ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK (ANNEXURES)

GUJARAT RESILIENT CITIES PARTNERSHIP:

AHMEDABAD CITY RESILIENCE PROJECT

(G-ACRP)

2022

Prepared by

AHMEDABAD MUNICIPAL CORPORATION

AND

GUJARAT URBAN DEVELOPMENT MISSION

Table of Contents

List of Tables

List of Figures

List of Abbreviations

Abbreviation	*Expansion*	*Abbreviation*	*Expansion*
ACRP	Ahmedabad City Resilience Project	**M&E**	Monitoring and Evaluation
AMASR	Ancient Monuments and Archaeological Sites and Remains Act	**MoEF & CC**	Ministry of Environment, Forests and Climate Change
AMC	Ahmedabad Municipal Corporation	**NCB**	National Competitive Bidding
APD	Assistant Project Director	**NDZ**	No Development Zone
ASI	Archeological Survey of India	**NEP**	National Environmental Policy
BMC	Biodiversity Management Committee	**NGO**	Non-Governmental Organization
BOD	Biological Oxygen Demand	**NMA**	National Monuments Authority
BOQ	Bill of Quantities	**NOC**	No Objection Certificate
BP	Bank Procedures	**NPDM**	National Policy on Disaster Management
BPL	Below Poverty Line	**O&M**	Operations and Maintenance
C&D	Construction and Demolition	**OD**	Operational Directives
CBD	Convention on Biological Diversity	**OHS**	Occupational Health and Safety
CBO	Community-Based Organization	**OP**	Operational Policies
CC	Climate Change	**PAF**	Project Affected Family
CETP	Common Effluent Treatment Plant	**PAP**	Project Affected Person
CMS	Conservation of Migratory Species	**PD**	Project Director
COD	Chemical Oxygen Demand	**PDO**	Project Development Outcome
CPCB	Central Pollution Control Board	**PIU**	Project Implementation Agency
CRZ	Coastal Regulation Zone	**PMC**	Project Management Consultant
DPR	Detailed Project Report	**POP**	Persistent Organic Pollutants
DTP	Directorate of Town Planning	**PPP**	Public-Private Partnership
EA	Environmental Assessment	**PWD**	Public Works Department
EAP	Externally Aided Project	**QA**	Quality Assurance
ECoP	Environmental Codes of Practice	**RMP**	Risk Management Plan
EE	Environmental Engineer	**SBM**	Swachh Bharat Mission
EHS	Environmental Health and Safety	**SDGs**	Sustainable Development Goals
EIA	Environmental Impact Assessment	**SDU**	Sustainable Development Unit
ESA	Environmentally Sensitive Areas	**SEC**	Sensitive Environmental Components
ESAR	Environmental and Social Assessment Report	**SHC**	Stakeholder Consultations
ESF	Environmental and Social Framework	**STP**	Sewage Treatment Plant
ESMF	Environmental Social Management Framework	**SUP**	Single Use Plastics
ESMP	Environmental Management Plan	**SW**	Solid Waste
ESZ	Eco-sensitive Zone	**SWD**	Storm Water Drains
ETP	Effluent Treatment Plant	**SWM**	Solid Waste Management
FGD	Focus Group Discussions	**TA**	Technical Assistance
GDP	Gross Domestic Product	**TDS**	Total Dissolved Solids
GHG	Greenhouse Gas	**TOC**	Total Organic Carbon
GIIP	Good International Industry Practice	**ToR**	Terms of Reference
GIS	Geographic Information System	**TPD**	Tons per Day
GoI	Government of India	**TSDF**	Treatment Storage and Disposal Facility (for Hazardous Wastes)
GPCB	Gujarat Pollution Control Board		
GRC	Grievance Redressal Committee	**TSS**	Total Suspended Solids
GRCP	Gujarat Resilient Cities Partnership:	**TTP**	Tertiary Treatment Plant
GUDM	Gujarat Urban Development Mission	**ULB**	Urban Local Body
Ha	Hectares	**WB**	The World Bank
HH	Households	**WLPA**	Wildlife Protection Act
HR	Human Resources	**WTP**	Water Treatment Plant
ICB	International Competitive Bidding		
IEC	Information Education Communication		
IESE	Initial Environmental and Social Examination		
IFC	International Finance Corporation		
IPF	Investment Project financing		
IUCN	International Union for Conservation of Nature		
LULC	Land use and Land Cover		

GUJARAT RESILIENT CITIES PROJECT (G-ACRP) ESMF: VOLUME II

1. ESMF GUIDANCE MANUAL

Section I: Layout of the ESMF Guidance Manual

The following sections of this Manual are as below:

Section II: presents the Environmental and Social Screening Form

Section III: presents the Documentation Formats (ESF compliance, Quarerly Reporting and Incident Reporting)

Section IV: presents Sample Terms of References for ESIA, Environmental and Social Experts at Project Management Units, E&S Audit

Section V: Indicative Environmental Management Plans and Monitoring Plans

Section VI: Environmental Codes of Practice

Section VII: GBV/ SEAH Risk Mitigation Framework (ESS 1)

Section II: G-ACRP Environmental and Social Screening Form

INITIAL ENVIRONMENTAL AND SOCIAL EXAMINATION
(to be prepared for each subproject)

Subproject Details

Name of Subproject:	
Subproject Components: (mention all subproject components including Networks, Treatment Plants, Disposal Arrangements, etc.)	
Associated Facilities if any (Refer ESS 1 for Associated facilities)	
Subproject Location (City/ Town/ Village with ward numbers):	

Stage 1: Exclusion List

Check the following criteria to confirm if the sub-project is excluded from consideration:

Sl No:	***Non-permissible Activities***	***Yes/ No***	***Description***
1	Sub-projects in sites/ locations which should be excluded as per prevailing Rules/ Laws on Natural Habitats and Forests or Archeologically Protected Monuments (National, State, Local): (i) any construction in demarcated Forest areas or protected natural areas or their buffers, (ii) any subproject which would impact critical natural habitats, (iii) any subproject which shall be excluded as per AMASR Act, (iv) any subproject components or activities in the Historic Walled City of Ahmedabad – the UNESCO World Heritage Site		
3	Sub-projects in sites/ locations which should be excluded as per applicable siting criteria prescribed by GPCB, Master Plan, Excluded Disaster Zones, or other applicable criteria set out by National, State, Local Body		
3	Subprojects involving (i) Activities that impact the safety of Dams/Barrages, (ii) purchase, storage, and use of Banned Pesticides/ Insecticides/ chemicals/asbestos		
4	Sub Projects displacing more than 200 tribal households or 100 Primitive Tribal households		

(Do not proceed to Stage 2; if the subproject is Excluded as per Stage 1 Exclusion List)

Name & Designation of Designated Official in charge:

Signature:

Date:

Verified by: Environmental Specialist of PIU (mark whichever is applicable)

Excluded from the Project	**Proceed to Stage 2**

Name:

Signature:

Date:

Stage 2: Environmental Screening Checklist

Important Note: This Screening sheet must be completed for each of the proposed sites by the respective Designated Nodal Officer on Environment and Social in the concerned department (Sewage/ Wastewater, Drainage) and forwarded to the E&S Specialist in the PIU along with the required enclosures. In the case of TA, appropriate parts of this shall be filled for areas of concern. Provide available information at the start of the subprojects to initiate assessment and update the same as required when more details are known.

<table>
<tr><th colspan="3">Project Details</th></tr>
<tr><td>Sl. No</td><td>Components</td><td>Details</td></tr>
<tr><td>1</td><td>Sub-project components</td><td></td></tr>
<tr><td>2</td><td>Details of Alignment/ Components: (main components including construction activities, environmental infrastructures like STP/ ETP and pipelines, disposal of treated/ untreated effluent, sludge, and other bye-products</td><td></td></tr>
<tr><td>3</td><td>Location of the Project Sites & Land use (Provide information for all sites involved in the project; including for Disposal/ Discharge points, Linked activities/ associated facilities) (attach map)</td><td>
<table>
<tr><td>Purpose</td><td>Current/ Historic Landuse</td><td>Survey No:</td><td>Geo Co-ordinates</td><td>Ownership</td><td>Area (Sqm)</td></tr>
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<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Discharge/ Disposal Point/s</td><td></td><td></td><td></td><td></td><td></td></tr>
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<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Associated Facilities</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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</td></tr>
<tr><td>4</td><td>Quantity of Water Required for Construction and Annual Operations with Details of Source/s (Ground/ Surface)</td><td></td></tr>
<tr><td>5</td><td>Power Required and Source of Power</td><td></td></tr>
<tr><td>6</td><td>Any Raw material, the chemical used for treatment</td><td></td></tr>
<tr><td>7</td><td>Estimated quantity of wastes, sludge, effluent (treated/ untreated)</td><td>
<table>
<tr><td rowspan="2">Quantity of Wastes (Kg/ Day)</td><td rowspan="2">Quantity of Sludge expected (Kg/ Day)</td><td colspan="2">Quantity of Effluent (litres/ day</td></tr>
<tr><td>Treated</td><td>Untreated</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
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Baseline Environmental Conditions

I.	***Environmental Aspects***	***Yes/ No***	***Distance in meters***	***Details on its Importance***
1	Is the project site located **on** or **adjacent to** any of the following (Provide Distance to these features in meters)			
(i)	Cultural Heritage site, Protected monuments - listed by ASI/ State/ Local Body			
(ii)	Culturally – socially important paths, areas/ religious occupancies, burial grounds, tourist, or pilgrim congregation areas, borders, etc.			
(iii)	Eco-sensitive Areas (ESAs) or Critically Vulnerable Coastal Areas (CVCAs)			
(iv)	Natural Forests/ Protected Areas/ Bio-Reserves Is the subproject in an eco-sensitive or adjoining an eco-sensitive area, with any schedule 1 species? If Yes, which are the area and species?			
(v)	Other Wetlands/ Mangrove/ Estuarine Region			
(vi)	Natural Habitat areas, Ponds, Lakes, Rivers, Streams, Canals, roosting/nesting areas, spawning areas, breeding areas; areas with natural features like waterfalls, sacred groves			
(vii)	Other Sensitive Environmental Components listed in ESMF			
(viii)	Drinking water source (Ground, Surface), upstream and downstream uses of rivers, etc.			
(ix)	Low-lying areas/ areas of Tidal Influence (provide CRZ details)			
(x)	Sensitive Receptors – a) Habitations/ Households/ Hostels, other special areas, etc. b) School c) Religious Places d) Tourist Areas			
2	Is the site in Critical/ Over Exploited Ground Water Block. Provide the level of the groundwater table			
3	Is the site vulnerable to major natural or induced hazards such as Earthquakes, Landslides, Flooding, Storm surge, Severe wind damage, Fire, Explosion, Other (specify)			
4	Describe the type of soil and vegetation on site			
5	Is the site present in the flood plains as recorded in the last 100 years? Provide the HFL level of the site/ region			
6	Existing pollution/ contamination or degradation on site			
7	Any other remark on baseline condition: its suitability to proposed use?			

Anticipated Environmental Impacts: Impacts on Air, Noise, Land, Geology, and Soils

II.	***Impacts on Land/ Soil Environment***	***Yes/ No***	***Area (in sqm)***	***Details***
1	Total extend of Demolition expected on-site (footprint in sqm and volume in cubic meter)			
2	Extend of Land to be remediated/ repurposed			
3	Extend of land expected to be under green belt			
4	Will the proposed project cause the following on Land/Soil?			

II.	***Impacts on Land/ Soil Environment***	***Yes/ No***	***Area (in sqm)***	***Details***
(i)	Impact on Surrounding Environmental Conditions including Occupation on Low lying lands/ flood plains			
(ii)	Substantial removal of Topsoil (mention area in sqm)			
(iii)	Any degradation of land/ eco-systems expected due to the project?			
(iv)	Loss or impacts on Cultural/ heritage areas/ properties			
(v)	Does the project activity involve cutting and filling/ blasting etc.?			
(vi)	Will the project cause physical changes in the project area (e.g., changes to the topography) due to excavation, earthwork, or any other activity?			
(vii)	Will the project involve any quarrying/ mining etc?			
(viii)	Will the project/ any of its components contaminate or pollute the Land?			
(ix)	Will the project contribute to any long-term significant adverse (negative), large scale, irreversible, sensitive impact at a regional scale or area broader than the project sites; in combination with other projects proposed/ existing?			

III.	***Impacts on Air and Noise Environment***	***Yes/ No***	***Details*** *(including any Quantity Estimation)*
1	Will the project cause or increase air pollution due to dust and/ or vehicle emissions?		
2	Will the project cause or increase pollution due to GHG emissions?		
3	Will the project cause or increase odor nuisance? (mention type of Gases expected)		
4	Is there a potential for the release of toxic gases or accident risks (eg: potential fire outbreaks)		
5	Will the project generate or increase noise levels or vibration which will impact surrounding biodiversity or communities?		

IV	***Impacts on Water Environment***	***Yes/ No***	***Details*** *(including any Quantity Estimation)*
1	Will the proposed activities at the site(s) impact water quality (surface or ground) – leachate, runoff, waste deposition, erosion, effluent disposal?		
2	Will the activities proposed at the site(s) impact water resource availability and use – effluent disposal, leachate, runoff, wastes deposition, erosion?		

IV	***Impacts on Water Environment***	***Yes/ No***	***Details*** *(including any Quantity Estimation)*
3	Chances of Pollution of Water bodies/ groundwater wells, nearby or downstream		
4	Will the activities proposed at the site(s) hinder natural drainage		
5	Will the activities proposed at the site(s) decrease permeability/ rainwater percolation		
6	Will this sub-project involve creation/ use/ result in impacts on water storage structures in any way? Is this structure/ dam in concern above 15m in height?		
7	Will this sub-project involve the dredging of waterbodies, sea, canals, etc?		
8	Will the project affect the River flow pattern, stream pattern, or any other irrigation canal?		
9	Will the project result in Stagnation of water flow or pondage or weed growth		

V	***Impacts on Biodiversity and Host Communities***	***Yes/ No***	***Details*** *(including any Quantity Estimation)*
1	Will the project necessitates cutting of Trees/ Loss of Vegetation		
2	Will the project necessitate substantial removal of Topsoil (mention area in sqm)		
3	Any degradation of land/ eco-systems expected due to the project?		
4	Will the project result in Health & Safety Risks in the neighborhood (upstream, downstream, nearby) including heightened traffic, the release of toxic gases, untreated sewage/ drainage, accident risks		
5	Potential Noise, Light Pollution/ movements causing disturbance to nearby habitats/ communities mainly during night hours		
6	Potential disruption to common property, accessibility, traffic disruptions, conflicts, or disruption to the local community within the subproject area?		
7	The potential risk of habitat fragmentation due to the clearing activities? (eg. Hindrance to the local biodiversity like disturbing the migratory path of animals/ birds etc.)		

VI	***Impacts due to Storage and Wastes, Pollution and Hazards***	***Yes/ No***	***Details*** *(including any Quantity Estimation)*
1	Will the project use or store dangerous substances (e.g., large quantities of hazardous chemicals used for treatment/ other uses; materials like Chlorine, Diesel, Petroleum products; any other?		

VI	***Impacts due to Storage and Wastes, Pollution and Hazards***	***Yes/ No***	***Details*** *(including any Quantity Estimation)*
2	Will the project produce solid or liquid wastes; including construction/ demolition wastes (including dredging, de-weeding wastes, muck/ silt, dust); polluted liquids?		
3	Will the project cause or increase air pollution or odor nuisance?		
4	Will the project generate or increase noise levels that will impact surrounding biodiversity or communities?		
5	Will the project generate or increase visual blight or light pollution?		
6	Will the project generate water pollution (waterbodies/ groundwater)?		
7	Will the project involve dangerous construction activities which may be a safety concern to workers/ host communities		
8	Describe any other features of the project that could influence the ambient environment		
9	Were the probable environmental impacts discussed with stakeholders?		

Suggested Environmental Enhancement Measures

VII	***Enhancement Measures***	***Yes/ No***	***Details***
1	Has the subproject considered energy conservation measures/ energy recovery options incorporated in subproject design		
2	Has the subproject considered energy efficiency options or use of alternate energy		
3	Has the subproject considered reducing climate impacts of GHG, other releases		
4	Has the subproject considered no disturbance to natural flora including trees		
5	Has the subproject considered water reuse/ recycle options		
6	Rainwater harvesting, water recycling, and other water resource enhancement measures		
7	Has the subproject considered waste minimization or waste reuse/ recycle options		
8	Considerations for extreme events, drought, flood, other natural disasters		

Land Use, Resettlement, and/ or Land Acquisition				
Sl.no	Components	Yes	No	Details
1	Does the project involve the acquisition of private land?			
2	Alienation of any type of Government land including that owned by Urban Local Body?			
3	Clearance of encroachment from			

Land Use, Resettlement, and/ or Land Acquisition				
Sl.no	Components	Yes	No	Details
	Government/ Local body Land?			
4	Clearance of squatters/ hawkers from Government/ Local Body Land?			
5	Number of structures, both authorized and/ or unauthorized to be acquired/ cleared			
6	Number of households to be displaced?			
7	Common properties to be alienated/ Pastureland (acres) Acquisition/ burial ground and others specify?			
8	Existing land uses on and around the project area (e.g., community facilities, agriculture, tourism, private property) will be affected?			
9	Will the project result in construction workers or other people moving into or having access to the area (for a long-time period and in large numbers compared to permanent residents)?			
10	Are financial compensation measures expected to be needed?			
Loss of Crops, Fruit Trees, Household Infrastructure, and livelihood				
11	Will the project result in the permanent or temporary loss of the following?			
11.1	Crops?			
11.2	Fruit trees? Specify with numbers			
11.3	Petty Shops			
11.4	Vegetable/Fish/Meat vending			
11.5	Cycle repair shop			
11.6	Garage			
11.7	Tea stalls			
11.8	Grazing			
11.9	Loss of access to forest produce			
11.10	Any others - specify			
Welfare, Employment, and Gender				
12	Is the project likely to provide local employment opportunities, including employment opportunities for women?			
13	Is the project being planned with sufficient attention to local poverty alleviation objectives?			
14	Is the project being designed with sufficient local participation (including the participation of women) in the planning, design, and implementation process?			

Land Use, Resettlement, and/ or Land Acquisition				
Sl.no	Components	Yes	No	Details
Historical, Archaeological, or Cultural Heritage Sites				
15	Historical heritage site(s) require excavation near the same?			
16	Archaeological heritage site(s) require excavation near the same?			
17	Cultural heritage site(s) require excavation near the same?			
18	Graves or sacred locations require excavations near the same?			
Tribal Population/ Indigenous People				
19	Does this project involve acquisition of any land belonging to Tribal people?			
Beneficiaries				
20	Population proposed to be benefitted by the proposed project	Approx. no.:		
21	No. of Females proposed to be benefitted by the proposed project	Approx. no.:		
22	Vulnerable households/ population to be benefitted	Approx. no.:		
23	No. of Families to be benefitted	Approx. no.:		

Clearances and Permits Required

IV.	**Type**	**Yes/ No**	**Details**
i)	Environmental Clearance (mention State/ Centre)		
ii)	Consent from SPCB for establishment and operation of STP/ WTP		
iii)	NOC Forest Department for either the conversion of forest land or for tree-cutting		
iv)	Permission from AMC for Tree cutting		
v)	NOC for the establishment of water supply intake		
vi)	NOC for water withdrawal from the surface water source		
vii)	Mining Permit (for dredging)		
viii)	Labor License and related		
ix)	Permit for Batching Plant		

IV.	Type	Yes/ No	Details
x)	NOC for transportation and storage of diesel, oil, and lubricants, etc.		
xi)	Others (Mention)		

Enclosures: Provide maps with the geographical location of the project; and an appropriately-scaled map clearly showing the project area and project sites with land use, existing buildings, infrastructure, vegetation, adjacent land use, utility lines, access roads, and any planned construction, and any other information to describe the project, locations and possible impact as required.

Project Categorisation and Need for Instruments, Oversight

Project Category	**□Low (L1) □ Moderate (M1) □Substantial (S1)**
Key Reasons	
Instruments Required	a) S1: Project-specific ESIA (impact assessment considering the project details & location) by Independent Consultant (with signed/ sealed Screening Form, Consultations, ESMP, Budget, Responsibilities); and/ or Environmental and Social Audit; RAP including LRP b) M1: Project-specific ESIA by DPR Consultant (with signed/ sealed Screening Form, Consultations, ESMP, Budget, Responsibilities); and/ or Environmental and Social Audit; RAP including LRP **c)** L1:signed/ sealed Screening Form, Consultations, ESMP, Budget, Responsibilities; and/ or Environmental and Social Audit
Additional Responsibilities Expected	Mention: i) Specialists to be hired for Physical/ Cultural resources, Natural Habitats/ others, GHG estimation, etc for ESIA preparation, and/ or supervision), ii) Consultations, iii) any other aspect

Status	***Agency/ Official***	***Name, Signature with Date, and Seal***
Prepared by	ULB_____Department (project in-charge)	
	Environmental Engineer/ Social Specialist	
Checked, categorised as ____ (S1, M1, L1) & ToR issued by:	PIU Environmental Specialist/ Social Specialist	
	Approved by PIU Project Director	

Section III: Documentation Formats

A. Model Format for ESMF Compliance Reporting

- The objective of these guidelines is to assist the PIU or the borrower in preparing the project compliance report document the Environmental and Social issues encountered in the sub-project and comply with the ESMP/ other recommendations.

- The sub-project compliance report shall have an exclusive section on the Environmental and Social Issues of the projects and provide the following information.

Project Name:				**Loan/ Disbursement No:**	
Borrower/ State/UT				**PMC Consultant:**	
Environmental and Social Issues encountered	**Mitigation Measures**			**Residual Issues Any**	
A. Environmental and Social Issues	As per EA	Implemented	Cost in Rs.	Description	Responsibility
1.					
2.					
3.					
4.					
5.					
B. Issues not identified in IESE/ Screening a. b. c.					
C. Status of the Regulatory Clearances	Obtained	Not Obtained – Reason for Delay and Expected Time	Remarks		
1.					
2					
D. Status of Agreed E&S Actions of Last Mission					
1.					
2.					

B. Format for Quarterly Reporting on Environmental and Social Aspects

Sl No:	*Projects which will be financed during the Quarter*	*Status of Detailed Project Report (Ex: Final/ Expecting Design Change)*	*E&S Classification as per ESMF*	*Proposed ESF Instrument (Ex: Independent ESIA, ESIA by DPR Consultant, Indicative ESM, RAP/ LRP)*	*Status of Stakeholder Consultations*	*Status of Approval of ESF Instrument*	*Remarks (incl. issues/ probable delay in finalizing etc)*	*Next Steps*
1								
2								
3								
Status of agreed Actions on Environmental and Social Aspects								
1	Action 1	Responsibility	Time Schedule	Status				
2	Action 1	Responsibility	Time Schedule	Status				

C. Incident Reporting Format

(Fill blanks)

G-ACRP – INCIDENT REPORTING

Reporting Period: ----------(Month) to ---------- (Month), ---------- (Year)

Sl NO	**Sub Project Name**	**Severe Incidents**		**Serious Incidents**		**Indicative Incidents**	
		No:	**Type**	**No:**	**Type**	**No:**	**Type**
1							
2							
3							
4							
5							
6							

The project has reported _____ **(no:s)** Occupational Health and Safety (OHS) incidents since its start. Of these, _____ **(no:s)** are classified as SEVERE, _____ **(no:s)** as SERIOUS, and _____ **(no:s)** as INDICATIVE. During this period, the Team checked with all PIUs and relevant contractors and consultants if any OHS incidents occurred, either reported or not yet reported. The mission found _____ **(no:s)** new incidents that occurred during this supervision period.

Name of Reporting Officials with Designation:

Date:

Section IV: Sample Terms of References (ToRs)

A. ToR for Preparing ESIA

The consultant shall use the guidance available under Environmental and Social Standard 1 (ESS1): Assessment and Management of Environmental and Social Risks and Impacts, and applicable to the current project, for undertaking an:

a) Conducting the ESIA to identify the anticipated E&S risks and impacts associated with city-level sub-project investments.
b) Developing the project-specific environmental and social management plans based on risk mitigation hierarchy for managing those risks and impacts
c) Proposing arrangements for implementation, monitoring, reporting on E&S Management Plan, grievance redress systems proposed for project stakeholders, capacity building measures needed to ensure effective handling of E&S risks and financial resources required to implement the ESMPs, and
d) Addressing the needs and concerns of vulnerable and disadvantaged groups and individuals likely to be impacted by the investments.

The ESIAs will cover in their scope all direct, indirect, and cumulative environmental and social risks and impacts emerging as a result of these sub-project investments and will be guided by the ESMF and E&S Commitment Plan (ESCP) developed for the project. It is important to note that the final ESMP will start getting implemented during the pre-construction/ construction phase and they will need to be in place before bidding and contractor ESMP modified as per site conditions shall be ready the start of any construction works on the site.

1. The Consultant Firm shall familiarize itself with the city-specific project details in both the cities, overall area/ corridor of project impacts, the sub-project investments which need to be assessed and familiarize itself with the technical, engineering assessment, and studies being conducted by the consultants and contractors to finalize the project design;
2. The Consultant shall initiate contact with the stakeholders to determine how ESIA activities fit into the overall project preparation/ sub-project cycle; and to coordinate the timelines for deliverables under the ESIA process, including the preparation and submission of ESMP;
3. Based on the inputs received from stakeholders, the firm will undertake an Environmental & Social Screening during the initial stages to update/ prepare the assessment of the E&S issues likely to be posed to the project, keeping in mind the possible risks under the different E&S Standards and the specific requirements/ investments under the project. The environmental and social impacts of the first 30% investment projects should be assessed.
4. **RISK SCREENING** The Consultant shall draw a list of information to be collected on various E&S parameters for preparation of the baseline of the project area as relevant, This information is to be collected from secondary sources as well as through primary data collection, at representative and sensitive locations, will help identify gaps and benchmark the E&S related status of the project area;
5. Identify the vulnerable groups (e.g. elderly, disabled people, female-headed households, extremely poor, roadside vendors, and hawkers) that will be affected by the project activities and recommend adoption of differentiated measures so that adverse impacts do not fall disproportionately on them and they are not disadvantaged in sharing development benefits and opportunities resulting from the project;
6. Update the listing of likely project impacts based on their nature, scale, and magnitude and they do a risk classification based on the scale and intensity of these likely impacts;

DATA COLLECTION

7. Conduct stakeholders consultations based on Stakeholder Engagement Plan (SEP) prepared for

the project, for seeking additional, stage-appropriate suggestions on actions and measures to be included in the management plans; this should include separate consultations with the affected, vulnerable, and interested parties.

8. Based on the project-specific and detailed risk assessment1 and as per guidance available under ESS1 and ESMF, the Consultant Firm will update the risk mitigation hierarchy, identifying activities that are likely to have substantial risks, and which may require detailed management actions for handling those risks, including off-setting residual and other types of long term direct as well as indirect E&S impacts;
9. The Consultant Firm will also collect baseline data as part of this assessment, which will cover (i) all bio-physical aspects of the environment include air, water noise, soil, land, hydro-geology/ geo-morphology, all environmental vulnerabilities, bio-diversity/ eco-system. This will include environmental quality (air, water, noise, and vibration) monitoring with an adequate number of samples, as established through a sampling frame to provide a representative picture of pollution levels all along the alignment, at the project sites, etc. All data collection for the preparation of the ESIAs and ESMPs will follow adequate COVID 19 related precautions.
10. Additional data on sensitive environmental/ecological receptors, if any, shall also be collected as part of the baseline to analyze and predict possible risks and impacts for bringing them to acceptable standards/ levels. The surveys shall necessarily cover an inventory of trees, streams/ rivers/ surface water bodies, historical/ cultural sites, construction material sources/borrow pits, human settlements, land use patterns, sensitive receptors, etc. in the project area and its RoW and assess their impacts.
11. From a social perspective, parameters related to human development attainments of the impacted population, settlement and occupational/ livelihoods patterns, economic participation, the extent of poverty and other social vulnerabilities among the impacted communities, degree of exclusion from access to related public services, infrastructure and amenities, the status of women- social and economic participation in development, trends of gender-based violence in the sub-project area will need to be collected and analyzed.

RISK EVALUATION

12. The comprehensive baseline data will facilitate the evaluation of all possible environmental and social risks likely to be faced due to the proposed project investments and later tracking of mitigation measures. To the extent possible, the Firm would try to depict the spatial spread of such risks on maps, superimposed on the project's alignments.
13. Based on the legal review, consultations with stakeholders, analysis of social and environmental baseline data related to the existing physical environment, biological-ecological environment, and socio-economic environment in and around the project's area/corridor of impact, the Consultant will identify all significant environmental and social aspects that are likely to be impacted by the proposed sub-projects;
14. The firm will also need to assess the applicability of different national/state policies, regulations, and guidelines, in addition to WBG frameworks and guidance, during the analysis for assessing the adequacy of the regulatory frameworks.
15. This impact assessment will also scope the presence of Associated Facilities related to the sub-projects. It will also update and/ or assess the applicability of different ES Standards, the likely risks, and the scope of the impacts from the perspective of the ESIA on these facilities
16. Based on the data collection and its analysis the Firm shall update or determine all relevant direct, indirect, residual, or cumulative environmental and social risks and impacts of the project. This will include assessing, among other E&S aspects, the- a) construction related impacts such as water and soil contamination from wastewater generated from construction/ workers camps; spillage and handlings of chemical, effluents, industrial and hazardous materials; damage to

[1]*Using assessment methods will include based on initial scoping a combination of ESIA, environmental audit or hazard assessment social and conflict analysis and ESMF.*

vegetation; b) potential impacts of road cutting and tunnelling; c) air pollution due to fugitive dust from road cutting and earthworks, emission from operations of vehicle, equipment and plant/ machinery; d) cutting of trees; e) reduction of natural resource and its degradation due to extraction/ quarrying; land degradation from project induced changes, especially in areas adjacent to the projects; f) impacts on archaeological and historical sites, culturally or religiously significant sites and common properties, especially considering the fact that walled part of city has several important sites of cultural–religious importance; g) distress among public/ community and workers (community plus occupational health and road safety related) due to disruptions in utility services through increased movement of traffic, material and labour during construction and operations phase and; h) labor influx and GBV-SEA related impacts; i) environmental and social impacts on the downstream of the river, including associated ecological and livelihoods risks; and j) risk/ hazard assessment and occupational health and safety assessment (including but not limited to Covid related OHS issues.

17. The Firm will also analyze the proposed project site, technology, design, and operations from the perspective of likely environmental and social risks and impacts and recommend the one with minimal adverse environmental and social footprint.
18. Based on the adverse risks and impacts identified and assessed by the Firm, it shall identify and update feasible measures and mitigation actions to address them based on World Bank's risk mitigation hierarchy. These E&S risk mitigation/ management plans would recommend measures for improved resource efficiency i.e. energy use, sewage management, and raw materials to minimize project's ecological footprints; safe disposal and management of construction and waste material, recommending design and technology options that minimize damage to natural and human resources, maximize efficiency apart from causing minimal stress and inconvenience to neighboring/ dependent communities that access utilities and services being impacted by the project investments;
19. The ESMPs would also include specific ESHS plans, such as that for management and redevelopment of quarries, borrow areas, construction camps, waste management, emergency response/ disaster management as well as labor management, apart from good industry practices. It would include the environmental supervision, monitoring, and auditing requirements apart from the performance indicators, monitoring parameters (air, water, noise, soil, and vibration), reference standards, monitoring method, frequency, duration, location, and reporting on progress and results during the project life-cycle.
20. The ESMP should also clearly specify what part of the plan/ activities will be implemented by the contractor and the part that will be implemented by the Municipal Corporation so that there is role clarity about ESMP implementation.
21. These sites, alignment, and design-technology specific Environmental and Social Management Plans will (a) identify a set of measures to respond to potentially adverse E&S impacts based on their nature and magnitude; (b) determine requirements for ensuring that those responses are made effectively and on time through the appropriate institutional mechanism and established accountability for implementing those measures; and (c) estimate the resources needed for meeting such requirements, including costs of all mitigation measures including the institutional and capacity building requirements and compensation to be paid to affected parties for unmitigated impacts;
22. The ESMP, as per the requirements under ESS1, would identify all material actions/ measures to address potential adverse impacts and needs to be consistent with commitments spelled out in the E&S Commitment Plan (ESCP) and procedures spelled in the E&S Management Framework (ESMF);
23. This ESMP will list all proposed project activities (stage-wise), risks, and impacts likely to directly or indirectly emerge as a result of those activities/ investments, measures required to mitigate these risks, designation of responsible parties- both for planning/ executing such mitigation measures as well as agencies for providing monitoring-supervision control over these measures

during different stage of the project-pre-construction, construction, post-construction. For risks that are irreversible and cannot be mitigated the ESIA Firm would recommend measures to offset them through compensatory mechanisms defined by the ESS and the national/ state legal framework.

24. The Consultant Firm shall prepare or update the ESIA and ESMP in line with World Bank's Environmental & Social Standards (ESS) and the Environmental, Health, and Safety Guidelines. This will be in line with ESMF principles and provisions which in turn are based on the E&S Standards of the ESF.
25. They will evaluate the project design to assess any potential environmental and social risks and impacts arising from the project activities, in the context of their applicability to the following Environment and Social Standards:
    - ESS1: Assessment and Management of Environmental and Social Risks and Impacts
    - ESS2: Labor and Working Conditions
    - ESS3: Resource Efficiency and Pollution Prevention and Management.
    - ESS4: Community Health and safety
    - ESS5: Land Acquisition, Restrictions on Land and Involuntary Resettlement
    - ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
    - ESS7: Indigenous Peoples/ Sub-Saharan African Historically Underserved Traditional Local Communities
    - ESS8: Cultural Heritage
    - ESS9: Financial Intermediaries
    - ESS10: Stakeholder Engagement and Information Disclosure
26. The overall objectives of carrying out ESIA will be to (i) identify potential environmental risks arising out of the project's support to the proposed first-year investments and recommend ways to mitigate or manage the risks (design improvements, EMPs, etc.) (ii) appraise the stakeholder concerns and recommend measures to mainstream environmental and social concerns in the sub-projects (iii) identify the critical social impacts on the livelihoods of the people to ensure that nobody is left worse off after implementing social risk management plan or Resettlement Action Plan (RAP) as applicable (iv) ensure that those affected have access to project benefits, both during project construction and operation thereafter.

    The EIA (to be prepared separately for each sub-project) for the proposed priority first-year project investments will be prepared to address all the environmental aspects associated with the sub-project and would fully comply with the environmental assessment requirements of The World Bank ESF and its ESSs[2]. The ESIA will also include an Environmental and Social Management Plan (ESMP) incorporating measures to avoid, minimize, mitigate, manage various environmental impacts and enhance positive impacts as identified, associated costs, implementation, management, and monitoring arrangements for the implementation of ESMP. To accomplish the above, the ESIA should perform the following tasks.

    Brief description of the sub-project activities and their inter-linkages with environmental and social risks and impacts.

    Detailed baseline environmental and social profile of the project influence area with details of all the environmental features such as forests area, sanctuaries/ national parks, water bodies, religious structures, archaeological monuments, natural habitats, irrigation canals, and other sensitive receptors. The profile shall be presented on a suitable map indicating the location of each feature and the project facilities. Data on water quality (surface & groundwater), ecological profile, ambient air quality, noise levels, demographic and socio-economic details, etc. shall be

[2] *https://www.worldbank.org/en/projects-operations/environmental-and-social-framework*

collated using a combination of primary and secondary data. The monitoring surveys shall be carried out depending on the sensitivity of the attribute and the possible risks/ impacts. The identification of social issues and stakeholders and communities is important, including socially and economically disadvantaged communities for each of the subprojects. This should enable identifying local populations likely to be affected by the sub-project, undertaking a census of those affected directly by the proposed project interventions. Also identify and define operationally relevant social issues that may affect project design, delivery, and outcomes. The tasks include but are not limited to the following.

i) Identify key social issues associated with the proposed subproject and specify the social development outcomes;
ii) Prepare based on available data the profile of the population and available infrastructure facilities for services (disaggregated by gender, ethnicity, vulnerable groups, socially and economically backward communities, youth and aged, economic aspects, etc) in the project affected area;
iii) Based on the assessment of potential social and economic impacts, the SIA should establish criteria that will assist in the formulation of strategies; to the extent possible maximize project benefits to the local population and minimize adverse impacts of the project interventions on the affected communities;
iv) Assess the likely impacts of the sub-project, in terms of land acquisition (loss of lands, houses, livelihood, etc.), and resultant involuntary resettlement extent and undertake the census of potential project affected people;
v) Identify likely loss of community assets including the religious structures and common property resources (e.g. forest, grazing land, drinking water source, etc); the impacts of their loss on the local population, and prepare mitigation plans;
vi) Review all policies, regulations, and other provisions that relate to land acquisition, resettlement, and rehabilitation of project-affected people and other social issues;
vii) Develop an R&R entitlement framework in consultation with the affected people and other stakeholders and prepare a resettlement action plan (RAP) that is acceptable to the sub-project affected people;
viii) Identify the presence of the Tribal population in the project area and organize consultations in a culturally appropriate way, develop a plan to make them beneficiaries of the project, and in case of any potential adverse impact on them, provide mitigation measures as part of RAP.
ix) Screen the social development issues in the project area and its vicinity and design the social services that may be provided by the project to improve the quality of life and achieve the projects economic and social goals;
x) Inform, consult and carry out dialogues with the project stakeholders on matters relating to sub-project design, objectives, and implementation and provide specific recommendations to avoid/ minimize high social risks (e.g. activities where it is advisable not to proceed), the proceedings of consultation with stakeholders shall be properly documented and video recorded;
xi) To develop a consultation framework for participatory planning and implementation of proposed mitigation plan;
xii) Assess the capacity of institutions and mechanisms for implementing social development aspects of the project implementation and recommend capacity-building measures; and,
xiii) Develop monitoring and evaluation mechanisms to assess development outcomes.

While carrying out the above tasks, the consultants shall adopt a methodology that will include both quantitative and qualitative approaches to the data collection and analysis. The quantitative data collection will necessarily include a census survey of potential project-affected people and

the likely impacts on their livelihood (on an individual basis). The qualitative data collection will include community meetings, focus group discussions with diverse stakeholders' groups, interviews with functionaries of relevant implementing agencies, civil societies, and other stakeholders. The consultants will also organize stakeholders' consultations to get their feedback on the proposed project interventions and their inputs on the social strategy (including resettlement policy) for the project.

Assessment of risks and impacts of the sub-project, including analysis of alternatives for various choices of site and technologies. The assessment should focus on both the construction and operational phase of the sub-project and their impacts on the physical, ecological and socio-economic environment. The impacts shall be predicted for all the alternative scenarios using appropriate impact prediction or other analytical techniques and ensure that they are comprehensive in their coverage. In case of STPs near Sabarmati, ESIA shall also take into account the recommendations of Hydrologic and Flood Risk Assessment including Dam Break Analysis and incorporate the outcomes in Designs, Mitigation measures, suggest following the Emergency Response Plan and Standard Operating Procedures (also incorporate in O&M Manual).

Public consultation and disclosure of the sub-project and its impacts shall be carried out as per ESF of The World Bank. This shall include conducting public consultation and focus group discussions with all stakeholders immediately after commencing the project to identify the environmental concerns of the project area. Inputs from these consultations shall be considered in assessing the environmental impacts, designing ESMP, and associated monitoring mechanisms. After the draft ESIA report, another consultation shall be carried out to ensure that all the critical environmental concerns are adequately addressed in the ESIA and share how stakeholders' concerns have been incorporated in the project design or addressed in the ESMP. The consultation should take place at appropriate places, to ensure that all the stakeholders in the project area have reasonable opportunities to attend such consultations. All the consultations shall be documented in detail with information on minutes of the consultation, details of people attended, issues raised, and shall be supported by photographs.

Environmental and Social Management and monitoring plan, comprising a set of remedial (prevention, mitigation, and compensation) measures shall be developed by the consultant and ensure that these are commensurate with nature, scale, and potential of the anticipated environmental impacts. The components of ESMP shall be supported by detailed cost estimates, bill of quantities, and necessary drawings (wherever necessary) for implementation. The ESMP should also include a monitoring and supervision plan for the implementation of ESMP and shall identify the responsibilities of the contractors, the project implementation, and monitoring agencies.

5. Disclosure of ESIAs/ ESMPs, RAP

The Consultant shall also assist the AMC in disclosing the ESIAs/ ESMPs and RAP in compliance with the ESF of the World Bank. The respective ESIA, ESMP, and RAP for each of the investments proposed under the project are also required to be disclosed prior to bidding in a similar manner.

6. Consultant Team & Qualifications Expected:

The consultants should have adequate experience in the environmental and social assessment of large-scale urban infrastructure investments. The core team for the assignment will be evaluated based on their qualifications and working experiences related to the following fields of work on earlier completed assignments. Thus, the CVs of the following specialists submitted in the proposal should have specific information in this respect.

Sl.No.	Position	Number	Experience
1	Environmental Specialist - Team Leader (Full-time on-site-Ahmedabad)	1	Postgraduate with 10-15 years of demonstrated experience in the preparation of ESMF and carrying out EIAs/ SIAs/ ESIAs for managing and monitoring environmental and social risks and impacts during and after implementation of large urban infrastructure projects involving among others wastewater treatment, drainage, Etc. The specialist should also be fully conversant with the ESF of the World Bank.
2	Social Development Specialist/ Sociologists/ Anthropologists	1	Postgraduate 10-15 years of demonstrated experience in designing and implementing social assessment programs in large-scale urban infrastructure projects involving among others wastewater treatment, drainage, Etc. The specialist should also be fully conversant with the ESF of the World Bank and LA regulations of GoI, issues around land management/ revenue administration in India. The specialist should have working experience on issues pertaining to vulnerable communities; religion and gender. Should also have wide experience of handling consultations with multiple stakeholders.
3	Community Consultation/ Communication Specialist	1	Graduate with 5-10 years, with extensive experience in preparation of social impact assessments and mitigation/ management strategies and the planning and implementation of community consultation and stakeholder management programs in the urban context.
4	Infrastructure/ Environmental Engineer/ planner	1	Graduate with 5-10of experience in urban infrastructure with a focus on wastewater treatment, drainage, Etc. The specialist should also be fully conversant with the ESF of the World Bank., and other issues related to urban infrastructure development.
5	Ecologist/ biodiversity specialist	1	Graduate with 5-10 years of demonstrated experience in carrying out ESIAs for managing and monitoring environmental impacts during and after implementation of large urban infrastructure projects involving among others wastewater treatment, drainage. Etc. The specialist should be experienced in monitoring/ identifying migratory birds. The specialist should also be fully conversant with the ESF of the World Bank.
6	Heritage / Conservation Expert (part time)	1	Post graduate / graduate in Heritage conservation and Architecture with experience in assessing impacts of works and preparing mitigation measures for impacts due to any works.
7	Hydrologist (Part time)/ Flood Management	1	Post graduate in Hydrology, with expertise in assessing floods, cumulative impacts and designing mitigation measures for any risk or impacts on / due to outfalls, flow patterns of discharge channels especially during extreme events, and emergencies.
8	labor laws expert	1	Graduate with 5-10 years of demonstrated experience in designing and implementing social assessment programs in large-scale urban infrastructure projects involving among others wastewater treatment, drainage. Etc. The specialist should also be fully conversant with the ESF of the World Bank and Land acquisition procedures and Municipal level

Sl.No.	Position	Number	Experience
			regulations. The professional should have working experience on issues on the vulnerable community; religion and gender.
9	Gender Expert/ Community expert Development	1	Graduate with 5-10 years of demonstrated experience in conducting ESIA/ SIA and demonstrated familiarity with World Banks ESF and of working on similar projects.
10	Health & safety specialist	1	Graduate with 5-10 years of demonstrated experience on OHS and development of H & S plan to address or manage occupational and community health &safety and demonstrated familiarity with World Banks ESF.
11	Stakeholder Engagement Specialist	1	Graduate with 5-10 years of experience in conducting ESIA/ SIA and demonstrated familiarity with World Banks ESF and Stakeholder Engagement Plan preparation.
12	Institutional Specialist	1	Graduate with 5-10 years of experience in conducting ESIA/ SIA and demonstrated familiarity with World Banks ESF and Stakeholder Engagement Plan preparation.

Note: Key specialists are indicated above. In addition, substantial additional inputs would be required from Junior and the support staff.

B. Assessment of Cumulative Impacts as part of ESIA

1. The assessment of Cumulative impacts shall be conducted as part of ESIA as per IFC guidelines/ GIP for CIA, taking into account impact of the G-ACRP projects and all other projects and activities (non G-ACRP) within a given time and space.
2. The ToR for ESIA should specify 5 steps as follows for determining Cumulative Impacts in case of subprojects or STPs clustered in a particular area, or contributing to cumulative discharge of effluents into a common discharge area:

- **Step 1**: Describe the proposed project, it's setting, and other projects and activities that may give rise to cumulative effects. This will need to sequence planned developments of the project in and ancillary and regional infrastructure development in the time horizon of the project. The consultants will need to propose geographic and temporal boundaries for the assessment based on the screening of potential impacts on key environmental components. The geographic context should include administrative boundaries or watersheds as appropriate.
- **Step 2**: Identify key project-related contributions to cumulative effects on selected resources of concern, such as groundwater, biodiversity, and the livelihood of local communities.
- **Step 3**: Assess the level of cumulative effects.
- **Step 4**: Determine the significance of cumulative effects.
- **Step 5**: Provide recommendations: Analyze reasonable, feasible options for mitigating or avoiding contribution to any significant cumulative effects, following the national legal system related to the cumulative impact assessment (or the lack thereof)).

Tasks:

Step 1: Describe the development and its setting

1. **Project Description**. The first step in the process is to describe the project and its phases, including key components that may give rise to cumulative effects. This will include the following:
   - Phases and timing of the project including all works that are planned simultaneously at various places;
   - Description of the scheme and project area of influence;

- Description of offsite facilities including transportation, access roads, material storage areas;
- Identify environmentally sensitive areas, including protected areas, key stakeholders, and affected people.

2. **Past, present, and probable future projects.** Once project issues have been identified, analyze past, present, and probable future projects and activities within a defined temporal and spatial framework. The evaluation of other projects and activities should consider the following:
   - Include those projects of known footprint that can be assessed;
   - Consider a time frame that extends backward to a pre-development scenario and forwards as realistically as possible;
   - Include projects that are approved, awaiting approval, announced, under design, or construction, and potentially coincide with the timeline of proposed works;
   - Include those projects whose environmental and social impacts and contribution to cumulative effects can be reasonably predicted, particularly projects with direct impacts on water resources, land, and biodiversity; and,
   - Discuss pending projects with regulators and incorporate the concerns of affected stakeholders.

Prepare a map or schematic of all existing and planned projects with the basic information on location, resource intake, discharges, ancillary infrastructure, operation, etc.

- Define geographic and temporal boundaries based on the screening of potential impacts on key environmental components. The geographic context could include administrative boundaries or watersheds. It is noted that there might be different contexts for each Valued Ecosystem Component (VEC - see below). The definition will also need to include the scale of maps and other tools to present data that will be collected during the study.

3. Define VECs. Typical VECs to include in wastewater/ stormwater development impacts include the following:
   - Impacts on water resources (water use, quality, quantity);
   - Impacts on ecology and biodiversity;
   - Impacts on land use;
   - Impacts on archaeological and cultural resources;
   - Impacts of wastes on the environment;
   - Impacts on air quality;
   - Impacts on the livelihood of local communities
   - Impacts on road traffic and inconvenience of the local population;
   - Visual Impacts.

4. The VECs should be defined based on the assessment of impacts on the above aspects and consultations with stakeholders. VECs could be (but are not limited to): water resources, land erosion, biodiversity, cultural resources, air quality, etc. Each VEC will need to have indicators, thresholds, historical trends on the status of the VEC in the time frame proposed.

Step 2: Identify key project-related contributions to cumulative effects on selected resources of concern

5. The study should identify key impacts of project activities throughout all phases (construction, operation, and decommissioning) in conjunction with other projects and activities. The following questions should be answered:
    - Are other projects and activities in the defined project area affecting the VECs?
    - Do the effects of the project overlap or increase the effects on the resource?
    - Do the effects of the project have the potential to affect the long-term sustainability of the resource?

Step 3: Assess the level of cumulative impacts

6. The next step is to assess the level of cumulative impacts of other projects and activities, in addition to the project in a defined spatial and temporal framework. For each resource/ issue in question, the cumulative effects should consider typical components – extent, frequency, duration, magnitude, uncertainty, and probability. Techniques will need to rely on qualitative data and already available quantitative data; no significant fieldwork for quantitative data collection is envisaged.

Step 4: Determine the significance of cumulative impacts

7. Once the cumulative impacts are determined, their significance must be considered relative to an established threshold limit, an established legal guideline or policy, or a qualitative assessment based on professional opinion and consultation. In any case, the significance of the cumulative impacts must be defensible. The significance of the cumulative impacts and the contribution of the project must be subsequently evaluated by project decision-makers. The consultant will need to define the level of "significance" or scale and apply it consistently. The significance should be assessed across past, present, and future projects on the trends of each VEC. The significance of the project interventions' contribution to the cumulative impacts should be defined in one of the following ways:
    - The project has a measurable effect on the resource;
    - The project acts in conjunction with the effects of past present or future projects and activities; and
    - The project in conjunction with other projects and activities shifts the resource to an unacceptable level or exceeds a threshold such that the impact is considered significant, in that:
        - The project's contribution to cumulative effects is responsible for exceeding the threshold and therefore is significant or,
        - The project is contributing to the effects of other projects and activities and the project contribution may or may not be significant, depending on the level of the contribution.

Step 5: Formulate recommendations.

8. This should conclude whether the contribution, if any, to the cumulative impacts by the project is significant or not. An action plan (with time, institutional responsibilities, budget) should be developed based on this conclusion, and clearly define what mitigation measures need to be incorporated into the project Environmental Management Plan, and what mitigation/ environmental management measures should be carried out above the project level. The management plan will be in three parts: (i) management plan for additional measures needed to be included in the project that has not been included in the EIA; (ii) recommended measures for the future projects in the area; and (iii) measures addressing needs for institutional and legal frameworks and acquisition of knowledge. The

recommendations will need to also include proposed adaptive management approaches for impacts that still will have a high level of uncertainty or lack sufficient information for an adequate assessment.

9. Mitigation/ environmental management measures that are needed but beyond the scope of the project, will be presented to relevant (government) agencies/ entities in the form of a workshop and finalized based on the views of the agencies. Their endorsement/ acknowledgment of the recommendations from the assessment should be sought.

C. Indicative outline of ESMP

An ESMP consists of the set of mitigation, monitoring, and institutional measures to be taken during the implementation and operation of a project to eliminate adverse environmental and social risks and impacts, offset them, or reduce them to acceptable levels. The ESMP also includes the measures and actions needed to implement these measures. The Borrower will (a) identify the set of responses to potentially adverse impacts; (b) determine requirements for ensuring that those responses are made effectively and promptly, and (c) describe the means for meeting those requirements.

Depending on the sub-project, the ESMP may be specific, prepared as a stand-alone document (for Substantial, or Moderate risk), an indicative/ General ESMP (for the low-risk projects), or the content may be incorporated directly into the ESCP. The content of the ESMP will include the following:

Mitigation

The ESMP identifies measures and actions following the mitigation hierarchy that reduces potentially adverse environmental and social impacts to acceptable levels. The plan will include compensatory measures, if applicable. Specifically, the ESMP:

- identifies and summarizes all anticipated adverse environmental and social impacts (including those involving indigenous people or involuntary resettlement);
- describes—with technical details—each mitigation measure, including the type of impact to which it relates and the conditions under which it is required (e.g., continuously or in the event of contingencies), together with designs, equipment descriptions, and operating procedures, as appropriate;
- estimates any potential environmental and social impacts of these measures; and considers, and is consistent with, other mitigation plans required for the project (e. g., for involuntary resettlement, indigenous peoples, or cultural heritage).

As the Borrower would be engaging contractors, and the ESMP sets out the requirements to be followed by contractors. In this case, the ESMP should be incorporated as part of the contract between the Borrower and the contractor, together with appropriate monitoring and enforcement provisions.

Monitoring

The ESMP identifies monitoring objectives and specifies the type of monitoring, with linkages to the impacts assessed in the environmental and social assessment and the mitigation measures described in the ESMP. Specifically, the monitoring section of the ESMP provides (a) a specific description, and technical details, of monitoring measures, including the parameters to be measured, methods to be used, sampling locations, frequency of measurements, detection limits (where appropriate), and definition of thresholds that will signal the need for corrective actions; and (b) monitoring and reporting procedures to (i) ensure early detection of conditions that necessitate particular mitigation measures, and (ii) furnish information on the progress and results of mitigation.

(Monitoring during project implementation provides information about key environmental and social aspects of the project, particularly the environmental and social impacts of the project and the effectiveness of mitigation measures. Such information enables the Borrower and the Bank to evaluate the success of mitigation as part of project supervision and allows corrective action to be taken when needed).

Capacity Development and Training

To support timely and effective implementation of environmental and social project components and mitigation measures, the ESMP draws on the environmental and social assessment of the existence, role, and capability of responsible parties on-site or at the agency and ministry level. Specifically, the ESMP provides a specific description of institutional arrangements, identifying which party is responsible for carrying out the mitigation and monitoring measures (e .g ., for operation, supervision, enforcement, monitoring of implementation, remedial action, financing, reporting, and staff training)

To strengthen environmental and social management capability in the agencies responsible for implementation, the ESMP recommends the establishment or expansion of the parties responsible, the training of staff, and any additional measures that may be necessary to support the implementation of mitigation measures and any other recommendations of the environmental and social assessment.

Implementation Schedule and Cost Estimates For all three aspects (mitigation, monitoring, and capacity development), the ESMP provides (a) an implementation schedule for measures that must be carried out as part of the project, showing phasing and coordination with overall project implementation plans; and (b) the capital and recurrent cost estimates and sources of funds for implementing the ESMP. These figures are also integrated into the total project cost tables.

Integration of ESMP with Project

The Borrower's decision to proceed with a project, and the Bank's decision to support it, are predicated in part on the expectation that the ESMP (either stand-alone or as incorporated into the ESCP) will be executed effectively. Consequently, each of the measures and actions to be implemented will be specified, including the individual mitigation and monitoring measures and actions and the institutional responsibilities relating to each, and the costs of so doing will be integrated into the project's overall planning, design, budget, and implementation.

D. Indicative outline of Environmental and Social Audit (for upgradation of STPs, other existing facilities)

(Ref Section 5.3 of ESMF vol1 - :".. In case of existing facilities, ESIA also shall include E&S Audit to determine the extent and nature of all E&S areas of concern at an existing project or activities in case of Substantial risk sub-projects; whereas audit can be standalone (without ESIA) in case of Moderate and Low-risk sub-projects.")

The audit aims to identify significant environmental and social issues in the existing project or activities and assess their current status, specifically in terms of meeting the requirements of the ESSs.

Executive Summary

Concisely discusses significant findings and sets out recommended measures and actions and timeframes.

Legal and Institutional Framework

Analyzes the legal and institutional framework for the existing project or activities, including the issues set out in ESS1, paragraph 26, and (where relevant) any applicable environmental and social requirements of existing financiers.

Project Description
Concisely describes the existing project or activities, and the geographic, environmental, social, and temporal context, and any Associated Facilities.

Identifies the existence of any plans already developed to address specific environmental and social risks and impacts (e.g., land acquisition or resettlement plan, cultural heritage plan, biodiversity plan).

Includes a map of sufficient detail, showing the site of the existing project or activities and the proposed site for the proposed project.

(Contents of process and Environmental performance audit of existing STPs is presented as Section I below)

Environmental and Social Issues Associated with the Existing Project or Activities
The review will consider the key risks and impacts relating to the existing project or activities. This will cover the risks and impacts identified in ESSs1–10, as relevant to the existing project or activities. The audit will also review issues not covered by the ESSs, to the extent that they represent key risks and impacts in the circumstances of the project.

Environmental and Social Analysis
The audit will also assess (i) the potential impacts of the proposed project (taking into account the findings of the audit concerning the existing project or activities); and (ii) the ability of the proposed project to meet the requirements of the ESSs.

Proposed Environmental and Social Measures
Based on the findings of the audit, this section will set out the suggested measures to address such findings. These measures will be included in the Environmental and Social Commitment Plan (ESCP) for the proposed Project. Measures typically covered under this section include the following:

- specific actions required to meet the requirements of the ESSs
- corrective measures and actions to mitigate potentially significant environmental and/ or social risks and impacts associated with the existing project or activities
- measures to avoid or mitigate any potential adverse environmental and social risks or impacts associated with the proposed project

E. ToR for Environmental Experts at the Project Implementation Units (PIUs)

Introduction
G-ACRP aims at enhancing and strengthening the institutional capacity of the urban local government system in Ahmedabad to deliver services and perform governance functions more inclusively and efficiently. The program enables the LBs to catch up with the current urbanization trend in the State by ensuring the urbanized areas and selected urbanizing local governments have proper administrative and service delivery systems and procedures in place to function effectively. The project would be coordinated by PIU (of AMC and GUDM) which will have full-time environmental experts to oversee, plan and co-ordinate the environmental aspects, and management during project planning and implementation stages. PIU will have an Environmental Engineer and an Environmental Specialist who will coordinate with various contractors, departments, stakeholder agencies, and citizens and oversee the preparation of

ESF documents and implementation of environmental measures during project implementation and operations.

Geographical Coverage

The Sub-projects will be Implemented in AMC limits. This area includes flood plains, heritage areas, lakes, rivers, and other eco-sensitive areas; (ii) environmental issues associated with wastewater/ stormwater/ infrastructure development sector are significant; (iii) there is a requirement for enhancing the efficacy and performance of existing infrastructure with environmentally appropriate practices. Considering the geographical disposition, the density of population, and environmental characteristics of the district and its urban areas, it is important to have a strategic understanding of the region and the focus sectors. The ESMF, ESCP for the overall project and ESIAs, and other instruments at the subproject level will be prepared and followed to ensure the effective management of environmental aspects during all stages. TA, capacity building activities also may include many municipalities around and areas or areas outside AMC.

Objectives of engaging Environment Engineer and Environmental Specialist at PIU/ ULB

Roles and Responsibilities

- Co-ordinate the Preparation of the ESMF, Prepare and Disclose the ESMF including guidelines for impact identification (for goods, works and consultancy contracts), project screening checklist, broad mitigation plans, guidance to prepare detailed impact assessment for projects, supervision mechanisms, monitoring requirements, training/ capacity building needs, and budgetary provisions in contracts. This shall comply with all National/ State regulations, local bylaws and guidance, and the World Bank ESF
- Review the investment proposals (sub-projects) and ensure that environmental issues are properly addressed by the development of a project-specific environmental analysis including (but not limited to) land use, habitats, cultural heritage, public consultations, and occupational health and safety
- Provide expert advice to the PIU/ ULB team with regards to mitigation measures to comply with National/ State laws and relevant World Bank ESF effectively and efficiently
- Co-ordinate the environmental aspects of the projects and subproject implementation at the local/ site level
- Provide expert guidance to the beneficiaries in the preparation and successful implementation of the project environmental assessment instruments/ documentation, including preparation of environmental impact/ risk assessments and environmental management plans
- Provide required update/ data/ information/ monthly reports to the PIU on ESMF implementation.
- Providing inputs/ onsite compliance of ESF into the MIS
- Report the status and progress of environmental mitigation measures as required & follow up with contractors for the submission of monthly reports
- Report the status and progress of institutional arrangements and functioning of environmental arrangement along with any impacts that should be addressed. These should be reflected in the Project Progress Report to be submitted to the Deputy Project Director/ Project Director
- Assist and advise the PIU/local body from time to time in monitoring and managing contractors' activities that may have environmental impacts, if any. Conduct random audits for ESMF compliance during various project stages
- Assist PIU in operationalizing the methods, procedures, and systems for the introduction of environment compliance practices into the existing systems of the AMC

- Carry out site supervision visits during the preparation and implementation of sub-projects and other activities related to the Project.
- Work with Social specialist in arranging Stakeholder consultations and consensus-building as outlined by the ESMF and required by National/ State regulations and World Bank ESF
- Coordinate and share information with World Bank project staff and consultants providing ESF cross-support
- Ensure that environmental assessment is an integral part of the planning of all project supported schemes and co-ordinate with PIU/ ULB procurement team to ensure that bid documents include ESMPs cleared at respective levels as per ESMF or report on non-inclusion of this to PIU
- Manage and coordinate with consultants and contractors on the preparation of Environmental and Social Impact Assessment (ESIA) with Environmental and Social Management Plans (ESMPs), Monitoring Plan, Budget for ESMP implementation and inclusion of Environmental and Social Management Plan and budget requirements in Contract documents to facilitate the implementation of mitigation measures.
- Develop, co-ordinate and support testing of environmental parameters and training programs on Environmental monitoring and management arrangements developed under the Project
- Ensure during the day-to-day functioning that the ESMF, ESCP and ESMPs are implemented by PIU, contractors/ others concerned properly in their respective sub-projects
- Ensure including the necessary activities related to the ESSs, such as training, studies, etc. in the project procurement plan if relevant.
- Ensure that all legal and regulatory provisions relevant to the environmental aspects are satisfactorily met through the project processes
- Ensure that environmental assessment is an integral part of the planning of all project supported schemes
- Ensure that ESF documents are prepared on time and disclosed well in time before the start of works and that all required clearances/ permits/ licenses are obtained for projects. This shall comply with all National/ State regulations, local bylaws/ guidance, and World Bank ESF requirements
- Oversee the contractors team, and ensure that they have environmental experts in their team, prepare and follow Contractors Environmental Management Plans (C-ESMP); as outlined in ESMF and maintain required permits/ licenses/ incident and grievance registers
- Facilitate the creation and documentation of experiences, lessons learned, case studies, success stories, etc.
- Monitor the fulfilment of the project-specific environmental requirements and ESF for all project activities, in all direct and indirect contracts; ensure proper reporting by monitoring agencies at various levels (district/ site), and maintain database and follow-up

Environmental Engineer will look at engineering / technical aspects and construction safety. Environmental specialist will look at environmental quality, discharge flow, biodiversity, heritage aspects.

Roles and Responsibilities

- Screening (Stage 1 & 2) and categorization of projects based on field visits and discussions. For this, they shall coordinate and get guidance from the specialists in PIU. Integrate findings of the screening and assessments (where applicable) in the sub-project selection and/ or design process.

- Support and co-ordinate for Government approvals and statutory clearances to ensure adoption of Environmental and Social Standards, submit the relevant documents/ reports for the adopting and compliance of the ESMF, as required.
- Take required actions on-site, including the application of contractual remedies, on contractors when needed
- Work with consultants/ contractors to ensure that ESF documents are prepared on time and disclosed well in time before the start of works and that all required clearances/ permits/ licenses are obtained for projects. This shall comply with all National/ State regulations, local bylaws/ guidance, and World Bank ESF requirements.

Reporting Requirements

The Environmental Engineer and Environmental Specialist will report to the Project Head of the PIU. These experts will report to the Deputy Project Director/ Project Director G-ACRP. He/ She will effectively:

- Maintain full documentation of ESF requirements and status of the same, for projects under different stages of planning and implementation,
- Coordinate the preparation and updation of ESMIS- Management Information System
- Undertake site inspection, and submit the report on random audits on ESMF Compliance during various project stages to the Deputy Project Director/ Project Director of the PIU
- Prepare and submit monthly progress report containing the list of activities planned for the reporting period, progress towards the target and the result of targeted activities shall be furnished to DPD/ PD,
- Carry out any other tasks assigned by the Deputy Project Director/ Project Director from time to time for the project.

Duration of Project

5 years (and expected to continue during Operation phase)

Qualification & Experience

Environmental Engineer: Master's degree in Civil/ Environmental Engineering; with a minimum of 8 years of working experience.

Environmental Specialist: Master's in Planning/Environmental Management, with a Bachelors's degree in Civil / Environmental Engineering, with a minimum of 8 years of working experience.

- The environmental engineer and specialist must have at least 10 years of working experience of which 5 years in the field of environmental activities as a consultant or working in an institution that deals with environmental concerns; preferably in wastewater/ stormwater management.
- The environmental experts must be fully conversant with the National/ State/ Local regulatory requirements on the environment, technical guidelines, and infrastructure provision and aware of the World Bank ESF or E&S requirements of other international agencies and must have completed, or involved in the preparation of, the environmental impact study of at least two infrastructure projects. The expert must have preferably demonstrated sound technical expertise in international good practices on environmental aspects.
- Proficiency in computer applications including MS office is essential, and working knowledge of GIS is desirable.
- Excellent written and oral communication skills in English & Gujarati.

- Ability to work efficiently and effectively in a multidisciplinary team. Good interpersonal skills and prior experience in efficient stakeholder consultations and consensus building in Ahmedabad would be an added advantage.

Duty Headquarters
The duty headquarters of the Environment Engineer and Environmental Specialist will be at the PIU/ ULB, at Ahmedabad. The experts may be required to travel frequently within and outside the project location, or State for project purposes.

Duration:
Appointment to the posts will be on a contract basis initially full-time for one year and likely to be extended based on the performance.

F. ToR for Social Specialist at PIUs

The project envisages varied social issues and impacts across the project works proposed to be taken up. As such project's infrastructure interventions would trigger Bank Environment and Social Framework (policy and standards), therefore these need to be factored into the preparation of necessary mitigation instruments (action plans and frameworks), besides ensuring compliance to existing and relevant national and state legislations. In this regard, PIU needs to hire an experienced Social Development Specialist in its unit to effectively coordinate necessary studies as part of project preparation and implementation. Specific tasks by preparation and implementation/ monitoring stages are as follows:

Preparation stage

Overall responsibility for overseeing the preparation of key plan documents including Land Acquisition Plan, Social Impact Assessment (SIA), Resettlement Policy Framework, Resettlement Action Plan(s), Stakeholder Engagement Plan, Labor Management Procedure and Gender-Based Violence Risk Mitigation Plan and Labor Influx Management Plan by coordinating with ESIA consultant agency, DPR consultant, Revenue Department. In this respect, s/he will liaise with and facilitate interaction with necessary institutional stakeholders, communities, organizing of community-level consultations, facilitate data collection for socio-economic surveys and impact assessments

- Manage Consultants responsible for the preparation of the afore-mentioned plan documents.
- Review draft outputs of the contracted agencies for conducting ESIA, provide timely feedback, observations, and comments
- Facilitate preparation of computerized database related to the Land acquisition, resettlement impacts.
- Ensure integration of ESIA/ ESMP findings related to social aspects in investment plans, engineering designs, and bidding documents
- Co-ordinate with State Revenue Departments and concerned SEs/ EEs for land acquisition
- Ensure time-bound preparation of Action Plans for the Land Acquisition Units.
- Liaise with counterpart (Social Development Specialist) at the World Bank to obtain comments and feedback on these draft outputs towards finalization and approval of the reports (Social Impact Assessment (SIA), Resettlement Policy Framework, Resettlement Action Plan(s), Stakeholder Engagement Plan, Labor Management Procedure and Gender-Based Violence Risk Mitigation Plan and Labor Influx Management Plan)

- Assist and guide IAs for information dissemination, stakeholder consultations, and proper disclosure of documents and ensure disclosure of these outputs including translation of the executive summaries into the local language of the prepared mitigation instruments.
- Facilitate the establishment of Grievance redressal committees/ cells
- Undertake any other activities as may be assigned for the efficient and smooth execution of the project following the Environment and Social Commitment Plan of the project.

Implementation/ Monitoring stage

- Support the IA in implementation of the above mitigation plans (Social Impact Assessment (SIA), Resettlement Policy Framework, Resettlement Action Plan(s), Stakeholder Engagement Plan, Labor Management Procedure, and Gender-Based Violence Risk Mitigation Plan and Labor Influx Management Plan.
- Maintain and continuously update the computerized database related to the delivery of Resettlement Entitlements and the generation of periodical progress reports.
- During implementation, s/he will also be responsible for internal monitoring of the implementation of mitigation plans, besides facilitating and contributing to the periodic external impact evaluation studies that would be undertaken at specified intervals during the implementation stage of the project
- Contribute to the continued implementation of the citizen engagement and feedback system during the implementation stage.
- Support IAs (AMC/ GUDM) in responding to queries from stakeholders.
- Undertake other tasks as required for satisfactory completion of the above-mentioned tasks
- Work with contractors (and other consultants), and others as applicable to organize and facilitate consultations and workshops with stakeholders.
- Coordinate the meetings of various committees established for the implementation of Resettlement Action Plans.
- Ensure compliance to all labor laws such as the prohibition of child labor, HIV/ AIDS, and gender issues by conducting necessary training/ orientation programs
- Prepare an Annual Action plan for implementation of these plans including stakeholder engagement
- Undertake periodic field visits as appropriate to review the progress at ground level.
- Track, document, and ensure follow up to stakeholders on all grievances and provide reporting data for progress reports.
- Undertake capacity building activities for PIU personnel on provisions and actions listed in the safeguard documents and process to be adopted
- Prepare monthly or quarterly status reports for AMC and the World Bank on social management aspects (grievance management, implementation progress on management plans, etc.) based on on-site visits, inputs from contractors, and construction supervision consultants.
- Any other duties as may be assigned for the efficient and smooth execution of the project by IA

Qualifications

Masters/ Post Graduate degree in Social Sciences relevant discipline e.g. Social work/ Sociology/ Anthropology.

Experience

Candidate must have/ possess

- Minimum seven to ten years experience in the area of social impact assessment, including facilitating land acquisition processes, undertaking stakeholder consultation, conducting/ facilitating socio-economic surveys, undertaking social impact assessments, and preparation of Resettlement Action Plans following World Bank's ESF. S/he should have worked on at least three (3) infrastructure projects preferably of similar nature, of which at least one should have been funded by multilateral agencies.
- Knowledge of legal/ regulatory requirements of GoI on land acquisition, resettlement and rehabilitation, and existing government welfare/ rehabilitation schemes.
- Experience of working as Social Development Expert/ Officer for major Infrastructure projects.
- Familiarity with working with Donor (World Bank, ADB, etc.) funded projects and other donor development agencies;
- Proficiency in use of computers to manage database and generation of reports, with overall good communication skills (in English, Hindi, Gujarati)
- Prior experience in the implementation and monitoring of such safeguard activities would be considered as an added advantage.

Duration of Assignment

The duration shall be for a minimum period of 1 year, to be reviewed and renewed based on performance and work requirements. The consultant shall be based full-time at the AMC project office and must be willing to travel extensively to different project sites.

Travel Requirements

The Social Specialist will be required to undertake field visits and tours as per the project requirements.

Reporting and Performance Review

The Social Specialist will report to the Project Director of AMC. The work and performance of the Social Specialist shall be reviewed by the project director periodically.

Facilities to be provided by the Client

- The client will provide office accommodation in the PIU office at Ahmedabad
- The Social Expert shall be paid TA & DA for field visits as per the applicable relevant Govt. Rules.

G. ToR for Annual Environmental and Social Audit of G-ACRP

- **Objectives**
  - To audit the conformity of Environmental and Social categorization of projects concerning the categorization prescribed in the ESMF.
  - To audit the compliance of the environmental aspects of approved projects, which are under implementation and its adherence with the ESCP and ESMP; and,
  - Review and comment on how the recommendations of the previous audit have followed so far.

- **Outline of the tasks to be carried out:**

  The selected Consultant will essentially provide services to PIU as required, for the following tasks.

  a. Audit the Environmental & Social Categorisation of Projects:

The consultants will audit the conformity of the E&S categorization of projects based on the ESMF. The consultants will also review the adequacy of screening procedures to identify the possible issues; considerations of incorporating the environmental issues identified during the screening process into the engineering designs and action plans.

