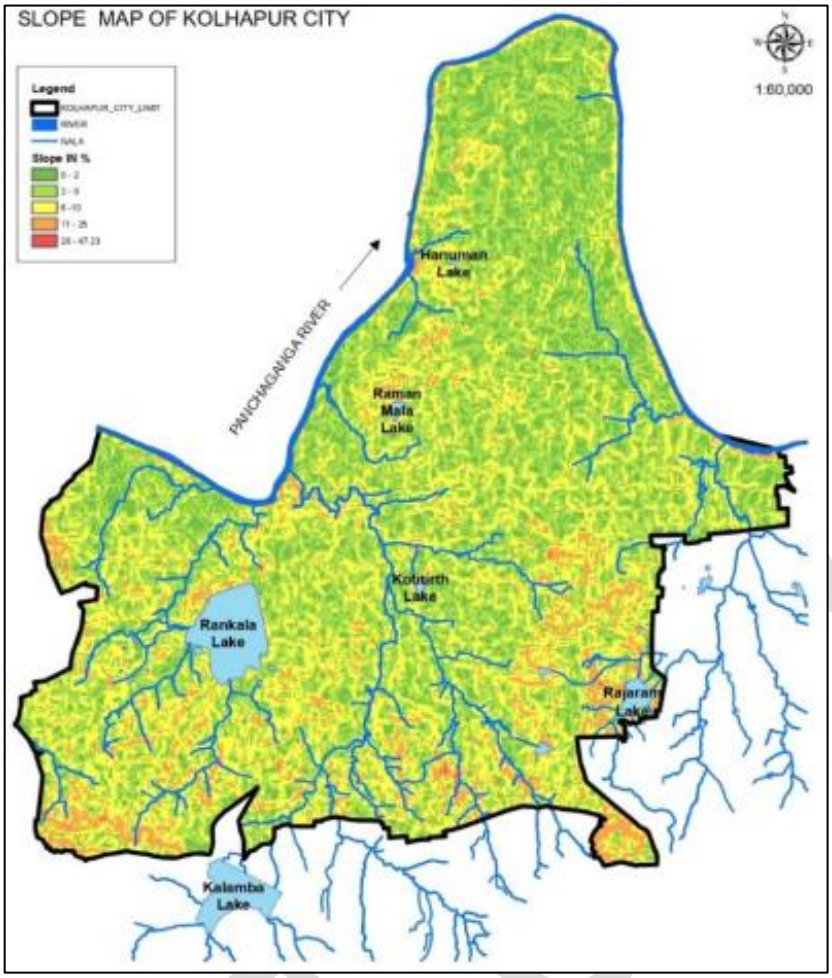


Figure 4-40: Slope Profile of Upper Panchganga Sub-basin and the position of Kolhapur City

4.8 Baseline Data

The environmental primary baseline study has been carried out in the month of January 2025. The baseline data has been collected through S A ENCON PRIVATE LIMITED, Satara Based MoEF&CC recognized and NABL Accredited laboratory.

The baseline monitoring is carried out considering nature and magnitude of project activity. Also, the environmental setting and potential receptors of the impact were considered for determining monitoring locations. The study area for primary data collection is set within 100mt radius from proposed project location. The following sections discusses the environmental monitoring for various attributes along with methodology and results are compared with various standards.

4.7.1 Ambient Air Quality

The objective of baseline data generation for Ambient air quality and its conformity to NAAQS. Observed sources of air pollution in the area are on-going construction activities, commercial activities and associated traffic load.

Monitoring at 9 locations based on the predominant wind direction of the study period and environmental setting is carried out for 24hrs twice a week for complete study period. Selection of Monitoring Locations. Reconnaissance survey is carried out to identify the sources of air pollution in the study area and different types of receptors (Sensitive receptors, etc.) and environmental setting of the area. The predominant wind pattern for the months of monitoring is referred from IMD and Meteoblue. Selection of monitoring locations and monitoring is carried out as per the procedure prescribed "Guidelines for Ambient Air Quality Monitoring, April 2003" by CPCB.

The ambient air quality monitoring is carried out at 9 locations as shown in the **Figure 4.41**, below. The ambient air quality result shown in **Table 4.10**, below.

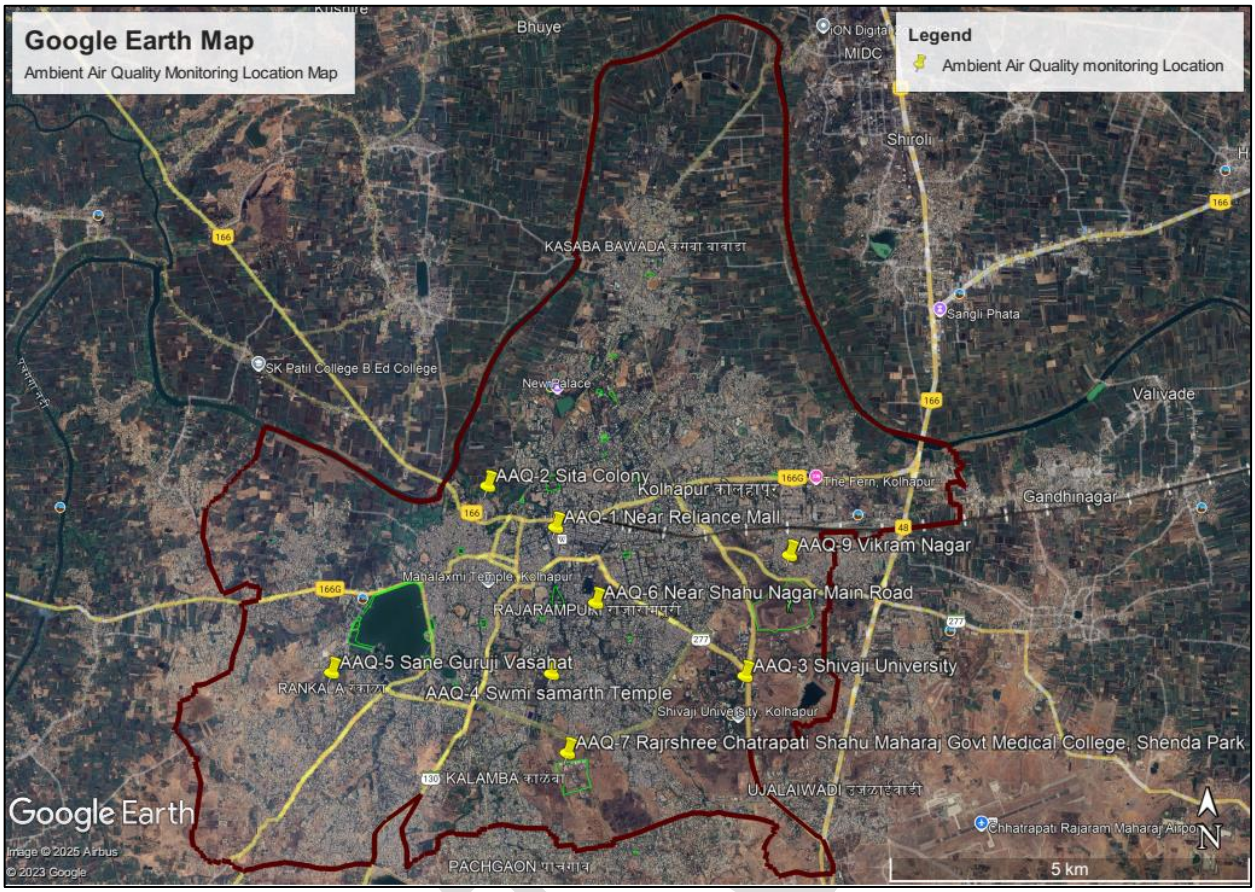


Figure 4-41: Ambient Air Quality Monitoring Location Map

4.7.1.1 Air Quality Index (AQI)

The objective of an AQI is to quickly disseminate air quality information that entails the system to account for pollutants which have short-term impacts. An air quality index (AQI) is a number related parameters (SO2, CO, visibility, etc.) used to communicate to the public how polluted the air currently is or how polluted it is forecast to become. As the AQI increases, an increasingly large percentage of the population is likely to experience increasingly severe adverse health effects.

4.7.1.2 Interpretation of Analytical Data Using AQI

AQI has been calculated for entire study period and it can be seen that the air quality is satisfactory for all the monitoring locations.

The average concentration of PM10 and PM2.5 in the study area is recorded 73.2 µg/m3 and 34.4µg/m3. The maximum concentration of PM10 is observed at Near Reliance Mall (73.2µg/m3) and concentration of PM2.5 is observed at the Near Shahu Nagar Main Road (34.4µg/m3) due to Vehicular traffic of Road. The concentration of SO2, NO2 and CO in the study area is recorded respectively 14.2µg/m3, 21.8µg/m3, and carbon monoxide is below detection limit. The concentration at all the monitoring locations is observed to be within the prescribed NAAQS limits for industrial, residential, rural and other areas. The graphical representation is provided in **Figure 4.42.**

Table 4-10: Ambient Air Quality Monitoring Results

Sr. No.	Parameters	Location Details of Air Quality Monitoring Stations									Test Method	Standard Limits
		AAQ-1 Near Reliance Mall	AAQ-2 Sita Colony	AAQ-3 Shivaji University	AAQ-4 Swami Samarth Temple	AAQ-5 Sane Guruji Vasahat	AAQ-6 Near Shahu Nagar	AAQ-7 Govt Medical College,	AAQ-8 Near Padmpuri Hall	AAQ- 9 Vikram Nagar		
		16.699915° 74.231950°	16.705151° 74.222922°	16.681261° 74.256818°	16.681488° 74.231468°	16.681629° 74.202619°	16.690379° 74.237253°	16.671660° 74.233588°	16.635915° 74.206391°	16.696385° 74.262797°		
1.	**PM10**	73.2	42.5	48.6	42.7	42.5	68.9	41.6	63.4	55.2	CPCB Guidelines – NAAQS Monitoring & Analysis Guidelines Volume-1 NAAQMS/36/2012	≤ 100
2.	**PM 2.5**	31.5	18.6	24.1	19.3	20.6	34.4	18.8	31.7	29.5		≤ 60
3.	**SO2**	13.3	9.6	11.6	8.1	9.5	13.6	9.5	14.2	10.6		≤ 80
4.	**NO2**	20.1	12.5	13.8	11.5	13.4	21.5	12.7	21.8	17.4		≤ 80
5.	**CO**	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL		≤ 4.0

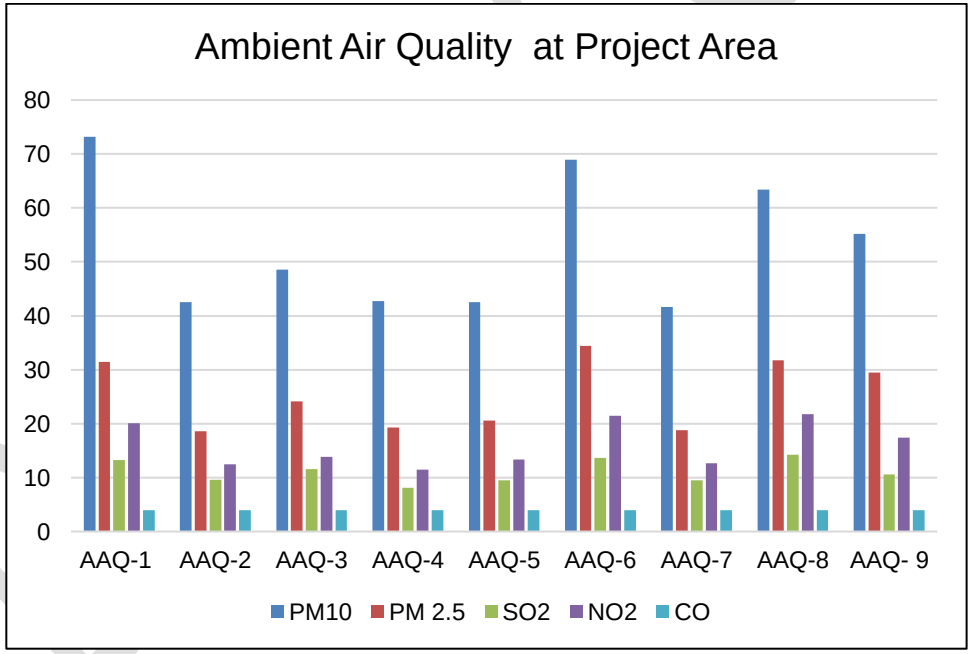


Figure 4-42: Ambient Air Quality Monitoring at Project Area

Table 4-11: Break-Point for AQI

AQI Category (Range)	PM_{10} (24 hr)	$PM_{2.5}$ (24hr)	NO_2 (24hr)	CO (8hr) mg/m^3	SO_2 (24hr)
Good (0–50)	0–50	0–30	0–40	0–1.0	0–40
Satisfactory (51–100)	51–100	31–60	41–80	1.1–2.0	41–80
Moderately polluted (101–200)	101–250	61–90	81–180	2.1–10	81–380
Poor (201–300)	251–350	91–120	181–280	10–17	381–800
Very poor (301–400)	351–430	121–250	281–400	17–34	801–1600
Severe (401–500)	430+	250+	400+	34+	1600+

Units: µg/m3 unless mentioned otherwise

AQI	Associated Health Impacts
Good(0–50)	Minimal Impact
Satisfactory (51–100)	May cause minor breathing discomfort to sensitive people
Moderately polluted (101–200)	May cause breathing discomfort to the people with lung disease such as asthma and discomfort to people with heart disease, children and older adults
Poor (201–300)	May cause breathing discomfort to people on prolonged exposure and discomfort to people with heart disease
Very Poor (301–400)	May cause respiratory illness to the people on prolonged exposure. Effect may be more pronounced in people with lung and heart diseases
Severe (401-500)	May cause respiratory effects even on healthy people and serious health impacts on people with lung/heart diseases. The health impacts may be experienced even during light physical activity

4.7.2 Ambient Noise Quality

Noise in general is a sound composed of frequency components of various loudness distributed over the audible frequency range. The factors on which the sound is described as noise depends upon its degree of loudness, period of exposure and time of day and location at which it occurs.

The noise levels measurements were carried out by measured (A-weighted) using precision noise level meter. The noise level survey was carried at all the air monitoring stations located within the 100mt radius of the proposed project area. The major source identified in the study area is of vehicular traffic movement and the construction activities. Background noise levels were also monitored in study area.

The ambient noise level monitoring is carried out at 9 locations as shown in the **Figure 4.43**, below. The ambient air quality result shown in **Table 4.12**, below.

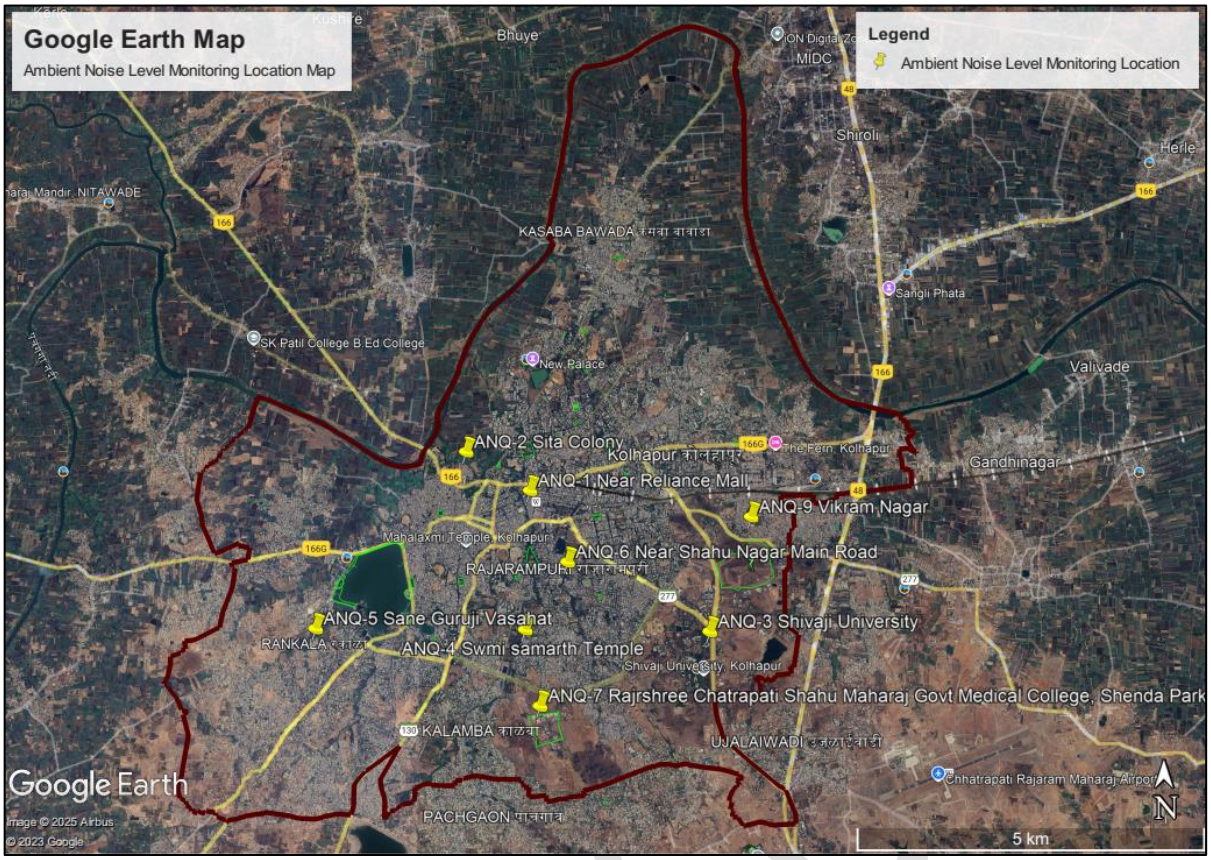


Figure 4-43: Ambient Noise Level Monitoring Location Map

4.7.2.1 Inference

Baseline noise levels are observed to be within permissible limits prescribed by CPCB. From the monitoring survey of noise levels, it is observed that the day time and night time noise at 9 locations is exceeding the limits prescribed by CPCB. This is due to construction activities and vehicular movement. The day time noise levels are observed in the range of 45.7-60.2 dB (A). The night time noise levels are observed in the range of 36.6-50.7 dB(A). The noise monitoring results during day and night time shown in the graph below **Figure 4.44**.

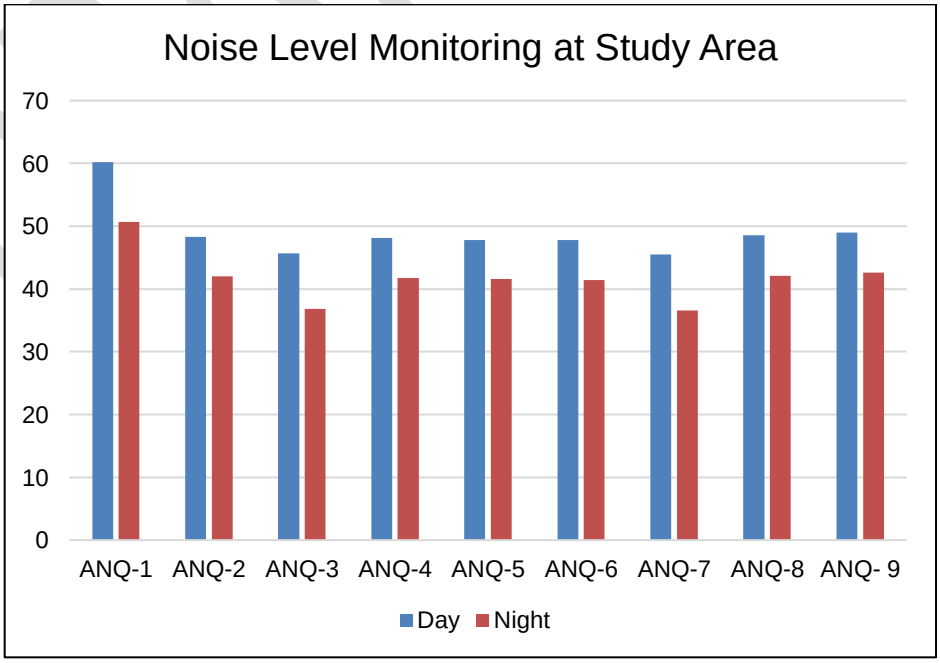


Figure 4-44: Graph of Noise Level at the Study Area

Table 4-12: Ambient Noise Monitoring Results

Sr. No.	Parameter		Location									Test Method	Standard Limits	
			ANQ-1 Near Reliance Mall	ANQ-2 Sita Colony	ANQ-3 Shivaji University	ANQ-4 Swmi Samarth Temple	ANQ-5 Sane Guruji Vasahat	ANQ-6 Near Shahu Nagar Main Road	ANQ-7 Govt Medical College	ANQ-8 Near Padmpuri Hall	ANQ- 9 Vikram Nagar			
			16.699915° 74.231950°	16.705151° 74.222922°	16.681261° 74.256818°	16.681488° 74.231468°	16.681629° 74.202619°	16.690379° 74.237253°	16.671660° 74.233588°	16.635915° 74.206391°	16.696385° 74.262797°		Residential	Commercial
1.	Leq in dB(A)	Day	60.2	48.3	45.7	48.1	47.8	47.8	45.5	48.6	49.0	IS: 9989-2020	55-45	65-55
		Night	50.7	42.0	36.8	41.8	41.6	41.4	41.4	42.1	42.6			

4.7.3 Soil Quality

It is essential to determine the potentiality of soil in the area and to identify the impacts of urbanization on soil quality. Accordingly, the soil quality assessment of the project site has been carried out. To assess the quality of soil, samples are collected from four different locations. Soil samples are collected within 100m distance from project interventions and 30 cm below the ground surface using sampling tools. The samples are collected in sampling bags, labelled and sent to laboratory for analysis. Soil samples are collected and analysed as per soil analysis methodology reference by IS:2720 2016 and ASTM, IS 14767: 2000, Ministry of Agriculture (MoA) 2011. The Soil sampling location details and map is given below in **Figure 4.45**.

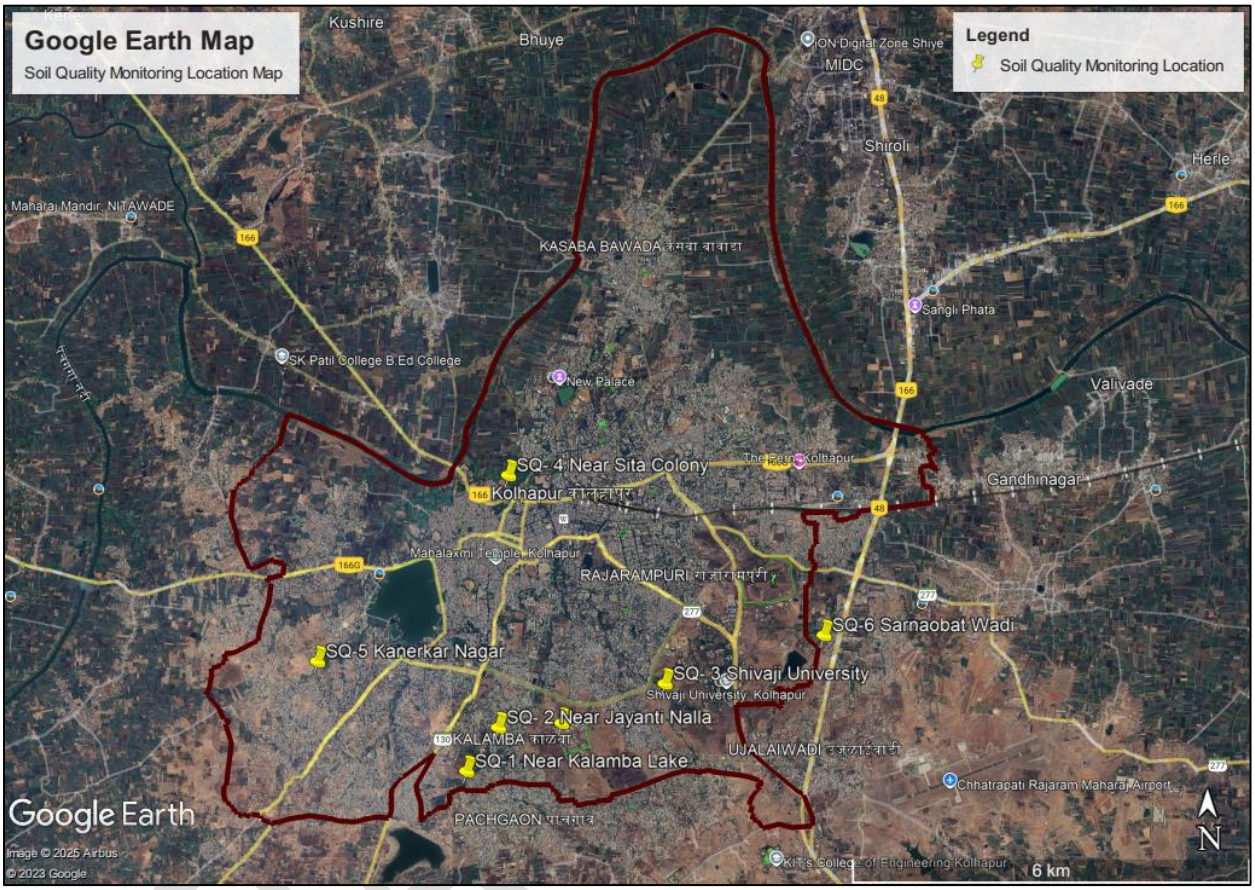


Figure 4-45: Soil Sampling Location Map

4.7.3.1 Interpretation of Analytical data

Soil quality analysis results indicated that the soil is Silty clay and sandy in texture. The soil has a very high electrical conductivity of water extract indicated that the soil should have higher concentrations of some of the nutrients like potassium, chloride, sodium, iron, lead etc. These are desirable indicators for good plant growth. Low quantities of nitrogen, phosphorus and moderate organic matter content indicate that the soils are moderate in soil fertility.

Table 4-13: Soil Quality Monitoring Results

Sr. No.	Parameters	Location							Test Methods	Standards Limits
		SQ-1 Near Kalamba Lake 16.664041° 74.219145°	SQ-2 Near Jayanti Nalla 16.669919° 74.223602°	SQ-3 Shivaji University 16.675848° 74.247236°	SQ-4 Near Sita Colony 16.704239° 74.224898°	SQ-5 Kanerkar Nagar 16.678872° 74.197892°	SQ-6 Sarnaobat Wadi 16.682432° 74.269844°	SQ-7 Shenda Park 16.670531° 74.232583°		
Physical Parameters										
1.	pH	6.78	6.82	7.03	6.91	7.56	8.12	8.21	Soil Testing in India, 2011	Not Available
2.	E. Conductivity	52.4	54.6	61.9	100.59	202.33	356.9	356.78		
3.	Bulk Density	1.08	1.12	1.20	1.34	1.20	1.37	1.24		
4.	Porosity	39.80	40.93	42.30	44.52	43.27	44.77	41.63		
5.	Water Holding Capacity	67.4	69.9	70.9	71.3	70.8	69.6	72.5		
6.	Percentage of Gravel	11.30	12.30	13.40	11.80	9.40	12.00	11.30		
7.	Percentage of Sand	17.46	17.50	15.50	15.80	13.50	16.55	17.20		
8.	Percentage of Clay	30.94	30.10	30.40	32.10	32.40	31.00	31.20		
9.	Percentage of Slit	40.30	40.10	40.70	40.30	44.70	40.45	40.30		
Chemical/Nutrient/Productivity Parameter										
10.	Organic Carbon	0.52	0.68	0.75	0.83	0.98	1.24	1.34	Soil Testing in India, 2011	Not Available
11.	Calcium (as Ca)	22.30	24.50	26.90	27.63	24.66	25.86	28.22		
12.	Magnesium (as Mg)	2.70	3.11	4.61	3.22	4.77	3.33	4.46		
13.	Sodium (as Na)	1.4	1.3	2.6	1.9	2.9	1.9	2.8		
14.	Sulphur (as S)	4.66	5.93	6.14	8.11	9.99	10.55	11.36		
15.	Nitrogen (as N)	6.2	6.5	6.0	7.1	6.9	7.0	6.3		
16.	Available Phosphorous	1.34	2.21	2.77	2.29	2.28	1.96	2.54		
17.	Available Potassium	4.67	5.92	6.1	5.9	6.34	7.42	6.73		
18.	Fluoride (as F)	0.5	0.8	0.9	0.5	0.8	0.9	0.8		
Heavy Metals										
19.	Arsenic (as As)	ND	ND	ND	ND	ND	ND	ND	Soil Testing in India, 2011	Not Available
20.	Cadmium (as Cd)	ND	ND	ND	ND	ND	ND	ND		
21.	Chromium (as Cr+6)	ND	ND	ND	ND	ND	ND	ND		
22.	Copper (as Cu)	0.10	0.30	0.40	0.31	0.44	0.29	0.42		
23.	Iron (as Fe)	2.73	3.24	4.19	3.67	4.15	3.96	4.16		
24.	Lead (as Pb)	ND	ND	ND	ND	ND	ND	ND		
25.	Manganese (as Mn)	1.26	1.79	1.85	2.24	2.37	1.88	2.26		
26.	Mercury (as Hg)	ND	ND	ND	ND	ND	ND	ND		
27.	Nickel (as Ni)	ND	ND	ND	ND	ND	ND	ND		
28.	Boron (as B)	ND	ND	ND	ND	ND	ND	ND		
29.	Zinc (as Zn)	0.10	0.20	0.25	0.19	0.24	0.28	0.19		

4.7.4 Surface Water Quality

The surface water quality of the proposed intervention area is assessed by analysing water samples collected from Kalamba lake, Rajaram Lake and Panchganga River in January 2025 and is presented in the **Figure 4.46**.

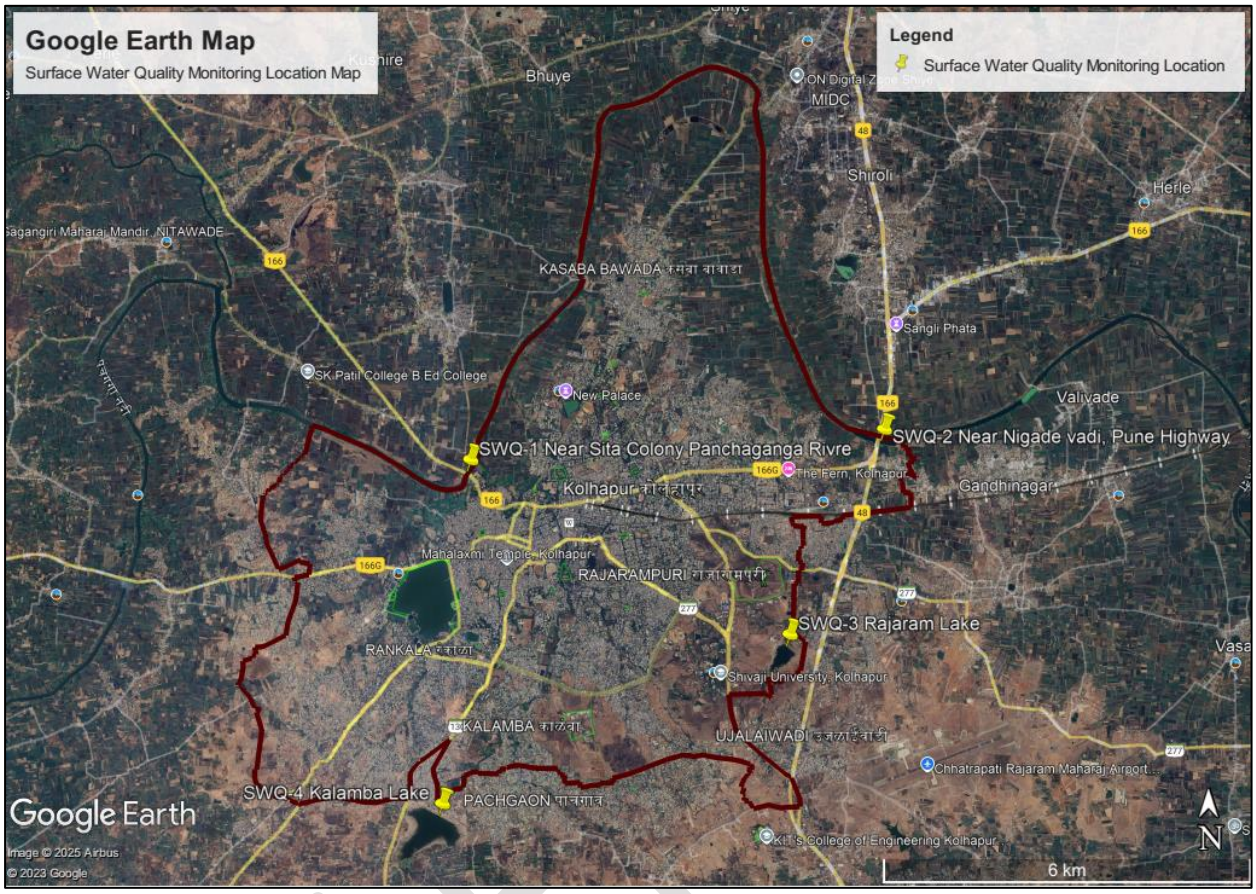


Figure 4-46: Surface Water Sampling Location Map

4.7.4.1 Interpretation of Analytical data

The physico-chemical characteristics of the surface water samples collected and analysed and compared with the IS: 10500:2012 standards. The analysis results indicate that the pH was between 7.55 to 7.66 which was well within the specified standard of 6.5 to 8.5. The TDS was observed to be 350.9 mg/l which is within the permissible limit of 500.

The levels of chloride vary between 28.90 to 42.50mg/l and sulphate were found to be in the range of 14.60mg/l and 26.30mg/l respectively. Coliform group of organisms are indicators of faecal contamination in water. Chemically & bacteriologically, not potable for drinking purpose.

Table 4-14: Surface Water Quality Monitoring Results

Sr. No	Parameters	Unit	Locations				Test Method	Standard Limits
			SWQ-1 Near Sita Colony Panchganga River	SWQ-2 Near Nagdevwadi, Pune Highway	SWQ- 3 Rajaram Lake	SWQ- 4 Kalamba Lake		
			16.707468° 74.217564°	16.711982° 74.281319°	16.681761° 74.266641°	16.657017° 74.213440°		
Chemical Discipline								
1	pH at 25°C	-	7.56	7.62	7.66	7.55	APHA 24th Edn. 4500 H'B	6.5 - 8.5
2	Conductivity at 25°C	µmhos/cm	75.9	79.6	82.9	80.9	APHA 24th Edn. 2510 B	-
3	Total Dissolved Solids	mg/l	250.9	300.6	324.7	350.9	APHA 24th Edn. 2540 C	< 500
4	Calcium (as Ca)	mg/l	12.40	13.70	14.60	12.60	APHA 24th Edn. 3500-Ca B	< 75
5	Magnesium (as Mg)	mg/l	3.80	4.73	3.80	4.97	APHA 24th Edn. 3500-Mg B	< 30
6	Chlorides (as Cl)	mg/l	28.90	30.92	29.70	42.50	APHA 24th Edn. 4500 Cl-B	< 250
7	Sulphate (as SO_4)	mg/l	14.60	18.92	22.50	26.30	APHA 24th Edn. 4500-SO_4 E	< 200
8	Iron as Fe	mg/l	1.86	2.21	3.76	3.64	APHA 24th Edn. 3500 Fe B	< 0.3
9	Fluoride (as F)	mg/l	ND	ND	ND	ND	APHA 24th Edn. 4500 F'D	< 1.0
10	Arsenic (as As)	mg/l	ND	ND	ND	ND	APHA 24th Edn. 3500 As	< 0.01
11	Cadmium (as Cd)	mg/l	ND	ND	ND	ND	APHA 24th Edn. 3500 Cd	< 0.003
12	Lead (as Pb)	mg/l	ND	ND	ND	ND	IS: 3025 "2"	< 0.01
13	Nitrate (as NO_3)	mg/l	63.50	64.98	71.40	69.10	APHA 24th Edn. 4500 NO_3 B	< 45
14	Zinc (as Zn)	mg/l	ND	ND	ND	ND	IS: 3025 "2"	< 5.0
15	Dissolved Oxygen	mg/l	4.60	5.10	6.11	6.37	APHA 24th Edn. 4500-O C	Not Specified
16	Biochemical Oxygen Demand (at 27°C for 3 days)	mg/l	4.93	6.72	5.99	5.01	IS:3025 (Part 44) 2023	Not Specified
17	Sodium (as Na)	mg/l	3.28	4.19	6.11	7.80	APHA 24th Edn. 3500 Na B	Not Specified
Biological Discipline								
18	Total Coliform	> 540	> 1600	> 540	> 540	> 540	IS: 15185-2021	/100ml

4.7.5 Stormwater Drain Water Quality

The storm water quality of the proposed interventions area was assessed by analysing water samples collected from Jayanti Nalla and Gomti Nalla. Storm water quality is assessed in the month of January 2025 for eight different locations selected within Jayanti Nalla and Gomti nalla, the Google image for surface water quality monitoring locations is presented in the **Figure 4.47.**

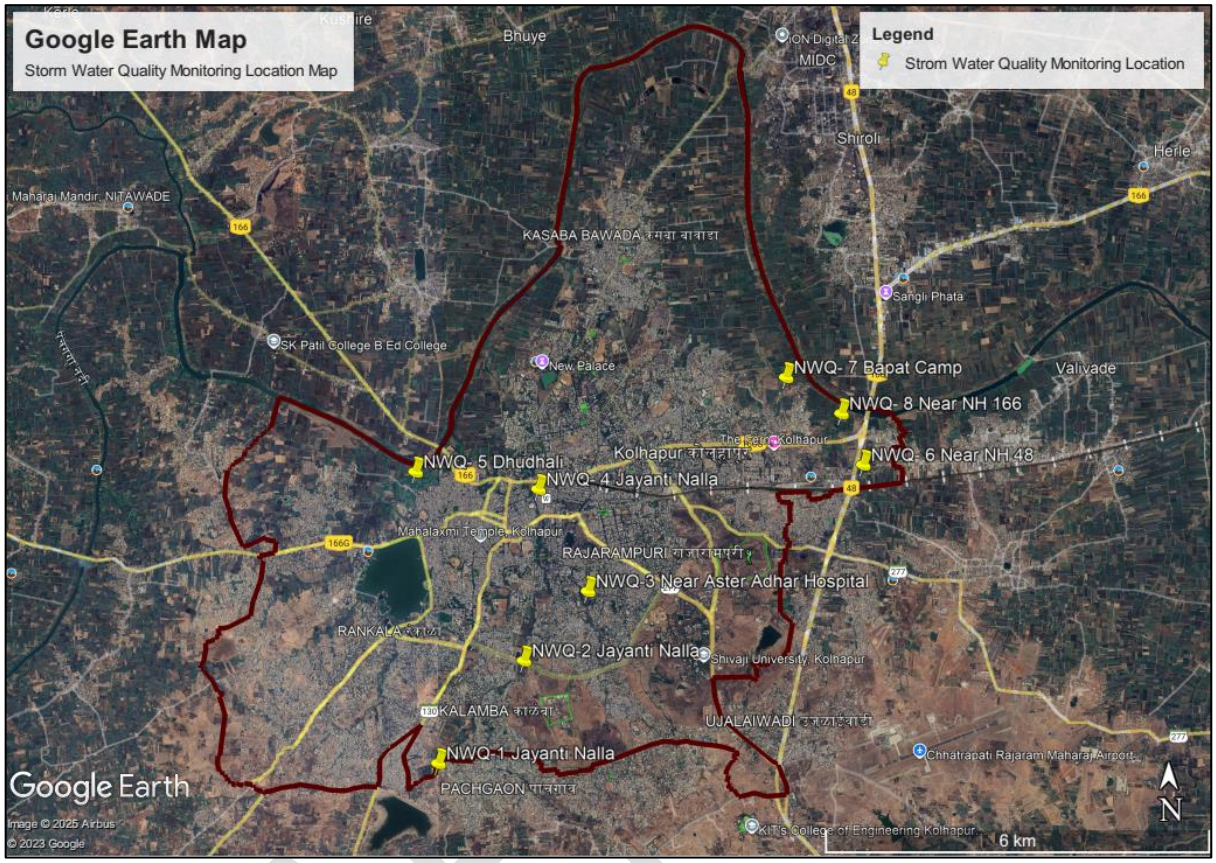


Figure 4-47: Storm Water Monitoring Location Map

4.7.5.1 Interpretation of Analytical data

The physico-chemical characteristics of the Nalla water samples collected and analysed and compared with the IS: 10500:2012 standards. The analysis results indicate that the storm water is highly polluted with high BOD levels. It interprets the sewage mixing in the storm water drains.

Table 4-15: Storm Water/Nalla Quality Monitoring Results

Sr. No.	Parameters	Unit	Locations								Test Method	Standard Limits
			NWQ- 1 Jayanti Nalla 16.675397° 74.229562°	NWQ- 2 Jayanti Nalla 16.675397° 74.229562°	NWQ- 3 Gomti Nalla 16.685171° 74.238963°	NWQ- 4 Jayanti Nalla 16.699575° 74.231633°	NWQ- 5 Dhudhali Nalla 16.702032° 74.213461°	NWQ- 6 Near NH 48 16.703026° 74.279613°	NWQ- 7 Bapat Camp 16.715466° 74.268275°	NWQ- 8 Near NH 166 16.710319° 74.276437°		
Chemical Discipline												
1	pH at 25°C	-	7.77	7.99	8.02	7.20	7.06	8.00	7.68	7.99	APHA 24th Edn. 4500 H'B	6.5 - 8.5
2	Conductivity at 25°C	µmhos /cm	106.5	122.7	135.6	146.3	132.5	147.2	94.6	113.4	APHA 24th Edn. 2510 B	-
3	Total Dissolved Solids	mg/l	1806.1	1900.9	1946.8	1902.4	1865.3	1893.2	1906.1	1809.6	APHA 24th Edn. 2540 C	< 500
4	Calcium (as Ca)	mg/l	17.90	19.80	23.70	17.96	19.90	24.30	21.90	23.40	APHA 24th Edn. 3500-Ca B	< 75
5	Magnesium (as Mg)	mg/l	3.80	4.31	23.70	4.09	3.42	4.29	3.76	4.52	APHA 24th Edn. 3500-Mg B	< 30
6	Chlorides (as Cl)	mg/l	141.90	149.60	158.20	171.30	176.40	137.20	146.50	166.70	APHA 24th Edn. 4500 Cl-B	< 250
7	Sulphate (as SO_4)	mg/l	25.30	28.70	32.90	38.90	36.20	29.86	33.80	38.90	APHA 24th Edn. 4500-SO_4 E	< 200
8	Nitrogen (as N)	Mg/l	9.1	9.5	8.6	89	9.9	10.2	10.3	10.9	APHA 24th Edn. 4500-SO_4 E	<45
9	Iron as Fe	mg/l	1.69	2.77	3.25	3.77	1.89	3.77	2.83	3.70	APHA 24th Edn. 3500 Fe B	< 0.3
10	Fluoride (as F)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	APHA 24th Edn. 4500 F'D	< 1.0
11	Arsenic (as As)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	APHA 24th Edn. 3500 As	< 0.01
12	Cadmium (as Cd)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	APHA 24th Edn. 3500 Cd	< 0.003

Sr. No.	Parameters	Unit	Locations								Test Method	Standard Limits
			NWQ- 1 Jayanti Nalla	NWQ- 2 Jayanti Nalla	NWQ- 3 Gomti Nalla	NWQ- 4 Jayanti Nalla	NWQ- 5 Dhudhali Nalla	NWQ- 6 Near NH 48	NWQ- 7 Bapat Camp	NWQ- 8 Near NH 166		
			16.675397° 74.229562°	16.675397° 74.229562°	16.685171° 74.238963°	16.699575° 74.231633°	16.702032° 74.213461°	16.703026° 74.279613°	16.715466° 74.268275°	16.710319° 74.276437°		
13	Lead (as Pb)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	IS: 3025 "2"	< 0.01
14	Nitrate (as NO_3)	mg/l	84.30	88.10	92.60	70.6	91.50	89.40	92.40	94.80	APHA 24th Edn. 4500 NO_3 B	< 45
15	Zinc (as Zn)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	IS: 3025 "2"	< 5.0
16	Dissolved Oxygen	mg/l	0.90	0.80	0.96	0.85	0.92	0.69	0.88	0.76	APHA 24th Edn. 4500-O C	Not Specified
17	Biochemical Oxygen Demand (at 27°C for 3 days)	mg/l	704.60	600.90	710.60	777.90	699.20	710.40	784.30	600.40	IS:3025 (Part 44) 2023	Not Specified
18	Sodium (as Na)	mg/l	7.80	8.70	9.77	8.22	9.01	8.96	9.22	7.58	APHA 24th Edn. 3500 Na B	Not Specified
Biological Discipline												
29	Total Coliform	> 540	> 1600	> 1600	> 1600	> 1600	> 1600	> 1600	> 1600	> 1600	IS: 15185-2021	/100ml

4.7.6 Ground Water Quality

The Ground water quality of the proposed intervention area is assessed by analysing ground water samples collected in January 2025 and is presented in the **Figure 4.48**.

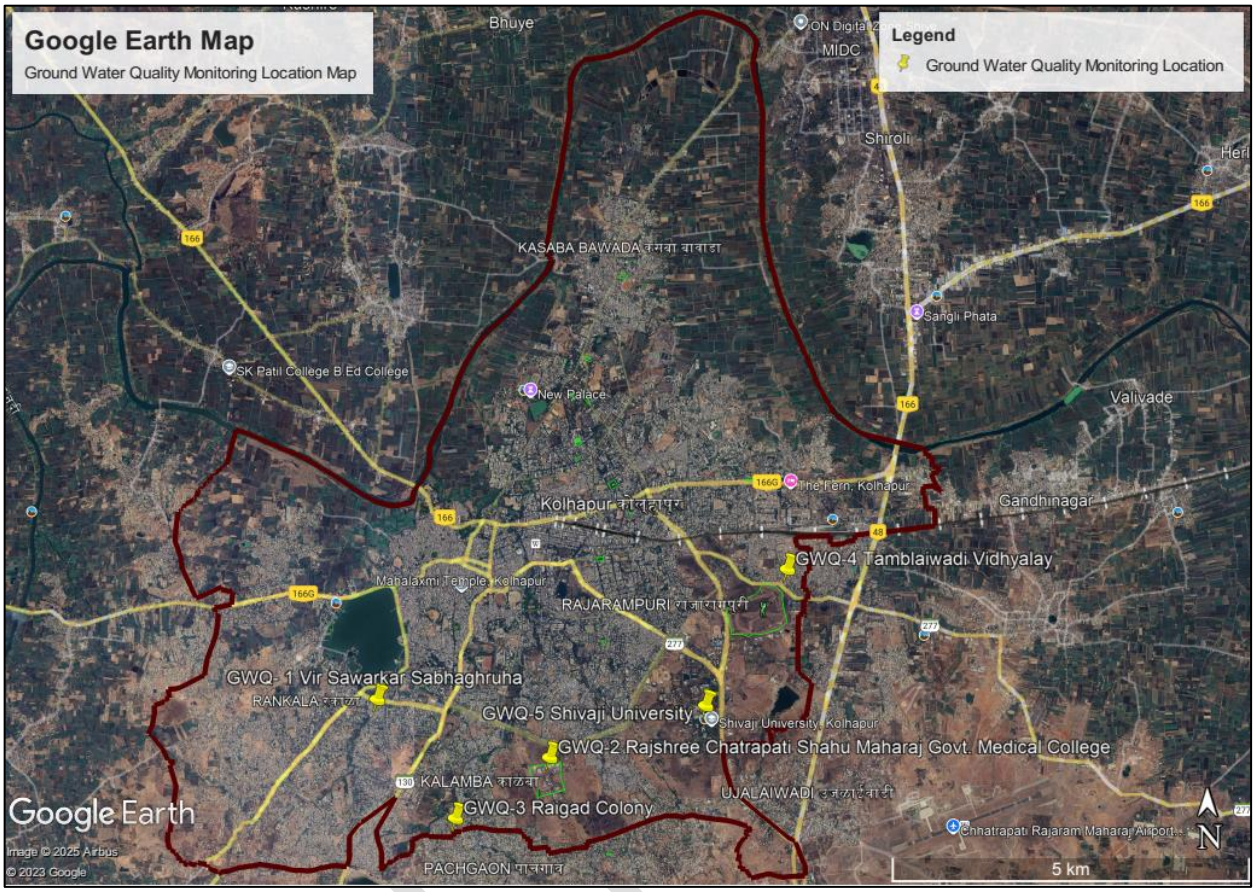


Figure 4-48: Ground Water Sampling Location Map

4.7.6.1 Interpretation of Analytical data

Chloride varied between 55.70 to 114.00 mg/l, Sulphate content varied between 69.1 to 70.7 mg/l, Calcium content varied between 24.70 to 88.22 mg/l and magnesium varied between 17.20 to 25.20 mg/l for the samples. Iron levels are found to be within the acceptable limit except. The fluoride levels are found to be in 0.06- 1.78, within the acceptable limit. Heavy metals (Cr, Cu, Hg, Pb, Zn, B) are found to be below the detection limit (BDL). From the above discussion, it can be concluded that the physico-chemical qualities of the ground water satisfy the acceptable limit as stipulated in Drinking Water Standards of India (IS 10500: 2012) and suitable for human consumption.