This audit will cover all the S1 category projects and 25 percent of the M1 projects (or M1/ L1 projects of special importance).

b. Auditing the compliance of the Projects:

The consultants shall

- Cover the compliance aspects regarding the agreed process at different stages of project development as well as the technical content of the ESIAs/ ESMPs. Such an exercise shall include the effectiveness of translating the ESMPs into contract conditions and technical specifications
- Critically review and report the compliance on Bank's recommendations during various supervision missions
- Undertake field visits to ascertain the actual level of compliance in implementing the ESMPs
- Audit and confirm that the payment of compensation and assistance has been paid following ESMF procedures wherever payment of compensation and assistance is involved for the projects affected people
- Undertake field visits to interact with the beneficiaries on a sample basis to assess their levels of satisfaction with the process followed in delivering the entitlements;
- Review the process followed for redressing the grievances filed by the affected people.
- Review and confirm that the disclosure of documents has been carried out following the established procedures; and,
- Review the internal monitoring followed by PIUs in managing the environmental and social impacts during the implementation of the sub-projects and suggest suitable measures for improving the process as needed.
- The consultant will audit the compliance of environmental and social aspects during construction, operation, and maintenance of projects approved under G-ACRP, across all categories and different sub-project locations. The selection of the sub-project shall be approved by PIU before the commencement of the Audit. The audit will be carried out in the presence of the representatives of PIU.

c. Adequacy of the ESMP

The consultant will audit the adequacy of the ESMP and recommend practicable measures to include/ improve the management measures and the agency responsible for carrying out the measures wherever found inadequate. The consultant will also document the best practices and possible environmental and Social enhancement measures concerning the audited projects. Apart from documenting the good practices, we shall discuss the deviations in following the ESMF and corrective measures (project level and in overall process).

d. Reporting

The consultant shall review the status report submitted by the PIUs/ Implementing Agencies on the implementation of ESMP and the process adopted by design consultants in identification and mitigation measures while preparing the DPRs. To report on the adequacy and timely submission of the Quarterly Progress Reports including the process involved in addressing the risk management.

e. Documentation

The consultant shall document the good practices and lessons on ESF implementation and management in the sub-projects.

f. Implementation of Audit Suggestions

During subsequent audits after the initial audit; the consultant would review the status of implementation of audit findings and suggest improvement opportunities and timelines for implementation if delayed. In case of non-compliance, the consultants need to undertake a follow-up visit after giving sufficient time (depending on the type of corrective measures) for the agency responsible to take corrective actions.

g. Preparation of Annual E&S Audit Report

The findings of the review and audit should be summarized in a tabular form to include compliance, noncompliance, best practices, and enhancement measures along with the name of the agency responsible and schedule for each of the above. This matrix should be provided as an attachment to the main report.

Section V: Indicative Environmental Management Plans and Monitoring Plans

A. Common Permits Required for Works as per Environmental Legislation

Guidance on permits and clearances required for various works are presented here. PIU is advised to update the clearance/ permit requirements and standards applicable to the project area/ activity at the start of the subproject preparation.

Sl. No	*Law/ Regulation/ Guidelines*	*Applicability (Yes/ No)*	*Relevance*	*Implementing/ Responsible Agency*
1.	The EIA Notification, 2006 & subsequent amendments	Applicable in case of Building Construction or area development Projects (not for STPs)	Environmental Clearance is required for building construction of more than 20,000 sq.m built-up area. In that case, the EC is required to be secured before initiation of any work on the project site (Category B) B1 if area ≥ 50 ha and or built-up area ≥1,50,000 sq .m. (EIA Report is required) B2 if BUA ≥20000 sq.m and <1,50,000 sq.m	SEIAA/ MoEFCC
2.	The Water (Prevention and Control of Pollution) Act, 1974	Yes	Consent to Establish and Consent to Operate to be obtained during the construction phase and operation of STPs, RMC plants, DG Sets	GPCB
3.	The Air (Prevention and Control of Pollution) Act. 1981	Yes	Consent to Establish and Consent to Operate to be obtained during the construction phase and operation of STPs, RMC plants, DG Sets	GPCB
4.	Tree felling permission	Yes	If felling of trees as defined in Ahmedabad Preservation of Trees Act, 1986 is involved	Forest Department
5.	Ancient Monuments and Archaeological Sites & Remains Act 1958	Yes	Permission is required if any archaeological site in the vicinity of the subproject site	Archaeological Survey of India, State Dept. of Archaeology
6.	The Motor Vehicle Act. 1988	Yes	All vehicles used for construction and operation will need to comply with the provisions of this act and should have valid Pollution Under Control Certificate (PUC).	State Motor Vehicles Department

Sl. No:	*NoC Requirement*	*Process*
1	NOC for State Highway (SH)/ National Highway	PIU to take permission for works within ROW. through application/ letter to SH/ NH Division, Executive Engineer
2	NOC from Road/ Public Works Department	PIU to take permission for works within ROW/ road cutting; through application to Division, or Executive Engineer
3	NOC for Water Source	Application to Water Resource Department/ Water Authority, Ground Water Board, or Irrigation Department (as applicable) of the corresponding State depending on the jurisdiction.
4	NOC for Railway division	PIU to take NoC for crossing Railway lines for any utilities if required; by applying for Divisional Railway Manager
5	NOC for Electricity Division	Application to Executive engineer, Electricity supply division/ Electricity Board in case of shifting of power utilities, or near
6	Construction of Road (Road Subproject,	PWD (R&B), NH, or ULB regarding the construction of road

Sl. No:	*NoC Requirement*	*Process*
7	Shifting of Water Supply Pipeline	Application to Drinking Water &Sanitation Department, Water Resources Department as the case may be
8	Shifting of Gas Supply Pipeline	Application to respective Gas Distribution Agency
9	Shifting of telecommunication tower	Application to General Manager, of a respective telecommunication company
10	NOC for groundwater abstraction	Application to Regional Director of CGWA (Groundwater Authority)
11	Use of Diesel Generator sets at any stage during	Contractor to take consent from SPCB under Air Act
12	Permission for temporary traffic diversions,	PIU to take Permission from Traffic Police Commissioner office for traffic management
13	PUC for Vehicle	Obtain Pollution under Control certificate from the motor vehicle department through its authorized agents, for all construction
14	Tree Cutting Permission	PIU to get permission from the State Forest Department under the Forest Conservation Act, 1980
15	Plants such as Crushers and/ or Batching plant	Concerned Contractor to ensure that crushers/ batching plants used for construction purposes under this project have a permit from SPCB
16	Storage, handling, and transport of hazardous material/s, equipment, and storage yards	Concerned Contractor to ensure that requisite permit is sourced from SPCB under Hazardous Waste (Management and Handling) Rules, 1989 and Manufacturing, Storage, and Import of Hazardous Chemicals Rules, 1989
17	Location/ layout of workers camp	Concerned Contractor to get approval from SPCB under Environment Protection Act, 1986 and layout to be approved by
18	Discharges from Labour Camp	Concerned Contractor to get approval from SPCB under Water (Prevention and Control of Pollution) Act, 1974
19	NOC for works near any site of Ancient Monuments and Archaeological Sites and Remains	Archaeology Department, Gujarat or National as applicable
20	NOC for works in the water bodies	State Water Resource Department, Gujarat (Irrigation Department – Canals)
21	Metro Operator	Any works near metro yards, lines as applicable

B. Indicative Environmental Social Management Plans (ESMPs) and Monitoring Plans

Indicative ESMPs and Monitoring Plans for various types of subprojects expected under G-ACRP are provided here. These shall be either directly used for L1 Projects – which the contractor can update based on site condition and guide the preparation of site-specific ESMPs for S1 and M1 during EIA preparation. These are provided as stand-alone ESMPs so that the PIUs do not miss key aspects and can directly use these and adapt them to site and project details. (It is difficult to provide a single ESMP including all types of subprojects. Hence, separate ESMP for each project type is provided so that the subprojects can use it after updating it based on site conditions. Use of indicative (generic) or site-specific ESMP in Bid document will be decided on a case-to-case basis at subproject level; based on risk levels/ mode/ type of contracting/ bidding). These are based on existing regulations and international best practices. These are also supported by good practices presented in ECoPs in Section 0. In case there is a conflict with the standards here and that in applicable regulations, the more stringent shall be followed.

In addition to these ESMPs, guidance for preparing the Cultural Heritage Management framework (CHMP) and Biodiversity Management Framework also have been included in this Guidance Manual to guide the preparation of relevant plans for inclusion in ESMP if such aspects are encountered in the project.

- ***Indicative ESMP for upgradation and Construction of Sewage Treatment Plant (STP), Networks and related infrastructure***

Before Execution

I. Specific activities to be performed by the contractor (BOT contractor or Construction Contractor, as applicable):

- ESMP included/referred to in the bid document shall be updated by the contractor when he is on board considering the design, locational aspects & Flood Impact Assessment Study (in case near / under impact of Vasna Barrage) and finalized for review at respective levels, clearance and disclosure as per the ESMF, before the start of any activity on any of the sites;
- Appointment of EHS personnel of required qualification and experience to supervise ESMP implementation; and laying out the good scope of works, supervising, reporting and monitoring schedule, preparing work permit system for special works in co-ordination with Construction Supervising Engineer and site engineer in charge;
- Plan and prepare a clear schedule for compensatory Tree plantation/ green belt around the STP and other facilities; establishment of labor camp if required, silt. Sludge, grit, and C&D/ other waste disposal plan to be prepared and submitted to Engineer-in-charge for approval and permits (in writing) before the start of work;
- Measures to store, drain, and dispose of all wastes (incl. sludge, grit, biodegradable/ non-biodegradable screenings, plastics; and all other, etc) and written agreement or permission from the local body in file for disposing as appropriate (after testing to find out the category of wastes) city-level facilities;
- List and obtain all permits, consents including (network across roads, discharge into water bodies, near heritage areas, rail lines, permit/consent for plants, storage of chemicals, fuels, etc, and any other) required to be obtained before the start of works. Any change in consent conditions or regulations shall be updated before the start of works and design, implementation and O&M should address the change.

- Discuss and obtain permits/cooperation from traffic police, health, fire, and other departments for works and to minimize the disturbances, and to ensure health and safety
- Inform communities about the works (through discussions, pamphlets, notice boards in local language (Gujarati) & English / Hindi) with PIU support
- Obtain consent to establish from GPCB for the STP; and once constructed, consent to Operate;
- Implementation of other mitigation measures and environmental enhancement measures, as recommended in ESMP and DPR

During Execution, Operation & Maintenance

II. Implementation of ESMP

The contractor shall be responsible to implement the ESMP primarily with agreed support from the Project Implementation Unit (PIU) team. Contractor to update ESIA before the start of construction based on design details & onsite conditions. Contractors EHS person shall support and guide the workers and work activities to adhere to ESMP. The Environmental Specialists of PIU, PMC, and Independent Engineer/ Supervision Consultant shall monitor the compliance of the ESMP and EHS, and all the design drawings of various civil structures shall be implemented after their approval.

- If the Project design does not have provision for holding of untreated sewage in case of STP breakdown and maintenance – to minimize direct bypass, this need to be included in the overall design; and contingency/ emergency plan shall be prepared, and staff shall be suitably trained;
- Specific site shall be identified for intermittent storage of biodegradable (such as sludge, biowaste from screening) and non-biodegradable waste (such as grit and plastics) at each STP and IPS and shall be disposed of in the city waste management facilities as permitted/agreed with the local body;
- Tree plantation shall be ensured as a green belt on the periphery of the STP site which shall help aesthetically as well as to control bad odor. Around 33percent of the STP area should be developed into a green belt preferably using indigenous tree varieties; and flowering shrubs in layers of rising tree heights as one move towards the compound wall.
- EHS monitoring is also as part of QAC / Construction Supervisors supervision and monitoring;
- The digested sludge from the STP having manure value may be used with a clear plan on how it can be stored or disposed of. The sale of digested sludge as manure may also be promoted only after quality testing and ensuring it is free of hazardous chemicals or material.
- Establish a schedule for monitoring for Site Engineer & EHS personnel, and work permit system to plan OHS arrangements and allow work permitting by specific laborers/equipment daily or regularly on each work/package site

Table A- 1: Indicative ESMP for upgradation and Construction of Sewage Treatment Plant (STP), Networks and related infrastructure

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
PLANNING, DESIGN, and PRE-CONSTRUCTION PHASE: ***Including Measures that should be considered by the PIU/Departments while preparing the Detailed Project Report (DPR). In case of Design contracts/DPR preparation, this shall be appended to bid documents for design and made part of the contract***					
Sub-project Siting	All applicable ESSs, EP Act, DP/TP Acts	Land cover and land use changes	▪ Select existing STP sites, and those demarcated by Master Plans, also following applicable siting criteria	AMC	NA
	ESS 6 Saurashtra Tree Felling Act	Loss of natural vegetation and trees	▪ Minimize any loss of vegetation and cutting of trees by careful layout planning ▪ In case any removal of trees is required, follow SOPs for careful uprooting ▪ Inform communities and barricade the site while uprooting to ensure safety ▪ Plan tree cutting based on local ecological aspects, erosion aspects which will be aggravated during monsoons, etc.	Design Consultant	Include in Design Cost
	ESS 6, Biological Diversity act, Wildlife Protection Act, Wetlands Act	Loss of aquatic habitat	▪ Avoid impacts on natural and critical habitats ▪ Avoid nesting, spawning, breeding areas for any infrastructure installation or placement, or outfall points for treated effluents, wastes, or rejects ▪ Promote environmental improvement and community-based biodiversity improvement activities associated with project activities, through Corporate Social Responsibility	Design Consultant and AMC	Include in Design Cost
	ESS 3, Gujarat Irrigation and Drainage Act, 2013 and Rules 2014	Drainage congestion and waterlogging	▪ Site planning, and landscaping / soft measures for minimizing water stagnation, and encouraging percolation of rainwater for groundwater recharge, and drainage channelizing	Design Consultant	Include in Design Cost
	ESS 3, 4, 6, 8, 10, TP/DP Acts, Noise Rules 2000	Disturbance to existing and known planned future use of neighbouring land parcels	▪ Design should consider existing and planned neighbouring landuses and activities, and minimize pollution and disturbance during construction and operations. ▪ Neighbours should be consulted during the design ▪ Noisy and odor generating activities shall be located away from sensitive receptors	Design Consultant	Include in Design Cost
Regulatory Compliance	All applicable ESSs Air Act, Water Act, NGT Act, AMASR Act, All	Non-compliance with essential environmental and safety requirements, Guidelines and delays due to non-compliance	▪ All clearances required from other departments shall be ensured and made available before the start of work including (but not limited to) the following: - Obtain Consent to Establish and Operate for STP (Or obtain amendment in existing consent)/ upgradation works	Contractor, AMC	AMC own funds or as agreed with Contractor

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
	Waste Management Rules, NBC, Labour Rules etc.		- Written agreement on the disposal of treated effluent, sludge, grit, wastes generated during construction and operations - Permit for construction of treated water and bypass outfalls - Consent for Extracting/ Procuring Building Materials, labor license for the project, etc. - Permits for access road improvements - Permits from highways, rail, road, and other agencies for laying / crossing/works on sewers - Permission from Archaeological Survey of India wherever applicable - Any other permit/clearance		
	All applicable ESSs, All applicable regulations	Unsatisfactory monitoring of environmental and social aspects	▪ Submission of updated ESMP, monitoring Plans based on design details; before the start of works	Contractor	Contractors cost
Disaster and Extreme Events	ESS 3, ESS 4, ESS 6, Fire Act, Disaster Management acts, Public Liability Act/Rules, Hazardous Waste / Chemicals Rules	Safety issues, breakage, and contamination	▪ Check the safety of nearby infrastructure which might have an impact on the construction or safety, or O&M of STPs/other subproject activities before the start of works ▪ Prepare SOPs to stop any works, disconnect and safely keep all tools, materials, equipment in case of warning or possibility of extreme events; as part of Operations Manual ▪ All facilities including main units, material stores, storage areas for sludge, waste, grit, chemicals, electrical installations, and appurtenances should be designed above high flood level ▪ Specifications of types of machinery to follow appropriate codes and standards to ensure safety and good performance ▪ All relevant national standards and GIIPs for structural safety in case of rains, floods, earthquakes, and other extreme events shall be followed in the design strictly. No structure shall be constructed in loose unsafe soil or stratum including lakes and river beds, wetlands, etc. considering disaster vulnerability ▪ Design and make allowances in specifications, and estimates for appropriate retaining walls, non-return valves, containment structures, treatment facilities should be designed to prevent the any disturbance to main structures, associated facilities, storage areas for including outfalls; and to ensure containment and treatment of pollutants	Design Consultant	Design Cost
Planning and Design of Sewage Treatment Plant, and Upgradation of STPs	ESS 3, 4, 6; Water Act, EP Rules	Pollution of stream water and other water bodies receiving STP discharges due to reduction in efficiency or non-working of STP due to breakdowns, routine	▪ Design should incorporate requirements to ensure that - the treated effluent quality complies with the best disposal standards for all contaminants suggested by regulators (CPCB, GPCB standards, or other national/state standards whichever is stringent) which are most beneficial to the environment. Arrangements for additional treatment shall be done if it has to meet any higher standards prescribed later. Treated effluent shall not be reused without proper disinfection as required for the use.	Design Consultant	Design Cost

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
		maintenance; Impacts on Downstream users	- integrate design considerations to avoid bypass of untreated effluents due to disasters, breakdowns, routine maintenance - mechanisms are integrated (design, construction schedule, institutional responsibility) to take care of wastewater accumulated in the plant or /and reaching the plant during the construction period, management of untreated or partially treated wastewater during construction and operation stages and extreme events, providing alerts to downstream users regarding any change in quality, bypass, anticipated change in STP functioning if any, etc.		
	ESS 3, EP Acts and Rules, Noise Rules, All Waste related Rules	Air, noise pollution, and disposal of wastes due to demolition of existing infrastructure	▪ Plan to minimize demolition of safe existing infrastructure especially while upgrading STPs, considering resource efficiency ▪ Existing safe infrastructure (such as existing STP / parts) should be integrated into the design of new facilities and/or put to alternate beneficial use	Design Consultant, AMC	Design Cost
	ESS 3, All Waste related Rules, other Disaster Related Acts, Rules	Plan for Disposal of C&D wastes, sludge, grit, and other waste screenings leading to degradation and contamination of land and water, foul odor, and flies	▪ Plan to collect sludge, grit, and other waste and screenings at constant intervals, store/transport (in a covered manner without dust particles, odor, leachate, or other pollutants contaminating any environmental components), treatment and disposal in a scientific manner, as agreed with AMC and GPCB as applicable/as per consent conditions ▪ Excess spoil shall be reused on site. Land for excess spoil disposal shall be selected in consultation with AMC. AMC shall arrange such site and use spoil for landfill cover or other uses within the site preferably. The written permit shall be arranged from AMC for disposal of spoil ▪ For excess uncontaminated spoil disposal, ensure (a) site shall be selected preferably from barren, infertile lands. In case agricultural land needs to be selected, written consent from landowners (not lessees) shall be obtained and spoil shall be tested before disposal; (b) debris disposal site shall be at least 200 m away from surface water bodies; (c) no residential areas shall be located within 50 m downwind side of the site; and (d) site is minimum 50 m away from sensitive locations like settlements, ponds/ lakes or other water bodies ▪ Reuse of sludge as manure/soil enricher only if found permissible as per suggested CPHEEO / other applicable standards after quality analysis considering all constituent contaminants including (but not limited to) metals and coliforms	Contractor	Contractors Cost
	ESS 3, 4, Water Act, All Waste related Rules	Low lying areas in the site, which can get flooded during monsoons Pollution of land, water, foul odor, and pests	▪ Design proper cut-off drains, drainage channels, storage arrangements, and landscaping or other approved means to avoid water stagnation on the site. ▪ Integrate with SCADA, mechanisms for alerts during any accidental burst/leak ▪ Site cut off drains and cut off drains around units to contain and collect any material and dispose of in case of burst or leaks, thus minimizing pollution	Design Cost	Include in Design Cost – for Site development and SCADA

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
			▪ Mechanisms to collect, store, recirculate and treat any material which gets released from the facility due to bursts, leaks		
	ESS 4, IPC, Noise Rules (also Epidemic Diseases, Pest Attack Acts)	Health risks - diseases in neighboring areas	▪ Layout planning of new/additional STP or pump station components or machinery for least noise, odor disturbance to nearby sensitive receptors ▪ Integrate design features for Noise, odor screening of existing and/or new STP, pump stations components, and other noise and odor generating activities ▪ Landscape design with greenbelt and fragrant flowering shrubs along the periphery of the pump station and STP site to prevent the spread of bad odor, noise, and visual blight	Design Consultant	Design Cost
Planning the Sewerage Network	ESS 3, 4, Water Act, Disaster Management Acts	Flooding of nearby areas due to leakage/ bursts Backlogging due to unexpected heavy flow rates	▪ Designing sewers with adequate capacity and flow velocity. Manhole to be replaced with Machine hole and this/ other required provisions to be ensured as per CPHEEO and other applicable guidelines, also incorporating requirements for the heatwave, flooding, earthquake, and other extreme events ▪ Plan schedule and prepare SOPs for Regular inspection and maintenance of the sewer lines, Design to mitigate any activity impacting the integrity of sewer lines ▪ Design for placement of sewers away from/below water lines to prevent mixing ▪ Plan timely alerts to control room in case of leaks, burst	Design Consultant	Design Cost
	ESS 4, 6, Water Act, Guidelines on Disasters, Heritage, IPC	Disturbance to communities, users	▪ Sewer or drainage works at business and market areas must be appropriately scheduled to minimize business loss ▪ Special conditions like cultural heritage, religious processions, group activities, special fairs/festivals, congregations, and market timings shall be considered while planning works	Design Consultant	Design Cost
	ESS 2, 3, 4, 6, EP Act and Rules, Water Act, Air Act, Labour Rules, BOCW Act, Epidemic Control Acts etc.	Nuisance due to leaks, overflows, contamination, occupation health and safety of workers, etc.	▪ DPR to specify an appropriate limit of the sewer depth ▪ Sewers shall be designed to be laid away from water supply lines and drain (at least 1 m preferably) if not possible, sewer lines shall be laid below the water lines. In all cases, the sewer line should be laid deeper than the water pipeline (the difference between the top of the sewer and the bottom of the water pipeline should be at least 300 mm) ▪ In unavoidable cases, where sewers are to be laid close to stormwater drains, appropriate pipe material (that has no or least infiltration risk) shall be selected ▪ Design to ensure cleaning of sewers through mechanical means (machine holes instead of manholes), thus minimizing human interventions. For shallower sewers and especially in narrow roads, design appropriate inspection chambers which can be checked using machines ▪ Design 'machine hole' covers to withstand anticipated loads and ensure that the covers can be readily replaced if broken to minimize silt/ garbage entry; covers shall be of proper specifications and designs to prevent unauthorized lifting (as in the case of disposal of industrial/other effluents	Design Consultant	Design Cost

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
			directly into it) and shall be fitted with appropriate sensors/ other arrangements to alert in case of any unauthorized access to these ▪ Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent buildup of solids and hydrogen sulfide generation ▪ Avoid prescribing hazardous material for construction and check the presence of historic pipelines with hazardous materials like asbestos for replacement. Incorporate SOPs to deal with such substances if encountered during implementation focusing on least disturbance and/or proper disposal of such hazardous material ▪ Minimize cutting of trees while planning network ▪ Minimize laying of the network through historic areas which should not be disturbed		
Planning Intermediate Pumping Stations (IPSs)	ESS 3, 4, 6 Noise Rules, Labour Rules, IPC	Noise and odor nuisance to surrounding areas	Plan for Pumping Stations (and rehabilitation of existing pumping stations, etc) to ensure the following: ▪ Locate pumping station as far as away from sensitive receptors ▪ Based on the site condition maintain maximum available buffer distance from suction well to residential areas ▪ Develop green buffer zone around the facility with a combination of tall and densely growing trees in multi rows or last row/s, flowery sweet-smelling shrubs in next row, and low height shrubs in first rows as per the land availability to control odor and also act as visual/odor shield, and improve aesthetics. ▪ Pumping station to ensure minimum noise generation by locating within a noise containing structure or in an enclosed space (such as concrete/ brick structure) ▪ Design specifications for use of less noise generating equipment such as submersible pumps, enclosed generators. Equipment's need to meet the noise standards as prescribed by CPCB ▪ Prepare O&M Plan including Regular maintenance and switching off equipment when not in use ▪ Prepare O&M SOPs for Regular clearance of sludge, grit, and solid waste to minimize odor nuisance and its disposal in approved/ permitted disposal areas in discussion with AMC and arrangements in design to store (covered and elevated storage with cut off drains ad leachate collection mechanism to account for rainy / flooding days), and to support transportation ▪ Select approved herbicides (not banned by WHO, and national or state bodies) accumulated sludge/ solid to reduce odor or use of odor control filters. ▪ Specifications should suggest the use of energy-efficient pumps, fixtures ▪ Incorporate in design proper noise muffles, screens, buffer space, and greenbelt surrounding pumping station/s	Design Consultant	Design Cost

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
Planning of Drainage network	ESS 3, 4, Water act, EP Act and Rules, Disaster Management related Acts	Impacts of poorly designed and managed drains on receiving waterbody and communities	▪ The drainage system shall be designed holistically for the catchment so that it is fully connected without resulting in the backlog or water ponding / poor drainage in certain areas ▪ The system shall be resilient to shocks of extreme events. Safety considerations shall be incorporated ▪ Sensors shall be provided to detect industrial effluents. Actions shall be taken against any users who cause such discharge. There shall be mechanisms to contain and treat such contaminated stormwater before disposal ▪ Solid waste disposal into the drains shall be prevented through design, awareness, ensuring full coverage of solid waste management services ▪ Recharge, recycling, and reuse of storm waters shall be incorporated in the design. Nature-based solutions shall be incorporated to ensure resilience ▪ There should be mechanisms to clean and maintain drains and canals using machines, and amphibious vehicles/equipment	Design Consultant	Design Cost
Contractors Personnel	All applicable ESSs, All applicable regulations, guidelines	The absence of institutional responsibility / focal point on E&S, Health, and Safety; may result in poor performance on E&S aspects	▪ The contractor shall have environmental experts to scrutinize the design of the proposed infrastructure and associated facilities ▪ Site EHS person shall be appointed before the start of works Contractor shall have qualified EHS specialist to supervise, monitor, and train workers and others; and to co-ordinate with site engineer, various agencies and stakeholders on permits, clearances ▪ The project manager and all key workers will be required to undergo training on ESMP implementation including spoils/ waste management, Standard operating procedures (SOP) for construction works; occupational health and safety (OHS), core labor laws, applicable national laws, etc.	Contractor	Contractors Cost (Institutional)
Site clearance and preparation	ESS 4, 6, Saurashtra Tree Cutting act	Impacts on communities, biodiversity, microclimate	▪ In case any removal of trees is required, prepare and follow SOPs for careful uprooting, with due regard to existing arboreal fauna including visitors ▪ Inform communities and barricade the site while uprooting to ensure safety ▪ Plan tree cutting based on local ecological aspects, (for example erosion aspects which will be aggravated during monsoons) ▪ For trees identified for cutting, obtain prior permission from concerned authorities before commencement of work ▪ Design to specify locations for Planting 10 trees as compensation or as per existing rules; preferably near areas from where it is cut, or in the parks or open spaces available in the project area ▪ Provide adequate protection to the saplings till such time they are well rooted and grown	Design Consultant	Design Cost for design elements, and ESMP cost for plantation

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
			▪ Trees to be retained with tree guards (e.g., Masonry tree guards, Low-level RCC tree guards, Circular Iron Tree Guard with Bars, etc.) as required. Tree guards shall not be a safety menace to other users of the spaces ▪ Take adequate care to determine root protection zone and minimize root loss. ▪ Fallen and cut trees shall be removed following safe practices from the construction sites immediately, to prevent any safety issues		
Preparatory site activities for Laying sewers, site preparation, or construction	ESS 2, 3, 4, IPC, Labour Rules, Gujarat Domestic Water Supply (Protection) Act,2019, Other utilities related acts	Planning to avoid Disturbances and incidents	▪ Identify the common utilities that would be affected such as telephone cables, electric cables, electric poles, water pipelines, public water taps, etc. ▪ Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during the construction phase; and	Design Consultant	Design Cost
	ESS 4, Labour protection, Motor Vehicles Acts etc.	Planning of temporary Traffic arrangements	▪ A temporary diversion for traffic shall be arranged/planned with the approval of the Traffic Police Department. Traffic control plans shall be prepared and submitted to the engineers for approval, one week before commencement of works. ▪ The traffic control plans shall contain details of temporary diversion, details of arrangements for construction under traffic, details of traffic arrangement after cessation of work each day, signages, safety measures for the transport of materials, and arrangement of flagmen especially in areas close to sensitive receptors including schools, hospitals, commercial areas and where dewatering is carried out and heavy equipment are used.	Contractor	Contractors Cost
	ESS 2, 4; Labour Laws, BOCW Act	Low attention on Considerations for Labor & Community Safety in Designs	▪ Layout, Designs, sourcing of materials, phasing, and work plan to consider labor and community safety as priorities ▪ Follow Operations Manual, applicable works manuals, to ensure safety (structural and work (eg: scaffolding), fire safety, electrical safety) and stability ▪ Follow Health and safety guidelines, Fire Safety provisions, Building and Other Construction Workers Act, Labor Acts/ Laws applicable to prepare a work plan, scheduling, monitoring, and estimate preparation ▪ Prepare emergency preparedness and evacuation plans as/ if applicable to work sites (eg: to adopt measures in case of STPs near/downstream of Vasna Barrage)	Design Consultant & Contractor	Design Costs, Contractors ESMP Costs
CONSTRUCTION PHASE:					

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
The following section contains instructions to the contractors, which should be adhered to while carrying out the construction activity. In case of works or DBOT contracts, this shall be appended to bid documents and made part of the contract.					
All works, including STP and associated infrastructure, Drainage networks, canal and lake redevelopment, etc.	ESS 3, 4; Mining Laws, Ground water Extraction Regulations, EP Act, Rules	Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and waterlogging, and water pollution.	▪ Obtain construction materials only from the existing government-approved quarries with prior approval of PIU ▪ Contractor to prepare a list of approved quarry sites and sources of materials with the approval of PIU. PIU to review, and ensure that proposed quarry sources have all necessary clearances/ permissions in place before approval ▪ Contractor to submit to PIU every month, the documentation on material obtained from each source (quarry/ borrow pit) ▪ No new borrow areas, quarries, etc., shall be developed for the project ▪ The contractor shall source water for construction after proper permission from the agency concerned	Contractor	NA
	ESS 3, 6; Water Act, Mining/Geology, NGT Acts, Wetland protection Act, EP Act and rules	Impact of burrowing or desilting from canal, lake or riverbeds, agriculture land, and wetlands (if required)	▪ No burrowing and/or desilting from riverbeds or wetlands which are critical/natural habitats shall be permitted under the project ▪ Compliance with relevant ECoPs for sand extraction while redeveloping waterbodies, agricultural topsoil management ▪ Follow all applicable rules and permit requirements ▪ Detailed material shall be tested for contaminants and a proper disposal plan shall be adhered to. In case it is tested for hazardous material it shall be disposed to TSDF for hazardous wastes ▪ Detailed material shall be used for any other purpose (such as for landscaping, any type of construction, etc) in or outside the project facilities only if it is proven safe	Contractor	Contractors ESMP Cost (for testing), dispose of as agreed with AMC in project implementation cost
	ESS 3, Air Act	Air pollution due to transfer and handling of materials	▪ Pollution prevention by demarcating material storage areas carefully, and providing buffers and covers for material storage areas ▪ Allow heavy vehicle movement only through well-topped roads (except near delivery sites) to prevent dust emission, use well-maintained vehicles adhering to pollution standards, cover for vehicles carrying construction sand and dusty materials, and implementation of ECoPs ▪ Schedule transport and hauling activities during non-peak hours; however local traffic characteristics shall be checked especially in the vicinity of schools, hospitals, tourists, religious places, others, and during festive seasons), etc. ▪ Before the start of works locate entry and exit points in areas where there is low potential for traffic congestion, and instruct to drive vehicles at permitted speed, preferably slow ▪ Notify affected public by public information notices, providing signboards informing nature and duration of material stacking, and contact numbers for concerns/ complaints	Contractor	Include in contractors cost for storing of materials

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
	ESS 2, 4; IPC, IS Codes - Safety code for handling and storage of building materials, Chemicals and Hazardous material storage rules	Storage of materials and housekeeping	▪ The contractor shall identify the site for temporary use of land for construction sites/ storage of construction materials, etc. No construction materials should be stored on the road, on top of or beside drains and footpaths, or on any other public area as this may restrict public access to these utilities, or in such a way that such storage would not be dangerous for moving people or traffic. ▪ Site for storage of construction materials to be identified without affecting the traffic and other common utilities, and the quality of the construction materials. ▪ Construction materials should only be stored and prepared on the site if they do not obstruct the road or any surrounding public utility. Construction materials should only be transported to the worksite as and when required for construction ▪ Storage space shall be well defined and marked/ with signboards/ berms	Contractor	Include in contractors cost for storing of materials
	ESS 3; Water Act, All Waste and Chemicals Rules	Water pollution and Soil contamination due to storage of construction material wastes and process rejects/wastes	▪ Prepare and implement a Pollution prevention and control plan ▪ Prevent material overflow into water bodies. Arrange containment, spill prevention means, cut off drains, or other approved means ▪ Prevent spill of hazardous materials, wastes, oils, fuels on soils. Provide raised impervious platforms to store hazardous materials and wastes. Dispose of soiled materials in hazardous wastes/ other disposal facilities arranged or inappropriate sites suggested by the local body or competent authority ▪ All earthworks are conducted during the dry season to prevent the problem of soil/ silt run-off during rains. Stored construction material like sand, soil, rock, etc., shall be prevented from running off during the wet season ▪ Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets; do not stock earth/ material close to water bodies (at least100 m) ▪ Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed of, only designated disposal areas shall be used	Contractor	Include in contractors cost for storing of materials
	ESS 3; Water act, Chemicals/Hazardous Materials Rules, Waste Rules	Water pollution and Soil contamination due to spillage of fuel and oil stocked on-site for construction	▪ The contractor shall ensure that all construction vehicle parking locations, fuel/ lubricants storage sites, vehicle, machinery and equipment maintenance, and new refueling sites shall be located at least 500 m from sensitive receptors ▪ Care to be taken to store fuel and oil (if required) at a place away from any drainage channel/ canal or river preferably to be stored in drums mounted on a concrete paved/ impervious platform with slightly raised edges (or suitable arrangements) so that drums do not get overturned, or appropriate means. Avoid spillage by careful handling; provide spill collection sets for effective spill management ▪ There shall be proper channels for any spill to flow to a secure containment	Contractor	Include in contractors cost for storing of materials

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
			▪ There shall be regular checks to determine any spillage of oil or fuel ▪ Mutually reactive/ hazardous materials shall be kept away from each other. Material Data Sheet shall be checked and precautions to be followed ▪ Take permits from respective authorities in the case for storing quantities of fuel or hazardous material above permissible limits ▪ Fire retardants and safe management measures suitable for each type of fuel/oil shall be arranged near the place of storage and use ▪ The contractor shall ensure that all vehicle/ machinery and equipment operation, maintenance, and refueling shall be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground ▪ The contractor shall arrange for collection, storing, and disposal of oily wastes to the pre-identified disposal sites (list to be submitted to Engineer) and approved by the Engineer. All spills and collected petroleum products shall be disposed of following MOEFCC and state PCB guidelines ▪ The engineer shall certify that all arrangements comply with the guidelines of PCB/ MOEFCC or any other relevant laws. ▪ The engineer shall certify that all liquid wastes disposed of from the sites meet the discharge standard ▪ Install temporary silt traps, oil traps, or sedimentation basins along the drainage leading to the water bodies		
	ESS 6; Biological Diversity act, Wetlands Act	Construction activities near water: Ecological impacts including the destruction of aquatic habitat	▪ Prevent the discharge of leachate, chemicals, untreated sewage, wastes into surface waters. Dispose of any wastes generated by construction activities in designated sites ▪ Preservation of aquatic habitats by restricting the movement of people and vehicles or equipment into them and preventing entry of sediments into water bodies ▪ Keep noise level (e.g., from equipment) to a minimum level, as certain aquatic or dependent fauna are very sensitive to loud noise ▪ Keep only appropriate light levels in areas near nesting / roosting/spawning sites/ flight pathways ▪ Conduct surface water quality monitoring and ESMP implementation checks ▪ As far as possible control the entry of runoff from upper areas into the excavated pits, and work area by creating temporary drains or bunds around the periphery of the work area. Pump out the water collected in the pits/ excavations to a temporary sedimentation pond; dispose of only clarified water into drainage channels/ streams after sedimentation in the temporary ponds	Contractor	Include in contractors cost for site preparation Include monitoring cost in ESMP monitoring Cost
	ESS 4; Air Act	Dust emissions lead to poor air quality and health impacts	▪ All earthwork shall be protected in a manner acceptable to the engineer to minimize the impact of wind movement and generation of dust. If it is expected that minor activities would generate an ample amount of dust, such construction shall be covered	Contractor	Include in contractors cost

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
			▪ Unpaved haul roads used for project activities near/ passing through residential and commercial areas to be watered thrice a day ▪ Trucks carrying construction material or wastes/ soil, aggregates, etc. to be adequately covered to avoid dust pollution and to avoid material spillage. Minimize the drop height when moving the excavated soil ▪ For all construction works, provide a dust screen (6m high) around the construction sites of pumping and lifting stations; provide 2m high barricades for the sewer works ▪ Cover the soil stocked at the sites with appropriate covers and surrounded by dust screens ▪ Control access to the work area, prevent unnecessary movement of the vehicle, public trespassing into work areas; limiting soil disturbance shall minimize dust generation ▪ Control dust generation while unloading the loose material (particularly aggregate, sand, soil) at the site by sprinkling water and unloading inside the barricaded area ▪ The sprinkling of water is to be done at regular intervals at places of work to protect the nearby inhabitants and road users ▪ Damp down the soil and any stockpiled material on-site by water sprinkling (3-4 times a day - before the start of work, 1- 2 times in between, and at the end of the day); when working in the roads there should permanently be one person responsible for directing when water sprinkling needs to take place to stop the dust moving ▪ Apply water before leveling or any other earth-moving activity to keep the soil moist throughout the process ▪ Clean wheels and undercarriage of haul trucks before leaving the construction site ▪ Ensure that all the construction equipment, machinery are fitted with pollution control devices, which are operating correctly, and have valid pollution under control (PUC) certificate ▪ No vehicles or plants to be left idling at site generators to be at placed maximum distance from properties		for transport of materials
	ESS 3, Noise Rules, Motor Vehicles Act	Noise impacts on sensitive receptors: Noise from plants, equipment, machinery, and vehicles	▪ Noisy construction operations in residential and sensitive areas should be done only between 7.30 am and 6.00 pm, or in discussion with communities ▪ Preventive maintenance of construction equipment and vehicles to meet emission standards and to keep them with low noise ▪ Provision of enclosing generators and concrete mixers at site ▪ Sound barriers shall be installed during the construction phase to protect the inhabited areas from noise due to construction activities ▪ Idling of temporary trucks or other equipment should not be permitted during periods of loading/ unloading or when they are not in active use. The practice must be ensured especially near residential/ commercial/ sensitive areas.	Contractor	Contractors costs for machinery, equipment

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
			▪ Stationary construction equipment shall be kept at least 500m away from sensitive receptors. ▪ All possible and practical measures to control noise emissions during drilling shall be employed. The implementing agency may direct to take adequate controls measures depending on site conditions ▪ Use of less noise-generating cutting equipment, provide personal protective equipment such as earplugs/ muffs and other safety measures to the laborer. In addition, the concrete mixture to be used for construction works shall be placed at a suitable location where noise generated from the machinery shall not impact/disturb people or the environment ▪ Servicing of all construction machinery shall be done regularly and during routine servicing operations, the effectiveness of exhaust silencers shall be checked and if found defective shall be replaced ▪ Maintenance of equipment and machinery shall be regular and up to the satisfaction of the Engineer to keep noise levels at the minimum		
	ESS 8	Chance found Flora & Fauna	▪ Training to Project Officials and workers on-site recce for special and rare fauna and flora before Site clearance and excavation ▪ Follow chance find procedures including: - The contractor shall take reasonable precautions to prevent his workmen or any other persons from removing and damaging any flora (plant/ vegetation, cultivation) and fauna (animals, birds) including fishing in any water body and hunting of any animal. - If any wild animal is found near the construction site at any point in time, stop work immediately to allow further investigation if any finds are suspected - the contractor shall immediately upon discovery thereof acquaint the Engineer and carry out the Engineer's instructions for dealing with the same - The Engineer shall report to the nearby forest office (range office or divisional office) and shall take appropriate steps/ measures if required in consultation with the forest officials.	Contractor	Include in contractors ESMP Cost
	ESS 8, AMASR Act	Chance found archaeological property	▪ Training to Project Officials and workers on-site recce for cultural heritage before Site clearance and excavation ▪ The chance finds Procedures to be followed including: - top work immediately to allow further investigation if any finds are suspected; - The contractor shall take reasonable precautions to prevent his workmen or any other persons from removing and damaging any such article or thing. - Inform State Archaeological Department if a find is suspected, and take any action they require to ensure its removal or protection in situ	Contractor	Include in contractors ESMP cost

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
	ESS 4, Building Byelaws	Temporary flooding during Construction activity	▪ The de-silting activity shall be scheduled during non-monsoon/non-flooding days ▪ Proper drainage arrangements to be made, to avoid the overflowing of existing drains due to construction activity ▪ An alternate arrangement like diversion of the drainage is ensured to allow the natural flow ▪ It shall be ensured that none of the construction activities affect the natural flow of the drainage ▪ Adequate cut off drains shall be provided as and when necessary	Contractor	Include in contractors Site Preparation cost
	ESS 2, Labour Laws	Lack of provisions for First Aid	▪ The contractor shall arrange for appropriate First Aid ▪ A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone ▪ Availability of suitable transport at all times to take an injured or sick person(s) to the nearest hospital and display of project details and emergency contact numbers near work sites in local language/ language understandable by the workers ▪ Training of community/laborers on First aid	Contractor	Include in contractors ESMP cost
	ESS 2, 4; Labour Laws	Lack of Informatory Signs and Hoardings	▪ The contractor shall provide, erect and maintain information/ safety signs, hoardings in English and local language, wherever required or as suggested by the Engineer. All emergency details to be in local language/ language understandable by the workers	Contractor	Include in contractors ESMP cost
	ESS 3; EP Acts and Rules, All Waste Related Rules	Disposal of de-silted/ Excavated material, Construction, and other waste	▪ The excavated/ de-silted material shall be disposed of without any accumulation. The soil excavated from any canal and river or ponds where waste has accumulated shall be tested for quality, adequately treated with methods like bioremediation and proper reuse option explored. The rest may be safely disposed of as agreed with the local authority. ▪ The following shall be ensured during silt disposal - 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. The disposal site should be agreeable by the local community, in consultation with the local authority and engineer - All vehicles delivering material to the site shall be covered to avoid material spillage and dust emissions.	Contractor	Contractors Cost
	ESS 2, 4, 10	Grievance Redressal	▪ Any grievance arising during implementation of the project shall be redressed by the Implementing agency through mechanism identified as in ESMF and a committee shall be established before the start of work.	AMC	Project Cost

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
	ESS 3, Noise Rules	Noise Levels and vibration	▪ Plan activities in consultation with the project implementation unit so that activities with the greatest potential to generate noise are conducted during periods of the day which shall result in the least disturbance, especially near schools and other sensitive receptors ▪ Minimize the noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and using portable street barriers to minimize sound impact to surrounding sensitive receptors ▪ Maintain maximum sound levels not exceeding 70 decibels (dBA) when measured at a distance of 10 m or more from the vehicle/s ▪ Undertake site assessment and discussions with authorities before starting any works in areas within 300m of heritage structures. Follow CHMP. Check any impacts due to vibration on these. Identify any buildings at risk from vibration damage and avoid any use of pneumatic drills or heavy vehicles in the vicinity; if any building is at risk, a structural survey be completed before work, to provide a baseline in case any issues from vibration, and if the building is structurally unsound that measures are taken to avoid any further damage ▪ Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach ▪ Consult local communities in advance of the work to identify and address key issues, and avoid working at sensitive times, such as night times, religious and cultural festivals.	Contractor	Contractor cost (include CHMP preparation in ESIA cost, site checks for vibration impacts in construction safety checks costs)
	ESS 3, 4; All Waste related rules	Landscape and aesthetics –waste management	▪ Prepare and implement a Construction & Demolition Waste Management Plan ▪ As far as possible utilize the debris and excess soil for construction purposes, for example for raising the ground level or construction of access roads, etc. ▪ Avoid stockpiling any excess spoils at the site for a long time. Excess excavated soils should be disposed of at approved designated areas immediately ▪ If the disposal is required, the site shall be selected preferably from barren, infertile lands; sites should locate away from residential areas, forests, water bodies and any other sensitive land uses ▪ Domestic solid wastes should be properly segregated into biodegradable and non-biodegradable at source and collected for treatment and disposal at designated solid waste treatment/disposal site as arranged by AMC ▪ Residual and hazardous wastes such as oils, fuels, and lubricants shall be disposed of via licensed (by GPCB) third parties ▪ Prohibit burning of construction and/ or domestic waste ▪ Ensure that wastes are not haphazardly thrown in and around the project site; provide proper collection bins, and create awareness to use the dust bins, recycle waste material where possible.	Contractor	Contractor cost

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
			▪ Conduct site clearance and restoration to original condition after the completion of construction work; PIU to ensure that site is properly restored before issuing of construction completion certificate ▪ Landscape and provide greenbelts as required to create a good environment in project areas		
	ESS 4, Building Byelaws, BOCW Act, Labour Laws	Loss of access to houses and business	▪ Consult businesses and institutions regarding operating hours and factoring this in work schedules. Inform all businesses and residents about the nature and duration of any work well in advance so that they can make necessary preparations ▪ Provide signboards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/ complaints ▪ Do not block any access; leave spaces for access between barricades/ mounds of excavated soil and other stored materials and machinery, and provide footbridges so that people can crossover open trenches ▪ Barricade the construction area and regulate the movement of people and vehicles in the vicinity, and maintain the surroundings safely with proper direction boards, lighting, and security personnel – people should feel safe to move around ▪ Control dust generation; immediately consolidate the backfilled soil and restore the road surface; this will also avoid any business loss due to dust and access inconvenience of construction work ▪ Employee best construction practices, speed up construction work with better equipment, increase the workforce, etc., in the areas with predominantly commercial, and with sensitive features like hospitals, and schools	Contractor	Contractor cost
Life and Fire safety during construction	ESS 2; BOCW Act, Labour Laws	Health impacts, man-day loss	*Planning & Regulations* ▪ Prepare and Implement Labour Management Procedures ▪ Prepare and Implement Emergency management procedures as required ▪ Follow the hierarchy of Elimination, Substitution, Engineering Controls, Administration, and PPEs as applicable to ensure safety ▪ Contractors shall follow all national, state, and local labor laws and also GIIPs such as the World Bank Group's Environment, Health, and Safety Guidelines; get all labor/migrant labor-related permits and insurances. The contractor shall comply with all the precautions as required for ensuring the safety of the workmen as per the International Labor Organization (ILO) Convention No. 62 as applied to this contract. ▪ The contractor shall make sure that during the construction work all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (Regulation of Employment and Conditions of Services) Act, 1996 and other relevant State/ Central Acts / Labour Codes are adhered to	Contractor	Contractor cost

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
			▪ Develop and implement site-specific occupational health and safety (OHS) Plan, informed by OHS risk assessment ▪ seeking to avoid, minimize and mitigate risk which shall include measures such as: ▪ plan to avoid risks by good design, specifications, and detailed work planning ▪ excluding the public from the work sites at all times, even during holidays ▪ safe and documented construction procedures to be followed for all site activities ▪ OHS Training for all site personnel ▪ ensuring all workers are provided with and use personal protective equipment ▪ documentation of work-related accidents and near misses and continuous course corrections and improvement of safety arrangements. *Adopting safe mechanisms* ▪ The contractor shall not employ any person below the age of 14 years for any work and no woman shall be employed on the work of painting with products containing lead in any form. Those of 14-18 years shall not be employed for hazardous works. ▪ Use of hazardous materials such as Asbestos is not permitted for any work ▪ Secure all sites, installations from unauthorized intrusion and accident risks ▪ Adequate precautions shall be taken to prevent accidents and from the machinery. All machines used shall conform with the relevant Indian standards Code and shall be regularly inspected by the Engineer-in-charge. ▪ Where loose soil is met with, shoring and strutting shall be provided to avoid the collapse of soil. Consider safety aspects related to pit collapse due to accumulation of water ▪ All excavations shall maintain a 'safe' slope ▪ Strong and safe Handrails of appropriate materials on both sides of walkways and work platforms close to tanks, higher walk/work area (at elevations/ heights), and STPs need to be ensured during construction and operation stages ▪ Proper barricading, signage boards and lighting shall be ensured to prevent accidents involving human beings, animals, or vehicles falling into trenches, or due to equipment/tools, movement of machinery, or any other accident during the construction period. The construction area should be barricaded at all times in a day with adequate marking, flags, reflectors, etc. for the safety of general traffic movement and pedestrians. For night-time visibility of barricades, reflectors shall be provided, in discussion with the community. Lighting height, type, and intensity shall consider impacts on fauna as well especially when work is near biodiverse areas/ movement paths/ nesting/ spawning/ breeding areas of fauna. Appropriate safety nets/screens shall be provided around work units and equipment to prevent trapping of birds, animals.		

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
			▪ Proper health and hygiene management plan shall be prepared for laborers who will be engaged in the demolition of the sludge drying beds/UASB reactors, etc including plan for periodic health checkup, and sanitization. This should also include safety measure to be undertaken while working in these areas. ▪ Prepare and implement fire safety arrangements and mock drills in coordination with the Fire and Rescue Department. And arrange appropriate portable fire extinguishers, fire hydrants, water storage for firefighting, etc. ▪ The Contractor shall take all required precautions to prevent danger from electrical equipment and ensure that ▪ No loose or hanging wires switchboards or extensions shall be allowed on site. All wires shall be checked and properly secured, without creating danger for works or visitors. Safety features shall be provided for all wires, and electrical equipment/appurtenances to cut off shocks ▪ Any vehicle to the site shall be prevented from hitting electric wires, appliances, or posts by providing signages, and directions at entry ▪ No material shall be so stacked or placed as to cause danger or inconvenience to any person or the public ▪ All necessary fencing and lights shall be provided to protect the public in construction zones. ▪ All machines to be used in the construction shall conform to the relevant Indian Standards (IS) codes, shall be free from patent defect, shall be kept in good working order, shall be regularly inspected and properly maintained as per IS provision, and to the satisfaction of the Engineer ▪ Smaller on and off switches at STP units to be installed with protection from rainwater to minimize electrical short circuit ▪ The project engineer shall plan and direct the contractor to execute the work progressively so that the length of the open excavated trench [if any] is minimized to reduce possible accidents ▪ Fire safety arrangements, Firefighting equipment, exit routes shall be well displayed and laborers and communities shall be trained on following and using these. Mock drills shall be conducted under the direction of the Fire and Rescue Department ▪ Take adequate precautions against accidents due to poor Slopes for excavations, poor stacking of materials/ housekeeping, improper scaffolding, slippages, and enclosed spaces *Orientation / Awareness* ▪ Laborers shall be provided orientation on ESMP requirements and COVID related regulations ▪ Work permit procedure shall be ensured for all works in the special environment including water, roads, excavations, heights, enclosed spaces. Workers working at height enclosed spaces, and water bodies need to be given appropriate PPE and training.		

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
			▪ Provide health and safety orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuries to fellow workers ▪ Train workers on immediate First Aid measures ▪ Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted and without PPEs ▪ Ensure moving equipment is outfitted with audible backup alarms ▪ Mark and provide signboards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage areas, excavated pits, water/wastewater/sludge-filled areas, and for storage and disposal of materials and wastes. Signage shall be following international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate ▪ Awareness to communities on probable issues and measures/arrangements for response and support in case of events. Ensure that the contact details of the police or security company and ambulance services are displayed on-site (in languages that are comfortable for the workers) and workers are trained to look at them and reach out for help when required ▪ Keep accident register on-site to record all accidents, including near misses. Contractor to follow up / monitor regularly ad report all incidents immediately to the borrower. Borrower shall inform the Bank immediately ▪ Workers shall be trained in COVID 19 good practices and related guidelines including disposal of PPEs *PPEs* ▪ Special PPEs, and facilities to be arranged in case of work in the hot sun and contaminated water. ▪ PPEs especially suited for work in/near water are to be arranged including life jackets, buoys, harnesses, and specialized lights while carrying out works in or near all tanks, inflow and outflow channels, outfalls, and for monitoring/supervising personnel. Arrangements for Fire protection and emergency response are also to be arranged for use during any events/emergencies during construction activities ▪ Ensure the visibility of workers through their use of high visibility vests and other PPE when working in or walking through heavy equipment operating areas ▪ Protective footwear and protective goggles to all workers employed on mixing of materials like cement, concrete, etc. ▪ Welder's protective eye-shields shall be provided to workers who are engaged in welding works.		

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
			▪ Earplugs shall be provided to workers exposed to loud noise, and workers working in crushing compaction, or concrete mixing operation. ▪ The contractor shall supply all necessary safety appliances of appropriate types such as safety goggles, helmets, safety belts, earplugs, masks, etc. to workers and staff, arrange sufficient supplies at all times and replace as required Health care and facilities ▪ Ensure that qualified and well-equipped first-aid is available and easily accessible to workers at all sites ▪ Disallow worker exposure to noise level greater than 85 dBA for more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively ▪ Ensure appropriate type and the number of sanitation facilities is available for women and male workers. Availability of water shall be ensured in toilets and wash areas ▪ Arrange facilities like a creche, shops, canteen facilities a required by workers ▪ Provide supplies of potable drinking water protected from contamination in any way ▪ Provide clean eating areas where workers are not exposed to hazardous or noxious substances, odor or pests, rest areas ▪ Arrange health check-up preferably in coordination with local primary health care unit		
	ESS 2, 4; BOCW Act, Labour Laws	Safety issues (workers and communities esp. children) while the use of modern machinery	▪ Site wise work details and precautionary measures to be taken shall be discussed with immediate communities and their representatives ▪ Modern machinery such as JCBs, backhoes, etc., may be used to minimize the construction period. SOPS for heavy equipment like excavators, JCBs shall be prepared and implemented carefully on site. Such machinery/vehicles shall be operated on-site only with adequately trained operators with required licenses and experience; only in the presence of flagmen ▪ Adequate cordoning and barricading, and guides/ flagmen shall be arranged while operating heavy and specialized equipment ▪ Community including children and workers shall be guided and warned against moving parts and workers (in trenches or working near vehicles) shall be shifted to a safe place while they are operated to excavate or place pipelines, or do works on site		
	ESS 2, 4; BOCW Act, Labour Laws	Impacts on labor and community health due to poor Labor camp & facilities	<u>Permits/Approvals</u> ▪ Setting up of labor camps needs to be done as per the procedures and with all permits. ▪ The location, layout, and basic facility provision of each labor camp shall be submitted to the Site/ Project Engineer for approval, before their construction.	Contractor	Contractor cost

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
			▪ The plan shall be approved in writing by the Engineer and PIU before commencing construction of project offices, sheds, construction plants, and labor camps. ▪ All approvals from the landowner shall be in place before planning such a camp <u>Location of Camp and communities</u> ▪ Camps shall be arranged in safe and hygienic areas, with prior intimation and agreement of host communities ▪ Prioritize areas within or nearest possible vacant space in the project location. However, camp in existing STP sites is undesirable considering possible health impacts ▪ Consider sites that shall not promote instability and result in the destruction of property, vegetation, irrigation, and drinking water supply systems; Do not consider residential areas; ▪ Take extreme care in selecting sites to avoid direct disposal to a water body which shall inconvenience the community. ▪ As far as possible located the campsite within the worksites (at STP or large pumping station sites); if any camp is to be established outside these, then select a campsite away from residential areas (at least 100 m buffer shall be maintained) or locate the campsite within the existing facilities of City Corporation ▪ Campsite shall not be located near (100 m) water bodies, flood plains flood-prone/ low lying areas, or any ecologically, socially, archeologically sensitive areas ▪ Separate the workers living areas and material storage areas clearly with fencing and separate entry and exit <u>Facilities in Camp</u> ▪ Adequate potable water facilities, sanitation, and drainage, etc., in conformity with the Indian labor laws, shall be ensured. There shall not be any water ponding or accumulation ▪ The Contractor shall construct and maintain all labor accommodation safely and hygienically, and ensure that uncontaminated water is available for drinking, cooking, and washing. Common Kitchen (with safe cooking fuel like LPG), creche facilities shall be arranged. Entertainment facilities and shops shall be arranged if the camp is away from these facilities in the city. ▪ Supply of sufficient quantity of potable water (as per IS) in every workplace/ labor campsite at suitable and easily accessible places and regular maintenance of such facilities. ▪ The sewage system for the camp shall be designed, built, and operated in such a fashion that no health hazards occur and no pollution to the air, groundwater, or adjacent watercourses take place. Ensure adequate water supply is to be provided in all toilets and urinals. ▪ The contractor shall provide garbage bins in the camps and ensure that these are regularly emptied and disposed of hygienically as approved by the Engineer.		

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
			▪ At all workplaces, temporary arrangements for drinking water, snacks, restrooms/ shades, and toilets separate for male/ female] laborers shall be arranged. Special PPEs, and facilities to be arranged in case of work in the hot sun and contaminated water. Health check-ups shall be arranged. ▪ Health check-ups and First aid shall be arranged by the contractor and training shall be provided for use of emergency procedures and equipment. The camp shall be well lit, safe, and easily accessible. ▪ Minimize removal of vegetation and disallow cutting of trees of the work site for setting up camp facilities or use ▪ Ensure conditions of liveability at work camps are maintained at the highest standards possible at all times; living quarters and construction camps shall be provided with standard materials. Thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be used as accommodation for workers. Provide proper temporary accommodation with proper materials, adequate lighting, and ventilation, appropriate facilities for monsoons, winters, and summers; ensure conditions of liveability at work camps are maintained at the highest standards possible at all times ▪ Safety of the camp and its facilities from fire, strong winds, heat waves, flooding, and other disasters / extreme events shall be ensured ▪ Ensure that a proper compound wall is provided, and erect a wind/ dust screen around ▪ Solid waste shall be well managed. Segregated storage and collection shall be arranged. Collected waste shall be sent to AMCs solid waste management facility for proper treatment and disposal. ▪ Prohibit employees from cutting of trees for firewood; a contractor should provide cooking fuel (cooking gas); firewood not allowed ▪ Provide a proper fencing/ compound wall for campsites ▪ Provide drinking water, water for other uses, and sanitation facilities for employees. Drinking water should be regularly tested to confirm that drinking water standards are met ▪ Recover used oil and lubricants and reuse or remove from the site ▪ Remove all wreckage, rubbish, or temporary structures which are no longer required ▪ Train employees in the storage and handling of materials that can potentially cause soil contamination ▪ Wastewater from the camps shall be disposed of properly either into the sewer system; if the sewer system is not available, provide on-site sanitation with the septic tank with soak pit arrangements (100 m away from a surface water body or groundwater well) or precast septic tanks which shall be emptied at agreed intervals into functional STPs <u>Camp closeout</u>		

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
			▪ After work, the camp area shall be cleaned and restored to pre-project conditions, and submit the report to PIU; PIU to review and approve camp clearance and closure of worksite		
	ESS 2, 3, 4; Water, Air Acts, Waste Rules, EP Act and Rules, Labour Laws	Site clearance and restoration at work close out: Accidents and health safety issues due to poor clearance of construction camps, restoration, and work exit	Contractor to prepare work close out strategy and site restoration plans, for approval by the Engineer and PIU. The plan is to be implemented by the contractor before demobilization. On completion of the works, all temporary structures shall be cleared away, all rubbish cleared, and the site left clean and tidy, at the contractor's expenses, to the entire satisfaction of the engineer. This shall be certified by the engineer in the works register maintained on-site and handed over to the Engineer of the PIU upon closure ▪ Site shall be restored with all pits and excavations closed safely and tools, wastes and materials removed, and good housekeeping shall be ensured before handing over the site ▪ Remove all spoils wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and ▪ All excavated roads shall be reinstated to their original condition ▪ All disrupted utilities restored ▪ All affected structures rehabilitated/ compensated ▪ The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc. and these shall be cleaned up. ▪ All hardened surfaces within the construction camp area shall be ripped, all imported materials removed, and the area shall be top soiled and re-grassed using the guidelines set out in the revegetation specification that forms part of this document. ▪ The contractor must arrange the cancellation of all temporary services ▪ Greenbelts/landscaping shall be completed ▪ Work close-out procedures shall be completed; the Work exit checklist shall be filled and the client shall approve the same to complete handing over. PIU to report in writing that worksites and camps have been vacated and restored to pre-project conditions before acceptance of work	Contractor	Contractor cost
Additional considerations for Sewerage network (laying of sewers), drainage networks	ESS 3; Waste related rules (Esp. C&D Waste Management Rules)	Generation of substantial debris, topsoil, and muck due to excavations and construction activities	▪ Instead of disposing of topsoil in low lying areas, topsoil if removed may be stored properly / stockpiled with cover and used for agricultural purpose or development of city parks or green belt development or other means, in discussion with Engineer ▪ Soil and non-hazardous debris may be managed for planned landfilling, landscaping, or appropriate use, which would not harm the environment	Contractor	Contractors Cost (Site preparation and development)

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
	ESS 2, 4, Labour and OHS legislations	Accidents/ damages due to erosion/ sliding of vertical sides of trenches	▪ Contractors EHS personnel (appointed before the start of works) with Site engineer to undertake daily worksite check before the start of works to initiate work permit suggest required safety measures to prevent accidents too; and due to the activity at each site, check and ensure the working of support mechanisms for emergency response. Without permits, hazardous and specialized works and pipe laying shall not be allowed to start ▪ Maintaining the excavation by shoring & shuttering trench sides by placing sheeting, timber shores, trench jacks, bracing, piles, etc. as per approved specifications. This should be included in contract conditions for excavation for networks ▪ Avoid placing any excavated material or construction material near excavating stretches to avoid it slipping back into the trenches ▪ Train workers on safe practices of working in trenches and nearby areas while excavating & placing pipes ▪ Arrange additional flagmen for alerts to workers, drivers, communities on large vehicles/equipment for excavations, placing of pipes, etc. ▪ Equipment and vehicles used for auxiliary works on pipeline laying or drain construction, shall not be allowed to initiate activities without licensed and experienced drivers and flagmen	Contractor	Cost estimate for laying pipelines, manholes, etc.
	ESS 3, 4, Air Act,	Dust Generation due to excavation, cutting, backfilling, and compaction operations	The ambient air quality shall be within the prescribed limits by MoEFCC. Following actions shall be taken during the construction stage: ▪ Regular Water sprinkling to be done in the construction and excavation areas in dry seasons ▪ It is recommended to wet and cover excavated material transported by trucks ▪ Provide dust containment enclosures to the site till appropriate height as suggested by PCB	Contractor	Contactors cost
	ESS 4, 6; IPC, Building byelaws	Networks across streams and canals	▪ Conduct works in the water body only during the no-flow season; also avoid seasons important for important fauna/flora in the streams, canals, water bodies ▪ Select a less disruptive construction method (e.g., precast type), strictly use non -hazardous material and tools for construction ▪ Do not spill or deposit construction chemicals, fuels, lubricants, wastes in the water body ▪ Clean up the site immediately after construction is complete; construction debris, materials, etc., shall be cleared and pre-project condition restored or improved	Contractor	Contractor cost
	ESS 2, 3, 4, 6, 8, Noise Rules; Labour Rules	Noise and vibration and other disturbances to residents and businesses while laying pipelines	▪ Information on contact person regarding the works, work schedule, type of disturbances, and contract personnel shall be provided to heritage precincts, all concerned authorities, utility managers/departments, tourists, general users/occupiers near network alignment before initiating the works ▪ Laying of pipelines to be done preferably during daytime after giving prior intimation	Contractor	Contractors Cost

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
			▪ Works near schools, colleges, hospitals to be carried out preferably during holidays with prior information ▪ Works near any areas frequented by local/ migrant fauna shall be done with due consideration to avoid and minimize disturbance ▪ Use of low noise and low vibrating equipment and provision of enclosures for such equipment on-site to be encouraged. Work should be well scheduled and designed in detail and care to be exercised in case of works near heritage precincts ▪ Instruments need to meet standards of CPCB ▪ Ensure provision of appropriate PPEs to construction workers; like earmuffs, plugs, etc.		
	ESS 3, 4 Air Act	Dust emissions impact air quality while laying networks	▪ Barricade the construction area using hard barricades (of 2 m height or as prescribed by PCB) on both sides ▪ Initiate site clearance and excavation work only after barricading of the site is done ▪ Confine all the material, excavated soil, debris, equipment, machinery (excavators, cranes, etc.), to the barricaded area ▪ Limit the stocking of excavated material at the pipe laying site or nearby; safely remove the excess soil from the site immediately to the designated disposal area ▪ Undertake the work section wise: a 500 m section or less should be demarcated and barricaded but preferably works shall take place at a time in 100m to 300 lengths; open up several such sections at a time, but care shall be taken to locate such sections in different zones or parts of the city ▪ Conduct work sequentially - excavation, sewer laying, backfilling, testing section-wise (for a minimum length as possible) so that backfilling, stabilization of soil can be done ▪ Remove the excavated soil of the first section to the disposal site; as the work progresses sequentially, by the time the second section is excavated, the first section shall be ready for backfilling, use the freshly excavated soil for backfilling, this shall avoid stocking of material, and minimize the dust ▪ Backfilled trench at any completed section after removal of barricading shall be the main source of dust pollution. The traffic, pedestrian movement, and wind shall generate dust from the backfilled section. Road restoration shall be undertaken in such areas immediately ▪ Immediately consolidate the backfilled soil and restore the road surface; if immediate road restoration is not possible, provide a layer of plain cement concrete (PCC) of suitable mix on the backfilled trench so that dust generation and erosion are arrested, and it will also provide a smooth riding surface for the traffic until the road is properly restored. Backfilled trench without any road restoration is a major source of dust	Contractor	Contractors Cost

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
	ESS 3, 4; EP Act, Rules	Temporary flooding due to excavation during monsoons or blockage of surface drains Erosion of stockpiles	▪ Excavation to be restricted only to areas manageable at a time ▪ Cut off for surface drains in areas prone to receive runoff from excavated areas ▪ Stockpiled areas to be bordered by berms ▪ Stockpiles to be done in high/elevated areas or platforms to avoid flow in stormwater run-off channels and erosion ▪ Check site geography including ravines, soil piping, etc; to manage excavations and stockpiling ▪ Arrange appropriate mechanisms for dewatering ▪ All electrical works should be safe, without any loose wires or appurtenances impacted by water pooling or rains; and equipment's duly protected to avoid any risks	Contractor	Contractors Costs
	ESS 2, 4; National Policy on Safety, Health and Environment At Work Place; Labour laws; Gujarat Provincial Municipal Corporations Act, 1949	Accidents while relocating utilities, inconvenience to communities	▪ Require construction contractors to prepare a contingency plan to include actions to be taken in case of unintentional interruption of services ▪ Identify the common utilities that would be affected such as telephone cables, electric cables, electric poles, water pipelines, internet cables, fiber optic cables, public water taps, footpaths, other utilities, and services ▪ Before works/shifting of utilities concerned line departments and citizens shall be made well aware of proposed works (through discussions/meetings and display boards) and possible disturbances due to utility shifting ▪ Affected utilities shall be relocated through the concerned line departments before construction starts ▪ Affected utilities shall be relocated with prior approval of the concerned agencies before construction starts. Plan to be discussed with respective utility agencies and adequate precautions (such as switching off electric supply, water supply, etc.) to be taken to avoid any danger to communities, workers. Prior information shall be provided to affected communities and adequate info boards/ signages shall be arranged on sites with contact details of concerned officials Identify the common utilities that would be affected such as telephone cables, electric cables, electric poles, water pipelines, public water taps, etc. ▪ All workers shall be given orientation on safe work, use appropriate Personnel Protective Equipment/s (PPEs) as appropriate even for pre-construction activities ▪ Roadside users shall be informed of proposed works/associated activities ▪ There shall be proper signages with multiple means to contact the site-in-charge ▪ Ensure that while laying sewers, access to properties is not hindered. In case of any issues, it shall be discussed immediately with project affected persons and local representatives, and a mutually agreeable solution be reached; including the provision of alternate facilities/ arrangements. Wherever the entry and exit to houses/establishments are affected due to construction activities, alternate temporary but safe ramp arrangement for crossing over shall be provided with	Contractor	Contractors Costs

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
			appropriate strong materials without causing access/safety issues, with all safety measures agreed with users and restore original permanent access as soon as the work is complete. Any grade changes (for human/ vehicular movement) shall be suitably remediated at the earliest ▪ Arrangements shall be made to safe keep existing pipes, and wastes extracted from them in case of replacement or if required and dispose of them immediately as per the pre-approved plan ▪ All safeguards against accidents shall be taken while shifting utilities, including (but not limited to) hard protective barricading of full workspace, notice to road users and communities, traffic management, PPEs to protect workers from all incidental issues including (but not limited to) electric shocks, hit, fall, vehicular conflicts following GIIPS and the Word Bank EHS ▪ Adequate provision shall be made to collect complaints if any from community/road users and resolve the same immediately (notice board with contact details of engineer; complaint box, logbook, etc.) ▪ Shifted utilities or construction materials shall not cause any disturbance to communities/road users. They shall be well stacked safely with flags/reflectors for easy visibility and transported as early as possible without causing any accidents/spills & stored at pre-agreed (before the start of works) disposal/storage point as directed by AMC ▪ All electronic wastes and hazardous material including existing asbestos material (eg: as in old pipes) or electric cables etc. shall be managed as per hazardous/e-waste management rules (as directed & arranged by AMC before the start of works). No such material shall be dismantled/broken on-site or allowed to cause an accident		
	ESS 4, Guidelines on C&D wastes, Building Codes	Backfilling the area after construction	▪ Backfilling activity should follow the construction schedule (for example: completing 500m stretch within 3 days or pre-approved schedule). ▪ Proper compaction as per the soil condition and retaining the original level/ alignment ▪ The backfilling material shall be free from petroleum products, slag, cinders, ash, or any contaminated or hazardous material.	Contractor	Contractors costs
	ESS 4, 8; Motor Vehicles Acts	Accessibility and traffic disruptions, Increased traffic inconvenience (emissions, congestions, longer travel times, blockage of access to communities for various uses)	▪ Alternate traffic routing to be adopted in consultation with traffic police authorities. This shall be properly displayed well ahead of diversion areas. Communities shall be informed through direct discussions with owners/users of the stretch before works, signages, print, and social media. ▪ Prepare a sewer work implementation plan in each zone separately and undertake the work accordingly; ensure that for each road where the work is being undertaken there is an alternative road for the traffic diversion; take up the work in a sequential way so that public inconvenience is minimal; prepare traffic management plans for each section ▪ Leave spaces for access between mounds of soil/materials to maintain access to the houses/ properties; access to any house or property shall not be blocked completely; alternative	Contractor	Contractor cost

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
			arrangements, at least to maintain pedestrian access at all times to be provided. Keep the site free from all unnecessary obstructions ▪ Inform the affected local population in advance about the work schedule, a week before, and a day before to start of work. Plan and execute the work in such a way that the period of disturbance/ loss of access is minimum. Notify affected public by public information notices, providing signboards informing nature and duration of construction works and contact numbers for concerns/ complaints ▪ Plan the sewer work in coordination with the traffic police; provide temporary diversions, where necessary with clear signage, and effectively communicate with the general public ▪ Avoiding conducting work on all roads in a colony at one go; it will render all roads unusable due to excavations at the same time, creating large scale inconvenience ▪ Undertake the work section wise: a 500 m or lesser length section should be demarcated and barricaded; open up several such sections at a time, but care shall be taken to locate such sections in different zones ▪ Confine work areas in the road carriageway to the minimum possible extent; all the activities, including material and waste/ surplus soil stocking should be confined to this area. ▪ Proper barricading should be provided; avoid material/ surplus soil stocking in congested areas – immediately removed from the site/ or brought to the as and when required ▪ Limit the width of trench excavation as much as possible by adopting best construction practices; adopt appropriate cutting approach (like vertical cutting approach with proper shoring and bracing in narrow roads and deeper sewers; sloped trenches for wider excavations) ▪ In case of alternate mechanisms such as tunneling, select appropriate safe areas as start and end of tunneling section, check the impact of vibration on nearby structures, especially heritage structures and dilapidated/old structures. Adopt safe practices without disturbances or incidents to workers, road users, or communities; irrespective of construction technology adopted		
Additional considerations for the Sewage treatment plant and Sewage pumping/lift stations – Upgradation, new construction	ESS 4, IS Code of safety for excavation work	Damage to nearby structures due to excavation activities	▪ Careful excavation is needed so that the existing structures do not get damaged ▪ In case access to a facility need to be disturbed, arrange alternate arrangement before demolition of existing structures ▪ Any damage done shall be rectified immediately; and restore facilities at the earliest to original condition	Contractor	Contractors Costs
	ESS 3, 4; C&D Wastes rules	Construction and demolition (C&D) waste	▪ Avoid storing C&D wastes near stormwater run-off channels or any low-lying areas	Contractor	Contractors Costs

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
			▪ No C&D waste shall be disposed of in low lying areas or natural/other watercourses, agricultural land, wetlands, or sensitive areas which might contaminate such areas or cause stagnation or hindrance to stormwater flow ▪ All the associated construction waste should be properly managed by storing on high platforms above HFL, in a covered manner away from construction/excavation area and disposing of at C&D Waste Disposal facility or sites agreed in writing by the local body		
	ESS 6, Biological Diversity Act	Impact on aquatic habitat	▪ Disposal of treated Effluents shall follow stringent standards to avoid impacts on fauna flora or downstream users of rivers ▪ No construction related activities shall be allowed on sensitive habitats (critical or natural) ▪ Use of low level of illumination at construction sites around nesting, breeding, spawning, flight paths, congregation areas of fauna	Contractor	Contractors Costs
	ESS2, 4, Labour Laws, BOCW Act, DM acts	Safety considerations	▪ Wells of pumping stations to be covered using reinforced cement concrete (RCC) slabs or similar other such material. Design of slab to consider both superimposed loads (human and equipment loads) and severe corrosion risk from sewer gas from within wells. ▪ Cover slab to be designed and fixed in a modular manner such that access to pumps/ appurtenances and other equipment can be provided for maintenance/ replacement/ renewal purposes. Since the human intervention is involved and safety shall be the primary and critical consideration, additional protection by way of a metalled grating/ grill work shall be provided over all the sections (or full cross-section if required) where workers would stand/ work for inspection and repair/ O& M purposes ▪ Submersible sewage pumps of suitable rating, minimum submergence requirements, open impeller with the cutting-tearing arrangement, and high strength-corrosion resistant heavy-duty construction shall be proposed ▪ In locations/ cases where sewage flow in the present to intermediate design stage is envisaged below, the position of the submersible pumps and design of the collection well floor by providing necessary side benching/ sloped flooring to allow for higher submergence during low flow shall be made to ensure regular pump operation and avoid sewage stagnation beyond the permissible limit. ▪ Diesel Generators shall be provided for pumping stations in case of lift manholes (road-side or road-center type structures with only provision of curbside kiosk), an electrical cut-out provision shall be made for connecting an Emergency Mobile/ Skid Mounted Diesel Generator for pumping out during the long period of electricity supply interruption. ▪ Develop standard operating procedures/ operations manual for operation and maintenance of lifting and pump stations; this shall include measures for emergencies		

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
			▪ Provide training to the staff in SOPs and emergency procedures, and appropriate PPEs especially for rehabilitation works considering wastewater accumulated and continuously reaching the stations during construction and O&M		
	ESS 4; EP Act Rules	Odor nuisance in pumping stations, lift stations	▪ In pumping stations where odor control measures are contemplated, provision of passive gas ventilation arrangement by providing a take-off vent from the top of well by positioning vent in such a way that cover slab fitment/ movement/ drawl if required for maintenance purposes is not compromised. ▪ Height of vent to be provided appropriately and a minimum 2m above the lintel level (top-level) of window(s)/ passageways/ doors of the adjoining buildings. ▪ Provision of odor control/ mitigation system as per site conditions/ requirements (expected at almost all IPS considering location within the city). A suitable granular activated carbon filter with bird-screen fitted at the vent outlet to control odor. The size of the filter (including material size) should be selected based on the vent diameter and expelled airflow rate expected. ▪ For lift stations close to residential areas provide closed wells fitted with necessary ventilation and odor abatement systems such as GAC air filters fitted to the ventilation shaft outlet(s). ▪ Conduct periodic monitoring of gases like Hydrogen Sulphide and others using a handheld meter ▪ Provide greenbelt (tree cover) around the lift stations, wherever possible, or arrange odor control measures and operating procedures ▪ Spraying of Bank/ WHO - approved herbicides on accumulated sludge/ solid waste to reduce odor or usage of odor control filters/ devices	Design Consultant and Contractor	Design & Contractor Costs
	ESS 3, 4, 6; Water Act, Waste related all rules	Leachate, accumulation of sludge, wastes	▪ Proper storage (to prevent disturbance due to weather, extreme events, pests, etc.) and Regular clearance (within 24 hours preferably) of sludge, grit, and solid waste to minimize odor nuisance and its disposal in approved/ permitted disposal areas (written permit/ arrangement) in discussion with the local body	Contractor	Contractors Costs
	ESS 3, 4, Noise Rules	Noise due to plant operations, equipment	▪ Procure good quality latest technology high pressure pumps that guarantee controlled noise at a level of around 70-80 dB(A) or as suggested by regulations, at a distance of 1 m ▪ Use appropriate building materials and construction techniques for pump houses that can absorb sound rather than reflect noise ▪ Use DG sets with acoustic enclosures ▪ Procure only CPCB/GPCB approved generators to meet air emission and noise level requirements ▪ Provide sound mufflers for ventilators in the plant rooms, and soundproof doors ▪ Provide earplugs designated for noise reduction to workers ▪ Make communities aware of the duration and schedule of noisy activities before the start of such works	Contractor	Contractors Costs

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
	ESS 3; energy Conservation act	Energy consumption	▪ Using low-noise and energy-efficient pumping systems, by careful specifications ▪ Ensure Efficient Pumping system operation	Contractor	Contractors Costs
	ESS 3, 6; water Act	Discharge of treated and untreated sewage/ wastewater: Pollution of water environment	▪ Implement mechanism for taking care of wastewater in the pumping stations, and STPs management of untreated or partially treated wastewater and bypass during construction, operation stages, and extreme events, including monitoring quantities and quality using SCADA, integrating mechanisms to alert to downstream users, etc.	Contractor	Contractors Costs
POST-CONSTRUCTION/ OPERATION PHASE: ***The following section contains instructions to the respective Lines Departments/ Local community entrusted with the operation and maintenance of the sub-project activity to ensure long-term sustainability.***					
O&M of Sewer network	ESS 3, 4; Water Act, EP Act/Rules	Leakage/ overflows	▪ Regular monitoring of sewer lines and manholes for visible leakages/ overflows ▪ Immediate repair operation for the damaged portion of the sewer line ▪ De-siltation of blocked sewers/ manholes with sewage pumping machines-storing and disposal at agreed refusal area after treatment ▪ Ensure proper covering of manhole and avoid dumping of solid waste to prevent chocking of the sewer line	O&M Contractor	O&M Contractors Costs
O&M of Sewage treatment plant and Intermediate pumping station	ESS 3, 4, Noise Rules	Noise pollution from operation activities	▪ Proper handling and regular maintenance of operating machines including pumps, generators, air diffusers, etc.	O&M Contractor	O&M Contractors Costs
	ESS 3, 4; Water Act, EP Act/Rules	Impairment of receiving water quality in surface/ sub-surface source due to inadequate/ inefficient treatment. Contamination of groundwater supplies due to leaching and impact on soil and agriculture	▪ Monitor the treated sewage/ effluent quality and ensure compliance with PCB standards for effluent disposal into surface water bodies, on land, or for agricultural use.	O&M Contractor	O&M Contractors Costs
	ESS 3, 4 Water / air Acts, EP Act/Rules, Noise Rules	Problems arising due to bad odor, insects, polluted air, noise pollution, etc.	▪ Ensure collection of fecal sludge only through mechanical means, and use of protective gear by all workers, fall prevention measures ▪ Ensure upkeep of buffer zones in the form of a green belt around the STP; to be ensured during the design and construction phase itself.	O&M Contractor	O&M Contractors Cost

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
	ESS 3, 4; Water Act, EP Act/Rules	Odor, leachate, accumulation of sludge	▪ Proper storage (to prevent disturbance due to weather, extreme events, pests, etc) and Regular clearance of sludge, grit, and solid waste to minimize odor nuisance and its disposal in approved/ permitted disposal areas (written permit/ arrangement) as agreed in writing by AMC, in consultation with GPCB ▪ Spraying of Bank approved herbicides accumulated sludge/ solid to reduce odor or use of odor control filters.	O&M Contractor	O&M Contractors Costs
	ESS 3, 4, 6, 10; Water Act, EP Act/Rules	Discharge of untreated wastewater Impacts on water environment and downstream users	▪ The Plant to operate as per design and consent conditions ▪ Implement mechanism for managing wastewater in the plant or reaching the plant, (untreated or partially treated) during operation stages and extreme events alert to downstream users, etc.	O&M Contractor	O&M Contractors Costs
Operation of Fecal sludge management system (in case planned)	ESS 2, 3, 4, 6; Water Act, EP Act/Rules	Odor nuisance affecting the nearby community Health and safety of workers Ecological impacts include destruction of aquatic habitat due to poor quality effluent discharge, leachate from solid waste Groundwater pollution due to FSTP	▪ Appropriate training for all types of workers ▪ Use of mechanical cleaning systems instead of manpower ▪ Secured transport of fecal sludge (preferably GIS-based, and using a manifest system as being used for Hazardous/ Biomedical wastes) ▪ Ensure treatment appropriate for disposal meeting the MOEFCC specified standards and consent conditions ▪ Prevent any spill or discharge of leachate, chemicals, and fecal sludge into surface waters	O&M Contractor	O&M Contractors Costs
Operation of sewage lifting and pumping stations	ESS 3, 4; EP Act/Rules	Odor nuisance	▪ Strictly follow standard operating procedures/ operational manual for operation and maintenance of lifting and pump stations ▪ Ensure that operating staff is properly trained, and have a clear understanding of odor issues vis a vis its relation with operational practices ▪ Ensure that pumping cycles are properly followed, and there is no buildup of sewage beyond design volume in the wells ▪ Conduct H2S monitoring periodically at pumping stations and at lifting stations using handheld meters	O&M Contractor	O&M Contractors Costs
Operation and maintenance of sewerage system and drains	ESS 3, 4; Gujarat Provincial Municipal	Blocks overflow, system malfunction, occupational health, and safety	Establish regular maintenance program, including: ▪ Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups. Cleaning should be conducted more frequently for problem areas	O&M Contractor	O&M Contractors Costs

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
	Corporations Act, 1949 act		▪ Inspection of the condition of sanitary sewer structures drains and all covers and identifying areas that need repair or maintenance. Items to note may include cracked/ deteriorating pipes; leaking joints or seals at manhole; frequent line blockages; lines that generally flow at or near capacity; and suspected infiltration or exfiltration; and ▪ Monitoring of sewer flow to identify potential inflows and outflows ▪ Conduct repairs on priority based on the nature and severity of the problem. Immediate clearing of blockage or repair is warranted where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, or sewer line blockages) ▪ Maintain records; review previous sewer maintenance records to help identify "hot spots" or areas with frequent maintenance problems and locations of potential system failure, and conduct preventative maintenance, rehabilitation, or replacement of lines as needed; ▪ When a spill, leak, and/ or overflow occurs, keep sewage from entering the storm drain system by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.). Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system. ▪ Prohibit/ prevent disposal of wastewater/ effluent from industrial units in the sewers; ensure regular checking to ensure no illegal entry of industrial wastewater into sewers ▪ Develop an Emergency Response System for the sewerage system leaks, bursts, and overflows, etc. ▪ Provide necessary health and safety training to the staff in sewer cleaning and maintenance ▪ Provide all necessary personnel protection equipment ▪ Do not conduct manual cleaning of sewers, canals, or drains; for personnel engaged in sewer maintenance work, there is a risk due to oxygen deficiency and harmful gaseous emissions (hydrogen sulfide, methane, etc.); provide for adequate equipment (including oxygen masks) for emergency use		
General Safety during O&M	ESS 2, 3, 4; Gujarat Provincial Municipal Corporations Act, 1949; Labour Acts; Fire Safety Act	Health/ safety hazards The toxic gases are likely to contract communicable diseases from exposure to pathogens present in the sewage. Workers exposed to toxic gases in sewers, chemicals, and hazardous materials	▪ Implement Labour management procedures during O&M ▪ During cleaning/ maintenance operation, the sewer line shall be adequately vented to ensure that no toxic or hazardous gases are present in the line. Test for gases before any work on sewers, or confined areas ▪ Ensure no accumulation of solid/ construction or hazardous wastes on-site, following proper plan for each for collection, treatment, and disposal as per applicable rules and as agreed in writing by the local body and PCB	O&M Contractor	O&M Contractors Costs

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
		Life and Fire safety, extreme events and disasters (also considering STPs near river, barrage)	▪ PPEs especially suited for work in/near water are to be arranged including life jackets, buoys, harnesses, and specialized lights while carrying out O&M activities, and wastewater quality testing; and for monitoring/supervising personnel. Arrangements for Fire protection and emergency response are also to be arranged for use during any events/emergencies during O&M activities ▪ Awareness to communities on probable issues and measures/arrangements for response and support in case of evets		
	ESS 6; Biological Diversity Act	Changes in watercourses (streams) if any (not expected)	▪ Long term monitoring and biodiversity conservation measures	AMC	O&M Costs
	ESS 3; All Wase Related Rules	Generation of solid waste	▪ Implementation waste management Plan	O&M Contractor	O&M Contractors Costs
	ESS 3, Air act, Noise Rules, EP Act & Rules	Air and noise pollution	▪ Air and noise quality monitoring for 5 years and appropriate mitigation/ management measures to be followed	O&M Contractor	O&M Contractors Costs
	ESS 3, water Act	Water pollution	▪ implement pollution prevention and control plan	O&M Contractor	O&M Contractors Costs
	ESS 6, Biological Diversity act, Wetlands Rule	Loss of vegetation, habitats	▪ Implement Biodiversity Management Plan prepared for the subproject in case of critical, and natural habitats ▪ Arrange implementation of best practices for plantation, habitat rejuvenation Follow natural means for growing plantations/ buffers, de-weeding, etc. ▪ Implementation of related ECoPs for fauna/ flora or biodiversity management ▪ Maintaining compensatory tree plantation	AMC and O&M Contractor	AMC costs and O&M Contractors Costs
	ESS 2, 4; Labour Laws, BOCW Act, Gujarat Provincial Municipal Corporations Act, 1949	Health and Operational issues due to Poor Maintenance	▪ The following practices should be adopted in maintaining stormwater drains, water channels, ponds: - No clogging of drains, channels, or waste accumulation in ponds - Water bodies/ channels shall be regularly inspected and cleaned especially before monsoons - Rubbish and silt removed from the water bodies created should not be left alongside the water body and shall be immediately disposed of in the pre-identified site with necessary precautions - Take immediate actions (penalty, permit objection, other remedial actions) on violators if sensors identify disposal of sewage or industrial effluents in drains	O&M Contractor	O&M Contractors Costs

Activity	Reference: ESSs, Key National, State Regulations	Potential Negative Impact/ Concern	Mitigation Measures	Responsible agency	Source of Funds
			- It shall be ensured that the Environmental, Health, and Safety Guidelines of the World Bank (Generic and Water & Sanitation) are followed for relevant activities during operation and maintenance.		
	ESS 4; Gujarat Provincial Municipal Corporations Act, 1949	Nuisance due to clogging of channels, formation of mosquito breeding areas etc.,	▪ Ensure timely de-silting of drains, water bodies, ponds ▪ Create awareness among the people not to throw garbage and other waste into water bodies created. This would, in turn, ensure community health and safety		
	ESS 2, 4; DM Acts	Lack of Emergency Response arrangements	▪ Ensure First Aid facilities & emergency contact details in local language ▪ Prepare and train workers and communities for emergency support/ First aid ▪ Neighborhood committees shall watch over any emergencies/ issues related to facilities created and shall be trained to report and respond at the earliest	O&M Contractor	O&M Contractors Costs

C. Indicative ESMP to redress Incidents/ Emergency Management during all work stages

Each contractor shall include as part of the Contractors ESMP an Incident and Emergency Response Plan that clearly defines triggers and procedures in case of an incident or emergency.
Risk situations/ problems arising are very diverse, and many measures to react to situations arising may include:

Table A- 2: Indicative ESMP for Incident / Emergency Management

Sl. No.	Situation	Action	Responsibility for implementing	Monitoring Agency
1.	Disturbance to Cultural Heritage, Historical artifacts encountered during excavation	▪ Prepare and follow CHMP ▪ The contractor protects the site or cordons off the area and reports to the Engineer and refers to Heritage Cell, Director of Culture in Gujarat, and the PIU for advice ▪ Hands over artifacts to museum/ cultural management agency ▪ Review to determine if the excavation can be continued ▪ The Director of Culture and Information office in the locality will be responsible for managing objects	Contractors	PIU / AMC in consultation with the Department of Culture
2	Grave encountered during excavation	▪ Inform the Engineer, protect the site and notify the local authorities ▪ Identify a solution to resolve the issue in discussion with the community/ individuals concerned, including timing and locations to be earmarked for relocation	Contractors,	PIU, AMC, and Department of Culture

Sl. No.	Situation	Action	Responsibility for implementing	Monitoring Agency
3	Complaints from the community on environmental issues related to construction activities	▪ Inform the engineer/PIU, supervision consultant, and immediately remedy if possible, in consultation with the community ▪ Record the issue and resolution in the site report/ register ▪ Talk with PIU/ local government in case of conflict and arrange a speedy resolution	Contractor	PIU
4	Accident related to construction or operation	▪ Provide First Aid for victims and transfer immediately to the nearest medical facility if necessary, using the vehicles ready on site ▪ Inform the victim's family and provide all types of support in getting required medical care immediately ▪ Cordon the area and Place 'danger' signs ▪ Make a formal record in an accident/ incident book and inform the PIU and PIU to inform the Bank for reporting through ESIRT ▪ Prepare Corrective Action Plan and implement measures immediately to prevent repeat accidents; also plan short and long term actions ▪ Arrange to provide insurance as per labor laws (contractor should be prior registered as per existing laws) ▪ Inform relevant authorities and PIU immediately following Indian laws and regulations, and provide details including medical records as soon as it is available	Contractors	PIU
5	Explosives found	▪ Protect the scene and set the danger signs preventing access ▪ Inform the Engineer, PIU, and concerned agencies ▪ Contact appropriate authorities in the locality to request support	Contractor	PIU and local police
6	Disasters and emergencies including impacts due to nearby facilities, or extreme events	▪ The contractor shall prepare Disaster Management Plan for his works including Emergency Response Procedures ▪ PIU to regularly Monitor DMP mechanisms on-site especially during alerts on possible extreme events ▪ Arrange mechanisms to inform relevant authorities at the earliest ▪ Stop all works till it is declared safe, and all workers shall be shifted to safe places. All materials, tools, and equipment shall be secured and safely placed ▪ Implement DMP in coordination with PIU and Revenue Department	Contractor	PIU and Disaster Management Authorities

- ***Indicative Ambient Environmental Component Monitoring Plan for works***

Table A- 3: Indicative Monitoring Plan for Ambient Environment

Parameter/ Activity	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented By	Monitored By
Sediment Quality for heavy metals	Lake/Canal sediment at 5 locations	Laboratory analysis for metals and oil/ grease (as per applicable MoEFCC guidelines)	Before sand extraction	Contractor through a nationally recognized laboratory	PIU
Soil Pollution	Canal, Lake, construction site, camp	Visual Inspection that filling is through several compartments	Beginning of earth filling works	Contractor	PIU
	Canal, Lakes, construction, and material storage sites	Ensure no contamination effluent is draining from the filling area to the nearby agriculture lands or water bodies	Weekly	Contractor	PIU
Stability of slopes	Side slopes of sluice gates, canal embankments, discharge points	Compaction as per contract specifications, shoring / shuttering provided, visual inspection of erosion prevention measures, and occurrence of erosion	Monthly	Contractor	PIU
Hydrocarbon and chemical, fuel storage	Construction camps and yards; material storage areas, fuelling areas	Visual inspection of storage facilities	Monthly	Contractor	PIU
Traffic safety	Construction Access Roads	Visual Inspection to see whether proper traffic signs are placed and flag-men for traffic management are engaged Records on intimation to departments such as transport and traffic police departments, schools, hospitals, communities, and other sensitive receptors	Monthly	Contractor	PIU
Air Quality (dust, smoke)	Construction sites	Visual inspection to ensure good standard equipment is in use and dust suppression measures (e.g., spraying of waters) are in place	Daily	Contractor	PIU
	Material storage sites	Visual inspection to ensure dust suppression work plan is being implemented	Monthly	Contractor	PIU
Air quality	Sensitive receptors along with work areas, work corridors	24 hours continuous monitoring with the help of appropriate instruments and analyzers (particulate matter, carbon dioxide, sulfur, and nitrogen oxides)	Quarterly	Contractor	PIU
Noise	Construction sites, material storage/loading areas	Noise measurement using noise meter; Ensure work restriction between 21:00-06:00 close to the sensitive locations, Comparison of noise levels with appropriate standards	Weekly	Contractor	PIU

Parameter/ Activity	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented By	**Monitored By**
Surface water quality	At the baseline monitoring sites, and sites downstream	Sampling and analysis of surface water quality all sampling criteria as per MoEFCC / CPCB guidelines for respective use class	Quarterly or frequency if mentioned in respective ESIA	Contractor through a nationally recognized laboratory	PIU
Groundwater quality	Tube/ other wells used (for workers camps or workers use)	Check permits from relevant authorities The depth of the tube well should be more than 30m. Test water for arsenic iron and manganese before installing the casing. If the quality is found not suitable further deepening shall be done	During drilling of wells and construction period	Contractor through a nationally recognized laboratory	PIU
	Water wells downstream or adjacent to the work sites, discharge points	Laboratory analysis of all drinking water parameters specified in prevalent national standards	Before and after works	Contractor through a NABL/ MoEF CC recognized laboratory	PIU
Plantation	Canal slopes, lakesides, construction sites greenbelts, plantation areas (as per landscaping plan)	Visual inspection to ensure plantations are taken care of Inspection of nurseries, sapling height at the plantation, tree guards, and sapling maintenance on site	Weekly	Contractor	PIU
Waste management	Construction camps and construction sites, other supportive infrastructure sites, laboratories, etc	Visual inspection to ensure that various types of wastes are segregated and stored well at source, safely transported in designated vehicles, and treated/disposed of in an agreed manner in designated sites	weekly	Contractor	PIU
Drinking water and sanitation	Construction camps and construction sites, network infrastructure sites	Ensure the construction workers are provided with safe water and sanitation facilities on the site, with adequate arrangements for sewage/wastewater disposal	Weekly	Contractor	PIU
Flora and fauna	Sensitive habitats in the project influence area	Survey and comparison with baseline environment. Ensure activities, noise, vibration, lighting conforms with the requirement to limit impacts on wildlife	Six-monthly	Contractor/ Biodiversity Conservation and monitoring consultants	PIU
Restoration of Work Sites	All work Sites	Visual Inspection	After completion of all works before handing over to ULB	Contractor	PIU

Parameter/ Activity	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented By	Monitored By
Safety of workers Monitoring and reporting accidents	At work sites	Usage of personal protective equipment and implementation of contractor OHS plan Incident report/record maintained onsite	Monthly	Contractor	PIU/Construction Supervising Firm
Grievances (environment and safety issues)	In the project	Number of grievances registered and addressed; time is taken to address grievances	Monthly	Contractor	PIU
Safety of Vasna Barrage	At barrage	Any safety issue of the barrage which might impact the STPs works near it	Once in Six-months or quarter	AMC with Water resources department	
During Post Construction (O&M) Period					
Stability of protection works	Embankments treated effluent discharge points and resettlement sites	Visual inspection of erosion prevention measures and occurrence of erosion	Monthly	O&M Contractor	PIU
Plantation	Construction sites, canal slopes, other project plantation areas, green belts	Visual inspection to ensure plantations are taken care of	Monthly	O&M Contractor	PIU
Waste effluents	Worker facilities, Offices, Labs	A visual inspection to ensure that solid and liquid waste effluents are properly managed during the post-project period	Six-monthly	O&M Contractor	PIU
Safety	Fire, disaster emergency preparedness, the safety of barrage in case of facilities near Vasna,	Checking equipment, records, and systems established for emergency preparedness and response, Mock drills, check no: of awareness programs to citizens	Quarterly	O&M Contractor	PIU

- ***Construction Stage Generic Environmental Monitoring Plan (to be modified for each site)***

Table A- 4: Generic Construction Stage Monitoring Plan

Plan Monitoring field	*Monitoring location*	*Monitoring parameters*	*Frequency*	*Responsibility*	*Cost and Source of Funds*
Construction disturbances, nuisances, public, and worker safety,	All work sites	Implementation of construction stage EMP including dust control, noise control, traffic management, and safety measures.	Weekly during construction	Supervising staff and safeguards specialists of Construction Management and	Staff and consultant costs are part of incremental administration costs

Plan Monitoring field	*Monitoring location*	*Monitoring parameters*	*Frequency*	*Responsibility*	*Cost and Source of Funds*
		Site inspection checklist to review implementation is appended at regular intervals		Supervision Consultant (CMSC)	
Ambient air quality	5 locations (locations 50 m downwind direction near sewer and pumping/ lifting station work sites in the city)	PM10, PM2.5 NO2, SO2, CO	Once before the start of construction Quarterly (except monsoon) during construction	Construction Contractor	Cost for implementation of monitoring measures responsibility of contractor (50 samples x Rs.5000/ per sample = Rs.250,000)
Ambient noise	5 locations (locations near sewer and pumping/ lifting station work sites in the city);	Day time and night time noise levels	Once before the start of construction Quarterly (except monsoon) during construction (2.5 year period)	Construction Contractor	Cost for implementation of monitoring measures responsibility of the contractor (50 samples x 1500 per sample = 75,000)
Surface water quality	2 locations (2 points in River u/ s and d/ s, and two points in lake u/ s and d/ s).	pH, Oil, and grease, Cl, F, NO3, TC, FC, Hardness, Turbidity BOD, COD, DO, Total Alkalinity	Once before the start of Construction Half-yearly during construction (2.5 year construction period considered)	Construction Contractor	Cost for implementation of monitoring measures responsibility of the contractor (28 samples x 4000 per sample = 112,000)

- ***Operation Stage Generic Environmental Monitoring Plan (to be modified for each site)***

Table A- 5: Generic Operation Stage Monitoring Plan

Monitoring Field	**Monitoring location**	**Monitoring Parameters**	**Frequency**	**Responsibility**	**Cost and Source of Funds**
Monitoring of treated wastewater quality from sewage treatment plant (STP)	Inlet and outlet of STP	Parameters as specified by Gujarat Pollution Control Board (GPCB) in the consent.	Monthly Once	GPCB	STP Operating cost
Disposal of treated wastewater	At the outlet measurement of STP flow	BOD = < 20mg/ l SS = < 30 mg/ l F. Coliform = <MPN/ 100 ML	Daily	AMC	STP Operating cost
Odor monitoring at pumping stations	3 points (downwind direction) at all pumping stations: near inlet/ suction well; outside the pumping station and at the nearest house, at the boundary wall of the pumping stations	Hydrogen sulfide (H2S)	Periodical	AMC	Handheld H2S meters to be procured as part of the project and operated by operating staff O and M Costs

Monitoring Field	Monitoring location	Monitoring Parameters	Frequency	Responsibility	Cost and Source of Funds
Odor monitoring at lifting stations	3 points (downwind direction) at all lift stations: near inlet/ suction well; outside the pumping station and at the nearest house, at the boundary wall of the pumping stations	Hydrogen sulfide (H2S) in ambient air	Periodical	AMC	Handheld H2S meters to be procured as part of the project and operated by operating staff O&M Costs
Sludge quality and suitability as manure	STP	Analysis for the concentration of heavy metals and confirm that value is within the approvable standards (CPHEEO, FCO)	Start of operation and Yearly once	AMC	O&M costs (testing to be done at an accredited external laboratory)

Section VI: Environmental Codes of Practice

This section presents the Environmental Codes of Practices (ECoP) developed to support the G-ACRP program. The ECoPs provide guidelines for environmental management of certain project activities including which are seen to be of the limited extent of impacts/ risk, temporary and reversible, and readily managed with good practices during the implementation of the proposed project interventions. The ECoPs will be considered while planning and designing facilities, included in bidding and contract documents as appropriate and its implementation will be closely monitored during implementation. The Contractors can use these while preparing and implementing Contractors ESMP at work start.

In case of overlap of the provisions of this guidance with Indicative ESMPs, the more stringent among these most suitable to the site conditions and activities shall be adopted. The provisions of both ESMP and ECoPs shall be integrated while preparing site/activity-specific ESMPs and design guidelines.

This could be modified and changed in line with the changing situation or scope of the activities, and/ or change or update existing regulations/ policies; subject to close consultation with the World Bank and clearance of the revised ECoPs.

ECoP 01: Guidance on Pre-construction Plan

- Finalization of project location
- Community consultations to identify the concerns and preferences need to be taken up during the selection of the location of the projects.
- Initial site survey such as geotechnical investigation, topography survey, etc.
- Identification of flood-prone or waterlogging areas before finalization of the project location and preparation of construction plan accordingly

ECoP 02: Guidance on Site Preparation

- Informing the local community and local ward councils of the construction schedule
- Marking and clearance of the required project area boundary before the mobilization of Contractor,
- The contractor shall submit the schedules and methods of operations for various items during the construction operations to the PIU for approval.
- In locations where erosion or sedimentation is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion and sedimentation control features can follow immediately if the project conditions permit.
- All excavated areas materials should be secured
- Filling of ditches
- The disposal of wastes shall be following the provisions of ECoP 4: Waste Management.
- All regulatory clearances shall be obtained before the actual start of work

ECoP 03: Construction Camps

Siting and layout:

- Locate the construction camps in areas that are acceptable from an environmental, cultural point of view.
- Consider the location of construction camps away from communities to avoid conflict in using natural resources such as water or to avoid the possible adverse impacts of the construction camps on the surrounding communities.

- Submit to the Site Engineer for approval a detailed layout plan for the development of the construction camp showing the relative locations of all temporary buildings and facilities that are to be constructed together with the location of site roads, fuel storage areas (for use in power supply generators), solid waste management and dumping locations, and drainage facilities, before the development of the construction camps.
- Local authorities responsible for health, religion, and security shall be duly informed on the set up of camp facilities to maintain effective surveillance over public health and security matters
- The construction camps will be located at least 500 m away from ecologically sensitive locations and 200 m away from archaeological sites or important monuments. These shall not be on agricultural lands or near sensitive habitats. The living accommodation and ancillary facilities for labor shall be erected and maintained to standards and scales approved by the resident engineer.

Facilities:

Adequate housing for all workers

- An adequate, easily accessible, and marked supply of drinking water to be provided at the project site
- Separate latrines and bathing places for males and females with total isolation by the wall or by location. The minimum number of toilet facilities required is one toilet for every ten persons, one urinal for 15 workers, and one washbasin for 15 workers or as per local building by-laws.
- All camp facilities shall be maintained in a safe clean and or appropriate condition throughout the construction period.
- Provide in-house community/ common entertainment facilities. Dependence of local entertainment outlets by the construction camps to be discouraged/ prohibited to the extent possible.
- Encourage greenery around the camp.
- Paved internal roads shall have grass/ vegetation coverage to be made of topsoil so that there is no dust generation from the loose/ exposed sandy surface. Pave the internal roads at least with bricks or porous materials to suppress dust and to work against a possible muddy surface during monsoon. This will help in water penetration and recharge as well.
- Provide fuel to the construction camps for their domestic purpose, to discourage them to use fuelwood or another biomass.
- Make available alternative fuels like natural gas or kerosene to the workforce to prevent them from using biomass for cooking.
- Conduct awareness campaigns to educate workers on preserving and protecting the surrounding environment including biodiversity and wildlife.
- Ensure that workers shall not engage in any activity of hunting/ poaching as listed in the WPA, 1972.
- In the areas of high biodiversity, it shall be made sure that the movement of stray dogs in the worker's camp shall be restricted.

Waste management:

- Ensure proper collection and disposal of solid wastes within the construction camp
- Ensure waste separation by source
- Store inorganic wastes in a safe place within the site and clear organic wastes daily to waste collectors. Establish waste collection, transportation, and disposal systems with the manpower and equipment/ vehicles needed.

- Hygienic sanitary facilities and sewage management. Provide Treatment facilities for sewerage of toilet and domestic wastes (preferably portable septic tanks which can be emptied into a septage treatment facility as and when full)

Health and Hygiene:

- Provide site safety kits, COVID 19 kits, first aid box facilities within construction sites
- The contractor should provide portable toilets at the construction sites
- Provide ambulance facility for the laborers during an emergency to be transported to nearest hospitals,
- Initial health screening of the laborers coming from outside areas/ migrant and provide health camps in coordination with nearby Primary Health Centre/ Clinic,
- Train all construction workers in basic sanitation and healthcare issues and safety matters and on the specific hazards of their work,
- Provide HIV awareness programming, including sexually transmitted infections (STI) and HIV information, education, and communication for all workers regularly,
- Complement educational interventions with easy access to condoms at campsites as well as voluntary counselling and testing,
- Provide adequate drainage facilities throughout the camps to ensure that disease vectors such as stagnant water bodies and puddles do not form. Regular mosquito repellent sprays during monsoon
- Carryout short training sessions on best hygiene practices

Safety:

- Conduct safety training for construction workers before beginning work
- The contractor shall provide appropriate security personnel (police/ home guard or private security guards) and enclosures to prevent unauthorized entry into the camp area even after work hours until the site is fully handed over to ULB
- Maintain register to keep track of a headcount of persons present in the camp at any given time
- Encourage the use of flameproof material for the construction of the labor housing/ site office. Also, ensure that these houses/ rooms are of sound construction and capable of withstanding windstorms/ cyclones,
- Provide the appropriate type of firefighting equipment suitable for the construction camps,
- Display emergency contact numbers clearly and prominently at strategic places in camps,
- Warning/ Cautionary signs/ Emergency exits to be appropriately marked at the site and be well known to, and easily understood by workers, visitors, and the general public as appropriate.
- Exits should be marked to be visible in total darkness.
- Communicate the roles and responsibilities of laborers in case of emergency in the monthly meetings with contractors,
- Place display boards at strategic locations within the camps containing messages on best hygienic practices.

Site restoration:

- Disinfection of the entire area before commencing other works
- The Contractor shall Dismantle and remove from the site all facilities established within the construction camp including the perimeter fence and lockable gates after the construction work
- Dismantle camps in phases and as the work gets decreased and not wait for the entire work to be completed,
- Give prior notice to the laborers before demolishing their camps/ units,
- Maintain the noise levels within the national standards during demolition activities,

- Different contractors shall be hired to demolish different structures to promote recycling or reuse of demolished material,
- Reuse the demolition debris to a maximum extent. Dispose of remaining debris at the designated waste disposal site, Clean sludge from septic tanks; dismantle the tanks and dispose or shift to another site; Pit shall be covered and compacted with soil and leveled

Day Crèche Facilities:
At every construction site, provision of a day crèche shall be worked out to enable women to leave behind their children. At construction sites where 20 or more women are ordinarily employed, there shall be a safe structure that is fireproof, for use of children under the age of 6 years.

ECoP 04: Guidance on Waste Management

Construction and Demolition waste:

- Disposal of the waste as per the C&D waste management rules.
- Preparation of debris management plan and getting it sanctioned from AMC.
- The Contractor shall establish and enforce daily site clean-up procedures, including maintenance of adequate disposal facilities for construction debris.
- C & D waste materials should be reused as far as possible.
- Asbestos sheets, batteries, CFL lights to be disposed of as per the Hazardous Waste Management rules
- Debris generated due to the demolition of the existing structures shall be suitably reused, to the extent feasible. The disposal of remaining debris shall be carried out only at sites identified and approved by local authorities
- The contractor should ensure that these disposal sites are not located within the designated forest areas, do not impact natural drainage courses, dispose of any material into environmentally sensitive areas.
- The generator shall ensure that other waste (such as solid waste) does not get mixed with this waste

General waste

- Adopt the 3R (Reduce, Recycle and Reuse) approach to minimize the production of wastes.
- Segregate and reuse/ recycle wherever practical.
- Prohibit burning of solid wastes at the construction site. Collect and transport non-hazardous wastes through authorized vendors.
- Vehicles transporting solid wastes shall be covered with tarps or nets to prevent spilling wastes or liquid along the route during transport.
- Train and instruct all personnel in waste management practices and procedures as a component of the environmental induction process.
- Provide refuse containers with appropriate color coding at each worksite.
- Request suppliers to minimize packaging where practicable.
- Place a high emphasis on good housekeeping practices.
- Maintain all construction sites in a cleaner, tidy and safe condition and provide and maintain appropriate facilities as temporary storage of all wastes before transportation and final disposal.

Hazardous waste:

- Store, transport, and handle all chemicals avoiding potential environmental pollution.
- Store all hazardous wastes appropriately in bounded areas away from watercourses.

- Make available Material Safety Data Sheets (MSDS) for hazardous materials on-site during construction.
- The Contractor shall be responsible for safe and environmentally sound management of hazardous wastes.
- Provide persons working on the site with appropriate training, equipment, and the information necessary to ensure their safety.

ECoP 5: Fuels and Hazardous Material Management

- Prepare spill control protocol and submit the plan to PIU for approval.
- Train the relevant construction personnel in the handling of fuels and spill control procedures.
- Store dangerous goods in bounded areas on top of a sealed plastic sheet away from watercourses.
- Refueling shall occur only within bounded areas.
- Make available MSDS for chemicals and dangerous goods on-site.
- Provide PPEs like protective clothing, safety boots, helmets, masks, gloves, goggles, etc. to the construction personnel.
- Make sure all containers, drums, and tanks that are used for storage are in good condition and are labeled with an expiry date.
- Any container, drum, or tank that is dented, cracked, or rusted might eventually leak. Check for leakage regularly to identify potential problems before they occur.
- Store hazardous materials above flood plain level.
- Put containers and drums in temporary storage in clearly marked areas, where they will not be run over by vehicles or heavy machinery.
- Take all precautionary measures when handling and storing fuels and lubricants, avoiding environmental pollution.

ECoP 6: Water Resource Management

- Minimize the generation of sediment, slurry, oil and grease, organic matter, litter, debris, and any form of waste (particularly petroleum and chemical wastes). These substances must not enter waterways, stormwater systems, or underground water table
- Install temporary drainage works (channels and bunds) in areas required for sediment and erosion control and around storage areas for construction materials
- Install temporary sediment basins, where appropriate, to capture sediment-laden runoff from the site
- Stockpile materials away from drainage lines
- Wash out ready-mix concrete agitators and concrete handling equipment at washing facilities off-site or into approved bounded areas on site.
- Ensure that the tires of construction vehicles are cleaned in the washing bay (constructed at the entrance of the construction site) to remove the mud from the wheels.
- Liquid spills of lubricant, fuel, and oil within the site should be attended at the earliest to minimize surface & groundwater contamination.
- The contractor must take all the efforts to prevent wastes (solid and liquid) discharge into surface and groundwater

Soil erosion and siltation

- Stabilize the cleared areas not used for construction activities with vegetation or appropriate surface water treatments a soon as practicable following earthwork to minimize erosion
- Ensure that roads used by construction vehicles are swept regularly to remove sediment.

- Spray water on material stockpiles, access roads, and bare soils on a required basis to minimize dust. Increase the watering frequency during periods of high risk (e.g. high winds, high temperature, etc.).

ECoP 7: Drainage Management

- Protect natural slopes of drainage channels to ensure adequate stormwater drains.
- Regularly inspect and maintain all drainage channels to assess and alleviate any drainage congestion problem.
- Prevent infiltration of contaminated drainage through stormwater management design.
- Ensure the internal roads/ hard surfaces in the construction yards/ construction camps that generate stormwater drainage to accommodate high runoff during a downpour and that there is no stagnant water in the area at the end of the downpour.
- Provide appropriate silt collector and silt screen at the inlet and manholes and periodically clean the drainage system to avoid drainage congestion.
- Cover the unused areas of disturbed or exposed surfaces immediately with mulch/ grass turfing/ tree plantations.
- Locate stockpiles away from drainage lines.
- Remove debris from drainage paths and sediment control structures.
- Cover the loose sediments and then spray water, if required.
- Properly divert natural runoff around construction areas before any site work.
- Install protective measures on-site before construction, for example, sediment traps

ECoP 8: Topsoil Management

- Topsoil can be mixed with organic material such as compost or manufactured soil amendments to improve the growing capability of seeded and planted vegetation.
- Strip the topsoil to a depth of 15 cm and store in stockpiles of height not exceeding 2m.
- Remove unwanted materials from topsoil like grass, roots of trees, and similar others.
- Topsoil stockpiles shall not be made near/ along drainage lines. It shall be protected from erosion
- Provide cut-off drains channels and silt bunds around the topsoil stockpiles to prevent erosion of topsoil
- The stored topsoil to be utilized for covering all disturbed areas and along with the proposed plantation sites

ECoP 9: Air Quality Management

- Material vehicles to be covered to minimize dust.
- Water sprinkling to be carried out for dust suppression
- DG sets have acoustic enclosure along with sufficient stack height of 3m to be used at construction site complying with emissions norms notified by MoEF&CC/ CPCB.
- The vehicles and equipment used in the construction activities to be routinely serviced and maintained with a valid Pollution Under Control (PUC) Certificate
- While clearing the debris the area should be sprinkled with water to reduce dust emissions.
- As far as practicable, construction activity to be halted during the periods of sustained strong winds

ECoP 10: Noise and Vibration Management

- Regular maintenance and servicing of machinery and equipment to minimize its operational noise.
- Maintain all equipment in good working condition following manufactures maintenance procedures/ protocols.
- Construction equipment and machinery will be fitted with silencers and maintained properly.

- The timing of noisy construction activities will be regulated near residential areas and sensitive receptors.
- Where feasible traffic will be re-routed during construction to avoid the accumulation of noise beyond standards
- Provision of temporary noise barrier will be made near identified sensitive locations or the noise source during construction.
- PPE (earplugs or earmuffs) to be provided to the workers operating in the vicinity of high noise generating machines

ECoP 11: Road Transport and Traffic Management

- Prepare traffic management plan before commencing work on any project component involved in traffic diversion
- Provide signs and display boards at road intersections that show the following information:
  -Type of project/ construction work
  -Duration of construction work
  -Name and contact of the PIU/ Contractor

ECoP 12: Cultural and Religious Issues

- Inform the public through consultations and newspaper announcements regarding the scope and schedule of construction, as well as certain construction activities causing disruptions or access restriction.
- Restrict all construction activities within the footprints of the construction sites.
- Do not block access to cultural and religious sites
- Prepare a mechanism that allows local people to raise grievances arising from the construction process.

ECoP 13: Occupational Health and Safety

- Regular safety meetings and toolbox talks
- Safety awareness training and induction training are to be carried out to ensure that all personnel is aware of specific hazards in their work area.
- Provide personal protective equipment (PPE) for workers, such as safety boots, helmets, masks, gloves, protective clothing, goggles, full-face eye shields, and ear protection.
- Monthly safety inspections to be carried out on-site and documented.
- Provide workers with clear and understandable, documented information regarding their rights under national labor and employment law and any applicable collective agreements.
- Accident reporting system to be implemented and records to be maintained
- Identify potential hazards to workers, particularly those that may be life-threatening, and provide necessary preventive and protective measures
- Provide training to workers and ensure a safe work environment,
- Mock drills and training to be conducted on-site
- Records of Preliminary Incident Report, Incident Investigation Report to be kept.
- Use of oxygen mask for every laborer in the excavated pit to be ensured
- Proper lightening and airflow shall be ensured in the excavated hole

ECoP 14: Community/ Public Health and Safety

The safety and health of the public are impacted due to the hazards created during the construction period. Measures that need to be taken to mitigate the impacts are as follows:

Pre-construction Stage

To incorporate public health and safety concerns, the PIU and the Contractor shall disseminate the following information to the community:

- Location of subproject activities,
- Borrow areas,
- Extent of work
- Time of construction
- Involvement of local laborers in subproject construction
- Health issues - exposure to dust, communicable diseases, etc.

Construction Stage

- Proper safety/ warning signs are to be installed by the contractor to inform the public of potential health and safety hazard situations during the construction phase in the vicinity of the project.
- The PIU shall carry out periodic inspections to ensure that all the measures are being undertaken as per this ECoP.

Post-construction Stage

- The construction site shall be cleaned of all debris, scrap materials, and machinery on completion of construction for the safety of the public and users.

ECoP 12: Guidance on Labour Work Safety during COVID 19

Provided in Labour Management Plan.

Section VII: GBV/ SEAH Risk Mitigation Framework (ESS 1)

Understanding GBV

GBV is an umbrella term for any harmful act that is perpetrated against a person's will and that is based on socially ascribed gender differences. GBV includes acts that inflict physical, mental, sexual harm or suffering; threats of such acts; and coercion and other deprivations of liberty. GBV also affects men, boys, and sexual minorities or those with gender-non-conforming identities. Disproportionately, however, GBV affects women and girls throughout their lifecycle, with profound, long-term impacts on well-being, agency [1], and self-actualization, including educational achievement, livelihood and employment prospects, physical and emotional health, involvement in civic activities, and many more. GBV greatly undermines the ability of survivors, and often their families, to engage in meaningful and productive lives. The key definitions of GBV are described in subsequent sections.

35% of women worldwide have experienced either non-partner sexual violence or physical and/ or sexual intimate partner violence (IPV) (WHO 2013), both manifestations of Gender-Based Violence. Violence against women in India is systematic and occurs in the public and private spheres. It is underpinned by the persistence of patriarchal social norms and inter- and intra-gender hierarchies. Women are discriminated against and subordinated not only on the basis of sex, but on other grounds, such as caste, class, ability, sexual orientation, tradition, and other realities. Women are subjected to different forms of violence including intimate partner violence, sexual violence, early marriage, forced marriage, deprivation of freedom of movement and of choice.

GBV in Major Infrastructure Projects

Large infrastructure projects often involve major civil works[2] that require labour force and associated goods and services that cannot be fully met by local supply. In such cases, workers are often brought in from outside the project area. Under G-ACRP, large scale construction activities are envisaged only for a few sub-projects[3]. However, all project interventions would create a presence of migrant workers due to the likely inability of local communities to fulfil the need for skilled manpower requirement. Other than this, there will also be a floating population of suppliers and transporters for the whole duration of the projects. This influx of workers can exacerbate existing GBV risks and even create new ones. Major civil works can exacerbate the risk of GBV in both public and private spaces by a range of perpetrators in many ways, for example[4]:

- Projects with a large influx of workers may increase the demand for sex work—even increase the risk for trafficking of women for the purposes of sex work—or the risk of forced early marriage in a community where marriage to an employed man is seen as the best livelihood strategy for an adolescent girl. Furthermore, higher wages for workers in a community can lead to an increase in transactional sex. The risk of incidents of sex between laborers and minors, even when it is not transactional, can also increase.
- Construction workers are predominantly young males, typically separated from their families on a construction job for extended periods of time. They can therefore act outside their normal spheres of social control, which can lead to a spectrum of unacceptable and illicit behaviours,

[1]At the individual level, agency means the capacity to make decisions about one's own life and act on them to achieve a desired outcome, free of violence, retribution, or fear.

[2]Major civil works include construction, maintenance and/or upgrading of infrastructure (transport, energy, water & sanitation, irrigation and urban infrastructure, school or hospital construction, etc.) and related supervision oversight, as well as technical assistance activities related to such projects.

[3] Project Appraisal Document of G-ACRP

[4]Good Practice Note: Addressing Gender Based Violence in Investment Project Financing involving Major Civil Works, 28 September 2018, the World Bank group.

including sexual exploitation and abuse of women and girls and illicit sexual relations with minors from the local community.

- Projects create changes in the communities in which they operate and can cause shifts in power dynamics between community members and within households. Male jealousy, a key driver of GBV, can be triggered by labour influx on a project when workers are believed to be interacting with community women.

Legal and Policy Environment for Women's Safety

International Instruments: The international legal and policy framework establishes standards for action by countries to meet their legal obligations and policy commitments to address violence against women. Some of the key International instruments[5] for the protection of women include the following:

- **United Nations General Assembly, Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW):** Under CEDAW, States ensure through competent national tribunals and other public institutions the effective protection of women against any act of discrimination and refrain from engaging in any practice of discrimination against women and to ensure that public authorities and institutions shall act in conformity with this obligation.
- **Fourth World Conference on Women, Beijing Declaration and Platform for *Action:*** The Platform for Action states that 'women may be vulnerable to violence perpetrated by persons in positions of authority in both conflict and non-conflict situations. Training of all officials in humanitarian and human rights law and the punishment of the perpetrators of violent acts against women would help to ensure that such violence does not take place at the hands of the public officials in whom women should be able to place trust, including police and prison officials and the security forces' (Para. 121).
- **United Nations General Assembly, Resolution 52/ 86 on Crime Prevention and Criminal Justice Measures to Eliminate Violence Against Women**
- **World Bank's Guidance note on Management of Labour Influx, 2016.** The document provides guidelines to address issues and risks arising from influx of migrant labour leading to gender-based violence, forced labour etc.

National Instruments

- India has signed and ratified **Convention on Elimination of Discrimination against Women (CEDAW)**[6]**.** Since then, the national policy for Women 2016 and other policies and amendments on acts has been reflecting the principles highlighted in the related international conventions. The goal of this Policy is to bring about the advancement, development, and empowerment of women.
- **The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013,** aims to prevent and provide redressal of complaints of sexual harassment. One of the main provisions in this act is that it calls for constituting an Internal Complaints Committee at each office or branch with 10 or more employees/ workers.

Gaps in Gender Institutional and Legal Framework

Despite the above-mentioned positive developments, deeply entrenched patriarchal attitudes, and the ineffective implementation of those laws and the allocation of financial resources to support their execution adequately is reportedly lacking in many instances as outlined below:

- Sexual violence, including rape and sexual harassment, is widespread across the country and perpetrated in public and private spaces. There is a general sense of insecurity for women in public spaces, especially in urban settings. Women are easy targets of attacks, including sexual violence,

[5]*Gender based violence: A guide for capacity building of gender responsive police service delivery: Institute for Development & Communication / International Development Research Centre*
[6]*http://treaties.un.org/*

whether while using public transportation or sanitation facilities or on the way to collect wood and water.

- Although the Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013 Act seeks to prevent the revictimization of victims who are unable to provide adequate proof or substantiate a complaint, in practice, women are reluctant to raise complaints against their male colleagues especially seniors.

Good Practices for Assessing, Addressing & Monitoring GBV

Finding solutions to reduce and respond to GBV is critical due to the high prevalence and social acceptability of violence against women and girls. The World Bank Good Practice Note[7] provides a comprehensive understanding of the nature and kinds of GBV (appended). The GPN establishes an approach to identifying risks of GBV, in particular sexual exploitation and abuse and sexual harassment, that can emerge in major infrastructure projects with civil works contracts. The GPN builds on World Bank experience and good international industry practices, including those of other development partners.

Methodology of addressing GBV

The GPN outlines the three Step that need to be undertaken during project preparation and implementation[8] as described below.

- **Identify and assess** the risks of GBV during preparation as part of exercise of undertaking ESDD/ ESIAs including social and capacity assessments and include measures for their mitigation in project design. Ideally, this is done during project preparation, with the understanding that GBV risk assessment is a continuous process and should take place throughout the project life cycle as GBV can occur at any moment.
- **Address** the risks during project implementation by identifying and implementing appropriate GBV risk mitigation and monitoring measures – that are commensurate to the risk level, on an ongoing basis
- **Respond** to any identified GBV incidents, whether related to the project or not, ensuring that effective monitoring and evaluation mechanisms are in place to report on such incidents and to monitor follow up.

Measures to address the Gender Gaps

Gap: Victims not reporting due to fear of reprisal and social stigma

Measure: The GRM will be handled by a capable and ethical GBV Service Provider who will be able to offer a suite of services to the survivor (health, legal, security etc). They will establish close ties with various civil departments like police, healthcare, judicial, Anganwadi, Asha Jyoti Kendra etc for their effective functioning. The GBV Service provider, in co-ordination with the GBV specialist within G-ACRP PIU, will route the complaints to the correct department and follow-up for redressal. Signing of CoCs by all workers and sensitization training's for workers at all levels will also be carried out in the project.

***Gap*:** Sexual Harassment of women in workplace despite of PoSH Act 2013

Measure: ICC committees will be formed/ strengthened as described in the action plan.

Assessment of GBV Risk and Capacity to respond

The GBV risk assessment process for G-ACRP comprised of the following:

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[7]Good Practice Note: Addressing Gender Based Violence in Investment Project Financing involving Major Civil Works, 28 September 2018, the World Bank group.

[8]Good Practice Note: Addressing Gender Based Violence in Investment Project Financing involving Major Civil Works, 28 September 2018, the World Bank group.

i. Review of existing surveys and research available at the national & State level.
ii. Assessment of Area of Impact

Table A- 6: Assessment of Area of Impact

Sl.No.	Areas of impact	Reasons
1	**Women workers at Construction sites**.	○ Since the planned project intervention is expected to take 3 to 5 years, the migrant workforce is required to stay for long durations. It is likely that the workers will come in contact with the local community and vice-versa. With varied cultural and economic backgrounds, the likely interactions between communities and workers may lead to potential GBV risks. ○ Cultural insensitivity towards women and the stigma associated with GBV, makes women silent and/ or are sceptical about a sincere and unbiased redressal.[9] ○ Lack of adequate and safe means of commuting to the project site and back. The risks are augmented significantly if travel is required at night. ○ There is lack of awareness of compliance to PoSH Act [10] in institutions. Women staff are often not aware of the escalation matrix (within the organization) for such violations. ○ Absence of Separate toilets for women at sites
2	**Community Women and Girls in adjoining communities**	The project interventions will cause an increased interaction between the staff/ workers and the communities and could exacerbate GBV risks as outlined below: ○ The movement of transport vehicles through the residential areas could make the public places (like markets, schools, playgrounds, access roads etc.) unsafe for women, adolescent girls, and children. ○ Some of the project works could take place in the vicinity might have interface with communities and for a longer duration
3	**GBV Hotspots – Labor camps**	Labour camps are sometimes negligent in following national labour laws with regards to safety and security provisions for women labourers. The key reasons that lead to incidents of GBV within the labour camps are: ○ Absence of adequate provisions for sanitation and water. ○ Same toilets and bathing areas for men and women. ○ No doors or broken locks on toilets doors. ○ Absence of creche and lack of privacy for lactating mothers for feeding their children. ○ Inadequate accommodation for women workers; women workers having to sleep in the open in the same area as men. ○ Inadequate lighting in the camps and the toilets. ○ Absence of adequate security personnel in the camp. ○ Lack of knowledge of an escalation matrix and coupled with the scepticism of a fair redressal.

[9]A recent study by Oxfam India across 8 cities showed that 17% of working women in India had faced sexual harassment at work and an overwhelming majority of them did not resort to any formal action against the perpetrator for the fear of 'losing the job' and 'absence of complaint mechanisms at the workplace'.

*[10]ICC committee to be constituted under the Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013 ("**POSH Act**")*

4	**GBV Hotspots Education institutions (including schools, colleges, vocational training centres)**	Children and adolescent girls in all educational institutes in the adjoining communities of the construction site, are susceptible to the risks of GBV perpetrated by the migrant and floating population of workers.

iii. Feed the site-specific data into the Risk Assessment Tool for each Dam sub-project and arrive at a score to determine the risk level

Risk Tier	Score out of 25
Low risk	0 – 12.25
Moderate risk	12.5-16
Substantial Risk	16.25-18
High Risk	18.25-25

iv. Developing a GBV Risk mitigation guideline for G-ACRP as per the above finding and the actions described in the GBV Risk Mitigation Framework below:

GBV ACTION FRAMEWORK

The steps and measures of the GBV Action Framework are summarized in ***Table A-7*** below:

Table A- 7: Actions to address project induced SEA/ SH Risks (By Level of Risk)

Key Action to Address SEA/ SH Risks	L	M	S	H	By when	By Whom
Include SEA/ SH risks in ESIAs *(based on visits, risk assessment tool, interactions); No prevalence data or baseline data should be collected as part of risk assessments)*	√	√	√	√	Preparation	PIU
Map out GBV service providers/ response actors in communities adjoining the projects	√	√	√	√	Preparation Implementation	PIU
Include adequately SEA/ SH risks, GBV service provider in mitigation plans documents – Project ESMP, C-ESMP	√	√	√	√	Preparation	PIU/ Contractor
Develop SEA/ SH Prevention and Response Action Plan including an Accountability and Response Framework, as part of the ESMP.	X	X	√	√	Preparation	PIU/ Contractor
Inform & Consult those affected by the project, of the SEA/ SH risks and project activities, to get their feedback on project design and safeguard issues.	X	X	√	√	Through-out project cycle	• GBV Focal Point at PIU • GBV Service Provider
Address SEA/ SH-related issues in the SEP of the project to keep the local communities and other	◯	◯	√	√	Through-out project cycle	• GBV Focal Point at PIU

Key Action to Address SEA/ SH Risks	L	M	S	H	By when	By Whom
stakeholders informed about the project's activities						• GBV Service Provider
Create an effective SEA/ SH GRM with multiple channels; should have specific procedures for SEA/ SH, including confidential reporting with safe and ethical documenting of SEA/ SH cases.	√	√	√	√	Prior to contractor mobilizing.	• GBV Focal Point at PIU • GBV Service Provider
Ensure GBV Focal Point to support project preparation	√	√	√	√	Preparation	PIU
Engage Third Party Monitoring (TPM) organization with experienced GBV staff to monitor implementation of the SEA/ SH Prevention and Response Action Plan.	X	X	◯	√	Preparation	PIU
Ensure funding is available to PIU for recruiting GBV Service Providers	X	X	◯	√	Preparation	PIU
Clearly define SEA/ SH requirements in Bid-documents and also the requirement for a CoC which addresses SEA/ SH	√	√	√	√	Preparation	PIU
Review C-ESMP to verify that appropriate mitigation actions are included.	√	√	√	√	Periodic during Implementation	PIU
Review SEA/ SH GM's reception and processing of complaints regularly to ensure that the protocols are being followed in a timely manner for addressing the SEA/ SH complaints arising in the project.	√	√	√	√	Implementation.	• GBV Focal Point at PIU • GBV Service Provider.
Ensure Codes of Conduct are clearly understood and signed by those with a physical presence at the project site; Train project staff on the behaviour obligations under the CoCs and Disseminate CoCs (including visual illustrations) and discuss with employees and local communities.	√	√	√	√	Upon contractor mobilization	• Contractor. • Consultant. • PIU Staff.
Train Project workers and local community on SEA/ SH	√	√	√	√	Implementation	• PIU • Contractors, • Consultants
Undertake regular M&E of progress on SEA/ SH prevention and response	√	√	√	√	Implementation	• GBV Focal Point at PIU

Key Action to Address SEA/ SH Risks	L	M	S	H	By when	By Whom
activities, including reassessment of risks as appropriate.						• GBV Service Provider, • Contractors, • Consultants
Implement appropriate project-level activities such as: • separate, safe, and easily accessible facilities for women and men in the place of work and the labour camps. (e.g. toilets should be located in separate areas, well-lit) • display signs that the project site is an area where SEA/ SH is prohibited.	√	√	√	√	Prior to works commencing.	• Contractor (implementation). • GBV Focal Point at PIU • GBV Service Provider

√: Action recommended; ◯: Action may be considered; ×: Action not required

The actions are further elaborated below

i. **Designating GBV Focal Point/ Hiring GBV Specialists (for Substantial or High-risk sub-projects[11]):** Designating/ hiring of a GBV specialist in these departments will assist in meeting the necessary GBV requirements and oversee all GBV activities of the project which includes:
   - Strengthening of the ICC Committee.
   - Working closely with the GBV service providers for developing and implementation of the GBV prevention and response strategy.
   - Supervision, oversight, monitoring and reporting of GBV strategy.
   - Channelizing the complaint appropriately for redressal (ICC committee in case the perpetrator is a staff member or the contractor for workers on contractor's payroll).
   - Following-up for redressal and either closing the case if the issue is resolved or escalating.
   - Develop IEC material in regional language and display adequate number of posters and signages with good visibility, all over the construction site and other hot spots, conveying the participating State's policy against sexual harassment in the workplace; zero tolerance for SEA or SH in the project, and contact persons for escalation and all help line numbers for reporting GBV incidents.
   - Supervision and oversight of labour camps to ensure that suitable work and accommodation conditions for migrant women labourers is provided for which is in accordance with country labour laws and WB ESS2. This includes, safety & security issues, child care facilities, health and sanitary requirements and separate toilets for women, gender-equal wage rates and temporary housing for families of labourers during the construction work at the labour camp site with strict compliance to availability of water and sanitation facilities.
   - Develop a Code of Conduct for the project and a strategy for implementing it.

ii. **Mapping & Contracting of GBV Service Providers[12]:** GBV Service Providers are critical in addressing any case of GBV that may arise and in assisting the project to proactively prevent GBV cases. After a thorough capacity assessment, PIU shall map and engage a GBV Service Provider/s

[11] *Assessment would be carried out by using the GBV risk assessment tool*
[12] *For Substantial and High risk operations.*

in the area in case GBV risk is identified as High. For an effective GBV plan execution, GBV service provider engaged with the project, will report directly to the PIU and will be managed and monitored by the GBV Specialist at PIU. Broadly the role of the GBV Service Provider is explained below:

- Creating synergies with various actors in community is the key to managing GBV risks. GBV service providers will identify active community members, women's groups, Gram Panchayat, and other Community Based Organization in the adjoining areas. Stakeholder guidance will be sought to identify existing and potential local GBV risks, and they will be consulted on interventions and risk mitigation measures. Consultations with those working with at-risk groups, will be prioritized to enable understanding of GBV risks and trends in the community.
- The GBV Service Providers will engage in continuous consultations/ dialogue with local communities in the project's adjoining areas throughout the life of the project. These regular consultations will provide opportunities to share information with communities on project-related risks, reporting, response measures, and in identifying new issues that may be arising with regards to GBV. This means the consultations will have a particular focus on women, children, and other at-risk groups—each of which may require different approaches to enable a safe space for discussion.
- Hot Spots will be identified, and close monitoring of these areas will be done throughout the project life cycle.
- Awareness Raising Strategy will play an important role in the risk mitigation process. GBV Service providers will regularly sensitize stakeholders and citizens about GBV risks exacerbated in the community by the project intervention and the redressal mechanism devised by the project management. The worker's CoC, GRM, principle of confidentiality of information, and all ways for submitting the GBV grievances will be explained.
- A GBV GRM will be managed by the project's GBV Service Provider and overseen by the GBV Specialist hired at PIU.
- Multiple channels will be made available (phone numbers of GBV Service Provider, for reporting GBV and checked regularly for proper functioning.
- GBV Service providers will periodically inspect the labour camps for living conditions to be in line with the Labour Laws of India and the Environment and Social Safeguard policies of the World Bank, since such adherence will help reduce risk of GBV in the labour camps, significantly.

iii. Addressing GBV risk and responses to GBV incidents

To properly address GBV risks, Implementing Agency will mandatorily set up GRM for workers and community members, prior to contractor's mobilization.For GBV—and particularly SEA and SH—complaints, there are risks of stigmatization, rejection, and reprisals against survivors. The GRM therefore needs to have multiple channels through which complaints can be registered in a safe and confidential manner. GRM operators should be trained on how to collect GBV cases confidentially and empathetically (with no judgment). The GRM should not ask for, or record, information on no more than three aspects related to the GBV incident[13]:

Accountability and Response Framework

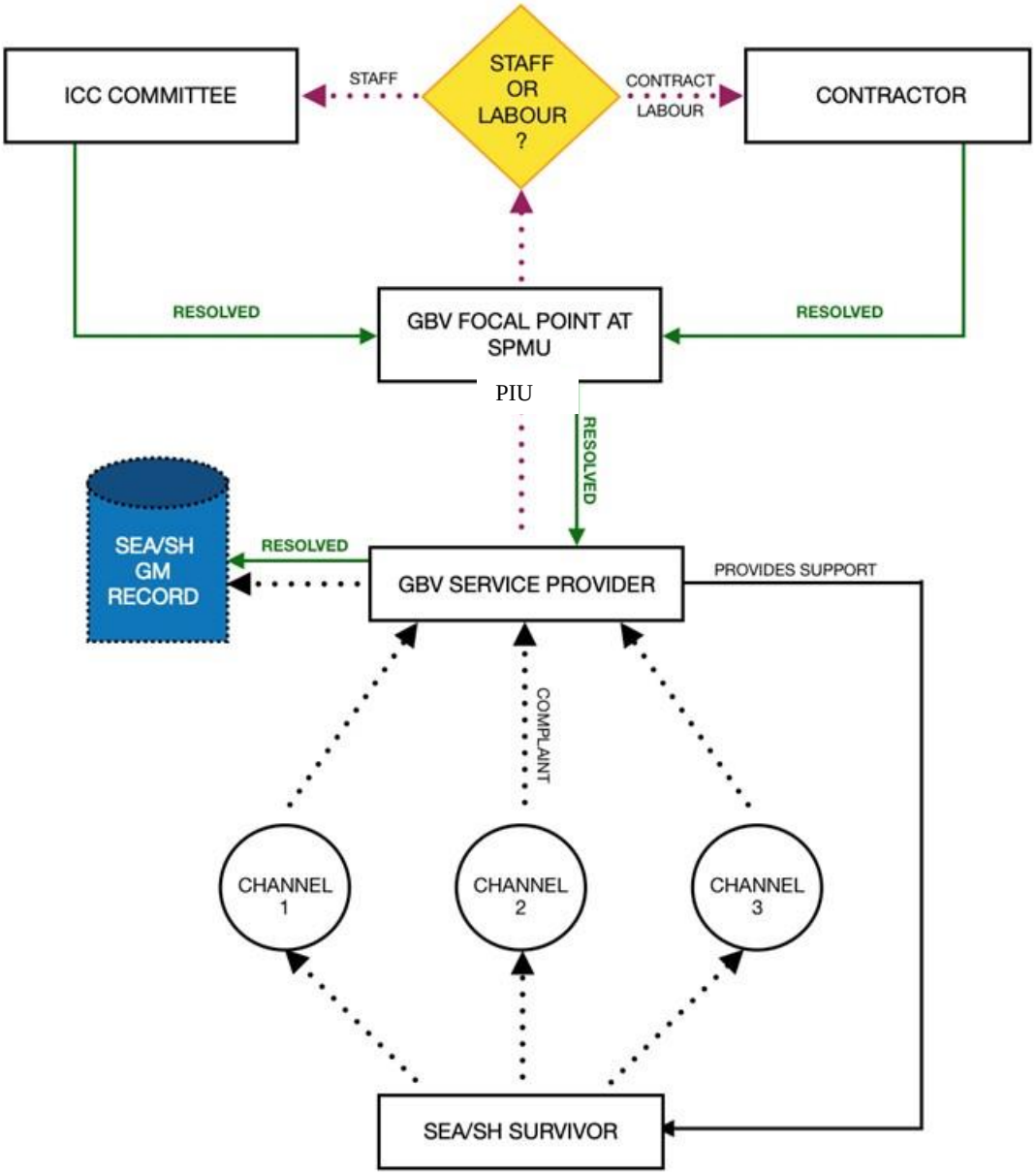
- As illustrated in the diagram below, the GBV survivor can lodge a complaint of SH or SEA through multiple channels like helpline number. The request will be received by the GBV Service provider. Owing to the sensitive nature of the complaint and the need for confidentiality, the GBV Service Provider will log only the following information in their records:
    - Nature of the complaint

[13]*Good Practice Note: Addressing Gender Based Violence in Investment Project Financing involving Major Civil Works,28 September 2018, the World Bank group*

- The age of the survivor
- If the perpetrator was associated with the project.

- Upon gaining the consent of the survivor, this information will be shared with the GBV Focal point/ Specialist in PIU.
- The GBV Service Provider will support the survivor with all the services needed (medical, paralegal, security, psycho-social, shelter etc), either through its own capabilities or through its institutional linkages.
- The GBV Specialist will be informed about the GBV incident as soon as it happens. Depending on whether it is a staff member or a contracted worker, either the escalation will be made to the appropriate level or the complaint will be sent to the contractor for necessary action.
- Upon redressal, then the GBV Service Provider will be informed by the GBV Specialist so that the case can be marked - "Closed" in the GRM record, along with the date of closure.

INSTITUTIONAL ARRANGEMENT FOR GBV FRAMEWORK IMPLEMENTATION



iv. Code of Conduct and Strategy for Implementation

Code of Conduct defines the mandatory Dos and Don'ts expected from each staff member, worker, contractor, and supplier/ vendor associated with the project and having footprint on the project site. A worker's Code of Conduct will be introduced and made a part of the employment contract and signed by all. At the time of signing, workers will be explained the required strict compliance of the CoC and the sanctions for a possible breach of the Code (e.g. termination). indicative CoC is appended in this section. Implementation of the CoC will be carried out as per strategy outlined in this section. The "Accountability and Response Framework" will be developed by PIU which defines a mechanism to hold accountable alleged perpetrators associated to the project and timeframe within which the supervisor/ contractor is expected to take action.[14] Mandatory trainings (appended) for the workforce on: state and department policies on sexual harassment in the workplace; unacceptable conduct toward local community members, specifically women; GBV CoC; "Zero tolerance" for SH and SEA; GRM for "reporting and response" of GBV incidents will be conducted regularly.

v. **E&S documents and Contractor's Bid document**

The client's E&S documents should identify the risk of SEA/ SH and propose prevention and mitigation measures—particularly through the project ESMP. The project ESMP is usually the foundation for the C-ESMP, which is the plan prepared by the contractor outlining specifically how it will implement the civil works activities in accordance with the project ESMP's requirements and with the contract.

Embedding SEA/ SH requirements in procurement processes is a critical mechanism to ensure legal accountability for addressing SEA/ SH in projects. Requisite provisions will be included in the bid documents as well, so that the contractors are aware of all required roles and responsibilities of GBV action plan and accordingly price the bids.

vi. Training

GBV COC Training to workers/ staff at all levels, will broadly cover:

- What GBV (particularly SEA and SH) is and how the project can exacerbate GBV risks
- Roles and responsibilities of actors involved in the project (the standards of conduct for project-related staff captured in CoCs).
- GBV incident reporting mechanism, accountability structures, and referral procedures within the project and for community members.
- Services available for survivors of GBV.

Training modality and frequency for all levels of staff/ workers is indicated in this section.

vii. Monitoring and Reporting

- Monitoring will be integrated into the projects safeguard monitoring framework with a special focus on identified Hot Spots.
- GBV action plans will be monitored during Joint Review Meetings (JRM) by a GBV specialist.
- QPRs will include updates on the status of the GBV activities on the project.
    - GBV GRM Indicators
        - Number of GBV cases received
        - Number of GBV cases resolved
        - Time taken to resolve
    - GBV Activities indicators

[14] *Accountability and Response Framework" outlines the disciplinary action for violation of the CoC by workers. It is essential that such actions be determined and carried out in a manner that is consistent with local labour legislation and applicable industrial agreements, otherwise there is risk that the CoC will not be implemented effectively.*

- Successful implementation of agreed GBV Action Plan.
- Number of training courses related to GBV delivered.
- Percentage of workers that have signed a CoC.
- Percentage of workers that have attended the CoC training.

viii. Supervision and Oversight

The supervision of Contractors on civil works under G-ACRP projects shall be done by a Chief Engineer, AMC. This section outlines activities that can be incorporated into the project to make supervision and oversight more proactive. Effective oversight requires various actors with additional ones needed in higher risk projects. All entities involved - supervision consultants, PMC, PIU, etc. must have clear roles and responsibilities throughout the implementation of the project. All those involved in GBV activities should have appropriate training and skills for the tasks assigned to them.

ix. Budget

Budgetary provisions for implementation of GBV plan for the sub-projects under G-ACRP (Ref ***Table A-8***). Requisite provisions will also be included in the bid documents, so that the contractors will be aware all required roles and responsibilities of GBV action plan and accordingly price the bids.