Table 4-16: Ground Water Quality Monitoring Results

Sr. No.	Parameters	Unit	Locations					Test Methods	Standers
			GWQ-1 Vir Sawarkar Sabhaghruha	GWQ-2 Govt. Medical College	GWQ- 3 Raigad Colony	GWQ- 4 Tamblai-wadi Vidyalaya	GWQ-5 Shivaji University		
			16.678807° 74.212060°	16.671551° 74.234719°	16.663935° 74.222381°	16.695191° 74.265922°	16.678097° 74.255133°		
1.	pH at 25 ºC	-	7.20	7.80	8.21	7.24	8.13	APHA 24th Edn. 4500 H+B	6.5 - 8.5
2.	Conductivity at 25ºC	µmhos/cm	210.5	279.8	340.7	310.8	504.7	APHA 24th Edn. 2510 B	-
3.	Bicarbonate Alkalinity (as CaCO3)	mg/l	304.2	258.1	407.9	457.3	601.9	IS:3025(Part 51)-2023	Not Specified
4.	Total Hardness (as CaCO3)	mg/l	266.4	302.7	358.6	274.6	320.8	APHA 24th Edn. 2340 C	< 200
5.	Calcium (as Ca)	mg/l	43.10	55.20	80.50	61.40	76.80	APHA 24th Edn. 3500-Ca B	< 75
6.	Magnesium (as Mg)	mg/l	17.20	20.50	22.80	25.20	21.40	APHA 24th Edn. 3500-Mg B	< 30
7.	Chlorides (as Cl)	mg/l	55.70	61.30	80.94	114.00	90.60	APHA 24th Edn. 4500 Cl-B	< 250
8.	Sulphate (as SO4)	mg/l	58.20	64.40	88.22	24.70	55.20	APHA 24th Edn. 4500-SO42- E	< 200
9.	Iron (as Fe)	mg/l	1.40	1.66	1.99	1.89	1.06	APHA 24th Edn. 3500 Fe B	< 0.3
10.	Fluoride (as F)	mg/l	0.09	0.07	0.06	1.78	0.08	APHA 24th Edn. 4500 F-D	< 1.0
11.	Sodium (as Na)	mg/l	8.30	9.50	13.20	14.63	13.70	APHA 24th Edn. 3500 Na B	Not Specified
12.	Potassium (as K)	mg/l	0.19	1.12	1.73	1.88	0.19	APHA 24th Edn. 3500 K B	Not Specified
13.	Phosphate (as PO4)	mg/l	1.31	1.46	1.52	1.94	1.83	APHA 24th Edn. 4500 P D	Not Specified
14.	Silica (as SiO2)	mg/l	2.44	3.20	4.70	2.76	3.88	APHA 24th Edn. 4500 SiO2 C	Not Specified

4.7.7 Sediment Quality

The sediment quality of the lake and storm water drain region is assessed by analysing sediment samples collected from Kalamba Lake, Rajaram Lake, Jayanti Nalla, Gomti Nalla and Dhudhani Nalla in the month of January 2025 for 8 different locations selected as per proposed interventions and desilting. The Google image for river, lake and storm water drain sediment quality monitoring locations is presented in the following **Figure 4.49.**

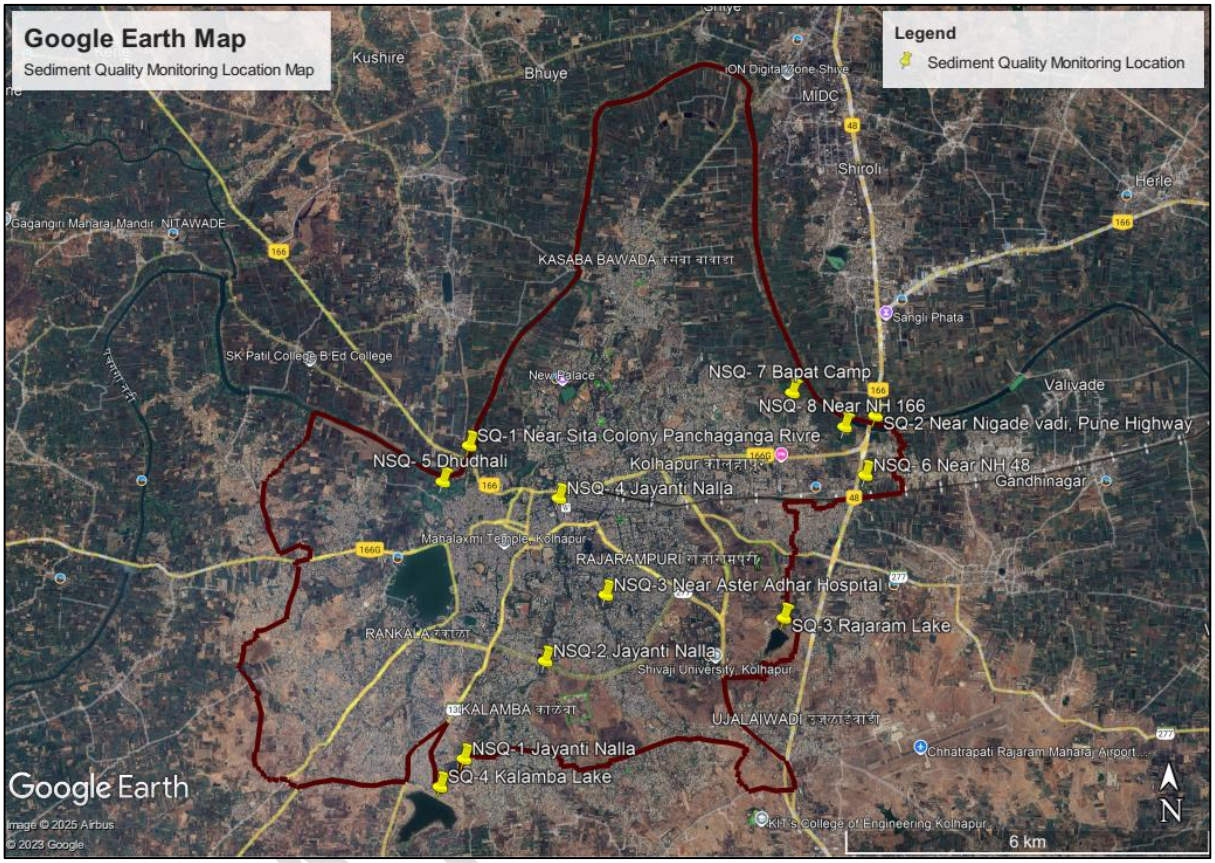


Figure 4-49: Ground Water Sampling Location Map

4.7.7.1 Interpretation of Analytical data

Analysis results shows that the sediment quality is good and no pollution. High nutrient parameters show that the sediment can be used for plantation and agriculture. Also, this sediment can be used for construction purpose.

Table 4-17: Sediment Quality Monitoring Results

Sr. No.	Parameter	Unit	Locations												Test Method	Standard Limits
			SQ-1 Near Sita Colony Panchaganga River	SQ-2 Near Nigadewadi, Pune Highway	SQ- 3 Rajaram Lake	SQ- 4 Kalamba Lake	NSQ- 1 Jayanti Nalla	NSQ- 2 Jayanti Nalla	NSQ- 3 Gomti Nalla	NSQ- 4 Jayanti Nalla	NSQ- 5 Dhudhali Nalla	NSQ- 6 Near NH 48	NSQ- 7 Bapat Camp	NSQ- 8 Near NH 166		
			16.707468° 74.217564°	16.711982° 74.281319°	16.681761° 74.266641°	16.657017° 74.213440°	16.661098° 74.217113°	16.675397° 74.229562°	16.685171° 74.238963°	16.699575° 74.231633°	16.702032° 74.213461°	16.703026° 74.279613°	16.715466° 74.268275°	16.710319° 74.276437°		
	Physical Parameters															
1.	pH	pH unit	6.81	7.22	7.91	6.93	6.99	7.24	7.68	6.9	7.19	7.63	6.94	7.64	Soil Testing in India, 2011	US EPA
2.	E. Conductivity	µS/Cm	85.9	92.86	100.56	85.4	100.52	116.92	125.46	94.7	144.07	176.96	88.3	162.8		
3.	Bulk Density	gm/cu cm	1.29	1.37	1.53	1.73	1.86	1.98	20.6	2.16	1.20	2.13	1.89	2.13		
4.	Porosity	%	51.63	52.88	53.33	54.57	47.63	48.61	49.01	46.93	48.63	49.97	45.39	47.91		
5.	Water Holding Capacity	%	36.77	37.2	39.92	42.88	37.89	38.05	41.31	37.56	38.99	43.55	38.97	39.96		
6.	Percentage of Gravel	%	10.12	10.31	9.7	9.83	10.89	9.57	10.70	11.40	11.29	9.22	10.51	11.90		
7.	Percentage of Sand	%	14.80	14.47	15.06	15.03	17.93	15.93	15.90	14.88	16.01	16.92	15.03	15.75		
8.	Percentage of Clay	%	30.06	30.16	30.22	30.04	31.28	31.70	31.50	31.92	31.80	31.93	32.06	30.45		
9.	Percentage of Slit	%	45.02	45.06	45.02	45.1	39.90	42.80	41.90	41.80	40.90	41.93	42.40	41.90		
	Chemical/Nutrient/Productivity Parameter															
10.	Organic Carbon	%	0.49	0.55	0.77	0.82	0.25	0.38	0.52	0.46	0.68	0.77	0.64	0.79	Soil Testing in India, 2011	US EPA
11.	Calcium (as Ca)	mg/kg	22.88	23.66	25.50	26.73	17.98	19.94	16.37	17.28	18.84	19.94	16.45	18.84		
12.	Magnesium (as Mg)	mg/kg	3.10	4.99	5.57	4.92	4.56	5.55	4.12	5.50	5.99	4.01	5.58	4.93		
13.	Sodium (as Na)	mg/kg	0.9	1.2	1.1	0.9	0.8	0.9	0.9	0.8	1.1	0.8	0.6	0.9		
14.	Sulphur (as S)	mg/Kg	4.63	5.55	6.73	5.50	3.58	5.56	7.88	6.93	5.88	6.93	4.92	6.64		
15.	Nitrogen (as N)	mg/Kg	8.62	8.92	7.14	8.54	7.0	8.45	8.23	7.32	6.96	8.92	7.86	7.21		
16.	Available Phosphorous	mg/Kg	0.93	0.81	0.98	1.46	0.72	0.94	1.27	1.55	0.93	1.49	1.54	0.98		
17.	Available Potassium	mg/Kg	4.54	5.59	8.88	7.79	2.53	4.31	5.57	4.97	5.55	5.96	4.02	5.52		
18.	Fluoride (as F)	mg/Kg	0.86	0.93	0.29	0.81	0.5	0.9	0.6	0.52	0.94	0.81	0.81	0.96		
	Heavy Metals															

Sr. No.	Parameter	Unit	Locations												Test Method	Standard Limits
			SQ-1 Near Sita Colony Panchaganga River 16.707468° 74.217564°	SQ-2 Near Nigadewadi, Pune Highway 16.711982° 74.281319°	SQ- 3 Rajaram Lake 16.681761° 74.266641°	SQ- 4 Kalamba Lake 16.657017° 74.213440°	NSQ- 1 Jayanti Nalla 16.661098° 74.217113°	NSQ- 2 Jayanti Nalla 16.675397° 74.229562°	NSQ- 3 Gomti Nalla 16.685171° 74.238963°	NSQ- 4 Jayanti Nalla 16.699575° 74.231633°	NSQ- 5 Dhudhali Nalla 16.702032° 74.213461°	NSQ- 6 Near NH 48 16.703026° 74.279613°	NSQ- 7 Bapat Camp 16.715466° 74.268275°	NSQ- 8 Near NH 166 16.710319° 74.276437°		
19.	Arsenic (as As)	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Soil Testing in India, 2011	Not Available
20.	Cadmium (as Cd)	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
21.	Chromium (as Cr+6)	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
22.	Copper (as Cu)	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
23.	Iron (as Fe)	mg/kg	0.51	0.66	0.81	1.09	0.40	0.59	0.34	0.58	0.46	0.64	0.37	0.55		
24.	Lead (as Pb)	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
25.	Manganese (as Mn)	mg/kg	0.50	0.67	0.77	0.63	0.88	1.06	0.73	0.98	1.02	0.83	1.07	0.98		
26.	Mercury (as Hg)	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
27.	Nickel (as Ni)	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
28.	Boron (as B)	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
29.	Zinc (as Zn)	mg/kg	0.002	0.004	0.008	0.004	0.01	0.05	0.06	0.05	0.09	0.05	0.08	4.00		

4.7.8 Biological Environment

Study of biological environment is one of the important aspects in environmental impact assessment in view of the need for conservation of environmental quality. Natural flora and fauna are the two important components of the biological environment of the ecosystem. They are organized into natural communities and constantly interact with their physical environment as well as among themselves. They show various responses and sensitivities to outside influences. The need to assess the change in status of the animal and plant resources is the primary requirement for a meaningful assessment. In view of this, baseline studies of biological environment with reference to terrestrial and aquatic ecosystem under the study area were carried out. Information regarding ecological resources was collected through field visits and from records of different Government Departments.

The main objective of biological survey is to collect the baseline data regarding flora and fauna in the study area. Data has been collected through extensive survey of the area with reference to flora and fauna. Information is also collected from different Government Departments, such as Social Forestry, Animal Husbandry & Forest Office of Kolhapur, GoM. On the basis of onsite observations as well as forest department records the checklist of flora and fauna is prepared. No threatened species of flora and fauna is recorded during survey. Also, no ESZ is within 5 km radius from city boundry and study area of project is within KMC boundry.

4.7.8.1 Ecological Profile of Kolhapur City

There are 53 gardens spread across 30 hectors (0.4% of city area), with the maximum gardens in E ward (29). To maintain the green cover of the city, the municipal corporation regularly undertakes tree plantation drives and in the year 2015-16 KMC planted around 4845 trees. KMC has also established Tree Authority to regulate various activities pertaining to tree plantations, tree census, and developing nurseries, organize exhibitions and extend support for tree plantation drives.

Table 4-18: Ecological Profile of Project Area

Sr. No.	Ecological Significant Feature		Availability within Project Area
1.	Elephant corridors		No
2.	Wildlife corridors		No
3.	Meandering rivers		Yes, Kolhapur District
4.	Flood-prone areas		Yes, Kolhapur District
5.	Areas of severe landslides		No
6.	River erosion		Yes, Embankment of Panchganga River
7.	Flood embankment		Yes, Embankment of Panchganga River
8.	Eco-sensitive areas/stretches in rivers (including habitats of endangered or vulnerable species)		No (There is no ecological sensitive area near to the project activity)
9.	Physical cultural properties		No at Intervention locations
10.	Protected Areas	National Parks	No
		Reserved Forest	No
		RAMSAR sites	No
		Biosphere reserves	No
11.	Unprotected and community forests		No
12.	Forest patches		No
13.	Protected Wetlands		No
14.	Surface water bodies		Yes, Lake water mostly used for domestic purpose

4.7.8.2 Assessment of Flora and Fauna (Kolhapur City)

The Ecology and Biodiversity in Kolhapur city are recorded through meetings, literature review, KMC records. The details of the biodiversity observed during the study in Kolhapur City is summarised in following **Table 4.19**.

Table 4-19: Biodiversity Recorded in KMC Area

Sr. No.	Biodiversity	No of Orders	No of Families	No. of Species
1	Butterflies	01	08	35
2	Fish	04	08	30
3	Reptiles	02	12	22
4	Birds	21	69	125
5	Mammals	08	12	27
6	Trees and Shrubs	25	50	189
Total		**61**	**159**	**427**

The vegetation in the surrounding area is studied randomly to assess the representative flora in and around the project site. Total 189 no. of trees existed on project area. The list of the herbs broadly found in the study area is presented in the enclosed tables. Similarly, the list of shrubs and trees is also presented in enclosed **Table 4.20.**

Table 4-20: Number of species associated with the five habitats in the study area

Type of Habitat	No of species						
	Butterflies	Fish	Reptiles	Birds	Mammals	Tree & shrub	Total
Wetland	28	30	19	107	25	89	298
Grassland	35	00	20	110	23	87	275
Hill	26	00	15	94	20	92	247
Woodland	29	00	18	89	24	70	230
Garden	35	00	17	105	17	105	279

Wetland Habitats

Plant species – Little hogweed- (Portulaca oleracea), Lesser Indian reed mace (*Typha angustata*), Lotus (Nelumbo nucifera), Water thyme (Hydrilla verticillata), Water morning glory (*Ipomoea aquatica*), Water hyacinth (Eichhornia crassipes), Arjun (*Terminalia arjuna*), Indian willow (*Salix tetrasperma*) etc.

Fishes- Rohu (*Labeo rohita*), Catla (*Catla catla*), Kolshi (*Punctitus kolus*), Murrel (*Channa leucopunctatus*), Dokrya (*Channa gachua*), Dandai (*Rasbora daniconius*) etc.

Butterflies- Common crow (*Euploea core core*), Common emigrant (*Catopsilia pomona*), Common bush brown (*Mycalesis perseus blasius*), Blue pansy (*Junonia orithiya*), Painted lady (*Vanessa cardui*).

Reptiles- Indian flapshell turtle (*Lissemys punctate*), Ghonus (*Scaled Viper)*, Checkered keelback (*Xenochorphis piscator*), Common skink (*Mabuya carinata*).

Birds- Indian cormorant (*Phalacrocorax fuscicollis*), Purple heron (*Ardea purpurea*), Pond heron (*Ardae grayil*), Purple moorhen (*Porphyno porphyno*), Coot (*Fulica atra*), Pheasant tailed jacana (*Hydrophasianus chirurgus*), Little egret (*Egretta garzetta*), Red wattled Lapwing (*Vanellus indicus*), Marsh harrier (*Circus aeruginosus*), Brahmany kite (*Haliastur indus*) etc.

Mammals- Common Langur (*Preshytis entellus*), Fulvous fruit bat (*Rousettus tescenaulti*), Smooth Indian otter (*Lutra perspicillata*) etc.

Grassland Habitats

Tree and shrub species – Silk cotton tree *(Bombax ceiba),* Acacia *(Accasia nilotica),* Indian lantana *(Lantana Camera),* Oleander *(Thevetia peruviana),* Pongam *(Pongamia pinnata),* Australian acacia (*Acacia ariculifermis),* Common Sesban (*Sesbania sesban), etc.*

Butterflies– Spotless grass yellow *(Eurema laeta sikkima),* Grass yellow *(Eurema hecabe contubernalis),* Common Crow *(Euploea core core), etc.*

Reptiles - Fan-throated Lizard *(Sitana ponticeriana),* Garden lizard *(Calotes versicolor*), Russell's viper (*Daboia russeli),* Indian Cobra *(Naja naja),* Ghonus (*Scaled Viper)*, Green Keelback (*Micropistodon plumbicolor),*
Birds– Black winged kite *(Elanus caeruleus),* Indian shikra *(Accipiter badius),* Harrier *(Circus aeruginosus),* Common Quail *(Coturnix corturnix),* Common Peafowl *(Pave cristatus),* Skylark *(Alauda arvensis),* Pipit *(Anthus pratensis) etc.*

Mammals - Common Mongoose *(Herpestes edwardsi),* Indian pangolin *(Manis crassicaudata),* Indian fox *(Vulpes bengalensis),* Black naped hare *(Lepus nigricollis*), etc.

Hilly Habitats

Tree and shrub species – Indian soapnut *(Sapindus laurifolius),* Madras thorn *(Pithocollobium dulce),* Auatralian acacia (*Acacia ariculifermis),* African tulip tree (*Spathodea campanulata),* Flame of forest *(Butea monosperma),* Siamese senna (*Cassia siamea),* Indian jujube (*Ziziphus mauritiana),* Bidi leaf tree (*Bauhinia racemosa), etc*

Butterflies– Grass yellow *(Eurema hecabe contubernalis),* Painted lady *(Vanessa cardui),* Lime butterfly *(Papilio demoleus),* Crimson rose *(Pachliopta hector) etc*

Reptiles – Monitor lizard (*Varanus indicus*), Ghonus (*Scaled Viper)*, Rat snake (*Ptyas mucosus),* Common krait *(Bungarus caruleus),* Skink (*Mabuya carinata), etc.*

Birds– Spotted Dove *(Streptopelia chinensis),* Laughing dove *(Spilopelia senegalensis),* Barn owl *(Fyto alba),* Wiretailed, Swallow *(Hirundo smithii),* Jungle babbler *(Turdoides striata),* Indian Shikra (*Accipiter badius) etc.*

Mammals- Blacknaped hare *(Lepus nigricollis*), Barking deer *(Muntiacus muntjak),* Wild boar *(Susscrofa cristatus),* Indian fox *(Vulpes bengalensis),* Common langur *(Preshytis entellus), etc.*

Woodland Habitat

Tree and shrub species – Neem (*Azadirachta indica),* Australian acacia (*Acacia ariculifermis),* Mango *(Mangifera indica), Peepal (Ficus religiosa),* Acacia *(Accasia nilotica),* Crape Jasmine (*Tabernaemontana divaricate),* Kashid (*Cassia siameia),* Peacock flower (*Caesalpinia pulcherrima), etc.*

Butterflies– Blue mormon *(Papilio polymnestor),* Common tiger *(Danaus genutia),* Common cerulean *(Jamides celeno),* Common emigrant *(Catopsilia pomona), etc.*

Reptiles- Common whipsnake (*Ahaetulla nasustus),* Ghonus (*Scaled Viper)*, Sawscaled viper (*Echis carinata),* Common ratsnake (*Ptyas mucosus),* Cobra *(Naja naja), etc*

Birds– Gery hornbill *(Tockus birostris),* Golden backed woodpecker *(Dinopium benghalenso),* Jungle myna *(Acridotheres fuscus),* Jungle babbler *(Tur doides striata), Indian cuckoo (Cuculus microptirus), Coucal (Centropus sinensis) etc.*

Mammals- *Common mongoose (Herpestes edwardsi), Blacknaped hare (Lepus nigricollis), Barking deer (Muntiacus muntjak), wild boar (Susscrofa cristatus) etc.*

Garden Habitat

Tree species - Bidi leaf tree (*Bauhinia racemosa),* Rubber *(Ficus elastic),* Qween crape myrtle *(Lagerstroemia speciosa),* Palm *(Palm Phoenix*), Cape jasmine *(Gardenia jasminoides),* Rain tree *(Albizia saman),* Gulmohur / Flame tree *(Delonix regia),* Pangara/ Lenten tree (*Erythrina indica) etc.*

Butterflies– Lime *(Papilio demoleus),*Crimson rose *(Atrophaneura hector),* Twany coster *(Acraea violae),* King Crow*(Euploea klugii), etc.*
Reptiles - Garden lizard *(Calotes versicolor*), Ghonus (*Scaled Viper)*, Earth boa (*Eryx johnii),* Cat snake (*Boiga trigonate),* Rat snake (*Ptyas mucosus), etc.*

Birds – Crimson breasted barbet *(Megalima haemacephala),* Red vented bulbul *(Pycnonotus café),* Purpple rumped sunbird *(Leptocoma zeylonica),* Dayal *(Copsychus saularis),* Indian robin *(Saxicoloides fulicatus),* Brahminy myna (*Sturnia pagodarum),* Common crow *(Corvus splendens*), *etc.*

Mammals- Common mongoose *(Herpestes edwardsi),* Indian flying fox *(Pteropus giganteus),* Common langur *(Preshytis entellus),* Three stripped squirrel *(Funambulus palmarum) etc.*

Presence of a mosaic of fragmented micro habitats such as streams, river, marshland, tanks, grassland, woodland, hills, and gardens make Kolhapur city and its surroundings rich in biodiversity, which is an asset to the city as it keeps urban environ healthy and clean. However, in the last decade the increased developmental pressures, mainly through changed landuse and pollution, have already seriously altered many of these habitats. Now it is posing a serious and immediate physical threat to ecology and biodiversity of the remaining intact habitats.

There is no threatened species of tree found in the project area. However, Ficus religiosa (Peepal) is not evaluated by IUCN but is holy tree in India. Ficus religiosa is found in the project area and its cutting should be avoided to the possible extent due to project activities.

4.7.8.3 Assessment of Flora and Fauna (Interventions Area)

Enumeration of the plant wealth is done by surveying the area by walking along the embankment of proposed interventions and it's both the sides (country side and nalla side). The enumeration has covered all trees having GBH (girth at breast height) greater than 50 cm. The height and conditions (i.e. Normal or Defective) of the trees are estimated by visual impression during the survey periods. It is observed during the transect walk that there is no forest area in the identified project work zones. However, trees of different size and GBH are found in either slope of embankment, set-back zone and land areas located in an around the embankment.

As per the enumeration (physical counting) of trees with more than 50 cm. GBH is done in the identified working zones at Flooding Hotspots. A total of 25 trees of various sizes will be cut down due to the project construction activities. The presence of Gulmohor trees has been recorded as the highest among other trees in project areas. None of these trees are of threatened status. However, Ficus religiosa (Peepal) is not evaluated by IUCN but is holy tree in India. Ficus religiosa is found in the project area and its cutting should be avoided to the possible extent due to project activities. The details of trees species and their presence in project area is given below in table to be felled in proposed sub projects.

Table 4-21: Distribution of Tree Species to be Felled in Project Area (29 Flooding Hotspots)

Tree Species Common Name	Tree Species Botanical Name	Nos
Coconut	Cocos nucifera	3
Betelnut	Areca catechu	2
Gulmohar	Royal poinciana	6
Badam tree	Terminalia catappa	1
Saptaparni	Alstonia scholaris	1
Karanj	Pongamia pinnata	1
kapok Tree	Ceiba pentandra	1
Pimpal	Ficus religiosa	1
Rain Tree	Samanea saman	1
Bakul	Mimusops elengi	1
Nilgiri	Eucalyptus globulus	2
Neem	Azadiracta indica	1
Vilayati Chinch	Pithecellobium dulce	1
Babhul	Vachellia Nilotica	3

Community consultation as part of Focus Group Discussion (FGD) also is performed to get idem about presence of fauna species, their habitat, possible impact and suitable mitigation measures.

Fisher community were consulted on fish diversity in lakes. Availability of different local as well as exotic species also was discussed during consultation.

Wide varieties of fauna species are found in entire project area. However, faunal diversity in this region is decreasing in last few decades. According to the primary observations at interventions study team observed cows, bullocks, buffaloes, donkeys, goat, poultry birds, dog, cat, rat snake, ghonus, cobra etc. As far as birds are concerned, the most common birds observed at various places were crow, sparrow, myna, dove, bulbul, pigeon, etc.

4.7.8.4 Assessment of Aquatic Biodiversity in Lakes in Kolhapur

Diatom community distribution in Kalamba and Rajaram lake is assessed to determine the combination of physical, chemical and biological factors which is reflected as their seasonal variations. The species of diatoms are shown in the following **Figure 4.50**, from Kalamba lake and Rajaram lake.

The similar variations in diatoms are observed in the two lakes. The observations revealed that the diversity of diatoms declined gradually and showed its lowest value in the monsoon season while the diversity becomes high during winter season. Also reported the same results related to increasing number of diatoms in winter season. Lowest number of diatoms in monsoon season is attributed due to rainfall which dilutes the water and distribute the structure and composition of aquatic ecosystem. *Synedra ulna and Aulacoseira ambigue* is a eutrophic species mostly observed in eutrophic lakes. *Cymbella, Gomphonema and Cocconicus* found in organically polluted water bodies which were observed in both lakes. *Cymbella turgidula* found in oligotrophic to mesotrophic alkaline water with moderate electrolyte contact while *Gomphonema pseudoaugur species* found in oligotrophic to mesotrophic water but not tolerate to critical level of pollution. *Nitzschia species* of diatom is large diverse and ecologically versatile genus occurs in oligotrophic water. *Surirella spp* are found in Rajaram Lake is a large and common freshwater to marine water genus. Another study related to diversity indices showed its potential application in aquatic ecosystem related to quality of water. It is reported that species diversity implies both richness and evenness in number of species and equitability for the distribution of individuals among the species.

Table 4-22: Diatoms Recorded from Kalamba and Rajaram Lakes of Kolhapur City

Sr. No.	Name of the Species	Sr. No.	Name of the Species
1	Gomphonema pseudoaugur	10	Encyonema silesiacum
2	Aulacoseira ambigua	11	Nitzschia solgesis
3	Cymbella turgida	12	Frustulia vulgaris
4	Navicula cryptocephala	13	Cymbella letecoros
5	Synedra ulna	14	Surirella tenera
6	Cocconeis pediculus	15	Gyrosigma
7	Protoderma spp	16	Ulnaria asus
8	Amphora pediculus	17	Amphora submontana
9	Eolimunai minina	18	Navicula species

Table 4-23: Diatom Species Observed in the Kalamba and Rajaram Lakes of Study Area

Sr. No.	Name of Species	Sr. No.	Name of Species
1.	Aulacoseira ambigau	8.	Surirella tene
2.	Cymbella turgidula	9.	Gyrosigma
3.	Gomphonema pseudoaugur	10	Amphora submontana
4.	Amphora pediculus,	11.	Cymbella leptoceros
5.	Protoderma	12.	Navicula spp
6.	Synedra ulna	13.	Encyonema
7.	Coconeis pediculus	14.	Nitzschia spp

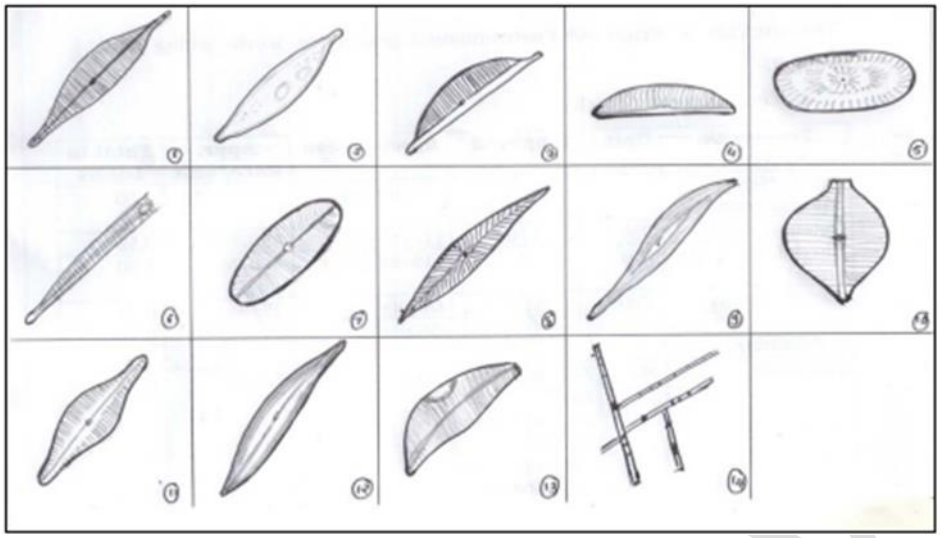


Figure 4-50: Diatoms Observed in Kalamba and Rajaram Lake

Table 4-24: Monthly variation of Diatom Species in Kalamba and Rajaram lakes of Study Area

Sr. No.	Diatoms Species	Kalamba Lake						Rajaram Lake					
		Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.
1	*Gomphonema pseudoaugur*	-	374	241	331	-	-	42	-	-	-	-	-
2	*Aulacoseira ambigau*	313	-	317	287	35	249	260	211	357	254	372	287
3	*Cymbella turgidula*	96	161	23	32	-	-	43	163	270	290	-	-
4	*Navicula cryptocrphala*	224	229	402	368	415	256	210	513	237	309	-	-
5	*Synedra ulna*	184	311	405	266	311	280	242	240	348	251	36	251
6	*Coconeis pediculus*	-	-	-	-	423	215	-	-	24	37	356	273
12	*Protoderma*	5	-	-	-	-	-	-	-	-	-	-	-
13	*Eolimunai minina*	-	-	-	-	112	120	-	-	-	-	-	-
14	*Encyonema silesiaus*	-	-	-	-	-	-	-	-	171	133	-	-
15	*Nitzschia solgesis*	-	-	-	-	-	-	-	-	-	-	367	252
16	*Frustulia vulgaris*	-	-	-	-	-	-	-	-	-	-	191	394
17	*Cymbella leptoceros*	-	-	-	-	-	-	-	-	-	-	63	302
18	*Amphora pediculus*	-	-	-	-	108	257	-	-	-	-	-	-

4.7.9 Sensitive Receptors in Project Area

In the proposed project, Temple, College, Residential area, Commercial area, School, Hospital, Railway station, Market place, Town, Govt. offices, Playground, Park and etc. are located within corridor of impact and zone of influence. Many of these features like market place, town, hospital, temple, which are located immediate vicinity of proposed interventions within 100meter.

Sensitive receptors like school, hospital, park area located within 100meter radius of active work site have increased sensitivity to the impacts of the project activities by virtue of their nature and location. Project intervention wise list of sensitive receptors located within 100meter of influence is listed below in **Table 4.25**.

Table 4-25: Avalability of School, Hospital, Park within 100 meter Influence zone of Proposed Interventions

Sr. No.	Proposed Interventions	Sensitive Receptors	Sensitive Receptors Name and Location in Kolhapur City	Availability within 100m radius from proposed interventions/Strom water drains			
				Left/ Right	Distance (Mt)	Latitude	Longitude
1.	Existing Earthen Bund to be Desilted	Residential	Jagar Nagar, Kalamba	Left	100	16.669056°	74.228639°
2.	Proposed Earthen Bund	Residential	Jagar Nagar, Kalamba	Left	90	16.670139°	74.228194°
		Medical College,	Ch Raj Shahu Maharaj Govt. Medical College, Shendra Park	Right	100	16.672203°	74.232433°
3.	Proposed CNB	Residential Area	Rajendra Nagar	Left	100	16.676179°	74.246423°
		University	Shivaji University Kolhapur, Vidya Nagar	Right	100	16.679214°	74.250773°
4.	Lake Desilting	Residential Area	Navnath Nagar, Near to Kalamba Lake, Kalamba	Right	100	16.654028°	74.210909°
5.	Proposed Sluice Gate and RCC Channel	Residential Area	Near Kalamba Lake, Kalamba	Right	50	16.654941°	74.218092°
6.	Strom Water Drain Desilting	Park	Hutatma Park, Shivaji Udyam Nagar	Right	60	16.692598°	74.232719°
		Hospital	Aster Adhar Hospital, Shastri Nagar	Left	60	16.685176°	74.238038°
		Heart Hospital	Shree Siddhivinayak Heart Hospital, Y. P. Pawar Nagar	Left	30	16.688469°	74.237364°
		College	Gopalkrishna Ghokhale College, Mangalwar Peth, Shivaji Udyam Nagar	Left	20	16.691974°	74.231688°
		High School	Baba School, Baba Jarag Nagar, Pach Gaon	Right	90	16.665383°	74.225732°
		School	Sai English Medium School, Baba Jarag Nagar, Pachgaon	Right	90	16.663617°	74.226896°
7.	Proposed Strom Water Drain	School	Shantiniketan School, Morevadi road, Near Shivaji University, Ratanappa Kumbhar Nagar	Right	50	16.666026°	74.257380°
		College	Industrial Training Institute, Kalamba Road, Tapowan	Left	60	16.674850°	74.220650°
		School	Podar International School, Mahada Colony, Survey Nagar	Right	30	16.664703°	74.199801°
		Park	Jivabha Nana Jadhav Park, Aurvey Nagar	Left	30	16.660519°	74.198526°
8.	Proposed Box Drain and Duct	Residential	Devkar Panand Chwak	Both	20	16.680066°	74.213599°
9.	RCC Open Drain and Box Culvert	Residential	Behind Nikam Park	Both	30	16.678591°	74.215086°
10.	Proposed Box Drain	Residential	Raj Luxmi Nagar, Kolhapur	Both	20	16.681671°	74.211714°
11.	Proposed Nalla Desilting	Residential	Prince Rajaram Colony Laxthirth Vasahat	Both	20	16.701324°	74.195895°
12.	Proposed Retailing Wall and Nalla Desalting	Residential	Dhudhali Nalla	Right	30	16.697855°	74.214412°
13.	Proposed Drain and Ground Box Drain	Commercial	Parvati Multiplex	Both	20	16.697205°	74.235188°
14.	RCC Drain	Temple	Bagal Chowk	Both	20	16.698033°	74.238215°
15.	Proposed Drain and Open Drain	Residential and Commercial	Parag Pool Nalla	Both	10	16.699273°	74.241000°
16.	Proposed Drain Box	College	Low College Chowk	Both	30	16.699781°	74.241914°

Sr. No.	Proposed Interventions	Sensitive Receptors	Sensitive Receptors Name and Location in Kolhapur City	Availability within 100m radius from proposed interventions/Strom water drains			
				Left/ Right	Distance (Mt)	Latitude	Longitude
17.	Proposed Drain and RCC Box Drain	College and Commercial	Janta Bazar Chowk	Both	30	16.698436°	74.242141°
18.	Proposed Box Drain	Residential	Rajaram Puri 1 st Lane	Both	20	16.698021°	74.242903°
19.	Proposed SWD	Residential	Mahadik Park Rajaram	Both	20	16.692921°	74.252201°
20.	Rain Water harvesting and Open Drain	Residential	Vidya Nagar	Both	30	16.692323°	74.253305°
21.	Rain Water harvesting and Open Drain	School	Radhabai Shinde School, Vidya Nagar	Both	30	16.689486°	74.252268°
22.	Proposed Drain	Residential	Nilgiri Apartment, Kolhapur	Right	20	16.677780°	74.245569°
23.	Inlet Chamber and Grating, Open Drain	Stadium, Temple	Ravbeshwar Mandir, Near Shahu Maharaj Stadium	Both	20	16.693765°	74.229565°
24.	RCC Box Drain and Inlet chamber and greeting	Commercial, government office, and Garden	Collector Office Basant	Both	30	16.707701°	74.233133°
25.	Retailing Wall, RCC Drain and Nalla desalting	Residential and College	Patil Wada, Near Mahavir Chowk	Both	30	16.711042°	74.232333°
26.	Proposed Nalla desalting and Low laying area	Residential and Commercial	Shahupuri Gavat Mandai	Both	20	16.699617°	74.232627°
27.	Proposed Box Drain	Residential	Mukta Sainik Chowak	Both	30	16.709876°	74.260069°
28.	Proposed Box Drain and Open Drain	Residential	Ashtakvinayak Colony, Vikram Nagar	Right	20	16.699724°	74.264704°
29.	Open RCC Drain, Proposed Pipe Culvert	Residential	Pragati Society, Vikram Nagar	Both	30	16.695501°	74.261809°
30.	RCC Box Drain	Residential and Commercial	Rasika Hotel to Sappihire, Mukta Sainek Colony	Both	30	16.710094°	74.265026°
31.	Proposed Box Drain, RCC Open Drain	Residential	Unik Park Lisha Hotel, Kadamwadi	Both	30	16.709535°	74.254390°
32.	Box Drain, and Box Culvert	Residential, Temple	Renuka Mandir Chowk Bawada	Both	30	16.730291°	74.241733°
33.	Box Drain and UCR Drain	Residential	Tramboli Nagar, Bavada	Both	20	16.728882°	74.242590°

4.9 Social Baseline

Kolhapur is a Municipal Corporation city in district of Kolhapur, Maharashtra. The Kolhapur Municipal Corporation has population of 549,236 of which 280,366 are males while 268,870 are females as per report released by Census India 2011.

Current estimated population of Kolhapur Municipal Corporation in 2025 is approximately 802,000. The schedule census of 2021 for Kolhapur city is postponed due to covid. We believe new population census for Kolhapur city will be conducted in 2025 and same will be updated once it's done. The current data for Kolhapur town are estimated only but all 2011 figures are accurate (Source: Kolhapur Town Population Census 2011 – 2025).

4.9.1 Ward Boundary

Kolhapur city, is divided into 77 wards and these wards have been divided into 4 Divisional Offices. which serve as administrative units under the Kolhapur Municipal Corporation (KMC). Each ward represents a specific geographical area, defined by natural features, roads, rivers, or significant landmarks to ensure clear distinctions. The city's wards vary in population and size, aligning with urban planning guidelines. They play a pivotal role in local governance, with each ward electing a corporator to represent its residents in the municipal corporation. Periodically, ward boundaries may be redefined based on population growth, urbanization, and administrative needs. The ward boundaries are shown in the **Figure 4.51** below.

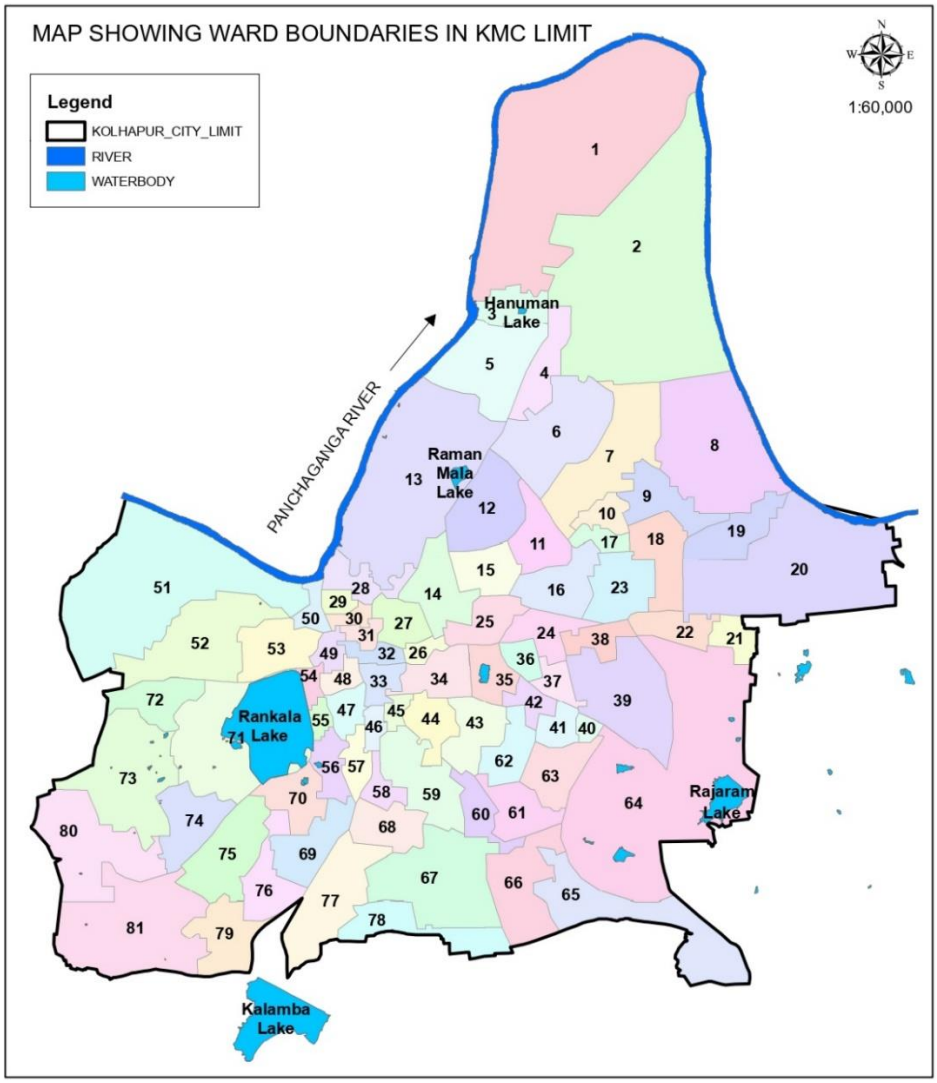


Figure 4-51: Ward Boundaries in KMC

In a stormwater management project for Kolhapur, ward boundaries serve as critical data points for planning and implementing localized interventions. They help identify specific areas requiring

drainage improvements, flood mitigation measures, and maintenance of natural watercourses. The boundaries assist in mapping population density, land use, and infrastructure, ensuring targeted and equitable solutions. By aligning stormwater strategies with ward-level governance, the project can optimize resource allocation and foster effective community participation. Additionally, they provide a framework for monitoring and managing stormwater systems within clearly defined administrative zones, enhancing overall urban resilience. This localized approach ensures sustainable and efficient stormwater management tailored to the city's needs.

4.9.2 Population Data[20]

KMC is divided into 77 wards. According to Census 2011 figures KMC has a population of **549,236**. The current estimate population of Kolhapur city in 2025 is 802,000. The last census was conducted in 2011 and the schedule census for Kolhapur city in 2021 was postponed due to Covid. The current estimates of Kolhapur are based on past growth rate. Ward-wise population as published in the official website is shown in the table below and will be used for the estimation of population at risk.

Table 4-26: Ward-wise Population Statistics in Kolhapur City

Sr. No.	Ward	Population	Sr. No.	Ward	Population	Sr. No.	Ward	Population
1	Ward 1	7140	27	Ward 27	6743	53	Ward 53	8279
2	Ward 2	7742	28	Ward 28	5754	54	Ward 54	7232
3	Ward 3	6287	29	Ward 29	5890	55	Ward 55	6810
4	Ward 4	7201	30	Ward 30	5018	56	Ward 56	6603
5	Ward 5	6809	31	Ward 31	5321	57	Ward 57	5252
6	Ward 6	8779	32	Ward 32	5411	58	Ward 58	6559
7	Ward 7	9229	33	Ward 33	5973	59	Ward 59	8856
8	Ward 8	9082	34	Ward 34	6279	60	Ward 60	6887
9	Ward 9	6120	35	Ward 35	6315	61	Ward 61	7806
10	Ward 10	6919	36	Ward 36	6760	62	Ward 62	8138
11	Ward 11	6613	37	Ward 37	6000	63	Ward 63	5741
12	Ward 12	6069	38	Ward 38	7718	64	Ward 64	6561
13	Ward 13	8062	39	Ward 39	7073	65	Ward 65	5990
14	Ward 14	6822	40	Ward 40	6826	66	Ward 66	7066
15	Ward 15	6894	41	Ward 41	7601	67	Ward 67	8961
16	Ward 16	6619	42	Ward 42	5818	68	Ward 68	8953
17	Ward 17	6410	43	Ward 43	5863	69	Ward 69	14787
18	Ward 18	7152	44	Ward 44	6942	70	Ward 70	10683
19	Ward 19	6529	45	Ward 45	5448	71	Ward 71	10227
20	Ward 20	5240	46	Ward 46	5214	72	Ward 72	8115
21	Ward 21	6291	47	Ward 47	6912	73	Ward 73	9213
22	Ward 22	6812	48	Ward 48	5876	74	Ward 74	7848
23	Ward 23	7657	49	Ward 49	6813	75	Ward 75	8209
24	Ward 24	9890	50	Ward 50	6259	76	Ward 76	7734
25	Ward 25	5815	51	Ward 51	6555	77	Ward 77	9599
26	Ward 26	6465	52	Ward 52	6097			

4.9.3 SC and ST Population KMC

Schedule Caste (SC) constitutes 13.11 % while Schedule Tribe (ST) were 0.54 % of total population in Kolhapur (KMC). The population of SC and ST shown in given **Table 4.27**.