Table A- 8: Budget for Implementation of GBV action Plan (in Substantial/ High Risk Projects)

Sl No	Particulars	Unit	Unit Cost Provision (INR)	Amount (INR)
1	Cost of GBV Service Provider			
2	Hiring of local field support on intermittent requirement basis, training requirement, cost of signage, resource materials and community meets/ interactions etc. *	Lumpsum	Lumpsum	
			Sub Total	
			Contingencies	
Total INR Rounded off to				
INR Only				

Appropriate budgetary allocations shall support and include the process to prevent and respond to GBV in the project. The budgetary provision includes for investment in:

- Staff development and training programs.
- Guidance notes and continuous learning.
- AMC capacity-building on SEA.
- To partner with GBV Services Providers to facilitate access to timely, safe, and confidential services for survivors (including money for transportation, documentation fees, and lodging if needed).

UNDERSTANDING GBV KEY TERMS AND DEFINITIONS

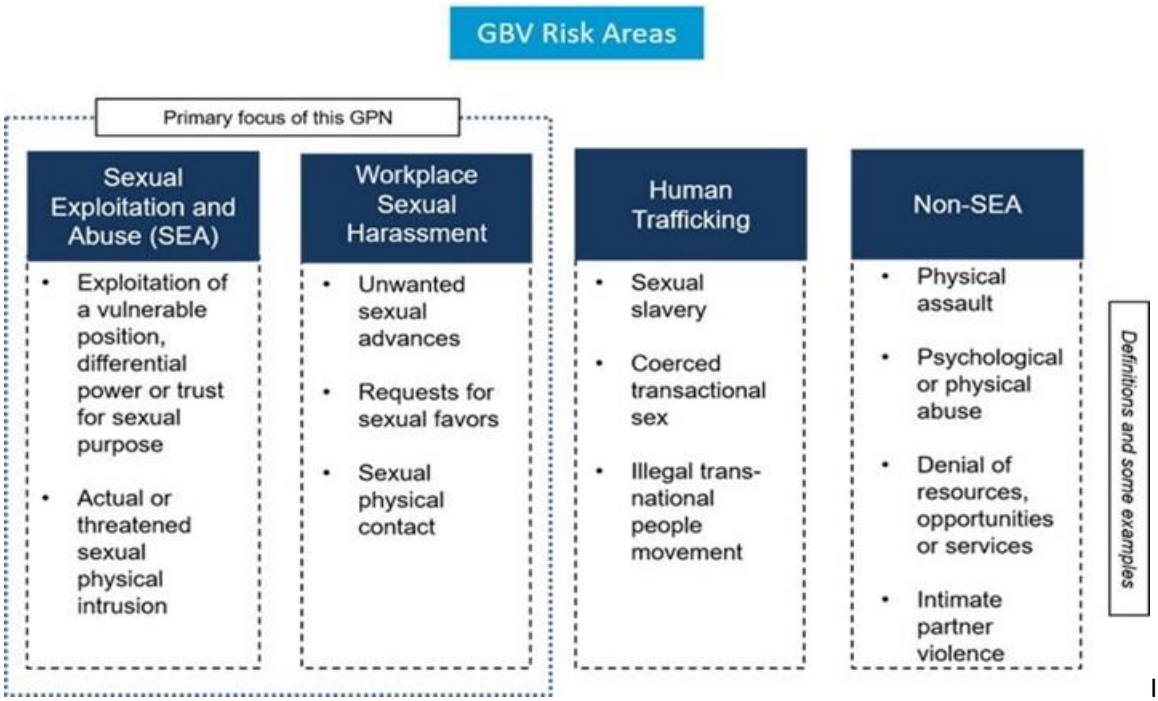
GBV is an umbrella term for any harmful act that is perpetrated against a person's will and that is based on socially ascribed gender differences. GBV includes acts that inflict physical, mental, sexual harm or suffering; threats of such acts; and coercion and other deprivations of liberty, whether occurring in public or in private life. The term GBV, is most commonly used to underscore systemic inequality between males and females - which exists in every society in the world - and acts as a unifying and foundational characteristic of most forms of violence perpetrated against women and

girls. The term GBV stems from the 1993 United Nations Declaration on the Elimination of Violence against Women, which defines violence against women as "any act of gender-based violence that results in, or is likely to result in, physical, sexual or psychological harm or suffering to women". Discrimination on the basis of sex or gender identity is not only a cause of many forms of GBV, but also contributes to the widespread acceptance and invisibility of such violence - so that perpetrators are not held accountable and survivors are discouraged from speaking out and accessing support.

Violence against women and girls (VAWG)	The 1993 UN *Declaration on the Elimination of Violence against Women* defined violence against women and girls as any act of gender-based violence that results in, or is likely to result in, physical, sexual or mental harm or suffering to women, including threats of such acts, coercion or arbitrary deprivation of liberty, whether occurring in public or in private life (Article 1). Violence against women and girls shall be understood to encompass, but not be limited to, the following: • Physical, sexual, and psychological violence occurring in the family, including battering, sexual abuse of female children in the household, dowry-related violence, marital rape, female genital mutilation, and other traditional practices harmful to women, non-spousal violence and violence related to exploitation. • Physical, sexual, and psychological violence occurring within the general community, including rape, sexual abuse, sexual harassment, and intimidation at work, in educational institutions and elsewhere, trafficking in women and forced sex work. • Physical, sexual, and psychological violence perpetrated or condoned by the State, wherever it occurs (Article 2). Violence against women and girls is a manifestation of historically unequal power relations between men and women, which have led to domination over and discrimination against women by men and to the prevention of the full advancement of women.
Gender-based violence (GBV)	Gender-based violence (GBV) is an umbrella term for any harmful act that is perpetrated against a person's will and that is based on socially ascribed (i.e. gender) differences between males and females. It includes acts that inflict physical, sexual, or mental harm or suffering, threats of such acts, coercion, and other deprivations of liberty. These acts can occur in public or in private (IASC 2015). Women and girls are disproportionately affected by GBV across the globe.
Sexual harassment (SH)	Unwelcome sexual advances, requests for sexual favours, and other unwanted verbal or physical conduct of a sexual nature. SH differs from SEA in that it occurs between personnel/ staff working on the project, and not between staff and project beneficiaries or communities. The distinction between SEA and SH is important so that agency policies and staff training can include specific instructions on the procedures to report each. Both women and men can experience SH.
Sexual Exploitation and Abuse (SEA)	Any actual or attempted abuse of a position of vulnerability, differential power, or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially, or politically from the sexual exploitation of another. Sexual abuse is further defined as "the actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions." Women, girls, boys, and men can experience SEA. In the context of World Bank

	supported projects, project beneficiaries or members of project-affected communities may experience SEA.
Child/ Forced early Marriage	Forced marriage is the marriage of an individual against her or his will. Child marriage is a formal marriage or informal union before age 18. Even though some countries permit marriage before age 18, international human rights standards classify these as child marriages, reasoning that those under age 18 are unable to give informed consent. Therefore, child marriage is a form of forced marriage as children are not legally competent to agree to such unions (IASC 2015).
Human Trafficking	The recruitment, transportation, transfer, harbouring or receipt of persons, by means of force, the threat of force, other forms of coercion, abduction, fraud, deception, of the abuse of power, or of a position of vulnerability, or giving or receiving of payments or benefits to achieve the consent of a person, having control over another person, for the purpose of exploitation. Exploitation includes, at a minimum, the exploitation of the sex work of others or other forms of sexual exploitation, forced labour or services, slavery, or practices similar to slavery, servitude, or the removal of organs (United Nations 2000. Protocol to Prevent, Suppress and Punish Trafficking in Persons, Especially Women and Children).

SCOPE OF GBV RISK



IPFs that involve major civil works, focuses on two of the four GBV risk categories that can arise – SEA and Workplace SH. (See ***Figure A-1*** below).

Figure A- 1: GBV Risk areas

GENDER BASED VIOLENCE – CODE OF CONDUCT

1. Compliance with applicable National and Company **laws, policies, rules**, and **regulations** (including policy on sexual harassment).

2. Compliance with applicable **health and safety requirements** to protect the Local Community (including vulnerable and disadvantaged groups), the Employer's Personnel, and the Contractor's Personnel (including wearing prescribed personal protective equipment, preventing avoidable accidents and a duty to report conditions or practices that pose a safety hazard or threaten the environment).
3. Will not use illegal substances.
4. Will **not discriminate** in dealing with the local community and all co-workers. Treat women, children (persons under the age of 18), and men with respect regardless of race, colour, language, religion, political or other opinions, national, ethnic, or social origin, property, disability, birth, or other status.
5. Will not indulge in **Sexual Harassment** (for example prohibition of the use of language or behaviour, particularly towards women and/ or children, that is inappropriate, abusive, sexually provocative, demeaning or culturally inappropriate).
6. **No Violence, including sexual** and/ or gender-based violence (for example acts that inflict physical, mental, or sexual harm or suffering, threats of such acts, coercion, and deprivation of liberties).
7. **No Exploitation** including sexual exploitation and abuse (for example the prohibition of the exchange of money, employment, goods, or services for sex, including sexual favours or other forms of humiliation, degrading behaviour, exploitative behaviour, and abuse of power).
8. Refrain from **Sex** with anyone under the age of 18 and that the breach of this code will incur sanctions that could impact employment.
9. Will not **mix/ interact with children** including sexual activity or abuse, or otherwise unacceptable behaviour towards children (anyone under the age of 18) and ensure their safety in the project areas.
10. **Sanitation** requirements (for example, to ensure workers use specified sanitary facilities provided by their employer).
11. Avoid **conflict of interest** (such that benefits, contracts, or employment, or any sort of preferential treatment or favours, are not provided to any person with whom there is a financial, family, or personal connection).
12. Respect reasonable **work instructions** (including environmental and social norms).
13. Protection and **proper use of property** (for example, to prohibit theft, carelessness, or waste).
14. Will **attend training** for the duration of the contract for understanding this Code of Conduct.
15. Will **report violations** of this Code. All staff must report suspected or actual violations by a fellow worker, whether in the same contracting firm or not. Reports must be made through the GRM setup for this purpose.
16. **Sanctions** may be applied if an employee is confirmed to be a gender-based violence perpetrator. The sanctions will be proportional to the transgression and in accordance with applicable laws and policies.
17. **Non- retaliation** against workers who report violations of the Code, if that report is made in good faith.

I have read and was explained all the contents given above, and I understand the requirement. I shall strictly adhere to this Code of Conduct in all the areas of work. I understand the insistence on compliance with these norms which are mandatory for me.

IR – INCHARGE NAME OF WORKMEN

CONSTRUCTION

DATE:

STRATEGY FOR IMPLEMENTATION OF CoC

Sl No	Particulars/ Actions	Responsibility	Timelines
1	Draft GBV CoC and inclusion in ESMP	Social Specialist at PIU	Before mobilization of contractor.
2	Sharing with AMC staff and all stakeholders through Half day Orientation Programme.	Social Specialist at PIU	Within one month of project effectiveness
3	Inclusion of GBV CoC in ESMP and Bid Documents.	PIU	Bid Documents Preparation/ Finalization Stage
4	Sharing Draft GBV CoC with Contractors and finalizing it	PIU and Social Specialist	Upon mobilization of contractor and before deployment of workforce
5	Signing of the CoC along with the Employment contract by each new worker	Contractor	For all new workers on their first day of employment
6	Inclusion in Health Safety Induction, Toolbox Talk and task Briefing/ Training's for new labour	PIU and Contractor	Monthly and when new workers join. For the complete duration of the project.
7	Training of Health and Safety Engineers/ staff on GBV	Social Specialist at PIU with support from Contractor	Quarterly after the mobilization of contractor and deployment of workforce for the complete duration of the project.
8	Review of QPRs on CoC	Social Specialist in PIU, Contractor	Every 3 months after the mobilization of the contractor, for the complete duration of the project.
9	Joint Review Meeting (JRM)	PIU and WB	Bi-annually after the mobilization of the contractor, for the complete duration of the project.

RESPONSIBILITY AND TIMELINES FOR GBV ACTION FRAMEWORK

Table A-9 below gives a comprehensive list of actions, the accountabilities, and the timeframe.

Table A- 9: Responsibility and actions for GBV Action Framework

Action to Address GBV Risks	Detail	By Whom	By When
Designating GBV Specialist by PIU	He/ she will supervise issues related to GBV (e.g., signing of Codes of Conduct (CoCs), verify working GRM for GBV, monitor activities of GBV Service Provide, routing complaints to the appropriate contractor/ dept within AMC and follow-up for redressal, periodic reporting etc)	PIU	At project initiation. Before mobilization of contractor/s.
Hiring of GBV Service Provider on need basis	PIU will hire a GBV Service Provider after a Capacity Assessment of its abilities to provide quality survivor centred services including security, legal, health care, safe space, case management and also providing referral services to link to other services not provided by it.	PIU	At project initiation
Identification of project's GBV Risks	Mapping of **At-Risk Groups** **Hot Spots**	Social Specialist at PIU	Once before mobilization of Contractor/s; Ongoing throughout

Action to Address GBV Risks	Detail	By Whom	By When
			the life of the Project.
Updation of Project Safeguard Documents	Have GBV risks adequately reflected in all safeguard instruments (i.e., **Project ESMP**)—particularly as part of the assessment in the ESIA. Include the GBV mapping in these instruments.	Social Specialist at PIU	Once before mobilization of Contractor/s; Ongoing throughout the life of the Project.
	Have the GBV Risk reflect in the Contractor's **C-ESMP** which is derived from the ESMP.	Social Specialist at PIU	Once before hiring workforce; Ongoing throughout the life of the project.
Accountability and Response Framework	Develop a GBV Action plan including the **Accountability and Response Framework** as part of the **ESMP**.	Social Specialist at PIU	Once before mobilization of Contractor/s; Ongoing throughout the life of the Project.
	Contractor's response to the Accountability and Response Framework in the ESMP, will be made in **C-ESMP.** C-ESMP will be evaluated at the time of bidding, to evaluate contractor's capacity to address the GBV risks of the project.	Contractor	Once before hiring workforce; Ongoing throughout the life of the project.
Capacity Assessment	Assessment of the local capacity of the GBV Service Provider to prevent and respond to GBV, including the availability of safe and ethical service provision for survivors.	Social Specialist at PIU	Once before hiring the GBV Service Provider/s; Ongoing throughout the life of the project.
Monitoring and implementation of Stakeholder Engagement Plan	As part of the project's stakeholder consultations, those affected by the project should be properly informed of GBV risks and project activities to get their **feedback on project design and safeguard issues**. Consultations need to engage with a variety of stakeholders (political, cultural, or religious leaders, health teams, local councils, social workers, women's organizations, and groups working with children).	Social Specialist at PIU	Once before Contract mobilisation, Consultations need to occur continuously throughout the life of the project.
	The Stakeholder Engagement Plan of the project, which will be implemented over the life of the project will create **awareness** in the local communities and other stakeholders about the project's activities, to specifically address GBV related issues.	Social Specialist at PIU	Once before Contract mobilization, Consultations need to occur continuously throughout the life of the project.

Action to Address GBV Risks	Detail	By Whom	By When
Institutionalizing and monitoring a GRM	Make certain the availability of an effective grievance redress mechanism (GRM) with multiple channels to initiate a complaint. It will have specific procedures for safe and ethical documenting of GBV cases. GBV GRM outside of the project GRM to ensure the requirement for confidentiality and delicate handling.	Social Specialist at PIU	Once before hiring the GBV Service Provider/s; Ongoing throughout the life of the project.
Review GRM	Review that the GRM receives and processes complaints to ensure that the protocols are being followed in a timely manner, referring complaints to an established mechanism to review and address GBV complaints.	Social Specialist at PIU	Ongoing throughout the life of the project.
Code of Conduct Implementation Strategy	**The implementation Strategy for CoC covers the following:** • Codes of Conduct to be created to cover the specific GBV Risks of the project. • Ensure requirements in CoCs are clearly understood by those signing. • Have CoCs signed by all those with a physical presence at the project site. • Train project-related staff on the behaviour obligations under the CoCs. • Disseminate CoCs and discuss with employees and surrounding communities.	Social Specialist at PIU	CoC to be created by PIU prior to mobilization of contractor/s. All CoC implementation activities are ongoing throughout the life of the project.
Training plan for SEA and SH	Have project workers and local community undergo mandatory training on SEA and SH. The training curriculum and schedule to be finalized before civil work begins. Orientation on SH/ SEA to be included in Safety Induction, Tool Box Talk and task Briefing/ Training's for new labour etc.	Social Specialist at PIU	Curriculum and training schedule to be fixed before mobilization of Contractor. Training ongoing throughout the life of the project.
Evaluation and Monitoring of Proper Residential and Working Conditions	Proper residential and work conditions can help reduce GBV Risks. Evaluation and monitoring of the working conditions to be in line with what is proposed as the GBV Action Framework, Labour laws of India and ESS of WB. Reporting and follow-up for deviations found in the facility.	Social Specialist PIU	Once before mobilization of Contractor/s; Ongoing throughout the life of the Project.
Signage	Adequate signages and posters are required to be placed in strategic places in the labour camp, dept and construction site. They will carry the message (in regional language) of "Zero Tolerance" to SH and SH. The IEC material will also have information of access points for reporting GBV.	Social Specialist at PIU	Once before mobilization of Contractor/s; Ongoing throughout the life of the Project.
Reporting	QPRs will report various parameters of the implemented GBV Action Framework. They will be circulated in the PIU	Social Specialist at PIU	Quarterly; Ongoing throughout the life of the project.

Action to Address GBV Risks	Detail	By Whom	By When
Supervision & Oversight	The performance of the GBV Action Framework will be will discussed in JRM for supervision.	Social Specialist at PIU	Bi-annually; Ongoing throughout the life of the project.

MODALITY, FREQUENCY AND CONTENT OF TRAINING

Group	Modality	Frequency	Topic
ICC Members for AMC and GUDM	2-day workshop including power point presentations, Oral discussions, case studies and Group work.	1-2 days orientation workshops every 6 months	• Introduction on GBV, SEA and SH. Identified GBV risks in the project. • National and state policies on SH and roles and responsibilities of ICC committee members. • Potential GBV risks and hotspots in the project. • Understanding of the roles and responsibilities in accordance with the accountability and results framework. • Mitigation strategies and effective implementation of the action plan. • Monitoring and reporting on GBV and GBV GRM.
AMC staff	1-day orientation programme on GBV. Power point presentation, Oral discussions, sharing of best practices andgroup activities	Every 6 months (1 month after the project initiation)	• Introduction on GBV, SEA and SH. Identified GBV risks in the project. • Working with contractors to prevent SH in the workplace (as well as within the agency and the contracting firms) and other forms of GBV in the project-affected communities (for example, through CoCs). • Strengthening GRMs and other monitoring mechanisms to provide safe and ethical reporting systems for people wishing to report cases of GBV, and their linkage with adequate response actors. • Understanding of the roles and responsibilities of the GBV CoC and the accountability and response framework. • Effective implementation of the action plan. • Available service providers working on GBV in the area and other referral pathways.
Contractor and including	1-day orientation program on GBV. Power point presentation	Every 6 months (one month after contractors are engaged)	• What constitutes GBV, SEA and SH. • National, state, and corporate policies on SH

Group	Modality	Frequency	Topic
sub-contractors	Oral discussions, case studies of best practices and group discussions/ work.		• Available service providers working on GBV in the area and other referral pathways. • Strengthening GRMs and other monitoring mechanisms to provide safe and ethical reporting systems for people wishing to report cases of GBV, and their linkage with adequate response actors. • Promoting interventions to reduce the level of tolerance to GBV by contributing to community mobilization around project sites, including the use of partnerships with NGOs, national and local authorities, and other leaders. • Key elements of the CoC, • Strengthening and monitoring of the GBV GRM systems and reporting and response protocols.
Workers	One day orientation. Power point presentations, Oral discussions and group activities.	Every 6 months and daily	• Explaining GBV, SEA and SH and key GBV risks identified. • Key elements of the CoC. • Zero tolerance policy on GBV
Workers	10 mins discussion in the toolbox talks and during safety inductions	Daily	• Explaining GBV, SEA and SH and key GBV risks identified. • Key elements of the CoC. • Zero tolerance policy on GBV
Community volunteers/ focal point	One day orientation. Power point presentations Oral discussions and group activities	Every 3 months	• Explaining GBV, SEA and SH in the context of the project, including identified GBV risks and hotspots. • Awareness about the key mitigation strategies and GRM mechanisms for GBV incidents and response. • Their roles as focal points for continuous dialogue and feedback from the community for GBV prevention and mitigation.

2. ANNEXURES

Annexure A: Baseline Environmental and Social Characteristics of Ahmedabad Region

1. Geographic Location

Gujarat in the North-Western coast of India is among its most urbanized states with a strong industrial base. Located to the north-central part of the state at nearly 100km from the coast (Gulf of Khambhat), is the Ahmedabad district surrounded by districts of Mahesana and Gandhinagar to the north, Sabarkantha to the northeast, Kheda to the east, Gulf of Cambay (Khambhat) and Bhavnagar to the south and Surendranagar to the west.[17] Between 22°55' & 23°08' North latitudes and 72°30' & 72°42' East longitudes at an elevation of 53 meters above MSL are its largest city, Ahmedabad in Dascroi taluka contributing about 60% of the State's productivity and well known for its architecture, and textile industry. With an estimated population of 7.3 million residing in the municipal area spread over 505 sq. km, under the jurisdiction of AMC, it is the country's seventh-largest metropolis, split along the eastern and western banks of river Sabarmati. Apart from its central position in the heart of Gujarat, Ahmedabad enjoyed strategic importance in the past given its location on the main highway to the Rajputana and Malwa regions on the one hand and the Saurashtra Peninsula on the other. It stays strategic, and well connected since the industrial era; was the center of the cotton textile industry till around 1975 and is now one of the most industrialized and urbanized megacities of the country.

Figure A- 2: Geographical Location of the City of Ahmedabad, India

2. The City, its form, and functions

(i) Evolution of the city

The city of Ahmedabad founded in 1411 by Sultan Ahmad Shah originated as a trading town next to the legendary town of Karnavati on an important route to the trading port of Kutch. Earlier, the river formed the controlling edge for the growth of the city. With the building of the bridges across the river, it started developing on the western bank. The form of the city started being governed by the radius from the center and it assumed a circular form. After Islamic rule till 1753, till 1808, the city saw a decline under the Maratha rule. Further, from 1817 to 1947 the British ruled Ahmedabad and the city functioned more as their regional trading center.

[17] *Ahmedabadcity.gov.in*

With the coming of the railway around 1860, development began to spill over (beyond the city limits) towards the northeast and southeast of the walled city. The first textile mill was started in 1861 hereby RanchhodlalChhotalal. This also resulted in industrial and residential development across the western side of the Sabarmati River. The construction of 5 bridges – Ellis Bridge, Gandhi Bridge, Sardar Patel Bridge, the Nehru Bridge, and the Subhash Bridge accelerated this development. However, the industrial development remained concentrated on the eastern side and the walled city continued to grow in density. The proliferation of textile mills and the consequent consolidation of its industrial base came to characterize the city in the second half of the 19th century when it came to be known as the 'Manchester of India'.

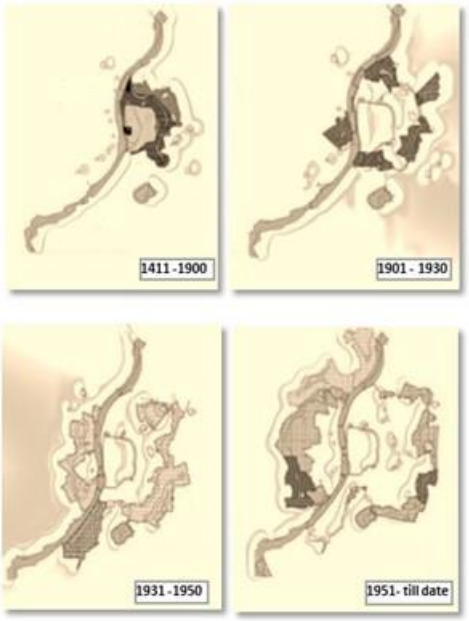


Figure A- 3: Evolution of Ahmedabad City

The city was given the status of Municipal Corporation in 1950 when the city started growing rapidly eastwards and southwards. In the later part of the century, the western part developed rapidly. The city is governed by AMC, established under the Bombay Provincial Corporation Act, 1949, and is responsible for the civic infrastructure. The city is divided into seven administrative zones - Central, East, West, North, South, southwest, and northwest; and depicts a concentric compact city around the Sabarmati River, with a density of around 14,450 people/ sq.km. The city could be segmented as (i) the 'walled' city (within the fort walls) – the old city of Ahmedabad in the central area to the east of River Sabarmati; (ii) industrial and residential localities to the Eastern peripheral areas of the Old City; and (iii) plotted residential colonies and institutional areas in the 'new city' to the west of the old city across Sabarmati. "The walled city is organized in pols or residential streets, with each pol being homogeneous in terms of religion, caste, and community. The area west of the river, then the greenfield sites, developed as the economically upwardly mobile, professional, and business families, that were modernizing, began to move out of the walled city in the 1930s and 1940s, in search of new housing. The new housing that came up west of the river was bungalow-type housing. During this period, western Ahmedabad attracted the university and colleges and the city's first public hospital. From the 1960s it also attracted elite educational institutions and new forms of commercial development. All the public institutions of education and health, including the university, were set up with philanthropic funds. Post-2000, the western periphery has attracted many gated communities and township developments. In the region, the north-west and south-west parts of the district attracted automobile industries and hence there is a low-density urban sprawl on the city's western periphery."[18]Post-independence, the regional industrial development utilizing the growth opportunities of the coast and the multitude of ports it dots has been impressive. Ahmedabad Mumbai Golden Corridor has long been recognized as an important development axis in Western India.

(ii) Urban Planning and Development mechanism

Gujarat has a very robust urban planning mechanism when compared to the other States of India. The legislative framework to aid this is the Gujarat Town Planning and Urban Development Act (GTPUDA) of 1976 which uses Town Planning (TP) Schemes as the planning tool primarily for managing peripheral urban growth, mostly in case of agricultural land repurposed for sustainable urban use. GTPUDA mandates the delineation of a larger area around town or city for development purposes and allows better planning and guided development. Gujarat Town planning mechanism is a two-stage process

[18]*https://cept.ac.in/UserFiles/File/CUE/Working%20Papers/Revised%20New/26CUEWP%2026_City%20Profile%20Ahmedabad.pdf*

called DP-TP mechanism, where initially a Development Plan (DP) is prepared, followed by TP Scheme of the envisaged development area. AUDA plans and regulates development in an urbanized areafalling beyond the periphery of AMCof over 1866 sq. km. The DP is now prepared by the AUDA, while the TP schemes are prepared and implemented by two designated authorities, AUDA and AMC, in their respective jurisdictions.TP Schemes are micro plans/ layouts based on Development Plans and are prepared for 10-200 hectares of land involving 100 to 250 landowners. This helps in the development of a gridiron road network, 15% of land for roads, 5% for parks, gardens, and open spaces, 5% for social infrastructures such as schools fire, public utility, hospitals, and 15% for sale by an appropriate authority for housing, commercial or industrial use depending on the nature/ location of the proposed development and up to 10% for housing for economically weaker sections (EWS). TP schemes have three stages: Preliminary, Draft, and Final Stages. After the draft stage, the authority takes possession of the scheme and lays down basic services. A Town Planning Officer is allotted for hearing objections and suggestions from landowners. The mechanism is operated by competent urban planners and is inexpensive, fair, and equitable.

3. Demographics

(i) Population Profile and Decadal Growth Rate

The city is the administrative headquarter of Ahmedabad district and is the judicial capital of Gujarat as the Gujarat High Court is located here. With a population of around 5.8 million (5577940) and an estimated population of 6.3 million for 2021; it is the fifth-largest city in India. With the increasing opportunities for trade and commerce and as a center for higher education, this heavy growth continues. ***Table A-10*** below shows the population and growth rate of AMC from the year 1981-2011.

Table A- 10: Population Growth Rate of AMC [19]

Year	Population in millions	CAGR
1981	2.16	
1991	2.88	3.2%
2001	3.52	2.3%
2011	5.57	5.2%
2020 (est.)	6.8	2.2%

(ii) Child Population (0-6 Age Group) and youth population (15-24 years), Working Age (15-59 years)

The total child population (0-6 Age Group) in Ahmedabad city as per census 2011 was 621034. The total male child population was 336063 and the total female child population was 284971. The percentage of the youth population is 19.26. The working-age group population is 66.78 percent [20]

(iii) Sex Ratio (Females Per 1000 Males)

The sex ratio of Ahmedabad city is 897 females for 1000 males. The child sex ratio of girls is 848 girls per 1000 boys.

(iv) Literacy

The literacy rate of Ahmedabad is 89.60 %. The total literate population of the city is 4376393. The number of literate males is 2402523 and the number of literate females is 1973870.

(v) Density of Population

[19] *City Profile: Ahmedabad, CEPT University,2014*
[20] *Source: smart city profile*

The Gross density of AMC in 2011 was 120 persons per hectare, which is the average gross density for a metropolis as per Urban Regional Development Plan Formulation and Implementation (URDPFI) guidelines.

(vi) Scheduled Caste/ Scheduled Tribe (SC/ ST) population

The SC/ ST Population in the city is 10.66 and 1.2 percent respectively[21]

4. Population Distribution

(i) Administrative Divisions

Administratively, the city is divided into 6 zones which are as follows- North zone, South zone, East zone, West zone, Central zone, and the New west zone. Each zone is divided into separate wards.[22] There are 48 wards in the city, every ward being represented by 4 corporators. An election is held every 5 years to elect the corporators to power. The mayor heads the administration of the city.

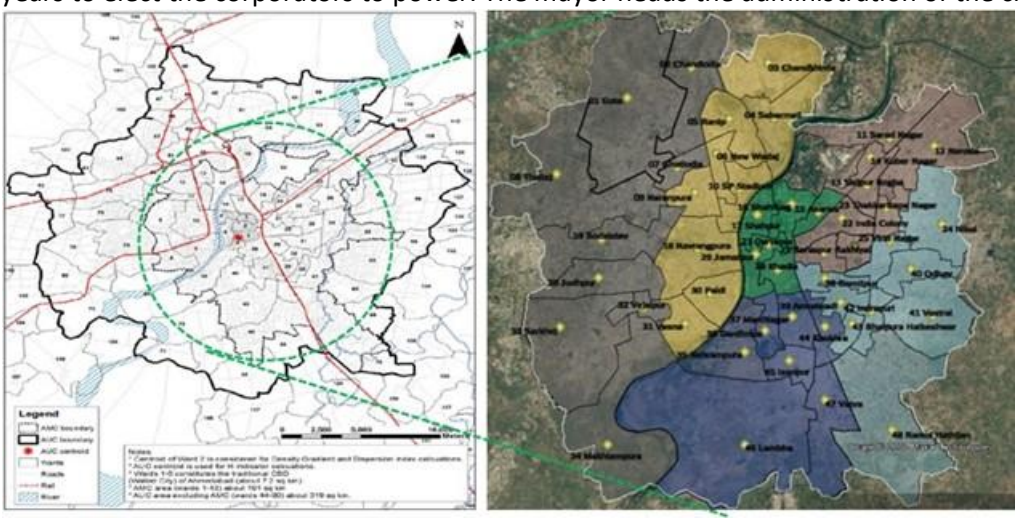


Figure A- 4: Administrative Divisions of Ahmedabad

As per section 63 and 66 of the Bombay Provincial Municipal Corporation Act, the AMC is responsible for certain obligatory and discretionary services.

Obligatory Services are as follows:

- Erection of boundary of city defining city limits.
- Watering, Scavenging, and Cleansing of all public streets and places
- Sewage services
- Drainage services
- Fire services
- Health & Medical services
- Street Lighting services
- Maintenance of monuments & open spaces Identification of streets & houses
- Regulation and abatement of offensive and dangerous trades or practices Maintenance of burial houses and funeral homes
- Construction or acquisition of public markets and slaughterhouses
- Construction or acquisition of cattle-pounds
- Primary education services
- Health and hygiene services
- Construction, maintenance, and alteration of bridges
- Water supply services
- Preventing and controlling the spread of dangerous diseases
- The securing or removal of unsafe buildings and places
- Construction of conservancy staff quarters
- Maintenance of relief works in scarcity, floe, etc.

[21] *Ibid*

[22] *ahmedabadcity.gov.in*

Discretionary Services are as follows:

- Construction and maintenance of maternity homes & infant welfare houses Maintenance of central laboratories
- Swimming pool and other public health services
- Tree plantation on roadsides
- Construction and maintenance of public parks and gardens
- The holding of exhibition, athletics, or games
- The maintenance of ambulance services
- Construction and maintenance of theatres, community halls, and museums, etc. Building or purchase of staff quarters
- Construction and maintenance of public transport facilities
- Construction and maintenance of educational institutes
- Construction and maintenance of infirmaries and hospitals
- The destruction of animals and birds causing a nuisance.
- Construction and maintenance of factory for the disposal of sewage
- The building or purchase and maintenance of suitable dwellings for the poor and working classes
- Provision of shelter to homeless persons and poor relief
- Surveys of buildings or lands
- Measures to meet any calamity affecting the public in the city any measure to promote public safety, health, convenience, or instruction

(ii) Housing & Urban Poor

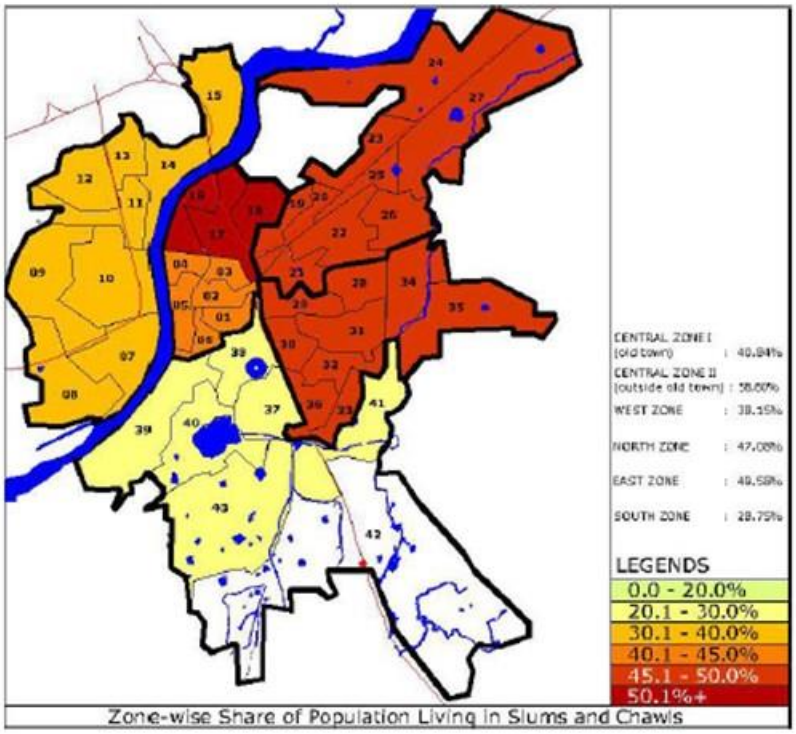
The percentage of populations living in urban slums is 4.49. Overall, 77.39 percent are residing in their own houses while 20.57 percent are residing in rented houses. The percentage of the population living in congested houses is 36.42.

The 2001 census reported 12 percent of the total population being poor in Ahmedabad. According to CDP of Ahmedabad, 2006-2012, SJSRY survey conducted in Ahmedabad in 1998 showed that 32.4 percent of the city‟s population living in the slums. The population of the poor in the city to be 19.5 percent assuming that there are no poor living outside slums[23]. The city of Ahmedabad has 710 slums and 958 chawls spread across different zones in the city. About 1.75 lakh households are residing in the slums and 1.49 lakh households in the chawls in the city.

Sanitation

Access to individual toilets was available to 69.59% of the households. Access to individual toilets is much higher in the chawls; 80% of the chawl households have individual toilets compared to 58% of the slum households. Another 16% used public toilets or someone else‟s toilet. This still left 14% of households who did not have access to any toilets. While the majority of households that had individual toilets were connected to the sewer lines, almost 10% of these households were not connected to a covered sewer line. This leaves 38% of all households without improved sanitation, i.e. individual toilets connected to a covered sewer.

[23] *NIUA, 2008, Urban Poverty Reduction Strategy for the City of Ahmedabad Final Report.Mahila Housing SEWA Trust*



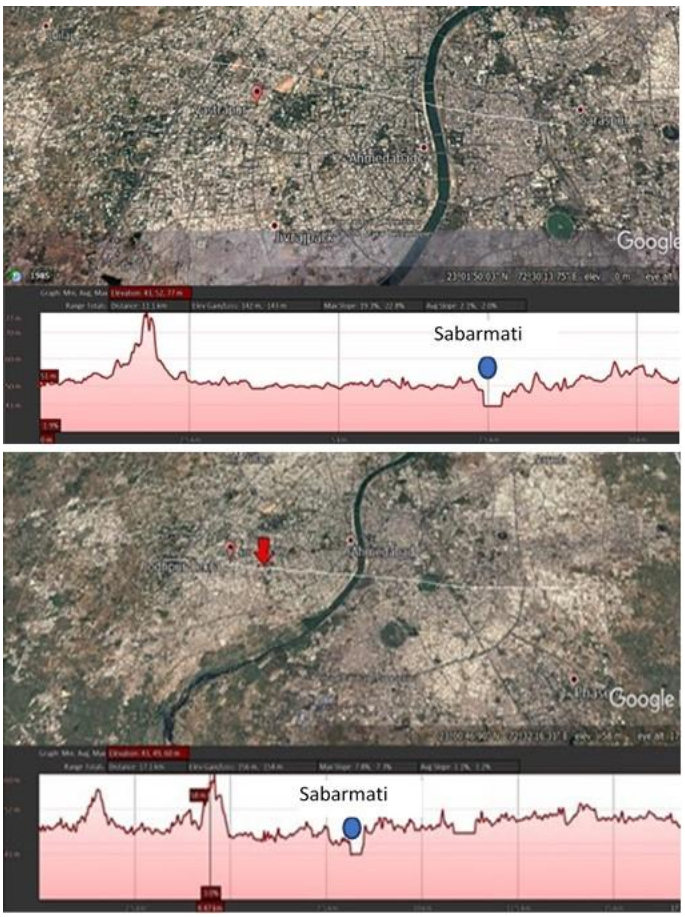
Zone-wise Share of Population Living in Slums and Chawls

The West zone settlements were the least serviced with regard to toilets. Only 41.26 percent of homes had individual toilets, and 38.4 percent of households had no access to any toilets. Households that do not have individual toilets expressed a willingness to pay about Rs. 200 as their contribution towards the construction of an individual toilet[24].

Source: NIUA, 2008, Urban Poverty Reduction Strategy for the City of Ahmedabad Final Report. Mahila Housing SEWA Trust.

5. Physical Characteristics

(i) Physiography and Terrain



The average elevation of Ahmedabad in the west coastal plan physiographic region is 40-60m above sea level with a master slope towards the south. The average elevation of the city area is about 48m AMSL. The area as a whole, in general monotonously flat except few mildly undulating topographies owing to the presence of stabilized dunal landforms. Isolated high grounds, with elevations more than 60m AMSL, are observed on both sides of river Sabarmati. The city is situated in a sandy and dry area. There are small hills in Thaltej-Jodhpur Tekra and Vastrapur while the rest of the city is almost flat. Since, Ahmedabad lies on the western side in the state of Gujarat, which is a desert area; it experiences an extreme type of climate. The Sabarmati divides the city into eastern and western parts, connected by nine bridges, two of which were constructed after independence.

Figure A- 5: Physiography of Ahmedabad

Sabarmati river enters AMC limits and flows for 14 km through the city with the fall of 13

[24] *Ibid*

m in-ground level along the riverbanks. The falling gradient is 1 in1100 in the eastern part of the city. The ground slopes towards the river at a gradient ranging from1:1250 to 1:1050. On the western side, ground-level slopes towards the river with a higher gradient ranging from1:500 to 1:1000.[25]

(iii) Climate

Droughts are frequent in north Gujarat, Saurashtra, and Kachchh regions due to poor and erratic rainfall. The climate varies from humid in the south through sub-humid in the central part to semi-arid and arid in the northern and western parts. The state receives rainfall mainly during the southwest monsoon period. The normal rainfall shows a steep reduction from 1883 mm in the extreme south (Valsad) of the State to 386 mm in the Kachchh district. Normal rainfall is a low 600 mm in Ahmedabad district (to the north of the State) while certain years show much less rain than this.

(iv) Geology and Soils

Soils found in the Ahmedabad district are classified as Black soils, Goradu soils, Kyari and Rocky soils. The Goradu soils are present as fertile brown to sandy loam and are found in Ahmedabad city, Dascroi, and parts of Sanand, Dholka, and Viramgam talukas. Most fertile Kyari soils are found in the city and have good moisture content and retentive capacity. The spread of the alluvial bed of the Sabarmati river from end to end of the district is an important natural feature being observed. The city area is mostly underlain by blown sand and silt deposits of aeolian character, except localized pockets where it is fluvial. The soil is therefore either coarse sandy or fine sandy loam, with less clay content and has good to excellent drain-ability. The soils in the entire area are deep to very deep, with soil depths more than 100 cm.

(v) Land use and Landcover

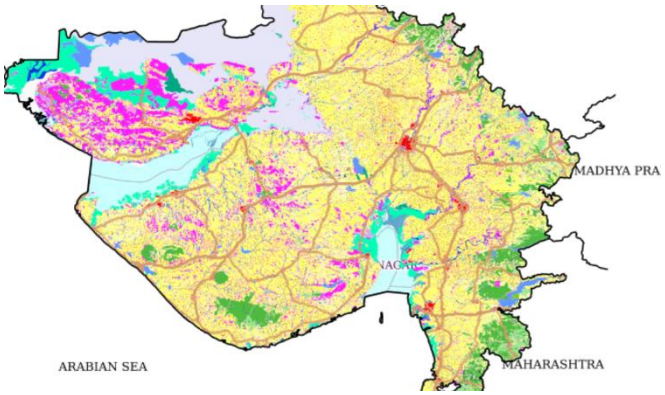


Figure A- 6: Land use of Ahmedabad and its Region

Gujarat is the fourth most urbanized state in the country. About 42.6% of Gujarat's population (25.71 million) lives in urban areas as compared to India's 31.16% (Census 2011). Urbanization refers to the process by which rural areas become urbanized through economic development and industrialization. Demographically, urbanization refers to the redistribution of the population from rural to urban settlements. An increase in the urban population causes urban sprawl that pressurizes natural resources. In increasingly urbanizing states like Gujarat, the shape of urban growth will be multi-municipal agglomerations but all that is urban which is comprised in these agglomerations will not be municipal either. The following corridors of growth stand out prominently in Gujarat:

- Mehsana-Gandhinagar-Ahmedabad-Vadodara-Bharuch-Surat-Valsad (72% of state's urban population by 2021)
- Ahmedabad-Rajkot-Junagarh (9% of state's urban population by 2021, excluding Ahmedabad)
- Coastal Corridors: Bhavnagar-Porbandar (6% of state's urban population by 2021), Jamnagar-Morvi-Gandhidham-Bhuj (6% of state's urban population by 2021).

[25] *City Sanitation Plan, Ahmedabad 2012*

Urban areas of Gujarat are distinct in landuse with nearly 40% of the urban population of Gujarat residing in the three large cities of Ahmedabad, Surat, and Vadodara. Urban areas are well linked with well-developed corridors, along which some small service areas/ towns show up. However, between the cities, there are rural areas, or census tows with marked disparity from the key urban areas.

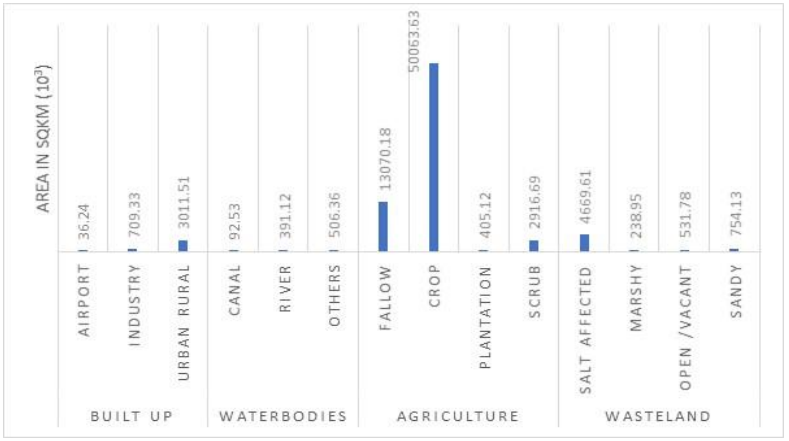


Figure A- 7: Area under various landuses: Ahmedabad City

Rural areas are distinctly rural in landuse and character as evident in the landuse pattern in ***Figure A-7*** above. Ahmedabad district comprises 11 talukas which include Ahmedabad City, Barwala, Bavla, Daskroi, Detroj-Rampura, Dhandhuka, Dholka, Mandal, Ranpur, Sanand, and Viramgam. The total area of Ahmedabad district is 7,170 sq. km. The urban and peri-urban regions of Ahmedabad are characterized by diverse microenvironments viz. rural areas in the West, densely populated urban conglomerates in the West and Central regions, industrial regions in the Central and East Ahmedabad. Landuse – Land Classification of Ahmedabad district is as presented in the following chart.[26] The district of Ahmedabad in total has almost three-fourths of the land under agriculture.

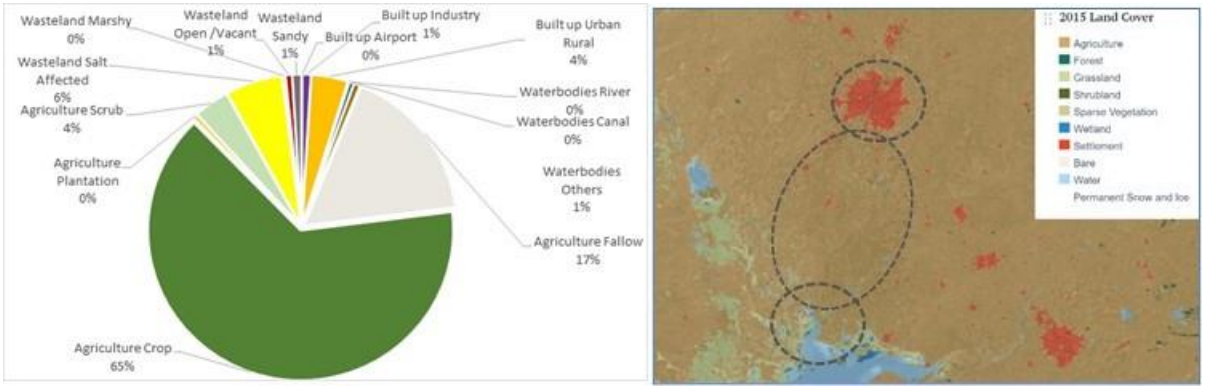
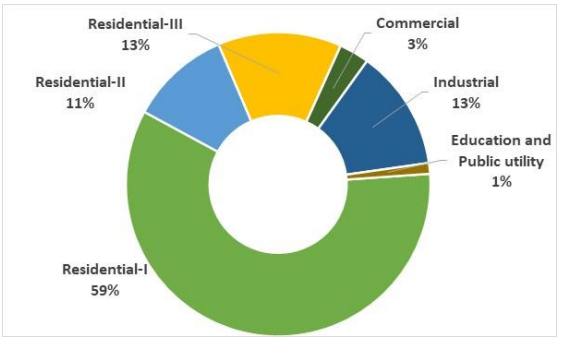


Figure A- 8: Land use Distribution in Ahmedabad Region



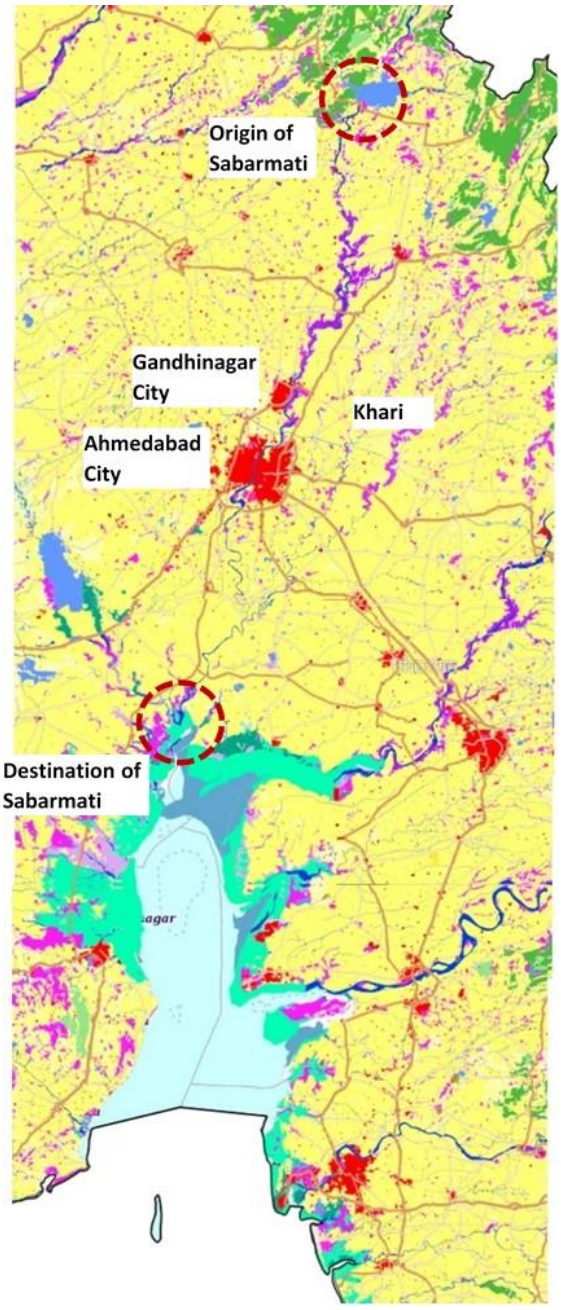
Landuse of AMC is as depicted in the following ***Figure A-8***. Almost 70-80 percent of the AMC area is under residential use and a good share (13%) under industrial use.

Figure A- 9: Land use of Ahmedabad City

[26] *Darshana R, etal. 2020. LAND USE AND LAND COVER MAPPING – A CASE STUDY OF AHMEDABAD DISTRICT, JO - ISPRS - International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*
Available at: https://www.researchgate.net/publication/343802850_LAND_USE_AND_LAND_COVER_MAPPING_-_A_CASE_STUDY_OF_AHMEDABAD_DISTRICT/citation/download
Accessed on: 27 May 2021

(vi) Hydrology and Rivers

River Sabarmati is the principal river of Ahmedabad. It originates from Dhebar lake in the Aravalli Range of Udaipur District, Rajasthan, and finally drains into the Gulf of Khambhat near the Vataman village of Dholka taluka. The Sabarmati basin extends over an area of 21,674 sq. km. It forms the eastern boundary of the Ahmedabad district flowing from NE to SW direction through Ahmedabad and Gandhinagar districts.[27]Within AMC limits, it flows for 14 km through the city with a fall of 13 m in-ground level along the riverbanks. On the upstream side of Ahmedabad, the river Sabarmati is bunded by constructing a dam at Dharoi, which is situated at 120 km. Further, a barrage has been constructed 5 km downstream of Nehru Bridge, Ahmedabad (at Vasna) for diverting river water for irrigation purposes. The river is non-perennial, it gets dried up in the summer, leaving only a small stream of water flowing.



The Narmada Canal, which crosses Sabarmati a few kilometers upstream from the city, is part of a larger canal network of Sardar Sarovar Dam. The canal feeds/ siphons excess water to the river in the city area and maintains the level of water, which is retained through Vasna Barrage, mainly as required by the Sabarmati Riverfront Project.

Figure A- 10: Key Rivers of Ahmedabad Region

The Khari River originates near village Kesharpura of Himatnagar taluka of Sabarkantha district. In the Ahmedabad district, it enters Dahegam taluka and flows near the villages of Chekhala, Babra, Halisa, Vadvasa, and Nandol. Thereafter it enters the Dascroi taluka and passes by Pardhol, Vahelal, Huka, Navrangpura villages. The total length of this river is 160 km, but it flows only for 53 km in the Ahmedabad district.[28] The Khari river runs almost parallel to the Sabarmati towards the east, beyond the city limits. It joins Vehari near Kheda, downstream of the city. One of the oldest irrigation schemes of Gujarat 'Kharicut canal scheme' passes through the eastern part of Ahmedabad City, which also serves as 'Storm Water Drainage' during monsoon. None of the rivers in the project area are international waterways.

River Canal system in the Ahmedabad[29] region is presented in the following ***Figure A-11.***

[27]*Ground water brochure, Ahmedabad, CGWB 2014*
[28]*District Census Handbook, 2011*
[29]*EPC 1998, Feasibility Report for Sabarmati River Front Development, Sabarmati Riverfront Development Company Ltd.*

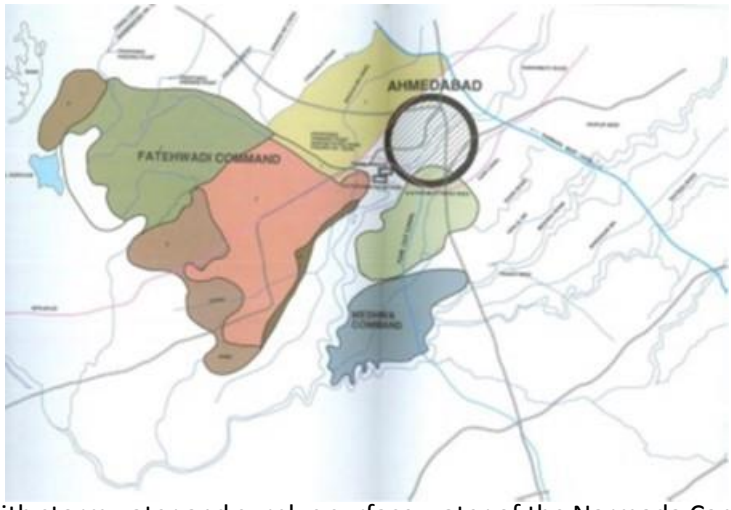


Figure A- 11: River- Canal System and command areas in Ahmedabad Region

There are 2 main lakes located in the city limits – the Kankaria lake, and the Vastapur lake. Kankaria lake, located in Maninagar, is an artificial lake developed by Qutb-ud-din Aybak in 1451. Under the ambitious 'National Lake Conservation Plan', AMC and AUDA have taken up a project to interlink 45 surface bodies (ponds & lakes) and recharge them with stormwater and surplus surface water of the Narmada Canal. The following ***Figure A-12*** presents the topographic map of the region, showing the gentle slope from the city to the final disposal point at Gulf of Khambat. [30]

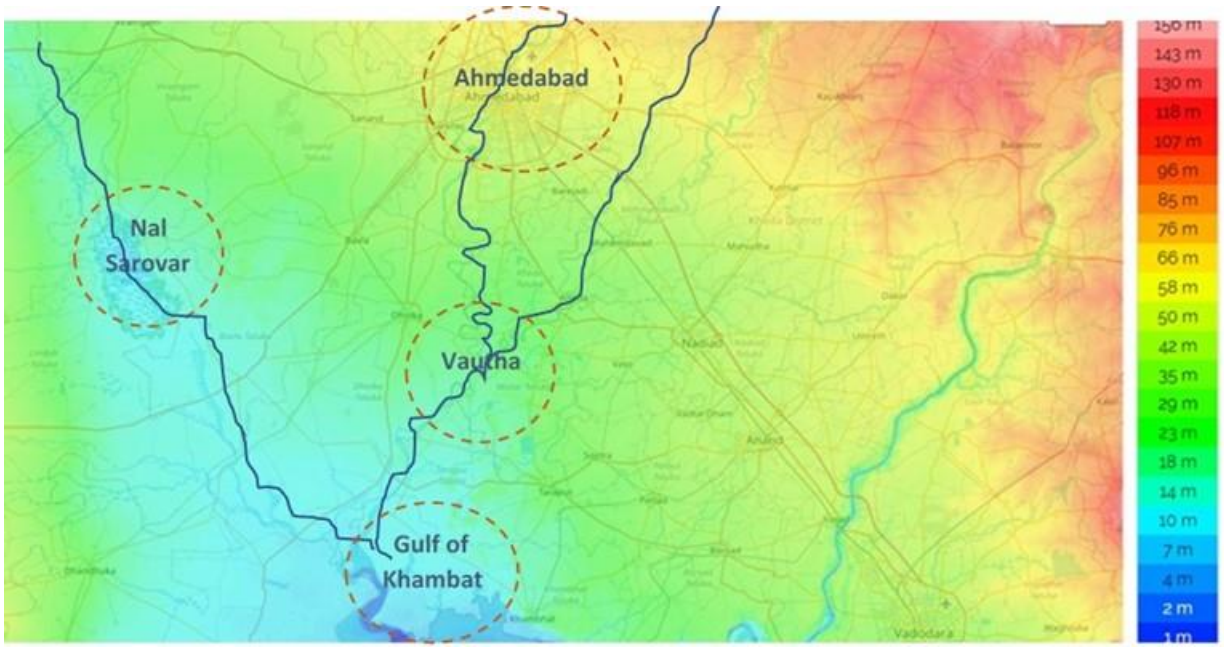


Figure A- 12: Topographic Map of Sabarmati and its Region Downstream

[30] Source: https://en-in.topographic-map.com/maps/zcgz/Sabarmati-River/

Sabarmati Watershed and Vasna Barrage: The Dharoi Dam constructed in 1976 upstream of Ahmedabad controls water and protects from flooding while Vasna Barrage constructed in 1976 downstream retains water in the river along the city banks and diverts it through Fatehwadi canal for irrigation. The Sabarmati Riverfront Walkway almost touches the Vasnabarrage area at its southern end. The purpose of the barrage is to strengthen the existing irrigation facility. Villages under its command are 87 including 33 villages in Dholka taluka, 45 in Sanand Taluka, 6 in Daskroi, and 1 in Viramgam. Its BedRock is of recent sandy river deposit, Maximum height above the lowest point of foundation is 20.75 m and the Length at the top of the dam is 611 m. For the sewage treatment plants located adjacent to Vasna barrage, community health, and safety, and pollution become important in case of extreme events, and resultant water levels.

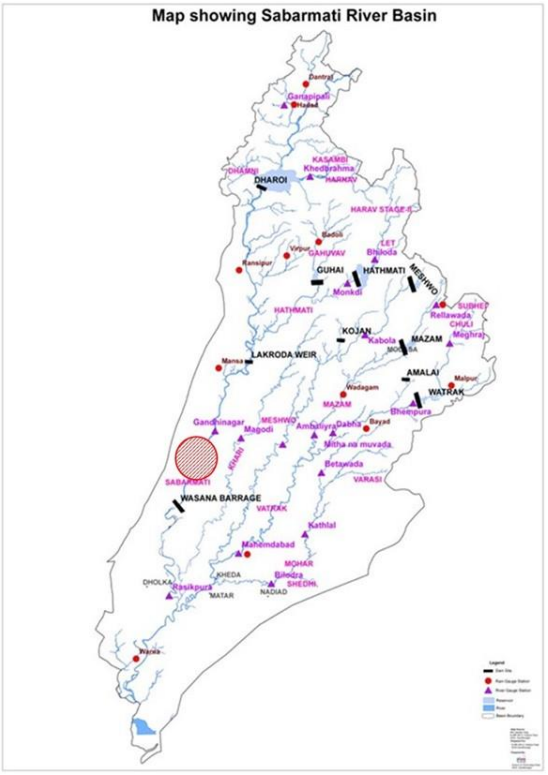


Figure A- 13: Sabarmati Watershed showing city and Barrages upstream and downstream

(vii) Groundwater Scenario

a. District Ground Water Scenario

The diverse physiographic, climatic, topographic, and geologic conditions have given rise to diversified groundwater situations in different parts of the state of Gujarat. The topography and rainfall virtually control the runoff and groundwater recharge.[31]A detailed study in Mahesana, Banaskantha, Rajkot, Surendranagar, Kheda, Sabarkantha, Kachchh, and Ahmedabad districts has revealed that multiple aquifers exist in major part of the alluvial plains of Gujarat up to a depth of 500 m.

In the region, due to over-exploitation, the water levels in the phreatic aquifer have declined rendering them almost dry. Presently, first and second confined aquifers are the most exploited. The decline of water level in these aquifers is more than 40 m since 1961 most of the area. The yield of tube wells varies from 20 to 40 lps with Large to moderate yield prospects in the Ahmedabad district of North Gujarat. In North Gujarat, about 93% of the area falls within the water level of 20 mbgl.

b. City Ground Water Scenario

In total there are 406 tube wells installed in AMC, but 43 tube wells are non-functional. There are many private borewells/ tube wells across the city. An increase in the withdrawal from the groundwater table over years has increased the failure rate of the tube wells. After the commissioning of the Raska project, and drawal of water from the Narmada Canal, the stress on the groundwater has reduced to some extent.

c. Ground Water Quality

Ground Water Quality under MINARS Project & annual status project, GPCB Annual Report 2019-20

- Borewells from the GIDC area of Vatva, Odhav, Naroda were assessed for groundwater quality. The ph range was observed from 7.44-7.65, BOD was 1.06mg/ l - 1.32mg/ l and COD was in a range of 8mg/ l-12mg/ l

Ground Water Quality under Annual Status Project 2019-20

[31] http://cgwb.gov.in/Regions/GW-year-Books/GWYB-%202016-17/Gujarat%20%20Daman%20and%20Diu.pdf

- The bore well of Shahibaug Jain Mandir: pH was found to be 7.8, DO was 4.5mg/l, BOD 0.83mg/l, COD 5.7mg/l, TDS 706mg/l
- At the bore well of Piplaj village, pH was 7.67, COD was 7mg/l while TDS was1262mg/l.

It can be observed that the TDS in borewells is beyond the BIS standard 500 mg/l and thus the hardness of water is quite high.

(viii) Extreme Events

As per the composite risk index[32] by Gujarat State Disaster Management Authority, considering all risks/ hazards, Ahmedabad city falls under a very high-risk zone.

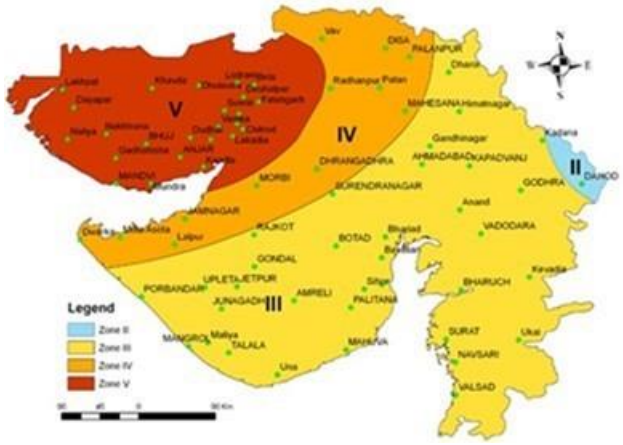


Figure A- 14: Earthquake Zonation of Gujarat

d. **Earthquakes**

Gujarat is in the "Himalayan Collision Zone"-where the Indo-Australian tectonic plate slides under Eurasian plate-causing active fault lines beneath. For seismic risk, the city falls into the Moderate Zone - III.

On 26 January 2001, one of the most destructive earthquakes ever to strike India occurred in the Kutch region (epicenter-Bachau Village) of Gujarat at 8.46 am. The damage was spread in an area of a 400 km radius from the epicenter. The official magnitude of the earthquake is 7.7 on the moment (Mw) scale. Over 7000 villages, Ahmedabad city, and 14 municipal towns were affected by the earthquake (GSDMA, 2002a). The official death toll is 13,805. About 215,000 houses collapsed fully and 928000 houses were damaged partially (Mishra, 2004: 58). In the urban areas affected by the earthquake 26,726 houses fully collapsed and 213,158 houses were partially damaged (GSDMA, 2007). (Oyo Corporation, 2004). Municipal Wastewater treatment plants and networks are vulnerable to earthquake damage.[33]During the earthquake of 2001, sewage networks of Ahmedabad were damaged.

e. **Cyclones**

Though the southern part of the Ahmedabad district near the coast is highly vulnerable to tropical cyclones generated in the Arabian sea; it is not so in the case of the city area. The southern part of the District falls in a mean wind speed zone of 40-44 m/sec whereas the northern part including the city falls in a lesser speed zone of 34-39 m/sec zone.

f. **Flooding**

[32]*The mega city of Ahmedabad tops the list of cities in composite risk and vulnerability ranking of cities in Gujarat based on base rock motion, surface amplification, liquefaction potential, slope failure potential, building vulnerability, demographic factor, and socioeconomic factor*

[33]*Panico A., etal. 2013. Seismic vulnerability of wastewater collection and treatment plants, Chemical Engineering Transactions, 32, 13-18, DOI. 10.3303/CET1332003*

Type of damage varies from Level 1: no damage; level 2: malfunction of plant for a short time (less than three days) due to loss of electric power and backup power if any, considerable damage to various equipment, light damage to sedimentation basins, light damage to chlorination tanks, or light damage to chemical tanks; Level 3: Loss of treated water quality, malfunction of plant for about a week due to loss of electric power and backup power if any, extensive damage to various equipment, considerable damage to sedimentation basins, considerable damage to chlorination tanks with no loss of contents, or considerable damage to chemical tanks, Level 4: networks and pipes connecting the different basins and chemical units being extensively damaged likely resulting in the shutdown of the plant and loss of contents, Level 5: complete failure of all piping, or extensive damage to structures composing the plant.

The climatology of Gujarat is influenced by the Arabian Sea in the West and three hill ranges along its Eastern border. While the Northern part of the State is mostly arid and semi-arid, the Southern part is humid to sub-humid. Extremes of climate, be it rainfall or temperatures are quite common in this region. All major rivers in the State pass through a wide stretch of very flat terrain before reaching the sea. Cities like Ahmedabad, Surat, and Bharuch are located on the flat alluvial plains of large rivers, which are flood-prone.

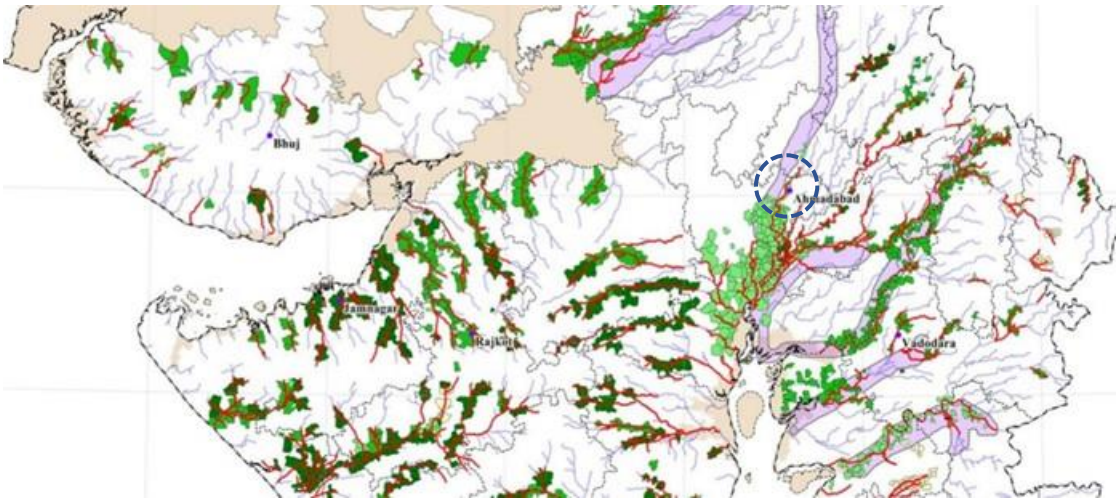


Figure A- 15: Flood-prone areas and river stretches in the city region

A study of low-lying areas conducted by CEPT University across 9 areas in Ahmedabad observed that the highest drainage densities (drains per hectare) are in Vasna and Naranpura catchments which were 2.5 and 2.43 respectively. The lowest was observed in Stadium and Sabarmati catchment areas. The southern portion of the Navrangpura catchment had maximum runoff of rainwater up to 116.16 cubic meters/sec while the Stadium catchment had minimum runoff at 2.45 cubic meters/sec.

A high drainage density value indicates a high density of streams and a rapid stormwater drainage process. Near around 15% of the west, zone is identified as having a very high flooding risk (area of 4,93.12ha). Areas with very high risk are Navrangpura, Sabarmati, Vadaj, Usmanpura, Ambawadi, Paldi, and Vasna. [34] ***Table A-11*** below shows the catchment area and watershed runoff of 9 areas in the western zone.

Table A- 11: Surface runoff from the Western zone of AMC[35]

Sl no	Ward	Catchment area (ha)	Watershed runoff (cubic meter/sec)
1	Navrangpura south	1,382.68	116.6
2	Gandhigram South	487.98	41.9
2	Naranpura	240.55	18.22
4	New Wadaj	494.12	41.25
5	Sabarmati	181	15.04
6	Paldi	172.47	15.34
7	Stadium	36.89	2.45
8	Vasna	56.52	4.85
9	Gandhigram north	179.73	14.2

[34] *TOI, AMC's West zone is flood prone, June 27, 2018*
[35] *TOI, AMC's West zone is flood prone, June 27, 2018*

Tsunami-prone areas in the State include coastal villages of Kutch, Jamnagar, Rajkot, Porbandar, Bhavnagar, Anand, Ahmedabad, Bharuch, Surat, Navsari, and Valsad districts. However, Ahmedabad city, being away from the coast is not Tsunami prone.

(ix) Sensitive Ecosystems

Sensitive ecosystems around Ahmedabad city include key biodiversity areas and Protected Areas as depicted in ***Figure A-16*** here.

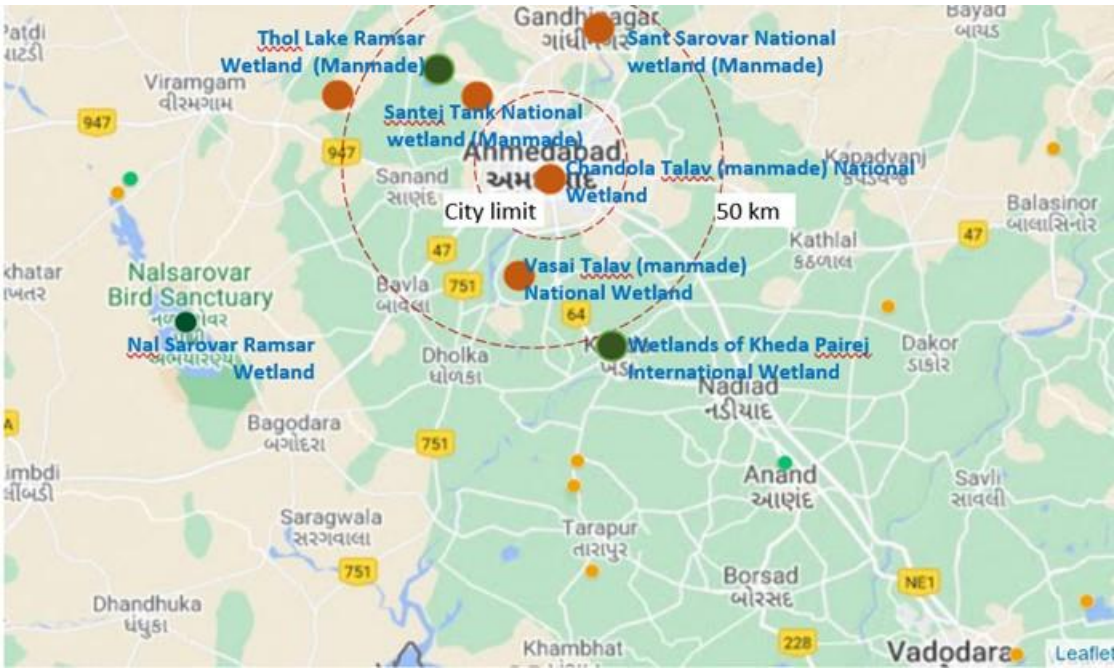


Figure A- 16: Sensitive Ecosystems in and around Ahmedabad City

Sensitive areas are described in subsections below.