Table 4-27: SC & ST Population in KMC

Sr. No.	Parameter	Male	Female	Total
1.	Schedule Caste	36,124	35,881	72,005
2.	Schedule Tribe	1,563	1,426	2,989

4.9.4 Religion-wise Population- KMC

[20] Census 2011 Website of GoI

As per the Census 2011, the total Hindu population in Kolhapur is 460,774 which is 83.89% of the total population. Also, the total Muslim population in Kolhapur is 59,760 which is 10.88% of the total population. Below is the religion-wise population of Kolhapur as per Census 2011. The religion wise population of KMC is shown in **Table 4.28.**

Table 4-28: Religion wise Population in KMC

Sr. No.	Religion	Male	Female	Total
1.	Hindu	235,652	225,122	460,774 (83.89%)
2.	Muslim	30,156	29,604	59,760 (10.88%)
3.	Christian	2,587	2,664	5,251 (0.96%)
4.	Sikh	304	277	581 (0.11%)
5.	Buddhist	1,555	1,374	2,929 (0.53%)
6.	Jain	9,333	9,087	18,420 (3.35%)
7.	Other Religion	124	108	232 (0.04%)
8.	No Religion Specified	655	634	1,289 (0.23%)

4.9.5 Literacy in KMC

The total literacy rate of KMC was 90.61% in 2011 which is greater than the average literacy rate of 82.34% of Maharashtra. Population-wise, out of total 450,265 literates, males were 236,761 while females were 213,504. Also, the male literacy rate was 93.95% and the female literacy rate was 87.18% in Kolhapur.

Table 4-29: Literacy Rate in KMC

Sr. No.	Parameters	KMC Area
1.	Female	87.18%
2.	Male	93.95%
3.	Total	90.61%

4.9.6 Sex Ratio in KMC

The Sex Ratio of KMC is 959. Thus, per every 1000 men there were 959 females in Kolhapur. Also, as per Census 2011, the Child Sex Ration was 845 which is less than Average Sex Ratio (959) of Kolhapur.

4.9.7 Population Density in KMC

As per 2011 census, it is observed that there were seventy-seven wards in the KMC where the density of population was above 82 persons per ha.

4.9.8 Working Population in KMC

In KMC out of total population, 191,556 were engaged in work activities. 93% of workers describe their work as Main Work (Employment or Earning more than 6 Months) while 7% were involved in Marginal activity providing livelihood for less than 6 months. Of 191,556 workers engaged in Main Work, 2,228 were cultivators (owner or co-owner) while 1,743 were Agricultural labourers.

Table 4-30: Working Population in KMC

Sr. No.	Parameters	KMC		
		Male	Female	Total
1.	Main Workers	1,42,598	35,613	1,78,211
2.	Cultivators	2,021	207	2,228
3.	Agriculture Labours	1,035	708	1,743
4.	Household Industries	5,097	2,693	7,790
5.	Other Workers	1,34,445	32,005	1,66,450
6.	Marginal Workers	8,058	5,287	13,345
7.	Non-Working	1,29,710	2,27,970	3,57,680

4.9.9 Encroachments and slum areas

Total no. of Slums in Kolhapur city numbers 14,799 in which population of 67,646 resides. This is around 12.32% of total population of Kolhapur city. Kolhapur city has many slums, including Takala, Jamsandekar Mai and Bondre Nagar, Awachit Nagar, Joshi Nagar and slum behind Ghadge Patil E-Ward. Poor Sanitation, lack of basic amenities and vulnerability to flooding are the key issues of these slums. The average income per month in these slums is INR. 5078 and average expenditure is INR.3155. **Table 4.31** provides details of working women in slums:

Table 4-31: Proportion of Working Women in Slums

Sr. No.	Name of Slum	Number of working women
1	Takala	7%
2	Joshi Nagar	5.1%
3	Kasba Bawada	4%
4	Vichare Mal	4.6%
5	Near Uchgaon Jakat Naka	3.6%
6	Near Sangam Theatre	4.5%
7	Laxthirth Vasahat	2%
8	Shenda park	4.7%

Source: Socio-economic Status of Slum Dwellers with Special Reference to Women by D.H.Pawar, Asst. Professor, Dept. of Geography, Shivaji University, Kolhapur.

4.9.10 Presence of "Community Organisations" like "Self Help Groups"[21]

There are total 1599 Self Help Groups within the limits of Kolhapur Municipal Corporation. Total 19,188 women are members of these SHGs and making small regular savings and also taking loans for livelihood activities or meeting emergency needs. All of these SHGs having Bank Account in the Nationalised Banks.

4.9.11 Status of Women in Kolhapur

There is a history of recognizing women's empowerment, with involvement in self help groups (SHG's) enabling women involvement. Many women in Kolhapur run businesses successfully, demonstrating the potential and talent of women entrepreneurs in the city. There are many community base organisations actively involved in workshops and training to help women development skills and acquire knowledge. The Kolhapur city has reported a study rise in cases of crime against women (Source:-Status of women in Kolhapur city by Dhyaneshwar Pawar, Shivaji University).

4.9.12 Land Use and Land Ownership

Earlier, Kolhapur was the smallest commercial centre. But with changing duration various commercial activities take place like Jaggery market, charmodyog (Lather Industry) and various types of factories and industries Kolhapur become an enlarging city. Before independence the city had having extent of 17.15 sq. km., but after independence city's extent became 66.82 sq. km.

4.9.13 Kolhapur City: Change in area occupancy with duration

Table 4-32: Area Occupancy

Sr. No.	Year	Area in Sq. km.
1	1871	8.96
2	1931	11.52
3	1941	17.15
4	1951	63.48
5	1977	63.48
6	1989	66.82
7	2000	66.82
8	2031	180 (Estimated)

Source: Urban Development and Changing Land Use in Kolhapur City by Dr, Sabhaji Shinde and Dr. Shubhangi Kale, Oct 2023.

[21] Source: NGOs India (Chanakya) Lajpat Nagar, New Delhi.

4.9.14 Income, Consumption, Poverty and Food Security

There is evident disparity in the education status of female and male members of the poor families, mostly from slum areas. Due to poor education, poor from slums are unable to get good jobs, therefore they choose unskilled jobs with low monitory returns. There is large disparity in the income of the slum household. Slum dwellers are provided with poor quality of basic amenities like water, roads, health centres, Waste disposal in these areas is not proper. Poverty is showing an impact on environment in terms of pollution of water resources, solid waste pollution, etc. On the other hand, the unhygienic conditions, poor quality of water and surrounding environment are also having an impact on their lives. Due to money constrain poor are not able to live quality of life or they are not having access to basic amenities which is a sort of social exclusion which is imposed by society and administrative system on the poor (Source: Socio-Economic and Environmental Status of Poor's Living in Urban Slums: A Case Study of Kolhapur City by Ms. Nilisha Desai, Shivaji University, 2014).

4.9.15 Housing, Water and Sanitation

Sanitation access: out of 1,26,937 (93%) households in the city, total 1,16,383 (92%) households are having household toilets. The remaining 10,554 (8%) households are dependent on CT/PT. There total 61 CTs with the capacity of 795 seats and 9 PTs with the capacity of 117 seats in Kolhapur city (Source: Faecal Sludge and Septage Management Plan (FSSM) of Kolhapur Municipal Corporation).

Drinking Water access: The Kolhapur Municipal Corporation provides the city of Kolhapur with a water supply that ranges from 120 to 130 MLD (Mega-litters per day), with an estimated average per capita supply of 135 LPCD (Litters per person per day). Before being provided to the city, the raw water from the syphon wells is treated and purified at the water treatment facilities. The water supply network supplies the city with the water once it has been cleaned up at the sewage treatment facilities. There are 22 different zones in the water supply network. 28 storage tanks in all, 20 ESRs (Elevated surface reservoirs) and 8 GSRs (Ground service reservoir), with a combined capacity of around 53 million litters. To lessen the water contamination brought on by residues entering the waste water, Kolhapur Municipal Corporation has enacted its own waste water legislation. Together with the construction codes, the waste water statute is officially implemented. The laws state that the following situations necessitate installing a personal sewage treatment plant, treating waste water, and reusing reclaimed water (Source: IMPORTANCE OF WATER MANAGEMENT IN KOLHAPUR CITY by Saba Riaz Lad, 2Prof. Sandeep Dige, 3Anjali S. Jadhav, Assistant Professor, 2Professor, 3Professor 1School of Architecture, D.Y. Patil College of Engineering and Technology, Kolhapur, India).

Access to Housing: he Kolhapur Municipal Corporation (KMC) has identified around 400 families as beneficiaries for the newly launched 'Pradhan Mantri Awas Yojana'. The scheme is a part of the central government's 'Housing for All' initiative meant to provide affordable houses to the urban poor and slum dwellers by 2022 on a mission mode. The erstwhile scheme of the 'Rajiv Awas Yojana' has been renamed and certain changes regarding the implementation modes have been made in the new scheme (Source: Housing for All, Abhijit Patil, 2015).

4.9.16 Economy of the Kolhapur

Over the years Kolhapur district has emerged for having one the highest per capita income in India. Today, Kolhapur boasts for having the maximum number of Mercedes car owners, being the Sugar bowl of India and with Sugar, Spinning and textile mills spread throughout Kolhapur district it surely has raced ahead of many other cities in terms of economic growth in recent years and has established itself as a prominent destination in the state of Maharashtra for investments.

4.9.17 Small Scale Industries in Kolhapur

The major small-scale industries are into manufacturing auto spare parts, casting work, engineering works, diesel engines, silver ornament and kolhapuri chappals. There are many other small scale and cottage industries in rural areas which are family run businesses run down through generations

into trades like hand-loom-weaving, gold smithy, oil crushing, brick and tile making, leather works and tanning, and black smithy etc in the Kolhapur district which collectively provides employment to large number people.

4.9.18 Health Issues

In Kolhapur city, health issues are linked to water pollution from the *Panchganga* River, leading to infectious diseases like diarrhoea, jaundice, and gastrointestinal problems, as well as vector-borne illnesses like malaria and dengue.

4.9.19 Access to Health Services

There are total 356 private hospitals, 3 major hospitals of KMC, 11 Urban Health Care Centres and 2 major hospitals like Chatrapti Pramila Raje Civil Hospital and Seva Hospital (source: Health Officer of KMC).

4.9.20 Vulnerable Groups

In Kolhapur city, vulnerable groups often include the urban poor, marginalized communities, and individuals facing specific challenges such as disabilities, HIV/AIDS, and those affected by climate change. Women, especially Woman headed families are facing challenges related to gender inequality, discrimination, and lack of access to the resources. Children, those living in poverty are vulnerable. Individuals with disabilities are encounter barriers to accessing education, employment, and healthcare.
There is no impact on land, residential structure, community property resources (CPR), so there is no impact on vulnerable people within KMC boundry.

4.9.21 Social Issues and Problems

Kolhapur is the most important cities of Maharashtra. Last three decades, Kolhapur city has observed rapid growth. The population growth is increasing very fast after independence. Due to urbanization, and population growth, some problematic issues are took place, like a) High Density b) Increase in Industrial units c) Heavy Traffic d) No space for Kolhapur Municipal Transport e) Increase in Slum Areas f) Lack of parking facilities g) Water Pollution h) Polluted River i) Limited city area, and j) High Land value (Source: Development Planning of Kolhapur City by Yashraj Kajave, 2020).

4.9.22 Dange Trible Communities in Kolhapu city

There are about 33 locations in Kolhapur city where Danges have been settled during the last 60 years. The total population of in-migrated Danges in the city is approximately 8280, distributed among 1066 households. The Kadamwadi, Fulewadi, Bondrenagar, Lakshtreath Vasahat, Sasanenagar are the major concentrations of Danges.

The economic activities which the in-migrants have been performing in the city are quite different from these in their original habitat. It is wonderful to note that they have acquired the skills and knowledge in carrying out these activities. The acceptance of these activities is the great adjustment with the new city environment.

The occupational structure of in-migrants is much varied. Out of the total in-migrant population 47.82 percent are workers which are more than the city average (34.87 %). The proportion of workers is high for males (55.75 %) to that of females (39.41 %) when the city average 78.64 percent and 21.35 percent for males and females respectively. This indicates that the hard-working Dange females contribute substantially to their family income.

The working status of Danges consists of varied working activities like administrative worker, professional and technical workers, sales workers, service workers, domestic workers and other workers. Out of the total workers (815) highest percent workers are domestic workers (32. 51 %)

which are totally females followed by the professional and technical workers (16.44 %) and service workers (15.58 %) which are male dominant occupations.

In short, the availability of amenities and facilities in their houses is at a satisfactory level, comparing those with their original places where it was totally absent.

The Dange tribes do not maintain distinct identity and they are mainstreamed

Chapter 5 Analysis of Alternatives

Alternatives are sorted out in three distinct aspects of the project implementation. These are critically analyzed for decision making on the basis of most feasible alternative. Three such aspects considered for analysis of alternatives are:

1. Without Project Alternative Scenario
2. With Project Alternatives
3. Pre-Project Development Alternatives
4. Project Locational Alternatives
5. Analysis of Technical Alternatives
6. Post Implementation Benefits

5.1 Without Project Alternative Scenario

The **Flood Event of 2019** prompted the state government to form a committee of experts to identify the causes of flooding and recommend solutions. The committee's report, **"A Report on Floods 2019 (Krishna Sub Basin)"**, was submitted in May 2020 and thoroughly analyzed by the consultant. It outlined several key factors contributing to the flooding, which included:

- **Increased Frequency of Cyclones**: Climate change has led to a 52% increase in the frequency of tropical cyclonic storms in the Arabian Sea. In 2019, five out of eight cyclones were in the Arabian Sea, compared to the normal frequency of one cyclone per year.
- **Runoff from Free Catchment Areas**: The runoff from surrounding catchment areas, in addition to upstream dam spills, exacerbated urban flooding.
- **Urbanization and Encroachment**: Urbanization and encroachment on natural drains have further worsened the situation, as the city's drainage infrastructure is inadequate to handle heavy rainfall.

These issues, coupled with changes in rainfall intensity, have highlighted the urgent need for a comprehensive master plan for stormwater drainage in urban areas. Without proper intervention, flooding will continue to disrupt urban life, damage infrastructure, and lead to significant economic losses.

Urban Flooding Challenges

Kolhapur faces frequent waterlogging during the monsoon season, leading to significant disruption of daily life. The city's drainage system is unable to cope with the increasing volume of runoff caused by rapid urbanization and the growing number of impervious surfaces, such as roads and buildings. Additionally, the system's capacity to handle high-intensity rainfall events is inadequate, leading to exacerbated flooding.

Recurring Flooding and Casualties

Kolhapur has experienced devastating floods in the years 2005, 2006, 2009, and 2021. These events caused widespread destruction, with the 2005 floods alone resulting in over 100 fatalities. Each flood has displaced thousands of people, leading to both direct and indirect economic losses. This highlights the urgent need for resilient flood management and improved stormwater infrastructure.

Climate Change Impact

The frequency and intensity of extreme rainfall events have significantly increased due to climate change. These unpredictable rainfall patterns overwhelm the existing drainage infrastructure and amplify the risk of flooding. Rising urbanization and changing weather patterns further exacerbate these risks. Therefore, implementing a sustainable stormwater management system that includes green infrastructure and adaptive measures is crucial to mitigating these effects.

Infrastructure Deficiencies

The current stormwater drainage network in Kolhapur is outdated and insufficient to manage both current and projected runoff levels. Inadequate maintenance and poor planning have contributed to bottlenecks in the drainage system, worsening the effects of heavy rainfall. Without the proposed project, Kolhapur's drainage capacity will continue to be inadequate for the region's growing needs.

Economic and Social Impacts

Flooding results in considerable economic damage, including destruction of property, loss of agricultural produce, and disruptions to businesses. Socially, floods force large-scale evacuations, disrupt public health, and degrade the overall quality of life for residents. Without timely intervention, these challenges will only grow in severity.

Environmental Concerns

Improper stormwater runoff management leads to soil erosion, sedimentation, and pollution of local water bodies, such as rivers and wetlands. These environmental impacts further weaken the region's natural resilience to flooding and degrade the quality of life for residents.

5.2 With Project Alternatives

Implementing the proposed stormwater drainage interventions will significantly improve the flow capacity at major flood-prone locations. The capacity upgrading of stormwater infrastructure will reduce floodwater volumes and allow smoother drainage, particularly at critical flooding points. These improvements will ensure better water flow discharge into the Panchganga River, reducing the likelihood of flooding.

The integration of **blue-green infrastructure (BGGI)** has proven even more effective in reducing flood volume, surpassing the benefits of traditional drainage alone.

Post-Implementation Benefits

The anticipated benefits of the project include:

- **Reduced Flooding**: A significant reduction in the area affected by flooding, particularly in built-up and agricultural areas.
- **Reduced Damage**: Flood-related damage to infrastructure, including roads and buildings, will decrease significantly.
- **Improved Public Health and Safety**: The improved drainage system will mitigate health risks associated with stagnant floodwater and improve the overall quality of life for residents.

Data Summary and Flood Impact Analysis

Receptor	Without Interventions	With Interventions	% Reduction
Total Area Affected (Ha)	307.34	158.17	↓ 48.5%
Built-Up Area (Ha)	153.2	56.02	↓ 63.4%
Cropland Area (Ha)	54.46	35.15	↓ 35.5%
Length of Roads (Km)	25.18	8.09	↓ 67.8%

Number of Buildings Affected (Nos.)	1,517	535	↓ 64.7%

Future Scenarios Under Climate Change

The following table shows the impact of future rainfall scenarios and land use changes on flooding, considering both with and without the proposed interventions:

Parameter	Without Interventions (Worst Case)	With Interventions	% Reduction
Total Area Affected (Ha)	514.65	351.44	↓ 31.7%
Built-Up Area Affected (Ha)	207.72	110.17	↓ 46.9%
Cropland Area Affected (Ha)	67.84	48.47	↓ 28.6%
Total Length of Roads Affected (Km)	36.96	19.97	↓ 46.0%
Buildings Affected (Nos.)	1,733	851	↓ 50.9%

Conclusion

The proposed interventions will significantly reduce the extent and impact of flooding in Kolhapur, safeguarding lives, property, and infrastructure. The integration of modern stormwater management techniques, including green infrastructure, ensures that Kolhapur is better prepared for future climatic challenges.

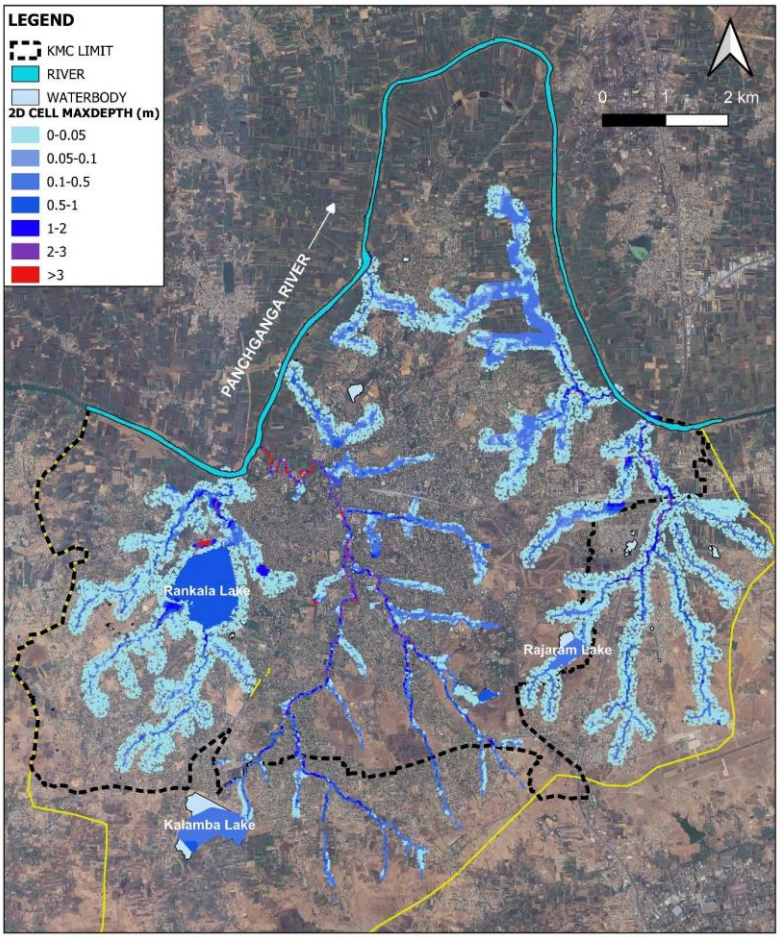


Figure 5-1: 5 year RP + Climate Change + Future LULC- Without Intervention ,FSL Level as Rajaram KT Weir

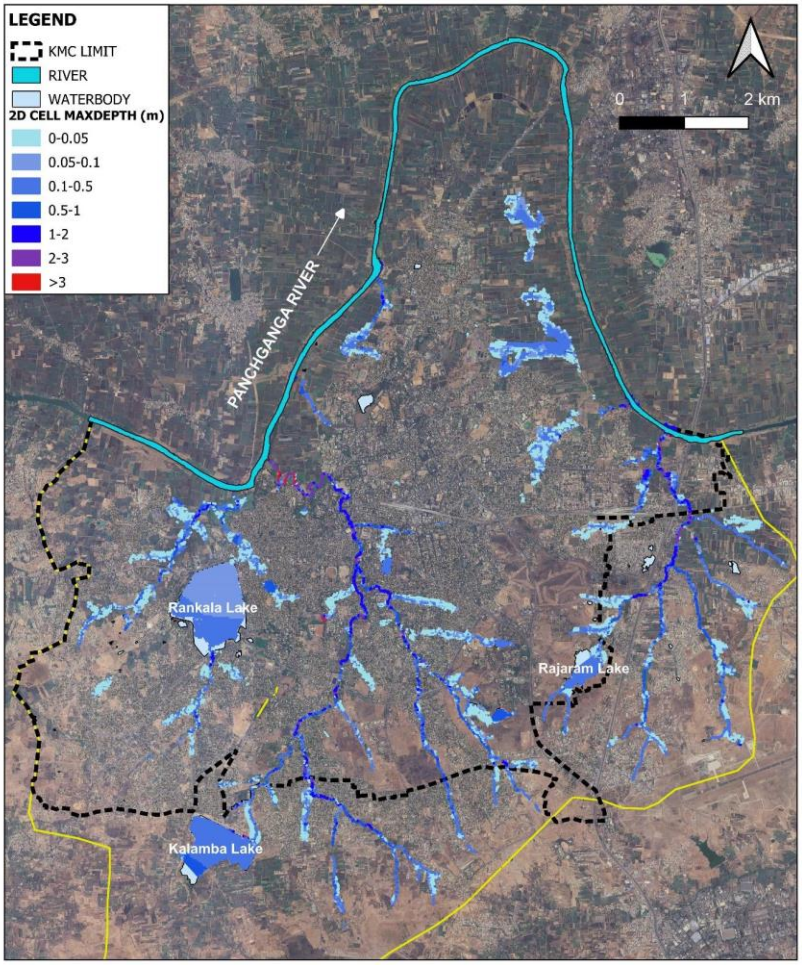


Figure 5-2: 5 year RP + Climate Change + Future LULC- With Intervention ,FSL Level as Rajaram KT Weir

Table 5-1: Reduction in peak flow considering of 5yr CC flow condition by applying the Interventions

Sr. No.	Flooding Location	5yr_Historical without Intervention	5yrCC_without Intervention				5yrCC_with Intervention				Remarks
		Peak Flow (m3/s)	Peak Flow (m3/s)	Water Depth (m)	Actual depth of Drains (m)	Max. Spread (m)	Reduction in Peak Flow (m3/s)	Water Depth (m)	Proposed Depth of Drain (m)	Max. Spread (m)	
1	Devakar Panand Chowk	2.784	3.37	0.28	Natural	57.03	13.02	1.9	2	0	Increased drain capacity allows more flow, reducing surface spread
2	Behind Nikam Park	0.187	0.21	0.21	1.2	0	13.06	1.45	1.5	0	Higher water depth in drain confines flow, preventing overland flooding.
3	Rajlaxmi Nagar	7.947	13.12	0.97	Natural	22.846	68.74	2.45	2.5	0	Drastic increase in peak flow due to improved channel capacity and connectivity.
4	Dhudhali Nala	6.81	8.40	1.39	1.5	0	25.11	1.5	1.5	0	Consistent water depth before & after intervention suggests optimized drainage.
5	Parvati Multiplex	No drain					1.503	0.44	1.2	0	Previously had no drain; now, controlled drainage eliminates surface spread.
6	Bagal Chowk	No drain					0.975	1.336	1.5	0	No prior drainage system; new intervention prevents stagnation and local flooding.
7	Parag Pool Nala	5.492	6.77	0.84	1.2	0	16.05	1.8	3	0	Increased depth improves flow velocity, reducing backwater effects.
8	Parikh Pull	2.766	3.47	2.77	0.3	123.623	4.417	0.84	1.5	0	Major reduction in flood spread due to efficient drainage network redesign.
9	Law College Chowk	0.353	0.38	0.40	1.2	0	9.307	0.62	1.5	0	Contained flow within the drainage system reduces overland flood impact.
10	Janata Bazar Chowk	4.153	4.23	1.54	Natural	82.341	61.33	2.48	3	0	Natural drains replaced with structured ones, ensuring proper flood routing.
11	Rajarampuri 1st Lane	No drain					2.652	1.902	3	0	New drain prevents water stagnation in an area previously without drainage.
12	Mandlik Park Rajaram Riffal	1.439	1.56	3.75	2	58.004	16.72	1.391	2	0	Increased water depth post-intervention suggests efficient drain conveyance.
13	13th lane	No drain					0.4005	0.53	1	0	No prior drain; new drainage intervention eliminates local waterlogging.
14	Radhabai Shinde School	2.461	3.06	0.57	0.3	32.923	4.972	0.623	1.5	0	Optimized depth and flow prevent uncontrolled spread in urban areas.

Sr. No.	Flooding Location	5yr_Historical without Intervention	5yrCC_without Intervention				5yrCC_with Intervention				Remarks
		Peak Flow (m3/s)	Peak Flow (m3/s)	Water Depth (m)	Actual depth of Drains (m)	Max. Spread (m)	Reduction in Peak Flow (m3/s)	Water Depth (m)	Proposed Depth of Drain (m)	Max. Spread (m)	
15	SSC bord Nilgiri Apartment	No drain					0.73	0.731	1	0	Previously had no drainage; new system prevents localized flooding.
18	Collector Office to Basant	2.968	3.71	0.98	0.9	52.49	3.78	0.576	1.5	0	Smoother flow in redesigned drains minimizes urban flooding.
19	Road in front of Patil wada	3.2	3.56	1.45	1	74.09	23.12	1.319	2	0	High pre-intervention flood spread eliminated due to deeper drains.
20	Shahupuri gavat mandai	25.16	29.15	2.67	2	12.01	87.64	3	3	0	Proper slope adjustments ensure better flow control, reducing spread.
21	Muktsainik Chowk to Patson	10.01	7.54	2.06	Natural	128.7	22.48	2	2.2	0	High initial spread (128.7m) reduced due to improved water conveyance.
22	IRB Godown	0.0267	0.03	0.32	1.5	Box Drain	22.58	1.5	1.7	0	Box drain system ensures confined water flow, preventing overflows.
23	Pragati Society	1.99	2.62	0.74	Natural	65.942	10.22	0.755	2	0	Improved drainage depth reduces floodwater accumulation in urban space
24	Rasika Hotel to Sappihire Park	8.523	10.61	0.90	0.6	97.799	10.45	1.25	2	0	Larger drain structure prevents road waterlogging during heavy rains.
25	Unik Park Lisha Hotel Samor	11.27	14.45	1.36	1	136.14	13.99	2	2.2	0	Significant peak flow increase due to enhanced drain flow capacity.
26	Renuka Mandir Chowk Bawada	0.44	0.48	0.90	0.9	Box Drain	8.292	1.5	1.7	0	Box drain controls water flow effectively, preventing urban flooding.
27	Tramboli Nagar Bavada	1.537	1.87	0.68	0.9	17.06	1.815	0.77	1.5	0	New drainage system efficiently contains peak flow within designed limits.

The change in runoff at the outfalls with respect to the baseline flood Model after implementation of BGGI interventions is given in the table below

Table 5-2: Change in Peak Runoff at Outfalls after implementation of BGGI Interventions

Sr. No.	Name of Outfall	By Keeping FSL level as per Salient feature of rajaram KT weir	Keeping Warning level from Rajaram KT weir	By Keeping FSL level as per Salient feature of rajaram KT weir	Keeping Warning level from Rajaram KT weir
		Without Intervention_Future LULC		With Intervention_CC+ Future LULC	
		5yr CC Peak flow (m3/s)	5yr CC Peak flow (m3/s)	5yr CC Peak flow (m3/s)	5yr CC Peak flow (m3/s)
1	Laxtirth Nalla	13.15	-609.4	27.55	-607.6
2	Phulewadi Nalla	323	-2581	265.3	-2585
3	Jayanti Nalla	186.4	-3153	378.4	-3154
4	Rajhauns Press Nalla	25.27	-899.1	47.39	-899.1
5	Line Bajar Nalla	24.37	-841.4	33.24	-839.3
6	Kasaba Bawada / Rajaram bandhara Nalla	16.04	-233.1	16.04	-231.6
7	Rajaram Sugar Factory/ Molassis Lake Nalla	10.84	-38.91	11.14	-38.55
8	Bapat Camp	5.979	-636.6	12.78	-828.4
9	Uchgaon/ Veet Bhati	57.8	-2915	96.2	-2754

The project is expected to improve water sharing and enhancing the storm water flow during monsoon and reducing socio-economic and environmental vulnerability.

5.3 Project Justification

In view of flooding events in Kolhapur City from 2005 to 2021 and lacunas observed in the present system as listed below, it is necessary to take full-fledged SWD project with up gradation of existing system for Kolhapur City. Motives of the project proposals are discussed below;

Fluvial Flooding from the Panchganga River: The Panchganga River, which flows through Kolhapur, plays a central role in the city's hydrology. During the monsoon season, heavy rainfall in the river's catchment area causes its water level to rise significantly. This leads to fluvial flooding, particularly when the river breaches its banks. The rising water levels in the Panchganga River directly impact Kolhapur city in the following ways:

- **Backflow into Nalas**: The nalas (natural drainage channels) in Kolhapur are directly connected to the river. When the river's water level rises, it prevents the nalas from draining efficiently, causing water to back up into the city. This exacerbates urban flooding, especially in low-lying areas.
- **High Flood Frequency**: Historical data shows a pattern of recurring floods during extreme rainfall events, with certain areas experiencing inundation for prolonged periods. This is often aggravated by the release of water from upstream dams, which adds to the river's flow.

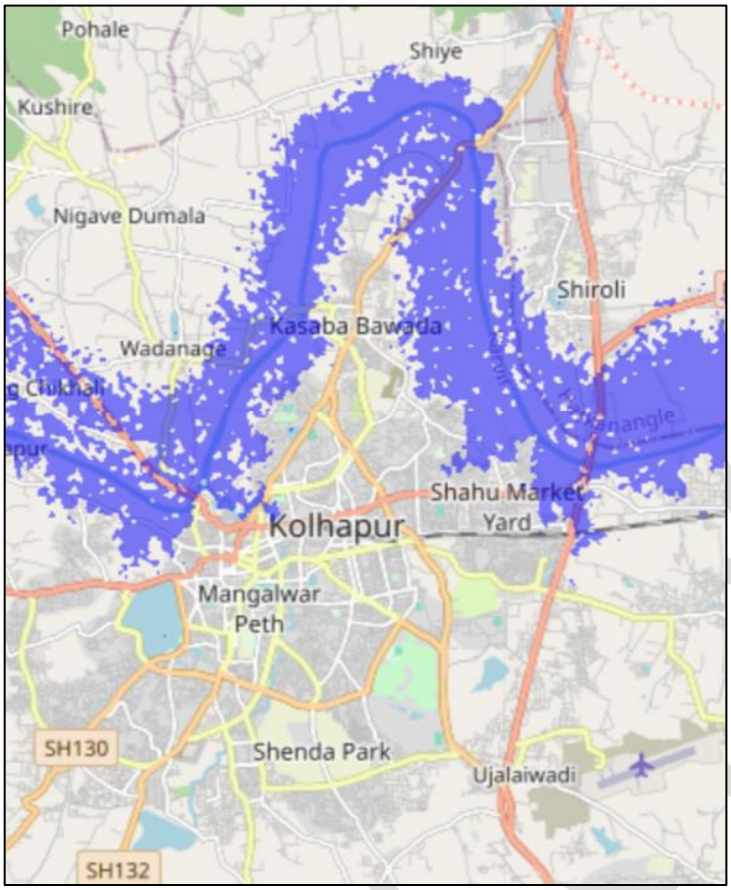


Figure 5-3: A Typical Inundation Map When Water Level in Panchganga River Is Near 'Danger' Mark

Inadequate or Absence of SWD System: Kolhapur's urban growth has outpaced the development of its drainage infrastructure, leaving the city vulnerable to flooding. The inadequacy of the SWD system can be attributed to the following factors:

- **Insufficient Capacity:** Existing drains are often undersized and incapable of handling high-intensity rainfall, leading to waterlogging in many parts of the city. Lack of facility to drain the storm excess from the road network and improper disposal of storm water.
- **Poor Maintenance:** Dilapidated SWD conditions, no proper embankments, many SWD are clogged with silt, solid waste dumping, and debris, weed growth further reducing their capacity to carry runoff. Lack of maintenance of holding ponds leading to encroachments, growth of bushes, silting of lakes due to which most of holding ponds/ structures has mostly abolished. No discharge gates / sluice gates at lake
- **Disconnected Network:** The absence of a well-planned drainage network results in uneven distribution of water flow, causing localized flooding.
- **Blockages in SWD:** Blockages of natural drains / storm water paths due to un-authorized building activities, or lack of interconnectivity between the drains due to new road constructions without CD works having inadequate carrying capacities. Additionally, the silting up and encroachments in water bodies and wetlands have further diminished the city's natural flood defences.

Diversion and Encroachment of Nalas: The natural nalas in Kolhapur have historically played a vital role in draining excess rainwater into the Panchganga River. However, urbanization has led to the diversion and encroachment of these watercourses, severely compromising their functionality.

- **Encroachments:** Construction of buildings, roads, and other infrastructure along the nalas has reduced their width and flow capacity. In some cases, nalas have been completely covered or converted into sewage lines. All these are leading to increased flood risks in urban areas. This not only endangers lives and property but also disrupts the ecological balance of the region.
- **Diversion:** Unplanned diversions of nalas to accommodate urban expansion have disrupted the natural flow of water, causing bottlenecks and localized flooding.

Loss of Natural Buffers: Kolhapur has been experiencing significant challenges related to flood management due to the loss of natural buffers. One of the primary issues is the degradation and loss of vegetation in the upstream reaches of the catchment area of cities main Nalas. This vegetation plays a crucial role in absorbing rainfall and reducing runoff, thereby mitigating flood risks. However, deforestation and land-use changes have led to increased surface runoff, contributing to more frequent flooding events.

Another critical factor is the increase in built-up areas across the city which has significantly raised the impermeability of the land. As Kolhapur city area gets more built up, more surfaces are covered with concrete and asphalt, preventing water from naturally percolating into the ground. This results in higher volumes of surface runoff during heavy rains, overwhelming the existing drainage systems and exacerbating flood conditions.

Due to the frequent and regular flooding Kolhapur City is affected with loss of productivity, loss of livelihood, loss of properties, disruption of normal life, increased risk of water borne diseases due to unhygienic environment, damage to the roads etc., To alleviate the problems caused due to flooding a proper storm water drainage system to collect, convey and dispose the rain water is required.

To address these issues, it is essential to implement sustainable urban planning practices, restore vegetation in upstream areas, protect and rehabilitate wetlands, and enforce strict regulations against encroachments in flood-prone zones. These measures can help restore the natural buffers and enhance the city's resilience to flooding.

Addressing these challenges necessitates a multifaceted approach:

- **Infrastructure Development:** Addressing the chronic flooding spots in the city by providing localized solutions to drain inundating areas.
  - Upgrading and expanding the stormwater drainage system to meet the demands of current and future urban landscapes.
  - Across all sites, the primary contributors to poor water quality are solid waste deposition, sewage inflows, and residential septic tank overflows. Immediate measures such as solid waste management and enforcement of sewage treatment protocols are recommended.
  - Many natural and semi-natural drains are obstructed by vegetation growth and sedimentation caused by erosion, leading to restricted flow. Regular desilting and vegetation removal are necessary to restore capacity.
  - Several semi-constructed drains show signs of damage and erosion, while many constructed drains lack sufficient inlet capacity. Structural improvements and proper design adjustments are essential.
  - Insufficient capacity and choked inlets are common across the sites. Hydraulic modelling is suggested to design drains capable of handling peak flows and mitigating urban flooding risks.
  - Address the management of overflow water from Kalamba Lake, possibly by enhancing the capacity of the Jayanti Nalla outlet or implementing better flood control measures around the lake. Regular monitoring of water levels and outlet capacity should be conducted to prevent further flooding incidents Rainfall Analysis.
- **Regulatory Enforcement:** Implementing and enforcing strict regulations to prevent encroachments and ensure the preservation of natural drainage channels. Regulations to ensure adequate runoff detention and rain water harvesting in existing and new developments in the city
- **Integrated Water Management:** Coordinating dam releases and river management practices to mitigate flooding risks caused by flooding in Panchganga River.

The existing SWD system in the merged area of KMC is grossly inadequate to meet the growing demands of civic infrastructure needs. For successful functioning of SWD system, it is necessary to design the SWD network in the expanded areas of town. Construct missing links, construct adequate CD structures with a prime view that it should seamlessly synergize with existing network in the erstwhile municipal corporation area of 69.018 Sq.km.

5.4 Project Development Alternatives

Based on the project development objective and in line with the project components, different activities are listed out at the initial stage of the project design for feasibility assessment and adoption in the project. Extensive exercises for identification of feasible alternatives in planning, design & location specific application are carried out in different phases during the project design stage, involving different stakeholders in the process.

Keeping the focused objective in the perspective as well as the key impact areas such as human settlements near interventions, length of the SWDs, it was urgently necessary to find out feasible solutions to control flood and improve SWD infrastructure through analysis of alternatives. Several structural and Non-Structural alternatives are discussed for and flood control in the impact area. Many activities under broad subprojects, having feasibility of execution, were considered at the initial stage of project formulation. However, after taking the E&S impact levels and locational suitability in to account, certain activities are considered for retention with change in design specification and few are dropped / discarded at the initial stage adhering to PDO. Many activities shortlisted at this stage are renamed or rephrase to bring more clarity. Project activities which are discussed at the initial stage of the project formulation are presented in the **Table 5.3**.

Table 5-3: Selection of Project Activities to meet Project Objectives

Sr. No.	Project activities considered at initial stage of project formulation	Decision after Review
1	Flooding Hotspot Rectification Works Total 29 Flooding Hotspots	Retained
2	Culvert A & B Basin	
	Total 18 Culverts Sizes Approximately (2m X 2m to 3.5 mX 3.5m)	Retained
3	Culvert A & B Basin	
	Total 16 Culverts Sizes Approximately (2m X 2m to 3.5 m X 3.5 m)	Retained
4	Culverts - C & D basin	
	Total 51 Culverts Sizes Approximately (2 m X 2 m to 2 m X 6.0 m)	Retained
5	Culverts C & D Basin	
	Total 40 Culverts Sizes Approximately (2 m X 2 m to 3.5 m X 3.5 m)	Retained
6	Retaining walls and Nala development	Retained
7	Creating flood relief culverts under highway with jacking pushing - Pune highway	Retained
8	Creating flood relief culverts under highway with jacking pushing – Kolhapur Panhala road	Retained
9	New Pump houses to be constructed for easing flood congestion in some areas. Land will be purchased for pump house construction	Dropped

5.5 Locational Alternative

Different alternative locations and other alternatives for all project activities are initially thought of during feasibility study process for flood management works. Based on the alternative analysis, decision is taken to the best possible alternatives.

E&S implications of selected project activities are considered for alternative study inter-alia supporting the decision-making mechanism. These are analyzed for project activities in construction phase and post-construction phases. The final selected options with quantity for components wise project activity are given in **Table 5.4**.

Table 5-4: Location Alternatives

Sr. No.	Sub-Project	Initially Selected location	Finally Selected location	Reason of Selection of Final Location
1	Rehabilitation and upgradation of existing SWD and CD structures in Kolhapur	All damaged Structure in KMC	29 Flood Locations 137 CD structures which are inadequate	Rehabilitation and upgradation of only inadequate and damaged SWD and CD structure will fulfil project objective; Stormwater flow without hurdles; Reduce flood risk; Rehabilitation and upgradation of only selected damaged structure will

Sr. No.	Sub-Project	Initially Selected location	Finally Selected location	Reason of Selection of Final Location
				reduce burden of generated C&D waste disposal;
2	Desiltation of SWD at identified stretches of SWD by desiltation	26.32 km	18.475 km	Drainage channels are silted up due to inadequate maintenance and uncontrolled human activity in last 5-6 decade; Improve water holding and carrying capacity and flood discharge; Improve and maintain environmental flow;
3	Retention wall Construction at SWD	15km	23.5km	Weaker section of embankment is selected for retention wall with pile work; Significantly reduce any chances of breaching of embankment and improve security to valuable public/ private and community asset located beside of SWD; Reduce bottom scouting effect and protect embankment; Reduce soil erosion and downstream sediment transportation; Reduce Flood Risk
4	Slope stabilization by continuous contour trench	Slopes Behind Kalamba lake-100 Ha Shivaji University-25 Ha Shenda Park-21 Ha	Retained as proposed initially	Decrease the surface runoff by as much as 75 to 85 % as compared to the untreated land useful in soil and water conservation Decrease water flow in the natural storm water drains and thus decrease the flood impacts
5	Plantation in Shivaji University	12Ha in Shivaji University Area	25Ha	Plantation is planned on 25Ha land with prior consultation with Shivaji University, The trees can play an important role in stormwater management by reducing the amount of runoff that enters stormwater; Will increase water holding capacity and groundwater recharge.
6	Plantation in Shenda park	Selected Locations at 5 Ha	21Ha	The social forestry department, as part of its annual plantation drive, will be planting as many as 40k saplings on 90-acre land in the Shenda park are of the city. The land belongs to Mahatma Phule Krishi Vidyapeeth, Rahuri; Dense forest development is planned on 21 Ha of this land with prior consultation with KMC, The trees can play an important role in stormwater management by reducing the amount of runoff that enters stormwater; Will increase water holding capacity and groundwater recharge.
7	Kalamba Lake Desilting	Kalamba Lake	Retained as proposed initially	Same area / location retained Desiltation will improve water holding capacity and reduce flood frequency and damage; Improve environmental flow;
8	Development of Jayanti Nala Plantation and desiltation	Entire Stretch	5956 RMT	To increase carrying capacity of the nala and reduce flood frequency and damage; improve environmental flow;

Sr. No.	Sub-Project	Initially Selected location	Finally Selected location	Reason of Selection of Final Location
				Reduce Surface runoff from the surrounding areas into nalla; Reduce soil erosion; Embankment Protection
9	Development of Gomti Nala Plantation and desiltation	Entire Stretch	3123 RMT	To increase carrying capacity of the nala and reduce flood frequency and damage; improve environmental flow; Reduce Surface runoff from the surrounding areas into nalla; Reduce soil erosion; Embankment Protection
10	Rainwater harvesting system for all buildings in city	Entire city	Entire city	To reduce surface runoff from concreted surface into SWDs and flood risk in the area; Water conservation and reuse
11	Sluice gates and RCC channel at lake		4 new sluice gates at Kalamba Lake	Improved management of flood discharge; reduce water loss/ seepage; this will help in recharging ground water as well;
12	Padtala desilting		New proposed location	New area / location identified Desiltation will improve water holding capacity and reduce flood frequency and damage;
13	Rajaram Lake Desilting		New proposed location	New area / location identified Desiltation will improve water holding capacity and reduce flood frequency and damage;
14	CD structure at highway with jacking pushing - Pune highway and Kolhapur Panhala Road	Pune highway and Kolhapur Panhala Road	Same Locations	Creating flood relief culverts

5.6 Technical Alternatives

Technical alternatives/construction methodologies are considered for selective project activities. After considering all feasible technical options, most suitable options are selected for implementation. Project activity wise alternate technical options and finally selected most preferred option with benefit is tabulated below in **Table 5.5**.

Table 5-5: Technical Alternatives

Sr. No.	Sub-Project	Option 1	Option 2	Recommended Option	Reason of Selection
1	Roadside drain network)	Box Drain	Pipe Drain	Box Drain	Better hydraulic efficiency, structural integrity and ease of maintenance Box culverts and drains are economical because of their rigidity and monolithic action, and they don't need separate foundations because the bottom slab functions as a raft slab and rests directly on the ground. The box culvert and drains are one of the most frequently utilised culvert
2	Capacity enhancement of Jayanti Main Line	Box Drain	Pipe Drain	Box Drain	
3	New drains in south side of city	Box Drain	Pipe Drain	Box Drain	
4	Culvert at Pune highway and Kolhapur Panhala Road	Box Culvert	Pipe culvert	Box culvert	
5	Culvert enhancement along Gomti Nala Main Line	Box Culvert	Pipe culvert	Box culvert	

Sr. No.	Sub-Project	Option 1	Option 2	Recommended Option	Reason of Selection
					designs. Due to the concrete bottom of box culverts, water may flow freely through them (although other materials might be utilised). Box culvert construction involves the use of reinforced concrete (RCC). Certain box culverts can be built using composite construction when water has to shift direction or a large flow of water is anticipated. **Advantages of Box culvert and box drains:** • **Structural strength:** Box culverts and drains are known for their strength and durability, which makes them ideal for use in harsh environments, where they are exposed to heavy loads, soil pressures, and water flow. • **Easy installation:** Box culverts and drains are prefabricated off-site and then transported to the construction site, which makes them easy and quick to install, reducing the overall construction time and cost. • **Low maintenance:** Box culverts and drains require minimal maintenance, as they are designed to last for a long time without any significant repairs. They are also resistant to environmental factors such as corrosion, abrasion, and chemical degradation. • **Versatile design:** Box culverts and drains can be designed to accommodate different sizes, shapes, and angles, which makes them adaptable to different site conditions and requirements. • **Environmental sustainability:** Box culverts and drains are environmentally friendly, as they are made of concrete, which is a

Sr. No.	Sub-Project	Option 1	Option 2	Recommended Option	Reason of Selection
					durable and recyclable material. • **Enhanced flow capacity:** Box culverts and drains have a larger flow capacity compared to other drainage structures, allowing them to handle higher volumes of water and reduce the risk of flooding. **Disadvantages of Box Culvert:** • **Limited span length:** Box culverts and drains are typically used for shorter spans, and their length is limited due to transportation constraints. Longer spans require more complex transportation arrangements, which can significantly increase the cost of the project. • **Restricted clearances:** Box culverts and drains have a fixed height and width, which can be a problem in projects with limited clearance. This can require excavation and backfilling, which can add to the overall cost and time of the project. • **Difficulty in repair and maintenance:** While box culverts and drains are generally low-maintenance, repairing or replacing them can be challenging. Access to the culvert is often limited, which can make repairs difficult and costly. • **Higher cost compared to some alternatives:** Box culverts and drains can be more expensive than other types of drainage structures, such as pipes or open channels, due to the required excavation, backfill, and transportation. • **Aesthetics:** Box culverts and drains are often considered to be unattractive, which can be a concern in some areas

Sr. No.	Sub-Project	Option 1	Option 2	Recommended Option	Reason of Selection
					where the visual impact of the structure is important.
6	RWH system for all buildings in city	Gravity fed	Direct Pumped	Gravity Fed	Low cost and low maintenance Rainwater harvesting offers numerous benefits, including reducing water scarcity, mitigating urban flooding, enhancing groundwater recharge, and providing environmental and economic advantages. It supports sustainable water management and contributes to resilient urban environments. Rainwater harvesting reduces urban flooding by capturing and storing rainwater, thereby decreasing the volume of runoff that overwhelms drainage systems. This helps prevent flooding and minimizes damage to infrastructure and property
7	Desilting of Jayanti Nala to outfall	Dry Silting	Wet Silting	Wet Silting	Most of the times Nala is having full of water
8	Desilting of Gomti Nala to outfall	Dry Silting	Wet Silting	Wet Silting	Most of the times Nala is having full of water
9	Sluice gates and RCC channel at Kalamba lake	Manual Gates	Automatic Gates	Automatic Gates	Better hydraulic efficiency, structural integrity and ease of maintenance Manual gates offer simplicity and affordability but lack the convenience and security features of automatic gates. On the other hand, automatic gates provide unmatched convenience and security but come with a higher upfront cost and require regular maintenance.
10	Padtala desilting	Dry Silting	Wet Silting	Wet Silting	The lake is having water most of the seasons in the year
11	Rajaram lake desilting	Dry Silting	Wet Silting	Wet Silting	The lake is having water most of the seasons in the year
12	Drains construction using precast drains or establishment of plant	Fully Precast drains	Partially Precast drains	Partially Precast drains	Precast road side drain was evaluated for drains upto 1m x 1m. The use of precast drains will significantly reduce environment and social risk during construction activities. Also, will provide additional safety during construction. Thus, it is proposed, wherever found feasible precast drains shall be used.

Sr. No.	Sub-Project	Option 1	Option 2	Recommended Option	Reason of Selection
					Advantages of Precast Drains: 1. Faster Construction: Precast drains can be installed more quickly since they are manufactured off-site and simply need to be placed and connected on-site. 2. Consistent Quality: Precast elements are produced in a controlled environment, which ensures consistent quality, strength, and finish. 3. Reduced Labor Costs: Since the elements are factory-made, the on-site labor involved is reduced, lowering overall construction costs. 4. Less Curing Time: Precast drains do not require time for curing as the concrete is already cured in the factory before transport. 5. Cast-in-Situ Drains are more flexible and suitable for unique site conditions but take longer to construct and require more labor. 6. Precast Drains are faster to install, have more consistent quality, and reduce on-site labor, but may be limited by transportation and standardization constraints. **However, use of precast drains has following constraints,** 1. There is no local manufacturing firm for precast box drains 2. Work in congested urban areas requires shifting of utilities during construction 3. Precast drains are available in fix sized and therefore difficult to install by negotiating underground utilities 4. The laying of precast drains requires heavy material handling equipment like Crains which are difficult to manure in crowded areas.

Sr. No.	Sub-Project	Option 1	Option 2	Recommended Option	Reason of Selection
13	Drains construction method	The open trenching method (open excavation method)	Horizontal Directional Drilling (HDD) method	Horizontal Directional Drilling (HDD) method	Consideration of construction method need to be analysed during pre-construction stage. It will analyse the suitable method based on the project location, geographical challenges, standard regulation, and cost and time limitation. The HDD method is usually used in densely populated areas. **Advantages of HDD method:** Horizontal Directional Drilling method is the most commonly recognised trenchless utilities method as a preferred construction method in this age. Among the reasons HDD method offers less disturbance on traffic, the public, business activities and neighbourhood, lower restoration cost, less noise, dust and minimum import/export of the construction materials. In addition, HDD method can drill through congested utilities areas with minimum cutting and shorter time. **Following are the constraints with HDD method:** a. Prevention / reduce the risk of pullback failure by boring the ground with a borehole diameter that exceeds the outer diameter of the pipe / 1.5 times the outer diameter of the pipe. b. Increase the number of slurry pumps with the aim that the mud can be sucked up quickly before the mud returns to fill the drill hole and disrupt the course of the pullback process. c. If a failure in the pullback process has occurred, then the pipe must be pulled back towards the inlet using an excavator heavy equipment.

5.7 Post Implementation Benefit

In this project construction proposals are confined to the KMC. Practically all the subproject components of SWD Works are planned in government land and therefore displacement of any

community will not arise except in the encroachment areas and land parcels where some greenfield interventions are planned. The findings have been used as inputs for comparative analysis of "Before Project Implementation" and "After Project Implementation" scenario as given in **Table 5.6** below.

Table 5-6: Alternative Analysis by with or without Project Activity

Sr. No.	Parameter	'Before Project Implementation' Scenario	'After Project Implementation' Scenario
1.	Robust SWD Maintenance System implementation	Without proper drainage system, maintenance of drainage system is not possible	Will have organized and better maintenance and therefore efficient operation of the created system
2.	Public health	Rodents, reptiles and vectors menace due to presence of open drains with low flow velocity	Clean surroundings eliminating bad odour and mosquito breeding from open drains, other harmful creatures like Snakes, Scorpios Thus, good for public health and safety
3.	Drainage Construction	No construction of SWD. This will result in periodic flooding in urbanized area shall results in property damages. Stagnation of water shall result in health-related problems including spread of vector borne diseases such as Dengue and Malaria. Livelihood loss, property loss Flood issues remain unaddressed without the project Continuation of high impact on life and livelihood; High social and economic loss; Embankment breaching	Drainage will be improved due to further development of culverts / bridges with adequate hydraulics Substantially will reduce the water logging in KMC Flood Prone Areas. Less probability of flood occurrence and inundation; reduce soil erosion and downstream sediment transportation; Enhance security to property, human and animal life; Scouting effect on embankment site will be reduced; The total flood volume estimated under future land use and a 5-year return period climate change scenario is 1,625.5 million litres. With the implementation of both grey and blue-green infrastructure solutions, this volume is expected to reduce to 1,324.5 million litres, representing an 18.52% reduction compared to the baseline.
4.	Desiltation of Kalamba Lake, Rajaram Lake and Padtala	Decrease in water holding capacity; Increase in water inundation due to overflow of water in the surrounding areas	Increase in water holding capacity; With completion of project, the inundation in the surrounding areas in downstream due to flood will be almost reduced to zero; Improvement in environmental flow; Quick discharge of flood water; Reduce pressure on embankment hence less incidence of embankment breaching; Enhance security to property, human and animal life;
5.	Construction of sluice gates at the outfalls of Kalamba lake	Back flow takes place with high water level of Lake; Defunct sluice gates;	Drainage outfall is well managed; Increased water holding management reduction of flood risk; Easy and managed discharge of flood discharge; Less probability of flood occurrence and inundation; reduce soil erosion and downstream sediment transportation; Enhance security to property, human and animal life; Scouting effect on embankment site will be reduced;
6.	Desiltation of SWD channels	Decrease in carrying capacity Drainage congestion and subsequent inundation due to	Drainage congestion cleared and no inundation and due to water logging; Improvement in environmental flow;

Sr. No.	Parameter	'Before Project Implementation' Scenario	'After Project Implementation' Scenario
		water overflow in the surrounding areas Frequent occurrence of embankment breaching and flood	quick discharge of flood water will solve prolonged water logging problem; reduce stretch on embankment hence less incidence of embankment breaching
7.	Re-sectioning and construction of missing links of SWD channels	Decrease in carrying capacity Frequent occurrence of embankment breaching and flood	Increase capacity of water flow in SWD Less occurrence of flood
8.	Embankment improvement, retention walls at identified locations, outfalls at discharge points of SWD	Soil erosion Embankment Breaching Un-controlled movement of water towards lower reaches causing flood	Protection from embankment breaching; Less probability of flood occurrence and inundation; Restriction of soil erosion; Strengthen flood protecting embankment; Enhance security to property, human and animal life;
9.	Raising & strengthening of countryside earthen bund to Nalla	Embankment breaching Soil erosion	Minimizing chances of embankment breaching; Use as a Nature Based Solution (NBS); Less probability of flood occurrence and inundation; Restriction of soil erosion
10.	Environmental and Social Condition	The environmental and social concerns arising due to regular flooding will continue for a longer period	Reduced occurrence of flood and related damages due to flood protection measures like desiltation, flood protection embankments, strengthening existing embankments, etc. By applying NBS helps in city beautification and aesthetic view; Reduces the impacts on property losses, temporary livelihood, physical social & cultural infrastructures and health.

Chapter 6 : Potential Environmental and Social Impacts

This chapter presents an overview of potential activities involved in various project components and identifies typical E&S impacts and risks. The objective of this exercise has been to assess the overall E&S risk of each subcomponent (on the scale of High, Substantial, Moderate and Low – consistent with ESF guidelines) and develop clear procedures for the preparation of ESIAs, ESMPs, and other detailed studies for the proposed project activities. According to the EIA Notification Act, 2006, none of the proposed investments in the project require preparation of ESIA, and hence the procedures described for the preparation of ESIA and ESMPs follow the World Bank ESF requirements. The E&S management procedures for **Components 2.2 i.e. Urban flood risk mitigation through SWD works**.

Though the project has several positive E&S impacts, proposed interventions in Component 2.2 **(Table 6.1)** will have construction works that are likely to have negative E&S impacts. Large land taking is not anticipated due to rehabilitation work of existing SWD system and flood management components. However, all encroachment on drainage embankment will be removed as per approved RAP.

6.1 Approach and Methodology

The basic approach is adopted for conducting the environmental impact study for the proposed project to assess the existing environmental scenario in and around the project area, components and activities of the project having potential environmental impacts, analyse the project proposals with respect to prevailing institutional and legislative setup of the GoI, GoM and World Bank ESS and ESF requirements on this subject.

The main approaches for the assessment covers:

1. Identification and analysis of positive and negative impacts, direct and indirect impacts, and short-term and long-term impacts likely to result from project intervention;
2. Identification of feasible and cost-effective mitigation measures to minimize negative impacts and enhance positive impacts by incorporating in the preliminary engineering design.
3. Exploration towards the opportunities for environmental enhancement;
4. Preparation of ESMP for effective implementation of environmental and social mitigation measures at different stages of the project.

6.2 Categorization of Project Aspects

The World Bank classifies all projects into one of four classifications i.e. High, Substantial, Moderate and Low on account of relevant issues, such as the type, location, sensitivity, and scale of the project; the nature and magnitude of the potential environmental and social risks and impacts; and the capacity and commitment of the Recipient to manage the E&S risks and impacts in a manner consistent with the ESSs. The proposed project will have Substantial risk and thus ESIA and ESMP is prepared as per ESMF and ESS requirements.
There are no Scheduled Tribes in the project area.

6.3 Potential Environmental Impacts

In the present study, potential environmental impacts and its extent on various Environmental parameters are studied for different stages of the project, i.e., design and pre-construction stage, construction stage and operation stage.

Table 6-1: Potential Environmental Risks and Impacts

Sr. No.	Interventions	Activities Proposed	Potential Environmental Risks and Impacts
1	• Desiltation of Nalla • Desiltation of Lakes	• Desilting of bottom silt deposited from SWD and Lakes • Transport of desilted material to designated place • Operation of dredgers and construction vehicles	• Approximately 525949 CUM of silt is expected to be removed from SWDs and Lakes (**Section 6.5.4**). • Soil pollution due to improper dumping of removed silt, aquatic weeds and solid waste may lead to unhygienic conditions, inconvenience to local commuters, odour pollution, etc. • Air and Noise pollution due to dredgers • Sediment release, transportation and mixing with water during desiltation may lead to increased TDS and turbidity • Littering of desilted material during transportation may cause inconvenience to local commuters, odour pollution. • Impact on aquatic fish and benthic communities in lakes • Health impact on workers and community due to desiltation operation • Impact on snakes and scorpios near proposed interventions during nalla cleaning operation • Risk of snake bite and Scorpio bite to workers and community • Increased Traffic on road may cause inconvenience to local people and accident risks
2	• Reconstruction of Nalla Sections • Construction of RCC Channel • Construction of Retention wall • Construction of Box drains and Open drains, • Upgradation of Culvert • Construction of Cement Check Dam	• Site clearance and excavation • Demolition of inadequate structures • Tree cutting • Operation of construction vehicles / Heavy Machinery • Transport of Materials & Machinery • Construction Material Handling and Storage • Running of batching plants	• Excavation of top soil during land preparation. Approximately 6,26,329.61 CUM of Top Soil is expected to be generated in the project (**Section 6.5.4**). • Loss of top soil if not stored at designated place • Top soil exposure due to denudation leading to soil erosion • Dust and air pollution due to demolition of inadequate structures and resectioning work • Noise pollution due to construction machineries • Impact due to disposal of C&D waste to be generated in various activities. Approximately 8,79,457 CUM C&D Waste is expected to be generated in the project (**Section 6.5.4**). • Felling of trees with GBH= > 30. Total 25 trees are expected to cut. • Water and land pollution due to debris from dismantling of structures and spoil • Littering of debris, earth materials on road during transportation may cause inconvenience to local community • Health impact on workers and community • Requirement of construction materials may cause impact on natural resources like quarry, water and energy resources • Construction Material Handling may cause soil pollution, water pollution • Generation of waste from empty & used cement poly bags, Nylon crates • Increased Traffic on road may cause inconvenience to local people and accident risks
3	• Earthen Nalla Bund Construction	• Site clearance and excavation • Operation of construction vehicles / Heavy Machinery • Transport of Materials & Machinery	• Change in Landuse is anticipated • Excavation of top soil during land preparation. **(Section 6.5.4)** • Loss of top soil if not stored at designated place • Air and noise pollution during implementation • The bunding of nalla will result in creation of water pond of varied areas. The bunds will change the water flow in Nalla. • Sedimentation may occur frequently in the water pond created.

Sr. No.	Interventions	Activities Proposed	Potential Environmental Risks and Impacts
		• Construction Material Handling and Storage	• If no sediment removal frequently the bund could slide lower down during rainy season and may eventually wash off. • Requirement of construction materials like earthen material and stones may cause impact on natural resources like stone quarry
4	• Plantation	• Site Preparation • Soil Improvement for landscaping • Species Selection • Plantation of Trees and Development of Dense Urban Forest	• Approximately 1,75,200 trees plantation is proposed on 146 Ha of land at various locations • Change in topography and Landuse is anticipated • Risk of cultivation of exotic species that may impact native populations • Fertilizers use for plantation may deteriorate the groundwater quality • Excavation of top soil during land preparation • Loss of top soil if not stored at designated place • Soil quality degradation due to excess use of Fertilizer and pesticide • Surface run off water from plantation areas to nearby water bodies may promote excessive growth of aquatic plants (such as algae, weed and water hyacinth) due to Use of fertilizers in plantation areas
5	• Continuous Contour Trenching and • Loose Boulder Structure	• Site clearance and excavation • Operation of construction vehicles / Heavy Machinery • Transport of Materials & Machinery • Construction Material Handling and Storage	• Continuous countering and trenching are proposed on 146 ha of land behind Kalamba Lake on GP land which is reserved for Gairan/Cattle feeding • 3667 CUM of loose boulder structures are proposed at Kalamba lake • Change in topography and Landuse is anticipated • Excavation of top soil during land preparation • Loss of top soil if not stored at designated place • Top soil exposure due to denudation leading to soil erosion • Requirement of construction materials like earthen material and stones may cause impact on natural resources like stone quarry • Dust Pollution due to stocking of top soil on site during Contour Trenching • Risks to workers while working on slopes
6	• Construction of Sluice gates	• Site clearance and excavation and digging • Operation of construction vehicles / Heavy Machinery • Transport of Materials & Machinery • Construction Material Handling and Storage	• 4 sluice gates are proposed at Kalamba lake • Air and dust pollution due to construction work; health impact on workers • Noise pollution & vibration and its impact on workers and community health • Requirement of construction materials may cause impact on natural resources like quarry, water and energy resources • Construction Material Handling may cause soil pollution, water pollution • Sedimentation may result in water flow. • Generation of waste from empty & used cement poly bags, Nylon crates • Increased Traffic on road may cause inconvenience to local people and accident risks
7	• Construction of Cement Nalla bund • Construction of Cement Check Dam	• Site clearance and excavation • Operation of construction vehicles / Heavy Machinery • Transport of Materials & Machinery	• Change in land Use is anticipated • Excavation of top soil during land preparation • Loss of top soil if not stored at designated place • The CNB and Check Dam will result in creation of water pond of varied areas and will change the water flow in nalla. • Sediment will reduce velocity of water flow. Due to reduction of velocity of water in reservoirs, part of incoming sediment gets trapped. Sedimentation in

Sr. No.	Interventions	Activities Proposed	Potential Environmental Risks and Impacts
		• Construction Material Handling and Storage • Running of batching plants	reservoir may result in loss of capacity, impacts dam safety, risk to downstream habitation etc. • Requirement of construction materials may cause impact on natural resources like quarry, water and energy resources • Construction Material Handling may cause soil pollution, water pollution • Generation of waste from empty & used cement poly bags, Nylon crates • Increased Traffic on road may cause inconvenience to local people and accident risks • The impact on safety of community at the construction site • Impact on ecosystems, biodiversity • Air and dust pollution due to construction work; health impact on workers • Noise pollution & vibration and its impact on workers and community health.

6.3.1 During Design or Pre-Constructional Phase

6.3.1.1 Impacts on Topography & Land Use

The proposed project includes flood management infrastructure development. Change in topography and land use is anticipated as construction of ENB, CNB and Check dam, green belt development along Jayanti and Gomati nalla, continuous contour and trenching along with loose boulders on hill slopes behind Kalamba lake to reduce soil erosion and surface runoff, plantation at proposed places will be taken up in the project as explained in **Chapter 2, Section 2.7 and Table 2.2**. The CCT is proposed on GP land in the catchments of Kalamba Lake along with loose boulder structures to avoid soil erosion and surface runoff which is reserved for Cattle grazing; thus, NOC is required from GP before implementation. These long-term impacts will be mitigated with the adoption mitigation measures.

6.3.1.2 Impacts on Trees

The baseline has identified a number of trees getting affected directly during implementation of interventions. These trees have been planted either by the local people residing in the area or by the KMC garden department. Trees will be impacted only due to retention wall construction and upgradation of SWD regulating structures activities proposed under project. Tree felling is not anticipated due to any other activities like desiltation of SWD and Lake, PCC block lining, ENB, check dam etc, activities proposed under project. As per the estimate, about 25 trees will be affected and required to be uprooted. This anticipated impact would be long term and irreversible. The baseline study indicates that there is no threatened species of tree found in the project area. However, Ficus religiosa (Peepal) which is not evaluated by IUCN but is holy tree in India is found in the project area. The details of trees species proposed to be removed in proposed sub projects are as follows;

Table 6-2: Distribution of Tree Species to be Felled in Project Area

Tree Species Common Name	Tree Species Botanical Name	Nos
Coconut	Cocos nucifera	3
Betelnut	Areca catechu	2
Gulmohar	Royal poinciana	6
Badam tree	Terminalia catappa	1
Saptaparni	Alstonia scholaris	1
Karanj	Pongamia pinnata	1
kapok Tree	Ceiba pentandra	1
Pimpal	Ficus religiosa	1
Rain Tree	Samanea saman	1
Bakul	Mimusops elengi	1

Tree Species Common Name	Tree Species Botanical Name	Nos
Nilgiri	Eucalyptus globulus	2
Neem	Azadiracta indica	1
Vilayati Chinch	Pithecellobium dulce	1
Babhul	Vachellia Nilotica	3

6.3.2 Impacts During Construction Phase

Most of the anticipated adverse environmental impacts are related to construction works which are inevitable but are manageable through practices that are environment friendly. The negative environmental effects can be taken care of at an early stage through proper engineering design and through the contract during construction practices.

The construction works will involve are site clearance, desilting / re-sectioning, filling of earth materials, concreting, laying of bituminous mixtures, handling of hazardous materials like bitumen, diesel, etc., dumping of unusable debris materials, transportation of materials from production site to construction site, and other construction activities and associated works like mobilization of construction equipment, setting up of different construction plants, setting up of workforce camps, material storage etc. These activities have certain impacts of various magnitudes on different components of environment. As component wise work packages are not done at this stage, package wise exact locations for establishing worker camps not been finalized for the project. Location of work package wise camp site will be determined during tendering stage considering various environmental and social factors proposed in camp site mitigation plan. Facilities in work camp shall be provided and mitigation measures to be followed in accordance with guidance provided in ESMP (Chapter 7). The anticipated impacts due to all these activities have been discussed below:

6.3.2.1 Impacts on Soil Environment

Impacts on Soil Quality

Desilted material: The desiltation of 18.475km drainage channels and lakes proposed will lead into generation of huge quantum of desilted materials which would mainly sands, silt and sediments. Estimated quantity of silt to be generated due to desiltation estimated to be **525949 Cum**. As per the current disposal plan in KMC desilted material will be utilized for agricultural works, road construction works, building construction and filling of the low-lying areas. The solid waste from SWD channels is also proposed to remove during nala cleaning. Desilted material handling may also contaminate soil. This contamination is likely to be carried over to water bodies in case of dumping being done near water body locations. These short-term impacts will be mitigated with the adoption mitigation measures.

Table 6-3: Total Silt Removal in the Project

Proposed Intervention	Quantity of Desilted Material (in Cum)
Desiltation of Kalamba Lake	231512
Desiltation of Rajaram Lake	51121
Desiltation of Padtala	25813
Desilting of Sangeet vibhag Lake	13080
Desilting of Bhasha Bhavan Lake	21369
Desilting of Existing Farm Pond	8750
Desilting Nala	161138
29 hotspot Flood Locations	13166
Total	525949

Source: DPR of KMC, PriMove

Storage of Construction material and use of construction equipment: Soil quality may get deteriorated because of storage and handling of construction material at construction site. These short-term impacts will be mitigated with the adoption mitigation measures. The sites where construction vehicles are parked and serviced are likely to be contaminated because of leakage or spillage of fuel and lubricants. Construction machineries will be operational throughout implementation period of 36 Years. Approximately 5 tons per annum used oil is expected to be

generated from construction vehicles/machineries. These short-term impacts will be mitigated with the adoption mitigation measures.

Construction and Demolition Waste: Contamination of soil during construction stage is primarily due to construction and allied activities. Total C&D waste is expected to be generated as 8,79,457 CUM. These short-term impacts will be mitigated with the adoption mitigation measures.

Domestic Solid Waste from workers Camp: Solid waste will be generated from the construction camps and offices, which includes food waste, paper and plastic, and garbage. Domestic Solid waste from Construction camp with 40 residential workers is expected as 10 kg per day @ 0.25kg per day. 75% of the waste will be food waste. If these wastes are not properly managed, they may harm the environment and the health of workers and nearby communities. These short-term impacts will be mitigated with the adoption mitigation measures.

Impacts due to Top Soil Removal

The site clearance process will involve excavation. Total excavated material is expected to be 6,26,329.61 CUM. Site clearance activity will induce loss of top soil. Vegetation clearance shall be confined to the minimum area required for construction works. The area affected would be limited to the identified zones where embankment strengthening and retention wall construction, contour trenching is proposed. The activities associated with the site preparation and excavation plus movement of vehicles can disturb the surrounding land. There is chance of loss to top soil due to various activities such as temporary camp site, stockyards, and other ancillary sites. These short-term impacts will be mitigated with the adoption mitigation measures.

Impacts due to Soil Erosion

The problem of soil erosion may arise due to restoration of carrying capacity of existing SWDs, water storage capacity of lakes and carrying capacity of SWDs channels through desiltation. Construction of 137 cross drainage structures proposed, Flood relief CD structure at highway with jacking pushing at Pune highway and Kolhapur Panhala Road for out falling drainage channels near Panchganga river will be constructed. This may lead to soil and sediment transportation in downstream of the SWD if debris not removed properly during construction work. The desiltation activities may aggravate the erosion problem in the area if not addressed properly. The continuous contour trenching, earthen embankment, nalla bund, check dam may suffer with soil erosion problem if it is not properly compacted. The desilted area may also face the problem of sediment deposition due to erosion. These short-term impacts will be mitigated with the adoption mitigation measures.

6.3.2.2 Impacts on Water Environment

Water Requirement

The baseline study indicates that the water table in most of the areas has water table ranging between 5 to 15 meters BGL and falls under safe zones. However, no ground water extraction for construction water and domestic water requirement is proposed in the project. There will be increased load on existing drinking water sources for consumption of workers. The water demands for the construction work will not pose any serious stress on ground water as the KMC public water supply will be utilized for construction activities through supply and storing mechanism. It is observed that on an average daily 83 MLD of treated waste water (TWW) is generated and the quality results from the on-site monitoring system shows that it is fit for reuse. Currently, 4% (3 KLD) of the total treated wastewater is generally reused for dousing fire, site dusting at SWM site and for road median watering. The treated sewage water from STP in Kolhapur city can be reused for construction purpose.

The total construction workers are expected as 210 amongst which 40 workers may be residential and 170 may be non-residential. The water requirement in litres per day (lpd) for 40 residential workers @135 litres per head per day (lphd) will be 5400 lpd and for remaining 170 non-residential workers @45 lphd will be 7600 lpd. KMC water supply and packaged drinking water will be used for

consumption purpose. These short-term impacts will be mitigated with the adoption mitigation measures.

Water Quality

No permanent impact is anticipated on water quality due to the project. Construction, desiltation of drainage channel and lakes, re-sectioning of SWD channels, may temporarily deteriorate surface water quality near the alignment. Surface and ground water quality may get impacted due to mixing of oil and grease due to accidental spillage, deposition of C&D waste and desilted material from construction area. Waste water from the construction area containing cement slurry, grease and oils etc. are likely to flow to the nearest water body causing contamination of water.

The water contamination may also be caused due to waste discharge from construction camps and labour camps. The wastewater from construction camps is expected to be about 1175 litres per day. These short-term impacts will be mitigated with the adoption mitigation measures.

6.3.2.3 Impacts on Ambient Air Environment

Deterioration of air quality due to various construction activities along the project site is the most common impact. However, such impacts associated with construction activities are mainly localized and temporary in nature. Anticipated cause of air pollution during construction phase are because of desiltation of lakes and drainage channels and re-sectioning of SWD Channels and CD works, embankment strengthening and other construction activities like disposal of wastes, construction spoils & debris, movement of vehicles and machineries, running of batching plant, mixing plant and dismantling of existing inadequate SWD structures. These activities are expected to generate fugitive dusts which can be settle down quickly. The effect will be localized in nature but may have spread over effect on local habitations that are close to the embankment. The construction activities may give rise temporary deterioration of air quality in the habitation areas near the proposed project sites and will have impact on human health. The list of sensitive receptors exposed to the air pollution is represented in **Table 6.4.** These short-term impacts will be mitigated with the adoption mitigation measures.

6.3.2.4 Impacts on Ambient Noise Level

The noise pollution generated due to different construction activities is a temporary affair. Each type of activity can generate different type and levels of noise that continue for a short period during the operations of those activities. Operation of heavy machineries; movement of heavy vehicles, stone crushing aggregate mixing activities, demolition of existing structures generates high noise increasing the ambient noise level in the surrounding. There will be noise impacts on sensitive receptors like School & Hospital located within 100meter radius from proposed interventions sites in presented in **Table 6.4**.

Likely impact on noise pollution in the surrounding area will be significant. Also, workers working near the noise generating equipment and plants are likely to be exposed to high noise level. Noise generated due to various activities may affect health of the workers if they are continuously exposed to high noise level. For reasons of occupational safety, impact of noise should not exceed 90 dB(A) (peak acoustic pressure). Implementing proper mitigation measures will reduce noise pollution that will arise due to construction activities.

Table 6-4: Sensitive Receptors within 100meter Influence zone of Proposed Interventions

Sr. No.	Proposed Interventions	Sensitive Receptors	Sensitive Receptors Name and Location in Kolhapur City	Availability within 100m radius from proposed interventions/Strom water drains			
				Left/ Right	Distance (Mt)	Latitude	Longitude
1	Existing Earthen Bund to be Desilted	Residential	Jagar Nagar, Kalamba	Left	100	16.669056°	74.228639°
2	Proposed Earthen Bund	Residential	Jagar Nagar, Kalamba	Left	90	16.670139°	74.228194°
		Medical College,	Ch Raj Shahu Maharaj Govt. Medical College, Shendra Park	Right	100	16.672203°	74.232433°
3	Proposed CNB	Residential Area	Rajendra Nagar	Left	100	16.676179°	74.246423°
		University	Shivaji University Kolhapur, Vidya Nagar	Right	100	16.679214°	74.250773°
4	Lake Desilting	Residential Area	Navnath Nagar, Near to Kalamba Lake, Kalamba	Right	100	16.654028°	74.210909°
5	Proposed Sluice Gate and RCC Channel	Residential Area	Near Kalamba Lake, Kalamba	Right	50	16.654941°	74.218092°
6	Strom Water Drain Desilting	Park	Hutatma Park, Shivaji Udyam Nagar	Right	60	16.692598°	74.232719°
		Hospital	Aster Adhar Hospital, Shastri Nagar	Left	60	16.685176°	74.238038°
		Heart Hospital	Shree Siddhivinayak Heart Hospital, Y. P. Pawar Nagar	Left	30	16.688469°	74.237364°
		College	Gopalkrishna Ghokhale College, Mangalwar Peth, Shivaji Udyam Nagar	Left	20	16.691974°	74.231688°
		High School	Baba School, Baba Jarag Nagar, Pach Gaon	Right	90	16.665383°	74.225732°
		School	Sai English Medium School, Baba Jarag Nagar, Pachgaon	Right	90	16.663617°	74.226896°
7	Proposed Strom Water Drain	School	Shantiniketan School, Morevadi road, Near Shivaji University, Ratanappa Kumbhar Nagar	Right	50	16.666026°	74.257380°
		College	Industrial Training Institute, Kalamba Road, Tapowan	Left	60	16.674850°	74.220650°
		School	Podar International School, Mahada Colony, Survey Nagar	Right	30	16.664703°	74.199801°
		Park	Jivabha Nana Jadhav Park, Aurvey Nagar	Left	30	16.660519°	74.198526°
8	Proposed Box Drain and Duct	Residential	Devkar Panand Chwak	Both	20	16.680066°	74.213599°
9	RCC Open Drain and Box Culvert	Residential	Behind Nikam Park	Both	30	16.678591°	74.215086°
10	Proposed Box Drain	Residential	Raj Luxmi Nagar, Kolhapur	Both	20	16.681671°	74.211714°
11	Proposed Nalla Desilting	Residential	Prince Rajaram Colony Laxthirth Vasahat	Both	20	16.701324°	74.195895°
12	Proposed Retailing Wall and Nalla Desalting	Residential	Dhudhali Nalla	Right	30	16.697855°	74.214412°
13	Proposed Drain and Ground Box Drain	Commercial	Parvati Multiplex	Both	20	16.697205°	74.235188°
14	RCC Drain	Temple	Bagal Chowk	Both	20	16.698033°	74.238215°
15	Proposed Drain and Open Drain	Residential and Commercial	Parag Pool Nalla	Both	10	16.699273°	74.241000°
16	Proposed Drain Box	College	Low College Chowk	Both	30	16.699781°	74.241914°

Sr. No.	Proposed Interventions	Sensitive Receptors	Sensitive Receptors Name and Location in Kolhapur City	Availability within 100m radius from proposed interventions/Strom water drains			
				Left/ Right	Distance (Mt)	Latitude	Longitude
17	Proposed Drain and RCC Box Drain	College and Commercial	Janta Bazar Chowk	Both	30	16.698436°	74.242141°
18	Proposed Box Drain	Residential	Rajaram Puri 1 st Lane	Both	20	16.698021°	74.242903°
19	Proposed SWD	Residential	Mahadik Park Rajaram	Both	20	16.692921°	74.252201°
20	Rain Water harvesting and Open Drain	Residential	Vidya Nagar	Both	30	16.692323°	74.253305°
21	Rain Water harvesting and Open Drain	School	Radhabai Shinde School, Vidya Nagar	Both	30	16.689486°	74.252268°
22	Proposed Drain	Residential	Nilgiri Apartment, Kolhapur	Right	20	16.677780°	74.245569°
23	Inlet Chamber and Grating, Open Drain	Stadium, Temple	Ravbeshwar Mandir, Near Shahu Maharaj Stadium	Both	20	16.693765°	74.229565°
24	RCC Box Drain and Inlet chamber and greeting	Commercial, government office, and Garden	Collector Office Basant	Both	30	16.707701°	74.233133°
25	Retailing Wall, RCC Drain and Nalla desalting	Residential and College	Patil Wada, Near Mahavir Chowk	Both	30	16.711042°	74.232333°
26	Proposed Nalla desalting and Low laying area	Residential and Commercial	Shahupuri Gavat Mandai	Both	20	16.699617°	74.232627°
27	Proposed Box Drain	Residential	Mukta Sainik Chowak	Both	30	16.709876°	74.260069°
28	Proposed Box Drain and Open Drain	Residential	Ashtakvinayak Colony, Vikram Nagar	Right	20	16.699724°	74.264704°
29	Open RCC Drain, Proposed Pipe Culvert	Residential	Pragati Society, Vikram Nagar	Both	30	16.695501°	74.261809°
30	RCC Box Drain	Residential and Commercial	Rasika Hotel to Sappihire, Mukta Sainek Colony	Both	30	16.710094°	74.265026°
31	Proposed Box Drain, RCC Open Drain	Residential	Unik Park Lisha Hotel, Kadamwadi	Both	30	16.709535°	74.254390°
32	Box Drain, and Box Culvert	Residential, Temple	Renuka Mandir Chowk Bawada	Both	30	16.730291°	74.241733°
33	Box Drain and UCR Drain	Residential	Tramboli Nagar, Bavada	Both	20	16.728882°	74.242590°

6.3.2.5 Impacts on Ecology and Biodiversity

Impacts due to Desilting

Desilting of lakes is proposed to enhance water holding capacity in the lake and increase its volume. However, desilting may impact ecology and biodiversity of lake sediment. It is suggested to perform the desilting works in the summer season, as the lake is seasonal and hence the impact on the biodiversity, especially the aquatic environment will have minimal impact. Desiltation process may result into oxygen depletion. A relatively common concern with lake desiltation involves destruction of the benthic and fish community. Thus, desiltation process may be conducted in the batches and at one or two locations at one time which will help in reestablishment of benthic and fish community in short period.

As per the sediment analysis, the silt material does not contain heavy metals and is rich in nutrient contents. The sit can be used as manure for landscaping and agriculture activities and remaining if any shall be disposed at designated silt dumping area within KMC boundary.

Impacts due to Plantation / Dense Forest Development

Approximately 1,75,200 trees plantation is proposed on 146 Ha of land at various locations. This will enhance ecology and biodiversity in the area. Change in topography and Landuse is anticipated. Risk of cultivation of exotic species that may impact native populations. Fertilizers use for plantation may deteriorate the groundwater quality and nearby water bodies as per project description because Surface run off water from plantation areas. Hight contents of nutrients in fertilizers may promote excessive growth of aquatic plants (such as algae, weed and water hyacinth) in the nearby water bodies.

6.3.2.6 Impact on Cultural Sites and heritage structures

The baseline has identified that are no historical and archaeological monuments near the project sites. Though there are no historical and archaeological monuments near the project sites, there are places of worship near the construction sites as mentioned in **Table 6.4**. Construction-related nuisances may impact the visitors. During earthworks, there could be some chance finds.

6.3.2.7 Impacts on Existing Traffic in the City

The construction activities can potentially impact the residents of settlements along the access roads, particularly the movement and safety of school children and elders. Due to traffic movement air and noise pollution is anticipated. Due to the increased use vehicles on the narrow roads in the project area, pedestrians, particularly elderly people, and children, will be more exposed to dangerous situations, leading to traffic accidents.

These roads have already been constructed as part of city's trunk infrastructure development as arterial and sub-arterial roads. No other village roads need to be used as all the disposal sites are next to the trunk roads within KMC. However, the settlements immediately next to the transportation referred roads would be subjected to potential road safety risks and fugitive dust and noise pollution. These impacts need to be addressed with relevant environmental management measures.

6.3.2.8 Community Exposure to Natural Disasters, Work Hazards, Communicable Diseases

Communities will be exposed to construction-related hazards due to excavation and heavy vehicular movements. These risks will be more at the construction works located close to the existing settlement in KMC. The area is a flood prone zone and the works and communities including labour may get exposed to these.

Also, there is major risk from snakes is anticipated in the project during construction works. The evacuation of snakes, scorpios from SWDs and Lake during desilting can cause major harm to workers and nearby community.

Labor influx may lead to negative impacts on the host community. Pre-existing social issues in the host community can easily be worsened by the influx of labour. The potential risks associated with labour influx are social tension arising between the local community and the construction workers, which may be related to differences due to competition for local resources, an increase in the rate of crimes and/or perception of insecurity by the local community, increased burden on and competition for public service provision, and the influx of people may bring communicable diseases to the project area, including sexually transmitted diseases (STDs), infectious diseases such as COVID-19, or the incoming workers may be exposed to diseases to which they have low resistance. The presence of workers in local communities can also result in intimate relations as well as sexual exploitation and abuse, and sexual harassment.

6.3.3 Impacts during O&M Phase

6.3.3.1 Impacts due to SWD Channel Operation

SWD Channel maintenance on regular basis could lead minor civil works and associated construction facilities. The maintenance works could lead to debris generation and marginal impacts. These impacts need to be managed with relevant environmental management measures.

The green buffer zones along the SWD channels, if not managed as per the design standards, could lead to channel side degradation including encroachments, disposal of municipal waste, construction debris, etc. In order to avoid such impacts, the ESMP lays basic minimum standards to be maintained along the channel network. Some antisocial activities may happen in green buffer area along the SWD.

Discharge of untreated effluents, silt & debris, and solid waste through natural storm water drains could occur. In such an event the aesthetics and the physical environment could be seriously affected. These impacts could be effectively managed since Kolhapur City has an elaborate waste management strategy integrated in to city development plans by KMC. However, specific environmental management measures need to be followed to avoid such a scenario.

Safety: given open channel configuration, there is potential risk of safety. This aspect has been addressed as part of the design measures by providing access control and safety railing and retention wall at adequate settlement locations.

Maintenance desilting in Lakes like Kalamba, Rajaram and Padtala and SWD channels will be regular activity in the project. The removed silt may impact on land resources i.e. increased load on dumping ground of KMC specifically for silt. These impacts need to be managed with relevant environmental management measures.

6.4 Social Impact Assessment

The project brings numerous positive impacts but also cause adverse social impacts in terms of loss of non-land assets and loss of livelihood particularly the vulnerable sections of the society who are susceptible to socio-economic risks. Assessment of such impacts and development of mitigation measures during the project preparation help achieving the social acceptance of the project. This section of the report presents the social impact assessment of the project. It details out the project benefits, the associated, and measures adopted to minimize the adverse social impacts.

6.4.1 Regarding requirement of SIA

Screening exercise has been undertaken for the project, and screening exercise indicated the limited impacts of the project. Most of the impacts are anticipated on the social and environmental sensitive receptors located within the proposed RoW. For construction of the Nallas, additional private, government and community land is not required. Thus, Involuntary Resettlement will not be triggered on the project. Further there are no tribal or scheduled/indigenous population residing in the project area thus World Benk ESS 7 is also not applicable on the project.

In the present study, likely impact and its extent on various E&S parameters are studied by assessing the baseline social status of the area and estimations are made as how this will change with commencement of project activity. The mitigation measures have been worked out with a view to bring down the levels of impacts within limits. In each of the areas of impact, measures have to be taken to mitigate adverse impacts and where these are beneficial in nature such impacts are to be enhanced. The potential E&S impacts due to the project has been studied for different stages of the project, i.e., design and pre-construction stage, construction stage and operation stage.

6.4.2 Impact on Project structures and Common Property Resources (CPR) Structures.

The MRDP project brings numerous positive impacts but also cause adverse social impacts in terms of loss of non-land assets and loss of livelihood. Assessment of such impacts and development of mitigation measures during the project preparation help achieving the social acceptance of the project. This section of the report presents the social impact assessment of the project It details out the project benefits, the associated, and measures adopted to minimize the adverse social impacts. Following table describes summary of potential Social Impacts.

Table 6-5: Potential Social Risks and Impacts

Key Intervention	Potential Social Risks and Impacts
Nalla Rehabilitation (dredging, retaining walls).	There is no loss of property due to proposed the new strom water alignment parallel to existing stormwater drain to save the loss of property and livelihood.
Disruption or demolition of Community Property Resources (CPRs)	There is no loss of property due to proposed the new strom water alignment parallel to existing stormwater drain to save the loss of property and livelihood
Impact on Livelihood.	There is no impact on livelihood

- **Land Acquisition Requirement:** There is no impact on private, government and community land in this project. The impact is avoided by proposed the new strom water alignment parallel to existing stormwater drain to save the loss of property and livelihood
- **Impact on Encroacher:** one encroacher running a business on moveable shop which will be affected but there will be no livelihood loos. The shop keeper will provide temporary location within the area to avoid loss of livelihood.
- **Impact on Livelihood:** There is no impact on livelihood **Businesses:** There is no impact on business or livelihood
- **Impact on Community Resource Property (CPRs):** There is impact on 1 community toilet in Shastri Nagar area, one temporary structure of youth club office structure in Vidhya Nagar.
- **Temporary Impact on Access Roads:** there are 35 likely affected access roads which will be temporarily affected the access to residential, commercial structures as well common roads.
- **Labour:** there will be labour movements and labour influx due to the project during construction phase. There will be labour camps and possibility of conflict with host community.
- **Gender Based Violence (GBV):** due to labour influx, there will be chances of violence against women and girls and also within labour camp.

Utility Shifting

- There will be impact on 34 Electrical Poles which will be shifted before implementation.
- There will be impact on 9 Transformers which required relocated before implementation.
- Around 186mts Water Supply line will be relocated before implementation.
- There will be impact on 114mts Electrical Cables which required relocated before implementation.
- Around 50mts Optical Fibber will be relocated before implementation.
- There will be impact on 2 Fuse Boxes which required relocated before implementation.

There will be impact on 52mts Gas Pipe Line which should be reinstalled before implementation.

6.5 Positive Impacts Anticipated from Project

Robust Stormwater infrastructure and its management is essential to prevent flooding of Kolhapur City during monsoon. It will reduce severe damages to environmental and social infrastructure in every monsoon. The sub project will have a positive long- term impact on city storm water management, the state's economy, living standards and quality of life of local population. Project will improve in Public Health Conditions by reduction in waterborne diseases and vector transmitted diseases by eliminating water logging during rainy/wet seasons. Project will have employment opportunities in both construction and operation stages of the project. Removal of silt and solid waste from the drains will increase the carrying capacity of storm water in the drains. City will experience improved environmental aesthetics and cleaner air due to reduced odour from the polluted waterlogged areas/ road surface/ lawns etc.

The project will implement CCT which will prove useful in soil erosion control and reduce siltation in Kalamba lake and natural storm water system in the surrounding area during rainy season. It will help in water conservation in the treated micro-watershed, leading to considerably higher groundwater recharge and less evapotranspiration (ET) than in the untreated micro-watershed. In this context, CCT is reported to decrease the surface runoff by as much as 80 to 85%. One recent case study of CCT is Manoli Watershed Development Project, Akola of Maharashtra State of India where 90% surface runoff is decreased after CCT implementation[22].

Approximately 1,75,000 trees will be planted on 146 ha of land at suitable location as described in project details. This will decrease overland flow volume and increase natural groundwater recharge Programme will enhance ecology and biodiversity of the area. Indigenous tree species of fruit and flower bearing can generate livelihood opportunities to local people by their participation in the programme along with KMC officials.

ENB, CNB and check dam will further benefit long term in storm water retention by reducing water flow velocity and volume. It will help in water percolation which will increase surrounding water level in wells and bore well.

The total flood volume estimated under future land use and a 5-year return period climate change scenario is 1,625.5 million litres. With the implementation of both grey and blue-green infrastructure solutions, this volume is expected to reduce to 1,324.5 million litres, representing an 18.52% reduction compared to the baseline.

[22] IGWDP Maharashtra and NABARD – A Study of Watershed Development Programme - 1998

Chapter 7 : Environmental and Social Management Plan (ESMP)

7.1 Overview of ESMP

Based on the assessment of potential negative impacts referred to as in Chapter 6 above, this chapter will present Environmental Management Plan (EMP) for the works of the amended and supplemented items for the sustainable development project of Flood Mitigation Works. An ESMP is an instrument that details (a) the measures to be taken during the implementation and operation of a project to eliminate or offset adverse environmental impacts or to reduce them to acceptable levels; and (b) the actions needed to implement these measures. ESMPs are therefore important tools for ensuring that the management actions arising from ESIA processes are clearly defined and implemented through all phases of the project life cycle. This plan also helps an organization map its progress toward achieving continual improvements.

The EMP has been prepared for three stages of storm water drainage construction activities as: (i) Pre-construction Stage; (ii) Construction Stage; and (iii) Demobilization/ Operational Stage.

7.1.1 Objective of This EMP

- To prepare a document which sets forth all the measures identified by the client
- To prevent, minimize, mitigate and compensate for the potential negative impacts derived from the flood mitigation works, as well as to strengthen the positive impacts.
- To define the parameters and variables to be used to assess the environmental quality in the influence area of the Project.
- To establish the mechanisms so that pertinent authorities can follow up on the Project environmental variables and implement the necessary controls.
- To design the mechanisms for accident prevention and response, and for contingencies which may arise during the execution and operation of the project

A brief overview of different type of management plan with their status and future action plan is tabulated in below **Table 7.1**. Contract package specific ESMP shall be developed by respective PIU with support from safeguard specialist at PMTC and Contractor's ESMP shall be prepared by contractor with guidance from safeguard specialist at PMTC and vetted by PMU.

Table 7-1: Overview of ESMP

Name of the ESMP	Timeframe for development	Responsibility for development	Approved By	Key features of the ESMP
Project ESMP	Developed (presented in Chapter 7 of this document).	Developed by PMU with support from ESIA Consultant.	World Bank	Provides mitigation measures specific to each project activity under component 2.2 • ESMP Includes mitigation plans on the following: - Activity specific ESMP under component 2.2 is given in **Table 7.2** for Preconstruction, Construction and Operation Stages; - Social Management Plan in **7.3 Section** - Construction Management Plan in **7.4 Section** - Workers' Camp Management Plan in **7.5 section** - Tree Plantation Strategy in **7.6 section** - Gender Based Violence Management Plan in **7.7 section** - Traffic Management Plan in **7.8 section** - Occupational health and safety management plan in **7.9 section** - Vectors, rodents, snakes management plan in **7.10 section** - Excavated earth material management plan in **7.11 section** - Waste management plan (Construction waste/solid waste/Sediment/Silt) in **7.12 section** - Integrated Pest Management Plan **in 7.13 Section** - Community health and safety management plan in **7.14 section**
Contract package ESMP	To be developed for each subsequent contract package parallel to the contract package development.	Developed by PIU with support from safeguard specialist at PMTC.	PMU	• Provides mitigation measures specific to the contract package with relevant links to the items in the Bill of Quantities and to the contract conditions. • Includes management plans on the following critical issues: • Activity specific ESMP; • Waste Management Plans; • Labor Influx and Construction Workers Camp Management plan; • Management plan for Construction related issues;
Contractor's ESMP	To be developed for each contract package within 14 days of delivery of letter of acceptance.	• Developed by Contractor with guidance from safeguard specialist at PMTC • The Contractor's ESHS shall be approved by the Project Manager prior to the commencement of construction activities. • The approved Contractor's ESHS shall be reviewed periodically by the Project Manager and updated in a timely manner, as required, by the Contractor with prior approval of the Project Manager.	PMTC	• Provides action plan for implementation of mitigation measures including details of quantities, locations, tie-ups with third party entities, etc. • Includes implementation plans on the following critical issues: • Waste Management; • Labor Influx and Construction Workers Camp Management; • Construction related issues;

A key provision for ensuring implementation of environmental and social safeguards is the Environmental, Social, Health and Safety (ESHS) Performance Security, amounting to 2% percent of the Contract Amount, which is to be submitted by every successful Bidder (Contractor) within twenty-one (21) days of the receipt of the Letter of Acceptance.