Figure A- 17: Sensitive Ecosystems of International Importance in the city region

g. **Protected Areas**

Nalsarovar Bird Sanctuary (121 sqkm), around 62 Kms southwest (aerial) of Ahmedabad city, is the largest protected wetland sanctuary under Wildlife Conservation Act, 1972. The wetland also declared as a Ramsar site in 2012[36] includes Nalsarovar Lake, iron-flat plains, and wetlands. The sanctuary has flocks of indigenous and migratory birds, with as many as 250 species passing through in the winters. Ducks, geese, eagles, spoonbills, cranes, pelicans, and flamingos are best seen at daybreak and dusk. Wild asses and blackbucks are also commonly seen in the lush region.

h. Key Biodiversity Areas around Ahmedabad

- ***Thol Lake Wildlife Sanctuary:***

This sanctuary in Mahesana District of Gujarat is at around 30 km from the city. Thol is an irrigation tank with a water storage capacity of about 84 million cubic meters. It was constructed in 1912 during the Gaekwad regime to supply irrigation water to villagers, thus they have the traditional right to use water. Thol is predominantly an open sheet of shallow water of about 1,450 ha command area, surrounded by cropland. In 1988, this inland wetland was declared as a Sanctuary as it provides excellent habitat to more than 20000 waterfowl during the post-monsoon to the winter season. There are emergent and floating aquatic plants in the vicinity of the wetland. Acacia nilotica, A. leucoploea, Zizyphus sp, Azadirachta indica, Ficus sp., Salvadora sp, Prosopis chilensis, Capparis sp. are the important tree species in and around this.

Main threats: Withdrawal of water for irrigation; Illegal cultivation; excessive use of pesticides in the surrounding paddy croplands may be toxic to the birds feeding on them. Most of the water of the lake is drawn for irrigation, leaving the water spread less than 10 ha during midwinter. Local villagers carry out cultivation within the Sanctuary. Natural systems modification, abstraction, and use of water for agriculture use are the key threats resulting in moderate to rapid deterioration of high impact.

- ***Wetlands of Kheda***

The canal irrigated paddy fields of the Kheda district (50-70 km from the city), bounded by Vatrak a tributary of Sabarmati to the Westside and Mahisagar to the East, and Gulf of Khambhat to the south is a key wetland. As paddy fields are temporary wetlands, they provide an alternative to the natural marshland habitat of the Sarus Crane Grus Antigone. Daloli, Gobrapura, Narda, and Machhial were found to be important roosting areas for these birds.

Main threats: Agricultural practices; Industrialisation and urbanization; alteration of habitat; disturbance to the birds by farming activities. Parasharya et al. (2000) found a significant positive correlation between the percentage of land under paddy crop and Sarus Crane density which results in conflicts with farmers.

- ***Bhashkarpura Wetlands***

Bhashkarpura wetland, near Narmada Canal, is situated near Vitthalgadh, Surendranagar district, about 20 km from Viramgam and 45 km from Surendranagar. The size of these wetlands is c. 200 ha area. It attracts thousands of waterfowl during winter. The wetlands are surrounded by agricultural fields and some natural vegetation. As the site is located near Nalsarovar, there is a regular exchange of birds between these two biodiversity areas.

Main threats: Fishing and Hunting are the major threats. As the water is used for irrigation, the wetland dries up in summer. There should be more control over overfishing activity,

[36] *www.nalsarovar.com*

especially during winter when many migratory birds are present. This can be done with the cooperation of local people who generally have a benign attitude towards wildlife.

- ***Bhal Area***

The Bhal (literally meaning the forehead) is a flat alluvial plain, made up of a mosaic of croplands, saline wastelands, grasslands, pasture land, and marshes (Dharmakumar sinhji 1978). The Bhal region is prone to droughts, floods, and cyclones when Bhal becomes a large swamp attracting a very large number of waders and other waterbirds. The Bhal area was an open treeless habitat as recently as 50 years ago and then Prosopis chilensis was planted near Mithapur, to provide fuelwood. It has since spread rampantly and converted much of the grasslands into savanna and thorn-forest habitats. Nearly forty species of grasses have been identified from the area.

Main threats: Destruction of grassland habitat due to an increasing number of saltpans and industries; Infestation by Prosopis chilensis; Canal network, change in landuse and possible waterlogging; Traffic; Livestock grazing; Industrial development and pollution. With the increasing number of saltpans in Bhal, industrial development and conversion of grassland for agriculture pose a threat to the natural habitat of the avifauna. The spread of Prosopis chilensis is reducing the open foraging ground for Houbara and Stoliczka's Bushchat.

Among these sensitive areas, the ones within 50 km of the city are Thol Lake Sanctuary and the Wetlands of Kheda. Though the impacts would be minimal considering the distance from the city, already altered and the developed area between the city and the sanctuary, no connection with the rivers such as Sabarmati and Khari, and wind directions, it is proposed that Thol sanctuary shall be assessed for any impacts on biodiversity in case of any treatment plant proposed in north or northwest zones of the city.

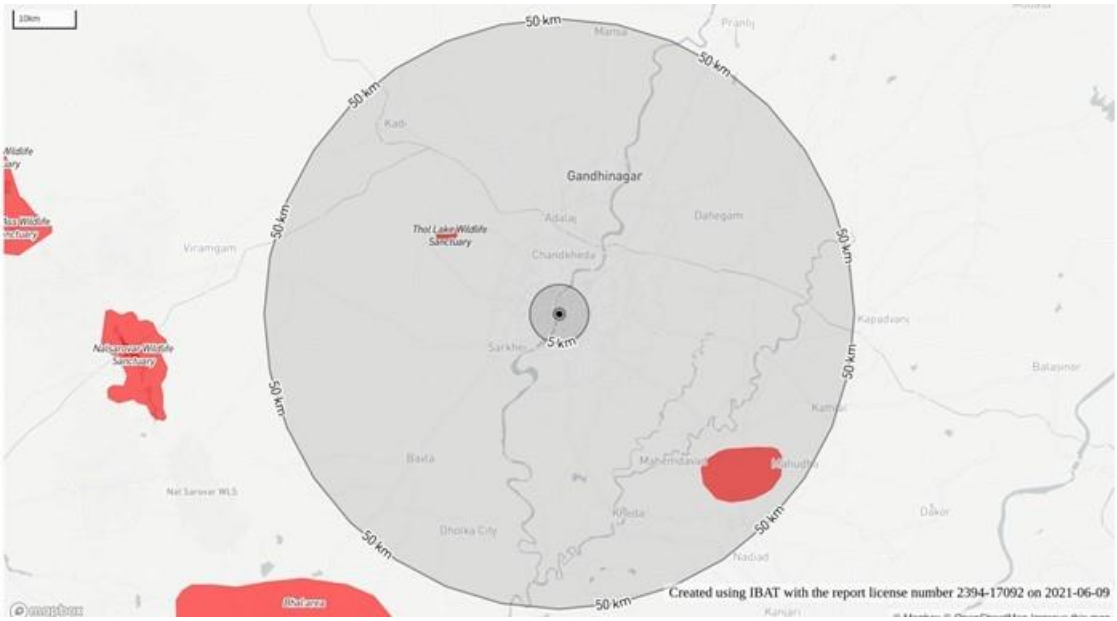


Figure A- 18: Key sensitive landuses within 50km of the city

i. **Key sensitive landuses in and near Ahmedabad City**

Key sensitive landuses in Ahmedabad city include (i) its main river Sabarmati which bifurcates the city into two, (ii) Kharicut Canal which passes through the east side of the city may be considered a sensitive artery as it meets Khari River downstream of the city which join Sabarmati near Vautha, (iii) Near around 122 big and small lakes in the city including the larger

Vastrapur, Kankaraia and Chandola lakes, (iv) many gardens, parks and open grounds in the city. Chandola Lake (56.78 ha, man-made) in Ahmedabad city (east) is a nationally recognized man-made wetland, in addition to the Santej Lake (5.96 ha, man-made, near the western boundary of the city) and Sant Sarovar (206 ha, 12 km north of the city) in its twin city of Gandhi Nagar and Vasai tank downstream of Sabarmati in Vasai Panchayat (around 25 km) of Ahmedabad district, are nationally recognized man-made tanks or wetlands near the project area. Among these Impacts of proposed subprojects on Chandola, Santej on proposed STP upgradation, drainage, and sewerage works (if in the area of influence of these) shall be analyzed while conducting ESIAs.

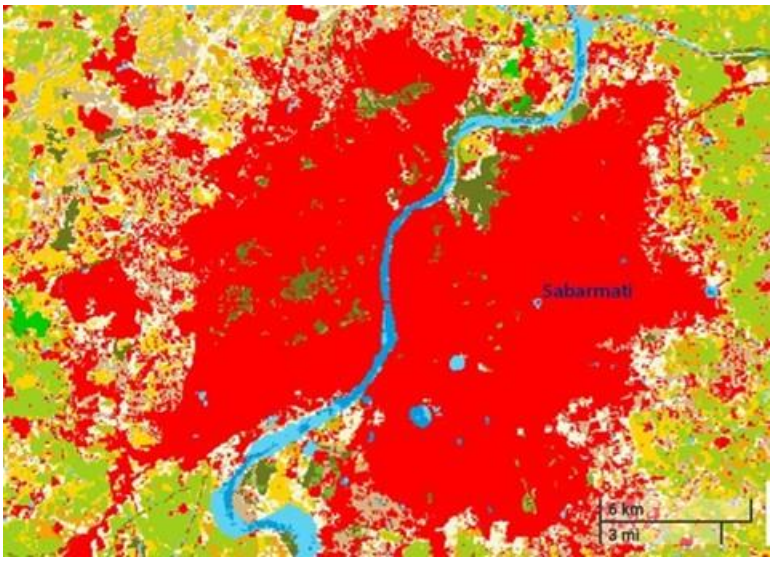


Figure A- 19: Landuse Map of the city showing large water bodies and open spaces

j.**Forest Cover**

According to the Forest Department, the total area under forest in Ahmedabad district is 106.82 sq. km. The type of forest found in Ahmedabad is southern tropical dry deciduous forests. Ahmadabad district is mainly classified into three kinds of forest area, one is reserved forest (45.8 sq.km), second is protected forest (1.09 sq. km), and third is unclassified forest (59.93 sq.km); totaling 106.82 sq.km.[37]There are no important forests in the city area except urban forests developed by the AMC. As per the Tree Census of 2012, there were 618,000 trees in the City. The area covered under green space is 4.66%, and there were 9 Municipal Nurseries and 43 Urban Forestry Sites in the city.

k. **Flora**

Tree cover in the study area is generally planted either as farmland plantation or homestead or roadside plantation. Dominant tree species in the study area by Prosopis cineraria, Salvodaraoleoides (Piludi), Acacia nilotica (Baval), Azadirachta indica (Neem), Ailanthus excels (Aardso). Homestead plantation is dominated by Mangifera indica (Keri), Tamarindus indica (Amali), Moringa oleifera (Sargavo), Pithecellobium dulce (Gorasmli), Ficus benghalensis (Vad), and Road side Plantations were dominated by Acacia auriculiformis, Peltophorumpterocarpum (Sonmukhi), Delonix regia (Gaulmor), Azadirachta indica (Limbado/ Neem), Acacia leucophloea, (Hermobaval), Acacia nilotica (Baval), Albizia lebbeck (Siris), Leucaena leucocephala (PardesiBaval), Prosopis cineraria (Khyigdo), Ficus benghalensis (Piplo), Ailanthus excelsa (Aurdso), and Tectona grandis (Sag).Climbers/ twiners in the study area dominated by, Ipomoea pes-tigridis (Wagpadi), Ipomea pes-caprae (Darianivel), Ipomea aquatica, Coccinia grandis (Ghiloda), Luffa cylindrica (Galku), and Abrusprecatorius (Chanothai). Around 25 species of trees are planted by the Gardens Department of AMC in their Oxygen park – Ugari Lake including Mangifera indica, Phyllanthus emblica, Tamarindu indicus, Psidium guajava, Albizia saman, etc.

[37]*forests.gujarat.gov.in*

l. **Fauna**

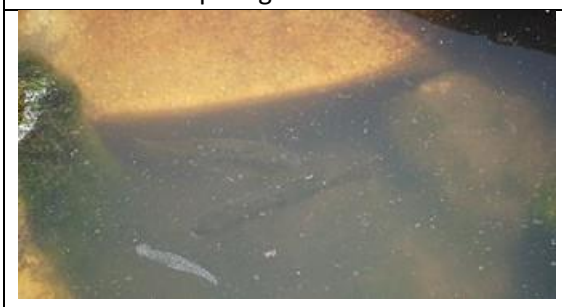
Some of the common fauna found in these sensitive areas in and around Ahmedabad are marked as vulnerable in the IUCN Red List. This includes Sarus crane, Black-Headed Ibis (Threskiornismelanocephalus), and Oriental Darter (Anhinga melanogaster). Some of the sighted fauna were given protection by the Indian Wildlife (Protection) Act, 1972 by including them in different schedules. Among the reptiles, the Indian Flapshell turtle (Lissemys punctata), is protected as a Schedule - I animal. While Indian Spiny Tailed Lizard (Uromastixhardwickii), Common Indian monitor (Varanus bengalensis), Indian Cobra (Najanaja), and common rat snake (Ptyas mucosa) are protected as per Schedule-II of Wildlife protection act, (1972). Among mammals, Chinkara (Gazella bennettii), is protected as a schedule –I animal. Common Mongoose (Herpestesedwardsi) and Jackal (Canis aureus) are Schedule–II animals. The Indian Wild Boar (Sus scrofa cristatus) and Nilgai (Boselaphustragocamelus) are protected as Schedule-III animals, five stripped palm squirrels and all Hares are included in schedule IV of Wildlife Protection act 1972. In addition, many varieties of reptiles, mammals, and insets are found in the study area. The most spotted bird species of this area are Peafowl, Cattle Egret, Pond heron, Black Ibis, Rock Pigeon, and Ring Dove, etc. Among the birds in the study area, Peafowl (Pavocristatus) is included in schedule I of the Wildlife Protection Act (1972), while many other birds are included in schedule IV.

Aquatic Flora Fauna of the Sabarmati River downstream of the city:

<table>
<tr><td> 
Pistia sp.</td><td> 
Eichhornia crassipes</td></tr>
<tr><td> 
Pistia & Eichhornia at Vasna Barrage</td><td> 
Purple Moorhen</td></tr>
<tr><td> 
Purple Heron</td><td> 
Intermediate Egret</td></tr>
</table>


Red Wattled Lapwing


Gambusia sp.


Tilapia sp.


Channa sp.

m. **Heritage**

The history of Ahmedabad stretches as far back as the 11th century and linking itself with the old towns of Ashaval and Karnavati about 1000 years ago. In the year 1411 AD, Sultan Ahmed Shah built a citadel and encouraged the development of trade and commerce. In 1456 AD, an enclosing wall was constructed defining a periphery to the city limits. The city within this wall got structured into wards, organized by 12 main roads each terminating at a gate in the wall. In 1487, Mahmud Begada, the grandson of Ahmed Shah, fortified the city with an outer wall 10 km (6.2 mi) in circumference and consisting of twelve gates, 189 bastions, and over 6,000 battlements.

The heritage resources in Ahmedabad can be looked at following three distinct levels:

(i) The entirety of the walled city: ASI has a total of 52 Indo-Islamic monuments under protection. In addition, there are many Hindu and Jain temples, the Gaekwad's Haveli enclave of the Maratha period, and several other institutional buildings and bungalows of the Colonial period. Now, these structures are in a state of disrepair except for the few Jain temples taken care of by the Jain community. The City Wall and its Gates are equally in dilapidated condition.

(ii) The pols which comprise it: The grouping of houses into pols is typical of Gujarat and especially of Ahmedabad. Destruction and de-structuring caused by new buildings, the invasion of business and traffic point to a worrisome future for the pols.

(iii) The individual houses: The houses of Ahmedabad were traditionally built of carved wood and brickwork characterized by low, single-family units, of which only some 10,000 survive now. The gradual progression of the model gave way to the transplantation of forms, which were foreign to local traditions. The apartment buildings are of a mediocre quality heralding a decline in the know-how and technique.

A list of 2236 residential buildings and 449 institutional buildings in the old walled city of Ahmedabad has been notified in the Gujarat government official gazette, in the year 2016. Ahmedabad has earned the distinction of being the first Indian city to get inscribed on the World Heritage list by UNESCO in July 2017 and the Best Heritage City award 2016-17 constituted by the Ministry of Tourism, Government of India. Ahmedabad is also home to some renowned modern buildings which are considered landmarks, for example, Indian

Institute Management, Centre for Environmental Planning and Technology, Doshi Husain Gunfa, Gandhi Ashram, etc.

Heritage Cell within AMC was established in collaboration with CRUTA Foundation, an NGO, in July 1996 to initiate strategic intervention to conserve and promote the rich heritage of the city. It was the first heritage cell in India within an Urban Local Body (ULB). The heritage cell has now been upgraded and transformed into a full-fledged Heritage Department. Heritage Department acts as a catalyst to preserve the cultural heritage, both tangible& intangible heritage aspects of the city. It undertakes programs and projects such as heritage awareness creation and educational programs, identification and listing of heritage resources, besides physical conservation and restoration of heritage buildings and structures located in the city. Processing of heritage building Repair/ restoration application including obtaining recommendations of the Heritage Conservation Committee appointed by the GoGon matters related to Heritage Conservation.[38]

As per The Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act, 2010; a prohibited area is an area beginning at the limit of the protected area or the protected monument and extending to a distance of 100 m in all directions; and the regulated area is the area beginning at the limit of the prohibited area in respect of every ancient monument and archaeological site and remains and extending to a distance of two hundred meters in all directions. The Act has barred all construction activities in the prohibited area to be taken up by all public bodies even if the purpose is related to public works or projects essential to the public. Prior approval is required for construction activities in a regulated area of these monuments from the Director of Archaeology, Gandhinagar, Archaeological Survey of India.[39]

6. Economic Activities

(i) Employment Characteristics

Around 67 percent of the population are in the working-age group of 15 – 59 years. The work participation rate of the city was 37% as per the 2011 census. Among those employed, self-employed constituted 50.56 percent, regular wage/ salaried employees were 45.65 percent while 3.8% were casual labor. During the census period, 1.94 percent of the workers in the city were employed in the primary sector, 47.76 in the secondary sector, and 50.30 percent were in tertiary sectors. Primary commodities manufactured in the ULB are chemicals, medicines, and cotton cloth.

Women participation in the workforce

Periodic Labour Force Survey (PLFS) 2018-19 reports that the female labor force participation rate (FLFPR) in Gujarat is 16.9 percent, lower than the national figure of 18.6 percent. Urban Gujarat shows the greater male-female disparity in LFPRs with a gender difference of47 percentage points, again higher than the gap observed at the all-India level. These figures indicate the prevalence of gender inequality in the labor market within the state.

In urban areas, the share of women workers is highest in services at 39.7 percent, closely followed by manufacturing (at 37.5 percent). In particular, 11.5 percent of women workers are employed in the field of education and 4.7 percent are engaged in health and social work activities, among services. A significant share of women workers in urban areas (9.1 percent) is also engaged in trade, hotels, and restaurants.[40]

(ii) Agriculture and Fisheries

[38] *https://ahmedabadcity.gov.in/portal/jsp/Static_pages/heritage_dept.jsp*
[39] *GOI notification no. S.O. 278(E) dt 13th February 2012*
[40] *https://iwwage.org/wp-content/uploads/2020/10/Gujarat-Factsheet.pdf*

According to the 2011 Census, 15.86 percent of the total working population of the district[41] was engaged in agriculture, as against 49.61 percent in the State as a whole. Agriculture of fisheries is not the mainstay in the city area. Residential landuse predominates in the city, followed by Industrial and commercial. Skilled agriculture and fisheries workers in the ULB are just around 0.73 percent of the total population. The fish population is reported in the lakes of Ahmedabad and the Sabarmati River. Fishing as activity occurs downstream of Vasna barrage usually post-monsoon when water is released from Dharoi dam.

(iii) Tourism and recreation

There are many tourist destinations in Ahmedabad city and around. Some of the features perfectly describe Ahmedabad city are splendid monuments, wonderful museums, and gorgeous lakes. Adalaj is one of the most excellent step wells or '*Baolis'* of Gujarat. Ahmedabad enjoys a thriving cultural tradition, being the center of Gujarati cultural activities and diverse traditions of different ethnic and religious communities. Popular celebrations and observances include Uttarayan an annual kite festival on 14 January and the festival of lights 'Deepavali'. The nine nights of Navratri are celebrated with people performing Garba the folk dance of Gujarat at venues across the city. Other festivals such as Holi, Ganesh Chaturthi, GudiPadwa, Eid ul-Fitr, and Christmas are celebrated with enthusiasm. The annual Rath Yatra procession on the Ashadhi-sud-bij of Vikram Samvat and the procession of Tajia as the ending of the Muslim holy month of Muharram; are integral parts of the city's culture.

(iv) Industries

Ahmedabad is an industrial base for sectors such as chemicals, textiles, drugs and pharmaceuticals, and food processing industries. Ahmedabad district accounts for 21.5% of factories and employs 18% of workers in the state. Several business conglomerates such as Adani Group, Reliance Industries, Nirma Group of Industries, Arvind Mills, Claris Life Sciences, Cadila Pharmaceuticals, Shell, Vadilal Industries Ltd., Rasna, Bosc Rexroth (Germany), Stork, and Rollepaal (Netherland) are present in the district. The presence of Ahmedabad Textile Industry's Research Association (ATIRA), the largest association for textile research and allied industries in India, has helped the district in becoming a thriving textile center. Most of the medium and large-scale industries are concentrated in talukas such as Ahmedabad city, Anand, Viramgam, Daskroi, and Dholka. Well-developed infrastructure, prudent industrial policy of the state government, and a peaceful industrial atmosphere have been the vital factors that have contributed to the industrial growth in the district. The decade of the 1970s and part of the 1980s witnessed the rapid growth of small-scale industries in Gujarat through State government investments in industrial estates developed by the Gujarat Industrial Development Corporation (GIDC). Ahmedabad's industrial base also expanded. Three GIDC estates, in Naroda, Odhav, and Vatva, were located beyond the textile industrial areas, where unorganized industries developed, employing a large number of unorganized workers. These areas witnessed the rapid development of slums. The eastern periphery of the city thus developed with the emergence of industrial suburbs with small-scale industries and housing for workers and low-income groups. [42] The district has over 23,734 small-scale industries generating over 95,591 jobs with a total investment of INR 89,356.5 lakhs (US$ 21,794 million). Engineering, textiles, chemical, and paper and paper products are the major small-scale industry sectors present in the district, with an investment to the tune of INR 68,220 lakhs (US$ 16,639 million). There are around 422 medium and large-scale industries based in Ahmedabad district with

[41]*The principal crops grown in the district are wheat, bajri, jowar and paddy among the food crops and cotton among the non-food crops. Cotton occupies the largest area under any single crop. In the western and south-eastern portions of the district, cotton, jowar, and unirrigated wheat are the principal crops. The famous Bhal tract growing unirrigated wheat is located in the south-western portion of the district: but this crop is never a regular one, and its yield is the lowest in the State, being only 250 to 300 kg per hectare. Crops in south western parts are irrigated by the water fed by Sabarmati.*

[42]*https://cept.ac.in/UserFiles/File/CUE/Working%20Papers/Revised%20New/26CUEWP%2026_City%20Profile%20Ahmedabad.pdf*

a total investment of INR 5,45,988 crore (US$ 1,33,167 million) employing around 79,904 people. The following ***Table A-12*** presents the no: of industries in various industrial estates in the city.

Table A- 12: Distribution of Industries in various Industrial Estates in the city

Industrial Estate	No. of Industries
Vatva	673
Naroda	179
Odhav	62
GVMM,Odhav	34
Narol	118
Danilimda-Behrampura	285
Total	**1351**

Total water consumption by industries is 299.7 MLD and Total industrial effluent generation is 150.88 MLD. Of this, 285 units have captive ETPs (Danilimda-Behrampura) individual ETPs and 1066 (CETP member units) totaling 1351 units. There are 7 CETPs with a total treatment capacity of 120.8 MLD. Gaps are observed in terms of the quality of treated effluents. There is a proposal for additional CETP in Danilimda (30 MLD).

Gujarat has the distinction of being the first state to enact the Special Economic Zone Act-2004. SEZs are growth engines that can boost manufacturing, augment exports and generate employment. Various Special Economic Zones like Reliance SEZ, Adani SEZ, GIDC Apparel Park, Zydus Industries Pvt Ltd is present in the city.

7. Major Infrastructure and Services

(i) Transportation

The number of goods and passenger vehicles on road is increasing at a quick rate in Ahmedabad. The major public transport accounts for AMTS and the BRTS. These are an integral part of the city's road transportation in Ahmedabad.

Road Network Characteristics

The road network in Ahmedabad may be classified as that of ring-radial form. There are 20 well-defined radials, which can be differentiated as arterials and collectors according to Indian Roads Congress (IRC). There is a total of 20 radials, 12 are in the west and 8 in the east. Ashram road running along the Sabarmati River also functions as a north-south radial. Different types of roads, their length, and the percentage of the road network as per the Ahmedabad Traffic Management Information Control Centre report, 2016 are presented in ***Table A-13***.

Table A- 13: Hierarchy of Road Network in AMC[43]

Sl No	Type	Road Length (Km)	% Road Network
1	Ring and radial roads	347	14.2
2	Sub- arterials and collectors	923	37.9
3	Other roads	1166	47.9
Total	**2436**	**2436**	**100**

The area under roads is 7.91% as against the desirable 15-18%. Road density reduced from 6.6 km/ sq. km. area to 5.2 km/ sq. km. the area between 2007 and 2011. It further burdens the existing road network and presents the need for introducing non-conventional measures in managing the use of

[43] *Ahmedabad TMICC 2016*

transport infrastructure optimally in Ahmedabad. Construction work on Ahmedabad Metro's Phase 1 with routes of 39.259 km started in 2015 and is expected to be completed in 2024. The first phase includes two corridors and 32 stations, connecting the four sectors of Ahmedabad city. The state government has appointed the Delhi Metro Rail Corporation for a Detailed project report for Phase II. The total length of phase one of the Ahmedabad Metro project is 40.03km, of which 6.5km is underground and the remainder is elevated.

Existing Traffic and Travel Characteristics

Presently transport demand of the city is met by public and intermediate public transport modes including intra-city buses, auto-rickshaws, hired cars, and personalized modes. However, buses continue to be a popular means of transportation for intra-city travel. The Eastern bank of the River houses the old city which includes closely clustered buildings and numerous places of worship. It also has a railway station, congested marketplaces, post office, and old buildings of the British era. The part of the city on the western side of the River is relatively new and houses educational institutions, residential areas, shopping malls, multiplexes, etc. These two parts are connected by several bridges across the River. A large number of trips using heterogeneous modes are made daily in both directions across the river.[44]

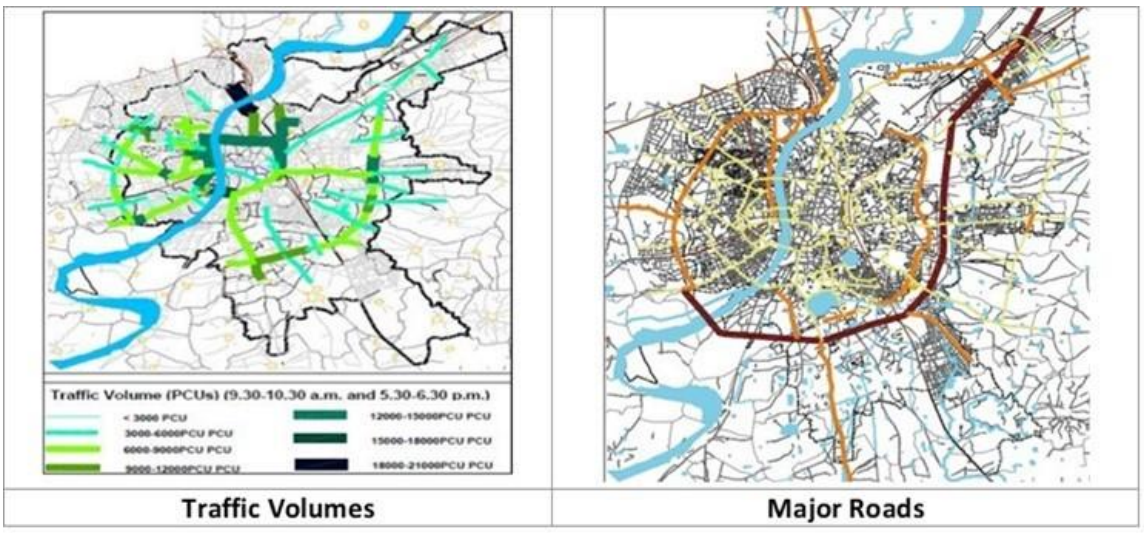
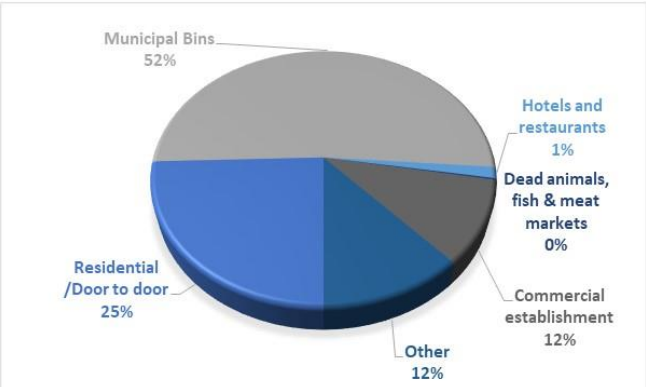


Figure A- 20: Traffic Volume on Major Roads of Ahmedabad [45]

(ii) Solid Waste (including Plastics)

The Solid Waste Management Rules by MoEF&CC came into force in April 2016 led down rules for handling and disposal of solid wastes by urban local bodies. Duties and responsibilities of waste generators are also mentioned in SWM notification 2016.



Waste Generation: The city generates 3500 TPD[46] to 4000 TPD including 3300 TPD of solid waste 1000 MT of construction and demolition waste. C&D waste is processed daily and 1400 TPD dry waste is collected.

Figure A- 21: Source wise Municipal Solid Waste Collection in AMC

[44] *Ahmedabad TMICC report 2016*
[45] *Ahmedabad TMICC report 2016*
[46] *River Action Plan for Ahmedabad, 2020*

Note: Door-to-door and Gate collection includes both residential as well as commercial establishments, it is assumed based on inputs from the SWM department of AMC that 70% of waste is residential while the remaining is commercial.

Segregation, Collection, and Transportation: AMC collects segregated (dry and wet) wastes from households and commercial areas by AMC in a collection vehicle with two separate chambers. *T*hree MRFs are provided at RDF premises. In each zone, there are transfer stations where small collection vehicles transfer the waste to hook loaders which takes the wastes to dumpsites/ RDF facilities. All grievances/ complaints on delay in the arrival of vehicles at premises, garbage not collected, etc; are resolved in 24 hours. Quantity of wastes from the western part of the city as well as complaints on SWM are more from the west part of the city where the residents are more aware.

Solid Waste Treatment and disposal: Existing treatment and disposal facilities are for 2500 TPD, of which 1000 TPD is for Composting, 1000 TPD for C & D Waste, 100 TPD for Plastic waste, 400 TPD is MRF. There are three composting plants for wet waste developed on PPP mode with AMC providing the land to set up the facility and receive revenue from the sale of compost. AMC is planning treatment plants for mixed solid waste, plastics, and also Waste to energy facilities.

There is one sanitary landfill site for solid wastes, hazardous wastes are handled by industries under the guidance of GPCB. There is a 40-year-old municipal dumpsite with three dumping areas. Incidence of fire is very common in summers, and people complain about odor and methane generation. Biomining of Pirana dump area is in the process; with 3300000 MT of waste being bio mined a day. The dumpsite is 40 years old.[47] There are 7 RDF facilities, where waste is segregated. The sanitary landfill in Ahmedabad caters to 42.3TPD of inerts/ rejects per day; in addition to that from nearby ULBs Bareja, Motera, Bavla, Sanand, and Dholka (up to 50km).[48] About 27.414 million MT of dry waste has been co-processed in the state since the year 2009-10 till 2020. SWM department undertakes cleaning of canals and drains pre-monsoon annually. Underground drains and silt pits are cleaned once a year before the monsoon. There is fencing all around the Kharicut canal, but there is no fencing around Lakes. CC TV cameras are placed around the canal and defaulters who throw waste into the canal are penalized.

SBM ranking: AMC is ranked 6th in 2020 among all MCs in the country, and for the same population category AMC stands at Rank one.

Ragpickers: There are around 1000 ragpickers in the AMC area. GoG has launched a scheme for grouping the ragpickers as an association and they are provided with ID cards, safety gear, incentives based on the quantity of waste collected. Regular health check-ups (once every month) are provided to ragpickers through Health Department. No ragpickers are allowed officially in dumpsites considering health issues. They are permitted to sort and take dry waste at MRFs.

Funding: SBM budget is approved by AMC through the SWM grant. Approximately 800 – 900 crore funding is made available to SWM department Waste Treatment is under PPP mode. AMC is charging Rs 1 as cess per head per day, and Rs 2 per commercial unit per day as part of property tax as directed by SWM Rules, 2016. This is added to the overall budget of AMC as a separate component in tax (in addition to Conservancy tax on sewerage, drainage). Property tax recovery is more than 95 percent in AMC.

Plastic Pollution

As in almost all parts of the world and the country, plastic pollution is a concern in the city. Sabarmati being the linear artery carrying pollutants across the region shows the accumulation of plastics/

[47] *Integrated Solid Waste management PPT, AMC*
[48] *Annual Report submitted to CPCB by AMC*

microplastics in the water and sediments. Plastics (as part of dry wastes) are being collected from the city and disposed of as per SWM Rules, though there are gaps in the existing system. Plastic/ waste is also managed in the Sabarmati Riverfront area. However, the presence of microplastics in the river sediments is estimated by various studies. Microplastics of 75micrometer to 5mm are reported in the sediment of the Sabarmati river in the city area in the form of small fibres. Its abundance is estimated as 47.1 mg (MP size from 75 to 212 micrometres) and 4 mg (212 micrometres to 4 micrometres). [49] from 2015-16 to 2020-21, 431.35 thousand MT of plastics were co-processed in cement industries.

(iii) Water supply

AMC provides water, wastewater, stormwater management services in addition to other functions like roads, solid-waste management, health, and fire services.

Sabarmati River was the historical source of water supplemented by additional supply from the barrage on Mahi River. However, with the growth of the city and limited availability of raw water in Sabarmati and Mahi, the city in recent past had invested to source the Narmada River water delivered through the Main Canal as well as branch canals at Shedhi and Dholka. The installed and current functional capacities of the existing water supply infrastructure are shown in ***Table A-14*** below.

Table A- 14: Existing Water Supply Infrastructure in Ahmedabad

Component	Unit	Value
Raw water extraction capacity	MLD	2375
Water Treatment Plants	Number	3
Treatment capacity	MLD	1450
Average production during 2019	MLD	1100
Groundwater supply from boreholes	MLD	124
Total average production during 2019	MLD	1224
Transmission Mains Length	km	481
Water Distribution Zones	Number	192
Storage Capacity	ML	1400
Water Distribution Length	km	3753
Property Service Connections	Number	Not Known
Supply continuity	Frequency	2 hours/day

Projected water demand and sewage generation in AMC area is presented in the following **Table A-15.**

Table A- 15: Projected Water demand and Sewage Generation in AMC – 2035, 2050

Sl No	Zone	Area Sq. Km	2035 Demand in MLD			2050 Demand in MLD		
			Population	Water Demand	Sewage Quantity to be treated	Population	Water Demand	Sewage Quantity to be treated
(A)	West Side							
1	West Zone	66	1954000	352	264	2595000	467	350
2	New West Zone	153	2286000	411	309	3498000	630	472
	Subtotal (West A)	*219*	*4240000*	*763*	*572*	*6093000*	*1097*	*822*
(B)	East Side							
1	North Zone	41	1586000	285	214	2026000	365	273
2	East Zone	73	1784000	321	241	2382000	429	322
3	Central Zone	18	1036000	186	140	1234000	222	167

[49] *Ram, B., Kumar, M., 2020. Correlation appraisal of antibiotic resistance with fecal, metal and microplastic contamination in a tropical Indian river, lakes and sewage. Npj Clean Water 3, 1–12. https://doi.org/10.1038/s41545-020-0050-1.*

Sl No	Zone	Area Sq. Km	2035 Demand in MLD Population	Water Demand	Sewage Quantity to be treated	2050 Demand in MLD Population	Water Demand	Sewage Quantity to be treated
4	South Zone	89	1810000	326	244	2484000	447	335
	Subtotal East (B)	*221*	*6216000*	*1118*	*839*	*8126000*	*1462*	*1097*
	Total (A+B)	***440***	***10456000***	***1881***	***1411***	***14219000***	***2559***	***1919***

Last year (2020), to help farmers of Ahmedabad district in bumper production of Rabi crops, the Gujarat government released 980 cusec water into Fathewadi canal and Kharicut canal with immediate effect to cater to areas of Daskroi, Bavla, Sanand, Dholka, Viramgam, Bareja, and Matar tehsils; south of Ahmedabad city.

(iv) Sewage/ Wastewater Management

The city area doubled between 2001 to 2020, with a proportionate increase in the wastewater infrastructure.

Access of households to toilets in Ahmedabad

Around 96 percent of the 12.71 lakh households in the city have access to individual toilets. Around 1.73 lakh households in the city are staying in slums, of which around 56,000 households (33 percent) do not have access to individual toilets.[50] AMC's earlier survey under Swatch Bharat Mission (SBM) is said to have indicated that about 80000 properties have no sewer connection and about 60000 properties have no individual toilets.

Coverage of Public Conveniences

Ahmedabad city has 1,827 community toilet blocks with 7,160 seats out of which 84 blocks were reported to be non-functional. In addition to community toilets, there are 314 toilet blocks with 1,256 pay and use toilet seats and around 807 bathing units.

Waste Water/Sewage Collection

The following ***Table A-16*** presents the wastewater collection and treatment infrastructure in AMC.

Table A- 16: Wastewater Collection and Treatment Infrastructure in AMC

Component	Unit	2001	2020
Area	SqKm	235	470
Population	Million	3.5	6.8
Sewage Treatment Plants	Number	2	9
Treatment capacity	MLD	250	925
Sewage Pumping Stations	Number	36	64
Sewerage Networks	Km	1200	3300
Sewer Connections	Number	Not Known	Not Known
Stormwater Drains	Km	280	937
Stormwater Pumping Stations	Number	-	29

AMC has no customer database and hence does not have accurate customer connection information. As the network covers the majority of the city, it is expected that all premises are connected. The data on connections vary between 1.27million (AMC ward-wise connection data 2017 for 48 wards) to 2.1

[50] *https://issuu.com/anushrialatagi/docs/sanitation_in_chalis/s/11394938*

million as per the PAS project report for FY 2019-20 reporting a coverage at 87%. It is expected that the total connections could be in the range of 1.31million to 2.1million.

Table A- 17: Existing Wastewater/ Sewage network in AMC

Sewer Dia in mm	Trunk Mains	Zone Wise Sewer Collection Network Length in Km							City Wise Grand Total
		Central	North	South	East	West	NW+SW	Subtotal	
300 and less		160	190	170	150	180	185	1035	1035
450		140	215	175	160	190	145	1025	1025
600		124	145	115	137	105	140	766	766
900	20	25	20	15	15	20	15	110	130
1100	67							0	67
1200	64							0	64
1400	73							0	73
1600	74							0	74
1800	35							0	35
2000	15							0	15
2200	10							0	10
Duct	8							0	8
Total Length	366	449	570	475	462	495	485	2936	3302

Source: AMC, Data for April 2021

Sewage Pumping

Most of the sewage generated on the Eastern Part of the City (old AMC) is conveyed to major 4 terminal sewage pumping stations i.e. Jamalpur, New Suburban, Maninagar, and Berhampur. From where the sewage is pumped into the inlet chamber of the sewage treatment plant at Pirana old Site. The sewage from the North Zone, East Zone, and Part of the South Zone of the Old AMC area is conveyed through intermediate sewage pumping stations and trunk main laid on 200ft NarolNaroda NH-8 to the sewage treatment plant at Pirana New Site. For the merged areas on the west, AMC constructed treatment facilities in Vasna, and for the East at Vinzol. There are 6 terminal sewage pumping stations and 41 intermediate sewage pumping stations in the AMC area.

Sewage Treatment

The details of existing sewage treatment plants are abstracted in ***Table A-18***. The entire AMC area is broadly divided into Five distinct sewerage zones. Total installed capacity (including ongoing STP constructions) of STPs is 1367 MLD, and maximum sewage generation estimated is 1742MLD.

Table A- 18: Existing Wastewater/ Sewage network in AMC

Zones	*STPs*	*Installed Capacity / ongoing (MLD)*	*Proposed / Feasible New STPs (MLD)*	*AMC Estimated Sewage Generation Max (MLD)*
Eastern Zone 1	Pirana – 180 MLD + 155 MLD Maleskban - 30 MLD (Under Construction) Saijpur - 7 MLD (Under Construction) Kotarpur - 60 MLD (Under Construction)	432	Pirana 25-50	580
Eastern Zone 2	Pirana - 106 MLD + 60 MLD S Bhuvan - 25 MLD Dafnala - 25 MLD (Under Construction)	216		268
Eastern Zone 3	Vinzol – 35 MLD + 70 MLD + 100 MLD Lambha – 5 MLD	210	Vinzol 75	213

Zones	*STPs*	*Installed Capacity / ongoing (MLD)*	*Proposed / Feasible New STPs (MLD)*	*AMC Estimated Sewage Generation Max (MLD)*
Western Zone 1	Vasna -240 MLD	240	Koteswar 60	220
Western Zone 2	Vasna – 126 MLD +48 MLD +35 MLD Jalvihar - 60 MLD	269	Vasna 126 upgradaton to 320 =+194	461

Source: AMC

Historically, the sewage from East was conveyed to the stabilization ponds at Pirana, for primary treatment. In the Western part of the city, the sewage was drained to the old Vasna sewage pumping station; from there, it was taken to 280 hectares of the area of Vasna Sewage Farm.

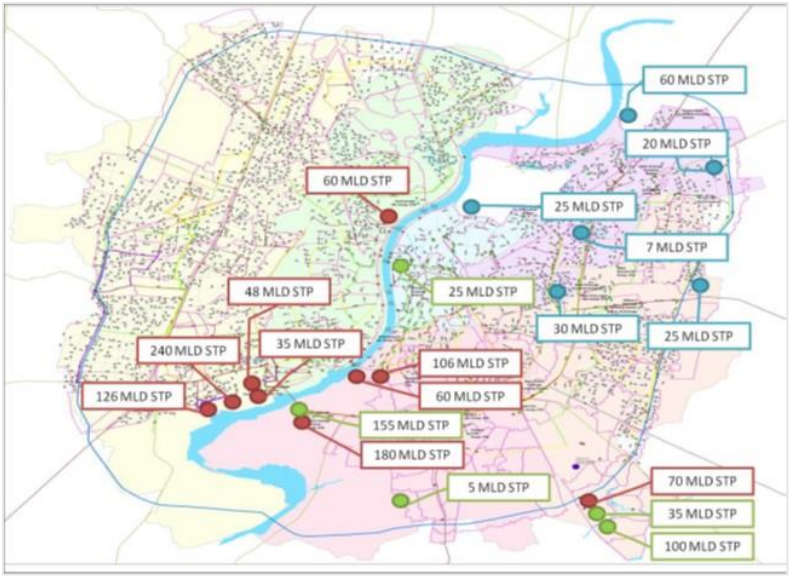


Figure A- 22: Existing and Planned STPs in Ahmedabad [51]

Today, the large capacity STPs are clustered in three locations of Pirana in the South East and Vinzol in East and Vasna in South West. An index map of the city showing the existing and upcoming sewage treatment plants are shown in ***Figure A-22***.

The details of existing sewage treatment plants and utilisation are presented in ***Table A-19*** below.

Table A- 19: Sewage Treatment Plants in Operation in AMC

Sl.No	Plant name	Design Capacity	Current measured flow	Technology	Year of commissioning	Capacity Utilisation	Use of Treated sewage
	Eastern side	**MLD**	**MLD**	**Type**	**Year**	**%**	
1	Old Pirana	106	50	UASB	2005	47%	
2	Old Pirana	60	60	ASP	2010	100%	
3	New Pirana	180	180	ASP	2009	100%	
4	Vinzol	70	70	ASP	2012	100%	
5	Vinzol	35	35	SBR	2020	100%	
6	Nikol	0.5	0.3	EC	2018	60%	0.5
7	Shankarbhuvan	25	18	SBR	2020	72%	
8	Lambha	5	3	SBR	2020	60%	
	Subtotal	**481.5**	**416.3**			**86%**	
	Western side						
9	Vasna	240	240	ASP	2011	100%	140
10	Vasna	126	90	UASB	2006	71%	
11	Vasna	35	20	ASP	2010	57%	20

[51] *https://gpcb.gujarat.gov.in/uploads/ROVER_ACTION_PLAN_SABARMATI.pdf*

Sl.No	Plant name	Design Capacity	Current measured flow	Technology	Year of commissioning	Capacity Utilisation	Use of Treated sewage
12	Vasna	48	45	SBR	2018	94%	48
13	Jalvihar	60	60	SBR	2019	100%	55
14	Vastrapur	0.5	0.48	MBBR	2018	96%	0.5
15	Rasala	1	0.8	MBBR	2016	80%	1
16	V.S. Hospital	1	0.5	MBR	2019	50%	1
	Subtotal	**511.5**	**456.78**			**89%**	
	Grand Total	**993**	**873.08**			**88%**	

Source: AMC

Note: *UASBUp-flow Aerobic Sludge Blanket, ASP- Activated Sludge Process, SBR- Sequential Batch Reactor, EC- Electrocoagulation, SBR - Sequencing batch reactor, MBR - Membrane Bioreactor, MBBR- Moving Bed Biofilm Reactor*

The plants receive more than design demand during peak flow days in the year. Utilization of designed capacity averages at around 70 percent for the STPs, and ranges from a minimum of 37 to 120 percent. This is encouraging when compared to utilization in other cities.

SCADA

The existing SCADA system captures the performance data partially and does not cover the entire wastewater system. AMC is planning total upgradation of the SCADA system to cover performance monitoring of flow and quality in all existing and proposed STPs, SPS, and TSPS.

Reuse of Treated Wastewater

The government of Gujarat had instituted a water reuse policy[52] (Refer ***Annexure II***) to reuse treated water for various purposes. In line with this, AMC had invested in tertiary treatment facilities for supplying treated water to local industries which are dependent on fresh-water resources. AMC estimated the potential for reuse water for industrial, horticulture/ agriculture purposes as 100 MLD as per current data, and 700 MLD after implementation of proposed projects.

Table A- 20: Wastewater Reuse Potential in AMC

Sl.No	STP	Capacity	Reuse Potential (MLD)		Purpose
		(MLD)	Current	Planning	
1	New Pirana	180			
2	Old Pirana	60			
3	Old Pirana	106		100	Industrial Reuse
4	Vasna	48	48		Agriculture
5	Vasna	240		150	Industrial/ Agriculture
6	Vasna	126		100	Agriculture
7	Vasna	35		25	Agriculture
8	Jalviahar, Vadaj	60	55	25	Power plant
9	Vinzol	70	4		Industrial
A.	Subtotal Existing	925	107	400	
B.	New STPs in planning	542		300	Agriculture/ horticulture and industrial reuse
C.	Grand Total	1467	107	700	

[52] *https://gwssb.gujarat.gov.in/downloads/Policy_Reuse_Of_WasteWaterA.pdf*

Sewage/ Wastewater Management: Service Levels and Complaints

Figure A-23 below presents the wastewater service levels discussed in the Performance Assessment System (PAS) Project.

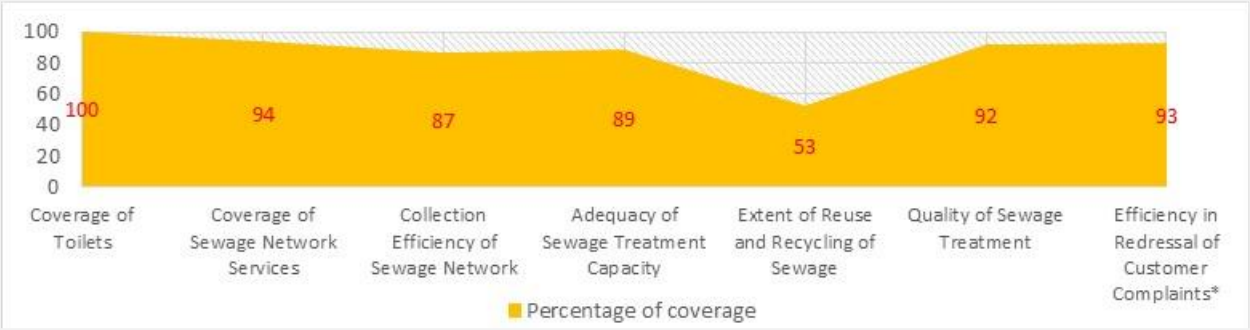


Figure A- 23: Current wastewater/ sewage management service levels

Quality of Treated Sewage Disposal from STPs

Ministry of Environment, Forests and Climate Change (MoEFCC) of the Government of India in 2017 revised the standards to be followed for disposal of treated sewage. Sewage discharge standards for disposal into water bodies and land applications of treated effluent were also discussed by the National Green Tribunal, the environmental watch agency of the country in its many important judgments. The following ***Table A-21*** presents the sewage discharge standards.

Table A- 21: Sewage Discharge Standards

	Parameters	General norms[g] 1986				Draft norms Nov. 2015**	MoEF & CC notification, Oct. 2017**	NGT order 2019**
		Inland surface water	Public sewers	Land irrigation	Marine coastal areas			
1	BOD [mg/l]	30	350	100	100	10	30 20 (metro cities)[h]	10
2	COD [mg/l]	250	–	–	250	50	–	50
3	TSS[i] [mg/l]	100	600	200	100 (process water)	20	100 50 (metro cities)	20
4	pH	5.5–9	5.5–9	5.5–9	5.5–9	6.5–9	6.5–9	5.5–9
5	TN[j] [mg/l]	100	–	–	100	10	–	10
6	Ammonical Nitrogen as N [mg/l]	50		–	50	5[k]	–	–
7	Free NH3 [mg/l]	5			5	–	–	–
8	Nitrate [mg/l]	10			20	–	–	–
9	Diss. PO4 as P [mg/l]	5	–	–	–	–	–	1[l]
10	Fecal Coliform [MPN/100ml]	–	–	–	–	<100	<1,000	<230

[g]Standards set in 1986 cover in total 40 parameters, which are not depicted in this illustration. NOTE: industrial wastewater standards are regulated under CETP (Common Effluent Treatment Plant) set, which is not focus of this this study.
*[h]Metro Cities, all state capitals except in the state of Arunachal Pradesh, Assam, Manipur, Meghalaya Mizoram, Nagaland, Tripura Sikkim, Himachal Pradesh, Uttarakhand, Jammu and Kashmir and Union Territory of Andaman and Nicobar Islands, Dadar and Nagar Haveli Daman and Diu and Lakshadweep Areas/Regions. **Standards applicable for discharge into water bodies and land disposal/applications, while reuse is encouraged.*
[i]As SS in [mg/l] in General Norms, 1986.
[j]As Total Kjedahl Nitrogen in General Norms, 1986.
[k]As NH_4-N.
[l]Valid for Phosphorus Total (for discharge into ponds and lakes).

A comparison [53]of India's Standards with those in other countries is presented below. It reads that NGT suggested standards for disposal of treated sewage is stringent than that of other prevalent standards.

[53] Schellenberg Tatjana, Subramanian Vrishali, Ganeshan Ganapathy, Tompkins David, Pradeep Rohinim, 2020. ***Wastewater Discharge Standards in the Evolving Context of Urban Sustainability–The Case of India***, Journal: Frontiers in Environmental Science, VOLUME-8

Country	PE treated	pH	t (°C)	SS (mg SS/l)	DO (mg O_2/l)	COD (mg COD/l)	BOD_5 (mg BOD_5/l)	TN (mg N/L)	Total ammonium (mg NH_4-N/l)	Total ammonia (mg NH_3-N/l)	TP (mg P/l)	Microbial indicators
EU Urban Wastewater Treatment Directive (UWWTD)[p]	>2,000			35/90% reduction		125/75% reduction	25/70-90% reduction	–			–	
	10,000 – 100,000							15			2	
	>100,000							10			1	
Ireland	≤10			30			20	5	20		2	
	>2,000	UWWTD apply as a minimum, but may be more stringent to comply with Water Framework Directive (WFD)										
France	<20			30			35					
	20 - 2000	6–8.5	<25	50% reduction		60% reduction	35, 60% reduction					
	>2000	UWWTD apply as a minimum, but may be more stringent to comply with Water Framework Directive (WFD)										
Romania	>2,000	UWWTD apply as a minimum, but may be more stringent to comply with Water Framework Directive (WFD)										
Ecuador		6 - 9	±3[q]	130		200	100	50 TKN	30		10	<2000 FC MPN/100 ml
Tanzania		6.5–8.5	20–35	100 TSS		60	30	15 TKN			6	<10,000 TC counts/ 100 ml
Jordan				60 TSS	>1	150	60	70			15 as $T\text{-}PO_4$	<1,000 *E. coli* MPN/100 ml Nematodes < 1
India 2015		6.5–9		20 TSS		50	10	10	<5			<100 FC MPN/100 ml
India 2017/18	Metro	6.5–9		50 TSS			20					<1,000 FC MPN/100 ml
	Non-metro			100 TSS			30					
India NGT 2019		5.5–9		20 TSS		50	10	10			1	<230 FC MPN/100 ml
India 1986[r] Inland water		5.5–9	<5	100		250	30	100 TKN		5 as free NH_3	5 diss. PO_4 as P	
Land irrigation				200			100					

Note to the table: Coliforms represented include E. coli, Fecal Coliforms (FC) and Total Coliforms (TC).
[q] Detail for ranges of permitted consents omitted from this version for clarity.
[p] TP and TN only considered in designated "sensitive" areas.
[q] Of the receiving water body.
[r] Total set covers a range of 40 parameters and three further application areas for discharge into public sewer, marine coastal areas.

Existing STPs were designed to comply with the sewage discharge standards prevailing until the year 2018 and need process/ technology up-gradation to comply with the latest discharge standards. Consent granted by GPCB to STPs in Ahmedabad stipulates upgrading the facilities to meet the MoEFCC 2017 standards in five years whereas NGT standards are more stringent as presented in ***Table A-21*** above. WB EHS suggests following Indian National Standards EP Rules, 1986, of which the proposed NGT standards is a more stringent updation. The influent and effluent wastewater quality is analysed and presented in ***Table A-22*** below. The existing consent conditions for STPs in Ahmedabad are as follows:

Parameter	Standards
BOD (5 days at 20^0 C)	Less than 20 mg/L
Suspended solids	Less than 30 mg/L
Residual Chlorine	Minimum 0.5 mg/L

Treated Sewage Confirming to above standards shall be discharged into the River Sabarmati.

STP shall achieve following standards within a period of Five Years from the date of publication Notification Dtd.13/10/2017

Parameter	Standards
pH	6.5-9.0
BOD (5 days at 20^0 C)	20 mg/L
Total Suspended solids (TSS)	Less than 50 mg/L
Fecal Coliform (FC)	< 1000 MPN/100 ml

Flow meter shall be provided at inlet line of sewage & at the outlet of the sewage discharge line.
STP shall provide online monitoring system at the outlet of STP.

In this context it is to be noted that, currently the discharge from Vasna 240 STP is into Fatehwadi Canal, upon request from Irrigation Department to support the water starved downstream areas for irrigation. NGT standards pertains to discharge of treated effluents to River, rather than for Irrigation Discharge standards for irrigation need to be agreed with GPCB, and Consent shall be updated. CPCB

Available at: https://www.frontiersin.org/article/10.3389/fenvs.2020.00030
Accessed on : September 7, 2021

has Guidelines for Utilisation of Treated Effluent (*as in Industrial Effluents*) in Irrigation and expert committee has suggested using treated sewage after secondary treatment for Irrigation in areas near cities which have STPs. However, it need to confirm to available Standards for discharge of Environmental Pollutants Part A-Effluents of EP Rules, 1986. NGT standards are more stringent than this standards.

CPCB suggests that industries shall engage an agricultural scientist or tie-up with an agricultural university or institute for advice on the utilization or the rate of application of the effluent for irrigation considering the agro-climatic conditions and stakeholders views. Irrigation Management Plan shall be prepared in consultation with the agricultural scientist or agriculture university/institute and submit to GPCB which should verify the same while issuing Consent to the industry. The treated sewage should meet the norms prescribed for irrigation under Environment (Protection) Rules, 1986/Consent. It is also important to understand the stakeholders perception on this.

Treated sewage quality of various STPs reported by GPCB in River Action Plan for Sabarmati is as follows.

Table A- 22: Quality of treated effluents from various STPs at Ahmedabad (2016-2018)

Location, Year	pH	COD mg/L	BOD mg/L	DO mg/L	TC (MPN/100ml)	FC (MPN/100ml)
MoEFCC 2017	6.5-9	-	20			<1000
NGT	5.5-9	50	10			230
35 MLD STP (VASNA)						
2016	7.7	82	32	-	18967	963
2017	7.4	69	25	-	-	-
2018	7.5	65	23	-	2815	548
60 MLD STP (PIRANA)						
2016	7.7	140	56	-	5840	990
2017	7.6	110	40	-	-	-
2018	7.5	121	41	-	1148	733
106 MLD STP (OLD PIRANA)						
2016	7.9	97	33	-	1243	302
2017	7.8	89	34	-	-	-
2018	7.7	106	35	-	1010	649
126 MLD STP (OLD VASNA)						
2016	7.7	75	26	-	18693	1240
2017	7.4	100	37	-	-	-
2018	7.5	109	39	-	2769	942
180 MLD STP (PIRANA)						
2016	7.8	232	86	-	6477	1067
2017	7.5	277	99	-	-	-
2018	7.5	307	100	-	3468	664
240 MLD STP (VASNA)						
2016	7.8	64	22	-	12513	1186
2017	7.6	45	15	-	-	-
2018	7.6	101	34	-	2444	593

** Green highlights indicate values overshooting the standards suggested by NGT*

STP operators collect grab samples once a day for influent and once in 15 days for effluent as per the regulatory reporting requirement. But the influent and effluent need to be collected in proportion to the flow on a 24hours continuous basis using Autosamplers and the composite sample need to be analyzed for a more reliable, effective, and prudent way of influent and effluent quality monitoring.

Existing STPs shall be upgraded so that they meet the discharge criteria set by NGT and as desired by AMC. In addition, monitoring mechanisms shall be improved for water quality and overall environmental improvement.

CPCB Status Report on STPs observes that "*Treatment schemes based on primary sedimentation followed by activated-sludge-process with anaerobic sludge digester and sludge drying beds for anaerobic sludge is quite a suitable scheme for large cities where land availability is a problem. However, the plant at Vasna, Ahmedabad based on an anaerobic-sludge-blanket reactor followed by coagulant aided tertiary sedimentation needs to be studied in detail for assessing its optimal efficiency, as this scheme also require less land and may be suitable for large cities. This scheme is most likely to be operationally economical as compared to the scheme based on activated-sludge-process in vogue. Moreover, better bacteriological quality may be achieved with the help of coagulants in tertiary sedimentation".*

As per consent conditions, the STPs shall achieve pH: 6.5-9, BOD: 20mg/L, TSS <50mg/L, Faecal Coliform <1000MPN/100ml in 5 years of provision of the Consent. However, AMC aspires to meet the stringent levels suggested by National Green Tribunal in all its STPs, considering the need to improve environmental quality. Treated effluent discharge quality of some of the main STPs in the city are also presented in ***Table A-23*** below.

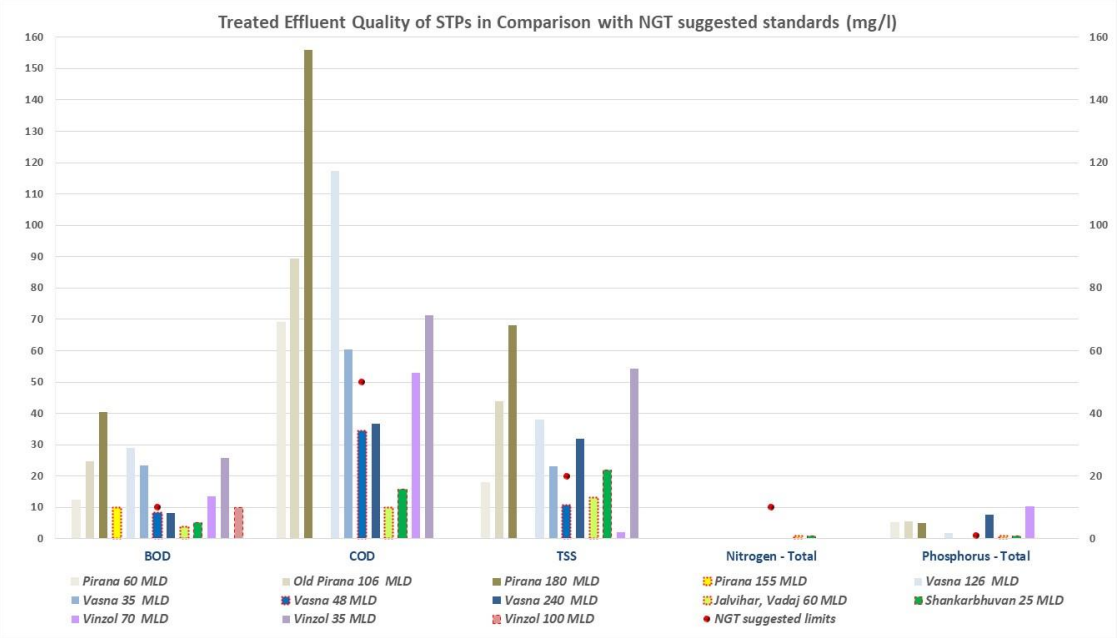
Table A- 23: Treated Effluent Discharge Quality for main STPs in the city

S.No	Plant name	Capacity Utilization	Discharge Quality Parameters of Key STPs discharging treated effluents into Sabarmati & Khari				
			pH 5.5-9	TDS	BOD 10	TSS 20	COD 50
	Eastern side	**%**	**No:**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
1	Old Pirana	47%	7.99	1073.14	28.81	89.06	79.95
2	Old Pirana	100%	7.71	1039.57	26.6	57.23	73.18
3	New Pirana	100%	7.59	1085.39	72.36	52.53	212.00
4	Vinzol	100%	7.43	1358.16	34.79	84.4	94.72
	Western side						
9	Vasna	100%	7.52	1021.53	28.93	39.17	85.62
10	Vasna	71%	7.52	927.29	32.35	39.76	96.87

Note: Effluent Quality from central Laboratory data of AMC, the average for the year 2019 (N, P, FC not available)

Treated effluent quality during 2020-21 in comparison with NGT prescribed limits is presented in the following ***Figure A-24***: This shows that the quality parameters are need more attention specially in older STPs (those columns with dotted outlines are new ones). However consent from GPCB is for MOEFCC prescribed discharge standards.

STPs have a bypass facility to direct untreated sewage to Sabarmati, mostly for about 10-20 days annually during monsoons (to prevent units from getting affected due to high washed down silt content) or maintenance. There is no flow meter at the bypass gate, but STP operators maintain data on the dates when the sewage is bypassed. Bypass in the rainy season is mostly done from the immediate pumping station which supplies sewage to STPs.



Source: Data from AMC and Data collected for G-ACRP

Figure A- 24: Current wastewater/ sewage management service levels

Sludge, Grit and Waste Screenings from STPs

The total quantity of sludge generated is 35 TPD (due to treatment inefficiency of STPs which are old and difficulties in sludge removal), Grit generated in STPs is around 50-60 cubic meters per day while screening material generated is 30 cubic meters per day. As discussed earlier, currently sludge is treated but not certified for agriculture use as a soil enricher. Further, untreated/ partially treated (only for coliforms) sludge is disposed of in dumpsites or areas near around STPs. Grit is also dumped in available sites/ STP premises. Sludge quantities generated varies from 300 kg/day in the case of Vinzol to 2500kg/day for Vasna STPs. The 180 MLD Pirana, 60 MLD Pirana, 35 MLD Vasna, 240 MLD Vasna, and 70 MLD Vinzol STPs have sludge digesters. Sludge is dried and carted to the gamma radiation unit for radiation treatment. Grit quantities range from 40 kg for 60MLD Old Pirana STP to 1200 Kg for Vasna 240MLD STP.

Sludge quality tests conducted by AMC observed Cadmium contents higher than permissible limits specified for 'FCO City Compost' but within the limits of USEPA-40 CFR, 503, and CPHEEO. If any one of the eight heavy metals content is higher than the maximum specified limits, the sludge cannot be sent for irradiation. AMC has decided not to send dry sludge from Vinzol STPs for Irradiation. It is also noted that other new STPs (not included in G-ACRP) also show high values for metals.

Table A- 24: Quality of Raw and Hygienized Sludge in AMC

Heavy Metal	FCO City Compost (mg/kg)[54] **	US EPA-40 CFR, 503 (mg/kg)	CPHEEO (Ceiling Concentration (mg/kg)) *	AMC Hygienized Sludge Max. (mg/kg) *	AMC raw sludge max (mg/kg) – 2020 data for STPs under this Project	Available 2021 data for new STPs (not considered in G-ACRP)
Arsenic	10	75	75	8.13	4.37 (126 Vasna – GEMI)	

[54] *http://cpheeo.gov.in/upload/uploadfiles/files/Advisory%20Note%20on%20Septage%20Management%20in%20Urban%20India.pdf*

Heavy Metal	FCO City Compost (mg/kg)[54] **	US EPA-40 CFR, 503 (mg/kg)	CPHEEO (Ceiling Concentration (mg/kg)) *	AMC Hygienized Sludge Max. (mg/kg) *	AMC raw sludge max (mg/kg) – 2020 data for STPs under this Project	Available 2021 data for new STPs (not considered in G-ACRP)
Cadmium	5	85	85	53.89	111 (60 MLD Pirana – Clab)	98 (Vinzol 35 MLD), BDL (Wadaj 60 MLD), 313 (Shahpur 25 MLD)
Chromium (T)	50	3000	500	1149	461.99 (180 MLD Pirana-GEMI)	310 (Vinzol 35 MLD), 49 (Wadaj 60 LLD), 158 (Shahpur 25 MLD)
Copper	300	4300	4300	1393.02	1393.02 (180 MLD Pirana – GEMI)	923 (Vinzol 35 MLD), 277 (Wadaj 60 LLD), 960 (Shahpur 25 MLD)
Mercury	0.15	57	57	4.97		
Nickel	50	420	420	319	301 (126 MLD Vasna- Clab)	
Lead	100	840	840	228	146 (106 MLD Pirana – Clab)	
Zinc	1000	7500	7500	1664		
Selenium		100	100			
Molybdenum		75	75			
Phenolic Compounds		49	49		250 (180 Pirana - Nisarg)	40 (Vinzol 35 MLD), 40 (Wadaj 60 LLD), BDL (Shahpur 25 MLD)

*Note: * If it exceeds these limits, land application is not permitted & it will need to be disposed of at a hazardous waste landfill. ** Standards to be met if this can be applied as compost/ for agricultural use*

Clab: Central Lab of AMC, GEMI- Gujarat Environmental Management Institute

As per River Action Plan for Ahmedabad total sewage sludge generated is 9125 m3/annum (25 m3/day). The sludge produced carries a heavy microbiological load and therefore its disposal has been a challenge to the cities the world over. Sludge may also contain worms, ova, viruses, helminths, weeds, etc., and metals and organic pollutants like pesticides, polyaromatic hydrocarbons, drugs, and other persistent pollutants. Sludge is often considered a rich source of many macro-nutrients (Nitrogen, Phosphorous, Potassium), micro-nutrients (Zinc, Iron, Copper, Manganese), and organic carbon essential for soil. The following ***Table A-25*** presents the quality of sludge of detected metals/ chemicals from various STPs draining to Sabarmati. The STPs at Vinzol reportedly show a high amount of heavy metals owing to the mixing of industrial effluents.

Table A- 25: STP Sludge Quality

Sl NO	*Parameters*	*Standards**	*Vasna 240 MLD STP sludge*	*Vasna 126 MLD STP sludge*	*Pirana 180 MLD STP sludge*	*Pirana 60 MLD STP sludge*	*Pirana106 MLD STP sludge*
1	Cadmium (as Cd)	85	BDL	38	BDL	111	BDL
2	Chromium (as Cr)	500	120	105	305	160	157
3	Copper (as Cu)	4300	212	296	1223	599	925
4	Nickel (as Ni)	420	76	301	109	241	136
5	Lead (as Pb)	840	121	123	116	112	146
6	Phenolic compound	49	30	20	10	10	30

Source: Tests conducted by CPCB Central Lab, for AM (2020)

** CPHEEO standards on Sludge quality (similar to US EPA standards)*

AMC signed an MoU in April 2015 with BARC for the technology of Cobalt -60 Gamma Irradiation Plant for the Hygienization of Sewage Sludge at Shahwadi in Ahmedabad to convert the sewage sludge to Bio-fertilizer. The plant designed by Symec Engineers has a design life of 50 years.[55]The capacity of the plant is 100 tonnes per day which is automated. The plant was inaugurated in 2019. Dry sludge from all STPs of Ahmedabad (estimated at 20 - 35 TPD) is hygienized in this plant and plant growth-promoting bacteria is added to it for better yield of crops. Sludge is retained in the sludge drying beds of STPs till moisture content is reduced to 30 percent and is taken to the radiation plant. Sludge is again dried in the drying bed of the radiation plant for a week and when dried, it is ground in the grinder. This powdered sludge is stored in boxes and transferred for radiation using Cobalt 60 in the radiation area (1.5m thick concrete walls). The hygienized sludge is rich in organic carbon (~20–40% by weight). However, to further enhance the nutrition value of the irradiated sludge, a solution comprising of a consortium of Plant Growth Promoting Bacteria named BioNPK is employed. Bio-NPK helps in nitrogen fixation, phosphate solubilization, potassium mobilization, and the biocontrol of plant pathogens. The beneficial bacteria consortium helps in converting the nitrogen and phosphorus to a usable form for the cash crops, leading to higher yield. The bacteria are cultured in an in-house laboratory facility, which was set up in collaboration with Anand Agricultural University, in Gujarat. The AMC is tying up with the Gujarat Agro Corporation to supply this pouched manure as 'Bio Gold' to farmers, subject to Fertilizer Control Order (FCO) certification. The irradiation unit is controlled using an automated routine in a Programmable Logic Control software platform developed by SYMEC Engineers (India) Private Ltd. A source loading scheme is already available with BARC for the industrial-scale irradiation units, and after every source loading, dosimetry is performed. The irradiated sludge has demonstrated initial success in enhancing soil productivity, and about a 12% increase in the crop yield has been observed for every 1% increase of organic matter in the soil. Field trial on the use of the finished product for soil enrichment was carried out by Agriculture University at Anand, on wheat, potato, tomato crops which suggested the addition of not more than 1 T/ ha. Currently, AMC is using this in its gardens. However, as 90% (by weight) of the fecal sludge consists of human manure, and human manure is not still approved as a fertilizer, for wider acceptance of the irradiated municipal sludge, necessary approval from the FCO is required.[56]High energy gamma radiation from Cobalt-60 can kill pathogens, reduce odors and degrade organic chemical contaminants and thus making sludge safer for use or disposal. AMC has applied for FCO approval for use of this finished product for agriculture. However, since there are no standards in India for use of this in agriculture AMC is discussing with FCO on using US EPA standards.