7.2 Environment Management Plan (EMP) for Component 2.2

The various EMP measures during pre-construction (planning and design stage) and construction stages are listed in this plan, including the monitoring indicators, monitoring plan. EMP is presented in **Table 7.2**.

Table 7-2: Activity Specific EMP Under Component 2.2

Project Activity	Impacts	Mitigation Measures	Time Frame	Planning & Implementation	Monitoring & Supervision
Pre-Construction Stage					
Compliance to Regulatory Requirements		Prior permission will be taken from line department like • Electric Pole Shifting; • Telecommunications (for OFC underground cables, etc), • Water Pipelines (PHE), etc. • Sewerage Pipeline; • Labour license from Department of Labour for employment of labours • Permission for Labour camp establishment and consent from MPCB under water and air act • For setting–up of Batching Plant, Stone Crusher Plant (required during restoration works) Consent to Establish and Consent to Operate will be obtained from MPCB • All clearances required from other departments and Environmental aspects shall be ensured and made available before start of work. • Acquire construction permit, • Provide Water management guidelines if subprojects are executed near surface watercourses. • **Refer Table 3.4**	Before Construction	Contractor	PIU

Project Activity	Impacts	Mitigation Measures	Time Frame	Planning & Implementation	Monitoring & Supervision
Construction Camp Locations - Selection, Design & Layout	Impact on Land resources, Impact on community	• If a contractor decides to establish a labour camp, the siting of the camp will be as per the guidelines given in **Annexure 7.1** and the layout of camp will be approved by PIU. • GIIPs for camp design and management, for Workers' accommodation: processes and standards guidance note by IFC and the EBRD. • Labour camp will not be established within 250 to 300m from the nearest settlement to avoid conflicts and stress with the local community. • The Contractor will obtain consent from land owners in writing for temporary use of labour camp, etc. • Planning of labour camps, needs to be done before construction to ensure adequate water supply, sanitation and drainage etc., in conformity with the Indian Labour Laws. Contractor will develop labour management plan along with campsite management plan before construction starts	Before Construction	Contractor	PIU/PMU
Tree Cutting	Loss of biodiversity	• 25 Tree are expected to be cut • Permission of tree cutting to be obtained from KMC Garden Department. Tree plantation i.e. dense forest development is already proposed on 146Ha of area. **Please refer Section 2.7.** • All efforts will be made to preserve trees by restricting tree cutting within the working zone. • Special attention will be given for protecting large trees with higher canopy size and locally important trees that are having cultural importance for the local people; cutting of holy tree Ficus religiosa (Peepal) will be avoided to the possible extent. • Compensatory plantation is planned to carry out in the project at ratio of 1:5 (**Section 2.7**);	Before Construction	Contractor	PIU/PMU
Planning for Construction Material Supply	• Use of natural resources for construction activity • Sourcing of material from unauthorized sources	• Requirement of construction material will be planned only from permitted sites and licensed/authorized quarries and authorised suppliers only in consultation with KMC/PIU • If contractor intends to procure construction materials from local authorized third-party agencies, then the contractor will collect and submit clearance/approval from PIU.	Before Construction	Contractor	PIU
Other Construction Vehicles, Equipment and Machinery		• All vehicles, equipment and machinery to be procured for construction/ protection work will conform to the relevant Bureau of Indian Standard (BIS) norms/ CPCB standards. The discharge	Before Construction	Contractor	PIU

Project Activity	Impacts	Mitigation Measures	Time Frame	Planning & Implementation	Monitoring & Supervision
		standards promulgated under the Environment Protection Act, 1986 and Motor Vehicles Act, 1988 will be strictly adhered to. • The contractor will maintain records of Pollution Under Control (PUC) certificates for all vehicles used during the contract period, which will be produced to Project Implementation Unit for verification whenever required.			
Traffic Management Plan	Traffic Impact	• The construction of the SWD system in KMC are located in residential, commercial zone. • The excavation of trenches, laying of drainage pipes and the construction of manholes will lead to disruption of traffic movement in the area in mainly internal colony roads and main road of the city. • It is essential that before start of the construction works, the contractor will prepare site-specific traffic management plan in consultation with PIU to transport construction materials, excavation activities, laying of drainage pipes/ manhole construction, etc. • Community heads of the locals should be taken into confidence in order to streamline pedestrian and vehicular movement within the affected areas. • Contractor to incorporate the above measures in the traffic management plan. • The contractor will make an effort to transport materials to the site in non-peak hours or at night time. Contractor to follow timing schedule as per SMC protocol i.e., 8:00 pm to 8:00 am.	Before Construction	Contractor	PIU/PMU
Design consideration for Flood Control	Disruption to Natural resources during Flood Control measures implementation, change in topography and Land Use	There are many design considerations taken for the project such as: • Design of storm water drains considering the peak run-off and discharge capacity of drains. • Erosion control measurements design. Continuous Contour and trenching are proposed on 146Ha area to control soil erosion. **Section 2.7**. • Proposed Embankment, Earthen Nalla Bund, Retention wall, sluice gate to be designed as per Seismic activity of the area • Using natural slope to the extent possible so that Minimal intervention to the natural contour • Management of catchment area with plantation etc. • Avoiding the interventions near to the Eco sensitive areas and ASI / Heritage structures	Design Stage	DPR Consultant	PMU, PIU, World Bank
Construction Phase					

Project Activity	Impacts	Mitigation Measures	Time Frame	Planning & Implementation	Monitoring & Supervision
Air Environment					
Clearing, grubbing, excavation and levelling	• Dust Generation • Vehicular emission • Deterioration in Air quality	• Use of tarpaulins to cover earth material when transported by dumpers and fit all heavy equipment and machinery with air pollution control devices, which are operating correctly. • Dust emission from stockpiles of excavated material will be controlled either by covering the stockpiled or by spraying water over it; • Regular water sprinkling at construction sites and access roads. • Enforced appropriate speed limit for vehicles engaged in construction activities. • As soon as construction is over in a specific zone, all the unutilized and surplus earth will be will be removed from the site and disposed-off properly; • Ensure that the air quality levels are constantly monitored.	During Construction	Contractor	PIU and PMTC
Operation of Vehicles, Equipment, and machinery	• Accidents and injuries to workers and risk to community health and safety	• Pollution under control (PUC) test shall be conducted on regular basis and PUC certificate shall be submitted to PIU. • Ensure regular maintenance of vehicles, boats to avoid leaks of oil • Please Follow Construction Related Issues and Mitigation Measures in **Table 7.3**	During Construction	Contractor	PIU and PMTC
Transporting Construction Materials for construction work at intervention site	• Dust Generation • Vehicular emission • Deterioration in Air quality	• The contractor will maintain all roads, which are used for transporting construction materials, equipment and machineries. • All vehicles delivering fine materials like aggregate, cement, earth, sand, etc, to the site will be covered by Tarpaulin to avoid spillage of materials and windblown dust from top of the vehicles. • Existing road used by vehicles of the contractor or any of his subcontractors or suppliers of materials will be kept clear of all dust/mud or other extraneous materials dropped by such vehicles. • All vehicles, equipment and machinery used for construction will be regularly maintained to ensure that pollution emission levels are below the prescribed CPCB standards; • Pollution Under Control (PUC) certificates will be mandatory for all vehicles / equipment / machinery to be used for the project works; • The contractor will make an effort to transport materials to the site in non- peak hours or in the night time.	During Construction	Contractor	PIU and PMTC
Water Environment					
Water requirement for project	Impact on Water resources	• No Ground water will be used in the project for construction purpose of civil works or domestic purpose in worker's camp	During Construction	Contractor	PIU and PMTC

Project Activity	Impacts	Mitigation Measures	Time Frame	Planning & Implementation	Monitoring & Supervision
		• KMC water will be used for domestic purpose at workers camp area • Tanker water from KMC will be used for construction works • Treated sewage water from STP can be reused for the construction works • Packaged drinking water will be used at construction camp • Wastage of water by labour shall be discouraged.			
Generation and management liquid waste	Contamination of surface / ground water	• Desiltation of lakes and SWD channels as proposed in **Section 2.7** and resectioning of SWD channels will be carried out only during non-monsoon period; • Silt traps are proposed to prevent floating matters and silt discharging to SWD in downstream. • Silt trap, trash screens, gabion structures are proposed at Kalamba Lake to avoid the soil erosion and silt transportation from upstream in the lake • Provide siltation or sedimentation chambers (or similar structures) at the outfalls of the drainage system to prevent solid wastes or silts from flowing directly to the receiving body of water • The Contractor will take all precautionary measures to prevent the wastewater generated during construction works from entering into water bodies; • Generated waste and earth will be properly disposed-off so as to avoid its in-flow to the water source; • The camp sites, plant site, stockyards and servicing centres will be established sufficiently away from water sources (river stream, channel and nearest water bodies) and will be provided with proper drainage system (garland drains) to regulate water flow from such sites; • All water and liquid wastes arising from construction activities will be properly disposed-off and will not be discharged into SWD / water bodies around the project area without treatment; • Adequate sanitation and waste management facility shall be provided in the construction camp. @1 bio mobile toilet with for 10 workers will be provided • Construction work close to water bodies will be avoided during the rainy season. • No construction materials / spoils will be stored along the water bodies and adequate provision will be made for preventing spillage of materials into these water bodies.	During Construction	Contractor	PIU and PMTC

Project Activity	Impacts	Mitigation Measures	Time Frame	Planning & Implementation	Monitoring & Supervision
		• All construction vehicle parking location, fuels/lubricants storage sites, vehicles, machinery and equipment maintenance sites are located at least 100 m away from any water body. It should be ensured that spillage of fuels and lubricants do not contaminate the ground. • Collection and storage of oily wastes and its handing over to the authorized hazardous waste collector; • Deposit the excavated material only at the specified site without disturbing the natural drainage. • Inspect facilities provided such as Bio toilets, Septic tank, disinfectant/ hand sanitizer etc.) • Ensure facility provided align with the expected number of workers • Regular water quality testing and monitoring during construction activities shall be carried out			
Soil Environment					
Domestic Waste Generation from Construction Workers Camp,	Impact on Soil quality	• Solid waste generated at the campsite will be collected in covered waste bins. Then, it will be segregated as biodegradable (food waste, paper, etc) and non-biodegradable (plastic, polyethylene bag, etc) wastes. Polyethylene/plastic wastes will be stored in empty cement bags and to be sent Zoom Project for management. • Biodegradable (food waste, paper, etc) solid waste and non-biodegradable inert wastes will be sent to the landfill site of KMC. • Proper drinking water, well-ventilated accommodation, sanitation, canteen facilities will be provided to workers at the labour camp. • Suitable signages will be displayed at labour camps. • LPG gas cylinders will be provided for cooking. • Procure the services of waste management contractors for collecting and managing recyclable waste in consultation with KMC • No disposal sites will be established by the Contractor.	During Construction	Contractor	PIU and PMTC
Storage of construction materials, oils and lubricants	Impact on Soil quality	• Contractor in consultation with PIU shall identify the site for temporary use of land for construction sites /storage of construction materials including pipes etc. These sites shall not cause an inconvenience to the local population/traffic movement. These locations shall be approved by the PIU. • Designated storage site with proper sign board for oil, lubricants and similar produces • Selection of location for materials storage and equipment lay-down areas must take into account prevailing winds, distances to	During Construction	Contractor	PIU and PMTC

Project Activity	Impacts	Mitigation Measures	Time Frame	Planning & Implementation	Monitoring & Supervision
		adjacent land uses, general on-site topography and water erosion potential of the soil. Impervious surfaces must be provided wherever necessary. • Protect material stockpiles from storm water (e.g. by excavating a cut-off ditch around stockpiles to keep away storm water). • Enclosed storage for fuel with non- permeable flooring. • The contractor shall cover material stockpiles with tarpaulin or other materials. Avoid stockpiling material near water bodies. • Proper cover and stacking of loose construction material will be ensured during the construction of outfall structures at the construction site to prevent surface runoff and contamination of receiving water bodies. • Staff dealing with these materials/substances must be aware of their potential impacts and follow the appropriate safety measures. The contractor must ensure that its staff is made aware of the health risks associated with any hazardous substances like bitumen, diesel, used oil and has been provided with the appropriate protective clothing/equipment in case of spillages or accidents and have received the necessary training. Necessary training and awareness programs shall be carried out to make aware the contractor and its staff aware of the hazardous nature of substances.			
Desilting of Kalamba and Rajaram akes lakes and SWDs as per proposed interventions	Impact on Soil and Land due to improper management of desilted materials	• **Total 525949 CUM** of silt is expected to be removed from SWD an Lakes as per interventions. • Silt removed will be sent to existing Silt Disposal area within KMC boundary • Sediment trapping system shall be adopted during desiltation work to arrest sediment release on downstream; • No stacking of desilted material on nearby habitation, empty plots during monsoon period; • Desilted quality is tested and results are depicted in Chapter 4. Sediment quality is suitable for agriculture and cultivation purpose. • Presently the farmers around the city are using the sediment for agriculture and landscaping. • The silt can be used in proposed plantation area of 146Ha in the project • Desilted material shall extensively be utilized in construction and civil work proposed under this project;	During Construction	Contractor	PIU and PMTC

Project Activity	Impacts	Mitigation Measures	Time Frame	Planning & Implementation	Monitoring & Supervision
Excavation, grubbing	Top Soil excavation	• The top soil will be preserved separately and will be reused for landscaping, grass turfing and site restoration work; • The top soil will be stripped to a specified depth of 6-8 inches and stored in stockpiles of height not exceeding 2 m. Piling of the top soil should be made away from water ways. The heap of the top soil will be covered with grass cover to minimize air pollution; • The stored topsoil will be spread back to maintain the soil physio-chemical and biological activity. The preserved top soil will be used for restoration of sites, in landscaping and avenue plantation proposed in the project;	During Construction	Contractor	PIU and PMTC
Construction of SWD system as proposed	Soil Erosion	• The earthen embankments will be provided with chutes and drains, where ever required, to minimize soil erosion; • All cross bund for dewatering or transportation of vehicle/ machineries shall be removed immediate after completion of proposed work; all bund/ ramp shall be cleared and levelled properly before monsoon season to maintain natural water flow; • Retaining walls are proposed to construct at embankments in critical areas.	During Construction	Contractor	PIU and PMTC
Noise Environment		•			
Noise from Vehicles and Equipment Operation	Noise from construction vehicles and equipment will lead to noise pollution and cause health and safety issues	• Construction operations should be undertaken primarily during daytime, i.e., 6:00am - 6:00pm, to minimize the noise impact and prohibited between 9 p.m. to 6 a.m. • The equipment used in construction shall strictly conform to the MoEF&CC/ CPCB noise standards and shall have the latest noise suppression mountings. • All noise generating equipment will be installed sufficiently away from settlement areas and sensitive receptors like school and hospital will not be permitted within 100-meter radius of sensitive receptors/ silence area or zone (i.e. school/ college/ hospital) during active working hours; • Provide and enforce the usage of hearing protection devices (ear plugs/muffs) for workers exposed to high noise levels. • Install appropriate safety signage and/or use signallers at strategic locations to avoid occurrence of any untoward incident. • Vehicles and equipment used will be fitted with silencer/ noise barrier and maintained as per the regulation; Any noise generating machineries used within 100 m periphery of Hospital shall be provided with noise shields/ barrier and vibrating damper	During Construction	Contractor	PIU and PMTC

Project Activity	Impacts	Mitigation Measures	Time Frame	Planning & Implementation	Monitoring & Supervision
		• Routine Noise monitoring with Noise meter instrument shall be done.			
Ecology and Biodiversity					
Loss of Trees / Felling of trees	Cutting trees can lead to loss of biodiversity	• Loss of commercial trees due to erosion and project activities shall be compensated as per the eligibility of compensation provision in the RAP • Clearing and uprooting shall be avoided beyond that which is directly required for construction activities. • Wherever possible, avoid the removal of existing mature trees, which form important visual focal points, very old age. • No tree felling will be allowed beyond the identified working zone; cutting of Ficus religiosa (Peepal) shall be avoided to the possible extent; • All the trees located in camp site, stockyards, disposal area and other allied sites will be preserved; • The project will have 9079 trees plantation along the Jayanti and Gomati Nala, 30000 in Shivaji university and 25200 in Shenda park in consultation with University, KMC garden department and Forest department of Kolhapur if required. Total 120000 plants will be planted over GP Gairan in the catchments of Kalamba Lake along with loose boulder structures to avoid erosion. Mixed plantation with locally grown species will be promoted in consultation with KMC Garden Department; NOC from GP regarding use of land is to be obtained. • Bamboo palisade will be provided around plantation area; after care measures for a period of three year will be taken up • In proposed green belt development alongside SWDs only indigenous species will be planted. Invasive species present a significant risk to biodiversity and can be easily spread unintentionally or intentionally through a lack of awareness of the risks. Measures are therefore required to not intentionally introduce any new alien species. • The strategic planning will be implemented like retain the tree by covering with cement box, transplantation at proposed plantation location **(section 2.7).** • LPG will be used as fuel in workers camp	During Construction	Contractor	PIU and PMTC
Disturbance to Fauna	Construction activities and workers may cause	• In case of finding of any fauna during construction, safeguard measures will be taken, i.e., (1) no harm to any fauna by the construction workers, (2) care by the construction vehicles to avoid	During Construction	Contractor	PIU and PMTC

Project Activity	Impacts	Mitigation Measures	Time Frame	Planning & Implementation	Monitoring & Supervision
	harm to fauna and vice versa	accidents to fauna, (3) information to forest dept. in case of any encounter takes place with wild animals. • Any animal sightings in this case snakes, scorpios during desiltation, construction works at SWDs and lakes will be recorded immediately by the Contractor and Sarpa Mitra will be contacted for relief. **(Annexure 7.2)** • The list of Sarpa Mitra will be kept at construction site and camp site to get immediate help. • Training to the workers on the potential impacts of their behaviour will be given prior to construction work during induction programme. • All the workers will need to be oriented so as not to cause any harm to the fauna, and handout on SOP shall be distributed to the supervisors. • First aid box, medical help, emergency plan will be kept ready in case of any snake bite circumstances • List of medical help equipment like hospital will be kept ready with supervisor on construction site and worker's camp. **(Annexure 7.3)** • Vectors, rodents and snakes management plan will be followed. **Refer 7.9 section**			
Traffic Impacts					
Traffic Management	Unplanned and unmanaged traffic diversion and detours can result in public nuisance.	• Project drivers working on vehicles, equipment will be trained in defensive driving. • Ensure that all construction vehicles observe speed limits on the construction sites and on public roads. • Necessary signage and barricading will be provided for the safety of road users. • Refer Traffic Management Plan given in **section 7.7**	During Construction	Contractor	PIU and PMTC
Cultural Heritage					
Cultural Heritage	• Potential impact on cultural heritage sites/ structures • There is a possibility of cultural relics, chance finds at the construction sites.	• No cultural heritage or ASI structures are within 300 meters from project interventions and hence not getting impacted due to construction works • The contractor shall take reasonable precautions to prevent his workers or any other persons from removing and damaging any such article or things. He shall immediately upon discovery thereof and before removal acquaint the Engineer – in charge/ supervisor of such discovery and carryout the Engineer's instruction for dealing with same, waiting which all work shall be stopped.	During Construction	Contractor	PIU and PMTC

Project Activity	Impacts	Mitigation Measures	Time Frame	Planning & Implementation	Monitoring & Supervision
	• Without proper plan these artifacts may be misused by contractors/ workers	• The Engineer shall seek direction from ASI before instructing the contractor to commence the work • Chance Find Procedure Should be Followed strictly. Please Refer **Annexure 7.4.**			
Community Health and Safety.	• addresses the health, safety, and security risks and impacts on project-affected communities	• Some groups within a community may be particularly vulnerable to health and safety risks from a project because of, for example, their age, health, level of education, occupation, socioeconomic conditions, status, gender, and/or disability. • Attention should be given to the health and safety risks posed by the influx of workers or people providing support services into an area as a result of the project. Risks related to labor influx are known to be potentially highest for large infrastructure projects in remote areas. • Establishing emergency-response planning and monitoring for pollution or other incidents during operation.	During construction phase	Contractor and PIU.	PIU and PMTC.
Operation Phase					
Restoration of Construction sites	Clean-up Operations, Restoration and Rehabilitation	• The contractor will prepare site restoration and demobilization plan, which will be approved by the Environmental Expert of Project Implementation Unit. The clean-up and restoration operation are to be implemented by the contractor prior to demobilization. The Contractor will clear all temporary structures; dispose all garbage, night soils and POL (Petroleum, Oil and Lubricants) wastes in environmental sound manner. • All disposal pits or trenches will be filled in and effectively sealed off. • All construction zones including camp, and any other area used/affected due to the project operations will be left clean and tidy at the contractor's expense to the entire satisfaction to the Environmental Expert of KMC	On Completion of Construction Work	PIU	PMU
Management and Maintenance of Storm Water Drainage	Public Awareness-Storm Water Management on Efficient lines	• The KMC with support from PMU would need to carry out education and awareness campaigns on efficient SWD management through periodic visit to project areas by way of announcement, sharing of pamphlets, Radio/ FM programs, regarding their 'responsible' activities in relation to drainage management, and discourage solid waste dumping, disposing of wastewater in the drainage system	Operation Phase	PIU	PMU

Project Activity	Impacts	Mitigation Measures	Time Frame	Planning & Implementation	Monitoring & Supervision
	Disposal of Waste and untreated effluents into SWD system	• KMC to ensure that no household wastewater connections are connected with the storm water drainage man-holes/ network. KMC will ensure that the drains carry only the storm water. • Drains are designed as closed/ covered in RCC type with cover on top which will curtail dumping of solid waste in drains. • The storm water drains would need to be periodically de-silted in order to maintain its carrying capacity. • KMC to go for periodic checking and source of waste generation and its identification, and additional bins in critical locations will be provided and frequent collection and disposal of waste will be ensured. This exercise will minimize the contamination from leaching solid/ liquid waste into the SWD system. • All structures comprising the construction camp/ ancillary sites are to be removed from the sites to be checked for spills of substances such as oil, paint, etc. and these shall be cleaned up. • KMC to ensure that the storm water drains are not clogged and correct operation and maintenance of drains and waste screen. • The drains will require regular inspection and maintenance with clearance of any accumulated silt or waste, and the waste screen will need regular removal of waste, the clearance interval will be shorter in the wet weather flow than in the dry weather flow. • Drains will be regularly inspected and cleaned especially prior to the rainy season. • KMC to ensure muck and silt that are removed from the drainage system will not be left alongside the drain and will be immediately disposed in the designated waste collection vehicles of KMC and subsequently ensure that it will be disposed at an approved municipal solid waste site in Kolhapur	Operation Phase	PIU	PMU
	Maintenance & Repairing works	• Dilapidated, damaged structures will be repaired immediately by KMC • The drainage system will be periodically cleared so as to ensure water flow. The outlet structure should be inspected for evidence of clogging or outflow release velocities that are greater than design flow • At least twice during the rainy season accumulated trash and debris should be removed from the side slopes, embankment, and spillway.	Operation Phase	PIU	PMU
	Maintenance and Desilting in Lakes	• Maintenance desilting in Lakes like Kalamba, Rajaram and Padtala and SWD channels will be regular activity in the project	Operation Phase	PIU	PMU

Project Activity	Impacts	Mitigation Measures	Time Frame	Planning & Implementation	Monitoring & Supervision
		• The removed silt will be sent to silt disposal site • Silt will be used by farmers for agriculture purpose and by KMC for plantation • Silt may be used for road construction • Kalamba Lake outlet devices / sluice gate should be protected from clogging. Sediment should be removed from the lakes as necessary and at least once every two years. • Maintain oxygen levels for aquatic life and avoid generation of odours by following approved clearing mechanism.			
	Pollution Monitoring	• The Project Implementation Unit will monitor the SWD and Lake Water Quality and Sediment Quality by engaging NABL approved Lab.	Operation Phase	PIU	PMU
	Green Buffer	• The proposed green buffer either side of the SWD channels and Shenda park and Shivaji University, contour and trenching behind Kalamba lake, if not, managed as per the standards could lead to degradation including encroachments, disposal of wastes, construction debris etc. In order to avoid such impacts following measures to be adopted	Operation Phase	PIU	PMU
Sluice Gate at Kalamba Lake	Vertical water fall with high velocity on the downstream side of crest may cause erosion	• Apron/ wave breaker where ever required shall be provided for decapitation of excess energy	Operation Phase	PIU	PMU

Table 7-3: Occupational Health and Safety Management Plan (OHSMP) Under Component 2.2

Project Activity	Impacts	Mitigation Measures	Time Frame	Planning & Implementation	Monitoring & Supervision
Occupational Health and Safety (OHS) Measures During Construction	Unsafe work practice at work site may lead to injury of workers	• All measures will be outlined in the Contract agreement • The contractor will follow the OHS Management plan, including provisions for emergency response and night time work • All workers will be provided with required personal protective equipment • Provision of all workers with requisite personal protective equipment will be made • Please Follow Construction Related Issues and Mitigation Measures in **Table 7.4**	During Construction	Contractor	PIU and PMTC

Project Activity	Impacts	Mitigation Measures	Time Frame	Planning & Implementation	Monitoring & Supervision
		• The project information board will be displayed at the labour campsite. • Housekeeping at the labour camp will be maintained properly. Daily sweeping and cleaning will be done at the labour camp. • HIV Aids awareness posters will be displayed at the campsite.			
	Electrical risk / Fires safety	• Fire risk assessment/fire safety training shall be conducted for all staff. • Electrical cables and wires will be properly arranged with proper electrical safety. Loose electrical connections will not be allowed at the labour camp. • Adequate precautions will be taken to prevent danger from electrical equipment. • No material in any of the sites will be stacked or placed as to cause danger or inconvenience to any person or the public. • All necessary fencing and lights will be provided to protect the public.	During Construction	Contractor	PIU and PMTC
	Accidents or injuries to workers due to unsafe practice at work site	• Necessary steps shall be taken to prevent accidents, injury, and disease. • Appropriate treatment shall be provided to those suffering from occupational injuries/diseases. • Reporting to PIU / PMU • Ensuring insurance facilities for labour. • All measures outlined in the ESMP, and contract agreement shall be implemented to achieve zero accident rates. • Awareness and training camp on OHS and health checkup camp shall be organized among the labour • The Contractor will provide, erect and maintain barricades, including signs marking flats, lights and flagmen as required by the PMC along the project works. • Please Follow Construction Related Issues and Mitigation Measures in **Table 7.3**	During Construction	Contractor	PIU and PMTC
Risk like Fire, Flood, accident during working / construction works	Sudden instruction of work	• Reasonable precaution will be taken to prevent danger of the workers and the public from flooding, fire, etc. • First aid facility shall be available with trained first aid personal. • Tie up with hospital in case of medical emergency and other contacts of emergency Management departments. **(Annexure 7.3)**	During Construction	Contractor	PIU and PMTC
Hazards due to trench collapse	Trench collapses and drowning risks	• Utilize shoring systems like hydraulic or timber shoring to stabilize trench walls and prevent collapse.			

Project Activity	Impacts	Mitigation Measures	Time Frame	Planning & Implementation	Monitoring & Supervision
associated with the drainage works	are significant hazards during drainage and instream construction.	• Create sloping or benched trench walls to reduce the angle of repose and minimize the risk of soil failure. • Employ prefabricated trench boxes to provide a safe workspace within the trench. • Ensure a competent person is on-site to assess soil conditions, monitor for instability, and implement necessary precautions. • Conduct thorough soil analysis to determine soil type and stability before excavation. • Follow safe excavation procedures, including avoiding over-excavation and maintaining proper distances from structures. • Install barriers, such as fencing or warning signs, around open excavations near water bodies. • Provide readily available floatation devices like life jackets or buoyant work platforms for workers in or near the water. • Ensure safe and stable access and egress points for workers entering and exiting the water. • Where possible, manage water flow to minimize currents and potential for drowning. • Develop and practice a comprehensive emergency response plan, including procedures for rescuing individuals from the water. • Ensure workers are trained in basic first aid and water rescue techniques. • Use precast concrete barriers or walls to create stable boundaries around excavations and prevent soil movement. • Consider using concrete supports or walls as a more permanent shoring solution in certain situations. • Utilize concrete structures, such as cofferdams, to isolate work areas from water sources. • Provide comprehensive safety training to all workers involved in the project, emphasizing the specific hazards associated with trenching and instream work. • Establish clear communication protocols to ensure that workers are aware of potential hazards and safety procedures. • Conduct regular inspections of the work site to identify and address potential hazards. • Following of GIIP guidelines of World Bank group during working			

7.3 Social Management Plan

This Social Management Plan (SMP) outlines strategy to address and mitigate potential social risks and impacts of MRDP, ensuring its positive impact on communities and stakeholders.

Purpose:

This SMP is a project – specific document that details how social issues and impacts will be managed throughout the project lifecycle, for planning to operation and beyond.

Scope:

This SMP covers wide range of social issues, including land acquisition, resettlement, labour practices, community engagement, and the potential for social conflicts.

Mitigation Measures:

This SMP outlines specific actions to avoid, minimize, or mitigate adverse social impacts.

Monitoring and Evaluation

The SMP includes a plan for monitoring the implementation of the SMP and evaluating its effectiveness in achieving its object.

Institutional Arrangements:

The SMP defines the roles and responsibilities of different stakeholders involved in managing social issues.

Community Engagement:

It outlines how the project will engage with affected communities, seeking their participation in planning and implementation.

Table 7-4: Social Management Plan

Sr. No.	Social Risks and Impacts	Key Social Mitigation Measures	Responsibilities	
Design & Pre-Construction Stage				
1	Stakeholder Engagement Activity	Identification of primary and secondary stakeholders through mapping. Stakeholders Consultation and consultation with communities.	KMC	PIU
2	Formation of Site Level Coordination Committee	Formation of site level coordination committee of elected representatives, ward level KMC officials like Jr. Engineer/health officer/member of disaster management unit and women member of SHG.	KMC	Contractor
3	Preparation of RAP	Identification of PAPs through Detailed Census Survey and Preparation of Resettlement Action Plan, in accordance with the Project's RPF and entitlement framework.	Primove	KMC
4	Grievance Redressal Mechanism:	Appointment of Grievance Redress Officer at KMC level for recording of the complaints and response.	KMC	PIU
5	Information Sharing	Exchange of data, insights, and knowledge with key stakeholders to facilitate better decision – making.	KMC	PIU
6	Contractor Code of Conduct, Contractor Orientation	Outline ethical standards and expectations for contractors in all business, legal and ethical matters, serving as a guide for	KMC	PIU

Sr. No.	Social Risks and Impacts	Key Social Mitigation Measures	Responsibilities	
		interactions with client, employees, vendors, and partners. Prepare orientation material on site safety and site access. Address concerns such as HR compliance issues, privacy and other sensitive areas.		
7	Loss of Structures	All the affected people will be compensated as per RPF of the Project before commencement of construction works No construction activities will be started prior to disbursement of compensation and necessary assistance as applicable to the affected persons.	KMC	PIU
8	Impacts on Public Utility (water, electricity, Gas Pipeline and Telephone cables etc.)	Shifting and relocating utilities like electric poles, water supply system to a safe place before the commencement of the construction / strengthening work. Concerned department will be consulted before hand for this purpose and the project will bear all the cost involved in shifting / relocating these utilities / infrastructures; The scheduling of the construction works will be shared with the electricity department, road and transport, water supply, Optical fibre cables, sewerage, gas pipeline and communities to ensure uninterrupted services during construction. The community structures, affected in the process, will be duly compensated for reconstruction/ rehabilitation Temporary access routes will be provided to the residences and agricultural fields (near Kalamba lake and Rajaram lake), where access is blocked. Proper barricading and sign boards will be erected around public utilities during construction	KMC	PIU
Construction Stage				
8	Labor Orientation	Introduce new hires to their jobs, the company and their work environment during their first few days or weeks, helping them feel comfortable and prepared to start work. Workers job roles, work area and risks, and company culture. Work time and attendance, breaks and meal times, security policy, and anti - discrimination and harassments.	Contractors	Contractors
9	Amenities; toilets, energy; first aid; camp waste;	Follow guidelines for labor camp accommodation welfare and provide basic facilities like living space; Toilet / washing facilities; Food preparation and cooking areas; Lighting and Ventilation; Evacuation; First – aid and Emergency; Hazardous areas; Fire safety and firefighting; Mechanical and electrical safety; Housekeeping.	Contractor	PIU

Sr. No.	Social Risks and Impacts	Key Social Mitigation Measures	Responsibilities	
10	Labor orientation on community health and safety;	Emphasize the importance of a safe and healthy work environment for all. Focus on preventing work place hazardous. Educate workers on identifying and mitigating workplace hazardous. Address community health issues.	Contractor	PIU
11	Labour influx from employment on project	Conduct screening and assessment of the type and significant of potential social impact that may be generated by labour influx. Implement appropriate mitigation and monitoring programs, which includes development and implementation of stakeholder engagement program. Established Grievance Redress Mechanisms (GRM) for workers. Implement robust measures to address the risk of gender-base violence. The contractor has to prepares and submit the CESMP for acceptance. Prepare a plan of workers required for the project, with what skill sets, and for what period and time. Assess the size and skill labour of the existing local workforce Assess adequacy/ level of existing public services and natural resources. Plan the duration of the incoming workers presence in the community.	Contractor	PIU
12	Community health and safety: safety Signage; vehicle movement, labor movement; labor orientation;	Make provisions and arrangements of a) Prohibition signage b) Warning signs c) Mandatory signage and d) Emergency signage. Identify designated traffic routs, parking areas, clear pathways and efficient entry and exits points to minimize congestion and accidents.	Contractor	PIU
13	disruption of access roads;	Prepare a comprehensive traffic management plan. Break down the project into smaller phases to minimize the duration of road closure, reducing overall disruption. Inform public well in advance through various channels, including local news, social media, and clear signage. Plan realistic and better construction scheduling. Establish better coordination with transport agencies, utilities companies, local authority, emergency services, and road users. Provide alternative routs during construction, minimizing disruptions to traffic flow.	Contractor	PIU
14	Monthly Meeting of Coordination Committee;	Prepare Site level coordination committee monthly meeting schedule with agenda, venue, time and date and communicate in advance to the members.	Contractor	PIU
15	Prevention of spread of HIV/AIDs and other STDs	The Contractor will organize medical tests for workers on regular basis. Time to time HIV/AIDS awareness training / program will be organized by the Environmental & Safety Officers of the contractor.	Contractor	PIU

Sr. No.	Social Risks and Impacts	Key Social Mitigation Measures	Responsibilities	
16	GBV & SEA/SH Prevention and Response	Contractor will prepare and implement measures to address the risk of gender-based violence that include (i) mandatory and repeated training and awareness raising for the workforce about refraining from unacceptable conduct toward local community members, specifically women; (ii) informing workers about national and state laws that make sexual harassment and gender-based violence a punishable offence which is prosecuted; (iii) introducing a Workers' Code of Conduct as part of the employment contract, and including sanctions for non-compliance (e.g., termination), and (iv) cooperating with law enforcement agencies in investigating complaints about SEA/SH and gender-based violence. Code of Conduct will be signed by all the labourers working on the project. Do's and Don'ts related to SEA/SH is part of daily tool box talk and displayed at sites so as to avoid any risk of SEA/SH. The Contractor will establish and build awareness among workers on Internal Complaints Committee (ICC) as mandated by the Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013 Identify and map GBV service providers in the vicinity to establish referral mechanism.	Contractor	PIU
17	Awareness training on Social Issues	The Contractor will organize trainings on the following social issues on quarterly basis: HIV/AIDS awareness Training SEA/SH and GBV prevention and response COVID 19 and other communicable diseases Workers' code of conduct Labor Laws including Grievance Redressal Mechanism for Labors The Contractor will ensure that all the workforce participate in the awareness training Record of all the trainings will be maintained and will be included in the progress reports on Environmental and Social Compliances	Contractor through Govt. approved agency / service provider	PIU
18	Public Utilities	Prepare Utility shifting plan in advance and share it with the concern agency / departments. Ensure supply of basic services like water, sanitation facilities, power and pipe gas are provided without delays. Install alternative supply in advance.	Contractor / respective agencies and departments	PIU
19	Stakeholder Engagement Activities	Identify, analyze and map stakeholders; Understand their interests and concerns; Develop and implement strategies to involve them in a project by defining objectives, setting communication channels, planning activities, and setting timeline. Develop monitoring and evaluation by tracking engagement, evaluating outcomes and feedback system.	KMC	PIU

7.4 Construction Management Plan

Table 7-5: Construction Related Issues and Mitigation Measures Under Component 2.2

Sr. No.	Issues/Expected Impacts	Mitigation Measures	Implementing Entity	Supervising & Monitoring Entity
Workers Safety and Hygienic Conditions				
1	Occupational Health and Safety (OHS) issues	Engage experienced contractor with requisite licenses and well-trained workers for the construction works.	PIU	PMU
		Contractor having well established Occupational Health & Safety (OHS) Policy to guide the construction activities.	Contractor	PIU, PMU
		Regular OHS trainings (Monthly) to construction staff. Organize Health camps periodically.	Contractor	PMTC/PIU
		The contractor will provide and enforce the use of appropriate personal protective equipment (PPE) such as safety boots, rain coats, hand gloves, earplugs and nose masks.	Contractor	PMTC/PIU
		The selected contractor will have adequate training in first aid to treat minor ailments.	PIU/PMU	PMTC/PIU
		Provision of first aid facilities and emergency vehicle. However, major cases will be referred to the nearest hospital or health centre.		PMTC/PIU
		Obligatory insurance of contractor's staff and labourers against accidents.	Contractor	PMTC/PIU
		Contingency measures in case of accidents;	Contractor	PMTC/PIU
		Provision of healthcare and medical care services in case of sickness	Contractor	PMTC/PIU
		Periodic health-check-ups (monthly) of all labourers employed at the project site;	Contractor	PMTC/PIU
		Provision of safe drinking water supply at the working places by the Contractor.	Contractor	PMTC/PIU
2	Health impact during metal work (cutting and welding) and handling of metal scrap	Ensuring use of PPEs such as welding helmet, hand goggles, Respirators specially during cutting and welding operation Enforcing wearing fire/flame resistant cloth and aprons during cutting and welding operation Ensuring use of hand and forearm protecting leather gloves; safety goggles; steel-toed safety shoes; and upper foot guards to protect the instep area from impact or compression.	Contractor	PMTC/PIU
3	Soil & Water contamination	Using techniques as beaming or diversion during construction to limit the exposure of disturbed sediments to moving water. Avoiding discharge of waste effluents to the nearby channel. Collection of wastewaters in a conservancy tank and removal from site on regular basis. Safe disposal/sealing of wastewater collection tanks and septic tanks on completion of works.	Contractor	PMTC/PIU
4	Work safety and human health risks	Provision of double containment for storage of hazardous material (if any). Storing chemicals appropriately and with labelling Promptly informing any accidental spill or incident to the concerned Authority. Providing a report explaining the reasons for the spill or incident, remedial action taken, consequences/damage from the spill, and proposed corrective actions.	Contractor	PMTC/PIU
5	Deterioration of air quality due to exhaust gases and dust emissions	Ensuring that excavators, tractors and other machinery hired for excavation and land levelling and development works are in good condition and are well serviced, and the operators are experienced and well trained. Good conditioned and well-maintained equipment will reduce	Contractor	PMTC/PIU

Sr. No.	Issues/Expected Impacts	Mitigation Measures	Implementing Entity	Supervising & Monitoring Entity
		frequent breakdowns, noise nuisance and smoke emissions which could affect the operators' and other workers' health and safety. Proper engine tuning of machinery/equipment/ transport vehicle to avoid the exhaust emissions; Protection of the exposed soil and material stockpiles against wind erosion and selection of the location of stockpiles in consideration of the prevailing wind directions and locations of sensitive receptors. Water sprinkling at dust prone areas particularly at work sites near the communities. Prohibiting burning of waste or construction materials or cleared vegetation on site. Setting up of construction material handling unit at minimum 500 m away from residential areas. Covering material loads during transportation to prevent the scattering of soil, sand, materials' dust.		
6	Labour Camps and Site Management	Not setting up Site offices, workers' camps, mixing stations, and workshops within 100m from any water courses, 300 meters of existing residential area. Engaging Safety and Environmental officer for environmental and safety issues including training for workers. Providing Septic tank toilets at all construction camp areas where there will be concentration of labour, with separate toilet block for male and female. First aid boxes shall be provided in each construction camp	Contractor	PMTC/PIU
Parking / repair of machinery and equipment				
7	Soil and water contamination with oil / grease spills	Restriction on repair of vehicles and equipment on working sites without impermeable top soil cover at the repairing site.	Contractor	PMTC/PIU
		Avoiding washing of vehicles near the drain		
		Ensuring proper storage and disposal of used oil etc.;		
		Adoption of good housekeeping practices at workshop areas;		
		Avoiding waste oil spill into soil and adjoining water source;		
		Appropriate arrangements such as usage of concrete base and drip pans to avoid spills during fuelling/oil change.		
		Oil interception chamber shall be provided at waste water discharge point		
Procurement				
8	Procurement of construction material	The construction material shall be procured from authorized vendor having required permission as far as possible. If Contractor wishes to procure from other sources he shall obtain the lease agreement of the supplier.	Contractor	PMTC/PIU
Construction works				
9	Noise pollution	Use of PPEs such as earplugs and earmuffs by the workers; avoid night time activity.	Contractor	PMTC/PIU
10	Land degradation; soil erosion; pooling of water and drainage problem	Temporary stacking in identified locations with preventive measures (covering, sprinkling water etc.)	Contractor	PMTC/PIU
		Disposal of demolished / excavated materials, after reuse, as per the plan.	Contractor	PMTC/PIU
11	Soil contamination	No waste effluents will be released to the nearby channel.	Contractor	PMTC/PIU
12		Remove any left-over construction material/wastes from the construction sites.	Contractor	PMTC/PIU

Sr. No.	Issues/Expected Impacts	Mitigation Measures	Implementing Entity	Supervising & Monitoring Entity
	Residual wastes; construction material waste	Plastic (HDPD, plastic) and metal waste shall be collected and stored separately and sold to authorised recycler	Contractor	PMTC/PIU
13	Accident risks during construction including demolition and welding operation	Provision of PPEs; Provision of first aid kits and emergency vehicle.	Contractor	PMTC/PIU
		Contractor shall ensure use of PPEs by all workers specially during demolition and welding operation.	Contractor	PMTC/PIU
14	Loss of top soil	Top soil shall be preserved and reused in turfing activities. If excess, shall be distributed to farmers for using in the agricultural lands after quality test.	Contractor/DPIU	PMTC/PIU
15	Stripping, stocking of construction material on fields near lakes, empty plots may cause damage to top soil of agricultural field	Storing of excavated material on agricultural field shall be avoided to the extent possible;	Contractor/DPIU	PMTC/PIU
		Tarpaulin lining shall be provided to arrest any kind of leaching from stored excavated material on agricultural field.	Contractor	PMTC/PIU
		Safe temporary access routes will be provided for community members to access their farms during the construction period.	Contractor	PMTC/PIU
		For those whose farming land will be affected by the construction works, will be compensated;	Contractor	PMTC/PIU
Use of water for construction and consumption				
16	Conflict with local water demand	The contractor has to make his own arrangements for meeting water required for construction ensuring that water availability and supply to nearby communities remain unaffected.	Contractor	PMTC/PIU
		While ground water can be used for construction works, for consumptive use, there will be dependency on available local resources. Required measures should be taken in consultation with local people for using available water sources for consumptive use.		
Storage, handling and transport of hazardous materials				
17	Work safety and human health risks	Provision of double containment for storage of hazardous material (if any).	Contractor	PMTC/PIU
Work site sanitation				
18	Unhygienic construction site environment may have health impact on public and workers	Provide waste bins on site for collection and disposal of plastic waste, cans and food waste. These bins shall be frequently emptied at approved dump sites.	Contractor	PMTC/PIU
		Regularly remove and dispose construction waste such as metal scrap, wood chippings, rubber seals, nails, etc. for disposal at approved dumpsites.		
		Provide temporary toilet facilities at the construction sites for use by the construction workers. The workers will be educated against open defecation or “free range” defecation.		
		Potable water shall be provided to workers at all time.		
		Appropriately and immediately cover trenches and/or excavations after they have served their purpose to prevent accidents and collection of stagnant water which could serve as a breeding ground for disease causing vectors.		
Environmental damage during flood				
19	Environmental damage from	Find alternative material handling sites that is located above flood plain, if possible.	Contractor	PMTC/PIU

Sr. No.	Issues/Expected Impacts	Mitigation Measures	Implementing Entity	Supervising & Monitoring Entity
	accidental release of toxic, infectious, or otherwise harmful material from construction site during flooding	Maintain design features, such as drainage structures, during construction and operation.		
		Avoid constructing sanitation or other facilities that will use and store harmful materials at flood-prone areas.		
		Chose dry sanitation options or closed disposal systems, instead of wet ones such as septic tanks or detention ponds		
Operation and movement of machinery and equipment				
20	Deterioration of air quality due to exhaust gases and dust emissions	Ensure that excavators, tractors and other machinery hired for excavation and land levelling and development works are in good condition and are well serviced, and the operators are experienced and well trained. Good conditioned and well-maintained equipment will reduce frequent breakdowns, noise nuisance and smoke emissions which could affect the operators' and other workers' health and safety.	Contractor	PMTC/PIU
		Proper engine tuning of machinery/equipment/ transport vehicle to avoid the exhaust emissions;	Contractor	PMTC/PIU
		Water sprinkling at dust prone areas particularly at work sites near the communities.	Contractor	PMTC/PIU
21	Noise from vehicles, compaction rollers, concrete mixers and construction equipment	All vehicles and machineries should have a valid Pollution Under Control (PUC) certificate.	Contractor	PMTC/PIU
		Use of noise reduction devices; Regular inspection, maintenance and lubrication of the construction vehicle and equipment.	Contractor	PMTC/PIU
		Use of muffles (silencers) in vehicles to minimize noise;	Contractor	PMTC/PIU
		Avoid night time traffic particularly near communities.	Contractor	PMTC/PIU
Transportation of construction material				
22	Chance of accidents	Material transport in closed containers or covered with canvas (Tarpaulin) sheets.	Contractor	PMTC/PIU
		Restrict vehicle speeds to 30km/h near habitations / settlements		
23	Damage to access roads/ infrastructure	Restore any damaged infrastructure to its pervious stage	Contractor	PMTC/PIU
		Regular repair of damaged roads throughout the construction period.		
24	Accident/Incidens risks	Public consultation to maintain community integrity and social links;	Contractor	PMTC/PIU
		Public awareness campaigns through displaying sign board at site and haulage routes;		
		The contractor will use warning signs at vantage points to indicate ongoing works. The contractor will guard all construction site including SWD and drains with caution tapes.		
		Restriction on movement of machinery on the designated haulage routes for transportation of materials;		
		The contractor will ensure that all haulage trucks comply with the approved speed limit of 30km/hr within the communities along the haulage road;		
		The contractor will adjust haul times to ensure trucks do not move to the communities during mornings when school children may be crossing the road to school and during closing time.		
		The contractor will enforce proper security at the project site during works to limit entry of		

Sr. No.	Issues/Expected Impacts	Mitigation Measures	Implementing Entity	Supervising & Monitoring Entity
		unauthorized persons, non- working persons, particularly children to the project site;		
		Adequate signage to manage traffic at sites, haulage and access roads;		
Road impacts and traffic issues, Obstruction of access ways to communities				
25	Mobility inconvenience to the local community	New roads provided in the designs will be constructed first to serve as alternative roads for the transport of materials obtained in-situ. This will ease pressure on existing community roads.	Contractor	PMTC/PIU
		Safe alternative access routes shall be provided for access ways that are obstructed/ destroyed during construction works.		PMTC/PIU
		Provide sirens in vehicles to avoid any collision with human/animals	Contractor	PMTC/PIU
		Sign posts will be erected at vantage points to manage traffic, guide community members through safe alternative access ways during construction works.	Contractor	PMTC/PIU
		Repair and maintain damaged sections of the road located at project site throughout the construction period.	Contractor	PMTC/PIU
		The contractor will ensure that all haulage trucks hired/contracted are in good condition to prevent breakdowns on roads.	Contractor	PMTC/PIU
		Not allowing parking of the vehicle in areas which may create inconvenience in mobility such as blind turning point or meeting point of village road with the embankment.	Contractor	PMTC/PIU
	Chance of finding Archaeological property	While excavating or dismantling any structure, if any fossils, coins, articles of value / antiquity and remains of archaeological interest discovered on the site shall be the property of the Government and shall be dealt with as per the provisions of the relevant legislation.	Contractor/PIU	PMTC/PIU

7.5 Workers' Camp Management Plan

7.5.1 Objective of the Plan

The objective of this plan is to provide guidance to the contractor or other agency involved in setting up of the construction and labour camp for keeping the health & Safety of workers and impacts of setting up such camps on the local community in consideration while developing and establishing such camp. This plan is prepared in reference to the Workers accommodation: processes and standards. The plan aims to promote "safe and healthy working conditions, and to protect and promote the health of workers."

7.5.2 Selection and layout of construction camp

Labour camps, plant sites and debris disposal site shall not be located close to habitations, schools, hospitals, religious places and other community places. A minimum distance of 500m shall be maintained from the habitations, sensitive locations like temple, school & hospitals, forest areas and other eco-sensitive zones for setting up such facilities.

7.5.3 Facilities at workers' camps

During the construction stage of the project, the construction contractor will construct and maintain necessary (temporary) living accommodation, rest area and ancillary facilities for labour. Facilities required are listed and elaborated below. Site barricading Clean Water Facility Clean kitchen area with provision of clean fuel like LPG Clean Living Facilities for Workers Sanitation

Facilities Waste Management Facilities Rest area for workers at construction site Adequate Illumination & ventilation Safe access road is required at camps. Health Care Facilities Crèche Facility & Play School Fire-fighting Facility Emergency Response Area.

7.5.4 Attendance & Working hours

Supervisor of the camp should take the attendance of the employee at each camp twice in a day (morning and evening) and should maintain the record. Further work hours of the workers should be maintained in accordance to the labour law and as mentioned in the labour licence. All workers should be provided with ID card and entry to the site should be through ID card only and should be ensured by security guard.

7.5.5 Site Barricading

Site should be completely barricaded from all the sides to prevent entry of outsiders and animals into the site. Entry gate should be provided at the site and labour camp which should be guarded by security guard. All workers should be issued ID cards and entry of outsiders shall be maintained in the register at the gate. Board should be displayed at the site and the labour camp, the name of project, capacity of project, authority carrying our projects, restriction of entry without authorization, no smoking zone and associated risks. Plant operation shall be restricted to 6:00 Am to 10:00 PM.

7.5.6 Clean Water Facility

Potable water shall be provided for construction labour for drinking & cooking purpose. Clean water shall be provided for bathing, cleaning and washing purpose. Water quality testing for drinking water provided for workers shall be carried out on monthly basis. Water dispensers should be cleaned on monthly basis. Adequate water per person should be provided at site for drinking, cooking, bathing, cleaning and other use purpose

7.5.7 Clean Kitchen Area

Provision of clean kitchen area for cooking and storage of eatables shall be provided. Clean fuels like LPG shall be provided for cooking purpose. Burning of firewood, garbage, paper and any other material for cooking or any other purpose shall strictly be prohibited at the site. Separate utensil washing area should be provided with proper drainage system. Kitchen waste should be daily cleaned and disposed off. Water storage facility at kitchen should be covered and cleaned on monthly basis. Kitchen area should be away from washing, toilets and bathing area.

Wall surfaces adjacent to cooking areas are made of fire-resistant materials. Food preparation tables are also equipped with a smooth durable washable surface. Lastly, in order to enable easy cleaning, it is good practice that stoves are not sealed against a wall, benches and fixtures are not built into the floor, and all cupboards and other fixtures and all walls and ceilings have a smooth durable washable surface.

7.5.8 Clean Living Facility for the Workers

Workers should be provided with proper bedding facility. Single bed should be provided to each workers and each bed should be at least 1 m apart from another. Double deck bedding should be avoided, in case provided, adequate fire-fighting facility should be provided. Bed linen should be washed regularly and should be applied with repellent and disinfectants so as to manage the diseases caused due to pests. Facilities for storage of personal belongings for workers should be provided in form of locker, shelf or cupboard. A separate storage area for the tools, boots, PPE should be provided. Proper ventilation through mechanical systems and lighting system should be ensured in construction camps.

7.5.9 Sanitation Facilities

Construction camps shall be provided with sanitary latrines and urinals. Toilets provided should have running water availability all the time. Bathing, washing & cleaning areas shall be provided at the site

for construction labour. Washing and bathing places shall be kept in clean and drained condition. Adequate nos. of bathing & toilet facility should be provided at site and should not exceed 1 unit per 10 person. Toilets and bathing facility should be closed to the camps

Workers shall be hired especially for cleaning of the toilets and bathing area. Septic tanks and soak pits shall be provided at site for disposal of the sewage generated. The toilets should be cleaned on daily basis. These tanks should be evacuated through authorized vendors if filled and at the time of closure. Pest management should be carried out at the camps if the area is infected by any pests. Adequate lighting should be ensured in camp area especially during night time. The area should be guarded by security guard to minimize the crime and thefts.

7.5.10 Waste Management Facilities

Waste generated should be segregated at the site by providing the different colour bins for recyclable and non-recyclable waste. Recyclable waste shall be sold to authorized vendors and non-recyclable shall be handed over to authority responsible in area for waste management.

Waste management for construction site shall be as per waste management plan proposed in EMP. Waste management area should be cleaned on regular basis to avoid germination of flies, mosquitoes, rodents and other pests.

7.5.11 Rest Area for Workers at Site

A rest area/shelter shall be provided at the site for construction workers where they can rest after lunch time and shall not lay down at site anywhere. The height of shelter shall not less than 3m from floor level to lowest part of the roof. Sheds shall be kept clean and the space provided shall be on the basis of at least 1.0 Sq. m per head.

7.5.12 Adequate Illumination & Ventilation

Construction worker camps shall be electrified and adequately illuminated. Illumination level shall be maintained after 5.30 P.M. at the site to minimum 200 lux. Labour camps shall be adequately ventilated. Fans shall be provided for ventilation purpose.

7.5.13 Safe Access Road for Labour Camps

Temporary paved surface shall be constructed to approach the labour camp from the site. Movement shall not be hampered during monsoon season due to water logging and muddiness.

7.5.14 Health care Facilities:

First aid box, first aid room and personnel trained in first aid (certified first-aider) shall be available at labour camp and site all the time (24X7). Equipment in first-aid box shall be maintained as pet State Factory's Law. Ambulance/ 4 wheeler motorized vehicle shall be available at the site for carrying injured to the nearby hospital. Tie-ups should be made with nearby hospital to handle emergency, if any. Nos. of ambulance, doctors and nearby hospital s hall be displayed in first-aid room, site office & labour camps. List of contact nos. of emergency personnel, hospitals, fire brigade and other emergency contact should be displayed at camp site, guard's room and first aid room. Workers shall be made aware about the causes, symptoms and prevention from HIV/AIDS through posters and awareness programs. Workers shall have access to adequate preventive measures such as contraception (condoms in particular) and mosquito nets.

7.5.15 Crèche Facility & Play School

Crèche facility and play school should be constructed at the site temporarily so as children of construction labour can be kept there. Care takers should be hired for taking care of children. Attendance records of children shall be maintained. Children should not be allowed to enter active work areas.

7.5.16 Fire-Fighting facilities

Fire-fighting facility such as sand filled buckets and potable fire-extinguishers shall be provided at labour camps and at site. Fire-extinguishers shall be provided as per NBC norms. Personnel trained in handling fire fighting equipment should be available at the site. Fire evacuation plan should be displayed at the site and should be communicated to all the workers and other staff at camp site.

7.5.17 Emergency Assembly Area

Area shall be demarcated as emergency collection area near the gate where all the workers shall be guided to collect in case of any emergency like fire, flood and earthquake.

7.5.18 Activities prohibited at site

- Activities which should be strictly prohibited at site shall include Open burning of wood, garbage and any other material at sit for cooking or any other purpose
- Disturbance to the local community.
- Adoption of any unfair means or getting indulgence in any criminal activity Non-compliance of the safety guidelines as communicated be safety officials and during the trainings
- Adoption and proper usage of PPEs all the time as required
- Operation of the plant and machinery between 10 pm to 6 am unless approved by team leader
- No animal (wild or domestic or bird) shall be harmed by any construction worker in any condition at site and nearby areas
- Cutting of tree without permission of team leader/authorized person
- No indigenous population shall be hurt or teased

7.5.19 Guidelines for night time working at the site.

No activity generating noise shall be carried out at the site after 10:00 PM. Night working protocol should be followed (if required) as per guidelines prepared by CPCB. Site should be well illuminated to maintain minimum illumination level of 200 lux. Personnel working shall obtain permit to work from the team leader prior carrying out any work in night time and the record of such working shall be maintained in register. Any accidents, if occurs at site during night time working shall be immediately reported and recorded. Penalty shall be imposed on the contractor for the accident. Analysis shall be carried out to find the reason for such accidents for future learning.

7.5.20 Record keeping & Maintenance

Record of entry/exit of the people in the construction site and labour camp area shall be maintained in register at gate. Record of material coming in and going out from site also shall be maintained.

7.5.21 Auditing & Inspection

Conditions of labour camp and site shall be inspected and audit report shall be submitted to PIU on monthly basis.

7.5.22 Grievance redressal System

Contractors' complaint register and a complaint box should be provided at the site so any person from local community can register their complaint, if any due to the camp, workers and other facilities. The system shall be communicated to local communities through consultations. Open house meetings should be conducted with workers on monthly basis to identify their problems and issues if any related health, hygiene, safety, comfort and other issues.

7.5.23 Security System

Site should be barricaded and should be guarded by security guards at all the gates. Security guards

should allow only authorized personnel to the campsite. Guards should be available during both morning and night time. Guard should allow entry of workers to the site only be seeing the ID cards. Guard should report if any unusual or unfair practise happening at site and nearby area. Guards should be trained to handle emergency situations like firefighting and should be responsible to contact the emergency personnel in case of any emergency.

7.5.24 Closure of the Construction Site and Construction labour Camps

Construction site and labour camps shall be restored back to the original site conditions. Following measures are required to be taken during closure

1. Septic tanks/soak pits should be dismantled
2. Any temporary/permanent structure constructed shall be dismantled
3. Construction/demolition waste, hazardous waste and municipal waste at site and labour camp site shall be disposed as per waste management plan in EMP
4. The site shall be cleaned properly
5. Tree plantation to be carried out, if any required for stabilizing the area
6. Any pit excavated shall be filled back

7.6 Tree Plantation Strategy

The sustainable economic development depends on the rational use of environmental resources and minimizing, to the extent possible, adverse environmental impacts through improved project selection and more responsible project planning and design. Under this strategy the development must be environmentally sound in the broadest sense. In proposed project tree plantation/dense forest development, environmental planning is concerned with good combination of improvements of physical, social, and economic parameters. It involves not only the environmental (land, water, and air) but is also concerned with integration of local, regional and national socio-economic development.

7.6.1 Aim and Objective of Tree Plantation/Dense Forest Development

- To reduce the surface run-off discharge and checking soil erosion along the embankments.
- To reduce temperature and increase humidity.
- To create green belt for meeting aesthetic recreational needs to the people.
- To beautify the areas for scenic beauty.
- To promote livelihood opportunities by local people participation.

7.6.2 Selection of Tree Species

The selection of the plants for road side plantation is to be made as per the following criteria

- Plants should be fast growing & have dense canopy cover
- Preferably dry deciduous with large leaf area index
- Indigenous species
- Species resistant to air pollutants and
- Should help to maintain the ecological and hydrological balance of the region
- The species should be fast growing and providing optimum penetrability
- Sustainable green cover with minimal maintenance

7.6.3 Tree Plantation Strategy

Plantation is proposed on 146 ha area in the project at suitable locations like 100Ha behind Kalamba Lake, 21 Ha in Shivaji University and 25 Ha in Shenda Park. The plantation of indigenous tree species is decided based on the physical growth characteristics of trees, like form and shape, foliage pattern, growth rate, branching pattern, soil characteristics etc. While selecting the species of trees for planttaion a great care is been taken to choose the species, which already exist in project city. Thus, local biodiversity will be not be disturbed. Following are the details of plantation in the project;

Table 7-6: Tree Species Proposed for Plantation

Sr.No.	Tree Species Common Name	Tree Species Botanical Name
1	Coconut	Cocos nucifera

2	Betelnut	Areca catechu
3	Gulmohar	Royal poinciana
4	Badam tree	Terminalia catappa
5	Saptaparni	Alstonia scholaris
6	Karanj	Pongamia pinnata
7	kapok Tree	Ceiba pentandra
8	Pimpal	Ficus religiosa
9	Rain Tree	Samanea saman
10	Bakul	Mimusops elengi
11	Nilgiri	Eucalyptus globulus
12	Neem	Azadiracta indica
13	Jamun	Syzygium Cumini
14	Vilayati Chinch	Pithecellobium dulce
15	Jack fruit	Artocarpus Heterophylus
16	Shevga	Moringa oleifera
17	Frangipani	Plumeria Obtusa
18	Shikekai	Acacia concina
19	Bel	Aegal marmalos
20	Shirish	Albizia lebbeck
21	Mango	Mangifera Indica
22	Umber	Ficus Racemosa
23	Jarul	Lagestroenia Speciosa
24	Behada	Terminalia bellerica
25	Kokum	Garcinia indica
26	Kuda (Kala Kuda)	Wrightia tinctoria
27	Pride of India	Lagerstroemia speciosa
28	Aola	Emblica officinalis
29	Chinch	Tamarindus indica
30	Hirda	Terminalia chebula
31	Arjuna	Terminalia cuneata
32	Kavath	Limonia acidissima
33	Bor	Ziziphus zuzuba
34	Sitaphal	Anona squamosa
35	Limbu	Citrus aurantifolia
36	Bartondi	Morinda pubescens

Table 7-7:

Shrub Species Proposed for Plantation

Sr.No.	Tree Species Common Name	Tree Species Botanical Name
1	Adulsa	Adhatoda Vasica
2	Kevada	Pandanus Furcatus
3	Aghada	Achyranthes asper
4	Shatavari	Asparagus racemosus
5	Rui	Calotropis procera
6	Karvand	Carissa carandas
7	Bitti/PivaliKaner	Cascabella thevetia
8	Shivan	Gmelina arborea
9	Jayphal	Myristica dactyloides
10	Nirgudi	Vitex negundo
11	Bhendi	Abelmoschus esculentus
12	Tulas	Oscimum tenuiflorum
13	Erand	Ricinus communis
14	Madhumalati	Combretum indicum
15	Kirmith	Grewia abutilifolia

7.6.4 Key Impacts and Enhancement measures

The project will have both positive and negative impacts to the natural and social environment.

The positive project impacts include:

- Tree plantation initiatives engage communities in environmental stewardship, promote awareness of environmental issues, and empower local residents to take action for positive change. Community-based tree planting projects create opportunities for collaboration, capacity-building, and social cohesion among diverse stakeholders. By involving schools,

community groups, and civil society organizations, tree plantation initiatives foster a sense of ownership, pride, and responsibility for local ecosystems and natural resources.

- Tree plantation initiatives generate socioeconomic benefits for communities by creating employment opportunities, generating income, and improving livelihoods.
- Tree plantation initiatives offer educational opportunities for children and adults to learn about the importance of trees, forests, and environmental conservation.
- Trees play a crucial role in soil conservation and watershed management by reducing soil erosion, improving soil fertility, and enhancing water quality.
- Tree plantation contributes to climate change mitigation by sequestering carbon dioxide from the atmosphere.
- Regulation of the local micro climate and air quality
- Tree plantation initiatives support biodiversity conservation by providing habitat and food sources for a wide range of plant and animal species
- Tree plantation initiatives facilitate the restoration of degraded ecosystems

The project negative impacts are rated as minor as most of them will be short term and will occur during establishment of the tree nursery and transplantation and will be related to:

- Soil disturbance, erosion and dust emission;
- Environmental pollution from tree nurseries like
    - Water use, Energy use,
    - Water pollution because of Nutrient and pesticide run-off
    - Material use like polybags, fertilisers and pesticides, pot, wood biomass-substrate
    - Air pollution
    - Waste generation like organic and inorganic wastes, packing materails, damaged pot, remainings of wood biomass-substrate etc
- Work safety and health risks to workers associated with tree nurseries and transplanting.

Prevention, mitigation and compensation measures to minimize the project negative impacts have been proposed in Environmental Management and Monitoring Plan and include:

During the tree pre-nursery period: The client will

- Educate the KMC officials of garden department, local communities on the benefits for planting trees (soil conservation, erosion control, local climate regulation, air quality improvement, carbon sink, etc) and encourage them to participate in the the project. People should understand that they will have the right and benefits to harvest the overgrown trees.

During the tree nursery period: Contractor will

- Minimize and reuse waste and discarded material (e.g., pot, wood biomass-substrate) from tree nurseries;
- Sort, collect and recover the discarded nursery materials according types (bio-degradable, plastics, metals, etc) and dispose in the sanitary landfill the material that cannot be reused or recycled.
- Avoid discharge of the nursery effluent and other waste streams to the nearby water bodies.

During Post tree nursery period: Contractor will

- Collect and remove the nursery remains (bags) and rehabilitate the site to its pre-project status, otherwise landscape and green the area
- Alternatively, train and handover the tree nursery to the local communities for future use (if this option is preferred by local community)

During the transplanting period: Contractor will

- Educate the KMC officials of garden department, local communities on the best practices for growing trees and associated benefits (soil conservation, erosion control, local climate regulation, air quality improvement, carbon sink, etc)
- Avoid leaving uncompacted loose soil which can be washed away by the stormwater
- Sort, collect and recover the discarded nursery materials according to types (biodegradable, plastics, metals, etc) and dispose in the sanitary landfill the material that cannot be reused or recycled.

During the growing period: the contractor and local People in coordination with KMC Garden Department will

- Maintain and monitor trees survival rates and request for replacement in case of tree death
- Will restrict the use of inorganic fertilizers, banned pesticides
- Will promote use of organic fertilizers, silt material removed from lake and SWD

The PIU will educate the local communities on the benefits for trees (soil conservation, erosion control, local climate regulation, air quality improvement, carbon sink, etc) and encourage them to own the project.

7.6.5 Precautionary Measures to be Adapted

- Barbed wire fencing around the plantation area will be provided to protect the plants. Iron Angles will be fixed at a spacing of 5m with 3-stand stretched barbed wire.
- Plantation will be made in the monsoon months (July-August)
- The height of the plants should not be less than 30 cm and should be supplied in polythene bags which are not to be removed until the moment of planting.
- All plants supplied must be planted within three days of removal from the nursery.
- Arrangements must be made to water in case of insufficient rains after planting
- Provide compost/manure suggested quantity for each pit before plantation

7.7 Gender Based Violence Action Plan (GBVAP)

The Gender-Based Violence (GBV) Action Plan aims to prevent and address GBV risks associated with the highway project. It incorporates measures to enhance safety, provide support services, and promote a zero-tolerance policy against GBV.

7.7.1 Objectives

- Prevent and mitigate risks of GBV within the project area.

- Establish a robust reporting and response mechanism.
- Raise awareness and build capacity on GBV prevention and response.
- Ensure survivors have access to support services and justice.

7.7.2 Prevention Measures

7.7.2.1 Safe Infrastructure and Environment

- Install adequate lighting along highways, bus stops, and rest areas.
- Provide separate and secure sanitation facilities for women and men.
- Deploy security personnel trained in GBV prevention and response.

7.7.2.2 Community Engagement and Awareness

- Conduct public awareness campaigns on GBV, legal rights, and reporting mechanisms.
- Engage local leaders, women's groups, and youth organizations in prevention efforts.
- Promote bystander intervention programs to encourage community accountability.

7.7.2.3 Workplace Policies and Training

- Implement a zero-tolerance policy on sexual harassment and GBV within the project.
- Train all project staff, contractors, and workers on GBV awareness and prevention.
- Establish a confidential grievance and redress mechanism for GBV complaints.

7.7.3 Response and Support Services

- Establish referral systems for survivors to access medical, psychological, and legal support.
- Partner with local organizations to provide safe shelters and counseling services.
- Ensure law enforcement agencies are trained and equipped to handle GBV cases sensitively.

7.7.4 Implementation and Monitoring

- Appoint a GBV Specialist to oversee implementation and compliance.
- Monitor and evaluate GBV-related incidents and response effectiveness.
- Regularly review and update the GBV Action Plan based on lessons learned.

Conclusion: The GBV Action Plan ensures a safe and supportive environment for all individuals affected by the highway project. Through preventive strategies, strong response mechanisms, and continuous community engagement, the project promotes gender equality and protection from GBV. It will be ensured by the respective PIUs to make sure that all the workers will sign CoC. espective PIUs will be responsible for the implementation of Awareness Camps and establishing a referral system and also appointment of GBV specialist).

7.8 Traffic Management Plan

This traffic management plan outlines strategies and measures designed to manage the flow of vehicles and pedestrians within project sites, ensuring safety and minimising disruptions to surrounding traffic. At its core, the plan identifies potential hazards, specifies control measures, and establishes protocols for emergency situations, aiming to maintain a safe environment for workers and the public alike.

In environments where the movement of heavy machinery, materials, and personnel occurs frequently, such as sites dedicated to infrastructure development and large-scale project areas, these plans are essential. They play a pivotal role in preventing accidents, reducing congestion around work zones, and ensuring that emergency vehicles can access sites without delay.

The requirement for traffic management plans in these settings stems from the need to balance daily work activities with keeping everyone safe. With certain work activities such the transport of heavy materials or the man evening of large vehicles, the potential for safety incidents increases

significantly. These plans provide a structured approach to mitigate risks, ensuring that all movements are coordinated and safe, and support the continued progress of projects and the well-being of all involved.

7.8.1 A Walkthrough of Traffic Management Plan

This section will provide a detailed walkthrough of a sample traffic management plan. The full sample traffic management plan document can be viewed at the very end. However, it is important to first understand what information a traffic management plan must contain and how it is structured.

This is the structure of the sample traffic management plan, which has all the necessary sections that would be required for a real plan to be approved and implemented:

- **Project Details**: Key information about the project.
- **Traffic Control**: A comprehensive checklist covering:
  - Separation
  - Pedestrian Routes
  - Vehicle Routes
  - Signs
  - Warning Devices
  - Information, Training, and Supervision
  - PPE (Personal Protective Equipment)
  - Vehicles and Drivers
- Traffic Management Layout: Diagrams showing traffic flow and management.
- **Communication and Emergency Procedure**: Steps for managing incidents and emergencies.

Here is detailed breakdown of the purpose of each section:

7.8.2 Project Details

The Project Details section of the sample traffic management plan serves as the foundation, offering essential information that outlines the scope, duration, and specific characteristics of the project. This information is critical for tailoring the traffic management strategies to the project's unique requirements:

Duration of Work: Specifies the start and end dates of the project, giving a clear timeline for all involved. This helps in planning the necessary traffic management measures throughout the project lifecycle. For instance, a project might run from March 4 to March 15, 2024, guiding the scheduling of traffic control measures.

Location: Details the exact site of the project, including any relevant geographical or environmental considerations that might affect traffic management. A precise location, such as Camden St, Canberra, helps with identifying potential external traffic challenges and planning accordingly.

Scope of Work: Describes the activities that will be carried out during the project, such as excavation works for pipe laying. Understanding the scope is vital for identifying the types of vehicles, machinery, and the volume of pedestrian traffic expected on site, informing the development of detailed traffic management strategies.

Hours/Days of Work: Outlines the operational hours and days, for example, 8am to 5pm, Monday to Saturday. This information is crucial for designing traffic management plans that address the specific times when traffic will be highest, ensuring that controls are in place during these peak periods.

7.8.3 Traffic Control

The Traffic Control section of the sample traffic management plan is pivotal in delineating how traffic, encompassing vehicles, heavy machinery, and pedestrians, is safely managed on-site. This section is divided into subsections, each addressing a specific aspect of traffic management to mitigate risks and enhance safety.

7.8.4 Separation

Effective separation strategies are essential to ensure that vehicles, pedestrians, and heavy machinery coexist safely. This involves creating distinct pathways and zones for each group, using physical barriers, signage, and clear markings. The aim is to minimise interaction between pedestrians and vehicles, significantly reducing the risk of accidents.

7.8.5 Pedestrian Routes

Pedestrian routes are carefully designed to provide safe, clear pathways for individuals moving around the site. These pathways are separated from vehicle routes and are marked with signs and barriers to guide pedestrians. Ensuring that pedestrians have access to all necessary site facilities without navigating dangerous areas is a priority.

7.8.6 Vehicle Routes

Vehicle routes are planned to accommodate the flow of all vehicles on site, ensuring they can move efficiently and safely. This planning includes the designation of specific routes for different types of vehicles, clear signage for directions, and rules to prevent congestion and accidents. Special consideration is given to ensure that these routes are maintained and free from obstacles that could impede movement.

7.8.7 Signs

Signage plays a critical role in traffic control by providing essential information and warnings to both pedestrians and drivers. Speed limits, directional signs, and notifications of restricted areas are strategically placed throughout the site to ensure that all individuals are aware of their surroundings and any potential hazards.

7.8.8 Warning Devices

Warning devices such as flashing lights, alarms, and barriers are employed to alert site personnel to imminent dangers, especially in areas where heavy machinery operates. These devices are crucial in preventing accidents by ensuring that everyone on site is aware of moving vehicles and machinery.

7.8.9 Information, Training, and Supervision

This subsection emphasises the importance of educating site personnel about traffic management policies and safety practices. Regular training sessions, informational materials, and strict supervision ensure compliance with the traffic management plan and reinforce safe practices among all workers and visitors.

7.8.10 PPE (Personal Protective Equipment)

The use of personal protective equipment, particularly high-visibility clothing, is mandated to ensure that individuals are easily seen by drivers and machinery operators. This measure is critical in high-traffic areas and wherever visibility may be compromised.

7.8.11 Vehicles and Drivers

Maintaining vehicle safety is paramount, which includes regular inspections, maintenance, and adherence to safety protocols. Drivers are required to perform pre-use checks and report any issues

immediately. This subsection outlines the responsibilities of drivers and the standards vehicles must meet to operate on site.

7.8.12 Traffic Management Layout

The Traffic Management Layout section of the sample traffic management plan provides a visual representation of how traffic control measures are implemented within the project site. In the sample plan, this section makes reference to the detailed diagram which is attached at the end of the plan.

The diagram illustrates the positioning of pedestrian routes, vehicle paths, safety zones, and other critical features necessary for safe navigation and operation. It marks out distinct areas designated for different types of traffic and activities. By presenting a layout, stakeholders can visualise the flow of movement, identifying potential conflict points and the measures in place to mitigate these risks. Here are some key features of the diagram:

- Pedestrian Walkways: Clearly defined and marked paths that ensure safe foot traffic, separated from vehicle routes.
- Vehicle Routes: Designated lanes for vehicles, with clear directions to support smooth flow and minimize cross-traffic interactions.
- Vehicle Routes: Designated lanes for vehicles, with clear directions to support smooth flow and minimize cross-traffic interactions.
- Vehicle Routes: Designated lanes for vehicles, with clear directions to support smooth flow and minimize cross-traffic interactions.

7.8.13 Communication and Emergency Procedure

The Communication and Emergency Procedure section is designed to articulate clear and efficient communication strategies and to delineate emergency response protocols for the project site:

7.8.14 Communication Protocols

This part details the established channels for ongoing communication among site personnel, including how information on traffic management and immediate updates are shared. It emphasises the importance of clear, timely communication to prevent incidents and ensure swift responses to any changes or emergencies.

7.8.15 Emergency Procedures

This subsection outlines specific procedures for various emergency scenarios, including traffic incidents, injuries, and critical equipment failure. It describes the initial steps to be taken in the event of an accident, such as securing the area, providing immediate assistance, and notifying emergency services. Detailed roles and responsibilities for site personnel during an emergency are defined to ensure a coordinated effort in managing the situation.

7.8.16 Incident Management

This subsection provides guidelines for assessing incidents, implementing immediate protective actions, and documenting occurrences for future review and prevention strategies. The aim is to minimise impact, provide for the safety and health of all individuals on site, and ensure compliance with legal and operational requirements.

7.8.17 Emergency Contact Information

A comprehensive list of internal and external emergency contacts, including local emergency services, project management, and safety officers, is included. This list ensures that all personnel know who to contact in various types of emergencies, facilitating rapid and effective response actions.

7.9 Occupational health and safety management plan

This section defines the principal requirements of the Employer on Environment, Health, Safety, and Social (EHSS) associated with the Contractor / sub-contractor and any other agency to be engaged/practiced at construction worksites at all time. The objective is to lay down the guidelines to ensure that adequate precautions are taken to avoid accidents, occupational illness and harmful effects on the environment during construction.
The OHS targets, goals and aims for the Works are to achieve:
(i) Zero total recordable injuries.
(ii) Zero reportable environmental incidents
(iii) All personnel inducted in accordance with the approved contractor OHS plan
(iv) Total compliance of conducting inspections and audits as per approved OHS plan
(v) 100% incident recording and reporting
(vi) 100% adherence to usage of appropriate PPEs at work
(vii) Executing construction work with least disturbance to the environment, adjoining road users and traffic
The works should be undertaken in accordance with the applicable international guidelines, standards and specifications on OHS and every contract shall aim to achieve ISO certifications listed below during the currency of the contract:
ISO 9001: 2008: Quality Management System
ISO 45001:2018: Occupational Health and Safety Management System.
ISO 14001:2015: Environmental Management Systems.

7.9.1 Contractor OHS Policy and Plan

The Contractor as per Rule 69 of the GBOCW shall formulate a Health & Safety policy and get it approved by Chief Inspector and display it at conspicuous places at work sites in Hindi and Marathi i.e. languages understood by the majority of construction workers.

7.9.2 Contractor's OHS Committee

All employees should be able to participate in the making and monitoring of arrangements for safety, industrial health and environment at their place of work. The establishment of site OEHS committees in which employees and Contractor and sub-contractor management are represented can increase the involvement and commitment of employees. The Contractor shall ensure the formation and monitor the functioning of Contractor OEHS committees.

7.9.3 OHS Training

The Contractor shall ensure that all personnel working at the Site receive an induction OHS training explaining the nature of the work, the hazards that may be encountered during the site work and the particular hazards attached to their own function within the operation.

The Contractor shall organise quality OHS training to engage managers, supervisors and other personnel in behavioural change and improve safety performance.

The refresher-training programme to all employees shall be conducted once in six months. On-the spot practical skill development training on height safety including scaffold safety, crane safety, welding safety, electrical safety, traffic safety for marshals shall also be conducted to all foremen / workmen who were associated to the concerned jobs. Ensure that Daily Tool Box Talk is taken before start the work.

7.9.4 OHS Inspection

The purpose of OHS inspection is to identify any variation in construction activities and operations, machineries, plant and equipment and processes against the OHS Plan and its supplementary procedures and programs.

7.9.5 OHS Audit

The purpose and scope of OHS audit is to assess potential risk, liabilities and the degree of compliance of construction Environment Health & Safety plan and its supplementary procedures and programs against applicable and current SHE regulations and requirements of the Employer.

7.9.6 OHS Communication

The Contractor shall take every effort to communicate the Safety, Occupational health and Environment management measures through posters campaigns / billboards / banners / glow signs being displayed around the work site as part of the effort to raise safety awareness amongst the work force. Posters should be in Hindi, English, Gujarati and other suitable language as deemed appropriate. Posters / billboards / banners/ glow signs should be changed at least once in a month to maintain the impact.

7.9.7 Accident Reporting and Investigation

All near miss, accidents and dangerous occurrences shall immediately be informed verbally to the Employer. This will enable the Employer to reach to the scene of accident / dangerous occurrences to monitor / assist any rescue work and/or start conducting the investigation process so that the evidences are not lost. Reports of all accidents (fatal / injury) and dangerous occurrences shall also be sent within 24 hours as per approved format.

Investigations should be conducted in an open and positive atmosphere that encourages the witnesses to talk freely. The primary objective is to ascertain the facts with a view to prevent future and possibly more serious occurrences.

Accidents and dangerous occurrences which result in death, serious injury or serious damage must be investigated by the Contractor immediately to find out the cause of the accident/occurrence so that measures can be formulated to prevent any recurrence.

1. Emergency Preparedness Plan

The Contractor shall prepare as required under Rule 36 of BOCWR, an Emergency Response Plan for all work sites as a part of the Contractor SHE Plan. The plan shall integrate the emergency response plans of the Contractor and all other subcontractors. The Emergency Response Plan shall detail the Contractor's procedures, including detailed communications arrangements, for dealing with all emergencies that could affect the Site. This include where applicable, injury, sickness, evacuation, fire, chemical spillage, severe weather and rescue.

The Contractor shall ensure that an Emergency Response Plan is prepared to deal with emergencies arising out of:

(i) Fire and explosion
(ii) Collapse of lifting appliances and transport equipment
(iii) Collapse of building, sheds or structure etc.
(iv) Gas leakage or spillage of dangerous goods or chemicals
(v) Bomb threatening, Criminal or Terrorist attack
(vi) Drowning of workers
(vii) Landslides getting workers buried floods, Earthquake, storms and other natural calamities.

Arrangements shall be made for emergency medical treatment and evacuation of the victim in the event of an accident or dangerous incident occurring, the chain of command and the responsible persons of the Contractor with their telephone numbers and addresses for quick communication shall be adequately publicized and conspicuously displayed in the workplace.

Contractors shall require to tie-up with the hospitals and fire stations located in the neighbourhood for attending to the casualties promptly and emergency vehicle kept on standby duty during the working hours for the purpose.

Contractor shall conduct an onsite emergency mock drill once in every month for all his workers and his subcontractor's workers.

Safety

1. Housekeeping

Housekeeping is the act of keeping the working environment cleared of all unnecessary waste, thereby providing a first-line of defence against accidents and injuries.

Housekeeping is the responsibility of all site personnel, and line management commitment shall be demonstrated by the continued efforts of supervising staff towards this activity. General Housekeeping shall be carried out by the Contractor and ensured at all times at Work Site, Construction Depot, Batching Plant, Labour Camp, Stores, Offices and toilets / urinals.

2. Overhead Protection

All contractors shall provide overhead protections as per Rule 41 of BOCWR. Overhead protection should be erected along the periphery of every building which is under construction and the building height shall be 15m or above after construction.

Overhead protection shall be minimum 2m wide and the outer edge shall be 150mm higher than the inner edge and an angle not more than 20o to its horizontal sloping into the building. Overhead protection shall not be erected more than a height of 5m from the base of the building. Areas of inadvertent hazard of falling of material shall be guarded or barricaded or roped-off thereby by the Contractor.

3. Slipping, Tripping, Cutting, and Falling Hazards

As per Rule 42 of BOCWR: All places should be free from dust, debris or similar materials.
Sharp projections or any protruding nails or similar objects shall be suitably guarded or shall even be avoided to make the place safe to work. Contractor shall not allow workmen to work or use platforms, scaffolds / passageways or any walkways, which has water, or oil or similar substances spilt and has a slipping hazard, unless it is cleaned off or covered or sanded or saw dusted or make it safe with any suitable material.

Open side or opening where worker, equipment, vehicle or lifting appliance may fall at a building or outside shall be guarded suitably except in places of free access by reasons of nature of work. Suitable safety net shall be provided at places of material / man falling is possible in accordance with national standards.

4. Lifting Appliances and Gear

Lifting appliances means a crane, hoist machinery, derrick, winch, gin pole, sheer legs, jack, hoist drum, slewing machinery, slewing bearing fasteners, loffing machinery sheaves, pulley blocks, hooks or other equipment used for lifting materials, objects or building workers and lifting gears means ropes, chain slings, shackles, hooks, lifting lugs, wire ropes, lifting eyebolts and eyenuts and other accessories of a lifting appliance.

The Contractor shall ensure that a valid certificate of fitness issued as per Clause available for all lifting appliances including synchronised mobile jacks, pre-stressing hydraulic jacks, jacks fitted with launching girders etc. and Employer's approval before inducting to the site. Only after obtaining the approval from the Employer any lifting appliances and gear shall be used.

5. Construction Machinery

Construction machineries may include dumpers and dump trucks, lift trucks and, vibro hammers, rail welding equipments, mobile elevating work platforms, cranes, tipper lorries, lorry loaders, skip

wagons, 360° excavators, 180° backhoe loaders, crawler tractors, scrapers, graders, loading shovels, trenchers, side booms, pavers, planers, chippers, road rollers, locomotives, tankers and browsers, trailers, hydraulic and mechanical breakers etc.

Every construction equipment shall be in sound mechanical working condition and certified by either competent person under Factories Act or manufacturers' warranty in case of brand new equipments or authorized persons / firms approved by Employer before induction to any site.

6. Site Electricity

The Contractor shall employ qualified and competent electrical personnel and shall assess the size and location of the electrical loads and the manner in which they vary with time during the currency of the Contract.

7. Lighting

The Contractor shall provide sufficient site lighting, of the right type and at the right place for it to be properly effective. Lighting ought not to introduce the risk of electric shock. The Contractor shall select the luminaries as per the area requirement indicated below:

SN	Type of Lighting	Area of Requirement	Luminaries
1	Area Lighting	Workmen and vehicles to move about in safely.	• Shovel type: non-symmetrical • Symmetrical or non-symmetrical tungsten halogen
2	Beam flood	Concentrated light over	• Portable flood light (Conical beam)
	lighting	an area from a relatively great distance.	• Wide angle flood (fan shaped beam) • Medium or narrow angle flood (Conical beam)
3	Dispersive lighting	Lighting for indoor	• Dispersive (Mercury florescent) • Cargo cluster • Florescent trough
4	Walkway lighting	Lighting for stairways, ladder ways, corridors, scaffold access routes, etc.	• Well glass unit • Bulkhead unit (tungsten filament) • Bulk head unit (Florescent)
5	Local lighting	Lighting on sites and fittings are generally	• PAR (Parabolic Aluminised Reflector) lamp cluster

8. Hand Tools and Power Tools

The Contractor is wholly responsible for the safe condition of tools and equipment used by his employees and that of his sub-contractors.
Use of short / damaged hand tools shall be avoided and the Contractor shall ensure all his hand tools used at his worksite are safe to work with or stored and shall also train his employees (including his sub-contractors) for proper use thereby. All hand tools and power tools shall be duly inspected before use for safe operation. All hand tools and power tools shall have sufficient grip and the design specification on per with national / international standards on anthropometrics.

9. Welding, Gouging and Cutting

Gas cylinders in use shall be kept upright on a custom-built stand or trolley fitted with a bracket to accommodate the hoses and equipment or otherwise secured. The metal cap shall be kept in place to protect the valve when the cylinder is not connected for use.

Hose clamp or clip shall be used to connect hoses firmly in both sides of cylinders and torches. All gas cylinders shall be fixed with pressure regulator and dial gauges. Non-return valve and Flashback arrester shall be fixed at both end of cylinder and torch. Domestic LPG cylinders shall not be used for Gas welding and Cutting purpose. DCP or CO_2 type Fire Extinguisher not less than 5 kg shall be fixed at or near to welding process zone in an easily accessible location. Fire Extinguisher should

confirm to IS 2190:1992. Use firewatchers if there is a possibility of ignition unobserved by the operator (e.g. on the other side of bulkheads).

10. Fire Prevention, Protection and Fighting System

The Contractor shall ensure that construction site is provided with fire extinguishing equipment sufficient to extinguish any probable fire at construction site. An adequate water supply is provided at ample pressure as per national standard.

Recharging of fire extinguishers and their proper maintenance should be ensured and as a minimum should meet Indian National Standards. All foreman, supervisors and managers shall be trained on operating the fire extinguishers and firefighting equipment.

Every fire, including those extinguished by Contractor personnel, shall be reported to the Employer representatives. Emergency plans and Fire Evacuation plans shall be prepared and issued. Mock drills should be held on a regular basis to ensure the effectiveness of the arrangements and as a part of the programme, the Telephone Number of the local fire brigade should be prominently displayed near each telephone on site.

11. Demolition

The Contractor shall ensure that:
(i) all demolition works be carried out in a controlled manner under the management of experienced and competent supervision.
(ii) the concerned department of the Government or local authority be informed and permission obtained wherever required. Media shall also be informed regarding this concern.
(iii) all glass or similar materials or articles in exterior openings are removed before commencing any demolition work and all water, steam, electric, gas and other similar supply lines are put- off and such lines so located or capped with substantial coverings so as to protect it from damage and to afford safety to the building workers and public.
(iv) examine the walls of all structures adjacent to the structure to be demolished to determine thickness, method of support to such adjacent structures
(v) no demolishing work be performed if the adjacent structure seems to be unsafe unless and until remedial measures life sheet piling, shoring, bracing or similar means be ensured for safety and stability for adjacent structure from collapsing.
(vi) debris / bricks and other materials or articles shall be removed by means of chutes, buckets or hoists through openings through floors or any other safe means
(vii) no person other than building workers or other persons essential to the operation of demolition work shall be permitted to enter a zone of demolition and the area be provided with substantial barricades.
viii) Demolition debris shall be segregated for reuse and recycling purposes.

12. Excavation

Excavation: The Contractor shall ensure:
(i) where any construction building worker engaged in excavation is exposed to hazard of falling or sliding material or article from any bank or side of such excavation which is more than one 1.5 m above his footing, such worker is protected by adequate piling and bracing against such bank or side.
(ii) where banks of an excavation are undercut, adequate shoring is provided to support the material or article overhanging such bank.
(iii) excavated material is not stored at least 0.65 m from the edge of an open excavation or trench and banks of such excavation or trench are stripped of loose rocks and the banks of such excavation or trench are stripped of loose rocks and other materials which may slide, roll or fall upon a construction building worker working below such bank.
(iv) trench and excavation is protected against falling of a person by suitable measures if the depth of such trench or excavation exceeds 1.5 m and such protection is an improved protection in accord

13. Work Permit System

The Contractor shall develop a Work Permit system, which is a formal written system used to control certain types of work that are potentially hazardous. A work permit is a document, which specifies the work to be done, and the precautions to be taken. Work Permits form an essential part of safe systems of work for many construction activities. They allow work to start only after safe procedures have been defined and they provide a clear record that all foreseeable hazards have been considered. Permits to Work are usually required in high-risk areas as identified by the Risk Assessments.

A permit is needed when construction work can only be carried out if normal safeguards are dropped or when new hazards are introduced by the work. Examples of high-risk activities include but are not limited to:
(i) Entry into confined spaces
(ii) Work in close proximity to overhead power lines and telecommunication cables.
(iii) Hot work
(iv) To dig where underground services may be located
(v) Work with heavy moving machinery
(vi) Working on electrical equipment
(vii) Work with radioactive isotopes
(viii) Heavy lifting operations and lifting operations closer to live power line

14. Personal Protective Equipment (PPE)

The Contractor shall provide required PPEs to workers to protect against safety and / or health hazards. These PPEs shall be adapted to the specificities and needs of both men and women employed on sites. Primarily PPEs are required for the following protection

(i) Head Protection (Safety helmets)
(ii) Foot Protection(Safety footwear, Gumboot, etc)
(iii) Body Protection (High visibility clothing (waistcoat / jacket), Apron, etc) (iv) Personal fall protection (Full body harness, Rope-grap fall arrester, etc) (v) Eye Protection (Goggles, Welders glasses, etc)
(vi) Protection (Gloves, Finger coats, etc)
(vii) Respiratory Protection. (Nose mask, SCBAs, etc.)

15. Visitors to Site

No visitor is allowed to enter the Site without the permission of the Employer. All authorised visitors should report at the site office. Contractor shall provide visitor's helmet (White helmet with visitor sticker) and other PPEs like Safety Shoe, reflective jacket, respiratory protection etc. as per requirement of the Site. All Visitors shall be accompanied at all times by a responsible member of the site personnel. The Contractor shall be fully responsible for all visitors' safety and health within the Site. All visitor should also receive a site induction awareness, commensurate to H&S risks, before entering the construction site.

7.10 Vectors, Rodents, Snakes Management Plan

Risk assessment is the process of identifying, evaluating, and analysing potential hazards or risks that could negatively impact people, property, the environment, or other assets. It involves determining the likelihood of these risks occurring and the potential severity of their consequences. The goal of risk assessment is to provide decision-makers with the information needed to make informed choices about how to manage or mitigate the identified risks.

The process typically includes the following steps:

- Hazard Identification
- Risk Analysis
- Risk Evaluation
- Risk Control

The proposed SWD works include activities such as desilting of water bodies, construction, rehabilitation, embankment strengthening, landscaping, and ecological restoration. While these activities improve flood control and drainage efficiency, they also pose environmental, health, and safety risks. A systematic risk assessment helps identify potential hazards, evaluate their impact, and implement effective mitigation measures. Due to excavation, desilting, and embankment activities, the SWD works present hazards such as rodent infestations, vector breeding, snake encounters

7.10.1 Identified Risks

7.10.1.1 Rodents

Risk Factors:

- Disturbed soil and embankments create hiding places for rodents.
- Accumulated debris and waste attract rodents, increasing the risk of infestation.
- Rodents may damage construction materials, gnaw electrical wiring, and contaminate food and water sources.
- Exposure to rodent allergens and diseases such as leptospirosis and hantavirus can impact worker health.

7.10.1.2 Vectors (Mosquitoes, Flies, etc.)

Risk Factors:

- Stagnant water from excavation and desilting becomes a breeding ground for mosquitoes.
- Organic waste attracts flies, leading to hygiene concerns and disease outbreaks.
- Mosquitoes spread malaria, dengue, and chikungunya, increasing absenteeism among workers.

7.10.1.3 Snakes

Risk Factors:

- Excavation and embankment work disturb natural snake habitats.
- Snakes may enter work zones, Houses, leading to safety concerns and panic.
- Risk of venomous snake bites to workers & Local public, requiring immediate medical attention.

7.10.2 Risk Evaluation

Each hazard is assessed based on probability and impact:

Hazard	Probability	Impact	Severity
Rodent Infestation	High	Moderate (disease transmission, material damage)	Medium
Vector Breeding	High	High (disease outbreaks, workforce absenteeism)	High
Snake Encounters	Moderate	High (risk of bites, worker safety)	High

7.10.3 Mitigation Measures

7.10.3.1 Rodent Control Measures

- **Site Cleanliness & Waste Management:** Ensure proper waste disposal (sediment/silt/solid waste to eliminate food sources)
- **Storage Practices:** Keep construction materials sealed and away from potential rodent access points.
- **Pest Control:** Deploy rodent traps, bait stations, and conduct regular pest control measures.
- **Sealing & Inspection:** Seal gaps in storage facilities and regularly inspect structures for rodent activity.

7.10.3.2 Vector Control Measures

- **Drainage Management:** Prevent water stagnation by ensuring proper drainage of excavation sites.
- **Insect Control:** Use larvicidal agents in standing water and conduct insecticide spraying.
- **Worker Protection:** Provide workers with protective clothing and insect repellents.
- **Public Health Coordination:** Work with local health authorities to monitor and control vector populations.

7.10.3.3 Snake Risk Management

- **Site Surveys & Habitat Assessment:** Conduct site inspections to identify potential snake habitats before excavation.
- **Vegetation Control:** Maintain clear surroundings by removing dense vegetation near work areas.
- **Snake Relocation:** Engage professional snake catchers/Sarpa Mitra for safe removal and relocation. **(refer Annexure 7.1)**
- **Worker Safety Training:** Educate workers on snake identification, first-aid measures, and emergency response.
- **Protective Gear:** Provide workers with PPE (boots and gloves) to reduce the risk of bites.