The technical details of the plant are shown in ***Table A-26*** below.

Table A- 26: Details of Radiation Based Sludge Treatment Plant in AMC

Parameter	Value
Plant capacity	100 MT/ day at 1500 kCi
Current Source loading	300 kCi
Capital cost	Approx. Rs.25 Crore (US$ 3.4million)
Sludge generation from 9 STPs	Approx. 35MT/ day
Sludge processed till March 2021	450 MT
Operation Cost per Annum	~1.5 Cr. (US$ 0.2 million)

Current loading is only 300 kCi of cobalt 60 to treat around 35TPD, and dosimetry study is ongoing, and AMC expects to reach 1500kCi capacity in the next 2 to 3 years. For treating in the plant, moisture content shall be only 25 – 30 percent whereas it is 60 to 70 percent when it comes out of STP. So the

[55]*A liquid sludge irradiator: Sludge Hygienization Research Irradiator (SHRI) is operating at Vadodara City for radiation treatment of raw sludge containing 3-4% solids for the last 30 years.*
[56]*https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7984811/*

sludge is spread in open spaces (lined/ unlined) in the STP compound and dried. Currently, after drying, the O&M operator of STP transfers sludge to the plant using the hydraulic tractor provided by AMC. During monsoons, it is difficult to reduce the moisture given the high humidity, and hence the hygienization plant will not be operational for the three monsoon months. Agricultural University has recommended a grain size of 4mm for sludge particles. Currently, large stones/ pebbles in the sludge make crusher functioning difficult, and hence with the support of BARC, AMC is in the process of developing a conditioning system (with trommel, mill, belt conveyor) to remove other materials from sludge before feeding into the system. Key operators in the hygienization plant are radio safety officers and plant operators who are accredited by the atomic energy regulatory board. The current operator is Pinnacle therapeutics who has a contract for 3 years to operate the plant.

The site was selected based on strict siting criteria laid out by BARC and the site at Piplaj was selected after their visit and approval. The source of radiation (CO64) is kept underwater in a concrete bunker with 2m thick concrete walls. Water is used to absorb the heat produced by the source. The source is brought above water to apply radiation to the sludge. The life of the source is around 25 years. At the end of the life, the source is taken back by the same agency. The entire design of the plant is as per the directions of the Atomic Energy Regulatory Board. This is important to get permission to start plant operations. The source of radiation is provided by the Board of Radiation Isotope Technology, BARC. The structure is designed to withstand the earthquake and the radiation source is safe in the concrete bunker. The water or any other material in the plant does not become radioactive because of the gamma radiation. Water is used only to absorb the heat produced by the source. There is no generation of liquid or solid waste in the plant except some grit. Grit generated from this plant is disposed of in the open areas around while the grit at STPs is dumped in dumpsites or low-lying areas.

Nearest Treatment, Storage, and Disposal Facilities (TSDF) for disposal of hazardous material is at Viramgam, 60 km from the city. There were TSDFs earlier in industrial areas of the city to the East, which have been closed at the end of useful life.

Reuse of treated effluents from STPs

GoG had instituted a water reuse policy[57] for supplying tertiary treated water to local industry which is currently said to be dependent upon fresh-water resources. AMC estimated the potential for reuse water is 700 MLD.

Letter from Narmada Water Resources, Water Supply and Kalpsar Department to AMC dated March 20, 2019 Sub: disposal of treated wastewater from 3 STPs in Fathewadi feeder canal for irrigation request AMC's permit for a project to dispose treated water from Vasna ESTPs to Fathewadi Canal that in response to the demand from farmers in Ahmedabad district that instead of discharging the sewage water in Sabarmati which is not used for any purpose, that water can be diverted to Fathewadi canal to feed the standing crops in case of the water crisis. For this, the Engineering Department of Ahmedabad Irrigation Division carried out a detailed survey to confirm the possibility of transfer of wastewater from the STPs at Vasna : 35 MLD, 240 MLD, and 126 MLD to Fathewadi canal. It is important to note the need for treated effluent for reuse in agriculture in downstream areas. However, it is important that the STPs discharge treated effluents for good quality and confirm NGT standards and the requirements for irrigation. Hence it is important to conduct proper quality analysis, ensure good system design and arrange for regular monitoring as part of subproject development.

[57] *http://www.indiaenvironmentportal.org.in/files/file/Policy_Reuse_Of_WasteWaterA.pdf*

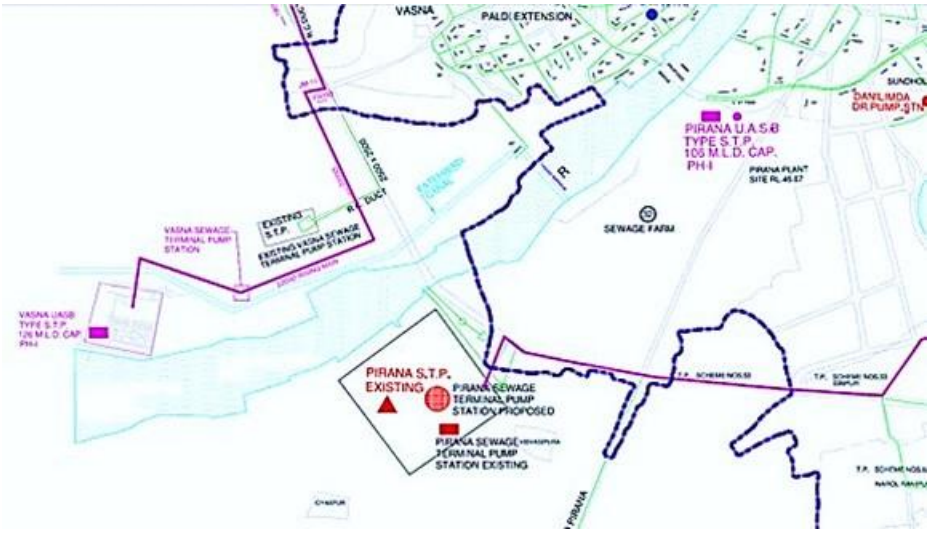


Figure A- 25: Fatehwadi canal starting from Vasna Barrage in the south

Water Quality of Sabarmati downstream of the Pirana STP discharge (100m) shows high levels for BOD, COD, and fecal coliforms when compared to MOEFCC standards for discharge into Inland Surface Waters. TDS, Copper, Nickel, arsenic, cadmium, manganese, zinc, and iron in the river were found to be within the limits prescribed by MoEFCC, but higher than that at the STP outlet. It is evident that the river carries the burden of combined effects of various STPs, CETPs, industrial effluent, and drain discharges which produce a higher load of pollutants in the river than at individual STP outlets. BOD, COD, FC at the STP outlet were above the NGT suggested limits, while the same in the river is even higher than at STP outlets.

(v) Storm Water Drainage

The natural drainage of the city is towards the south. The AMC has planned and implemented a stormwater collection and disposal system dividing into 6 zones. The total length of roads in AMC is 2976 km with 1484 km classified as major roads (30 feet and wider), while the length of stormwater drains is 731.71 km. According to the service level benchmark standards, stormwater drains cover only 25 percent of the roads in the city. As per River Action Plan for Ahmedabad, the major drains in Ahmedabad are four in number:

I. The outfall of the old city area (D/S of Vasna Barrage)
II. AMC stormwater drain (Danilimda)
III. Pumping Station 76 MLD (Old Vasna area)
IV. Pumping Station 182 MLD (Old Pirana area)

The major outfalls of treated/ untreated, domestic/ industrial wastewater are as below[58].

[58] *Reproduced from River Action Plan for Ahmedabad, 2020*

E1	The outfall of the Old City area	W1	Outfall of Stormwater Drain Vasna
E2	Outfallof106&60 MLDSTP	W2	Outfallof35MLDSTP
E3	Outfall of storm water drain from Danilimbda Area	W3	Outfallof240MLDSTP
E4	OutfallofoldPirana182MLD TSPS	W4	Outfallof76MLDSTP
E5	OutfallofNewPirana180MLDSTP	W5	Outfallof126MLDSTP
E6	MEGA Pipeline Outlet		
E7	ATPA CETP outlet		
ICE	Interceptor outlet	IC W	Interceptor outlet

Figure A- 26: Drainage/ Wastewater and Effluent outfalls into Sabarmati

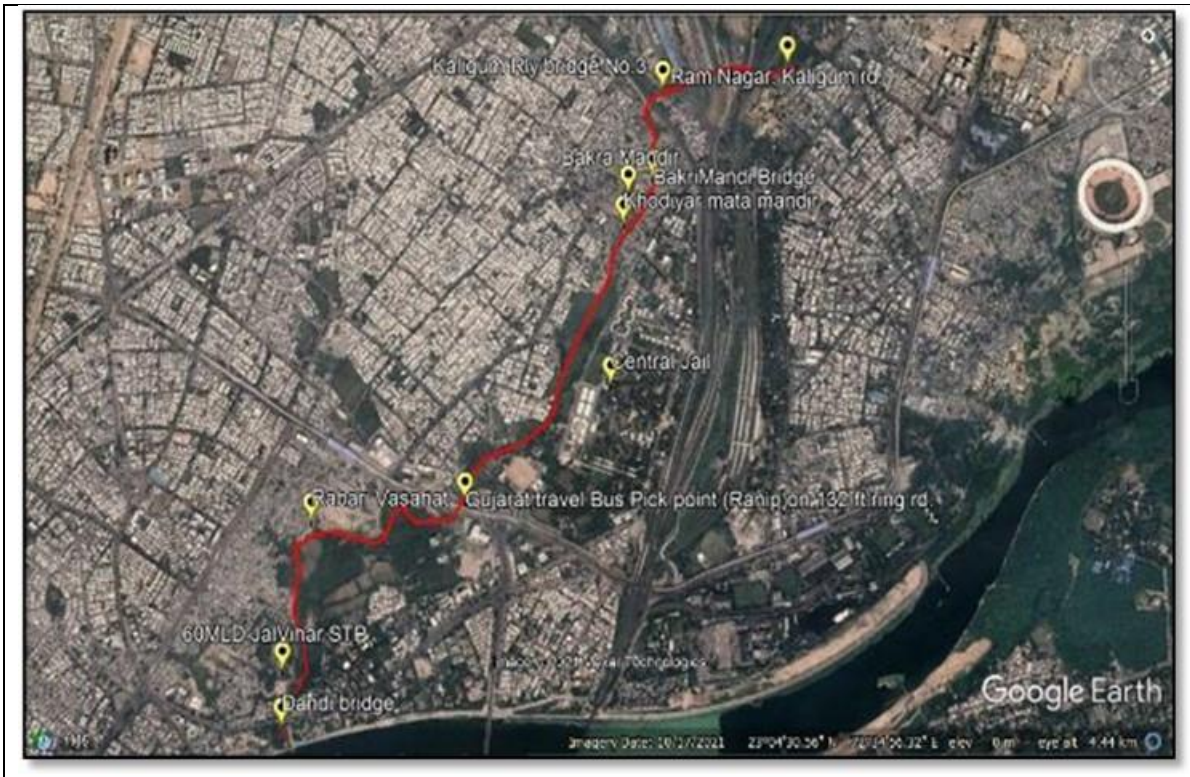
- All the *nallas* (drains) opening to the river were connected through a diversion interceptor line in the Riverfront development stretch on both banks and partially treated in STPs on both the sides of the bank of river Sabarmati. Excess quantity of sewage from interceptor is discharged into river through an outlet after Vasna barrage.
- Industrial units operating within walled city area (16 Large Textile units) were discharging their treated effluent (22.925 MLD) through the drainage network system of AMC which is further treated in STP and then discharged into River Sabarmati. However, the Hon'ble High court of Gujarat has constituted a task force to disconnect all such connections of industrial effluents into the drains / sewers and the taskforce has disconnected 382 such connections already by December 2021 and the drive is ongoing to ensure full disconnection of all such connections. There is regular reporting to the Hon'ble High Court on its progress.
- Industrial units located in Danilimda & Behrampura area; mainly Textile industries and scattered chemical units are discharging their treated effluent into the stormwater drain of AMC leading to river Sabarmati, the estimated quantity being 30 MLD. Industrial units in this cluster have provided individual ETPs.
- Trade effluent from the CETPs of GIDC industrial estates is discharged into the river through Mega Pipeline. All CETP member units have provided at least functional primary ETP to meet the norms.
- Treated effluent from NTIEM CETP of Narol Textile cluster (100 MLD) is discharged through the ATPA pipeline.

Details of the sample Lakes / Ponds and main storm water drains namely, Chandrabhaga Canal and Kharicut canal are presented here:

Rapid Baseline Assessment of Chandrabhaga Canal proposed for upgradation under G-ACRPChandrabhaga is a small tributary of the Sabarmati river flowing through Ahmedabad and with its origin near the Adalaj stepwell. It is said that a huge depression acted as a reservoir in the stepwell backyard and held a large quantity of water, which percolated & entered the stepwell after filtration as sweet water. Along with the locals, communities of farmers and Khumbhar (potters) were dependent on Chandrabhaga water for agriculture, cattle rearing & pottery. The nalla was diverted from its origin with the construction of Narmada Canal. Chadrabhaga Nalla (4.6 km approximately) is proposed to be improved under G-ACRP from Ramnagar (near Kaligum Rd.) to 60 MLD Jal Vihar STP near Dandi Bridge and empties into Sabarmati.

Key issues which need consideration while upgrading the canal include:

- Sewage and polluted stormwater inflow from various areas into the nalla, and its ultimate discharge into the River Sabarmati without treatment
- Open bathing and open defecation near nalla
- Livestock grazing and washing of livestock in nalla
- Moderate to heavy vegetation at various stretches in nalla
- Certain stretches of the Nalla are low lying
- Odor issues
- Potential displacement of squatter and encroached settlement near Bakri mandi at Ranip
- Soil erosion and flood risk to squatter settlement near nalla.



Chandrabhaga Nala from Ramnagar to Bakra mandi towards RTO Circle (132 ft Ring Road) till Dandi Bridge.

132 Ring road near RTO circle.

Near Khodiyar Mata temple (23° 4'49.89"N, 72°34'47.72"E)

Bakri mandi – Bridge (23° 4'57.28"N, 72°34'48.20"E)

Nala near Jal Vihar STP

Nala near Jal Vihar STP

Figure A- 27: Photo Essay of Chandrabhaga Nala proposed for Redevelopment under G-ACRP

Cleaning of the nalla and its upgradation with cut off and prevention of sewage, and stormwater, management of wastes, silt, vegetation/weeds, carcasses from cleaning the canal, shifting of utilities, prevention of disturbance to fauna, flora and communities, the safety of workers and communities due to works and activities especially in sensitive areas are important during works. Interventions to prevent flooding, watch and ward / long-term monitoring are important. Maintenance of the redeveloped/improved nalla without pollution and odor and institutional, regulatory, and service interventions for this is very crucial.

Rapid Baseline Assessment of Urban Lakes proposed for upgradation under G-ACRP

AMC has many lakes within its boundaries; totalling 122. Lakes to be rejuvenated under G-ACRP are yet to be finalized hence sample four lakes were considered for rapid baseline assessment. Details of the sample lakes studied are provided here:

Sl. No.	Attribute	Name of the lake			
		Ramol Bandh Lake	**Isanpur Gaam Lake**	**Shilaj Gaam Lake**	**Bhadaj Gaam Lake**
1)	Location	Adjoining to Kharicut Canal near CT	Near Isanpur Cross Road	Shilaj Village	Bhadaj Village. Bhadaj-Ranakpur road

Sl. No.	Attribute	Name of the lake			
		Ramol Bandh Lake	**Isanpur Gaam Lake**	**Shilaj Gaam Lake**	**Bhadaj Gaam Lake**
2)	GPS Coordinates	22°59'12.25"N 72°38'26.89"E	22°58'41.86"N 72°36'7.56"E	23° 3'15.63"N, 72°28'28.62"E	23° 5'22.86"N, 72°29'12.53"E
3)	Area of Lake	15132 sq.m.	29509 sq.m.	44336 sq.m.	7682 sq.m.
4)	Inlets	Multiple (sewage from encroachments/nearby areas, dye-industry effluent, waste water from cow sheds)	Multiple (sewage from encroachments/nearby areas, waste from crematorium)	1, North	1, North - sewage
5)	Nearest road	CTM Ramol Road, Nikol canal road	Vatwa-Isanpur Road, Ramwadi-Anandwadi Road	Thaltej Shilaj Road, Village road	Bhadaj-Ranakpur road, Village road
6)	Religious structures	Gafurbasti masjid, 10 m	Ramwadi temple 60 m, Shiva temple, 5 m	Vardayini mata mandir, 43 m Ramdev pir mandir, 120 m Jogini mata mandir, 80 m	Bhadrakali Temple, 260 m
7)	Encroachment	Yes, Residential, 50 Nos. HH	Yes, Residential, 100 Nos. HH	No	Yes, temporary Tea stall between bank & road. No. 02
8)	Embankment/ Fencing	No	No	No	Broken railing on eastern bank
9)	Solid-waste dumping	Domestic waste	Municipal waste, waste from crematorium and temple rituals	Yes, Municipal waste, and waste from temple rituals	C&D waste & Municipal waste
10)	Open defecation	Yes	Yes	Yes	Yes, Western bank
11)	Presence of migratory birds	No	No	Yes, High	Yes, Moderate
12)	Biodiversity in Waterbody	Aquatic birds, fauna	Catfish	Aquatic birds, fauna, invasive flora (Eichhornia sp.)	Aquatic birds, fauna
13)	Presence of mosquito	Yes, High	Yes	No	No
14)	Other structures	NA	Hindu crematorium, 10 m	NA	NA
15)	Condition & key activities	Highly Polluted, degraded	heavily encroached, deteriorated structures in Lake, highly degraded and highly polluted Fishing is the main activity	Biodiverse, but polluted. Used by the ragpickers for sorting of recyclable waste	

Lakes are mostly man-made but serve an important role in water conservation and groundwater replenishment. It is a source of water for migratory birds and other species. Lakes are important considering the heat emissions of the city microclimate. Rejuvenation of lakes is important, with adequate consideration for biodiversity and communities dependent on these. These are already in developed parts of the city, and hence demarcation of lake areas will be important. A detailed assessment is important especially in the case of key biodiverse lakes like Shilaj gam talav. Adequate precautions are to be taken during rejuvenation works and in the long run, to maintain the ponds clean and pollution-free. It is important to divert sewage, polluted stormwater, industrial effluents,

and wastes from getting disposed of into the tank. Management of wastes, silt, vegetation/weeds, from cleaning the lakes, shifting of utilities, prevention of disturbance to fauna, flora, and communities, the safety of workers and communities due to works and activities especially in sensitive areas are important during works. Maintenance of the redeveloped/improved nalla without pollution and odor and institutional, regulatory, and service interventions for this is very crucial. Involvement of communities in rejuvenation attempts will ensure its good maintenance.

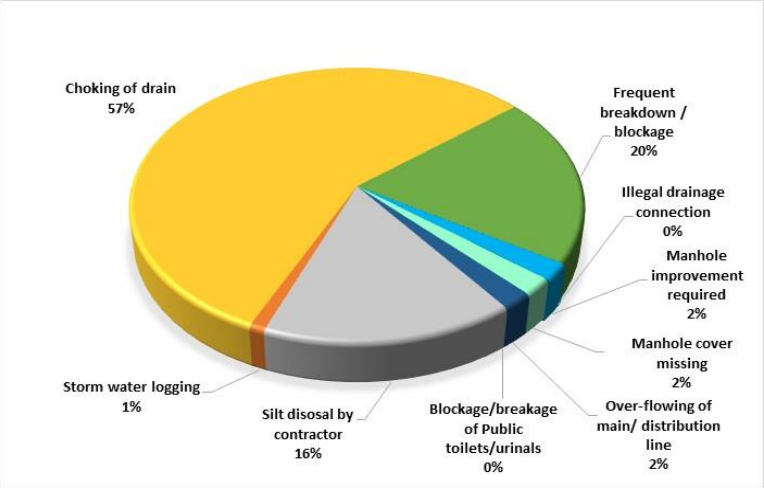
Figure A- 28: Ramol Bandh Talav

Figure A- 29: Isaanpur Gaam Talav

Figure A- 30: Shilaj Gaam Talav

Figure A- 31: Bhadaj Gaam Talav

Complaints on Wastewater/ Drainage



AMC receives complaints from the public on existing drainage and sewage/ wastewater management. Major complaint categories for this year (2020-21) are presented here.

Figure A- 32: Types of Complaints received by AMC on Wastewater Management

(vi) Industrial effluents

GIDC supplies water to the industries in its Naroda, Odhav, Vatva estates. The industries located in Behrampura- Danilimda, Narol Process houses, Karnavati Textile Association, Narol Dye Stuff are dependent upon groundwater for industrial use. A Mega Line (Sewer Outfall) of about 27 Km in length from Naroda to Pirana including a pumping station was established in the year 2000 with the contribution of GoG, AMC and Industries, to divert industrial effluent. Now the industrial estates discharge their treated effluent in Mega line except the industries situated at Behrampura and Danilimda which are outside the demarcated industrial estates. These industries still use AMC's drainage and SWD network for the discharge of their effluent. These units in Behrampura- Danilimda area are in process of establishing their separate Common Effluent Treatment Plant (CETP)of 30 MLD capacity with future expansion to 45 MLD. AMC has undertaken the work on behalf of the industrial association. Earlier it was planned that the discharge from the Mega Line mixes with treated sewage effluents from Pirana STP and the combined diluted effluent would be discharged into the Sabarmati River. However, today, both the STP and mega line discharge separately into the River.

Ahmedabad Textile Processors Association (ATPA) representing about 125 small, medium, and large units, during the year 2012, established its system of effluent collection, conveyance pumping, and treatment for 100 MLD effluent with the capability of additional 50 MLD expansion and discontinued discharging into the Mega Line. Recently Industries and GoG have agreed to lay a Deep-Sea Disposal Outfall from Ahmedabad to Khambhat to collect, convey and dispose of the treated effluent from all the industries in deep-sea near Khambhat or any suitable place for Rs. 2100 Crores (US$288million) with 70 % grant support from the State Government. The proposal is said to be at the procurement stage. So far, several industrial associations have registered for discharging about 276.4MLD into the outfall.

At present total of around 230 MLD of effluent is generated and being discharged in River Sabarmati by industries after treatment. Quantity of treated industrial effluents disposed into Sabarmati and proposed quantity to be discharged through the deep-sea pipeline are presented in ***Table A-27*** below.

Table A- 27: Industrial Effluent Disposal

Effluent discharge quantity details from Industries of Ahmedabad City

Sl. No	Industrial Cluster	Source of water	Present Effluent Discharge in River Sabarmati Details after Treatment				Remarks
			Through Mega Line (in MLD)	After ETP treatment through own pipeline(MLD)	Through AMC drains (in MLD)	Registered Volume in Deep Sea Disposal line considering future Expansion (in MLD)	
1	**Naroda Enviro Protection Ltd**	Through GIDC by Bore	14.0	0		10	All these estates discharge their treated effluent in Mega line for final disposal in river after mixing with domestic sewer in mixing chamber.
2	**Reliance Industries Naroda**	Private Bore (to confirm)	5.0	0		5	
3	**Odhav Enviro Protection Limited**	Through GIDC by Bore	1.6	0		2	
4	**Gujarat Vepari Mahamandal**	Through GIDC by Bore	1.0	0		2	
5	**Odhav Green Enviro Odhav**	Private Bore (to confirm)	1.0	0		2	
6	**The Green Environment Society Vatva**	Through GIDC by Bore	27.0	0		30	
7	**Ahmedabad Hand Screen Printing Association - Danilimda**	Private Bores	0.0	0	30	45	At present both the estates discharge their effluent in river through AMC Drainage/ SWD lines
8	**Karnavati Textile Association - Danilimda-Behrampura**	Private Bores	0.0	0	50	50	
9	**Ahmedabad Textile Processors Association Narol**	Private Bores	0.0	100	0	130	Discharge was through mega line till June 2012. Now, their pipeline network, Pumping Station, and 100 Mld capacity CETP - discharging in the river through this.
10	**Narol dyes stuff Association**	Private Bores	0.4	0	0	0.45	
Total Flow in Mld			**50.0**	**100**	**80**	**276.45**	
	Total Present Industrial Effluent Flow		**230.0**				
	Total Future expected flow considering future expansion					**276.45**	

In addition, there are discharges from industries into sewers and drains which the Hon'ble High Court of Gujarat has intervened to disconnect, and disposal of industrial effluents through tankers into manholes and sewers / drains or even open areas or water bodies (as noticed by NGT), which is difficult to estimate as no data is being maintained on actual quantities.

8. Institutional Baseline

Key institutions involved in environmental aspects of urban infrastructure development and management include:

(i) *Urban Development and Urban Housing Department, Government of Gujarat*

Department of Urban Development and Urban Housing has geared up its work since 1st July 1983 to focus on issues relating to accommodation and organized development in the cities timely and properly. This Department makes policymaking decisions in matters related to urban development and urban housing and monitors its implementation, procures guidance, and issues orders related to it.

Figure A- 33: Various Institutions under Urban Development Department

(ii) *AMC*

The AMC, established in July 1950 under the Bombay Provincial Corporation Act, 1949, is responsible for the civic infrastructure and administration of the city of Ahmedabad. For administrative purposes, the city is at present divided into 7 zones - Central, East, West, North, South, South West Zone, and northwest zone. Each zone is further split into wards represented by corporators, elected every 5 years. The mayor heads the party with the largest number of corporators elected. The executive power of the corporation is with the Municipal Commissioner, an IAS officer appointed by the government of Gujarat. As per sections 63 and 66 of the Bombay Provincial Municipal Corporation Act, the AMC is responsible for certain obligatory and discretionary services. Among the obligatory services of AMC include sewage, drainage services, and water supply and preventing the spread of diseases, and discretionary services include 'construction and maintenance of factory for disposal of sewage', 'Measures to meet any calamity affecting the public in the city any measure to promote public safety, health, convenience, or instruction. Over the years, though AMC has faced growth challenges, it has overcome them effectively and provided urban services at a level significantly higher than the national averages, making it one of the top-tier service providers in the country. Coverage levels in water supply, solid waste collection, and sewerage are well above national norms.

Of particular importance in the case of this project is the Drainage Department of AMC, Garden Department, and Biodiversity Management Committee with expertise in ensuring biodiversity and forests related aspects; and the Heritage Department which can coordinate and ensure tangible and intangible cultural heritage and related aspects of the city.

Estates wing and Urban Community Development wings of AMC are involved in assisting the land/ Row procurement, R&R of PAPs, livelihoods support activities. PIU shall closely coordinate with these two departments regarding identification and mitigation of impacts on account of land acquisition/ construction stage economic displacement.

(iii) ***Ahmedabad Urban Development Authority (AUDA)***

AUDA was constituted under the Gujarat Town Planning and Urban Development Act, 1976 in 1978 to regulate and monitor the development in the periphery of the AMC limits and the adjoining 300 villages and 9 municipalities. The major function of the authority is to undertake the preparation of the development plan, Town planning schemes, regulate the development, and collect the development charges in its jurisdiction. In addition to the area falling under AMC's limit, it also includes 107 settlements around it, 4 towns, 103 villages of Ahmedabad district.

(iv) ***Gujarat Urban Development Mission***

To ensure rightful spending of GOI's funds under AMRUT/ SMART CITY, the Government of Gujarat constituted Gujarat Urban Development Mission (GUDM) and designated the same as a nodal agency for AMRUT/ SMART CITY. The objective of the Mission is to support urban renewal and urban infrastructure development in the given timeframe for attaining better living standards, amenities and creating a congenial environment for people to live and work, in the urban areas of Gujarat. The GUDM will be the implementing unit for the institutional/ capacity-building component under G-ACRP. This is to ensure that they have capacitated to handhold all other municipalities towards the successful implantation of water/ sewerage services.

(v) ***Other State Departments***

Various state government departments are involved in water supply and drainage in Gujarat, mainly in villages and towns, while these functions are under the purview of the Municipal Corporation in the case of cities. Such departments/ agencies include ***(i) Narmada and Water Resources, Water Supply and Kalpsar Department,*** Government of Gujarat working with a clear vision of maximum harnessing of the water resources for the use of the people of Gujarat. Some of the agencies/ missions directly indirectly under the department includes Water and Land Management Institute WALMI, Gujarat, Gujarat Engineering Research Institute (GERI), State Water Data Centre (SWDC), Ground Water Resources Development Corporation (GWRDC), Sardar Sarovar Punarvasvat agency and SujalamSufalam Jal Abhiyan; (***ii) Gujarat Water Supply and Sewerage Board (GWSSB)*** is a statutory body set up by the State Government for Development, Regulation, and Control of the Drinking water sector in the State. The Board largely works for putting in place rural water supply systems as well as operational management of Rural Regional water supply schemes covering a cluster of villages. The Rural water supply systems include Installation of hand pumps, mini water supply systems, etc. in small habitations and piped water supply systems for individual villages including large water supply systems covering several villages. It also undertakes underground drainage works in various municipalities under Swarnim Jayanti Mukhya Mantri Shaheri Vikas Yojana (SJMMSVY) and the Jawaharlal Nehru National Urban Renewal Mission (JNNURM); ***(iii) Gujarat Water Infrastructure Limited (GWIL)*** is a registered company of Govt. of Gujarat. The registered office is situated in Gandhinagar in the state of Gujarat. The mission of GWIL is to establish a bulk water pipe grid based on Narmada water in Gujarat state for satisfying the water needs of Gujarat state through bulk supply for the growth of Gujarat. Its vision is to establish bulk water Infrastructure projects across the state for drinking water and ensure equitable and efficient distribution of water for Regional Water Supply Schemes (RWSS) for villages covered by GWSSB, Nagar Palikas, Corporations, and Industries.

(vi) ***Industries Department:*** Industries and Mines department plays a key and important role in effective and economic industrial development and focuses on the possibilities to develop fast growth in small, medium and large-scale industries. GIDC and GIDB are among the corporations/ boards under this department.

(vii) ***Gujarat Pollution Control Board***

Water (Prevention and Control of Pollution) Act, 1974 has paved the way for the setting up of GPCB for the management of environmental attributes of Gujarat State. GPCB scrutinizes applications from

various proponents for permissions/ clearances under various Acts/ Rules of MoEFCC/ CPCB and grants as per the procedure. STPs are required to obtain consent to Establish and Consent to Operate (Consolidated Consents and Authorisations (CCA)) and these will be subject to monitoring by PCB on compliance conditions. GPCB has adopted a speedy transparent e-governance procedure XGN (eXtended Green Node) with the help of NIC, facilitating applicants for online applications to its final disposal.

In the territory of Gujarat state, under the provisions of "The Water (Prevention & Control of Pollution) Act-1974, every water polluting industry has to obtain the consent of the Board for bringing in to use an outlet for discharge of effluent into a stream, sea or land. "AND accordance with the provisions of the Air (Prevention and Control of Pollution) Act-1981, every industry emitting gases has to obtain the consent of the Board." AND accordance with the provisions of Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008 framed under Environment (Protection) Act, 1986 every unit generating/ handling/ managing hazardous wastes and operating any facility for collection, reception, treatment, transportation, storage and disposal of hazardous wastes have to obtain the authorization of the Board. Before the establishment of such an industrial project, the applicant is required to obtain the CTE. The CCA is required to obtain at the time of starting of the operation/ production at the industrial plant. As per the revised Industrial Categorization as per Modified Direction issued by CPCB dated 07.03.2016, Sewage Treatment Plant is a 'Red category' Industry.

As part of the preparation of the River Action Plan, GPCB has written to concerned departments for actions to support the rejuvenation of the Sabarmati and Khari Rivers; including the following.

Concerned Authority/Organizations	**issues**
Central Ground Water Authority/ Gujarat Water Resource Development Corporation Ltd.	Groundwater-related issues & for the execution of the plan for the same etc.
Irrigation department	E-flow, regulation of activities in flood plain zone & Flood plain management, Good Irrigation Practices, etc.
Forest offices of Gujarat	Plantation/Vegetation cover along the River stretch/ River, setting up of Biodiversity Park, etc.
Ahmadabad Municipal Corporation (AMC)	Proper disposal/ Treatment of Sewage

(viii) ***Role of National Green Tribunal***

1. NGT has suggested new standards for the disposal of treated sewage from STPs into the environment.

2. National Green Tribunal vide Order dated 28.08.2019 in OA No 593/ 2017 stipulated that all the Local Bodies and or the concerned departments of the State Government have to ensure 100% treatment of the generated sewage and in default to pay compensation which is to be recovered by the States/ UTs, with effect from 01.04.2020. In default of such collection, the States/ UTs are liable to pay such compensation. The CPCB is to collect the same and utilize it for the restoration of the environment.

3. Order dated 21.05.2020 in OA No 593/2017: The directions are as follows: All States/ UTs through their concerned departments such as Urban/ Rural Development, Irrigation & Public Health, Local Bodies, Environment, etc. may ensure formulation and execution of plans for sewage treatment and utilization of treated sewage effluent for each city, town, and village, adhering to the timeline as directed by Hon'ble Supreme Court. STPs must meet the prescribed standards, including fecal

coliform. The Ministry of Jal Shakti and Ministry of Housing and Urban Affairs may facilitate States/ UTs for ensuring that water quality of rivers, lakes, water bodies, and groundwater is maintained.

4. Order dated 05.08.2019 in the Original Application (OA) No. 510/2019 regarding pollution by CETP, Narol, Ahmedabad operated by Narol Textile Infrastructure and Enviro Management, causing air and water pollution. Untreated effluents are discharged in the Sabarmati River. The pollution is adversely affecting the inhabitants of the area. Hon'ble NGT has given the following direction: Apart from recovering compensation for the damage to the environment, the SPCB must reduce the pollution load by proportionately decreasing the capacity of the units contributing to said pollution. The SPCB needs to ensure that the load is reduced in such a way that the CETP outlets achieve the norms. The quantum of compensation should be as per 3 laydown norms and the quantum of bank guarantee for the future should also be on that basis. The capacity may be restored once remedial steps are taken to ensure that the outlet of CETP achieves the laid down norms.

5. NGT order dated 6.12.2019: The Pollution Control Boards of the various States as well as the Central Pollution Control Board and various Governments to place the data and material concerning various rivers in the concerned States, and what steps they are taking to curb the pollution in such rivers and to management as to industrial effluents, sewage, garbage, waste and air pollution, including the water management.

   The Hon'ble NGT, in the matter of OA No. 593 of 2017, vide order 28.08.2019, directed CPCB to collect the data of ETPs, CETPs, STPs, MSW facilities, and legacy waste sites and prepare a river-basin-wise macro picture in terms of gaps. Based on Hon'ble NGT's observations, CPCB has developed an online portal for the collection of river-basin wise information. As per the information, the most polluted stretches are from Powai to Dharavi – with Biochemical Oxygen Demand (BOD) 250 mg/L; the Godavari - from Someshwar to Rahed – with BOD of 5.0-80 mg/L; *the Sabarmati – Kheroj to Vautha – with BOD from 4.0-147 mg/L*; and the Hindon – Saharanpur to Ghaziabad – with a BOD of 48-120 mg/L.

(ix) *MoEFCC and CPCB*

These agencies at the central level enact environmental regulations applicable to the whole country. This includes the EP Act, Water, and Air Acts, and General Standards for discharge of treated effluents, and also separate standards for CETP Treated Effluent Discharge. The CPCB also has a program to monitor the quality of rivers by measuring BOD. BOD greater than or equal to 30mg/L is termed as 'Priority-I', while that between 3.1- 6 mg/L is 'Priority-V'. The CPCB considers BOD less than 3mg/L an indicator of a healthy river. The applicable standards for discharge of treated sewage are the MoEFCC General Discharge standards 1986, updated in 2017. However, NGT has recommended more stringent standards for discharge for better environmental quality.

9. Baseline Environmental Quality

(i) Air Quality

Based on the Comprehensive Environmental Pollution Index developed by Central Pollution Control Board (CPCB), the CEPI Index of Ahmedabad (Naroda and Odhav industrial areas) is 57.11 and is classified as Other Polluted Industrial Area (CEPI <60 categories). According to CPCB, Ahmedabad was ranked as the 4th most polluted city in India, in 2001. This led to the formation of the Bhure Lai committee to mitigate the situation. In 2019 the ranking stood at 69 with 59 PM2.5 µg/m³ which was slightly better than 76.1 µg/m³ the year before. After the capital city of Delhi, Ahmedabad recorded the worst air quality recently, mainly owing to transport and industries.

The PM10 particulate matter presently recorded consists mainly of fine dust and smoke which are large enough to become lodged in the mouth, throat, and nose. The smaller PM2.5 particles are worse

because they are small enough to enter the bloodstream after being inhaled into the lungs and trapped in the alveoli. Research conducted by the Air Pollution Knowledge Assessment city program lists power plant emissions of 39 percent and vehicle emissions and road dust make up 22 percent.

Ahmedabad recorded increasing levels of Sulphur Dioxide since 2018 and the same trend applies to Nitrogen Dioxide which increased during 2016 and 2017 but remained at a constant level in 2018. As with most large cities, the main source of air pollution within the city comes from vehicles and emissions from coal-fired power plants. The burning of rubbish and garbage at the Pirana dumping yard also contributes to the dirty air as does the ceremonial burning of items of a religious nature. Residents living near the Pirana site complain that their houses are covered in dust and that if they are not careful with their laundry, it becomes black due to the fine soot particles landing on it. A level of over 300 is often recorded for this area. This soot is often referred to as Black Carbon (BC). It is formed by the incomplete combustion of organic matter and enters the air as PM2.5 Particles. To protect local communities from rising air pollution levels, the AMC has developed two key tools: an air quality index (AQI), and this Air Information & Response (AIR) Plan.

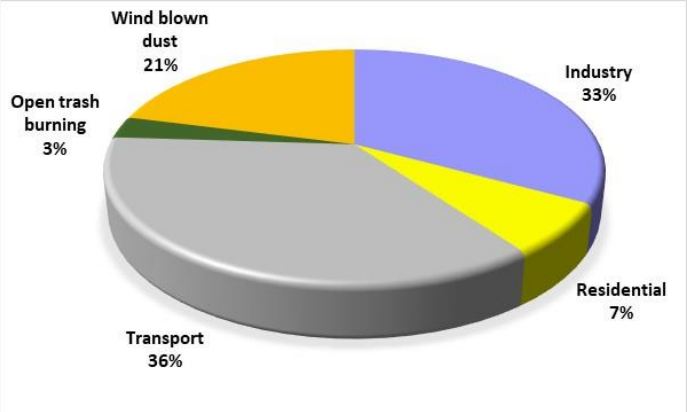


Figure A- 34: PM2.5 contributions by source in Ahmedabad (2016-17)59

(ii) Soil Quality

Key soil polluted areas of Ahmedabad include its waste dumping sites and Industrial areas. From sewage treatment plants, waste grit is disposed of part in the open. Sludge used to be deposited in areas near STPs from where it leaches to nearby areas/ water bodies; but currently, this is sent for hygienization at the Radiation Based sludge treatment facility, after dewatering in the open lined/ unlined platforms. It is expected that the soil in Sabarmati Riverbed may be polluted due to heavy metal and other pollutants disposed of/ run off into the river over the years from this city and its region which are equally industrialized, mainly due to less water flow during summers. Ten TSDFs are present in Gujarat State, including the one in Vatva, Ahmedabad which has been capped and closed after useful life. In addition, there are 7 Common Hazardous Waste Incineration Facilities in Gujarat, mainly in the Industrial belt – Golden Corridor. There is at present no TSDF/ incineration facility in Ahmedabad. Hazardous waste from SWM facilities is sent to TSDF/ incineration facility at Viramgam. Grit from STPs and Hygienization facilities are disposed of in open or low-lying areas.

(iii) Water Quality

Water Quality of Surface water bodies in Ahmedabad

Water Quality monitoring stations are set up under Global Environmental Monitoring System (GEMS) and the Monitoring of Indian National Aquatic Resource System (MINARS) as per CPCB guidelines. The results of water monitoring as per the CPCB River Water Quality Data for 2019 are provided here.

The following ***Table A-28*** presents the water quality of the key receiving waterbody namely, Sabarmati.

Table A- 28:Sabarmati Water Quality as per CPCB River Water Quality data 2019

[59]*https://www.nrdc.org/experts/vijay-limaye/new-monitoring-air-quality-ahmedabad-protects-health*

Sampling Points	DO (mg/l)	pH	Conductivity (mmho/cm)	BOD (mg/l)	N	FC (MPN/100ml)	TC
	>4-5.0mg/l	**6.5-8.5**	max 2250 (av 225)	**<3mg/l**		**<2500MPN/100ml**	
Dharoi Dam, Dist. Mehsana. (upstream near origin)	7.35	8.05	375.5	0.95	0.1	2.9	24.5
Sabarmati At Kheroj Bridge (upstream of Ahmedabad city)	7.25	7.75	429.5	1.65	0.65	48	117
Sabarmati At Mahudi Jain Temple, 150 Km. Form Origin, (Upstream of AMC &Gandhinagar)	7	8.35	245	1.4	0.3	10.5	71
Sabarmati At Dharoi Dam (Upstream of AMC)	7.6	7.25	452	0.85	0.2	1.9	47.5
Sabarmati At Gandhi Nagar Chiloda Bridge, Lekawada, (Upstream)	7.3	8	328	1.85	0.65	71	270
Sabarmati At Railway Bridge Ahmedabad (in AMC)	6.75	7.95	668.5	7.55	0.85	61.5	380
Sabarmati River at Hansol Bridge	6.7	7.85	692.5	2.5	1.25	64.5	222
Sabarmati At Ahmedabad At V.N. Bridge	1.6	7.95	2278.5	123.5	0.39	366.5	1025
Sabarmati At Vill. Miroli Taluka Dascroi (Downstream of Narol/ AMC; upstream of Vautha)	-	-	1959.5	32.5	0.35	410	5700
Sabarmati After Conf. With Meshwa At Vautha (Near Dhokla-downstream of AMC)	3.4	7.7	2096	27	0.25	175.5	1135

It is obvious that Sabarmati water quality downstream of the city is not as per required standards prescribed by CPCB especially with respect to BOD and DO values. A recent study[60] carried out by the Collaborative Regional Research Programme (CRRP) of the Asia Pacific Network (APN) and the discipline of earth sciences at IIT-Gandhinagar found that copper levels were 7 to 9 times higher in the river water than limits set by the Bureau of Indian Standards (BIS). Nickel was found to be 2 to 5 times higher; iron, 4 to 5 times higher; selenium, 4 to 10 times higher; and chromium, 8 to 9 times higher.

Note: * CPCB Designated Best use Classes as below

Designated-Best-Use	Class of water	Criteria
Drinking water source without conventional treatment but after disinfection	A	Total Coliforms Organism MPN/100ml shall be 50 or less pH between 6.5 and 8.5 Dissolved Oxygen 6mg/l or more Biochemical Oxygen Demand 5 days 20C 2mg/l or less
Outdoor bathing (Organised)	B	Total Coliforms Organism MPN/100ml shall be 500 or less pH between 6.5 and 8.5 Dissolved Oxygen 5mg/l or more Biochemical Oxygen Demand 5 days 20C 3mg/l or less

[60] *https://timesofindia.indiatimes.com/city/ahmedabad/sabarmati-heavy-metals-may-soon-hit-your-plate/articleshow/66944688.cms*

Designated-Best-Use	Class of water	Criteria
Drinking water source after conventional treatment and disinfection	C	Total Coliforms Organism MPN/100ml shall be 5000 or less pH between 6 to 9 Dissolved Oxygen 4mg/l or more Biochemical Oxygen Demand 5 days 20C 3mg/l or less
Propagation of Wildlife and Fisheries	D	pH between 6.5 to 8.5 Dissolved Oxygen 4mg/l or more Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	pH between 6.0 to 8.5 Electrical Conductivity at 25C micro mhos/cm Max.2250 Sodium absorption Ratio Max. 26 Boron Max. 2mg/l
	Below-E	Not Meeting A, B, C, D & E Criteria

From the above data, the decline in water quality is observed as one moves downstream of the river Sabarmati from Dharoi Dam. DO levels drop while BOD and COD rise drastically. Water near Vasna Narol bridge shows parameters beyond permissible limits. GPCB observed that the health of River Sabarmati has been significantly improved after the enforcement of Nationwide Lockdown cause by the Corona Virus outbreak which has reduced the inflow of industrial pollutants into it. [61]

A recent study[62] carried out by the Collaborative Regional Research Programme (CRRP) of the Asia Pacific Network (APN) and the discipline of earth sciences at IIT-Gandhinagar found that copper levels were 7 to 9 times higher in the river water than limits set by the Bureau of Indian Standards (BIS). Nickel was found to be 2 to 5 times higher; iron, 4 to 5 times higher; selenium, 4 to 10 times higher; and chromium, 8 to 9 times higher.

Also, in case of Khari River, based on a complaint from a civil society organization in the court of law, on the pollution of Khari River and Khari Cut Canal, the NGT - appointed joint committee conducted a joint inspection[63]with officials from CPCB, GPCB, and AMC during December 2019. The committee found high pollution levels in the Khari River and Khari Cut Canal.

Biological Indicators

In general, pollution affects the occurrence of some species of phyto or zooplanktons whereas, other species were found to be tolerant to the extreme conditions of the abiotic parameters in case of polluted bodies and thus, working as potential biological indicators in water quality. Diversity and abundance of phytoplankton and zooplankton are usually well correlated with the abiotic factors (temperature, pH, TDS, DO, BOD, nitrate, phosphate, hardness, alkalinity) of the aquatic environment. The productivity of an aquatic environment is directly correlated, with the density of phytoplankton (Narasimha, 2013) as they play an important role as primary producers and thus can affect higher trophic levels by providing nutritional bases for zooplankton and subsequently to other invertebrates, shellfish, and finfish (Emmanuel and Onyema, 2007). Phytoplankton abundance should be higher than those of zooplankton being in the lower trophic level than the latter.

Table A- 29: Details of Phytoplankton and Zooplankton abundance in Sabarmati

Test Parameter	Present/ Absent	Group	*Indicates*	% Count of Cells
Phytoplankton	Present	Bacillariophyaceae	Low calcium	1
		Euglenopbyaceae	Organic pollution	4

[61]*https://gpcb.gujarat.gov.in/uploads/GPCB_SURFACE_WAT_QUALITY_IN_GUJARAT_DURING_COVID19_LOCKDOWN.pdf*
[62]*https://timesofindia.indiatimes.com/city/ahmedabad/sabarmati-heavy-metals-may-soon-hit-your-plate/articleshow/66944688.cms*
[63]*Joint Inspection Report dated 13-12-2019 by CPCB and GPCB*

Test Parameter	Present/ Absent	Group	*Indicates*	% Count of Cells
		Dinophyaceae		5
		Chlorophyaceae	high pH, alkalinity, DO, TDS and BOD	30
		Cynobacteria	High Nitrate and phosphate	60
		Cryptophyaceae		0
Zooplankton	Present	Cladocera	inverse relationship of DO	24
		Copepods	inverse relationship of DO	1
		Rotifera	High Water temperature, turbidity, and transparency. inverse relationship of DO	75

Source: Water quality Analysis conducted for G-ACRP, 2021

About 100m from the discharge point of STP Pirana 180MLD, the phytoplankton occurrence was in the order as Cyanophyceae> Chlorophyceae >Dinophyaceae>Euglenopbyaceae> Bacillariophyceae. Alkalinity, nitrates, and phosphates are responsible for the luxuriant growth of Cyanophyceae. A similar trend was observed through a study conducted a year back in the river stretch in Ahmedabad. Dermal reaction, nausea, vomiting, hay fever, toxic reactions are caused by cyanobacteria in waters and the water body hence unsuitable for direct interaction. This is also in contrast with the higher numbers of Bacillariophyceae (46.88 to 81.75%) followed by Myxophyceae and Chlorophyceae at the estuary in GoK (2020). In the Sabarmati river stretch in Ahmedabad, the abundance of phytoplankton was highest during the pre-monsoon period, which could be attributed to more stable hydrographical conditions prevailing during the summer months. The abundance of phytoplankton was lowered during the monsoon months when the water column was remarkably stratified to a large extent because of heavy rainfall, high turbidity caused by run-off, and decreased temperature and pH. Chlorophyceae, Cyanophyceae, and Euglenophyceae were found to be most abundant in the pre-monsoon season followed by the monsoon and post-monsoon seasons.

The population density of various groups of zooplankton was observed, and it was found to be following order Rotifera> Cladocera >Copepoda. Venkateswarlu and Jayanti (1968), Mishra and Saksena (1998), Shinde et al. (2011), Spoljar et al. (2011), and Verma et al. (2013) confirmed the presence of a comparatively higher rotifer population at the sites receiving waste which aligns with present findings. Sensitive species normally disappear as the water becomes polluted while tolerant ones survive the pollution stress and readily recover downstream of the point of discharge. In Sabarmati estuary (2020) among the zooplankton, rotifers, copepods, and cladocerans were the major groups.

Based on the discussions above, it is obvious that this industrial city face many challenges in pollution from multiple sources in the city and its heavily industrialised region. The following figure presents the industrial areas, major infrastructure, and future growth of the region. This is derived from primary studies and water, air, soil quality analysis conducted for G-ACRP subproject ESIAs.

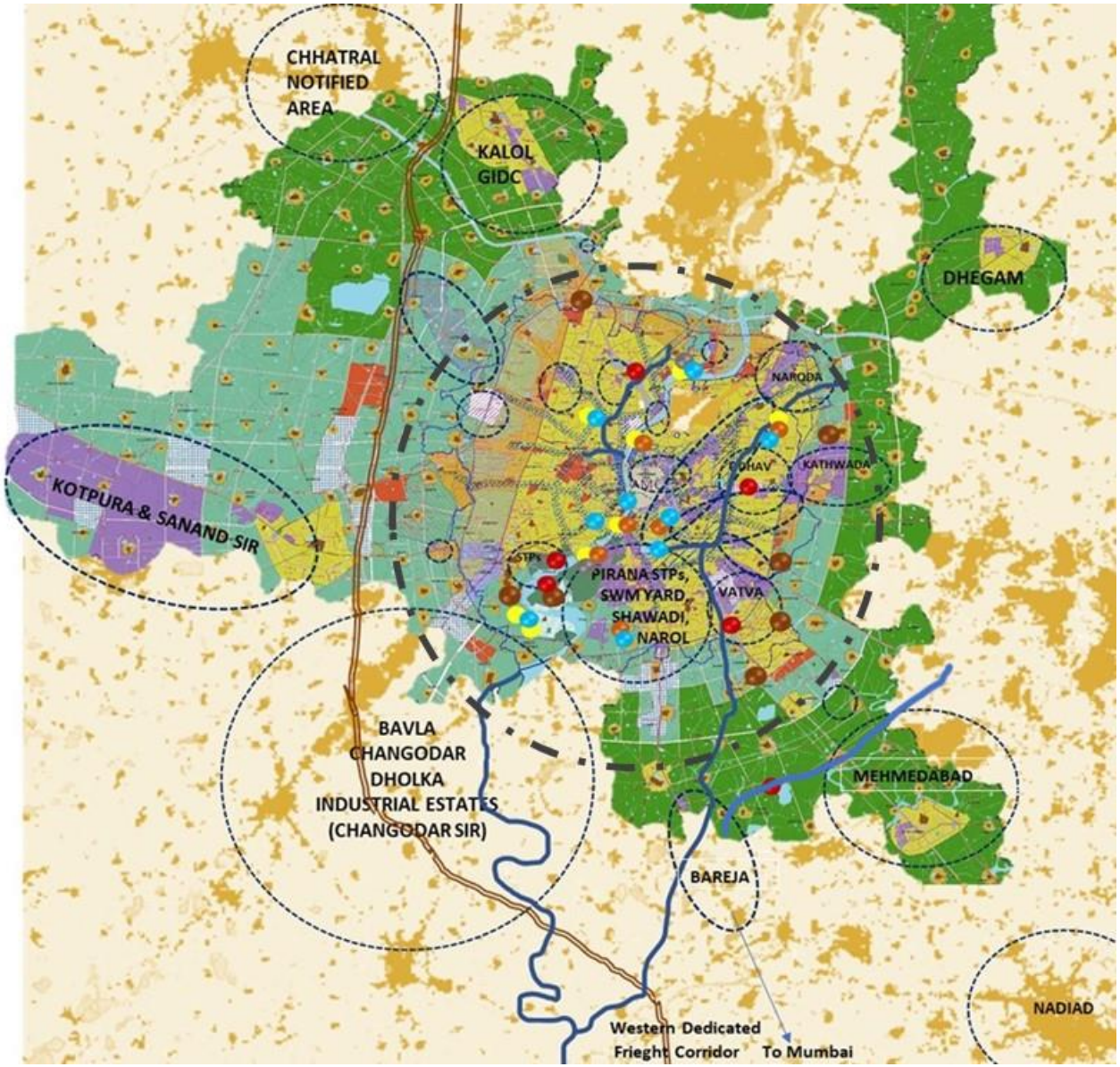


Figure A- 35: Landuses and Pollution Scenario of the city and its Region

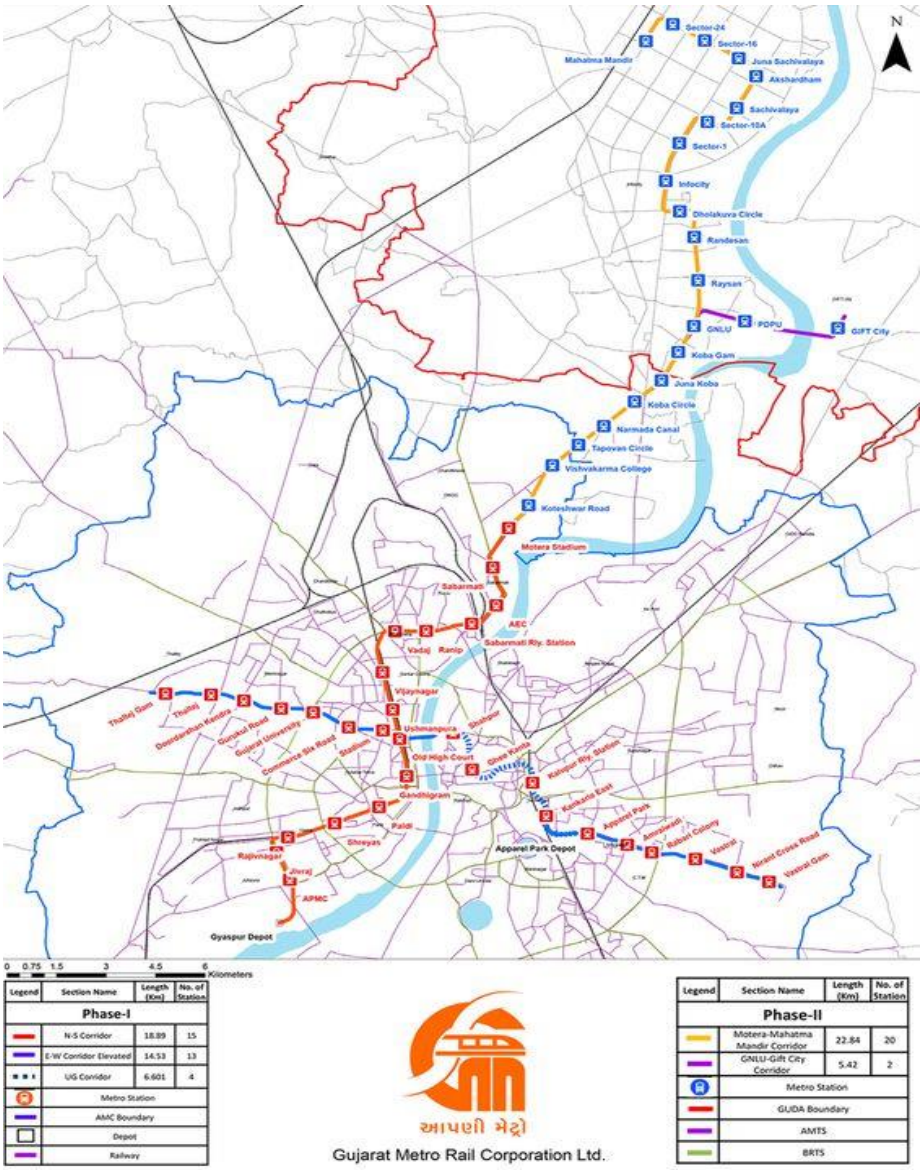
10. Major Ongoing and proposed Projects in the city

A discussion of the major ongoing and proposed projects in the city are presented here; with pointers on possible impacts during identified subprojects.

<table>
<tr><th>Sl NO</th><th>Project</th><th>Ahmedabad Metro Phase 1 and Phase 2</th></tr>
<tr><td>1</td><td>Proponent</td><td>Gujarat Metro Rail Corporation Ltd (GMRC); SPV of Government of Gujarat and Government of India; earlier known as Metro-Link Express For Gandhinagar And Ahmedabad (Mega) Company Ltd.</td></tr>
<tr><td>2</td><td>EIA /Risk Assessment</td><td>Yes; by RITES</td></tr>
<tr><td>3</td><td>Details</td><td>Phase 1:
<table>
<tr><td>Date of Opening Phase 1</td><td>06/03/2019</td></tr>
<tr><td>Current Operational Length</td><td>6.10 Km</td></tr>
<tr><td>Current Ridership</td><td>820 Passenger/day for FY 2019-20</td></tr>
<tr><td>No. of Train</td><td>1(One)</td></tr>
<tr><td>Frequency</td><td>50 minutes</td></tr>
<tr><td>Lines operated</td><td>1 (One)</td></tr>
<tr><td>No. of Station in operation</td><td>4</td></tr>
<tr><td>Important Destinations covered by metro</td><td>Ahmedabad famous Cotton Mills near ARPK stat Ahmedabad Railway station (4.4 Km) and reside societies of Vastral Gam</td></tr>
</table>


The total length of the Ahmedabad Metro Rail Project Phase-I is about 40.03 km out of which approximately 6.5 KM is underground, and the rest is elevated section. The project will connect 4 corners of the Ahmedabad city with 2 corridors and 32 stations.

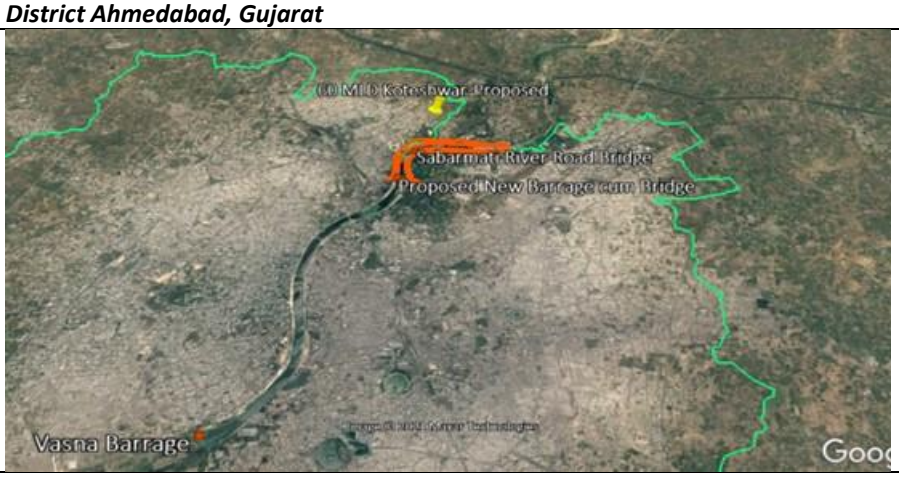

The length of the East-West Corridor is about 21.16 km with 17 stations in the route. This corridor will connect Vastral Gaam to Thaltej Gaam and will be passing through Nirant Cross Road, Vastral, Rabari Colony, Amraiwadi, Apparel Park, Kankaria East, Kalupur Railway Station, Ghee Kanta, Shahpur, Old High Court, Stadium, Commerce Six Road, Gujarat University, Gurukul Road, Doordarshan Kendra, Thaltej stations. In the East-West corridor, approximately 6.5 km is the underground section with 4 underground stations and the rest is the elevated section with 13 elevated stations. Old High Court station will be an interchange station for both the corridors.
Phase 2:
Phase-2 of Ahmedabad Metro Rail Project comprises construction of 28.25 km long fully elevated corridor in 2 parts. The first part is Line-2 from Motera Stadium to Mahatma Mandir of length 22.83 km with 20 stations while the second part is Line-3 from GNLU to GIFT City of length 5.41 km with two stations.
Phase-2 received approval from Union Government in February 2019 with an estimated cost of INR 5384.17 Crores with civil construction activities started from February this year. This is expected to be complete by 2023 December.</td></tr>
</table>

Sl NO	Project	Ahmedabad Metro Phase 1 and Phase 2
4	**Map**	Phase 1 & 2 
5	***Important points for G-ACRP Subproject ESIA***	– The influence zone of 11 meter has been created as per GMRC policy. No construction shall be permitted within 5 meters from the edge of metro corridor/ station structure for the safety reasons as per GMRC NOC policy. Applicable for subprojects (STP new constructions) at Vasna – Alignment of trunk sewers along metro line to consider impacts; especially work scheduling, Occupational and Community Health and Safety, cumulative air pollution impacts – Check corridor from Koteswar to Airport; and consider impacts of Metro corridor passing near proposed Koteswar STP. Vibration, pollution. – New Metro bridge upstream o proposed Barrage for water supply to city

Sl NO	Project	Smart City Project, Ahmedabad
1	**Proponent**	Government of India and Ahmedabad Municipal Corporation

Sl NO	*Project*	*Smart City Project, Ahmedabad*
2	***EIA / Risk Assessment***	No
3	***Details***	Car parking, IT for parking, health; street lighting LED, OFC, Water supply, Anganwadi, Water & Drainage network in Ranip, Kali, STP with power plant – 100 mld; micro-tunnelling : Vadaj to Paldi, Juna Vadaj Slum Rehabilitation, Waste to Energy, BRT automated swing gates, Water SCADA, Cybersecurity, NMT, Veg supply E-Rick, GRM chatbots
4	***Map***	
5	***Important points for G-ACRP Subproject ESIA***	– Check at subproject ESIA if any associated facility, in drainage or sewerage micro tunneling, or STP development contemporaneous to G-ACRP.

Sl NO	*Project*	*Sabarmati Riverfront Development Phase 2 From Acher – Hansol to Indira Bridge at District Ahmedabad, Gujarat*
1	***Proponent***	Ahmedabad Municipal Corporation, through its SPV Sabarmati Riverfront Development Corporation Ltd (SRFDCL)
2	***EIA /Risk Assessment***	Yes (except for newly proposed Barrage), by Kadam Enviro Group of Companies
3	***Details***	Extending existing riverfront (11 kms) to further 5 kms towards Gandhinagar, along both edges of the river Sabarmati for Rs 850 Crores (113 million USD). The newly upgraded area will have recreational facilities and pathways as in the case of existing riverfront development from Vasna Barrage to Hansol. During first phase of Riverfront development SRFDCL was provided with a seed capital of Rs. 9 crore and entrusted with the responsibility of developing the riverfront on a Build, Maintain, Operate and Transfer (BMOT) basis. The SPV model was used to avoid the delays associated with municipal decision-making. Riverbed land, which was originally held by the Government of Gujarat, was transferred to the AMC. AMC has, in turn, granted development rights to SRFDCL for this reclaimed riverbed land. Activities under Phase 2 include : 1. Construction of green embankment on both banks of the river. 2. Reclamation of approximately 108 Ha of land 3. Annual retention of water in the river 4. Development of public gardens, amenities and facilities 5. Development of wide public promenades along the entire length of river 6. Development of street network along the river for North-South connectivity 7. Development of Urban infrastructure along both the banks 8. Self-Financed mechanism for the development of the entire project

Sl NO	*Project*	*Sabarmati Riverfront Development Phase 2 From Acher – Hansol to Indira Bridge at District Ahmedabad, Gujarat*
4	***Map***	
5	***Important points for G-ACRP Subproject ESIA***	– Though the location of proposed barrage (upstream of Vasna Barrage within city limits) is indicated in approved EIA, no impacts or risks identified or assessed for proposed Barrage – Disposal of treated effluent from proposed subprojects upstream of proposed barrage, or into riverfront may have health impacts considering the dead storage – New metro bridge upstream of Barrage – Safety : Vasna Barrage, Flooding

Sl NO	*Project*	*Waste to Energy Plant at Gyaspur, near Pirana*
1	***Proponent***	Ahmedabad Municipal Corporation
2	***EIA /Risk Assessment***	No
3	***Details***	Waste to Energy plant at Piplaj near Pirana, will get operational by Dec 2021. Abelleon Clean Energy is implementing this 14 MW plant on DBOT for 30 years, for a cost of 240 crore (including 8-10% for O&M annually), spread over 13 acres. Power generated from the plant will be fed into the national power grid. It will convert 1,000 metric tonnes of mixed waste into energy daily.
4	***Map***	
5	***Important points for G-ACRP Subproject ESIA***	– Pirana and Vasna areas are complexes for waste management including solid wastes and sewage. This entire area needs need comprehensive and integrated environmental management and flood /resilience approaches, considering location near Sabarmati and Earthquake Zone III. AMC has mechanisms to manage solid and mixed wastes which might also be generated during construction and operations of the subprojects

Sl NO	Project	Biomining of Pirana Dumpsite
1	Proponent	AMC
2	EIA /Risk Assessment	No
3	Details	Started in 2019. AMC reclaimed around 24% of the Pirana dump yard land (19 acres of the total 80 acres) by freeing it from garbage through biomining. Around 33 lakh metric tonnes of garbage have been processed and expects to remove the dump in next three years. At present, 39 trommel machine are processing about 15,000 MT of garbage daily. Construction debris and large stones, which form about 30% of the garbage, is sent to AMC C&D plant at Piplaj, Pirana for construction of paver blocks, 50% of the garbage is mud and another 20% is plastic or small clothes with plastic being almost 15%.
4	Map	
5	Important points for G-ACRP Subproject ESIA	– C&D waste from biomining is sent to C&D processing facility. AMC has made a policy to buy 25 % of Paver blocks and 50% of Manhole covers Final product of the C & D Waste processing agency in the development of different civil & infrastructures projects of AMC by the approval of competent authority. Recently, competent authority of AMC has also approved a policy of procuring Precast / Prestress wall from the agency to build compound wall for AMC's various properties. This source shall be considered in project estimates.

11. Discussion on Cumulative Risks and Impacts of Urban Infrastructure and services on Environmental Components in the study region[64]

- ***Spatial and Temporal Scope of environmental assessments required at Subproject stage***

The geographic scope includes the city of Ahmedabad and the areas downstream (south of the Ahmedabad city) of Rivers Sabarmati and Khari. The ideal temporal scope is 2035 when the projected population renders the city a megacity, and considering the need to upgrade and plan new STPs in next 15 years in line with the growth of the city.

- ***Natural Environmental Drivers/ Stressors***

a) Slope: The city slopes gently to its south, and towards the river from both sides (east and west sides of the city bifurcated by Sabarmati) and hence treatment facilities get a natural gradient as they are clustered in the south part of the city near rivers. However with the growth of the city and the sprawl, recently treatment units are proposed in other parts as well,

[64] *Refer Baseline Analysis in Sections 1 – 9 of this Annexure A for details*

b) Wind Direction: Predominant wind direction is from southwest followed by west-northwest[65], minimizing odor impacts of existing STPs on the sensitive landuses. This needs to be a consideration while planning new STPs and their components especially odor, and emission reuse. City's microclimate is much influenced by the high dense developments and industrialisation here. Eastern parts face the brunt of industrial emissions. Sensitive ecosystems in the region (outside the city) do not receive drainage from these areas. Predominant wind direction is from southwest followed by west-northwest[66], minimizing odor impacts on these environmental features,

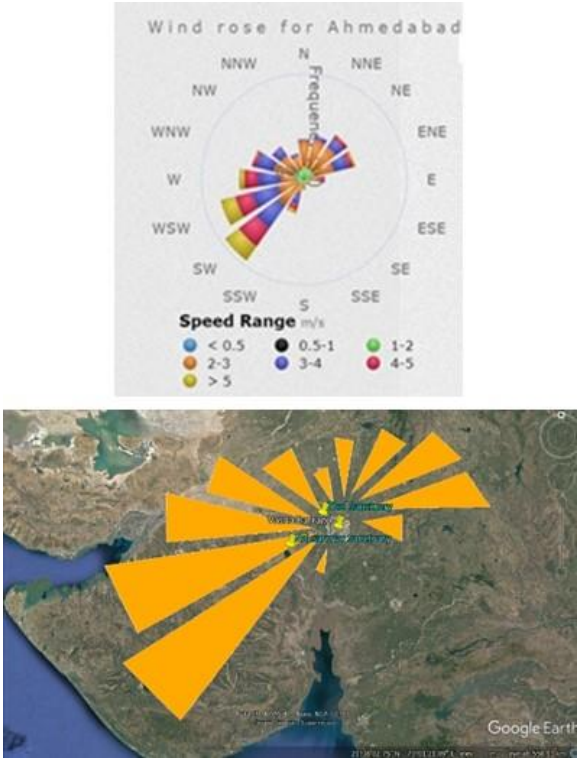


Figure A- 36: Predominant wind directions

c) River flow paths: Rivers flows towards the south, to the Gulf of Khambhat in Gujarat Coast with tidal influence till around Vautha, where River Vatrak, meets Sabarmati. Khari, and other rivers also meets downstream of the city. Hence the impacts and risks due to water pollution on the villages downstream till near around Vautha to be considered,

d) Decreasing rainfall in upper Sabarmati catchment, droughts, other extreme climatic events like flooding, earthquakes are important aspects to be considered in ESIAs.

Other Projects, Stressors and Drivers

e) all discharges from the city and the region including all other existing and proposed STP discharges into Sabarmati, Fatehwadi Canal, Kharicut Canal, industrial effluents, treated effluents carried by Mega Line, stormwater drains

f) Multiple barrages between Dharoi Dam and the city, new Sabarmati Riverfront project and newly proposed barrage upstream of Vasna at the beginning of new Riverfront project

g) intensive industrialization of downstream areas of Sabarmati, to the South of Ahmedabad city which is given impetus by the nationally significant freight corridor – the Western Dedicated Freight Corridor (DFC); the mega rail transport project for freight connecting industrial areas to west of India.

- ***Valued Ecosystem Components (VECs)***

  The key VECs in the project area are

  (i) Water: the two rivers Sabarmati and Khari; Lakes: Water quality degradation from multiple point source discharges (including discharge from STPs, drains, canals) and their cumulative impacts with other discharges/ development around. Among the Lakes, Chandola Lake (recognised as a man-made wetland) receives water from Kharicut canal and hence to be considered

  (ii) Air (particles and odor): The population and heritage areas mostly to the central and southern parts of Ahmedabad

[65] *https://www.indianclimate.com/show-data.php?request=LVVOE8OOOJ*
[66] *Ibid*

(iii) Land and Soil / Socio-economic drivers: Diminished land fertility and agricultural productivity in downstream villages affected by polluted inflow from upstream areas including the city of Ahmedabad

(iv) Biodiversity: Thol Sanctuary (40 km from city) and Santej Lake, in case of subprojects to the north or northwest parts of the city; Chandola Lake for those projects to east of the city, and any other Lakes which has significant fauna/flora if impacted by subprojects.

Discussion on the Key environmental components forming the line source of pollution in the region in around Ahmedabad namely; (i) Khari River, and (ii) Sabarmati River are presented here.