7.10.4 Emergency Response Plan

7.10.4.1 Rodent & Vector Exposure Response

- Immediate medical attention for workers showing symptoms of rodent or vector-borne diseases.
- Quarantine affected areas and implement additional pest control measures.
- Notify local health authorities in case of outbreaks.

7.10.4.2 Snake Bite Response

- **Immediate Actions:**
  - Keep the affected person calm and restrict movement.
  - Do not attempt to catch the snake; instead, identify it from a safe distance.

- **Medical Response:**
  - Call emergency medical services immediately.
  - Apply first aid (clean wound, immobilize limb, and avoid cutting the wound or applying tourniquets).

7.10.4.3 Monitoring & Reporting

- **Routine Inspections:** Safety officers conduct regular site inspections to monitor rodent, vector, and snake risks.
- **Incident Documentation:** Record all incidents, including rodent sightings, mosquito breeding areas, and snake encounters.
- **Review & Improvement:** Evaluate and update risk management strategies based on reported incidents and changing site conditions

7.11 Excavated Earth (Top Soil) Material Management Plan

Total Excavated material during project implementation is expected to be 6,26,329.61 CUM. Loss of topsoil is a long-term impact due to the following reasons: (i) site clearance (ii) temporary construction activities such as construction camps, material storage locations (iii) diversion routes (iv) Counter and Trenching etc. The environmental measures for both these activities during all stages of construction activity in Urban Flood Management Component 2.2 of MRDP project in Kolhapur City are discussed in the subsequent sections.

The top soil from all sites shall be stripped to a specified depth of 15 cm and stored in stock piles for reuse. A portion of temporarily acquired area and/or RoW edges will be earmarked for storing top

soil. The locations for stacking will be pre-identified in consultation and with approval of PIU. The following precautionary measures will be taken by the Contractor to preserve the stock piles till they are re-used:

- Stockpiles will be such that the slope doesn't exceed 1:2 (vertical to horizontal), and height is restricted to 2 m
- To retain soil and allow percolation of water, the edges of pile will be protected by silt fencing
- Multiple handling kept to a minimum to ensure that no compaction occurs
- Stockpiles shall be covered with empty gunny bags or will be planted with grasses to prevent the loss during rains
- Such stockpiled topsoil will be utilized for:
    - Covering reclamation sites or other disturbed areas
    - Top dressing and raising turfs
    - Filling up of tree pits
    - For developing compensatory plantation ·
    - In the agricultural fields of farmers, acquired temporarily that needs to be restored
    - Residual top soil, if there is any, shall be utilized for the plantations works on 25 Ha as proposed in the project
    - The utilization as far as possible shall be in the same area from where top soil was removed. The stripping, preservation and reuse shall be carefully inspected, closely supervised and properly recorded by PMTC and PIU
    - As per interventions the plantation is proposed on 210.84 Ha of land. The excavated material will be used for this plantation.

7.12 Waste Management Plan (Construction Waste/Solid Waste/Sediment/Silt)

Management of the following types of waste generated from the construction activity is a key aspect of the ESMP:

- General construction and demolition waste
- Domestic Solid Waste
- Hazardous Waste
- Desilted Material from SWD and Lakes

For each construction contract, within 30 days of the appointed date, the contractor is required prepare and submit a Waste Management Plan (WMP) to Environmental Expert at PIU and PMU level (as one activity maybe may be packaged as one or as multiple contracts). The Contractor's obligation for proper WMP must be included in contract document.

These plans spell out specific measures that will be undertaken to segregate, store and appropriately dispose wastes generated from the proposed construction activities.

7.12.1 Potential Sources of Waste Generation

The expected solid waste as expected to be generated during construction phase and their disposal method is provided in the table below:

Table 7-8: Solid and Hazardous Waste- Construction Phase

Sr. No	Type of Waste	Estimated Quantity	Disposal
1.	Excavated Top Soil	6,26,329.61 CUM	Excavated to top soil will be stored at designated place and will be used at the proposed plantation areas in the project.
2	Construction and demolition waste	8,79,457 CUM	Construction debris will be reused in construction activity and to level low lying areas at approved site. Rest will be sent to Zoom Project for its Management.
3	Domestic waste including food wastes, sludge from septic tanks	10 kg per day	All domestic solid waste will be handed over to local agency for disposal at KMC Solid waste management site in Zoom Project

Sr. No	Type of Waste	Estimated Quantity	Disposal
	and household packaging wastes		
4	Used Oil from construction machinery	Approx. 5 tons per annum	To be disposed to MPCB authorised Vendors
5	Desilted materials From Lakes and SWDs	525949 CUM	To be disposed of at KMC authorised silt disposal site in KMC boundary

Note: The quantity will be for the entire construction period

7.12.2 Comprehensive Waste Management Plan

The contractor should prepare a WMP to be submitted to PIU and PMU for approval prior to setting up of construction and labour camp and it should comprise the following details:

- Categorization of waste into degradable, biodegradable and hazardous categories
- and list of different types of waste that falls in each of these categories.
- Estimates about the quantity of waste generated in each category and type of storage units required.
- Detail the provisions for storage and handling of waste until disposed.
- A plan of the respective camps / areas like construction camp, labour camp etc. to be submitted indicating in it the space allocated for storage and handling of wastes.
- Based on the type of wastes generated, treatment and disposal mechanisms should be presented. Measures for waste reduction, treatment and disposal should be implemented. Record of all designated disposal locations which require approval of the Supervising Engineer are to be presented. These should necessarily include details of:
    - Disposal of cut-to-spoil indicating quantity generated
    - Trees cut during the progress of clearing and grubbing or other activities should be presented,
    - Waste concrete, bitumen, bags indicating quantity expected to be generated and dispose,
    - Waste oils from service bay and oil spills as well as oil from cleaning of service bay
    - Oil and grease from vehicle washing bays,
    - Kitchen waste indicating quantity generated, quantity disposed and location of disposal
- Detail the precautions to be taken while storing, handling and disposing each type of waste, trainings to be given to workers to create awareness about waste management.
- Details of each debris disposal site: Copy of approved site identification report along with location plan on a village map showing the debris disposal sites, site, its survey no., access road, project stretch, distance from the project stretch, surrounding features and land use like residences, agricultural land, water bodies etc., photograph of the site showing the topography and other existing features.

7.12.3 Precautions to be adopted during disposal of debris waste material

The contractor shall take the following precautions during transportation and disposal of debris/waste material:

- A register should be kept for recording the details of the waste generated and their disposal.
- The contractor will take full care to ensure that public or private properties are not damaged/ affected during the site clearance for disposal of debris and the traffic is not interrupted.
- All arrangements for transportation during dismantling and clearing debris, considered incidental to the work, will be implemented by contractor in a planned manner as approved and directed by KMC after prior approval.
- In the event of any accidental spill or spread of wastes onto adjacent parcels of land, the contractor will immediately remove all such waste material/s and restore the affected area to its original state to the satisfaction of KMC.
- Contractor should ensure that any spoils/materials unsuitable shall not be disposed off near any water course; water body; agricultural land; natural habitats like grass lands, wet lands, flood plains, forests etc. pasture; eroded slopes; and in ditches, which may pollute the surrounding including water sources.
- Contractor should ensure effective water sprinkling during the handling and transportation of materials where dust is likely to be created.
- Contractor Materials having the potential to produce dust will not be loaded beyond the side and tail board level and will be covered with a tarpaulin in good condition.
- Any diversion required for traffic during disposal of debris shall be provided with traffic control signals and barriers after discussion with the local body and as approved by KMC.
- During the debris disposal, Contractor will take care of surrounding features and avoid any damage to trees and properties
- No hazardous and contagious waste material shall be disposed at such locations.
- Contractor needs to quantify the debris to be generated. Contractor to make the feasibility study as per the proposed debris/construction waste quantity in the project and accordingly the disposal plan is to be prepared. The suitable site / land parcels to be explored in case of existing debris disposal site is not adequate for huge waste material generation in the proposed project. The detailed plans and technical aspects should be approved from KMC and then the areas may be used for dumping of construction waste materials.

7.12.4 Management of Excavated Earth

- The top soil will be stripped to a specified depth of 6-8 inches and stored in stockpiles of height not exceeding 2 m. Piling of the top soil will be made away from water ways. The heap of the top soil will be covered with grass cover to minimize air pollution;
- The stored topsoil will be spread back to maintain the soil physio-chemical and biological activity.
- The preserved top soil will be used for restoration of sites, in area of plantation proposed in the project;

7.12.5 Management of Domestic Waste from Workers Camp

- The municipal waste from the labour camp will only be routed through proper collection and handover to KMC for further disposal at Zoom Project Site after prior approval.
- No incineration or burning of wastes shall be carried out.
- Discarded plastic bags, paper and paper products, bottles, packaging material, gunny bags, hessian, metal containers, strips and scraps of metal, PVC pipes, rubber and poly urethane foam, auto mobile spares, tubes, tires, belts, filters, waste oil, drums and other such materials will be handed over to MPCB authorised vendors.
- Septic tank will be provided for toilets in labour camp or mobile bio toilets to be provided in worker's camp. If septic tanks then should be cleaned frequently through municipal exhausters.

7.12.6 Management of Used Oil from Construction Machinery

- Concrete flooring and oil interceptors should be provided in vehicle washing and maintenance area if any.
- Petroleum, oil and lubricants waste shall be stored safely in separate containers and should be disposed of by transfer only to recycler/ re-refiners possessing valid authorization from the MPCB.
- Used lead batteries, if any, should be disposed as per the Batteries (Management and Handling) Rules 2016.
- There should be a register to record the details of the oil wastes generated if any and oil storage areas.

7.12.7 Management of Construction and Demolition (C&D) Waste

- Debris generated from construction activities along the SWD channels and lakes shall be carefully disposed in such a manner that it does not flow into the surface water bodies or form puddles in the area.
- Maximum C&D waste will be reused for SWD and road construction works, levelling in the low-lying areas
- The Contractor will suitably dispose off unutilized C&D debris at pre-designated disposal sites (Zoom Project), subject to the approval of KMC.

7.12.8 Desilted Material Disposal

The desilted material shall be disposed of without any accumulation. The silt removed from the SWD channel and Lakes shall be tested for quality and proper reuse option will be explored. In current scenario, the periodic desilted materials by KMC operations, is being deposited at designated place within KMC boundary. The local farmers and residents are already using it for plantation and agriculture purpose free of cost.

Contractor needs to quantify the silt from desilting to be generated. Contractor to make the feasibility study as per the proposed removed silt waste quantity in the project and accordingly the disposal plan is to be prepared. The suitable site / land parcels to be explored in case of existing silt disposal site is not adequate for huge waste material generation in the proposed project. The detailed plans and technical aspects should be approved from KMC and then the areas may be used for dumping of desilted materials.

It is also recommended that contractor has to carry out the monitoring and testing of this desilted material in NABL laboratory to study the suitability to dump and avoid pollution of soil and ground water in case of contaminated. Accordingly, the reuse strategy may be developed. (Please note during ESIA study the sediment quality is already tested through NABL accredited Laboratory and the results depicts that the sediment is having high nutrient values and devoid of chemical pollution. Thus, suitable for agriculture and plantation purpose).

KMC should promote people to reuse the desilted maximum at free of cost. It may reduce the soil resource overexploitation.

The desilted material may be used as manure for plantation proposed in the project. The developers may be convinced suitably to use this silt for filling and levelling of land activity.

The silt can also be used for the proposed plantation intervention in the project.

The following shall be ensured during site feasibility study of new disposal site in case of existing site is inadequate

- The dumping does not impact natural drainage courses
- No endangered / rare flora is impacted by such dumping
- Settlement area located at least 1.0 km away from the site.
- Should be located in non-residential areas located in the downwind side
- located at least 100m from the designated forest land
- avoid disposal on productive land

- should be located with the consensus of the local community, in consultation with the engineer
- All vehicles delivering material to the site shall be covered to avoid material spillage

7.13 Integrated Pest Management Plan (IPMP)

The project intends plantation/dense forest development on about 146 ha of land. Approximately 1,75,000 trees will be planted which may lead to use of pesticides and fertilizers. In order to minimise the level of impact, the project will promote IPMP sensitizing horticulturists and educating them on scientific application of fertilizer and pesticides along with the application of organic fertilizers. Effective implementation of IPMP practices will reduce the risk of water pollution through leaching of chemicals from plantation area to water sources, both surface and sub-surface. This section discusses about IPMP in line with the project activities.

The project will adopt IPMP as the key strategy to combat pests and diseases in the project and regulate its environmental impact. However, appropriate strategy to be adopted for its implementation among the contractor/workers/officials/horticulturists like sensitization on environment, awareness on environmental impact of indiscriminate use of pesticides, on restricted and banned pesticides, regular orientation training and follow up, providing hand holding / field guidance and monitoring the implementation of IPM.

7.13.1 The World Bank Operational Guidelines

The World Bank & IFC pesticide guidelines aim to ensure that;

1. It should have negligible adverse human health effects
2. Should be effective against target pests and minimal effect on non-target species
3. Development of pest resistance to be kept in view
4. Public health pesticides must be safe for inhabitants and animals
5. Integrated pesticide management specifically identifies the following as the key in pest control.
6. A categorical preference for bio control methods along with institutional and capacity building for the same.
7. Reducing reliance on synthetic chemical pesticides and only if approved by IPM approach.
8. Does not permit under any circumstance the use IA, IB and II classified pesticides (WHO Classified).
9. Recommends the use of Participatory IPM along with specific investment components for the same.
10. Permits WHO enlisted category III type chemicals as a part of the IPM strategy.

7.13.2 Objectives of IPMP

The objective of IPMP is to promote and support safe, effective and environmentally sound pest management under the project. Along with regulating the use of synthetic pesticides (based on prescribed doses and type of pesticides to be used), the objective of IPMP is to promote the use of biological and environmental control methods and the reduction in reliance on synthetic chemical pesticides. Promotion of IPMP is objectively driven to achieve the followings.

1. Minimize tree loss with scientific application of synthetic pesticides;
2. Reduce environmental pollution caused due to the application of synthetic pesticides;
3. Introduction and adoption of biological and cultural methods and managing pests;
4. Reduction in health hazards arising due to chemical pesticides during handling;
5. Minimizing pesticide residues through the application of appropriate doses;
6. Promotion of bio pesticides

7.13.3 Salient Features of the Project Approach

1. Popularising IPM approach among farming community through demonstration, awareness, training and exposure;
2. Organising regular pest surveillance and monitoring to assess pest/disease situation and study landscaper-eco-system to advise timely IPM control measures in a convergence mode;

3. Encourage landscapers to rear biological control agents for their field use and conservation of naturally occurring biological control agents for control of crop pests;
4. Promoting use of bio-pesticides, neem-based pesticides, bacillus-based bio-pesticides, insect pathogen as alternative to chemical pesticides;
5. To play a catalytic role in transfer of innovative IPM skills/methods/ techniques to farmers through extension services, training and awareness.
6. Issuing insect-pest and disease related information and control measures to farmers.

7.13.4 IPMP Approach

Alternative pest control strategies such as IPM that deploys a combination of different control measures such as cultural control, use of resistant genotype, physical and mechanical control, and rational use of pesticide would reduce the number and amount of pesticide applications. Sensitization, awareness and extension support would educate and encourage farmers to adopt the innovative IPM strategies that would be key to reduce the harmful impact of pesticides on life and environment.

Table 7-9: Integrated Pest Management Approach

Sr. No.	Standard Pest Control Measures	Integrated Pest Management
1	Use of synthetic pesticides is common and widespread	More knowledge intensive
2	Less emphasis on preventive approach	Emphasis on prevention of pest problems
3	More reactive to pest outbreaks	Systematic approach for long-term pest control
4	Pesticide application is more chemical intensive	Change in field conditions that prevent pest attack
5	Use of synthetic pesticides focus more on killing pests directly	Regular inspection / monitor and taking recommended actions
6	Use of Higher Doses	Doses and type of pesticides use as per need

The project will adopt the suggested steps for IPMP implementation. Specific IPMP measures that the project will promote / encourage horticulturists/workers to adopt are;

- Deep summer ploughing (only in suitable cases).
- Recycling and appropriate disposal of plant residues, weeds etc.
- Seed treatment.
- Growing pest and disease resistant/tolerant varieties.
- Timely and synchronous sowing operation.
- Maintaining optimum plant/tree spacing.
- Post-sowing cultural/sapling plantation operations.
- Balanced use of fertilizers.
- Proper water management.
- Timely weed control.
- Use of light, yellow, sticky and pheromone traps for monitoring of pests.
- Regular monitoring on pests and their natural enemies.
- Conservation of plant defenders (parasites, predators and pathogens).
- Use of bio-pesticides against chemical pests.
- Observation of pests and defender's ratio (2:1) before taking control action.

The IPMP strategy will cover (1) identification of pests & diseases for the proposed plants species in the area through regular monitoring, (2) assessment of major pests/diseases for different plants, (3) promotion of physical / mechanical / cultural / biological control methods, (4) facilitating use of bio-pesticides and (5) prescribing appropriate use of synthetic pesticides with recommended doses.

7.13.5 Identification Process and IPM Methods

Field monitoring helps to keep track of the pests and their potential damage, which forms the base of IPMP. So, the process starts with monitoring, which includes inspection and identification. This provides knowledge about the current pests and plant situation and is helpful in selecting the best possible combinations of the pest management methods. Identification of minor and major pests, diseases in the project areas will be conducted regularly for the purpose. Package of practices

developed by the Maharashtra State Agriculture Universities and Garden Department of KMC can be adopted accordingly. A priority list of different control methods of IPM is presented below.

Table 7-10: Adoption of IPM Methods and its Priority

IPM Procedures	Methods of Executing	Priority in Application
Cultural	Avoidance of monoculture; Improved disease resistant varieties; Summer ploughing; Optimum plant densities; Avoiding excessive irrigation; Avoiding high nitrogenous fertilization;	To be given preference as preventive mechanism
Biological	Conservation / promotion of bio agents like birds, parasites & pathogens for biological control of pests.	Second Priority
Mechanical	Damage/Destroying all the eggs of the insect; Destroy any material infested by insect, pest and diseases.	Third Priority
Chemical	Chemical Control (Use of recommended chemicals only)	Last Priority

7.13.6 Pest and Disease Surveillance

As part of IPMP strategy, a pest and disease surveillance will be undertaken electronically. Pest surveillance is an effective tool as an information system, which renders all pest control methods more effective. It aims at monitoring and forewarning of likely build-up of pests in order to facilitate planning and adoption of suitable control strategy. It acts as a guiding principle in determining the areas and time needing the pest control. The existing pest and disease surveillance system of the Government will be inbuilt in to the project.

7.13.7 Major Activities under IPM Strategy

Table 7-11: IPM Strategy and Key Activities

Key Activities	Execution Strategy
Training of project officials on IPM (all levels)	Orientation training by Plant type
Training of Horticulturists	Tree Species specific orientation on IPM in phased manner
Developing Information Education and Communication materials and distribution with list of banned / WHO enlisted / restricted pesticides	Information Education and Communication materials in local language with visual display; Using these materials in orientation
Demonstration of IPM in demonstration plots	Involving Locals/Horticulturists/PIU Garden Department
Extending technical inputs and support to Locals/Horticulturists/PIU Garden Department	Inputs support, i.e., bio-pesticides, bio-weedicides, bio fungicides, bio-fertilizers, bio-control agents (predators) etc.
Setting up of vermicompost units for litter generated from plants	Encouraging Locals/Horticulturists/PIU Garden officials for inter / planting of legume plants; technical support for vermi-compost establishment.
Providing / supporting Locals/Horticulturists/PIU Garden with biocontrol agents	Collaboration with other agencies / state bio-control labs.
Process monitoring and documentation of learning cases / best practices	Periodic on-field assessment and documentation of economic gain.

7.13.8 Associated Risks and Mitigation Measures

The plan for implementation of IPMP may be constrains due to various factors which are discussed below. However, the project will take multi prong remedial measures to minimize the associated risks, in collaboration with different other research institutions, agricultural universities and technical support organizations.

Table 7-12: Risks and Mitigation Measures

Constraint/Risks	Mitigation
Availability of prescribed / selective pesticides, effective against pests but not against natural enemies of pests.	Making available selective bio-pesticides to horticulturist, as per their requirements through linkage and collaboration.
Potential of bio-control agents to deal with different insects / pests / diseases.	Use of only duly approved bio-control agents.
Techniques of mass rearing of several bio-agents are still not well developed.	Fostering collaboration / convergence with different institutions / universities for timely supply of bio-agents to farmers.

Constraint/Risks	Mitigation
On field guidance and providing hand holding support to the horticulturist through extension services.	Project envisages to develop a cadre at the cluster level who are trained in IPM for extending support. Apart from this, the existing extension mechanism of ATMA will be useful for supporting farmers in adopting IPM.

7.13.9 Criteria for Pesticide Selection and Use

The criteria to be followed for the selection and use of pesticides are (1) they must have negligible adverse human health effects, (2) they must be shown to be effective against the target species and (3) they must have minimal effect on non-target species and the natural environment, (4) must not be in the 1a, 1b and II category as enlisted by WHO, (5) must not be banned or proposed for restricted use in the country.

7.13.10 Pesticide Storage, Handling and Disposal

7.13.10.1 Precautionary Measures

The horticulturists will be educated / sensitised on the following general precaution measures when administering synthetic pesticides.
1. Wearing protective body cover by the operator, use of personal protection equipment (PPE);
2. While applying pesticide, restraining from taking food items, drink or smoke;
3. Washing hands, face and other body parts with soap after spraying;
4. Wash overalls and other protective clothing at the end of every working day in soap and water and keep them separate from the rest of the family's clothes.
5. In case if any part of the body is exposed and come in contact with the pesticide, it should be washed-off immediately;
6. Change clothes immediately after spray and cleaning body properly.
7. Visit to doctor in case of feeling unwell.

7.13.10.2 Storage

Horticulturists will be oriented to take precautions in storing the pesticides, such as (1) keeping the place of storing of pesticides away from human and animals, (2) keeping away from water sources, (3) keeping at a height which should be out of reach of children, (4) keeping away from exposure to sunlight and moisture, (5) well-ventilated place of storing, (6) well stacking to avoid of spillage, (7) the place of storage should be out of reach of children.

7.13.10.3 Transportation

Horticulturists will be advised to take protective measures during transportation of the synthetic pesticides, like (1) transportation in well-sealed and labelled containers, (2) should be transported separately, i.e. not with any other consumable items, cloths, drugs etc., (3) proper stacking to prevent leakage, (4) display of warning notice on the vehicle transporting pesticides, if transported in bulk with regular checking during transportation.

7.13.10.4 Disposal System

Appropriate disposal of the containers / unused remains is essential to prevent contamination of soil, water or its adverse impact on human health. Farmers will be oriented on these aspects covering following disposal systems.
1. At the end of the day's work, the inside of the spray pump should be washed and any residual pesticides should be flushed out.
2. The rinsing water should be collected and carefully contained in clearly marked drums with a tightly fitted lid. This should be used to dilute the next day's tank loads or disposed properly at disposal sites like pits or digs.
3. Disposal of the remaining pesticides into surface water sources like stream, nala, rivers, wells or any drinking-water sources is strictly prohibited.

4. Decontaminate containers where possible. For glass, plastic or metal containers are used, this can be achieved by triple rinsing, i.e. part-filling the empty container with water three times and emptying into a bucket or sprayer for the next application.
5. All empty packaging should be kept away from common approach space and should be returned to the designated organisation / individual for safe disposal. Re-use of empty insecticide containers will be prohibited. The used packages shall not be left outside to prevent their reuse. Used packages shall be broken and buried away from habitation.
6. While purchasing, date of manufacture and date of expiry will be reviewed, as per the print;
7. In case the stock remained unutilised and crossed the date of expiry, it should be returned to the supplier.

7.13.10.5 Capacity Building on IPMP

Under the promotion of IPMP, it is important that horticulturists understand its importance and adopt it in the plantation areas, following the prescribed procedures. To improve the understanding of horticulturists/workers, it is essential to develop their knowledge base through training, exposures, handholding and extension services. For the capacity building, the project will adopt training and capacity building programmes in assistance with Garden Department of KMC, Agriculture Department, Shivaji University. The extension service providers, operating at the local level will also be trained and exposed to IPM initiatives.

7.13.10.6 IMPM Implementation Arrangement

The IMPM implementation will be the primary responsibility of the Garden Department of KMC. They will organize required training and awareness drive to make local participating people, horticulturists, garden department officials understand about the importance of IPM, including other methods of pest control. Different Information Education and Communication materials will be developed and distributed by KMC along with providing required extension and hand holding support. Selection of disease specific appropriate pesticides and personal safety measures will also be a part of the promotion of IPM and PMP implementation strategy. The concerned departments will also facilitate promotion of bio-control agents and bio-pesticides. The KMC and PMU will assess the PMP implementation with the support of the M&E agency (concurrent monitoring, mid-term review and end-line assessment) and PMTC. The M&E agency and PMTC will look in to the implementation of PMP and they will submit periodic report to the PIU for review and onward reporting.

Table 7-13: Monitoring of IPMP

Sr. No.	Activity	Monitoring Areas	Responsibility	Time Frame
1	Development of IPM Related Learning Materials and its Distribution to Farmers / FPCs	Learning materials cover crop specific IPM practices	PIU / Garden Dept.	6 Months from project inception (printed materials)
		Availability of reading / reference materials with the horticulturists	Ground force of Garden Dept.	1 month from printing of documents Monitoring of adoption by farmers during field visits
2	Promotion of Cultural Procedures	Availability of resistant varieties of seeds, plant density maintenance etc.	Ground force of Garden Dept.	Extending support (physical / technical) prior to sowing; Regular monitoring
3	Promotion of Bio Control Agents	Support to Horticulturists in getting bio-control agents	PIU / Garden Dept.	During initial identification of pest / disease, within 7-10 days of such identification
		Application of biocontrol agents by the Horticulturists	Ground level Staff Garden Dept.	Regular field visit and preparation of report
4		Purchase and use of banned pesticides	PIU / Garden Dept.	Periodic field visits

Sr. No.	Activity	Monitoring Areas	Responsibility	Time Frame
	Purchase and use of Pesticides	Use of pesticides as per the disease specific prescription of doses.	Ground level Staff Garden Dept.	Periodic field visits
5	Use of Bio-fertilizers and vermi-compost	Awareness inputs Extension of Required Technical Support Use of bio-fertiliser / pesticides / vermicompost	PIU / Garden Dept	Periodic field visits, physical observation and consultations
6	Training and awareness creation	Organisation of Training on IPM; Understanding of horticulturists on IPM Organisation of awareness camps	PIU / Garden Dept	Periodic field visits, consultation with horticulturists Assessment of application of training inputs

7.14 Community health and safety management plan

This Community Health and Safety Plan (CHSP) outlines the measures to protect the health, safety, and well-being of the surrounding community during the construction of Storm water management plan for Kolhapur. The plan ensures compliance with local regulations and international best practices.

Objectives

- Minimize health and safety risks to the community.
- Prevent environmental hazards and pollution.
- Ensure effective communication between the project team and the community.
- Promote emergency preparedness and response measures.

Risk Assessment Potential risks to the community include:

- Air and noise pollution
- Traffic disruptions
- Water contamination
- Structural hazards
- Fire and hazardous material exposure
- Communicable diseases

Mitigation Measures

- **Air and Noise Pollution Control**
  1. Use dust suppression methods (e.g., water sprinkling, covered loads).
  2. Limit construction activities to designated hours.
  3. Use noise-reducing equipment.
- **Traffic and Road Safety**
  1. Designate safe pedestrian walkways.
  2. Implement traffic control measures (e.g., signs, flaggers, speed limits).
  3. Coordinate with local authorities for road closures or detours.
- **Water and Soil Protection**
  1. Proper waste disposal and spill prevention measures.
  2. Implement erosion control systems.
  3. Monitor water quality regularly.
- **Structural and Fire Safety**
  1. Ensure proper fencing around hazardous zones.
  2. Conduct routine safety inspections.
  3. Provide fire extinguishers and train workers in fire response.
- **Disease Prevention**
  1. Ensure clean and sanitary worker accommodations.
  2. Promote hygiene practices and provide handwashing stations.
  3. Conduct health screenings and vaccination drives.

Emergency Response Plan

- Establish an emergency communication system.
- Identify local emergency contacts and hospitals.
- Conduct regular emergency drills.
- Provide first aid stations and trained personnel.

Community Engagement and Communication

- Designate a community liaison officer.
- Establish a grievance redress mechanism.
- Conduct regular meetings with community representatives.
- Provide updates on project progress and safety measures.

Monitoring and Compliance

- Perform regular health and safety audits.
- Maintain incident reporting and investigation records.
- Adjust mitigation measures as needed based on feedback and observations.

This plan will be continuously reviewed and updated to ensure the safety and well-being of the community throughout the construction project. All stakeholders are encouraged to participate in maintaining a safe environment.

Chapter 8 : Environmental and Social Monitoring Action Plan

The project will take up monitoring and evaluation of the ESMP implementation covering process, output and outcome indicators in different intervals during the life of the project. The Monitoring (M&E) of ESMP implementation shall be conducted in continuous basic to assess the progress and achievements made in line with the identified risks and mitigation measures. By providing feedback loop, the M&E will enable decision makers to take up mid-course corrections if required. The M&E framework is designed to measure the impacts that have taken place; evaluate the performance of mitigation measures proposed; suggest improvements in management plan, if so required; achievement of benefits expected from the implementation of safeguard measures; and ensure compliance with the legal obligations. The M&E is to be undertaken at two levels as below.

Monitoring and Evaluation (M&E) of the ESMP implementation of the project as a whole: The application and effectiveness of ESMP elements including preparation of Contract Package ESMPs, preparation and implementation of Contractor's ESMPs, monitoring, capacity building and institutional arrangements will be monitored. Mid-term and end-term audit of the environmental and social management aspects of the project will also be undertaken by engaging third party M&E agency.

Monitoring of Mitigation Measures and Environmental Quality: This will monitor the effectiveness of implementation of the identified mitigation measures and the environmental quality parameters relevant to each project activity.

To ascertain the implementation of the project activities in a socially and environmentally acceptable manner and in line with the acts / policies of Government and World Bank, periodic monitoring will be conducted by Contractor, PIUs and PMUs. It will help to assess the progress made in implementation of E&S safeguards and measures required for its improvement. It will provide necessary feedback for project management for timely decision making and achieving the objectives.

8.1 Monitoring of Statutory Compliances

For every contract under the project, statutory compliances of the contractor will be monitored. The statutory compliances include availability of (1) Consent to Establish (CtE) and Consent to Operate (CtO) for erection of batching plants (if required), (2) Approval of local government authority for sites identified for temporary storage and disposal of waste materials including de-silted material, vegetation waste, C&D waste, etc., (3) permission from KMC for labour camp establishment, (4) labour license and (5) permission for tree felling etc. PIU along with PMTC and PMU shall monitor status of each clearance/ permission condition before implementation of the project.

8.2 Environment and Social Aspects to Be Monitored

The social, physical, biological and environmental components, which are significant impact areas at work locations, have been suggested for periodic monitoring. The following specific environmental parameters should be measured, in terms of qualitative and quantitative terms, and compared over a period of 36 months of project implementation and post project implementation with the baseline figures. The impact areas of monitoring would encompass the followings.

8.2.1 Water Quality

Water quality of Lake water (Kalamba, Padtala, Rajaram) resources that is used by local community shall be monitored as per Environmental and Social Monitoring Action Plan (ES-MAP) described in **Table 8.1**. The Water samples from Jayanti Nalla and Gomati Nalla will be collected and analysed to study the quality and assessment of pollution during project implementation.

The monitoring of the water quality will be carried out at all locations identified along the project locations during construction and operation phase. Monitoring parameters will be as per IS-10500 for ground water quality and for surface water quality as per CPCB guidelines on Inland Surface Water (Class C - IS: 2296-1982) **(Annexure 8.1)**.

8.2.2 Ambient Air Quality (AAQ)

Ambient air quality to be monitored at selected locations such as plant and machinery sites, crusher sites, desiltation / excavation work sites, sensitive receptor area and etc. starting from the commencement of construction activity till operation. Data should be generated quarterly basis at the selected monitoring locations in accordance with National Ambient Air Quality (NAAQ) Standards 2009 **(Annexure 8.1)**.

8.2.3 Ambient Noise Level

The measurement for monitoring the noise levels to be carried out at the work sites / desilting area/ sensitive receptor area and near dumping areas in accordance to the Ambient Noise Standards formulated by CPCB **(Annexure 3.1)**. Noise shall be recorded using digitized noise monitoring instrument. The equivalent Noise Level will be recorded for comparison with prescribed limit and baseline data.

8.2.4 Soil/Sediment Quality

The soil quality of the surround fields, close to the construction site/s, plant site and nearby agricultural fields will be monitored to understand the impact on soil quality. The physical and chemical parameters shall be monitored quarterly as per **(Annexure 8.1)**.

The sediment quality of the proposed desilted area will be tested before commencement of desilting operation to understand its impact on soil. Heavy metal parameters shall be compared with US EPA standard on sediment quality (given in **Annexure 3.1**). The physio-chemical parameters recommended to be tested and analyzed are:

- Physical Parameter: Soil Texture, Grain Size, Gravel, Sand, Silt and Clay
- Chemical Parameter: pH, Conductivity, Calcium, Magnesium, Sodium, Nitrogen and Absorption Ratio.
- For desilted materials, the parameters to be tested will include: PCBs, heavy metals (Arsenic, Lead, Mercury, Chromium, Cadmium), organochlorine pesticides, etc.

8.2.5 Plantation Survival Rate

Compensatory afforestation measures and plant survival rates will be monitored to understand the measures taken for ensuring restoration of the vegetation coverage. This component will be monitored throughout the life of the project, covering all sites. Visual observation of the tree survival will be recorded at every quarter

8.2.6 Construction Camp Management

The visual inspection of site will be done every month to check the labour standards and facilities provided in the camp and access to facilities by the workers.

8.2.7 Waste Management and Debris Removal

Clearance and disposal of construction and demolition wastes and silt disposal will be monitored on a Monthly basis. A record of the types and quantities of the waste generated, their clearance and disposal mechanisms will be recorded along with details of residual wastes. Monitoring will be carried out on periodical basis at monthly frequency. Waste management registers will be maintained for each construction contract along with photographic evidence. Visual observation on management of waste and debris at different site will be made on regular basis.

8.2.8 Site Restoration

The restoration of all the temporary sites/ local village road utilized for construction such as stock yards, camp site, movement of transportation vehicle etc. will be monitored after completion of works

to ensure that appropriate restoration measures are taken and it is in improved or in the same condition before its use for the works purpose. Plantation works will also be monitored if such activity is planned for the site/s. Visual observation will be made to verify the site restoration activities after completion of works.

8.2.9 Rate of Accidents/Incidents and Fatality

Regular auditing of safety at works including supply and use of PPEs, safe working conditions, first Aid facilities, incidence report, safety trainings, etc. will be carried to check the effectiveness of safety measures at site. For each construction activity, safety aspects at the work and camp sites will be supervised on day to day basis by the site supervisor/ Engineer to ascertain (1) number of labourers – men and women – working at the site, (2) percentage of workers using PPEs, (3) safe access to worksite and safe working platform, (4) availability of first-aid kit, (5) display of emergency numbers in a prominently visible place, (6) orientation of workers on safety protocols to be followed at camp and work sites, (7) periodic health check-up of workers and health issues reported, (8) number and type of safety incidents including minor injuries, major injuries requiring hospitalization, near-miss incidents, fatal injuries, etc.

8.2.10 Capacity Building of PIU and Contractors

Capacity building and trainings to be arranged for contractors and PIU and PMTC E&S experts who will monitor the implementation of ESMP, C-ESPM and environmental monitoring plan suggested.

8.2.11 Information disclosure on ESMP

The draft ESMP will be disclosed for public knowledge through the website of the KMC and the World Bank. The Executive Summary of the ESMP will also be disclosed in both Marathi and English languages in the web. Following information shall be displayed / disclosed / disseminated, wherever applicable.

i. Project specific information need to be made available at each project intervention (hard / soft / display);
ii. Project information brochures shall be made available at all the construction sites as well as the office of PIU.
iii. Reports and publications, as deemed fit, shall be expressly prepared for public dissemination e.g., English versions of the ESIA, ESMP and RAP and Executive Summary of ESIA, ESMP and RAP in local language.
iv. Wherever civil work will be carried out a board will be put up for public information which will disclose all desired information to the public, as a part of pro-active and Suo-motto disclosure, transparency and accountability.
v. All information will be translated into local language and will be disclosed to the public through the KMC, District Magistrate's office, websites of KMC

Table 8-1: Environment Monitoring Action Plan

Sr. No.	Performance Indicator	Monitoring Parameters	Standards	Locations	Frequency	Monitoring Method	Action Plan in case deviation	Monitoring Responsibility
Pre-Construction								
1	Dissemination of information on project and social issues	1. No. of consultations carried out with the community; 2. Period and location of consultation	As per ESMF	Each project activity site	Once in the project cycle	Review of record on community consultation;	Consult with community immediately	PIU, PMU
2	Compliance to Statutory Requirements	Compliance to all necessary approvals obtained for the project work (Section 3.2)	Regulatory Framework Section 3.1 and approvals to be obtained in Section 3.2	Desk review	Before Commencement of Work and Expiry of validity	Availability and Validity of consent/permission letter	Stop construction work immediately, Obtain or renew consent/ permission immediately	PIU, PMTC
3	Public information and Signage	Public informed of project activities in advance of works contractors occupying each section of work site or use of roads for movement of materials. information regarding the project, and contact of the Environmental Safety Officer (ESO) officer in case of complaints.	As per Bid Document	Each project activity site	Throughout the project Implementation cycle	Site review	Concern to contractor	PIU, PMTC
4.	Baseline Environment and Social Monitoring	As per Baseline Environmental Monitoring plan in this ESIA report Chapter 4	Compliance with WB ESF requirements, ESS, GoI, GoM regulations,	As per Monitoring Plan in Chapter 4	Before Construction	Review of Secondary data and primary data	Immediate testing of Samples in NABL Accredited laboratory	ESIA Consultant, DPR Team
5.	Sediment Quality	1. Physical Parameter: Soil Texture, Grain Size, Gravel, Sand, Silt and Clay 2. Chemical Parameter: pH,	Compliance with US EPA Standards	Panchganga River 2 Kalamba Lake 1 Rajaram 1 SWD/Nalla Water 8	Before Desiltation work at proposed sites	Review of Disposal plan of desilted material, testing report	Immediate testing in NABL Accredited laboratory and modification in disposal plan accordingly (in	ESIA Consultant, DPR Team

Sr. No.	Performance Indicator	Monitoring Parameters	Standards	Locations	Frequency	Monitoring Method	Action Plan in case deviation	Monitoring Responsibility
		Conductivity, Calcium, Magnesium, Sodium, Nitrogen and Absorption Ratio. 3. Other: heavy metals (Arsenic, Lead, Mercury, Chromium, Cadmium), etc		(12 As per Annexure 8.1)			presence of heavy metal beyond permissible limit)	
	Construction Phase							
1.	Air quality	As per Annexure 8.1	National Ambient Air Quality Standard (CPCB), 2009	9 (As per Annexure 8.1)	Monthly	Environmental Monitoring Visual Observation	Check and implement dust control operations as per ESMP	Contractor through NABL Accredited laboratory in supervision of M&E Agency and PMTC
2.	Noise quality	As per Annexure 8.1	Ambient Noise Standard (CPCB), 2000	9 (As per Annexure 8.1)	Monthly	Environmental Monitoring Visual Observation	Check and implement noise control operations as per ESMP	Contractor through NABL Accredited laboratory in supervision of M&E Agency and PMTC
3.	Surface Water quality	As per Annexure 8.1	Inland Surface Water (Class C) Quality (IS: 2296-1982)	Panchganga River 2 Kalamba Lake 1 Rajaram 1 SWD/Nalla Water 8 (12 As per Annexure 8.1)	Monthly	Environmental Monitoring Visual Observation	Check & modify silt fencing devices and mitigation measures as per ESMP	Contractor through NABL Accredited laboratory in supervision of M&E Agency and PMTC
4.	Ground water Quality	As per Annexure 8.1	Ground Water Quality Standard as per BIS:10500, 2.13	Nearby Habitations of interventions proposed (5 As per Annexure 8.1)	Quarterly	Environmental Monitoring	Identify reasons and taking measures	Contractor through NABL Accredited laboratory in supervision of M&E

Sr. No.	Performance Indicator	Monitoring Parameters	Standards	Locations	Frequency	Monitoring Method	Action Plan in case deviation	Monitoring Responsibility
								Agency and PMTC
5.	Soil Quality	As per Annexure 8.1		In and around construction site	Quarterly	Environmental Monitoring Visual Observation	Check & modify the arrangement of containment of oil, drainage to protect soil quality and mitigation measures as per ESMP	Contractor through NABL Accredited laboratory in supervision of M&E Agency and PMTC
6.	Sediment Quality	As per Annexure 8.1	Compliance with US EPA Standards	Panchganga River 2 Kalamba Lake 1 Rajaram 1 SWD/Nalla Water 8 (12 As per Annexure 8.1)	Quarterly	Environmental Monitoring Visual Observation	Modify disposal plan;	Contractor through NABL Accredited laboratory in supervision of M&E Agency and PMTC
7.	Soil Erosion	Removal of cross bund, cleaning and levelling of desilted/ re-sectioned site		SWD and CD Sections where resectioning proposed	Once in a month; after completion of desiltation/ each site; Before monsoon period	Site visit; monthly and quarterly EMR submitted by contractor; assessment of storing and disposal of desilted material	Immediately adopt mitigation measures as per plan; remove all cross bund/ ramp; clean each desilted/ resection site specially before monsoon	Contractor in supervision of M&E Agency and PMTC
8.	Safety at Work	Use of PPE, Health conditions, first aid and ambulance, Training Awareness program on HIV/AIDS, Incidents including minor & injuries, major injuries, fatal injuries, etc.	Compliance with worker Safety Standards	Worksite; Labour Camps	Daily observations for PPEs and Safe access and working platform, and first-Aid Kits. During	PPE purchase records Daily safety records Issue records Visual observation	Immediate supply of adequate numbers of PPEs, Mandatory / Enforcement of use of PPEs;	PIU, M&E Agency and PMTC

Sr. No.	Performance Indicator	Monitoring Parameters	Standards	Locations	Frequency	Monitoring Method	Action Plan in case deviation	Monitoring Responsibility
					construction period. Training on health, safety, HIV/AIDS awareness program			
9.	Plant Survival Rate	No. of Plants Planted and No. of Plants Survived; Plant Growth Rate	80% Survival rate	Shenda Park, Shivaji University, Along the side of Jayanti Nalla and Gomati Nala	Six Monthly till 5 years	Analysis reports Visual observations	Replacement of dead plants with healthy saplings of same species, Strengthening / Repairing tree fencing	Garden Department of KMC
10.	Construction Camp Management	Basic Facility at labour camp & general hygienic conditions	As per BOCW Act 1996	Labour Camp	Weekly / Monthly	Visual observations	Restoration of labour facilities at labour camp	Contractor in supervision of M&E Agency and PMTC
11.	Waste management and debris removal	1. Quantity of construction and demolition waste generated 2. Quantity and percentage of construction and demolition waste disposed as per the approved Waste Management Plan 3. Generated desilted material quantity 4. Quantity and percentage of desilted material disposed as per the approved WMP 5. Clean and hygienic conditions at worker's campsite (visual observation)	Periodical removal of debris and other waste	Demolition site; construction worksite	Weekly during construction period	Vehicle log book; Site observation; Stock taking of debris	Removal of Debris to disposal sites / reusing to the possible extent	Contractor in supervision of M&E Agency and PMTC

Sr. No.	Performance Indicator	Monitoring Parameters	Standards	Locations	Frequency	Monitoring Method	Action Plan in case deviation	Monitoring Responsibility
12.	Site restoration	Restoration of all temporary sites to its pre-project or improved conditions		Compensatory plantation site, camp site, local road and other construction sites and workers camp site	Once after completion of activities at site	Record Checking Visual observations	Restoration to be completed for all the sites before issuance of completion certificate	Contractor in supervision of M&E Agency and PMTC
13.	Assistance to PAPs	Number of PAPs received compensation and other assistance within time		Community	Before civil work activity	Record Checking	RAP	PIU and PMU
14.	Percentage of grievances resolved a. Workers b. Citizens c. GBV	Number of grievances recorded and resolved within time		Community/ citizens, Labour Camp	During civil work activity and operation	Record Checking	GRM	Contractor PIU and PMU
15.	Rate of Accidents, incidents and fatality	Number of accidents, incidents, and fatality happened at work site, labour camp and community		Work site, labour camp and community	During civil work activity and operation	Record Checking	Accident and Incidents register and detailed reporting	Contractor PIU and PMU
16.	Capacity building of PIU and contractors	Training of Contractor E&S team, PIU E&S team and PMTC E&S team	Training checklists	PIU Office	6 months	Record Checking	Training arrangements	M&E Agency and PMTC
	Operation Phase							
1.	Surface Water Quality	As per Annexure 8.2	Inland Surface Water (Class C) Quality (IS: 2296-1982)	Kalamba Lake 1 Rajaram 1 Jayanti Nala 1 Kalamba Nala 1 (12 As per Annexure 8.2)	Twice in a year	Environmental Monitoring Visual Observation	Clearing of all SWDs Regulating the waste water flow into the SWD and Lakes	Contractor appointed by KMC through NABL Accredited laboratory
2.	Sediment Quality	As per Annexure 8.2	Compliance with US EPA Standards	Kalamba Lake 1 Rajaram 1 Jayanti Nala 1	Twice in a year	Environmental Monitoring Visual Observation	Modify disposal plan;	Contractor appointed by KMC through NABL

Sr. No.	Performance Indicator	Monitoring Parameters	Standards	Locations	Frequency	Monitoring Method	Action Plan in case deviation	Monitoring Responsibility
				Kalamba Nala 1 (12 As per Annexure 8.2)				Accredited laboratory
3.	Water Logging in Drainage	Visual inspection as well as measurement of groundwater level		SWD, Lakes channels, dumping ground	Twice a year (once in Premonsoon and once in post monsoon)	Visual observations; Photographic record of drain cleaning; Water level record	Removal of water logging conditions.	Contractor appointed by KMC
4.	Survival of Plantations	Visual inspection		Plantation areas Shenda park, Shivaji University	At least two times in a year of gestation period	Survival Record	Replacement of dead plants Guard repairing, application of manures etc	Contractor appointed by KMC Garden Department

8.3 Budget for Environmental Monitoring

This budget for environmental monitoring by M&E agency has already been integrated into the overall ESMP budget presented in Chapter 13. One-time sediment quality testing will be responsibility of implementing contractor and cost is included in work package.

Table 8-2: Budget for Environmental Monitoring

Sr. No.	Parameter	Items to be monitored	No. of locations	Frequency per annum	Rate per Sample (Rs.)	Amount (Rs.) per annum
A.	**Construction Phase**					
i.	Air quality	Parameters as per Annexure 8.1	9	Monthly	10,000/-	10,80,000.00
ii.	Surface water quality	Parameters as per Annexure 8.1	Panchganga River 2 Kalamba Lake 1 Rajaram 1	Monthly	10,000/-	14,40,000.00
			SWD/Nalla Water 8			
iii.	Ground water quality	Parameters as per Annexure 8.1	5	Quarterly	10,000/-	2,00,000.00
iv.	Noise level	Noise level as per Table 8.1	9	Monthly	7,000/-	7,56,000.00
v.	Soil quality	Parameters Annexure 8.1	7	Quarterly	10,000/-	2,10,000.00
vi.	Sediment Quality	As per section 8.2.4 and Table 8.1	Panchganga River 2 Kalamba Lake 1 Rajaram 1	Quarterly	10,000/-	40,000.00
			SWD/Nalla Water 8		10,000/-	80,000.00
2	Other Performance Indicators	• Survival rate of plants	Shenda Park Shivaji University	Quarterly		Considered in Project Cost
		• Debris clearance • Safety arrangement for workers • Gender participation		Monthly		Considered in Project Cost
Sub Total						**38,06,000.00**
B	**Post-Implementation Phase**					
(i)	Surface water quality	Parameters as per Annexure 8.1	Kalamba Lake 1 Rajaram 1 Gomati Nalla 1 Jayanti Nalla 1	Six Monthly	10,000/-	80,000.00
(ii)	Sediment Quality	As per section 8.2.4 and Table 8.1	Kalamba Lake 1 Rajaram 1 Gomati Nalla 1 Jayanti Nalla 1	Six Monthly	10,000/-	80,000.00
2	Other Performance Indicators	• Survival rate of plants	Shenda Park	Six Monthly		Considered in Project Cost

Sr. No.	Parameter	Items to be monitored	No. of locations	Frequency per annum	Rate per Sample (Rs.)	Amount (Rs.) per annum
			Shivaji University			
Sub Total						**1,60,000.00**
Grand Total						**39,66,000.00**

Note: In post implementation phase the air quality, noise level monitoring, ground water quality and soil quality has not been considered because of its insignificant effect. In case pollution is noticed at any time during this period then necessary remedial measures will be taken up.

8.4 Reporting System of Environmental and Social Monitoring

The reporting system will be bottom-up and feedback mechanism will be in a top-down approach in the implementation frame. The Contractor will prepare report on E&S safeguards implementation, making it a part of the monthly progress report (**Annexure- 8.3).** The Environment / Social Expert at the PIU level will review the reports and prepare the action taken report on monthly basis. Based on the review of the E&S safeguard measures taken at the project level, should discuss with the MRDP at PMU on critical issues for decision. The experts at the PIU level will prepare quarterly environmental and social monitoring reports **(as per Annexure- 8.3)** for onwards submission to PMU. PMU, after review of the report, may seek further clarification from PIU on critical aspects, whichever it feels appropriate. The report submitted by the PMC would be examined by the PMU along with the report of the PIU. The environment / social expert at the PMU will compile the quarterly report and submit half-yearly progress report (**as per Annexure 8.4)** to the World Bank.

8.5 Initial, Mid-Term and End-Term Audit

The Third-Party M&E Agency hired by the PMU will undertake an initial, mid-term and end-term audit of the ESMP implementation in order to identify issues, good practices and make recommendations for strengthening E&S management. The audit will be undertaken thrice in the project duration – at initial, midterm and at the end of the project. Mid-term audit shall be carried out only after implementation of 40% -45% of project activities or after 1.5 to 2 years but before 3 years from the date of Loan Agreement with the World Bank; whichever is prior. The audit reports will be shared by the PIU and PMU and the World Bank. The audit of the ESMP will cover the following aspects.

Preparation of Package Specific ESMP:

- Has the package specific ESMP, contractors ESHS been prepared within stipulated time period?
- Was ESMP and contractors ESHS conditions were included in bid documents and contractor agreement documents?
- Was cost for ESMP implementation considered in contractors contract packages or BoQ documents?

Preparation of Plan Before Implementation:

- Has contractor prepared OHS plan and vetted it from implementing agency?
- Was testing of silted material done by contractor before initiation of desiltation of SWD and Lakes where interventions are proposed as per section 2.7
- Was detail disposal plan prepared and implemented accordingly?

Regulatory Compliance:

- Has contractor/ implementing agency has obtained and regularly updated all regulatory permissions as per section 3.2?
- Does project violate any related environmental or social laws of State GoM or GoI
- Has contractor obtained permission from KMC before establishment of Camp or storing of waste material?

Implementation of ESMPs:

- Whether all ESMP measures were followed during project implementation?
- Whether EHS measures are adopted as per plan?

- Was equipment/ machineries maintained properly and pollution testing (PUC) done regularly?

Monitoring of E&S aspects in project activities:

- Is the PMU/ PIU undertaking periodic and regular monitoring of the E&S implementation in the project activities?
- Has contractor prepared and submitted all monthly report on ESMP implementation on time?
- Has PIU prepared and submitted monthly and quarterly report?
- Was half-yearly assessment was done by PMU on ESMP implementation?
- Was testing of environmental parameters carried out on regular basis?

Institutional arrangements for management of E&S aspects:

- Are the E&S Specialists at the PIU and PMU available?
- Whether M&E agency was engaged for entire project implementation?

Capacity building arrangements for management of E&S aspects:

- What training programs on E&S aspects have been organized for the PIU and PMU staff?
- What training programs on E&S aspects have been organized for the contractors?

The format for the 'Audit Report on ESMP Implementation' is provided in **Annexure 8.4.**

Chapter 9 : Stakeholders Consultation and Engagement

The Environmental and Social Standard (ESS) 10 recognizes the importance of open, transparent, and safe engagement between the client (Implementing Agency) and the persons affected by a project including local communities, host communities, project workers and worker representatives, and other project stakeholders. Effective stakeholder engagement and information disclosure proportionate to the nature and scale of a project can improve the environmental and social sustainability of projects, enhance project acceptance, and lead to improved social, environmental, and financial outcomes. Stakeholder engagement is consistent with the policy objectives of timely disclosure of project information, effective public participation in assessing a project's environmental and social (E&S) risks and impacts, and in decision making processes, and reception and management of grievances and concerns.

Stakeholder engagement process in the project area (KMC and SMKMC area) initiated since beginning of the planning and design phase and it will be conducted throughout the project cycle. Stakeholder engagement conducted during planning and design phase has sets up strong, constructive, and responsive relationships that are fundamental for the successful assessment, management, and monitoring of a project's E&S risks and impacts and forms an integral part of informed decision-making.

9.1 Objectives

b. Establish an informed systematic approach to stakeholder engagement that will help the Implementing Agency develop and maintain a constructive and responsive relationship with its stakeholders.
c. Assess levels of stakeholder interest and support for a project through meaningful consultation and enable stakeholders' views to be considered in the project development process, and in the implementation and monitoring of E&S performance.
d. Promote and provide the means for effective and inclusive engagement with stakeholders on issues that could potentially affect them throughout the preparation and implementation phases of a project cycle.
e. Ensure appropriate project information on E&S risks and impacts is disclosed to stakeholders in a timely, understandable, and accessible manner and format.
f. Ensure the needs and concerns of disadvantaged or vulnerable project-affected persons are recognized and accounted for in the stakeholder engagement and information disclosure process.
g. Provide stakeholders with safe, accessible, and inclusive means to raise questions, proposals, concerns, and grievances, without threat of reprisal, and ensure that the Implementing Agency responds and manages them effectively.

9.2 General Requirements of SED

1. Stakeholder engagement requires (i) stakeholder identification and analysis, (ii) stakeholder engagement planning and implementation, (iii) information disclosure, (iv) meaningful consultation, (v) monitoring and reporting, and (vi) addressing and responding to concerns and grievances.
2. The Implementing Agency will maintain and disclose, as part of the E&S assessment process as described in ESS1, a documented record of stakeholder engagement. Such records will include a description of the stakeholders consulted, a summary of the feedback received, and a brief explanation of how the feedback was considered, or the reasons why it was not.
3. The term stakeholder refers to individuals, communities, or groups who: (i) are affected or likely to be affected by a project, referred to as project-affected persons; and (ii) may have an interest in a project, referred to as other interested parties.
4. All disclosure requirements set out in the ESS10 and other ESSs are guided by WB's Access to Information Policy, including the exceptions to disclosure. The IA will agree with WB on the management of confidential information or personal information especially for project-affected persons, including the timing and content of the disclosure of such information.

9.3 Specific Requirements

a. Stakeholder Identification and Analysis: The IA will identify and document the different stakeholders and their characteristics, assess how they may be affected by a project, and what level of interest, support, and concerns they might have at the time of project preparation.
b. When stakeholder engagement with local individuals and communities within the project affected area depends substantially on community representation, the IA will make reasonable efforts to verify that such persons represent the views of those individuals and communities and that they are facilitating the communication process in an appropriate manner.
c. Stakeholder Engagement Plan: As part of the E&S assessment the IA will undertake stakeholder engagement planning, in consultation with the WB, develop an SEP proportionate to the nature and scale of a project and to its potential E&S risks and impacts and project context, and implement the SEP. An SEP may be a stand-alone document or may be a part of another document prepared in accordance with ESS1. The IA will disclose the SEP and will also submit it to the WB for disclosure as early as possible in project preparation.
d. SEP will outline stakeholder engagement undertaken and to be undertaken, clarify roles and responsibilities, identify the necessary resources and timelines, serve as a guiding document for stakeholder engagement and adaptive management, and specify the phases of a project cycle where stakeholder engagement will be needed.

9.4 Stakeholder Engagement Activities

Consultations have been carried out during the preparation of ESMF from October 2024 to December 2024. Transect walks were conducted along the potentially impacted areas to understand land requirements the presence of human settlements, and to collect the communities' views on any adverse social and environmental impacts and to elicit necessary community participation in the program. Focused consultations were also held with Self Help Groups (SHGs). Before the consultations, relevant information in the local language was shared with the stakeholders to give them information on the project objectives and activities and seek their feedback and concerns.

Total 2 Stakeholders Consultations have been conducted at the community level in Sutarwada and Vijay Apartment near Venus Corner on December 24, 2024 in KMC area. The process of consultation will be continued till the end of the project (Detailed report of the consultations is provided in **Annexure 9.1**)

Total 17 Meetings has been conducted with the client (MITRA, KMC, SMKMC and the WB during October 16, 2024 to Jan 8, 2025 (Details of the meetings are provided in **Annexure 9.2**). Environmental and Social Screening activity is also carried out and outcomes are annexed as **Annexure 9.3**. The questionnaire list of stakeholder consultation plan is also filled after overall observations which is enclosed as **Annexure 9.4** with this report.

9.5 Feedback from Stakeholders Consultations (Community Level)

A summary of the feedback received from the consultations is given in **Table 9.1**. There has been overwhelming support for the project from the communities as it will help the communities vulnerable to floods and Strom Water.

Table 9-1: Feedback from Stakeholder Consultations

Affected Parties	Issues	Conclusions / Remarks
Project affected parties (and also beneficiaries of such measures.	1. Wanted early construction of proposed civil work interventions as every year they face loss of livelihood, assets / properties. 2. were also of the opinion that floods are now part of their life. 3. were of the view that during the strengthening of the Nallas, i.e., during construction, the works will obstruct access to people from settlements to the riverside / Nalla side resources and requested make appropriate design provisions. 4. there could be accidents due to vehicular movements during construction.	This feedback from the stakeholders will be included in the ESIA and in the respective ESMPs.

Affected Parties	Issues	Conclusions / Remarks
	5. willing to work during construction if proper payments are made. 6. Encroachers, mostly doing small scale businesses, were apprehensive that they would be evicted when the construction activities occurred. 7. Communities have mentioned that Flood shelters close to the flood-affected area are really helpful during floods but need to provide privacy for women and girls, transportation arrangement to carry essential commodities etc.	
Disadvantaged/ vulnerable	8. No proper toilet facilities at the shelters. 9. Mostly the shelters are not disabled friendly. 10. There are no separate rooms for men, women & lactating mother.	This feedback from the stakeholders will be included in the ESIA and in the respective ESMPs.

Based on the feedback from the above consultations, the PIA has to propose suitable measures in the ESIA, RAP, and the ESMPs; which include the following actions. Specific consultations will be held near the sites/ facilities proposed. The consultations will be documented, and the outcome will be incorporated as appropriate in the sub-project designs and mitigation plans.

During consultations, the draft mitigation plans will also be presented and explained to the people on the content and process of the implementation of the plans as well as how their suggestions were incorporated into the project design, such as minimizing land taken by design changes in the project, restricted tree cutting, avoidance of social and environmental sensitive locations etc.

The PIU shall also hold consultations not only with the community but also with the concerned line departments at the project are level and provide opportunities for information sharing and collaboration measures.

9.6 Disclosure of Project Documents

The client will provide stakeholders with access to the following information as early as possible in a project cycle and in a time frame that enables meaningful consultation with stakeholders on the project:

- The purpose, nature, and scale of a project;
- The expected duration of proposed project activities;
- An analysis of project alternatives, potential E&S risks and impacts on communities within the project-affected area, and the proposals for avoiding, minimizing, or mitigating E&S risks and impacts, including the differentiated measures taken for disadvantaged or vulnerable groups;
- The proposed stakeholder engagement process highlighting the different ways in which stakeholders can participate and have their views considered in the process;
- The time and venue of any proposed public consultation meetings, and the process by which meetings will be notified, summarized, and reported; and
- The process and means by which concerns and grievances can be raised and will be addressed.

Draft ESIA and ESMP, along with RAP and SEP will also be disclosed on the MITRA and KMC websites. The executive summary of the ESIA will be translated into the Marathi language and uploaded on the MITRA and KMC websites, and hard copies of these documents will be made available at local MC offices for public access.

Chapter 10 : Capacity Building

Effective implementation of the ESMP suggested requires proper understanding of the implementing entities and their capacity to manage these aspects in an acceptable manner. The project will take proactive measures to improve the understanding of the project personnel at PMU, PIU level and building the capacity of the contractor/s engaged to carry out the activities. The MITRA will organize training and workshops for the project implementing entities, i.e., E&S specialists in PMU, PIU, Contractor and elected representatives and community groups associated in the project execution. Apart from inhouse training, the design of capacity building would also include field / site visit and interaction.

10.1 Technical Assistance for the Implementation of ESMP

It is proposed to provide capacity building for ESMP implementation and supervision as per ESS and ESF requirements through technical assistance that will support the PIU during the construction phase. The technical assistance will provide the necessary technical support the PIU in its work with contractors as well as other entities involved in the implementation of the EMP.

The scope of the technical assistance would cover support from experts and training on knowledge on safeguards requirements and procedures for the project as well as training that covers both specific knowledge on safeguard procedures and requirement for the project staff, consultants, and contractor. This would include, assistance in the preparation of documents and implementation of training program on environmental management and environmental monitoring for E&S Staff of PMU, PIU, PMTC/Construction Supervision Consultant (CSC) and Contractors. It would also include assisting the PIU's E&S staffs with the review of contract documents on the bidding packages for construction items of the project to ensure compliance with ESS and ESF requirements and ESMP and monitoring of ESMP as well as provide general environmental guidance as directed by the PMU to enhance overall project implementation and performance.

Given the nature, locations, and scale of construction, it is anticipated that the safeguard technical assistance support and training will be provided at least during the first 2 years of the project implementation. The World Bank safeguard specialists will participate in the capacity building in particular in the training activities as appropriate.

10.2 Resource for Training

In view of the specialized training and capacity building required, it is necessary to identify nodal training institutes that will work closely with PMU for conceptualizing, designing and conducting training programs on the ESMP implementation. The PMU and PIU may collaborate / engage with different National and State level institutions as Technical Assistance Team to facilitate the project level training program to be organized. The project can also send the trainees for custom-made trainings on ESMP at autonomous institutions like Engineering Staff College of India, Hyderabad, which conducts such programs on a regular basis.

The training programs will be developed and delivered to PMU and PIU E&S Staff by the Technical Assistance team for the implementation and supervision of ESMP. The PMU/PIU with the support of the Technical Assistance team will provide the training to contractors and local representatives.

10.3 Capacity Building Plan Proposed

- Target groups for the training: include PMU E&S staff, PIU E&S staff, Construction Contractor E&S staff, PMTC/Construction Supervision Consultant (CSC), elected representatives and community groups in the project area. Training of workers and drivers is the responsibility of the contractor;
- Training schedule: At least 1 month before the construction starts of each construction package. The training can be adjusted in line with the implementation schedule of the subproject/contracts;

– Training frequency: The basic training programs proposed in **Table 10.1** will take place every six months on a yearly basis and its content updated and adapted to implementation issues. Training frequency and content will be reassessed during implementation depending on needs.

Table 10.1 below provides examples of the basic trainings for safeguards during project ESMP implementation.

Table 10-1: Capacity Building Plan Proposed

Objects	Project Entities
Project Management Unit (PMU)	
Training course	Environmental Supervision and Monitoring and Project Disclosure
Participators	2 Nos Environment and 2 Nos of Social Staff
Training Frequency	Soon after project effectiveness but at least 1 month before the construction of the first contract. The follow-up training will be scheduled 2 times in a year during implementation period.
Time	5 days of training twice a year for 3 years of implementation of ESMP
Content	• Context and concept of ESIA and ESMP relating to project including requirements of World Bank; • National and State Environmental Acts / legislations; • Implementation, Monitoring and Supervision Mechanism; • ESMP Implementation, Monitoring and Supervision Mechanism; • Risk response and control Mechanism; • Monthly Progress Reports (MPR) from PIU; • Grievance Redressal mechanism from PIU; • Social and Environmental Audit; • Provision made in Contract Document
Responsibilities	PMU with support of the Technical Assistance team for the implementation of ESMP
Project Implementation Unit (PIU)	
Training course	Environmental Supervision, Monitoring and Reporting during ESMP Implementation
Participators	2 Nos Environment and 3 Nos of Social Staff
Training Frequency	Soon after project effectiveness but at least 1 month before the construction of the first contract. The follow-up training will be scheduled 2 times in a year during implementation period.
Time	5 days of training twice a year for 3 years of implementation of ESMP
Content	• Context and concept of ESIA and ESMP relating to project including requirements of World Bank; • National and State Environmental Acts / legislations; • Project Site specific ESMP relating to project E&S Issues and Mitigation Plan; • ESMP Implementation, Monitoring and Supervision Mechanism; • Community participation in environmental supervision. • Guide and supervise contractor, PMTC/CSC and community representatives in implementation of ESMP; • Forms used in E&S supervision during ESMP implementation; • Risk response and control Mechanism; • MPR to PMU; • MPR from Contractors; • MPR from PMTC/CSC; • Grievance Redressal Mechanism; • Good Practices and Learning by Project Components on ESMP; • Social and Environmental Audit; • Provision made in Contract Document
Responsibilities	PMU with support of the Technical Assistance team for the implementation of ESMP
PMTC/CSC, Contractor	
Training course	Implementation of ESMP and Environmental Monitoring Programme
Participators	4 Nos Environment and 4 Nos of Social Staff
Training Frequency	After bidding, soon after project effectiveness but at least 1 month before the construction of the first contract. The follow-up training will be scheduled 2 times in a year during implementation period.
Time	5 days of training twice a year for 3 years of implementation of ESMP

Objects		Project Entities
Content		• Context and concept of ESIA and ESMP relating to project including requirements of World Bank; • C-ESMP Preparation identifying E&S issues and addressing E&S impacts and mitigation plan; • Requirements of ESMP Implementation; • Requirements of environmental monitoring; • Role and responsibilities of contractors and PMTC/CSC • Content and methods of environmental monitoring; • Response and risk control; • Propagate monitoring forms and guide how to fill in the forms and risk report; • Preparation and submission of report i.e. MPR. • Reporting Requirements; • Good Practices and Learning by Project Components on ESMP
Responsibilities		PIU with support of the Technical Assistance team for the implementation of ESMP
Construction Workers		
Training course		EHS and Code of Conduct
Participators		All Workers (40 residential workers)
Training Frequency		2 times in a year during implementation period.
Time		5 days of training twice a year for 3 years of implementation of ESMP
Content	ESHS	• Sources of health and fire hazard • List of flammable items • Mock drill on fire fighting • Mitigation measures to deal with occurrence of fire • Use of PPE • Training on first- aid facilities • Reporting of accident • Waste Management • Camp and work-related sanitation
	Code of Conduct	• Dealing with local community • Respecting culture of local community and migrant labour • Non-permitted items under MRDP • Reporting system on siting of endangered / wild animals and “Chance finding” • Waste management plan
Responsibilities		PIU with support of the Technical Assistance team for the implementation of ESMP
Elected Representatives and Community Groups		
Training course		Implementation of ESMP and Environmental Monitoring Programme
Participators		5 Nos Environment and 5 Nos of Social Staff
Training Frequency		As Appropriate
Time		One-day presentation and one-day on-the job training twice a year to be repeated on a per needs basis
Content		• Preliminary presentation on environmental protection and environmental overview; • Key issues that require community and workers attention to minimize safety risks (roads, equipment, machines, etc.) as well as reduce pollution (dust, fume gases, oil/grease spill, waste management, etc.) • Management of environmental safety and sanitation in work sites and worker camps; • Mitigation measures at construction site and work camps; • Safety measures on electricity, mechanical, transportation, air pollution; • Procedures to deal with emergency situation.
Responsibilities		Contractor, PIU, with support from PMU

Chapter 11 : Grievance Redressal Mechanism

A Grievance Redressal Mechanism (GRM) is needed to address stakeholders’ grievances and dissatisfactions about actual or perceived impacts and to find a satisfactory solution. Some grievances may arise during the design and planning phase, while others may come up during

project implementation. Towards this, the GRM will be implemented throughout the program cycle for use by stakeholders to address concerns and complaints promptly and transparently.

The GRM will ensure that the stakeholders have access to legitimate, reliable, transparent, and efficient institutional mechanisms that are responsive to their complaints. The GRM will work within existing legal and cultural frameworks, providing an additional opportunity to resolve grievances at the local and sub-project level.

Current Status: KMC has an online grievance submission system which can be accessed through the web portal. The system generates a docket no. for each complaint received. The portal can file complaints related to LAR&R, corruption, administrative irregularity, progress delays, financial irregularity and road quality, among others. However, no staff and budgetary resources have been allocated to manage and maintain the backend system.

At present, none of the uptake channels (portal, phone, email, and verbal) for grievances are functional due to lack of resources (staff, budget, etc.) and standardized documentation process. Thus, the proposed GRM elaborated below, builds from this previous experience of KMC and proposes a setting up of an KMC Helpline no. for effective management of grievances.

11.1 Procedure for Grievance Response

The steps to be taken by the KMC for receiving and handling grievances pertaining to the Project are outlined below and graphically presented in Figure.

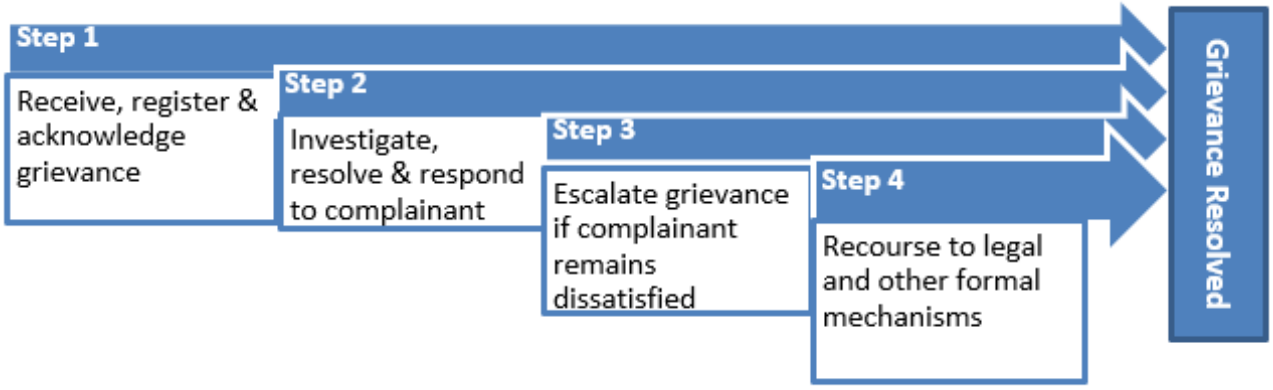


Figure 11-1: Procedures in GRM

11.2 STEP 1: Receive, register, and acknowledge the Grievances

A grievance can be submitted to the PIU through the following channels:

1. During regular meetings held between communities and program stakeholders (field level staff, contractors, supervision consultants, etc.);
2. Through communication directly with management – for example a letter addressed to site management, GRCs or other operational offices of PIU;
3. Directly by e-mail to the official mail address;
4. Placing a query in the community suggestion boxes in the Divisional offices and Sub-Divisional offices;
5. Directly on toll free Helpline number displayed at the sites;
6. Web portal which is disclosed in the official website of KMC
7. Through twitter, Facebook and other social media accounts.

Upon receipt of complaints, unique identification number will be issued to each grievance for easy tracking- once it is logged into the online grievance register.

In cases of complaints received through Channels 1 to 4, the PIU personnel (field and divisional level staff) will log the complaint in the online grievance register and inform the Helpline call center/ operators within 3 working days. The helpline operators on behalf of the PIU personnel will acknowledge the receipt of the complaint through a phone call or text message to the complainant.

The acknowledgment will include the unique identification number so the complainant can use this as a reference to track the status of the complaint. If the grievance is not well understood or if additional information is required, the PIU personnel or the Helpline operator will contact the complainant during this step for further clarification.

If the complaint is received through Channels 5 to 7, the Helpline call center/operator will log the complaint in the online grievance register and acknowledge its receipt immediately. The complaint will then be transferred to the KMC personnel for investigation and resolution.

11.3 STEP 2: Develop resolution and respond to Complainant

Upon investigation, the PIU personnel (field and divisional level staff) will propose a resolution as soon as possible, and in consultation with the complainant and others concerned. The PIU personnel, through the Helpline operator will continually update the complainant on the progress of the investigation and the timeline for conclusion. The resolution is communicated to the complainant through the proper channel. The Helpline operator will ask the complainant for a written acceptance of the resolution and close the grievance if he/she is satisfied with the resolution. The PIU personnel will aim to complete investigation within 15 working days of the grievance first being logged.

11.4 STEP 3: Scale up the grievance if the complainant remains dissatisfied

If the complainant rejects the proposed resolution, the Helpline operator will refer the case to the Environmental and Social Management Unit PIU Head office) within 30 days of its decision. The PIU will facilitate to reach an agreeable resolution and will produce a resolution within 15 working days. If the resolution is accepted by the complainant, it will be implemented, and the grievance will be closed once the implementation is completed.

11.5 STEP 4: Recourse to legal and other formal recourse

If the complainant rejects the proposed resolution, the complainant is free to approach the court of law/any other formal mechanisms in place at the local/state level.

11.6 Record Keeping

All queries and grievances are to be logged into the online grievance register. This includes details of the queries/ grievance, the complainant, and the steps taken to resolve the grievance. Any accompanying documentation e.g. written statements, photographic evidence, or investigation reports are to be filed along with the grievance log both in hard and soft copies.

11.7 Roles and Responsibilities of Key Agencies

Environmental and Social Management Unit: The Environmental and Social Management Unit will be responsible for ensuring that the grievance mechanisms are responsive to the needs of the affected individuals. A master database will be maintained by the PIU to record and track management of all queries and grievances that will be periodically audited by the PIU. This will serve to help monitor and improve performance of the grievance mechanism. The PIU will also supervise the functioning of the Helpline Call Center and undertake trainings of staff, consultants and contractors on the grievance redressal process. Further, escalated complaints will be handled by the PIU.

Helpline Call Center/ Operator: The Helpline no. will be operated by the Call Center, which will be responsible for documentation and acknowledgement of complaints and communication with complainants till their complaints are satisfactorily closed. The Helpline operators will also send alerts/reminders to the project personnel for investigation and resolution, so that grievances are resolved within the stipulated timeframe. The Call Center will be operational from 8.00 am till 10.00 pm in two shifts daily.

Filed Level Staff: Field level staff, supervision consultants, and contractors will be responsible for investigating and resolving grievances in a timely manner. They will also record direct complaints on

the online grievance registration portal and follow-up with the Helpline operators to update them on the status of the complaint.

11.8 Types of Grievances

The types of grievances the complainants may file include, but are not limited to:

- Non-payment, or inadequate compensation and/or due R&R assistances; wrong measurement of parcel
- Construction related impacts – damages to structures; dust damaging crops/trees
- Health and safety risks
- Adverse impacts on the environment
- Adverse impacts on communities, which may include, but not be limited to financial loss
- Physical harm and nuisance from construction or operational activities
- Impacts arising from migrant labor on local communities
- Exclusion from beneficiary lists
- Lack of information and opportunities for participation

11.9 Complaints related to Workplace SEA/SH

KMC is mandated by the Sexual Harassment at the Workplace (Prevention, Prohibition and Redressal) Act, 2013 (POSH Act) to form an Internal Complaints Committee (ICC) to address workplace related SEA/SH complaints. The KMC will ensure that the contact information of ICC is displayed in the office (head office, divisional and sub-divisional offices) and that regular trainings/orientation programs are organized for staff and ICC members.
It will be ensured by the respective PIUs to make sure that all the workers will sign CoC. Respective PIUs will be responsible for the implementation of Awareness Camps and establishing a referral system and also appointment of GBV specialist.

Chapter 12 : Institutional Arrangement for Implementation of ESMP

The overall responsibility for coordinating and implementing MRDP lies with the Project Management Unit (PMU), established at the Maharashtra Institution for Transformation (MITRA). The Project implementation will be led by the PMU that will be established within MITRA. PIU has been established under the three Urban Local Bodies & Relief & Rehabilitation Department to implement Component 2.2 activities. The PMU will be responsible for procurement of consultants for carrying out the ESIA for the proposed sub components. A Project Management and Technical Support Consultancy (PMTC) will be engaged by the PMU to support them in the implementation of all project activities. An E&S Independent External Evaluation Consultant (IEEC) will be engaged by PMU for an independent evaluation of the ESMF implementation. The overall project arrangements are summarized in **Figure 12.1.**

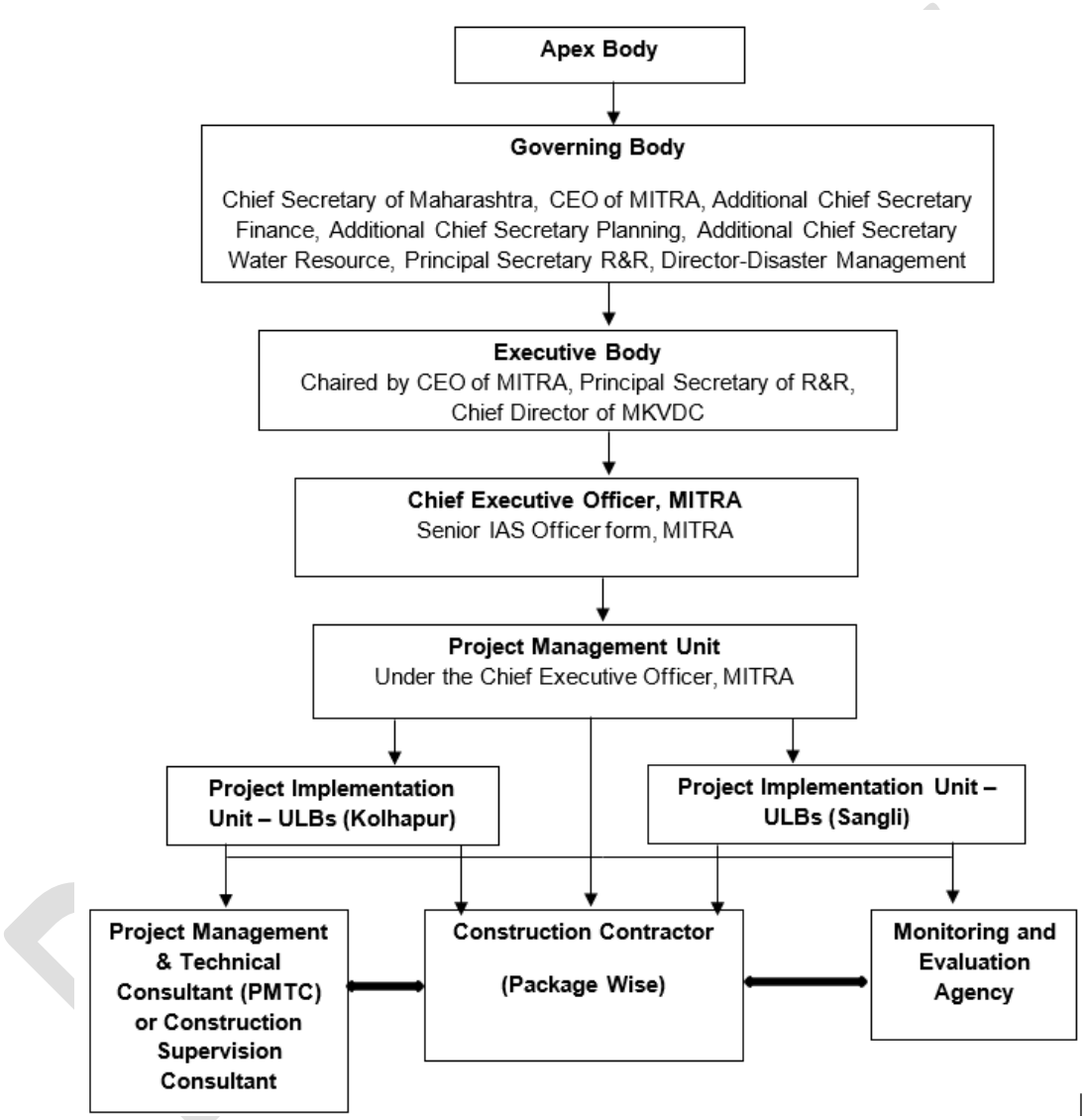


Figure 12-1: Institutinal Arrangements of MRDP

12.1 Roles and Responsibilities of Implementing Agencies

The roles and responsibilities of implementation agencies are:

- Apex Body: The Apex Body makes policy decisions regarding Krishna Valley flood control measures and water resources in the basin.
- Governing Body: The Governing body directs all the stakeholder departments to implement the policy decisions taken by the Apex Body.
- Executive Body: The Executive Body executes the actions initiated to implement the policy decisions taken by the Apex Body and coordinates with the stakeholder departments

PMU. The primary responsibility for implementing ESMF, RPF, ESCP, etc., rests with the PMU. The PMU is headed by a Chief Executive Officer (CEO) and will be responsible for the overall coordination and implementation of the project. For environment and social management, the overall responsibility for day-to-day monitoring and supervision will be with the Deputy CEO, supported by E&S specialists.

PIU of ULBs. The PIU is established in ULBs and is headed by a Municipal Commissioner. The PIU will be responsible for the procurement of contractors and supervision of the construction works. The E&S Specialists at the PIU will coordinate internally with the procurement and civil works units, and ensure that the subproject ESIA/ESMPs are prepared before bidding and included in the bidding documents. The E&S specialists at PIU will be directly responsible for overseeing the implementation of ESMPs and RAPs of the subprojects and for the preparation of documentation for future investments. The PIU shall work closely with other line departments for participation, inclusiveness, accountability, equity, transparency, and sustainable implementation of these instruments, including contractors and suppliers/ vendors.

Contractors: The contractors will have adequate ESHS specialists to implement the environmental and social management plans prescribed in the ESMP.

PMTC/CSC: The PMTC team is responsible for supporting the technical activities of water resource/risk management. The major role of PMTC is to prepare DPR for Component 2.2 support MITRA and its PIUs for managing Urban Flood Risk Management through SWD Works, including preparing feasibility studies and ESIA reports of the subprojects. The PMTC will have team of environmental specialist and a social specialist as per requirement.

M&E Agency: Along with PMTC/CSC, one M&E agency will be engaged to monitor and periodic evaluation of project implementation work. M&E agency will evaluate implementation of ESMP along with other monitoring activities. Agency will be responsible for conducting quarterly monitoring of environmental parameters for Air, Surface Water, Ground Water, Soil and Noise quality and mid-term as well as end term evaluation of ESMP implementation.

E&S Consultants: PMU will engage environmental and social consultants for independent monitoring and evaluation, and the ToR for the consultancy is in project files. The objective of the evaluation is to review the LMP, GAP, SEP, ESMP and RAP compliance in project implementation for corrective action. NGOs will be hired to support social mobilization, provide oversight on the process of SIA, ensure identification of vulnerable/ excluded groups and likely project impacts on them, facilitate community consultations as part of RAP preparation and implementation, facilitate RAP implementation, stakeholder engagement through the project life cycle and support capacity building on livelihoods, skill development, and income restoration and on R&R procedures.

The detailed responsibilities of all the above implementing agencies are given in **Table 12.1**.

Table 12-1: Responsibilities of the Implementing Agencies in E&S Management

Organization	Responsibility
PMU	• Coordination with ULBs and other line agencies • Recruitment of PMTC, Independent External Evaluation Consultant (IEEC) Consultants and RAP implementation consultants • Preparation of Quarterly Progress Reports and sharing with the World Bank. • Ensure that all project activities are well-managed and coordinated • Coordination for land acquisition & implementation of RAPs • Payment of compensation to the project affected households; • Coordination for clearances related to safeguards • Implementation of ESCP • Preparation of implementation report on SEP • The CEO, MITRA has administrative and financial powers of INR 2 Crores. Over and above this, the Executive Body (EB) permission is required
E&S staff within PMU	• Screening of proposed subprojects to identify their risk category and requirement of safeguard instruments to be prepared (ESIA or ESMP, RAP, etc.)

Organization	Responsibility
	• Prepare terms of reference for the E&S studies of subprojects • Supervising PIU for the implementation of ESMP • Reviewing consultant deliverables related to environmental assessment, reviewing bid documents for inclusion of ESMP measures, supervising construction activities, producing periodic monitoring reports, • Closely coordinate with other concerned agencies, local governments, and communities to support the implementation of ESMP • Assist in Land Acquisition & RAP implementation
PIU, ULBs	• Ensure that all project activities are well-managed and coordinated • Procurement of works and goods; • Supervising PMTC/CSC for the implementation of ESMP • Supervision of c ivil works, ensuring compliance with all design parameters and ESMP implementation; • Ensure day-to-day compliance monitoring during the execution of works • Obtain clearances related to safeguards
E&S staff within PIU	• Implementation of ESMP and related management plans and fulfillment of all commitments within the scope of ESCP • Sharing the ESMP and management plans with the Contractor, guiding the Contractor in preparing the implementation plans, approving these plans • Updating the ESMP when necessary and sharing additional commitments with the Contractor • Employment of competent EHS staff and external experts to work under the project • Providing EHS trainings to all Project staff • Environmental review, monitoring and audits related to ESMP practices, evaluation of results • Auditing contractor activities in line with ESMP requirements • Ensuring compliance with project standards, making necessary emergency corrections in case of non-compliance • Stopping work in any situation that threatens environment and human health and safety • Providing follow-up and analysis of environmental and social accidents • Ensuring stakeholder participation, implementing the grievance mechanism, ensuring continuous information transfer through open communication • Promptly notify the Bank of any incident or accident related to the Project which has, or is likely to have, a significant adverse effect on the environment, the affected communities, the public or workers including but not limited to; incidents and accidents encountered during construction works, environmental spills, etc. • Provide sufficient detail regarding the incident or accident, findings of the Root Cause Analysis (RCA), indicating immediate measures or corrective actions taken or that are planned to be taken to address it, compensation paid, and any information provided by any contractor and supervision consultant, as appropriate. Ensure the incident report is in line with the World Bank's Environment and Social Incidence Response Toolkit (ESIRT). • Subsequently, as per the Bank's request, prepare a report on the incident or accident and propose any measures to prevent its recurrence. • Coordination of the actions and assessments if a change due to engineering/design changes, route/location changes, applicable legislation changes related to environmental and social issues, authority provision changes, any new environmental/social data is introduced, construction/operation strategy changes or stakeholders influence the project.
Monitoring and Evaluation Agency	• Independent • Undertake Evaluation of ESMP implementation by PMU and PIUs • Prepare corrective actions required by any stakeholders. • Submit the Evaluation Report to PMU for sharing with World Bank. • Evaluation will include: - Compliance with ESIA and ESMPs requirements developed for the project - Compliance with different subject specific plans if required under ESMP; like Biodiversity Management Plan, Occupational Health and Safety Management Plan,

Organization	Responsibility
	Cultural Heritage Management Plan, Labor management plan, implementation status and compliance level. - Effectiveness of GRMs - Reporting on the Implementation of SEP
PMTC/CSC	• Preparing activity schedule in line with the ESMP; • Initial field visit to project sites and assessment of environmental and social aspects of project activities; • Discussion with different stakeholders, including implementing agencies (Dept. of agriculture, • Food Processing and Horticulture, Fishery and Agri-Marketing) on safeguard measures and their expected role; • Finalizing TOR of the contractors incorporating safeguard measures to be taken; • Facilitate / organize training / workshops on safeguard measures for the stakeholders; • Designing study / assessment tools for periodic assessment, its piloting and finalization. • Conducting periodic site visits and observe the measures taken as per the safeguard norms; • On the spot guidance to contractor / implementing agencies on safeguards; • Preparation of site-specific reports and sharing with PIU and PMU; • Documentation of learning cases for sharing and dissemination; • Visual documentation of site-specific safeguard measures; • Tracking activity specific environmental and social monitoring indicators; • Organizing / facilitating refresher training courses for stakeholders; • Monthly and quarterly progress report preparation and submission to PIU and PMU. • Consolidation of periodic monitoring reports; • Support in conducting environment and social audit; • Consolidation of good practice documents and its submission to PIU and PMU; • Final sharing workshop on environment and social safeguard practices and its outcome.
Contractors	• Prepare construction ESMP (C-ESMP) with site-specific mitigation measures; • Implementation of mitigation and monitoring measures proposed in the ESMP; • Each contractor will recruit an Environmental, Social, Health, and Safety Manager, who will be responsible for implementing the contractors' environmental, health and safety responsibilities, and liaising with government agencies. • The contractors will have adequate environmental, social, health, and safety staff. • Prepare monthly & Quarterly reports (E&S report) and submit to PIU as per the ESMP & C-ESMP • Fulfillment of all requirements of the ESMP and management plans • Implementation of additional commitments determined by PIU • Ensuring compliance with project standards, obtaining all relevant permits and licenses • Monitoring construction activities (including subcontractor activities) and taking measures within the scope of the ESMP • Development of implementation and monitoring plans / procedures in line with the ESMP structure, implementation after the approval of PIU • Employment of competent ESHS staff within the scope of the project • Providing the necessary trainings to the contractor and sub-contractor staff on environmental and social issues • Providing follow-up and analysis of environmental and social accidents • Environmental inspections, monitoring and audits related to ESMP practices, reporting to PIU • Prompt notification of accident and incidents and keeping an incident register at construction site throughout the Project life. • Consolidation of periodic monitoring reports; • Assisting in conducting environment and social audit; • Consolidation of good practice documents and its submission to PIU;

12.2 Progress Reporting

At a minimum, the reporting will include

- The overall implementation of E&S risk management instruments,

- Any E&S issues arising as a result of Project works and how these issues will be remedied or mitigated,
- OHS performance (including incidents and accidents),
- Community consultation updates,
- Public notification and communications,
- Progress on the completion of project works, and
- Summary of grievances/beneficiary feedback received, actions taken and complaints closed out.

Reporting by Contractor to Supervising Consultant

- The E&S Specialists will also track grievances/beneficiary feedback during project implementation to use as a monitoring tool for implementation of project activities and E&S mitigation measures.
- The Construction Contractors will prepare and send monthly implementation reports to the E&S Focal Points on E&S performance in accordance with the metrics specified in the respective bidding documents and contracts.
- During the implementation of the subprojects, all contractors shall submit monthly progress reports to respective Supervising consultants detailing ESHS performance. The monthly report shall include provisions for ESHS performance management on sites including training, incident investigation, inspection and audit findings.
- Additionally, for any serious incident which may have significant adverse effects on the environment, the affected communities, the public or workers, the Construction Contractor will inform Supervising consultants PIU and PMU and E&S Focal point immediately and PMU will notify the World Bank within 24 hours of becoming aware of such incident. Furthermore, the Construction Contractor will submit the incident report including Root Cause Analysis (RCA), precautions, and plan of compensation measures taken or to be taken, to PIU and PMU in 10 days and PMU will forward the incident report to the World Bank in 15 days.
- Throughout the Project implementation stage, the PIU/PMU will continue to provide training and awareness raising to relevant stakeholders, such as staff, E&S Focal Points at the Regional Directorates of DSI and the Construction Contractors to support the implementation of the E&S risk management mitigation measures.

Reporting by PMTC/CSC to the PIU and PMU

- The monthly and ad-hoc reporting will integrate information on environmental and social risks management based on their day-to-day supervision of the works and the information provided by Contractors.

Reporting by PMU to World Bank

- The PMU will provide on a quarterly basis or as needed, and as part of the progress report, and information on implementation of ESMP to World Bank including supervision missions and the project's mid-term review.

Chapter 13 : Budget for ESMP Implementation

Sr. No.	Budget Heads	Unit	Quantity	Frequency	Quantity	Unit Cost	Total Cost	Reference
A	**Regulatory Approvals**					**Lumpsum**	**20,00,000/-**	ESIA and ESMP
1	**Workers Safety and Construction Camp**							ESIA and ESMP
	Camp establishment (to be built into Contractor's contract specifications)					**Lumpsum**	20,00,000/-	
	Workers ESHS Measures							
	Subtotal						**20,00,000/-**	**ESIA and ESMP**
2	**Plantation**						**49,80,18,046/-**	**Built into Project Cost**
3	**Waste Management**							Built into Project Cost
	Disposal of desilted material						42,40,89,480/-	
	Disposal of C&D Waste						22,22,36,003/-	
	Subtotal						**64,74,25,483/-**	**Built into Project Cost**
B	**Environmental Quality Monitoring by Contractor including inspection of Tree Survival Rate**						**1,18,98,000/-**	**ESIA and ESMP**
4	**Human Resource**							
	PMU-Social & Gender Expert	Nos	2	Month	36	50000	36,00,000/-	ESIA and ESMP
	PMU-Env Expert	Nos	2	Month	36	50000	36,00,000/-	
	PIU-Social & Gender Expert	Nos	2	Month	36	50000	36,00,000/-	
	PIU-Env Expert	Nos	2	Month	36	50000	36,00,000/-	
	Sub Total						**1,44,00,000/-**	**ESIA and ESMP**
C	**Resettlement and Rehabilitation**							
5	Provision in case of Displacement - Choice of Annuity / Employment - /Loss of Livelihood PAF's -6 Lakh onetime payment or 2000/- per month for 20 years							
6	One-time Subsistence Grant for DP						**Nil**	**ESIA and ESMP**
7	Transportation Cost						**15,00,000**	
8	Resettlement / Livelihood Allowance						**45,00,000**	**ESIA and ESMP**
9	Vulnerability Allowance						**1,80,000**	**ESIA and ESMP**
10	CPR Rehabilitation						**2,00,000**	**ESIA and ESMP**
	C – Sub Total: R&R Entitlements						**63,80,000/-**	**Built into Project Cost**
D	**Implementation of Resettlement Plan and LA**							
11	The hiring of NGO for Implementation						**50,00,000/-**	**If required**
12	Stakeholders Engagement						**10,00,000/-**	**ESIA and ESMP**
13	Hiring of an Independent Agency for Monitoring and Evaluation (Lump Sum)						**25,00,000/-**	**ESIA and ESMP**
	D – Sub Total Implementation of RAP						**85,00,000/-**	
E	**Capacity Building**							
	PIU	Days	5	Person	4 (6 times)	3500	4,20,000/-	Built into Project Cost
	PMU	Days	5	Person	4 (6 times)	3500	4,20,000/-	
	Contractors	Days	5	Person	8 (6 times)	3500	8,40,000/-	
	Elected community representatives	Days	5	Person	10 (6 times)	2000	6,00,000/-	

	Subtotal						**22,80,000/-**	**Built into Project Cost**
F	**Environmental Audit**	**No**	**1**	**Per Year**	**3 times**	**1000000**	**30,00,000/-**	**ESIA and ESMP**
G	**Awareness Drive for Workers**	**No**	**2**	**Camps**	**6 times**	**75000**	**9,00,000/-**	**ESIA and ESMP**
H	**Awareness Drive for Community**	**Days**	**12**	**Community**	**12 times in the project period**	**25,000**	**3,00,000/-**	**ESIA and ESMP**
I	**HIV / AIDS Awareness and GBV Awareness**	**Days**	**16**	**Labour camps and community**	**16 times in the project period**	**25,000**	**4,00,000/-**	**ESIA and ESMP**
						Grand Total		**119,84,01,529/-**