- **Khari River and Kharicut Canal[67]**

Kharicut canal to which drains the STPs at Vinzol is a tributary of Khari River in District Khera, Gujarat which is a source of irrigation and drinking water for animals. Both edges of the canal are lined. Discharge through the canal is 78.51 cumecs, canal bed width is 7.62 m, depth is 2.9 m, Freeboard is 0.45+0.15m, and side slope 1.5H:1V. Many reports mention drains and leakage of manholes and pipelines carrying effluents adding to the pollution in the canal. NGT has observed suboptimal quality of water flowing through the canal and the river and that the canal carries effluents from some industries in the eastern part of Ahmedabad and bypassing of sewage containing industrial effluents into the canal from Vinzol STP. No flow was observed upstream of Ropda village where the Kharicut canal meets the river, and hence the report assumes that the entire flow through the river is contributed by the canal. The farmers of the land located adjacent to the bank of Khari River and Kharicut canal are fetching the wastewater from the Khari River/ Kharicut canal through diesel-operated pumps & flexible pipelines for irrigation. Downstream villages had been raising the issue of industrial pollution affecting their water as early as 1978 with court interventions for setting up CETPs and other treatment facilities. Some of the villages affected include 11 Kheda villages which are Kalambandhi villages (Kalambandhi means bound by the agreement) villages are those that had an agreement with the British government to use Kharicut water for irrigation purposes. Affected villages also include Lali, Kashipura, Navagam, Bidaj, Sarsa, Aslali, Jetalpur, Bareja, and others. The report discusses that there is the discharge of trade effluents to these water bodies to save treatment charges in the CETPs. The river at this stretch receives flow mainly from Kharicut canal and is a modified habitat having received wastes and effluents over the years. Baseline assessment of Kharicut canal is presented here:

Baseline Assessment of Kharicut Canal proposed for upgradation under G-ACRP

In 1881, the British constructed the "Khari Cut" canal about 80 Km long and trapezoidal section, with 10 meters width at the bottom and 20 meters at the top, which originates at village Raipur, to convey waters from River Khari to the Chandola Lake, a nationally recognized human-made wetland[68]. This is one of the oldest irrigation schemes of Gujarat constructed to irrigate 1,200 acres of rice land near Chandola lake in Ahmedabad. Khari Cut canal passes through the eastern part of Ahmedabad City.

Key aspects which need consideration while upgrading the canal include:

- Canal sections are not barricaded uniformly, and various activities are visible. For example, the stretches connecting the canal to Chandola and Isanpur areas are covered and converted to playgrounds, and formal gardens.
- Ramps meant for operation and maintenance for canals are used for feeding and keeping livestock, dung drying, open defecation, and encroachments (like part of the temple,

[67] *NGT Order: Original Application No. 105/2019 (With report dated 19.08.2020)*
Available at: http://www.indiaenvironmentportal.org.in/files/file/Kharicut-canal-pollution-NGT-order.pdf
Accessed on : July 10, 2021

[68] https://indianwetlands.in/view-wetland/?profile=MzQ0

ragpickers/recyclers stores, slums, small shops), new constructions close to the canal, grazing of domestic animals, and other unsanitary uses.

- Canal lining is damaged, or cracks are observed throughout the stretch
- Sewage, waste water/effluent, and wastes (solid waste, C&D Wastes, animal carcasses) were dumped all along the canal, also near sluice gates
- Vegetation inside the lined canal and water birds were observed at many locations
- Foul odor emanates from the canal
- There are no streetlights in some stretches, and this poses safety risks especially in unfenced areas
- Canal width is varied and there are bridges at intervals and pedestrian and two-wheelers pathways/crossings. In certain stretches, the road is seen along the canal
- Water pipelines crossing the canals in some locations
- Waterlogging in nearby areas is an issue. Some nearby areas/houses are below canal level (almost one floor) and waterlogging during small rains is a main issue. AMC pumps out water from these areas during the monsoons.

Figure A- 37: Photo Essay of Kharicut Canal proposed for Redevelopment under G-ACRP

Cleaning of the canal and its upgradation cut off and prevention of sewage, effluents which are disposed into the canal, management of wastes, silt, vegetation/weeds, carcasses from cleaning the canal, shifting of utilities, prevention of disturbance to fauna, flora, and communities, the safety of workers and communities due to works and activities especially in sensitive areas are important during works. Maintenance of the redeveloped/improved canal without pollution and odor and institutional, regulatory, and service interventions for this is very crucial.

Discussion on the Modified Habitat: Sabarmati River

(i) Profile of Sabarmati River

With catchment spread across Rajasthan and Gujarat States, Sabarmati originates from Aravalli hills at an elevation of 762 m near village Tepur in the Udaipur district of Rajasthan. The total length of the river from origin to outfall into the Arabian Sea is 371 km and its principal tributaries joining from left are Wakal, Hathmati, and Watrak whereas Sei joins the river from right. Basin is bounded by Aravalli hills in the north and north-east, Rann of Kutch in the west, and Gulf of Khambhat in the south. Its principal tributaries joining from left are Wakal, Hathmati, and Watrak whereas Sei joins the river from right. The northern part of the basin is marked by hilly terrain while the southern part has a large alluvial plain with a gentle slope. According to the topographic features, Ahmedabad city can be mainly divided into two basins, (i) Sabarmati River basin, (ii) Nalsarovar Basin. Further Sabarmati River Basin has been divided into five basins:

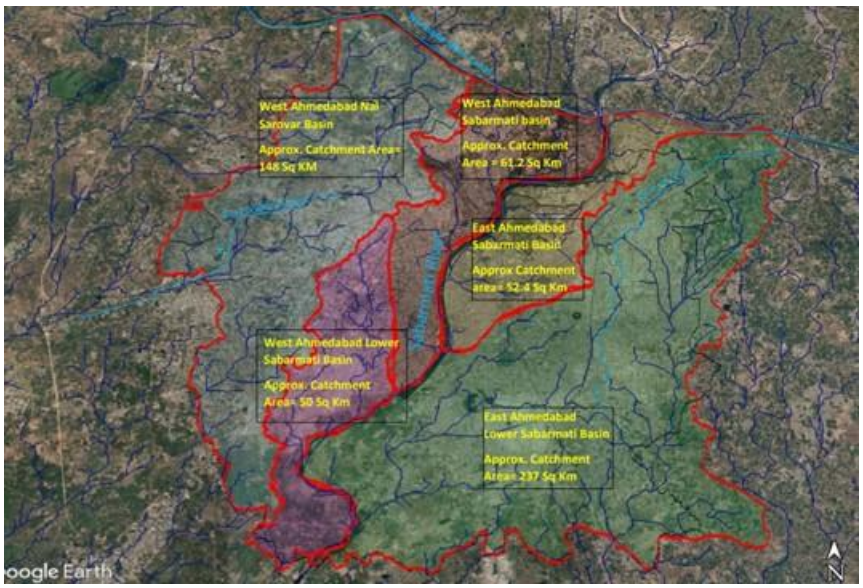


Figure A- 38: River Basins in the Project Area

On the Eastern part of Ahmedabad

(1) East Ahmedabad Sabarmati Basin- The catchment area of this basin is approximately 52.4 Sq Km. The main waterway is Muthiya Vehlo

(2) East Ahmedabad Lower Sabarmati Basin- The catchment area of this basin is approximately 237 Sq Km. Main Waterway is the Kharicut canal & Khari River.

On the western part of Ahmedabad

(1) West Ahmedabad Sabarmati Basin- The catchment area of this basin is approximately 61.2 Sq Km. The main waterway is Chandrabhaga Nala

(2) West Ahmedabad Nal Sarovar Basin-Catchment area of this basin is approximately 148 Sq Km. The main waterways are Gota Godhavi Drain, Santej drain.

(3) West Ahmedabad Lower Sabarmati Basin - The catchment area of this basin is approximately 50 Sq Km

(ii) Upstream and downstream landuses and water use [69]

While the predominant landuse through which Sabarmati flows are mixed (including residential, commercial, and industrial) in the city, in the upstream and downstream villages it flows through vegetated lands/ croplands mostly recently converted to industrial uses (with many industrial establishments and estates) and then further at near 100 km away, through salt pans to the Gulf of Khambat area. A large number of industries related to textiles, chemicals, machinery, metal products, pharmaceutical, engineering, plastics, electrical appliances, electronics, passenger cars, etc. are located in the district. The 212 km stretch of river from Sadoliya Barrage upstream of Ahmedabad (and Gandhinagar) to the Gulf of Khambat is designated as National Waterway NO: 87. Survey of India

[69] Data mainly from IWAI Report

toposheets for the coastal zone, shows the tidal reach of the river as about 30 km but the effective tidal effect for water transport purposes is considered up to 14 km. from the coast. [70] The average bed slope for Sabarmati River for the reach under consideration is about 1/2560.

a) North end of Ahmedabad city

The total length of the Sabarmati river passing through the city is 15.7 km from Indira bridge to Vasna barrage. The width of the river is 263 meters. The riverfront is developed with concrete structures and paving, for 11.25 km.

The Narmada Canal crosses the Sabarmati River at the Police Academy area near Gandhinagar to the North. The water flows through a huge tunnel built under the bed of the river and continues on the other side. Narmada canal siphon. Just 500 m to the east of this junction is a Sabarmati Gate canal escape through which water from Narmada nourishes Sabarmati during lean seasons. This escape gate from Narmada leads to a curved 50m wide canal that passes through open land (for 800m) and joins Sabarmati near *Kodiyar Mata nu Mandir* at 500 m from the Siphon. The Narmada canal bed is at 53m asl while the diversion canal bed is at 47m asl on average and the Sabarmati river is at 43 m asl on an average. The profile of this stretch is presented in ***Figure A-39***. Gandhinagar has seven Special Economic Zones and ten Industrial Estates along with creative IT Park and Gujarat International Finance Tech City.

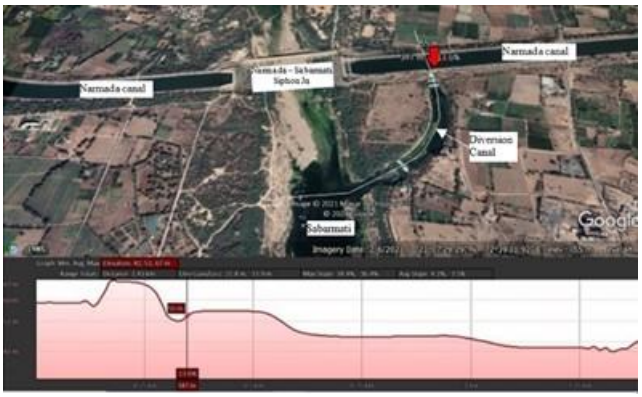


Figure A- 39: Plan and Profile of the stretch of Sabarmati at North end of Ahmedabad City

Reach: Sardar Patel Ring Road Bridge (Ch 156 km) to Lakroda Bridge (210 km) - This reach is at the upstream of siphon over Narmada Canal where water from Narmada canal is released into Sabarmati river. This is beyond the north of Ahmedabad (Gandhinagar area). It is important to note that there is practically no flow in this reach except during monsoon season for 4-5 months or Narmada canal release upstream.

b) Length through Ahmedabad city

Key urban infrastructure on both banks (0-200m) of Sabarmati in Ahmedabad city include Sewage Treatment Plant and old sewage Farm, CETP, outlets of STP, drainage, and CETP, Sabarmati riverfront - walkway and other recreational amenities associated with riverfront development, Slums (eg: Pirana, Santhosh Nagar, etc.), residential buildings and housing colonies/ apartments, industrial buildings, religious and institutional buildings, market activities, Thermal Power Station (400MW), etc. Part of the airport and crematorium also are aligned near this river. There are three prominent clusters of STPs; one to the east bank of Sabarmati – Pirana; and the other to its west bank – Vasna, and the next to the further east of the city at Vinzol. To the south of the city, downstream of Vasna barrage and Vishala Bridge are the 120 MLD and 240 MLD STPs at Vasna and their outlets on the western side of the river, almost at the edge of the riverbed. Riverbed is heavily sedimented with relatively no flow here, as water inflow to this side is controlled by the barrage. Though 180 MLD STP at Pirana is almost 800m to the east of the River its outlet is half a kilometer from the Vishala bridge. Further north, the outlet of 106 and 60 MLD STPs are at around 150m downstream of Vasna Barrage, while the Sabarmati riverfront walkway extending till near Vasna barrage is saved

[70] *http://iwai.nic.in/sites/default/files/1814791015NW-87%20Sabarmati%20Final%20FSR.pdf*

from any STP outlets, and clear water is retained with the help of Vasna Barrage, for good views from the walkway.

The Fatehwadi Canal which starts at the barrage itself; diverts water from the Vasna-Gyaspur area for irrigation to villages and towns south and southwest of Ahmedabad and has been operational since the time the barrage was built. In times of floods or heavy rains in the Sabarmati watershed areas or at specific periods for flushing the riverbed, the barrage releases water downstream. For the most part, however, the barrage gates remain closed for purposes of controlled irrigation and retaining water in the river's city Riverfront stretch till the barrage. Since the barrage started receiving Narmada waters, the water level at Vasna reservoir is maintained usually at 135 ft or 41.159 m in normal rains or 130 ft in heavy rains; and in the Fatehwadi canal at 6 ft., Gates are opened, alerts are issued to downstream villages, and water is released downstream above this point. Generally, Fatehwadi canal releases 1200 cusecs during Kharif and 800 cusecs during Rabi.

Infrastructure on/across Sabarmati in the City Area

Seven Road bridges and one railway bridge are crossing the river and connecting the east and west part of Ahmedabad. From the north, Sardar Patel Ring Road River Bridge (Ch.156), Indira Bridge (Ch.151.7) (carrying Gandhinagar Ahmedabad Road), Railway bridge (Ch.145.4) near Shahibaug, Subhash Bridge (Ch.145) carrying Khwaja Nazruddin Chishty Road (connecting Subhash Bridge Riverfront Park and Gandhi Ashram area), Vadaj – Dudheswar Bridge (Ch.143.8), Gandhi Bridge (Ch.142.2-Usmanpura), Nehru Bridge (Ch.140.7) and Ellis Bridge (Ch.140.2) connecting Eastern side to Ashram Road in the Western CBD, Sardar Patel Bridge carrying Bhagtacharya road from Eastern side to Paldi, Ambedkar bridge (Ch.136.8) at Pirana, Vasna barrage and Sastri bridge carrying NH 228 Ahmedabad - Dandi heritage highway) at Gyaspur.

Narmada Main Canal (NMC) to Subhash Bridge (North of City area to Centre of the city): The river runs a meandering course of a total of 11.65 km from Narmada Main Canal to Subhash Bridge with an average width varying from 296 to 732 m. There are three meandering loops at old village sites of Kotarpur, Ashram Bapu's Ashram (near Koteshwar) and near AEC at Subhash Bridge. The average reduced levels of the riverbed at Narmada Main Canal and Subhash Bridge are 44.73 m and 39.25 m respectively, and the slope of the river is generally mild. The height of the banks ranges from 4.75 to 12.50 m. The edge is not clearly defined by embankments or retaining walls at most places, and the river edge gently slopes down to the riverbed at several places, with vegetation.

Subhash Bridge to Vasna Barrage (Centre to South of the city area): The river runs a meandering course of about 9 km from Subhash Bridge up to the Vasna Barrage through the city with an average width varying from 325 to 500 m, with two meandering loops at Gaikwad Haveli and Wadaj. The average reduced levels (RL) of the riverbed at Subhash Bridge and Vasna Barrage are 39.2 m and 37.4 m respectively, and the average slope is mild. The height of the banks ranges from 4 to 9 m. A negative slope is observed from Sardar Bridge to Vasna Barrage. The edge is not clearly defined by embankments or retaining walls at most places. The river edge gently slopes down to the riverbed at several places, which have vegetation and have been encroached by slum settlements. The reduced level of the top gate of the Vasna Barrage is 41.756 m. Filling Vasna Barrage up to these levels results in flooding of the nearby areas in monsoons. The C.D. at Subhash Bridge is nearly 2.5 m above Riverbed level at the Subhash Bridge gauging site. A part of this stretch near Sardar bazaar up to Vasna Barrage is already developed as Sabarmati waterfront by Govt of Gujarat. Upstream of Indira Bridge,

released water from Narmada canal ensures all-round the year availability of water in this stretch and downstream.

c) The south end of Ahmedabad City

Reach: Vasna Barrage (Ch 135.7 km) to Sardar Patel Ring Road Bridge (Ch 156 km)
Depths of 0.5 – 1.0 m (above C.D.) are available for all round the year360 days. Depths of 1.0 – 1.5 m are available for around 75-90 days during monsoon (75 days). Details of Vasna Barrage are as under:

Name of the structure	**Vasna Barrage (B00580)**
Nearest city	Ahmedabad City
Name of River and Basin	Sabarmati
Year of Commencement & Completion	1971, 1976
Design flood (cumec)	21000 cumec
Width of the River and Anicut (m)	610.67m
Length up to crest (m)	20.75
No.of bays (no of openings)	24
Width of the bay (m) Vautha	18.29
Type of spillway gate	Others
Spillway gates number	30
Pond level	14.77
Means for dissipating energy (hydraulic)	Energy breaking cone block

Further to the south of the city, a narrow stretch of Sabarmati further flows through Timba, Chitrasar, and Vautha where it meets other 7 rivers and further flows south to reach the Gulf of Khambhat.
Reach: Vautha Gauge (at Ch 75.4 m) to Vasna Barrage (Ch 135.7 km). Depths of 0.5 – 1.0 m (above C.D.) are available for around 170 days. Depths above 1.0 m are available for around 75-90 days during monsoon. Depths above 0.5 m (from 0.5 to above 1 m) are available for 170-200 days. This stretch starts from Downstream of Vasna Barrage.
Reach: Ch 30.0 to Vautha Gauge (at Ch 75.4 km). Depths of 0 – 0.5 m (above C.D.) and above are available for around 170 days in a year. Depths of 0.5 – 1.2m and more are available for around 120 days during monsoon.
Reach: River Mouth to 30.0 km (Ch 0.0 to 30.0 km). From the analysis of toposheets for the coastal zone, it was found that the tidal reach of the river is about 30 km, but the tidal effect considered in earlier studies is up to 14 km. The tidal variation is about 6 m. Reduced water depths of around 2 m are easily available up to 14 km from the mouth since the tidal effect is dominant. From 14 km to 30 km, depths are available in the range of 1-1.5 m except for a small stretch.
Sabarmati drains ultimately into the Gulf of Khambhat (GOK) a Critically Vulnerable Coastal Area (CVCA) requiring special consideration for protecting the critical coastal environment and difficulties faced by local communities identified under the Environmental (Protection) Act, 1986 and managed with the involvement of Coastal communities including fisherfolk. The tidally influenced area is 30m upstream of the drainage point of Sabarmati. The slope from Ahmedabad to GoK is 36m to 0m; with an average slope of 0.2 percent.

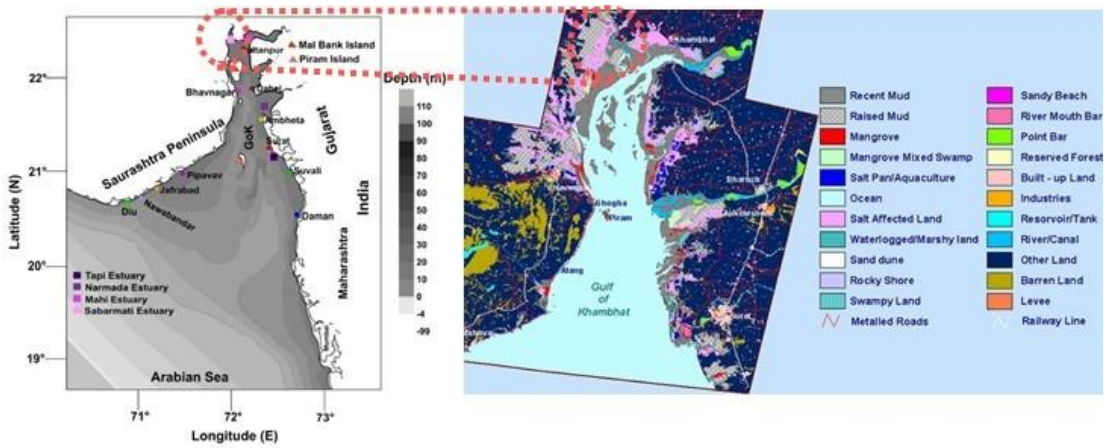


Figure A- 40: Sabarmati River mouth at Gulf of Khambhat

The gulf receives many rivers, including the Sabarmati, Mahi, Narmada, and Tapti. Its shape and its orientation in relation to the southwest monsoon winds account for its high tidal range (12 metres) and the high velocity of the entering tides.

Seasonal Flow differentials of Sabarmati River

The average annual rainfall in the Sabarmati basin is 689.90 mm. The southwest monsoon sets in by the middle of June and withdraws by the first week of October. The rainfall is mainly influenced by the southwest monsoon. Monsoon contributes nearly 91-94% of annual precipitation. As per a study conducted by IWAI, 15-year minimum water level a Vautha Gauge Station downstream of Ahmedabad) where minimum 12m and maximum 26m. Yearly minimum and maximum Water Levels at Subhash Bridge gauge station were minimum 39 m and maximum 47.45m. High flood levels are computed from the last twenty years Gauge discharge data collected from Central Water Commission (CWC) for the Subhash Bridge GD site is 47.45m. HFL at Vasna Barrage is 41.77m. The reduced water depth in the city section is a minimum of 0 m (CH 167.446) and the maximum depth is 6.973 m (CH 171.733). The bank levels are about 5 to 10 higher than the river bed levels in most of the reach up to Vasna barrage and 4 to 6 m in the lower reach.

Flood magnitude considered for various infrastructures in Ahmedabad city is 4.5 to 5 lakh cusecs. In 2016, heavy discharge of 16,250 cusecs, against the inflow of 26,000 cusecs, overnight at Dharoi dam in Mehsana district caused the opening of six gates of the dam. This caused the water level to rise at Indira bridge by 20 meters, Subhash Bridge by 39.4 meters, and by 37.8 meters at Vasna barrage (there is a small reverse slope here). This forced the AMC to open all the 21 gates at Vasna barrage gradually in consultation with the state irrigation department. Accordingly, the riverfront was closed for the public and people living in low-lying areas were alerted. After the opening of the barrage gates, the water level in the Sabarmati river level reached 39 m. Last year (Aug 2020), when the water level at Dharoi reached 80%, a flood alert was raised to Ahmedabad city and downstream villages by a flood warning system. Incoming water in Dharoi was 46,000 cusec and about 15,000 cusec was released from Dharoi at 6 pm. Since the Sant Sarovar upstream of the river was full, the authorities had to release water from this barrage. Release of 10,000 cusec to 15,000 cusec was supposed to allow seepage of water to the dry riverbed. While flow increase to around 50,000 cusec may result in water logging in the low-lying areas along the river as the drains start overflowing. A detailed analysis of the flow in Sabarmati is presented in next section to derive the key pointers on environmental and social aspects of planning project infrastructure.

Discussion on the Flow, water levels, and impacts on Pollution in Sabarmati

As described above, Sabarmati is a non-perennial river, which flows from Dharoi Dam in Rajasthan to the Arabian Sea only during monsoons and extreme events like floods or heavy rains associated with cyclonic activities in the larger region. *The Sabarmati was once a perennial river, however, after the construction of a dam near Dharoi, it is generally dry during lean periods except for a small channel of flow due to water released from Dharoi dam. Recently water from the Narmada canal is being fed to the river and the river retains water downstream of the Narmada canal*.[71]

From Sardar Patel Ring Road Bridge (Ch 156 km from Gulf of Khambat) to Lakroda Bridge (210 km) at the upstream of siphon over Narmada Canal where water from Narmada canal is released into Sabarmati river; there is practically no flow except during monsoon season for 4-5 months.[72]

Following is the data on the inflow from NMC into the Riverfront and outflows from the Riverfront for the period July 20 to October 21. ***(Table A-30)***

Table A- 30: Inflow from NMC into Sabarmati Riverfront and Outflows from Vasna Barrage

Month (July 2020 to October 2020-21)	**Inflow in Sabarmati river from Narmada Main Canal (NMC) in mcm**	**Outflow from Vasna Barrage into Fatehwadi Canal in mcm**	**Outflow from Vasna Barrage into Sabarmati River (after Vasna barrage) in mcm**
July-20	59.58	65.01	3.94
August-20	61.00	36.20	44.73
September-20	178.72	27.94	279.15
October-20	104.74	21.69	120.30
November-20	8.74	6.71	0.00
December-20	53.12	57.36	0.00
January-21	63.57	63.84	0.00
February-21	48.40	47.28	0.00
March-21	68.34	70.52	0.00
April-21	18.53	35.06	0.00
May-21	9.87	0.00	10.33
June-21	29.81	7.49	17.54
July-21	0.00	19.41	14.35
August-21	25.78	28.69	0.00
September-21	1.99	15.68	0.00
October-21	0.00	4.56	0.00

At the Narmada Canal siphon, some water is diverted as agreed for River Front Project, to ensure maintaining the water level at 130-135 m. Data analyzed for the period between two monsoons (1 July 2020 to 30 June 2021), out of 365 days, flow from the canal was Zero (0) mcm in 96 days; ie. for 25 percent of the days. This corroborates the above analysis that for one-fourth of the year river at Ahmedabad stretch gets water from Dharoi, whereas for the rest of the period, it depends on Narmada Canal. In addition, treated effluents from STPs Jalvihar (60 MLD), and Shankarbhuvan (25 MLD) is also let out into the Riverfront and further into Fatehwadi Canal for reuse.

[71] *http://cgwb.gov.in/District_Profile/Gujarat/GANDHINAGAR.pdf*
[72] *http://iwai.nic.in/sites/default/files/1814791015NW-87%20Sabarmati%20Final%20FSR.pdf*

Vasna Barrage of Ahmedabad

Dharoi dam (constructed in 1978) of Dharoi Village in Mahesana district is 165 km north of the city (upstream) is the major dam in Sabarmati River. Vasna Barrage (a weir for diverting irrigation water) is around 200 km from the Dam, in the south part of Ahmedabad city.

Figure A- 41: Map showing Fatehwadi canal originating from Vasna Barrage

The barrage is having total 30 numbers of vertical gates among 26 numbers are on River and 4 numbers are on the Fatehwadi canal on the Right bank of the barrage. The length of the Fatehwadi canal is 6.9 km having a capacity of 45.35 cumecs. Filling Vasna Barrage up to this level results in flooding of nearby areas during monsoons.

Downstream of the barrage the river is almost dry, and eutrophication is observed for most of the months except during rains. The maximum flood discharge of Vasna Barrage is 7,50,000 cusecs.[73] Sabarmati Riverfront embankments were built to prevent flooding in case of floods, and pier anchorages were provided for bridges across the river for 5 lakh cusecs flood.

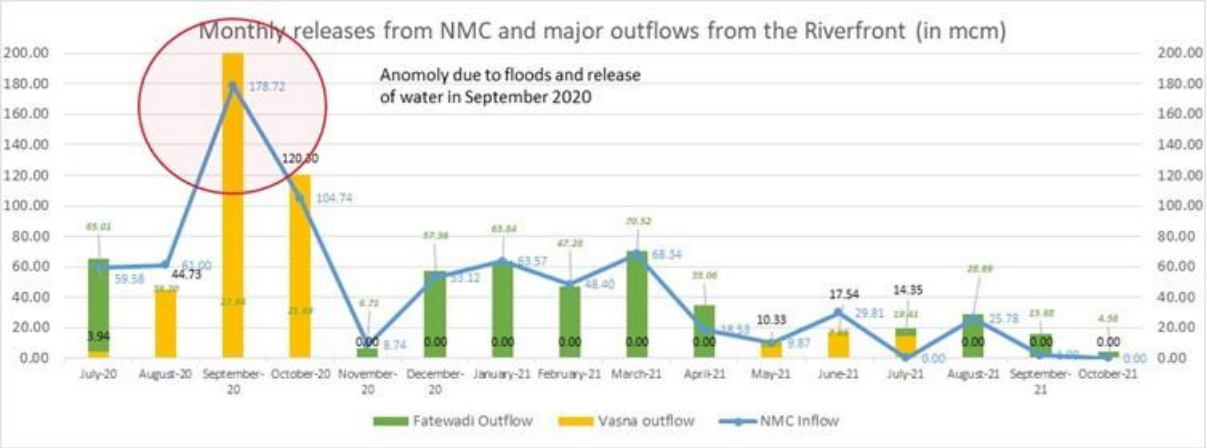


Figure A- 42: Monthly release from NMC and major outflows from the Riverfront

The freshwater from the Vasna barrage is discharged into the river/ drainage channel only during the monsoon period which is also occasional as it depends on the rainfall intensity in the catchment area of the Vasna barrage and the resulting water level at the barrage. [74]During monsoons, inflow from the canal through Siphon averages at 1.94 mcm during July and August months, whereas it is 5.96 mcm during September and 3.38 mcm during October. The water level is maintained at an average of 133 m at the riverfront from 1 July to October 31; which is also the monsoon season. 1 Nov to July 30, when rains are minimal (and summer from March to July) inflow from NMC is an average of 1.10 mcm, with more than 40 percent of the days during this period with zero discharge. During this period, flow

[73] *Sabarmati Riverfront Authority (1997) Feasibility Report for Sabarmati Riverfront Development*

[74] *The Narol Dyestuff Enviro Society, 2017. Environmental Impact Assessment Report for Proposed expansion of CETP, unpublished*

from upstream Sabarmati is also zero, as the flow is minimal in his non-perennial river during this period.

- The releases from Vasna barrage are generally during monsoon
- No flow is observed downstream of Vasna barrage during the lean season on 79% days (387/490) during the period July 2020 to October 2021
- Zero releases from Vasna barrage in 9 out of 16 monthly summarized data
- Zero releases are noticed from NMC into Sabarmati on many days (191 days) due to:
  - September 2020 – floods in Sabarmati
  - May 2021 – Tauktae cyclone
  - Monsoon periods – as there was already water in the Sabarmati river (there are have 2 monsoons in the above period).

Data shows that the release of water through the barrage was much during September 2020 due to unprecedented floods, which shows up as an outlier in the above ***Table A-30*** /**Figure 42** in water outflow into Sabarmati downstream as a release from Vasna Barrage. Also, during the flood of July 2017, Dharoi released 125-250 mcm of water downstream, when the riverfront flooded and all 2 gates of the Vasna barrage were open fully to let the water escape downstream.

Dead storage at the Sabarmati Riverfront during certain periods

The period November 1 to 25, 16 April to 27 May is noteworthy; as there is no flow into the Riverfront from NMC, or any significant outflows (except on one or two days) from Vasna Barrage to Fatehwadi Canal or Sabarmati downstream of Vasna. We can infer that the storage at the riverfront is dead during November (25 days) April – May (summer – 45 days). It is known that many drainage outflows empty into the riverfront, which determines the quality of the water here during the dead storage period.

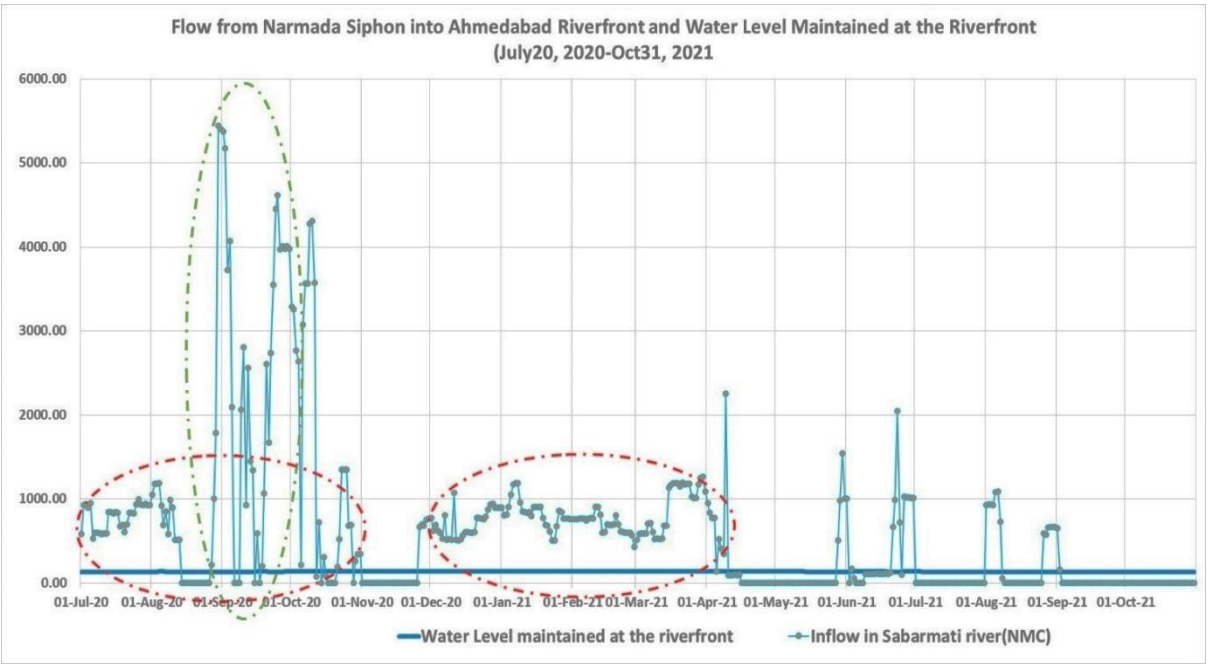


Figure A- 43: Inflow from AMC and level maintained at the Riverfront

The freshwater from the Vasna barrage is discharged into the river with widely varying flow rates depending upon the availability of the water in the reservoir. Varying levels of discharge is observed from Vasna barrage to Fatehwadi canal, which is used for agricultural purposes downstream of Sabarmati, However, since the discharge from the Vasna barrage is zero during most of the year except in case of extreme events, sewage and treated wastewater disposed downstream of Vasna barrage

do not get diluted during most of the year. In addition, there is untreated sewage discharge into canals and manholes mainly as the STPs and networks do not cover all premises.

Figure A- 44: Sabarmati, on both sides of Vasna Barrage

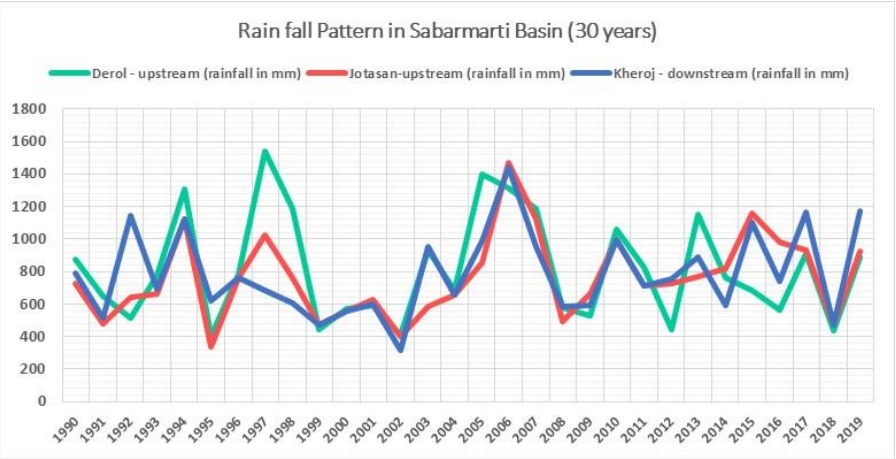


Figure A- 45: Rainfall pattern in Sabarmati Catchment – 30 years

Rainfall data of Sabarmati catchment

An analysis of the rainfall data in the Sabarmati catchment shows declining rains over the past 30 years. Parts of the Sabarmati catchment upstream of the Dharoi dam have lesser intensity when compared to downstream areas (near Ahmedabad). [75]

Rainfall is mostly confined to June, July August, and September months.

Key proposals in the pipeline:

(i) The Foundation stone of the barrage to be built for Rs 2140 million on Sabarmati river with a storage capacity of 3.47 million cubic meters was laid in October 2021 at Hirpura in Vijapur taluka of Mehsana district, around 50 km upstream of Ahmedabad city. With the completion of this scheme 3,200-hectare areas including 2 villages of Vijapur taluka and 4 villages of Himmatnagar taluka, will get an irrigation facility.

[75] *Chourushi, S, Lodha P, 2020. Rainfall trend analysis of three rain gauge stations of Sabarmati river basin, India, Journal of Emerging Technologies and Innovative Research (JETIR), June 2020, Volume 7, Issue 6 (based on data collected from is collected from Central water commission (CWC) Gandhinagar and missing rainfall data from NASA Agro Climate data website)*

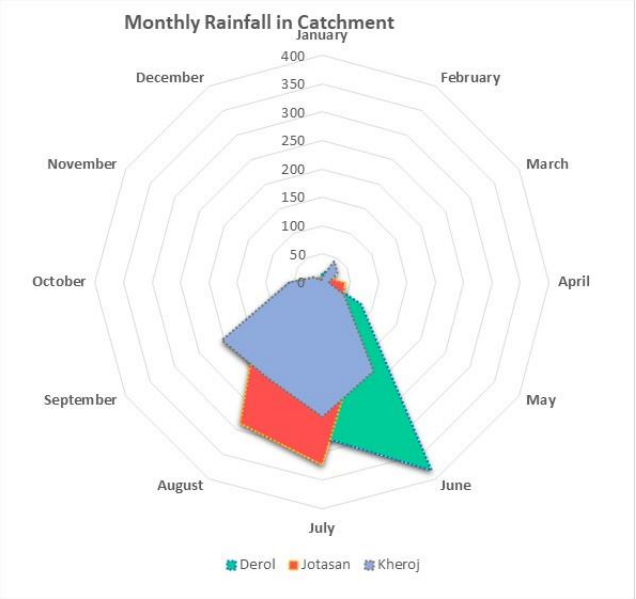


Figure A- 46: Monthly rainfall pattern in Sabarmati Catchment

(ii) As part of Phase 2 of Sabarmati Riverfront Development, it is proposed by Sabarmati Riverfront Authority to construct another barrage cum bridge upstream of Vasna, near Koteshwar in the riverfront, near Sardar Bridge to the north part of the city, downstream of Narmada Siphon. The authority proposes to draw water from here for the city water supply.

With these two barrages upstream of Gandhinagar and Ahmedabad, the natural flow of Sabarmati available at Vasna may decrease. Water from Narmada Canal also may get controlled at the proposed new barrage at the riverfront. The following map (***Figure A-47***) presents a regional map of Sabarmati, Ahmedabad, Vasna Barrage, and other proposed barrages.

There are two dams (Guhai Dam and Hathmathi Dam) on Hathmathi River which joins Sabarmati River near Vijapur (Hirpura) upstream of Ahmedabad. Demand for Dharoi water for Irrigation is high upstream of Gandhinagar and Ahmedabad.

Figure A- 47: Map Key features of Sabarmati Catchment

River Action Plan for Sabarmati

River Action Plan for Sabarmati also suggests Plantation /Vegetation cover along with the River stretch/River, Biodiversity Park, etc., and a letter has been issued to the concerned Forest office by GPCB. Forest Department informed that 25,000 Plants were planted along the Sabarmati and Meshwo rivers in the areas available under the Vanmahotsav and other Schemes of the forest Department with the co-operation of local People and plans to plant 1.54 Lacs saplings during 2020-2021.

In addition, GPCB has issued a letter to Health & Family Welfare Department to submit the action plan of Health Aspects including Health impact study and mitigation measures to improve the health in the catchment of polluted river stretch. In addition, the NGT has suggested GPCB get details on E-flow, Good Irrigation Practices, and Details on Flood Plain Management Zone. The following are the

responses provided by the Irrigation Department/water Resources Department, Government of Gujarat to GPCBs follow-up on this aspect.

Environmental flow:

- *50 to 100 Cusecs of water is released from Dharoi Dam into the Sabarmati river as per the requirement in the Down Stream of Dharoi Dam. Sabarmati is not a perennial river*
- *Proposed plan to achieve minimum e-flow: Sufficient water is released downstream of Dharoi dam in Sabarmati River hence question does not arise.*

Details of Good Irrigation Practices:

- *General government practice of irrigation is maintained in the command area of Vasna Barrage.*
- *Farmers are made aware to use water efficiently.*
- *Canal System of Fatehwadi canal system is 80% lined to minimize seepage losses. As such, no water logging issues noticed so far in the command area of Vasna Barrage.*

Detail on Flood Plain Management Zone:

- *As far as Vasna Barrage is concerned 7 villages of Ahmadabad District, 8 villages of Kheda, and 1 Village of Anand is identified which and may be affected due to floods downstream of Vasna Barrage, for more than 2,00,000 lakh cusecs[76] discharge from dam. In such conditions, people of these villages are warned through early warning arrangements in consultation with the revenue department.*

Biodiversity of Sabarmati:

In a research study conducted in 2012[77] In the Sabarmati river stretch in Ahmedabad, the abundance of phytoplankton was highest during the pre-monsoon period, which could be attributed to more stable hydrographical conditions prevailing during summer months. The abundance of phytoplankton was lowered during the monsoon months when the water column was remarkably stratified to a large extent because of heavy rainfall, high turbidity caused by run-off, and decreased temperature and pH. Chlorophyceae, Cyanophyceae, and Euglenophyceae were most abundant in the pre-monsoon season followed by the monsoon and post-monsoon seasons. At the upstream of Ahmedabad, green algal flora like Zygnema, Spirogyra, Eustrum, and Staurastrum was observed, which are indicators of less polluted water. The algal flora of polluted water bodies at the Riverfront and downstream of Vasna Bridge showed blue-green alga and diatoms like Oscillatoria, Anabaena, Microcystis, Navicula, Nitzschia, Synedra, Gomphonema, etc. Many green algae such as Pandorina, Endorina, Scenedesmus, Stigeoclonium, Ankistrodesmus, Chlamydomonas, Pediastrum, Coelastrum, also occurred abundantly and frequently. The most pollution-tolerant species Euglena, Oscillatoria, Navicula, Nitzschia, Stigeoclonium, Ankistrodesmus, Scenedesmus, Chlamydomonas, were recorded to be maximal downstream of Vasna Barrage, indicating the organic pollution. Local fish varieties are observed in the Sabarmati riverfront and beyond the Vasna barrage when the barrage gates are open.

Aquatic Biodiversity study:

An aquatic biodiversity study was conducted along the Sabarmati river in the stretch of Valad village (upstream of Sabarmati river – before inlet from Narmada Canal) to Vanzar village (downstream after Vasna Barrage – Sabarmati River) of approximately 20 Km. The biodiversity study was based on secondary data and field observations. Following are the findings of this study:

1. It was observed that the entire stretch of Sabarmati is infested with the *Pistia sp.* & *Eucornia crassipes* Which has altered the natural habitat.
2. Sabarmati river is non-perennial (seasonal river which are among the aquatic habitats most altered by human activities) and is a modified habitat as it is dry fr most part of the year, due

[76] *5663 cumecs*

[77] *Solanki R.H, 2012. Spatial variation in Phytoplankton Diversity in the Sabarmati River at Ahmedabad, Gujarat, India, publication at: https://www.researchgate.net/publication/305402693*

to which the water is being sourced from Narmada canal and held at the Vasna Barrage to improve the aesthetics of the riverfront development. The riparian zone of the Sabarmati is converted into the heavily built riverfront in the Ahmedabad city.

3. Riverfront development has many parks and plantations (including Miyawaki plantation of 67000 saplings) along the river in city area. Though without a natural riparian zone, a biodiversity park has been designed along the riverfront between Vasna Barrage and the next bridge to the north of it (Ambedkar Bridge).
4. Downstream, the river has a riparian zone, with tree growth majorly *Prosopis sp, which is invasive and found throughout Gujarat).* The entire stretch including downstream of river after Vasna Barrage has presence of invasive plants like *Pistia sp., Eucornia crassipes, Ipomea sp., Typha sp., Wolffia sp. etc.*
5. Pisces fauna of the river includes majorly *Tilapia sp., Gambusia sp., Clarius batrachus, Garra gotyala, Catla catla, Channa sp. etc.* Tilapia is an invasive species which was found in Sabarmati river, Vasna Barrage area, Fatehwadi canal and downstream area of Sabarmati river.
6. Seasonal aquatic birds and migratory birds are observed along the Sabarmati and Khari river.
7. Aquatic flora in the river and downstream provides habitat for aquatic birds like Purple moorhen, Bronze winged jacana, white breasted waterhen, Red Wattled lapwing egrets, herons etc.
8. It can be concluded that overall aquatic ecology has been altered as there is no flow especially downstream of the barrage and is influenced by invasive species. The poor water quality supports the species like *Pistia, Euchornia, Tilapia* etc, dominant in nature, which does not allow native species to grow and survive. The proposed project will help in improving the water quality and in turn the diversity in aquatic ecosystem downstream, while water inflow from Narmada Canal influences the conditions upstream of the barrage.

Safety of Vasna Barrage:

Vasna barrage extends across the width of the Sabarmati River at the place; 610.67 m. Height up to crest is 20.75 m, with 24 bays of 18.29m. Maximum observed water level of last twenty years or Maximum Water level as mentioned in CWC data is 41.770m adopted as (Highest Flood Level) H.F.L. Design flood level is 750000 cusecs.

Figure A- 48: Vasna Barrage and nearby infrastructure proposed for upgradation under G-ACRP

STPs near the barrage which is proposed for upgradation under G-ACRP Pirana 60 MLD (800m upstream, east, near Ambedkar Bridge), Pirana 106 MLD (1000m upstream, east), Pirana 180 MLD (2000m downstream, east, beyond Narol Vishala Bridge), Vasna 240 MLD (3000m downstream west, beyond Narol Vishala Bridge), Vasna 126 MLD (3300m downstream west, beyond Narol Vishala Bridge). The STPs at Pirana, upstream of the barrage are protected by embankments that can withstand floods, as part of Riverfront Development. The STPs at Vasna to the west downstream of the barrage beyond the existing Bridge are around 3km from the barrage.

In India, Central Water Commission (CWC) has encouraged the formation of Dam Safety Organizations (DSOs) at the State level. Including Gujarat, 18 States and four dam owing organizations (namely, NHPC, BBMB, DVC, and Kerala State Electricity Board) have created their DSOs. DSO of Gujarat was established in July 1981 under the Central Design Organization which was in 1986 brought under the control of Chief Engineer and Director Gujarat Engineering Research Institute, Vadodara. GERI monitors the safety aspects of dams in Gujarat state and functions in coordination with the Safety Monitoring Directorate CWC New Delhi. GERI deals with the Inspection of all existing large dams in state 4 determining the status of safety in respect of civil mechanical and electrical aspects and suggesting measures to improve it as a sing hazard potential and determining priority for repairs. Periodical inspection is carried out in 14 major and 193 medium dams once in two to three years and the deficiencies noted R pointed out and reported to big government. It publishes hence status reports of dams and dam safety activities in Gujarat yearly. All large dams of Gujarat are owned and operated by the Water Resources Department of Government of Gujarat, except the 7 Water Supply-related Dams.

Regular pre and post-monsoon inspection of Vasna Barrage; covering the masonry dam, earthen bank under sluice, out sluice, waste weir gates, etc; is carried out by Ahmedabad Irrigation Project Circle of the Narmada Water Resources Water Supply and Kalpasar Department and inspection report and certificate for each year is submitted to the Chief Engineer of the Department. As per the latest inspection[78], the barrage is certified as in good condition structurally without cracks and mechanical/electrical; parts are working well.

Impacted Landuses:

Most of the impacts and risks of these cumulative diffused environmental pollution is felt on two major landuses / users. They are the (i) residential areas in central, eastern south zones of Ahmedabad City (AMC limits), and (ii) villages downstream of Sabarmati and Khari Rivers. A discussion on these impacted areas are presented here.

- **Residential areas in Central, Eastern and Southern parts of Ahmedabad**

Wards Vasna, Maktampura, in New West South Zone, Lambha, Vatva, Behrampura, Danilimda in South zone and wards Shahpur, Daryapur, Jamalpur, Shahibaug Khadia, and Asarwa in Central Zone are critical areas for infrastructure development. While the wards in South West and South parts are proximal to STPs, CETPs, and their outlets, the wards in the Central zone are critical during network laying and upgradation due to the higher densities, old structures, and heritage areas here.

It is important to clean and green (mitigating the impacts of pollution) the critical wards in the southwest and new west south zones, by mitigating air, land, and water pollution due to STPs nearby; also to ensure that the river stretch just next to Vasna barrage rejuvenates, through River Action Plan. It is also important to plan and execute network laying in the central zone considering the impacts of vibration, noise and visual blight, issue of narrow roads, density, heritage community, and worker health and safety.

[78] *No. AIPC/PB/Pre-Monsoon Inspection 2020/ 1347/ 2020; dated 08/06/2020 and AIPC/PB/Post Monsoon Inspection/2021/Sant Sarovar/Wasna /2021 Date:-3/3 /2021*

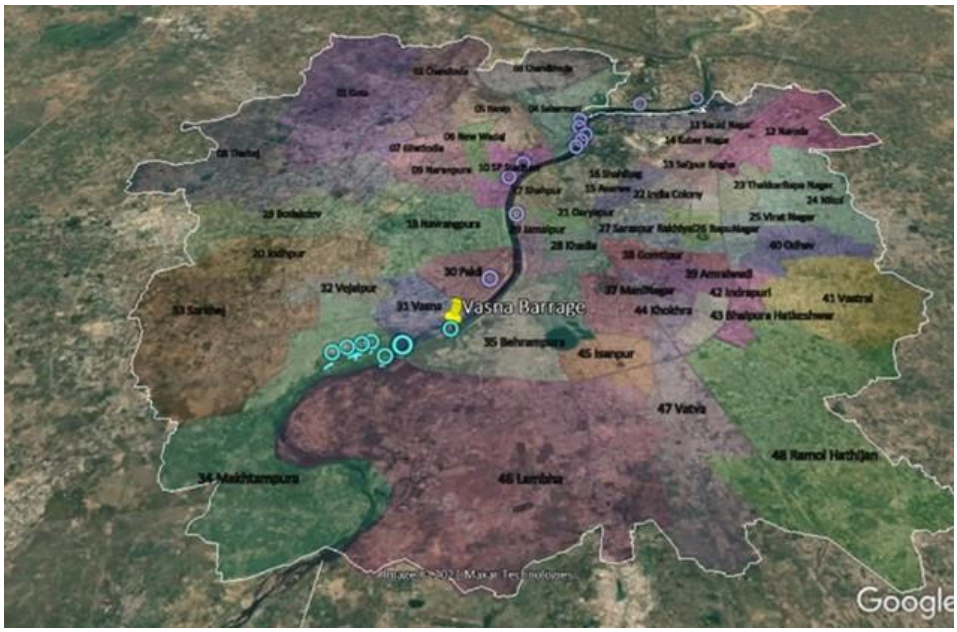


Figure A- 49: Wastewater, Treated Effluent, and Drainage Discharge points in Sabarmati

- **Downstream Villages to the south of Ahmedabad towards the Gulf of Khambhat**

Gulf of Khambhat is a north-south penetration of the Arabian Sea on the west coast of India between Saurashtra Peninsula and mainland Gujarat. It is 80 km from Ahmedabad along the west coast of India. Villages along the flow path of Sabarmati in the districts of Ahmedabad (Daskroi, Dholka, Dholera talukas), Kheda, and Anand depend partially on the rivers Sabarmati and Khari. From the discharge point in GoK till Vautha, the river is more or less under the tidal influence (mostly up to 14km from GoK) and much polluted due to industrial growth in the region; mainly the Gulf area with many industries including power generation, oil exploration and salt making; and Dholera SEZ and nearby areas. Critical stretch is the region till Vautha. The river Sabarmati u/s of Ahmedabad city to Sabarmati Ashram and from Sabarmati Ashram to Vautha have been identified as polluted stretches under the proposed River action Plan. [79] The total length of the stretch from Ahmedabad city to Vautha is 52 km and in the polluted river stretch; the main contributing outfalls are the Maninagar (mixed effluent) and river Khari.

Downstream villages along Sabarmati in Daskroi Taluka are: Fathewadi, Vanzar, Ode, Bakol badraad, Visalpur, PaldiKakaj, Kasindra, Miroli, Navapura, Mahijjda, Thimba and others

Downstream villages along Sabarmati in Dholka Taluka: Saroda, Chandisar, Ambaliyara, Sathal, Sahij, Vautha, Girand, Raypur and others

Downstream villages along Sabarmati in Kheda Taluka: Kaloli, Chitrasar, Dharoda, Radhu, Rasikpura, Varsang, Palla and others

Downstream villages along Khari in Kheda Taluka: Lali, Bidaj, Sarsa, Pinglaj, Kanera and others

Downstream villages along Khari in Daskroi Taluka: Chosar, Istolabad, Gamdi, Geratpur, Ropda, and others

Downstream villages along Fatehwadi in Daskroi Taluka are: Chaloda, Badrabd, Vanzol, Bakrol, Visalpur, Navapura, Changodar, Tajpur. Near Ahmedabad Rajkot Road, at Visalpur multiple irrigation canals from upstream industrial areas connects to this canal. Fathewadi canal command area is Dholka upto Vautha.

[79] *http://nhp.mowr.gov.in/docs/HP2/PDS/Surface%20Water/1062/GUJ_SW_Monitoring%20Water%20Quality%20Fluctuation%20In%20The%20River%20Sab.pdf*

Depending on the location and type of subprojects respective impact areas can be considered. Vautha (60 km downstream of the Ahmedabad city – with tidal influence) is famous for its annual (5 days) village agricultural fair in November annually. Tens of thousands of donkeys, as well as hundreds of camels, adorned in an array of colors and bright embellishments are brought here for the largest animal fair in Gujarat, where they are traded on the fair grounds at the river meeting point of Sabarmati and Vatrak - *sangam tirtha*.

Many of these villages and nearby areas are industrialized, with poor groundwater quality and availability and it is important to have long-term regional planning to ensure healthy living conditions here, and for the health of the rivers. Based on discussions with Gujarat Water supply and Sanitation Board, Village Representatives, Farmers AMC villages downstream are not dependant on the Sabarmati or Khari rivers or Fatehwadi Canal for drinking water. Some use it for agriculture, directly or indirectly. Narmada Canal, and other canals (including Dhandhuka and Valbhipur branch canals of Narmada canal and also Pariej branch canal of Mahi main canal) are used for some downstream water supply through WASMO projects, Gujarat Water Supply and Sewerage Boards village water supply, Individual Water Supply schemes, Regional Water Supply and Sanitation schemes etc. (Consultations will be conducted on the Draft ESMF). However since the river which is identified as a polluted stretch by NGT and CPCB, and some of the quality parameters exceed the limits suggested for bathing (B Class as per CPCB Classification) NGT has suggested bringing the standards to match at least Class B levels. Considering WB EHS on W&S, and NGT direction it is suggested to add additional parameters for Class B and Class E in treated sewage discharge quality.

Discussion:

- The downstream reaches of Sabarmati, up to Vautha is mostly devoid of tidal influences. Khari meets Sabarmati upstream of Vautha. Fathewadi canal, and another canal inlet from Vanzar downstream of Vasna Barrage meets and joins multiple other irrigation canals from rapidly growing industrialised rural / peri-urban areas North, west and south of Ahmedabad city near around Visalpur. Fathewadi Canal command area is up to Vautha. The stretch from Vasna to Vautha is considered as the critical stretch, carrying pollution (diffused – industrial pollution from the entire region, wastes and sewage from rural and peri-urban areas as well - not fully attributed to pollution from STPs in the city) from both the rivers and canal. Further, the stretch from Ahmedabad (Sabarmati Ashram) to Vautha is considered as among the most polluted stretches in India by River action Plan for Ahmedabad, NGT and CPCB. This region south of the city will be the impact area for the project overall though pollution is heavily contributed by the entire region - north of Ahmedabad through the irrigation canals, to the west of Ahmedabad through canals, land pollution from highly industrialised peri-urban and rural areas, east of Ahmedabad through Kharicut canal and Khari river. Unless reuse of treated sewage is suggested, the Impact area for STPs at Vinzol area will be till the point Khari meets Sabarmati River, while impact area for those STPs at Pirana, Vasna and upstream discharging into Sabarmati (ie. If no reuse is suggested) will be villages downstream of Sabarmati.

- Impact area for those STPs which reuse treated sewage through Fatehwadi will be villages near Visalpur and Changodar in the command area of Fatehwadi Canal.

- Along its length through the city of around 12kms, Sabarmati River is spanned across as many as 12 no: of bridges / other structures across it; on an average one in around 1.2 m distance; the shortest being the distance between Railway Bridge and Subhash Bridge – around 400m. Two more cross structures will come up in this stretch of river: Metro Bridge and Bridge cum Barrage. All structures here are designed considering the maximum flow from Dharoi and High Flood Levels (100 year). Guage station is set up at Subhash Bridge, where danger level HFL is 45.09m, and warning level is 44.09m. At Vasna barrage, Danger Level HFL is 41.75m.

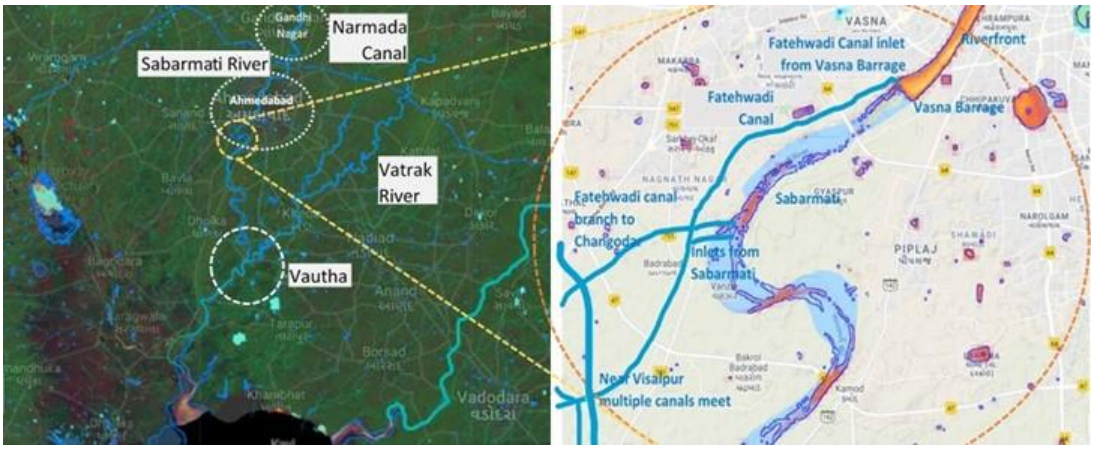


Figure A- 50: Areas downstream of Sabarmati

- There are other barrages (constructed/ under construction/ proposed) upstream of Vasna. All these structures would withstand the shocks of water released from Dharoi (165km upstream). Vasna Barrage exists since 1970s at its south, and another barrage is proposed upstream at north end of the city. As part of Riverfront redevelopment Phase II, a proposal for a 350 m long bridge-cum-weir project on the Sabarmati that will store 15 days of water for the city, has been submitted to the state's irrigation department for approval. This considers that water supply to city would be disrupted for 15 days because of repairs on Narmada Canal. Experts from the Central Design Organisation (CDO – of GERI; the Dam Safety Authority of Gujarat) will help AMC finalize the structure of the water barrage and technology to be used. This will further regulate the water levels at the riverfront as required for first and second phase of riverfront development. Construction of the barrage is expected to commence from as soon as they receive required permissions (timeline not known today). The design and safety of this barrage will be important also to control water stored at river front, safety and flooding of Ahmedabad a prominent primate city in the country; and release of water/flood waters downstream to Vasna. **This proposed barrage does not qualify as an associated facility as per ESS 1[80].**
- A modelling on Flood Levels at Sabarmati in Ahmedabad[81] (100 years) shows that flood depth, velocity extent has reduced downstream of Vasna due to Riverfront. Part of Vasna 126 MLD Plant, and Vasna 240 MLD may be affected by future floods such that happened in 2016 and 2017.

[80] *a) Directly and significantly related to the project*
b) Carried out, or planned to be carried out, contemporaneously with the project; and
c) Necessary for the project to be viable and would not have been constructed, expanded or conducted if the project did not exist.

[81] Chandel, Sejal, Shal Suvarna, 2018. Integrating 1d-2d Hydrodynamic Model For Sabarmati Upper River Basin With Special Reference to Ahmedabad City Area, MS University Baroda.
Available at: https://presentations.copernicus.org/EGU21/EGU21-12680_presentation.pdf
Accessed on: September 2021

Figure A- 51: Sabarmati Flood Depth map for 100 year recurrence interval

Figure A- 52: Sabarmati Flood Velocity map for 100 year recurrence interval

- Sabarmati River in the city of Ahmedabad is highly modified into a channel of reduced width (250-300m) almost uniformly as part of riverfront development project for more than half of the length through the city and has proposal for similar development along the remaining stretch (north) in the city. Height the banks at riverfront is 4 to 9m. Water is retained here with the help of Vasna Barrage whose purpose is only diversion of water for irrigation into Fathewadi canal. The barrage will not hold more water at any time than required to maintain 4m, at the riverfront considering the riverfront flooding, and as only the required amount of water is released from Narmada Main canal for retaining such water at the riverfront for its aesthetics / recreational purposes. Flood water will be released from Dharoi only during maximum rains or extreme events during monsoons. *Gross storage capacity of Vasna Barrage is 5340 Th.cum (5.34 MCM at FRL); and now holds 5.5m deep water column at Vasna Barrage end of the riverfront which reduces to 0.5m at 11.5 kms away from it upstream (Asper Water Resources Department, it holds around 3 to 10 million cubic meters of Narmada Water throughout the year). Safety is reviewed regularly by Irrigation Department (pre-post monsoon annually) and GERI (at intervals; latest 2013), the Dam Safety Organisation in Gujarat and periodic monitoring takes place pre-and-post monsoon. Operation of the barrages including all Dams and barrages from Dharoi to Vasna is co-ordinated well by Water Resources Department, and Disaster Management Authority and systems and institutional capacities are in place (See Annexure D on Safety of Vasna Barrage). The State has a Disaster Management Plan, which also suggests evacuation of people from downstream villages as a precautionary measure during the monsoons. Ahmedabad City Disaster Management Plan has a series of Standard Operating Protocols to ensure early warning and institutional coordination*

during floods. Vasna Barrage is not an associated facility of the project as per ESS1 definition. All types of infrastructure downstream of Vasna Barrage (including all existing structures and their upgradation) need to take precautions to protect facilities and operations during extreme events.

- Sabarmati stretch from north end of the city receives water mostly from Narmada Canal. This is retained in the riverfront using the Vasna barrage for up to 45 days especially during summers. The river is flushed out only during monsoons.

- At the Narmada Canal siphon, some water is diverted as agreed for River Front Project, to ensure maintaining the water level at 4 m. Data analyzed for the period between two monsoons (1 July 2020 to 30 June 2021), out of 365 days, flow from the canal was Zero (0) mcm in 96 days; ie. for 25 percent of the days. For one-fourth of the year river at Ahmedabad stretch gets water from Dharoi, whereas for the rest of the period, it depends on Narmada Canal.

- Flow in Sabarmati from upstream Dharoi is currently observed only during monsoons or extreme rain events. Release from Dharoi has many priority users including domestic and irrigation in the areas upstream of Ahmedabad. Further, there are two proposed barrages across Sabarmati one to the upstream of Gandhinagar and another to the north part of the city, which will further reduce the water availability for downstream users. Even today, water is maintained at the city riverfront through supply from Narmada Main Canal and not the rains or natural flow from Dharoi. Maintenance of required flow in Sabarmati is being monitored by NGT, the apex umbrella authority for protection and cause of environment; and River Action Plan has been prepared.

- There are no interventions under G-ACRP that would draw water from Sabarmati. However, some of the project facilities would continue to discharge treated effluent into the river, as per GPCB consent conditions. Hence, there must be continuous monitoring of outflows from project facilities into the Sabarmati and Fatehwadi Canal, and stringent measures to ensure the best quality of outflows. This shall be studied and discussed with stakeholders. There shall be a mechanism to alert downstream users in case of any concern on quality.

Cumulative Pollution in Sabarmati and Khari

As discussed above, the city of Ahmedabad and its region is highly industrialised. Agriculture is practiced in upstream and downstream regions of the city including major crops and vegetables. Industrial discharges and wastes from industrial estates and their CETPs and individual industries outside the estates, general solid waste and plastics of the city population, its institutional and commercial areas, wastes and waste water from Storm Water Drains and STPs all contributes to pollution in the city. The pollution in the city is 'diffused' and spread all over the city. Industrial pollution is mainly towards its eastern side where industrial activity is concentrated and is carried mostly by Kharicut canal into the Khari River. However, industrial effluents also finds its way into drains and sewers which ultimately empties into River Sabarmati which runs through the center of the city; in addition to the mega pipeline discharging treated industrial effluent into Sabarmati, downstream of Vasna. It is important that the Hon'ble High court of Gujarat has constituted a task force to disconnect all such connections of industrial effluents into the drains / sewers and the taskforce has disconnected 382 such connections already by December 2021 and the drive is ongoing to ensure full disconnection of all such connections. There is regular reporting to the Hon'ble High Court on its progress. In addition, the city's major solid waste dumpsite (80 acres at Pirana, which is being bio-mined) is located next to the river, and the leachate and wastes from here also contributes to pollution. All these, along with discharges from old STPs which do not function optimally, reaches Sabarmati.

Cumulative Impacts of sewerage and drainage services on Sabarmati

CPCB has identified Sabarmati – Kheroj to Vautha – with BOD from 4.0-147 mg/L; as among the 35 most polluted river stretches in India. [82] The highest cadmium concentration (70.51 µg/L) was observed in the Vautha water quality monitoring station at Sabarmati River during February, 2015. It is also observed that a Cadmium concentration exceeds the acceptable limit during non-monsoon period.[83] In addition, metals like Lead, Nickel and Iron were observed in some samples across years. To assess the water quality of the Sabarmati River, a study was undertaken by GPCB. They critically analyzed and compared the quality of water by studying the major parameters like pH, BOD, COD, and DO from four different locations namely Hansol Bridge (north), Ambedkar Bridge (in the city), Miroli Village (south of the city) and Vautha Village (30 km south of City where River Vatrak joins; and 40 km south of the GoK coast). The key findings of the report are as under 1) The concentration of pH and DO decreases from upstream to downstream which shows that the water quality is deteriorating. A decrease in pH indicates that the water slowly turns towards being acidic. 2) The value of BOD and COD increases which indicates that the quantum of pollution in the river water increases because of the tremendous concentration of toxic and acidic substances. Thus, from upstream to downstream, the level of pollution increases. 3) At Ambedkar Bridge and Miroli, the quality of water is highly polluted because the so-called treated industrial wastewater gets discharged via the mega pipeline at Gyaspur; which is below Ambedkar Bridge and above Miroli. 4) When the river water reaches Vautha, the concentration of these parameters changes and shows a slight improvement as compared to Miroli readings. This is because the concentration of these parameters decreases when they get dissolved with river water. Thus, in correlation with the flow, the Sabarmati River water quality degrades from Hansol to Vautha[84] where it is joined by Vatrak. This flow and quality-related concerns of Sabarmati along with increasing industrial land use in the downstream regions have an impact on the health of downstream users, soil, biodiversity agriculture livelihoods.

Drains discharging into Sabarmati from the immediate region (11 Major Drains) (AMC and others): [85]

- The outfall of old city area, Danilimda (D/S of Vasna Barrage)
- AMC storm water drain (Danilimda)-30 MLD
- Pumping Station 76 MLD (Old Vasna area)
- Pumping Station 182 MLD (Old Pirana area)
- The outfall of new city area, Vasna ((D/S of Vasna Barrage)
- Domestic wastewater discharged at Wagha Kotar, Sukhadeshwar Pumping station, Pethapur Nagarpalika, flow-55.3 MLD
- Domestic wastewater discharged through natural drain Nala, Village – Koteshwar, flow- 0.73 MLD
- Domestic wastewater discharged through the underground pipeline at Bank of River Sabarmati near Indira Bridge, Vill – Bhat, flow- 0.06 MLD
- Domestic wastewater discharged through the underground pipeline at Bank of River Sabarmati near Indira Bridge, Village – Bhat, flow-2.16 MLD
- Domestic wastewater discharged from the outfall of AUDA line, Village Nana Chiloda, flow-0.43 MLD
- Domestic wastewater discharged from the outfall of Village Nana Chiloda, Flow-6.48 MLD

Hon'ble High Court of Gujarat in 2021 invoked the public trust doctrine to hold industries and municipal bodies liable for the pollution in Sabarmati. The Amicus Curie appointed by the Court suggested creating a Joint Task Force including members of GPCB and AMC. It was identified that STPs need improvement, and poorly treated and completely untreated industrial discharge from effluent

[82] *The CPCB considers BOD less than 3mg/L an indicator of a healthy river. https://nmcg.nic.in/writereaddata/fileupload/ngtmatters/NGT%20order%2022.02.2021.pdf*

[83] *CWC, 2018. Status of Trace and Toxic Metals in Indian Rivers, Ministry of Water Resources, Government of India.*

[84] *http://www.ijesd.org/vol7/907-C0001.pdf*

[85] *GPCB, May 2020. Monthly Progress Report - Sabarmati*

treatment plants (ETPs) are being illegally released into the drains and sewage network designed for household sewage. In response to the PIL-98/2021, Joint Task Force was appointed and has till now has visited all STPs, CETPs, River outfalls and some of the industries. They have submitted their observations and suggestions to the Court through Amicus Curie, in the form of Reports. AMC has initiated drive of disconnecting industrial connections in the drainage lines of AMC as part of the Order. Till Jan 10, 2022, approximately 400 connections are disconnected. AMC is in the process of relating this to quality and quantity of flow.

In addition, effluents are being discharged into access points such as manholes and machine holes. In addition, some reports[86] that reverse boring is being used to discharge industrial waste directly into the ground. The mega pipeline which carries the industrial effluents from CETPs of Naroda, Odhav, and Vatva Industrial Estates (among which 8 CETPs are found non-compliant or partially compliant with respect to COD, BOD, SS, NH3-N) to Sabarmati disposes treated industrial effluent directly into the River. River Sabarmati downstream of Vasna barrage receives the wastewaters from various STPs, Stormwater drains, by-pass lines from Old Pirana Pumping Station, the by-pass line from Old Pirana and Mega pipeline which carries the industrial effluents from CETPs of Naroda, Odhav and Vatva Industrial Estates (among which 8 CETPs are found non-compliant or partially compliant to COD, BOD, SS, NH3-N). To reduce cumulative pollution load AMC is undertaking the following actions:

1. Improving Solid wastes management and biomining dumping yard:

AMC is biomining the Pirana dumpsite, with an aim to reduce pollution, segregate and reuse the wastes and inerts, and retrieve at least 25 percent of the area.

2. Controlling Industrial Pollution:

The total outflow of industrial effluent to the river is 230 MLD, of which near around 65 percent is treated. Around 80 MLD find its way to AMC's SWD/ sewage channels and thus to STP (bypassed in case of rains or maintenance for 10-20 days) with no facility to treat metal content. The Joint Task Force set up by the Hon'ble High Court and AMC have already disconnected many industrial connections into storm water and sewage networks. Around 393 illegal drainage lines that pumped untreated waste into domestic sewage lines of the AMC have been disconnected till January 2022, manly from Odhav, Shahpur, Odhav, Behrampura, Gomtipur, Sardarnagar, India Colony, Naroda, Lambha, Isanpur and Danilimda areas under the strict direction of the Hon'ble High Court of Gujarat. The Court has asked these industries to commence operations after installing working ETPs or connecting to CETPs.

3. Comprehensive Sewerage and Drainage Management and Reuse:

AMC through G-ACRP intends to improve the quality of treated sewage and better stormwater drainage from Ahmedabad city reaching Sabarmati for the overall betterment of the regional environment. It is estimated that the current total outflow of untreated sewage is 350 MLD directly from terminal pumping stations, bypass events, or through stormwater drains. the Further, 873 MLD of treated sewage disposed of in Sabarmati does not comply with new standards for treated wastewater. The following ***Figure A-53*** presents the major STPs in the city, proposed improvements including those under G-ACRP and reuse.

[86] *http://gujenvis.nic.in/PDF/soe-water.pdf*

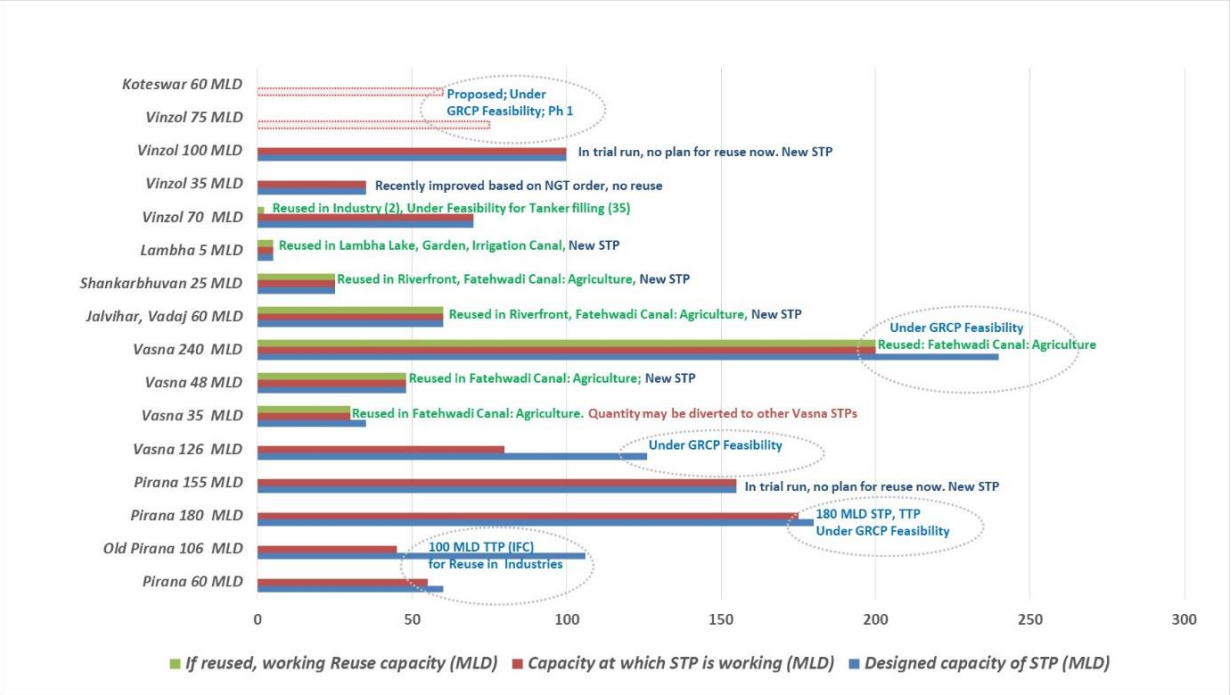


Figure A- 53: Existing and Proposed major STPs in Ahmedabad City

- AMC has newly constructed Vinzol 100 MLD STP, Lambha 5 MLD STP, Shankar Bhuvan 25 MLD STP, Jalvihar 60 MLD, and Vasna 48 MLD STPs which confirms to NGT prescribed stringent discharge norms. AMC is also in advanced stage of planning the upgradation of Pirana 106 MLD and 60 MLD STPs for industrial reuse through support from International Finance Corporation (IFC).

- By improving Vasna 240 MLD STP and Vasna 126 MLD STPs through G-ACRP, AMC intends to improve the discharge quality of these STP effluents to NGT suggested stringent norms and thereby better quality of treated effluent reaching Fathewadi Canal for reuse. Further, by upgrading Pirana 180 MLD STP and proposed reuse of treated effluents for industrial use, AMC aims to minimise effluent discharge into Sabarmati and resource recovery and reuse. AMC also aims to construct two new STPs, one at Koteswar and other at Vinzol to allow treatment of waste water which is currently treated in suboptimal septic tanks or discharged directly into the drains.

- In addition, through the proposed Kharicut Canal which carries industrial effluents (treated and untreated) down to River Khari, and Chandrabhaga Nala (which carries effluents and sewage), Lakes and other improvements proposed for Phase II, AMC aims to improve the environmental condition of the city.

- With this comprehensive and multipronged attempt, AMC intends to improve the environmental pollution associated with current situation of sewerage and drainage management in the city.

Total sewage treated in all STPs in AMC area (including 10-15 years old ones, and those under trial run) is approximately 1245 MLD (1.29 mcm). Of this, 205 MLD (0.025 mcm) is disposed into Kharicut Canal, while around 1035 MLD (1.035 mcm) will be disposed into Sabarmati River and Fatehwadi Canal (for agricultural reuse) together. When all proposed and under construction STPs move to operating phase total sewage treated will be near around 1742 MLD (1.85 mcm) with 1074 MLD (1.08 mcm) discharged into Sabarmati and Fathewadi canal for reuse in agriculture lands while 280 MLD will be reused in industries after tertiary treatment. Around 37 MLD will be reused for industrial purposes at

Vinzol, while 280 MLD (0.028 mcm) will be discharged into Kharicut Canal. G-ACRP will manage around 800 MLD (0.8 mcm) reaching Sabarmati and 75 MLD (0.8 mcm) reaching Kharicut Canal. However, additional discharge due to the project will be around 200 MLD (0.02 mcm) in Sabarmati (as many of the subprojects would aim at upgradation of existing STPs, and reuse of water for industrial use is also intended) and 75 MLD (0.8 mcm) in Kharicut canal.

In February 2021, inflow to Sabarmati riverfront was 1.73 mcm, while outflow in Fatehwadi was 1.69 mcm and there was no outflow into Sabarmati downstream of Barrage. Inflow into the riverfront is on an average 1.5 mcm a day. Treated sewage can increase the flow in Fatehwadi and / or Sabarmati to nearly the same amount as provided by supply from NMC.

However, currently, quality of treated effluent is suboptimal. AMC aims to achieve stringent quality of treated effluent in its new STPs and those proposed under G-ACRP, and at the same time reuse treated effluents to ensure resource efficiency, and reduce BOD load on receiving water bodies.

Three scenarios are considered for evaluating the cumulative impacts on the water bodies:

- Scenario 1: Change in Strategy towards Decentralized Sewage Management - No STP Scenario: when there are no STPs to treat sewage generated in the city, with all sewage going to toilets with / without appropriate septic tanks. In this case, total diffused pollution load ultimately reaching Sabarmati, Fatehwadi and Khari River would be high mainly as the soil is alluvium. With increased soaking of soils through open disposal, disposal into canals, septic tanks, and soak pits leaching of polluted water to the rivers will be high and from multiple areas. This also increases chance of leaching of pollutants from land disposed pollutants.

- Scenario 2: 'As is' scenario – No Project Alternative: If the existing STPs continue to maintain same performance levels and standards. Here, currently untreated sewage (that not being sent to STPs due to lack of full coverage of facilities/infrastructure) is assumed to be continuing decentralized disposal through pits, open land disposal and septic tanks. In this case pollutant levels will be high in both Kharicut and Sabarmati. This will continue to impact agricultural users downstream, near riverside, and also those receiving treated sewage for irrigation (though currently without consent).

- Scenario 3: STPs follows stringent discharge norms – Technology / Capacity Upgradation of existing STPs: If all STPs follow NGT norms and well upgraded and maintained, as envisaged by G-ACRP and on-going improvements in AMC, Pollution load in Kharicut canal and Sabarmati will reduce. Better water available for agriculture and in turn, improve overall health of the region.

A graphical representation of the comparison of these three scenarios above is presented here in ***Figure A-54.*** These graphs shows that ***the project can ensure around 85 percent reduction in pollution load on Sabarmati and Khari Rivers by upgrading and constructing new STPs conforming to NGT standards.***

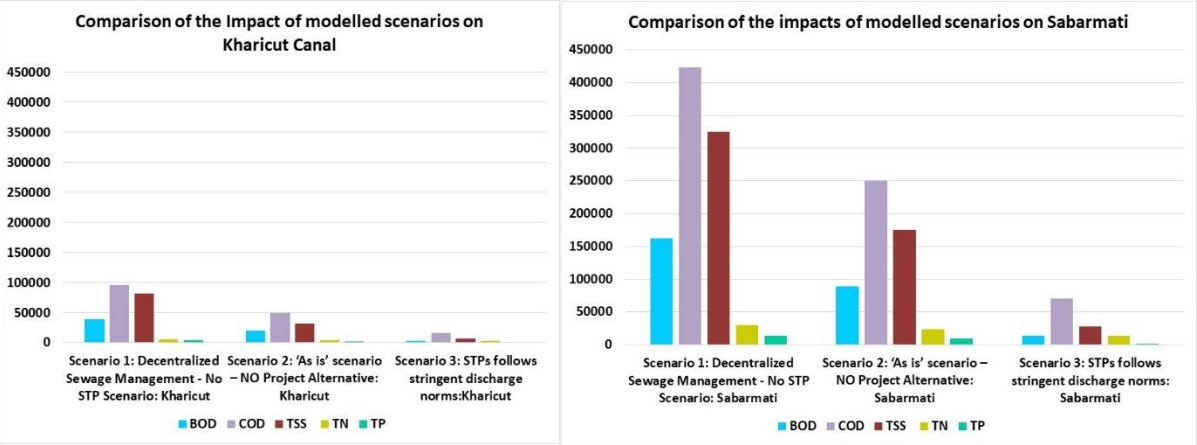


Figure A- 54: Pollution Impact of the modelled Scenarios on Kharicut Canal and Sabarmati River

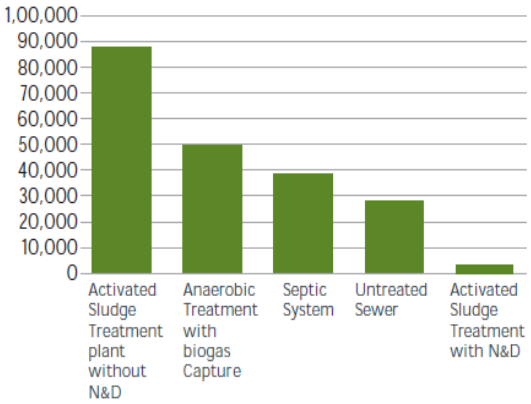
Climate Benefits of G-ACRP: Green House Gas Emissions

Wastewater can be a source of methane (CH4) when treated or disposed anaerobically. It can also be a source of nitrous oxide (N2O) emissions. Carbon dioxide (CO2) emissions from wastewater are not considered in the IPCC Guidelines because these are of biogenic origin and should not be included in national total emissions. [87]

AMCs GHG inventory findings by IFC[88] allow us to identify which sectors, among the services AMC provides to Ahmedabad city, emit the most CO2. It shows that AMC's total GHG emissions were 681,589 tCO2e (6 percent of the city's emissions) and predominantly stemmed from electricity usage (43 percent) and waste water treatment (30 percent). Emissions from Waste Water treatment (205,550 tCO2e/ year or 30 percent of AMC's total emissions). AMC uses several technologies to treat 925 million litres per (MLD) waste water: Septic tank, Activated Sludge process without nitrification, anaerobic process with biogas capture and Sequential batch reactor (SBR) while approx. 150 MLD of the total waste water was discharged without any treatment in 2019.

Due to the complexity of the emissions from waste- water treatment, the CURB tool was used by IFC to estimate GHG emissions, which uses inputs in the form of total waste water treated and type of treatment. CURB's output showed the distribution of total wastewater emissions of 205,550 tCO2e by treatment method. Approximately 55 percent of emissions were generated from the activated sludge process (without nitrification). Each MLD of waste water treatment in septic tank releases 773 tCO2e in a year, while SBR releases least GHG per MLD waste water treated i.e. 27 tCO2e. The report identifies waste water treatment using SBR technology for 60 percent of waste water to be treated, and recycling and reuse of 70 percent of treated water (consistent with the "Policy for Reuse of Treated Wastewater" announced by the Gujarat Government in 2018) as the possible way forwards in reducing carbon emissions in this sector, and to effect savings of 130,192 tC02/year. In 2019, only 10% of the total wastewater currently treated was using SBR technology (which releases lower GHG than anaerobic or aerobic (without nitrification) treatment. All STPs of AMC commissioned after 2019 / under construction are based on SBR technology (around 500 MLD). AMC plans to convert at least 50 percent of its existing treatment system to SBR technology by 2025. G-ACRP aims to support AMC in achieving this goal. G-ACRP would better manage around 875 MLD of sewage with attention on

[87] *https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/5_Volume5/V5_6_Ch6_Wastewater.pdf*
[88] *IFC, 2019.* ***Carbon Neutral Vision for Ahmedabad Municipal Corporation****, Ahmedabad Municipal Corporation*



energy efficiency and reuse (however, type of treatment technologies for each STP will be finalised only by the DBOT contractor during implementation stage). By providing treatment for additional 350 MLD of sewage, the project would reduce 261100 tCO2e annually. In addition, the project also would improve canals and lakes which are Stagnant, overloaded open collection sewers or ditches/canals are likely significant sources of CH4.

Figure A- 55: Distribution of Wastewater emissions by treatment method
Source: IFC, 2019 [89]

[89] *Ibid*

Table A- 31: Cumulative Environmental Impacts on VECs

VECs that may be affected by the development	*VEC Threshold(s)*	*Spatial boundaries*	*Temporal boundary*	*Impacted by project*	*Impacted by activities and environmental drivers*	*Impacts on thresholds and Project Mitigation / monitoring measures*
River Sabarmati & Khari users	Improved water quality and better biodiversity due to better treated sewage discharged	Till Vautha around 50 km from where it is tidally influenced	15 years, planning period taken after which STP upgradation would be necessary	Positively impacts, as dry river will get well treated discharge Quality ensured by ongoing hon'ble high court and task force's action to disconnect all industrial connections from sewer network	Less rainfall and the proposed (in early stages) new barrage upstream of Vasna, will have no impact on discharged treated water as it depends on population served	Positive Impacts due to better discharge quality of treated sewage - Monitoring of quality of treated water and measuring quantity of treated water discharged and bypasses if any during construction and operation phases; - Periodic measurement of Trophic Status of the River to understand the improved quality due to the project
Fatehwadi Canal irrigation scheme users 240MLD can serve around 5000 ha in command area (not part of Narmada Command area, but now receiving waters from the Narmada Main Canal)	Water available for irrigation as announced by GoG; and requested by Irrigation Department for the water scarce region	Agricultural areas of villages of Daskroi, Sanand, Bavla and Dholka – villages around 20 kms aerial from Vasna.	15 years, within which the landuse conversion can be expected, considering the pace of industrialization of the region, as it is in the influence region of DMIC	Positively impacts, as canal which gets less supply now from NMC and suboptimal quality of treated sewage from STPs, will get well treated discharge for irrigation due to the project	Less demand for agriculture in future, as downstream region is fast getting industrialized with many industrial areas, also due to Western Dedicated Freight Corridor. Ahmedabad District is the largest inland industrial center in western India. Provides a manufacturing base for industries like chemical, textiles, agriculture, and food processing. The GDP of Ahmedabad and Gujarat depend heavily on the output and capacity of these industries.	Positive Impacts due to better discharge quality of treated sewage - Ensure Consent to Discharge from GPCB for discharge of treated sewage through canal - Detailed study with stakeholder consultation through Agricultural University, in line with CPCB (2019) Guidelines for Discharge of Treated effluents for Irrigation to determine and manage discharge for better irrigation practices - Monitoring of quality and measuring quantity of treated water discharged during construction and operation phases

12. Long, Medium and Short Term Recommendations for managing the risks and impacts

Based on baseline analysis, the following are the key aspects for consideration for managing Environmental and social risks and impacts. These considerations are grouped under the policy and institutional aspects, infrastructure and service improvements for sewerage and drainage, and Actions to improve regional environmental conditions.

A. Policy and Institutional Aspects

- ***Bridging the Gaps in Environmental Aspects***
  - Integrated Long-Term planning for Storm Water Management with consideration on disasters, water conservation, utilizing the lakes, open areas, parks as sponges. Main canals of Ahmedabad which travels through the dense city need conservation, protection and stringent actions to prevent disposal of wastes and effluents,
  - Plan and ensure the required extent of 'appropriate' land in existing/growing areas for STPs, drainage services, and future upgradation requirements,
  - Ensure treated water reuse and zero discharge for industrial effluents,
  - Long term institutional capacities for this is essential.

- ***Bridging the gaps in Social Aspect***
  - Ensure that water supply and sanitation and stormwater infrastructure are planned in a manner to prevent contamination of water supply from other sources,
  - Ensure that migrant poor and vulnerable communities living near STPs and existing villages (Koteshwar) are given access to community sanitation and water supply facilities. Ensure the inclusion of vulnerable and poor groups with no access to sanitation and drainage services, in municipal services,
  - Ensure minimum land requirements for sub-projects to prevent R&R-related concerns and reduce the economic disruption of affected persons and groups.

- ***Integrated Management of Pollution***
  - In the long term, identify polluting industrial clusters outside formal industrial estates and undertake microplanning/ cluster planning (TP redevelopment scheme) of areas with predominant industrial sprawl – to infuse environmental infrastructure and energy-efficient mechanisms through a time-bound action plan,
  - Best Management Practices for all industrial areas for preventing trade effluents from entering Storm Water Drainage network. As part of drainage improvements, the stormwater if found carrying industrial/other contaminants must be treated before release into the Sabarmati Riverfront, Kari River or downstream of Vasna Barrage considering the dead storage at the riverfront and no flow downstream of the Vasna barrage during non-monsoon periods.
  - Overall pollution prevention master plan and action plan is essential for the city, also to ensure a healthy Resilient City. Integrated environmental management plan for lower Ahmedabad Sabarmati area (wards to south, southwest, southeast),
  - Online monitoring of the outlets, discharge points
  - It is important that AMC in co-ordination with the Water Resources Department of Gujarat; studies (also in the TA activities under the Project) and integrates mechanisms to rejuvenate the river through recharge mechanisms both upstream and downstream, and strengthening its banks and downstream stretches using Nature-Based Solutions to improve resilience against extreme events. Landuse planning and management downstream of Vasna is important; and it is time the city adopts a 'whole-region approach' to ensure best environmental effects.

- ***Capacities for Environmental Infrastructure and Services***
  - Improved capacities for environmental and social management through setting up of a ***'Sustainable Urban Unit'*** in AMC of all infrastructure and development; including stormwater and sewerage management,
  - Environmental planning of proposed infrastructure and nearby areas, with resilience focus
  - GIS-based planning, asset management, and quantity and quality monitoring of stormwater and sewage management assets and services,
  - Training and capacity building for environmental and social considerations including ESF.

B. Infrastructure and service improvements for wastewater and drainage

- ***Upgradation of existing facilities and Development of New facilities***

  Inputs to Design for better environmental performance

  - New and upgradation proposals need to adjust the hydraulic designs to ensure compliance of the treated sewage to the NGT targets. Technologies like ASP if properly designed, implemented, and operated can achieve NGT prescribed standards. SBR technology can help reduce GHG emissions, along with recycling/reuse of treated sewage.
  - Detailed design/ DPR stage shall verify upstream infrastructure such as TSPS, SPSs, connected sewer outfalls and the contributory catchment with sewer connections need any further improvements to ensure designed sewage flow to the proposed upgraded STPs.
  - At the design stage, Average Dry Weather Flow (ADWF), Peak Dry Weather Flow (PDWF), and Peak Wet Weather Flow (PWWF) shall be determined separately for each STP due to local variations in the collection network - age, inflows, infiltration, etc.
  - Representative sewage quality and quantity data, rainfall, etc. shall be collected for a few dry and wet seasons on a design basis. Dry weather quality data is important to determine sewage quality
  - Ensure fully functional super-chlorination facilities or preferably UV disinfection in each STP to address the bypass of sewage mixed with stormwater during rainy days and electronic recording of the data of bypass events and associated flows and chlorine content in the discharge water including reporting the bypass events to the regulatory agencies.
  - Ensure that all effluent passes through inlet screens, to minimize the discharge of plastic, waste, paper, napkins, etc. to the receiving environment. The inlet screens shall be designed to 10x ADWF
  - Sufficient lined, above flood level storage space for sludge
  - Proper planning for all process rejects and by-products including oil/ grease, metals, sludge, grit should be part of design/ DPR. Sewage sludge management depends on sludge stabilization grade, P and N nutrients and other constituent concentration, sewage treatment process (such as ASP vs. UASB), and sludge stabilization grade. Aerobic processes produce around 6 times more sludge compared to anaerobic processes. Sludge treatment streams shall be treated for phosphorus removal. Sludge thickening and digestion processes should be included to reduce sludge quantities (for ex: rotary drum thickeners). Mechanisms with reduced noise levels shall be used for dewatering the sludge (such as screw press instead of centrifuge). Drying beds shall be lined to prevent further leaching of pollutants and shall be protected from extreme events. Upgrade STPs with coagulant dosing systems to ensure P discharge limits.
  - Special operation mechanisms, SOPs shall be devised and followed for heavy flow during rains

- Consider additional issues like plastic polluting in case of a breakdown of floating media like in IFAS
- With the process upgradation, and completion of ongoing new STPs, the volume of sludge generated will increase to over 500 TPD, and it would be very expensive to use electricity to press the sludge to bring down the moisture content to 25 percent to transport the same to the central sludge irradiation processing facility. Sludge digestors shall be provided at STPs to minimize the sludge volumes and recover the energy for use in STP premises itself, and thus reduce operating costs
- All pumps and other machinery, appliances shall be energy efficient; biogas recovery, using of alternate energy for sewage collection operations and plant operations will help reduce GHG emissions
- All STPs shall be equipped to follow all consent conditions including Green Belts. This shall be ensured not only as a 'requirement in permit' but as an overall contributor to improved living conditions in the city areas near STPs. It will help in odor control by H2S and ammonia.
- The technical design shall accord special attention to sewage collection from slums and chawls including making sewer connections available, unclogging sewers and pumping stations, and preventing sewage mixing with drinking water
- Sludge reduction and management, gas utilization from sewage treatment, issue of wastes in large canals (like Kharicut, Chandrabhaga) need attention while preparing DPRs
- Disaster Management Plan for safety of STPs, spillage prevention/ control of inlet chambers, workers in STPs and related facilities; nearby areas and downstream areas in case of any safety concerns to Vasna barrage
- Fully implement ESMP (including Biodiversity and Heritage considerations) and monitor and report as per ESMF procedures.
- Works shall incorporate requirements for emergencies/disasters, pandemic response
- STPs shall not release treated effluents into the riverfront where dead storage happens also during summer months. If it is proposed to release treated effluents upstream of the proposed barrage under Phase II of Riverfront development, it shall ascertain the possible quality-related issues at the proposed water supply project while preparing the Feasibility Reports.
- All sewage treatment plants upgradations and construction of new STPs shall ensure compliance to the NGT suggested the quality of discharge of treated effluents (into Sabarmati downstream if Vasna and Fatehwadi Canal). Monitoring of sewage quality shall be ideally entrusted to a committee comprising of representatives of AMC, GPCB, downstream water users, and others, instead of O&M contractors and immediate corrective action shall be taken in case of non-compliance to agreed standards. O&M contracts shall nevertheless monitor discharge quality continuously in their well-equipped and functional laboratories in the Treatment Plants.
- All bypasses or leakages of sewage without treatment into Sabarmati shall be arrested. There should be a planned mechanism to manage and treat sewage reaching the existing STPs during the upgradation phase. Chemicals and materials used for construction / upgradation of existing STPs, outflow points, Stormwater drainage systems shall be stored on paved and secured areas about high flood level of Sabarmati to prevent contamination of the already contaminated and heavily modified water body.
- Safety aspects and extreme events:
    - Irrigation Department confirms the safety aspects of the Barrage, through its Post and Pre Monsoon audit reports. The impoundment it creates currently mainly for retaining water at the riverfront, which will not create an impact downstream in case of a breach and water will follow its normal path downstream of the barrage, which is wider (around 610m) than the upstream stretch (around 250m-350m) or city's riverfront

where it is impounded. Water Resources Department of the GOG undertakes routine maintenance activities and inspections using a comprehensive checklist on the civil structure and mechanical parts of the Barrage regularly, while the DSO, GERI also undertakes periodic reviews of the safety of all barrages and dams. All STPs near Vasna barrage and all connected facilities need to be guarded against high floods especially during construction. This shall be ensured through structures above HFL, features such as retaining walls, appropriate plantations, safe structural design, and required structural support for preventing all impacts of floods; and shall be incorporated in design of STPs and other infrastructure, after detailed studies as part of detailed designs. Regular alerts shall be built into the project monitoring software and or ESMIS to alert supervisors, engineers, and workers on extreme events or rains. All works shall be stopped and materials, labor camps, and other work-related activities and storages are secured based on this; and always before monsoon. Works during monsoon shall be appropriately scheduled.

- Maintaining the width and depth of the river is very important and hence all constructions along the edge shall leave an appropriate buffer (20-30m as in Gandhi nagar) in discussion with the Water Resources Department of Gujarat and GPCB. Construction outflows leading to canal shall confirm with relevant structural codes to withstand impacts of floods and shall be of safe design in discussion with the Water Resources Department of Gujarat. Required structural safety measures, storage of untreated and treated sewage, nature-based solutions for resilience, appropriate green belts shall be provided to minimize the impacts of floods.

Guidance for studies and monitoring

- Audit existing STPs considering environmental aspects before planning upgradation
- Complaint monitoring and redressal system
- Prevention of stormwater/ sewerage spillage/ cut-offs to lakes and water bodies without treatment
- AMC is receiving many complaints from the central zone and hence, network and other component improvements here are important. ESIAs should take into consideration narrow roads, community health and safety, traffic management, and heritage-related aspects in these cases.
- Automated Monitoring mechanism for illegal discharges into various parts of the network including sensors for manholes
- Mechanisms for monitoring energy use in all pumping stations and STPs shall be integrated and monitored. All equipment shall be upgraded to energy-efficient (rated) ones. This shall be included in DPRs, ESIAs
- Installation of pH meter or other sensors at specific intervals along with the drainage network, Kharicut canal, and Khari River to identify sections where there is a discharge of industrial effluents
- Sampling for monitoring shall be continuous flow linked composite sampling for enhancing operational efficiency and environmental compliance. Sampling protocol shall ensure monitoring of each unit of STP rather than just inlet and outlet grab sampling in practice today
- Real-time monitoring at each step of the treatment process is necessary for ensuring reliability and effective risk management in the STPs. SCADA shall report online quality details; it is also important to monitor the quantity and quality of wastewater from a representative sample of households, other premises at least twice a year
- Stakeholder and Customer feedback and engagement to be ensured
- Monitor ESMP implementation through subject experts, including EHS monitoring by QAQC consultants during works

- ***O&M***

  Conditions and Protocols

  - Preparation and operationalization of an O&M manual for drainage, sewerage system development, and management at zonal & city levels with SOPs to address Environmental aspects. Strong environmental clauses shall be introduced in O&M contracts, linking penalties
  - Preventive maintenance is a requirement and shall be included in O&M STPs
  - Development of Protocol for continuous monitoring of water, sludge quality, quantity, and systems breakdowns including bypassed sewage (metering of bypass) during disaster events/ maintenance

  Additional facilities

  - Retrofit facilities to hold, manage sewage in case of breakdowns and extreme events
  - Audit and ensure continuously that all facilities are resilient to all types of disasters by integrating design considerations for structural stability, flooding issues including in sludge and grit storage areas
  - Mechanisms for reuse of treated wastewater, stormwater, sludge, grit as per applicable environmental regulations
  - Water and wastewater Management and Planning are very important for Ahmedabad. Quantity and quality of water and wastewater become crucial for years to come considering the scarcity the region would continue to experience. SCADA shall report online quality details; it is also important to monitor the quantity and quality of wastewater from households, other premises at least twice a year considering the low water availability
  - Customer data on sewage connections are important for monitoring and pricing of services. Possible future illegal connections: especially of industrial and large commercial units to existing networks and future networks shall be prevented by appropriate design, monitoring and polluter pays principles
  - Rehabilitation works may take place through new technologies such as no-dig technology. For such specialized work, specialized labor is required to come in. Labour camps to be continuously monitored for good living conditions and environmental quality
  - SCADA should be well maintained, against high temperatures and gases in the plant
  - Deploy efficient machines/ equipment for cleaning and maintaining networks. No manual labor shall be allowed for sewage/ drainage network cleaning and maintenance (also applicable to contractors) which can be unsafe
  - There shall be provisions to minimize siltation and mechanical unclogging
  - Continuous monitoring to prevent future encroachments
  - Improve workers' health and safety in STPs, pumping stations, and all networks by flowing Good International Industry Practices (GIIPS). This shall be an essential bid condition.
  - Monitor ESMP inputs to O&M stage through subject experts/ SDU, including EHS

Keep aspects for inclusion in ESCP are provided in ESMF main report, under mitigation measures.

C. Improving Regional Environmental Conditions

- Identifying Cumulative Effects at Environmental and Social Impact Assessment Stage

  While designing STPs and drainage subprojects cumulative effects of urban infrastructure (existing and proposed) on the river Sabarmati and Khari, and other sensitive components in impact area shall be evaluated through the following process:

  - Scoping Exercise

- Describing the Environmental and Social characteristics and Potential risks and Impacts
- Determination of Consequences: Significance of Impacts
- Management of impacts/ risks by following mitigation Hierarchy: Avoid, minimize, mitigate or compensate.

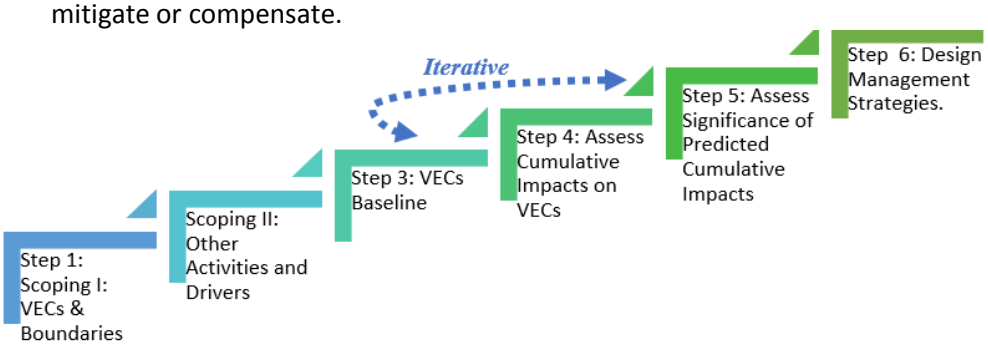


Figure A- 56: Process for Assessing Cumulative Impacts as part of ESIA

Detailed ToR for ESIA also considering cumulative Impacts as part of ESIA through the above process, is presented in the ESMF Guidance Manual.

- Upstream Catchment treatment and planning for water conservation and recharge ensuring adequate flow during dry seasons and minimizing pollution in Narmada canal and Sabarmati.
- Rejuvenation plan forwards/ area inclusive/ immediate downstream of Vasna barrage shall be developed
- Disaster management Plan and SOPs for the STP areas including those to the south of the city at Vasna, Pirana clusters also considering disaster vulnerability of the area, and the safety of Vasna barrage shall be developed and implemented
- At the end of useful life, a proper exit strategy shall be in place for end-of-life disposal of assets at STPs and other facilities and reclamation of sites for future best use.

Annexure B: Applicable Regulations

Table A- 32: Applicable Environmental Regulations at National Level

Act/ Rule/ Guidelines	Relevance	Implementing/ Responsible Agency
Regulations/ Policies related to Environmental Conservation & Management		
National Environment Policy, 2006	The National Environment Policy by the MoEFCC aims at mainstreaming environmental concerns into all developmental activities. It emphasizes the conservation of resources and points out that the best way to aid conservation is to ensure that people dependent on resources obtain better livelihoods from conservation than from degradation of the resources. It argues that environmental degradation often leads to poverty and poor health outcomes among populations. The objectives of the National Environmental Policy are- • Conservation of Critical Environmental Resources • Intra-generational Equity: Livelihood Security for the Poor • Inter-generational Equity: ensure judicious use of environmental resources • Integration of Environmental Concerns in Economic and Social Development • Efficiency in Environmental Resource Use • Environmental Governance • Enhancement of Resources for Environmental Conservation	MoEFCC

The Environment Protection (Act) 1986 and The Environmental Protection Rules	The Environment (Protection) Act was enacted in 1986 to provide for the protection and improvement of the environment. It empowers the Central Government to establish authorities [under section 3(3)] charged with the mandate of preventing environmental pollution in all its forms and to tackle specific environmental problems that are peculiar to different parts of the country. The Act was last amended in 1991. This act was passed as an overall comprehensive act "for protection and improvement of environment". Under this act, rules have been specified for the discharge/ emission of effluents and different standards for environmental quality. These include Ambient Noise Standard, Emission from Motor Vehicles, Mass Emission Standard for Petrol Driven Vehicles, General Effluent Standards, etc. in the exercise of the powers conferred under the Act, the following rules are devised
	• The Water (Prevention and Control of Pollution) Act, 1974 and Water Cess Act, 1977
	• The Air (Prevention and Control of Pollution) Act, 1981
	• The Noise Pollution (Regulation and Control) Rules, 2000
	• Environment Protection (EP) Act, 1986
	• National Green Tribunal Act, 2010
	• Waste Management Rules under EP Act including
	  ○ Solid Waste Management Rules, 2016
	  ○ Construction and Demolition Waste Management Rules, 2016.
	  ○ Hazardous Waste (Management, Handling & Transboundary Movement) Rules, 2016, amended 2019
	  ○ E-Waste (Management) Rules, 2016, amended 2018
	  ○ Bio-medical Waste Management Rules, 2016, amended 2019
		MoEFCC, State Department of Environment & Forest CPCB, SPCB

<table>
<tr><th>Act/ Rule/ Guidelines</th><th>Relevance</th><th>Implementing/ Responsible Agency</th></tr>
<tr><td></td><td>

Plastic Waste Management (Amendment) Rules, 2018
Batteries (Management and Handling) Amendment Rules, 2010

This umbrella Act brings in capacities at the Central and State levels to monitor and regulate environmental performance. It also laid the foundation for sector/ sub-sector-specific Rules and guidelines applicable to all States
</td><td></td></tr>
<tr><td>Environmental Impact Assessment Notification, 2006</td><td>
EIA notification 2006 and its subsequent amendments list out the type of project that requires Environmental Impact Assessment and Environmental Clearance from MoEFCC or State Environment Impact Assessment Authority before the commencement of any developmental work or project expansion. The notification gives stage-wise guidance for the processing of Environmental Clearance. The objective of the notification is to formulate a transparent, decentralized, and efficient regulatory mechanism to:

Incorporate necessary environmental considerations at the planning stage
Involve stakeholders through the public hearing process
Identify developmental projects based on impact potential
Securing provision for mitigation efforts

Subprojects that fall under the purview of EIA Notification and are relevant to G-ACRP are listed below. Stormwater, Sewage projects do not fall under the purview of EIA notification. However, in the case of any building construction for capacity development of GUDI, it may fall under the notification if it falls under the following category.
<table>
<tr><th>Sl. No.</th><th>Sectors as per EIA Notification</th><th>Remarks</th><th>Categorization</th></tr>
<tr><td>1</td><td>Building and Construction projects</td><td>Construction-related to Capacity Building.
These projects are to be appraised by State Environmental Impact Assessment Appraisal Committee, Gujarat as category B2 projects and Activity Number 8(a) –“Building Construction Projects”
“List of Projects or Activities requiring Prior Environmental Clearance” given in the EIA Notification dated 14th September 2006 & subsequent amendments.</td><td>Category B2
≥20000 sq.m and <1,50,000 sq.m. of built-up area#
#(built-up area for covered construction; in the case of facilities open to the sky, it will be the activity area)</td></tr>
</table>
</td><td>SEIAA/ MoEFCC</td></tr>
<tr><td>The Water (Prevention and Control of Pollution) Act, 1974 and The Water Cess Act 1977</td><td>
The Act is enacted to prevent pollution of water sources through industrial or any other construction activity and for maintaining or restoring of wholesomeness of water. The Act prohibits the discharge of pollutants into water bodies beyond a given standard and lays down penalties for non-compliance with its provisions.

The act resulted in the establishment of the Central and State Level Pollution Control Boards whose responsibilities include managing water quality and effluent standards, as well as monitoring water quality, prosecuting offenders, and issuing licenses for construction and operation of any facility. This will include the generation of liquid effluent during construction/ civil engineering activities or from domestic activities in workers' colonies. Water (Prevention and Control of Pollution) Cess Act was enacted in 1977, to provide for the levy and collection of a cess on water consumed by persons operating and carrying on certain types of industrial activities. This cess is collected to augment the resources
</td><td>CPCB, SPCB, AMC</td></tr>
</table>

Act/ Rule/ Guidelines	Relevance	Implementing/ Responsible Agency
	of the Central Board and the State Boards for the prevention and control of water pollution constituted under the Water (Prevention and Control of Pollution) Act, 1974. The Act was last amended in 2003. *Prior CTE and CTO are e applicable to establish STPs. Consent to Establish & Operate/ Authorization shall be obtained, before Establishing and commissioning the subprojects eligible for this under the Water (Prevention and Control of Pollution) Act 1974, the Air (Prevention and Control of Pollution) Act 1981, and the relevant Rules under Environment (Protection) Act 1986.* *Effluent and stormwater analysis report and flow details (once a week) and Water consumption returns (Monthly) shall be furnished to the District office of the State PCB.*	
The Air (Prevention and Control of Pollution) Act. 1981	The purpose of this act is to prevent, and control air pollution and preserve air quality. This act empowers Central and State Pollution Control Boards for managing air quality and emission standards, as well as monitoring air quality, prosecuting offenders, and issuing licenses for construction and operation of any facility. Air quality includes noise levels also. This act has notified the National Ambient Air Quality Standard for different land uses. *Prior CTE and CTO are applicable to establish STPs under the Water (Prevention and Control of Pollution) Act 1974, the Air (Prevention and Control of Pollution) Act 1981, and the relevant Rules under Environment (Protection) Act 1986.* *Emission analysis report and flow measurement (monthly) shall be submitted to the District office of Ahmedabad, SPCB.*	CPCB, SPCB, AMC
The Noise Pollution (Regulation and Control) Rule,2000	The Noise Pollution (Regulation and Control) rules are promulgated under the Environmental (protection) Act, 1986. The noise pollution rules lay down terms and conditions as are necessary to reduce noise pollution, including during night hours. The rule provides ambient noise level standards for various types of land uses. PCB can take action if the sound level exceeds the standards by 10 dBA. Noise standard for different zones. - Industrial zone- 75 & 70 dBA Leq during daytime and night-time respectively - Commercial zone- 65 & 55 dBA Leq during daytime & night-time respectively - Residential zone- 55 & 45 dBA Leq during daytime and night-time respectively - Silence zone 50 & 40 dBA Leq during daytime and night-time respectively *Construction vehicle/ equipment, construction and operation, and management of STPs, public healthcare units, should comply with the standards as stipulated in the rule.*	CPCB, SPCB, AMC
The Wildlife Protection Act, 1972	The Wildlife Protection Act, 1972 has allowed the government to establish several Protected Areas like National Parks and Sanctuaries over the past 37 years, to protect and conserve the flora and fauna and their habitat. *Prior recommendation of the National Board for Wildlife (NBWL) will be required* • *in case any subproject activity is proposed within the boundaries of a Protected area* • *in case any project requiring Environmental Clearance (under the purview of EIA Notification 2006 and its subsequent amendments) is located within the eco-sensitive zone around a Wildlife Sanctuary or National Park or in absence of delineation of such a zone, within a distance of 10 km from its boundaries* *In the case of G-ACRP, all subprojects are in the AMC area and are not hence near sensitive/ protected areas.*	NBWL, SBWL, AMC

Act/ Rule/ Guidelines	Relevance	Implementing/ Responsible Agency
The Wetlands (Conservation and Management) Rules, 2017	Wetlands (Conservation and Management) Rules, 2017 are promulgated under the Environmental (protection) Act, 1986 for prohibiting reclamation and degradation through drainage and landfill, pollution (discharge of domestic and industrial effluents, disposal of solid wastes), hydrological alteration (water withdrawal and changes in inflow and outflow), over-exploitation of their natural resources resulting in loss of biodiversity and disruption in ecosystem services provided by wetlands by conservation of wetlands. As defined in the rule, 'wetland' means an area of marsh, fen, peatland, or water; whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish, or salt, including areas of marine water the depth of which at low tide does not exceed six meters, but does not include river channels, paddy fields, human-made water bodies/ tanks specifically constructed for drinking water purposes and structures specifically constructed for aquaculture, salt production, recreation, and irrigation purposes. Whereas, 'wetlands complexes' means two or more ecologically and hydrologically contiguous wetlands and may include their connecting channels/ ducts *The rules shall apply to the wetlands or wetlands complexes of the following types-* *(a) wetlands categorized as 'wetlands of international importance under the Ramsar Convention* *(b) wetlands as notified by the Central Government, State Government, and Union Territory Administration* ***Section 4** of the rule elaborates Restrictions of activities in wetlands which includes handling or storage or disposal of construction and demolition waste covered under the Construction and Demolition Waste Management Rules, 2016; hazardous substances covered under the Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 or the Rules for the Manufacture, Use, Import, Export, and Storage of Hazardous Microorganisms/ Genetically Engineered Organisms or Cells, 1989 or the Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008; Solid waste dumping; Discharge of untreated wastes and effluents from industries, cities, towns, villages and other human settlements; and any construction of a permanent nature.* *Since all G-ACRP subprojects will be implemented in the Ahmedabad city area where there are no wetlands, this may not be applicable. However, in case of any construction for GUDI in the course of the project, as part of capacity development, this shall be considered.*	State Department of Environment, AMC
Regulations Related to Waste Management		
Solid Waste Management Rules, 2016	The Rules shall apply to every urban local body, other areas and to every domestic, institutional, commercial, and any other non-residential solid waste generator except industrial waste, hazardous waste, hazardous chemicals, biomedical wastes, e-waste, lead-acid batteries, and radioactive waste. The rules define the duties of solid waste generators. The rules outline the responsibilities of line ministries, ULB's and other stakeholders, the duty of the operator of the Solid Waste Processing and Treatment Facility. *Labour camps, wastewater, storm drainage network operating units shall follow SWM Rules 2016. All capacity building/ training activities shall 'Green Protocol' and ensure management for biowaste, packaging waste, and e-waste. In addition, all general SW from STP including Grit shall be tested and channelized to the SWM system.*	MoEFCC, Waste Generators, CPCB, SPCB, various stakeholders at state/ local level, etc., AMC, GUDM/ GUDI
Construction and Demolition Waste	Construction and demolition waste include waste comprising of building materials, debris, and rubble resulting from construction, remodeling, repair, and demolition of any civil structure. As per rule-	MoEFCC, C&D Waste Generators, CPCB, SPCB, various

Act/ Rule/ Guidelines	Relevance	Implementing/ Responsible Agency
Management Rules, 2016	1. Every waste generator shall prima-facie be responsible for the collection, segregation of concrete, soil, and others and storage of construction and demolition waste generated, as directed or notified by the concerned local authority in consonance with these rules ((Rule 4 sub-rule (1)) 2. there should be no littering or deposition of construction and demolition waste to prevent obstruction to the traffic or the public or drains (Rule 4 sub-rule (4)) *All construction activities under the subprojects shall follow the C&D waste management rules. In addition, all silt, grit, pebbles, and such material from STP Grit shall be tested and channelized to the C&D WM system.*	stakeholders at state/ local level, AMC, GUDM/ GUDI
Plastic Waste Management Rules, 2016, amended 2018	MoEFCC issued the Plastic Waste Management Rules, 2016 to give thrust on plastic waste minimization, source segregation, recycling, and disposal effectively. These rules shall apply to every waste generator, local body, Gram Panchayat, manufacturer, Importers, and producer. Section 6 and Section 8 of the rule explain the Responsibility of the Local Body and the Responsibility of the waste generator respectively. *All activities under the subprojects & capacity building activities shall follow the Plastic waste management rules. Waste plastics from STP sieve/ Grit shall be tested and channelized to the SWM system.*	MoEFCC, Waste Generators, producers, CPCB, SPCB, AMC, GUDM/ GUDI
Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016, amended 2019	The rule dictates the entity generating hazardous wastes (as defined in the rule), to take all practical steps to ensure that such wastes are properly handled without any adverse effects, which may result from such wastes. It stipulates proper collection, reception, treatment, storage, and disposal of such wastes and provides for the process/ mechanism to do so. Waste generators will need to obtain permission from the State Pollution Control Boards and other designated authorities for the storage and handling of any hazardous material. **Schedule I** of the rule lists out of processes that generate hazardous wastes. **Schedule II** of the rule provide a list of waste constituents with concentration limits Chapter 2 Section 4 states *(3) The hazardous and other wastes generated in the establishment of an occupier shall be sent or sold to an authorized actual user or shall be disposed of in an authorized disposal facility. This applies to untreated sludge, treated sludge with a high amount of heavy metals/ hazardous components if any. This also applies to the use and management of asbestos and silica under the project, and all chemicals/ fuel used must be checked for quantity to be stored on site.*	MoEFCC, CPCB, SPCB, State Government/ Administration, AMC
E-Waste Management Rule, 2016, amended 2018	These rules shall apply to every manufacturer, producer, consumer, bulk consumer, collection centers, dealers, e-retailer, refurbisher, dismantler, and recycler involved in the manufacture, sale, transfer, purchase, collection, storage, and processing of e-waste or electrical and electronic equipment listed in Schedule I of the rule, including their components, consumables, parts, and spares which make the product operational. These rules are applicable Two categories of electrical and electronic equipment namely (i) IT and Telecommunication Equipment and (ii.) Consumer Electricals and Electronics such as TVs, Washing Machines, Refrigerators Air Conditioners including fluorescent and other mercury-containing lamps are covered under these Rules **Section 5** of the rule defines the responsibilities of the producer of e-waste.	MoEFCC, CPCB, SPCB, AMC, GUDM/ GUDI

Act/ Rule/ Guidelines	Relevance	Implementing/ Responsible Agency
	This applies to any E-Wastes generated as part of capacity building activities or general upgradation/ construction of facilities; including electric/ electronic appurtenances, bulbs, switches, wires, etc.	
Bio-medical Waste Management Rules, 2016, amended 2019	To improve the collection, segregation, processing, treatment, and disposal of these bio-medical wastes in environmentally sound management thereby, reducing biomedical waste generation and its impact on the environment. These rules shall apply to all persons who generate, collect, receive, store, transport, treat, dispose, or handle biomedical waste in any form including hospitals, nursing homes, clinics, dispensaries, veterinary institutions, animal houses, pathological laboratories, blood banks, Ayush hospitals, clinical establishments, research or educational institutions, health camps, medical or surgical camps, vaccination camps, blood donation camps, first aid rooms of schools, forensic laboratories, and research labs. **Schedule I** provides guidelines for storage and disposal of various types of biomedical waste (including Liquid Waste) **Schedule II** defines Standards for Treatment and Disposal of Bio-Medical Waste i.e. incinerators, Plasma Pyrolysis or Gasification, Autoclaving, microwaving, deep burial, etc. **Schedule III** of the rule defines the responsibilities of Municipalities or Corporations, Urban Local Bodies, and Gram Panchayats along with other line ministries and concerned entities. *This project would not deal with Biomedical waste except marginal quantities which might be emerging from drain outlets, sewage inlets mostly during the O&M phase. There shall be proper segregation, collection, and channelization of such waste to nearby authorized BWM facility.*	MoEFCC, Waste Generators CPCB, SPCB, AMC
Batteries (Management and Handling) Rules, 2001	MoEFCC under the provisions of the Environmental Protection Act, 1986 issued the Batteries (Management and Handling) Rules, 2001. The rules were enacted with the primary objective of ensuring the safe disposal of discarded lead-acid batteries. Rules mandate proper control and record-keeping on the sale or import of lead-acid batteries and recollection of the used batteries by registered recyclers to ensure environmentally sound recycling of used batteries. *All project, subproject activities having applicability of batteries, shall have in their plan measures stipulated to prevent the batteries from reaching the municipal stream.*	MoEFCC, CPCB, SPCB, AMC
The Motor Vehicle Act, 1988 & Motor Vehicles Rules, 1989	The Act regulates all aspects of road transport vehicles. It provides in detail the legislative provisions regarding licensing of drivers/ conductors, registration of motor vehicles, control of motor vehicles through permits, traffic regulation, insurance, liability, offenses, and penalties, etc. *This act will be applicable for all construction equipment/ plant and machinery including vehicles deployed during implementation. Motor Vehicles Rules, 1989 mandates Pollution Under Control (PUC) certificate for motor vehicles and valid licenses for eligible drivers.*	CPCB, SPCB, State Motor Vehicles Department, AMC
Pesticides/ Insecticide related Regulations:		
Insecticide Act 1968 and Rules 1971	The Insecticides Act, 1968 and Insecticides Rules, 1971 regulate the import, registration process, manufacture, sale, transport, distribution, and use of insecticides (pesticides) to prevent risk to human beings or animals and for all connected matters, throughout India. All insecticides (pesticides) have to necessarily undergo the registration process with the Central Insecticides Board & Registration Committee (CIB & RC) before they can be made available for use or sale. The Act also has guidelines stipulated for the protective clothing of persons handling insecticides. Disposal of used packages, surplus material, and washing of insecticides are also included in the Act.	Central Insecticides Board and Registration Committees (CIB & RC), AMC

Act/ Rule/ Guidelines	Relevance	Implementing/ Responsible Agency
	This act will be applicable for the sewerage network, STP, and drainage network subprojects. No banned pesticides shall be purchased or used under the project.	
Draft Bill on Pesticide management, 2020 introduced in Rajya Sabha in March 2020	The purpose of the bill is to minimize risk to human beings, animals, living organisms other than pests and the environment, with an endeavor to promote pesticides that are biological and based on traditional knowledge. The bill on Pesticide management seeks to regulate the manufacture, import, sale, storage, distribution, use, and disposal of pesticides, to ensure the availability of safe pesticides and minimize the risk to humans, animals, and the environment. The Bill seeks to replace the Insecticides Act, 1968	AMC, Ministry of Agriculture and Family Welfare.
Acts/ Rules applicable to Land Acquisition, RoW use		
The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013	Aims to ensure, a humane, participative, informed, and transparent process for land acquisition with the least disturbance to the owners of the land and other affected families and provide just and fair compensation to the affected families whose land has been acquired or proposed to be acquired or those that are affected by such acquisition and make adequate provisions for their rehabilitation and resettlement and for ensuring that the cumulative outcome of compulsory acquisition should be that affected persons become partners in development leading to an improvement in their post-acquisition social and economic status. *Upgradation of existing STPs does not require land acquisition. At the time of this assessment, the two new STPs are proposed to be located in areas owned by GUDA/ GMC/ AMC and land will be transferred to AMC as per process. The trunk line and rehabilitation of the existing line are expected to result in temporary impacts. However, in case during the G-ACRP implementation, any new land acquisition requirements shall be taken up duly following the provisions of this Act.*	District Administration AMC
The supreme court order, on removal and restriction of encroachment of religious structures on the public space	Provisions of the Order: disallow/ regulate the use of RoW, public spaces for the construction of temples, mosques, shrines, the church in public land, and public spaces.	AMC
Other Regulations/ Policies/ Guidelines applicable to various construction/ implementation activities		
Central Ground Water Authority- 'Guidelines to control and regulate groundwater extraction in India' September 2020	Central Ground Water Authority (CGWA), constituted by the Government of India under Section 3 (3) of the Environment (Protection) Act (EPA) of 1986, in pursuance of the Order of the Hon"ble Supreme Court of India, has been regulating groundwater development and management in the country and has proposed the guidelines for groundwater withdrawal. The drawing/ proposing to draw groundwater through a pump of more than 2 HP and/ or through more than one functional tube well shall be required to seek NOC for groundwater withdrawal. NOC will be granted for drinking and domestic purpose only. NOC for groundwater withdrawal will be considered only in cases where the water supply department concerned is unable to supply an adequate amount of water in the area. Government water supply agencies are also required to seek NOC from the authorized officers for existing as well as new schemes based on groundwater sources. NOC shall not be granted for extraction of groundwater for construction activities in the project in Critical/ Over-exploited areas.	AMC

Act/ Rule/ Guidelines	Relevance	Implementing/ Responsible Agency
	Quantum of groundwater for purposes other than drinking/ domestic use shall not exceed 25% of total groundwater abstraction *As per the revised guidelines of September 2020, applications for NOC for groundwater abstraction will be processed based on the category of groundwater assessment units and not by notified/ non-notified areas. AMC shall arrange required water for construction purposes from its supply.*	
The Building & Other Construction Workers (Regulation of Employment & Conditions of Service) BOCW Act, 1996	As per the Act, the employer is required to provide safety measures at the building or construction work site along with other welfare measures, such as canteens, first-aid facilities, ambulance, housing accommodation, etc. to the workers. These are comprehensive guidelines for the Occupational Health and Safety of Laborers. *This applies to all subprojects during construction and O&M stages where labor would be employed.*	Dept. of Labour; Govt. of Gujarat
Child Labour (Prohibition and Regulation) Act, 1986 and Rules, amended 2016 and Child Labour (Prohibition and Regulation) Amendment Rules, 2017	The Child Labour (Prohibition and Regulation) Act of 1986 designates a child as a person who has not completed their 14th year of age. It aims to regulate the hours and the working conditions of child workers and to prohibit child workers from being employed in hazardous industries. Children between the age of 14 and 18 are defined as "Adolescent" and the law allows adolescents to be employed except in the listed hazardous occupation and processes which include mining, inflammable substance, and explosives-related work, and any other hazardous process as per the Factories Act, 1948. *This applies to all subprojects during construction and O&M stages where labor would be employed.*	Department of Labour, Gujarat Government
Minimum Wages Act, 1948	This act sets the minimum wages that must be paid to skilled and unskilled laborers. The act is legally non-binding but statutory. Payment of wages below the minimum wage rate amounts to forced labor. Wage boards are set up to review the industry's capacity to pay and fix minimum wages such that they at least cover a family of four's requirements of calories, shelter, clothing, education, medical assistance, and entertainment. *This applies to all subprojects during construction and O&M stages where labor would be employed.*	Department of Labour, Gujarat Government
The Bonded Labor System (Abolition) Act 1976	The Bonded Labor System (Abolition) Act 1976: States that all forms of bonded labor stands abolished and every bonded labor stands freed and discharged from any obligations to render any bonded labor	PIU to ensure compliance
Workmen's Compensation Act, 1923 & Rules 1924	The Act requires if personal injury is caused to a workman by accident arising out of and during his employment, his employer should be liable to pay compensation following the provisions of this Act. *Applicable during the construction phase. PIU should ensure through its contractors in case of any accident/ injury/ loss of life the workmen should be paid a minimum compensation as calculated under this act both during the construction and operation phase of the project. The reporting of accidents needs to be done in prescribed forms as per the act and the incident/ accident register needs to be maintained accordingly. The Act also gives a framework for calculating the amount of compensation and wages.*	Commissionerate of Labour PIU to ensure compliance
Interstate Migrant Workmen Act 1979	The provisions of this Act regulate the conditions of service and protect the interests of interstate migrant workers. The project requires engaging interstate migrant workers for specialized activities The Inter-State migrant workmen, in an establishment to which this Act	Commissionerate of Labour

Act/ Rule/ Guidelines	Relevance	Implementing/ Responsible Agency
	becomes applicable, are required to be provided certain facilities such as housing, medical aid, traveling expenses from home up to the establishment and back, among others	PIU to ensure contractor's compliance
Ancient Monuments and Archaeological Sites & Remains (Amendment and Validation) Act 2010	This Act is to ensure the preservation of ancient and historical monuments and archaeological sites and remains of national importance and for the regulation of archaeological excavations and the protection of sculptures, carvings, and other like objects. According to this Act, areas within the radii of 100m and 200m from the "protected property" are designated as "prohibited areas" and "regulated areas" respectively. **No development activity is permitted in the "prohibited areas"**. Development activities are not permitted in the "regulated areas" without prior permission from the Archaeological Survey of India (ASI) if the site/ remains/ monuments are protected by ASI or the State Directorate of Archaeology. *If any subproject is proposed within regulated areas of protected monuments, prior permission will be required from ASI. Pertinent to state that the act does not allow the development of any facility within the limit of the Prohibited Area.*	Archaeological Survey of India, State Dept. of Archaeology, AMC Department of Heritage
Indian Treasure Trove Act, 1878	Whenever any treasure (anything of any value hidden in the soil, or anything affixed thereto) exceeding in amount or value ten rupees is found, the finder shall intimate District Collector in writing as soon as practicable. *The Act gives direction about the process to be followed in case of the chance finds.*	Archaeological Survey of India, State Dept. of Archaeology; District Collector, AMC Department of Heritage
Right to Information Act, 2005	Provides a practical regime of right to information for citizens to secure access to information under the control of Public Authorities. The act sets out (a) obligations of public authorities for the provision of information; (b) requires designating of a Public Information Officer; (c) process for any citizen to obtain information/ disposal of request, etc.; and (d) provides for institutions such as Central Information Commission/ State Information Commission *Relevant as all documentation of G-ACRP requires to be disclosed to the public.*	AMC
Scheduled Castes and Scheduled Tribes (Prevention of Atrocities) Act 1989 and further Amendments 2018.	To prevent atrocities against scheduled castes and scheduled tribes. The objectives of the Act clearly emphasized the intention of the government to deliver justice to these communities through proactive efforts to enable them to live in a society with dignity and self-esteem and without fear or violence or suppression from the dominant castes. With the reported misuse of the Act, In August 2018, the parliament of India passed the Scheduled Castes and Scheduled Tribes (Prevention of Atrocities) Amendment Bill, 2018, to bypass the ruling of the Supreme Court of India laying down procedures for arrests under the Act. *Relevant in the context of safeguarding the rights of SC and STs.*	AMC
The Sexual Harassment of Women at Workplace (Prevention,	An act that aims at providing a sense of security at the workplace that improves women's participation in work and results in their economic empowerment. It requires an employer to set up an "Internal Complaints Committee" (ICC) and the Government to set up a 'Local Complaints Committee' (LCC) at the district level to investigate complaints regarding sexual harassment at the workplace and for inquiring into the complaint in a time-bound manner. The ICC needs to be set up by every organization and its branches with more than 10 employees.	AMC

Act/ Rule/ Guidelines	Relevance	Implementing/ Responsible Agency
Prohibition and Redressal) Act, 2013	*Applicable to all institutions of the Project*	
The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013	An Act to provide for the prohibition of employment as manual scavengers, rehabilitation of manual scavengers and their families, and for matters connected therewith or incidental thereto. The Bill prohibits the employment of manual scavengers, the manual cleaning of sewers and septic tanks without protective equipment, and the construction of insanitary latrines. All the sub-projects where manual cleaning of the sewers and septic tanks shall be prohibited.	AMC

Table A- 33: Key Guidelines for Sewerage, Drainage and related aspects at National Level

Agency	Guidelines	Particulars
Central Public Health and Environmental Engineering Organisation (CPHEEO), Ministry of Urban Development	Manual on Sewerage and Sewage Treatment Systems - 2013	**Part A** of the manual is on the **Engineering** aspect related to the sewerage system. The manual provides detailed guidelines for: • Planning • Design and construction of sewers • Design and construction of sewage pumping stations and sewage pumping mains • Design and construction of sewage treatment facilities • Design and construction of sludge treatment facilities • Recycling and reuse of sewage • Decentralized sewerage system • On-site sanitation • Preparation of city sanitation plan **Part B** of the manual is on **Operation and Maintenance** aspects related to sewerage systems and includes: • Sewer systems • Pumping station • Sewage treatment facilities • Sludge treatment facilities • Electrical and instrumentation facilities • Monitoring of water quality • Environmental conservation • Occupational health hazards and safety measures • On-site systems

Agency	Guidelines	Particulars
		Part C of the manual is on the **Management** aspect related to the sewerage system: • Legal framework and policies • Institutional aspects and capacity building • Financing and financial management • Budget estimates for operation and maintenance • Public-private partnership • Community awareness and participation • Asset management • Management information system • Potential disasters in sewerage and management
Central Public Health and Environmental Engineering Organisation (CPHEEO), Ministry of Urban Development	Manual on Storm Water Drainage Systems, 2019	This manual has been prepared for assisting engineers, planners, designers, architects, geographers, and hydrologists working in government/ private institutions, urban local bodies, industrial and business concerns, consultancy services, etc., in planning and design of urban stormwater drainage systems in the country. The manual is contained in three distinct Parts over two volumes. Volume 1 contains Part A: Engineering Design, Volume 2 contains Part B: Operation, Maintenance, and Part C: Management. Volume 1 of Manual contains the planning and Engineering Design of various elements of stormwater drainage systems and includes: • Planning aspects of urban stormwater drainage projects, related Investigation, data collection, survey inputs, and environmental as well as financial aspects. Rainfall analysis and development of IDF curves using empirical and probabilistic methods. • Runoff estimation resulting from urban catchments by various methods viz. rational method, time area method, unit hydrograph method, and rainfall-runoff simulation method. Hydraulic design of stormwater drains with applicable flow equations. • Additional design considerations for special areas to be considered while designing stormwater drains in hilly and coastal areas. Structural design of stormwater drains covering process design of underground rigid and flexible conduits for carrying stormwater. • Handling of stormwater through pumping and planning and design of pumping station for pumping of stormwater. • Planning and design of rainwater harvesting to be used for multiple purposes like artificial recharge of groundwater and attenuation of flash floods. • Methodology for using existing drains to allow excess runoff to percolate in the groundwater. It also deals with various emerging practices adopted across the world for stormwater drainage design such as Water Sensitive Urban Design (WSUD), Low Impact Development (LID), and Sustainable Urban Drainage System (SUDS). • Best Management Practices (BMPs) of stormwater drainage systems are also discussed briefly. Construction aspects of stormwater drains, and their appurtenant structures. Volume 2: Operation, Maintenance, and Management

Agency	Guidelines	Particulars
		Volume 2 of the Manual is divided into two parts: Part B: Operation and Maintenance, deals with operation & maintenance, inspection and replacement & rehabilitation of stormwater drains. Part C: Management deals with public awareness, capacity building, institutional arrangement, and financial sustainability.
Central Public Health and Environmental Engineering Organisation (CPHEEO), Ministry of Urban Development	Manual on Operation and Maintenance of Water Supply System - 2005	The manual aims to serve as a guide for strengthening the technical, operational, and managerial capabilities required of the concerned personnel to operate and maintain water supply services as per acceptable norms of quantity, quality, sustainability, reliability, and cost. This manual provides systematic guidelines that provide the details of the operation, functioning, maintenance, and safety considerations of all the technical aspects related to water supply O & M including: Sources of water supply Transmission of water Water treatment plant Disinfection Reservoirs including service reservoirs Distribution systems Drinking-Water Quality, Monitoring, and Surveillance Repair of pipeline Drinking-Water Quality Monitoring and Surveillance Water Meters, Instrumentation, Telemetry & SCADA Billing and collection System management Water audit and leakage control Energy audit and conservation of energy Human resources development Public awareness and customer relations Safety practices Public-Private partnership
Central Public Health and Environmental Engineering Organisation (CPHEEO) Ministry of Housing and Urban Affairs	Advisory on On-Site and Decentralized Composting of Municipal Organic Waste, June 2018	Methods to treat organic wastes, reduce, recycle, reuse, Waste to Compost systems: Waste to Compost systems for Individual Households, Small Communities, Apartments, etc. up to 10 Household; Waste to Compost systems for Medium-Sized Communities, Apartments, RWAs - for 11 – 300 Households; medium-sized Offices, medium Hotels, Resorts, medium Schools, Canteens, Marriage Halls; Waste to Compost systems for large Communities, Apartments, RWAs, high rise buildings for 301 - 1000 Households; Large Offices, Large Hotels, Large Schools, Waste to Compost systems for Decentralized plants for more than 1000 Households operated by ULBs/ Institutions/ Outsourced agencies
Central Pollution Control Board	Guidelines for Management of Sanitary Waste, May'18	It covers possible waste management options for such kinds of wastes. Role of various stakeholders etc.

Agency	Guidelines	Particulars
Central Pollution Control Board	Guidelines on Environmental Management of Construction & Demolition (C & D) Wastes	It discusses the Quantum & composition of C & D waste generation, Initiatives in promoting C & D waste products by GoI, C & D waste processing, Existing Guidelines on C & D waste management, Introduction to Guidelines on Environmental Management of C& D Wastes, Guidelines on Environmental Management of C & D Wastes – NOISE management, Guidelines on Environmental Management of C & D Wastes – DUST management, Guidelines on Environmental Management of C & D Wastes – Other issues Annexures on: Initiatives in C & D waste management in 69 cities (Literature Survey); Potential uses of C & D wastes, Global practices of the utilization of C & D wastes, Criteria for site selection of C & D waste processing facility Separate CPCB Guidelines: Guidelines on Dust mitigation measures in handling Construction material and C&D wastes Guidelines on Environmental Management of Construction & Demolition (C & D) wastes

Table A- 34: Applicable Policies and Regulations at State Level

Act/ Rule/ Guidelines	Relevance	Implementing/ Responsible Agency
Regulations/ Policies related to Environmental Conservation & Management		
The Gujarat Infrastructure Development Act, 1999	This Act provides the framework for participation by persons other than the State Government and Government agencies in the financing, construction, maintenance, and operation of infrastructure projects and for that purpose to establish a Board and to provide for the matters connected therewith. *As per Schedule I of this act, sewerage system, irrigation, land reclamation, health facilities, inland waterways shall come under the purview of this*	AMC
Gujarat Irrigation and Drainage Act, 2013	This Act is to provide for irrigation and drainage in the State of Gujarat. Whereas it is necessary to make provisions for the construction relating to irrigation in the State of Gujarat and for the matters connected therewith and incidental thereto *Applicability due to the proposed various activities such as construction and maintenance of canals interruption/ obstruction/ damage/ construction to the existing water supply network, canals, tube wells, artisanal wells, borewells*	AMC
Gujarat Irrigation and Drainage Rules, 2014	It shall apply to all the works constructed and maintained relating to irrigation including drainage and water supply for drinking and industrial purpose by the State Government, State Government institutions, and Grant-in-Aid Institutions of the State and includes all services rendered thereof *Applicability due to the proposed various activities such as construction and maintenance of canals, channels, water-courses, pipes and reservoirs for the supply or storage of water, escape-channels from a canal, dams, weirs, embankments, sluices, groins, and other work all tube wells, artesian wells, borewells and dug wells, percolation tank or pond used for recharge of groundwater*	AMC
The Gujarat Water Supply and Sewerage Board Act, 1978	An Act to provide for the establishment of a Water Supply and Sewerage Board for the rapid development and proper regulation of water supply and sewerage services in the State of Gujarat. It extends to the whole of the State of Gujarat excluding the areas comprised of Cities and cantonments. *Applicable to all necessary services concerning water supply and sewerage subprojects*	AMC
Saurashtra Felling of Trees (Infliction of Punishment) Act, 1951	An Act to provide for heavier punishment for felling of trees and for certain other matters Whereas it is expedient to provide for heavier punishment for the unauthorized felling of trees and certain other matters *Applicable to any activity of the subproject requiring felling of trees*	AMC

Act/ Rule/ Guidelines	Relevance	Implementing/ Responsible Agency
The Gujarat Highways Act, 1955	An Act to provide for the restriction of ribbon development along highways, for the prevention and removal of encroachment thereon, for the construction maintenance and development of highways, for the levy of betterment charges, and certain other matters. Subprojects that involve works in the ROW of highways	AMC
The Gujarat Water and Gas Pipelines (Acquisition of Right of User in Land) Act, 2000	An Act to provide for the acquisition of the right of users in land for laying water pipelines and gas pipelines in the State of Gujarat and for the matters connected therewith. *Applicable to the pipe laying of water supply, stormwater drainage network, shifting of existing water and gas pipelines*	AMC
Gujarat Industrial Development Act, 1962	This act is to make special provision for securing the orderly establishment and organization of industries in industrial areas and industrial estates in the State of Gujarat and to establish commercial centers in Connection with the establishment and organization of such industries and for that purpose to establish an Industrial Development Corporation, and for purposes connected with the matters aforesaid. *Applicable if any subproject is a part of industries, in industrial areas and industrial estates, connection/ supply of treated water to the industrial area*	AMC
The Gujarat Special Economic Zone Act, 2004	An Act to provide for the operation, maintenance, management, and administration of a Special Economic Zone in the State of Gujarat and to constitute an Authority and for matters connected therewith or incidental thereto *Applicable to any subproject/ activity to be developed in the Special Economic Zone in the State*	AMC
The Gujarat Vacant Lands in Urban Areas (Prohibition of Alienation) Act, 1972	An Act to prohibit the alienation of certain vacant lands in urban areas in the State of Gujarat. *Applicable to any activity/ subproject is to be located in vacant lands*	AMC
The Gujarat Town Planning and Urban Development Act, 1976	An Act to consolidate and amend the law relating to the making and execution of development plans and town planning schemes in the State of Gujarat. *Applicable to all subprojects*	AMC
The Right to fair compensation and Transparency in LandAcquisition, Rehabilitation and resettlement Gujarat Amendment) Act, 2016 (effective from August 2016)	A further amendment to the "Principal Act" referred to the Right to Fair Compensation, Transparency in Land Acquisition and Resettlement and Rehabilitation Act, 2013 in its application to the State of Gujarat, enacted the Gujarat Amendment Act, 2016 with simplifying the provisions, which was commenced on 15th August 2016.; Major amendments include Power of State government to exempt public interest and SIA for certain projects mentioned in the subsection of 10A., R&R Assistance - lump sum amount equal to 50% of the amount of land compensation as determined under section 27 of principal Act to the affected families, in case of a project which are linear.	District Administration/ AMC
The Gujarat Ancient Monuments and Archaeological Sites and Remains Act, 1965	An Act to make better provision for the preservation of ancient and historical monuments and records and archaeological sites and remains (other than those declared to be of national importance) in the State of Gujarat and for matters connected with the purposes aforesaid. *Applicable to building, structures, and other works in the vicinity of the prohibited and regulated area of the protected ancient monuments.* ***Prohibited area**-Beginning at the limit of the protected area or the protected monument, as the case, maybe, and extending to a distance of one hundred meters in all directions shall be the prohibited area in respect of such protected area or protected monument:* ***Regulated area**-Every area, beginning at the limit of prohibited area in respect of every ancient monument and archaeological site and remains, declared as of national importance and extending to a distance of two hundred meters in all directions shall be the regulated area in respect of every ancient monument and archaeological site and remains:*	AMC

Act/ Rule/ Guidelines	Relevance	Implementing/ Responsible Agency
Gujarat Fisheries Act, 2003	An Act to provide for the protection, conservation, and development of fisheries in inland and territorial waters of the State of Gujarat and regulation of fishing in the inland and territorial waters along the coastline of the State and matters connected therewith or incidental thereto. *Applicable to the sewerage network subprojects releasing sewage/ effluents to the inland waters which may be harmful to species of fish or the food of fish.*	AMC
The Gujarat Public Premises (Eviction of Unauthorised Occupants) Act, 1972	An Act to provide for the eviction of unauthorized occupants from public premises and for certain incidental matters. *Applicable to any subproject/ activity which will require the eviction of unauthorized occupants in public premises*	AMC
The Gujarat Slum Areas (Improvement, Clearance, and Redevelopment) Act, 1973	An Act to provide for the improvement and clearance of Slum areas in the State of Gujarat and their development; and matters connected with the purposes aforesaid. *Applicable to projects mainly sewerage network, stormwater drainage network in the vicinity/ connected with declared slum areas*	AMC
Gujarat Special Investment Region Act, 2009	An Act to provide for the establishment, operation, regulation, and management of large size Investment Regions and Industrial Areas in the State of Gujarat; and to especially enable their development as global hubs of economic activity supported by world-class infrastructure, premium civic amenities, centers of excellence and proactive policy framework; and for setting up an organizational structure with that purpose and for matters connected therewith or incidental thereto. *Applicable to wastewater treatment/ stormwater network/ water supply network if they are a part of the development plan for the Special Investment Region or in the periphery area of the Special Investment Region*	AMC
Gujarat State Disaster Management Act, 2003	An Act to provide for effective management of disaster, for mitigation of the effects of disaster, for administering, facilitating, coordinating, and monitoring emergency relief during and after the occurrence of disasters, and for implementing, monitoring, and coordinating measures for reconstruction and rehabilitation in the aftermath of disasters, in the State of Gujarat and for these purposes to establish the Gujarat State Disaster Management Authority and to specify other agencies and for matters connected therewith or incidental thereto.	AMC
Gujarat Municipalities Act, 1963	An Act to consolidate and amend the law relating to municipalities in the State of Gujarat to give them wider powers in the management of municipal affairs. Includes power to require owners to keep drains etc. in proper order or to demolish or close privy or cess pool, Power to close existing private drains, Power in respect of sewer, etc., unauthorizedly, constructed, rebuilt, or unstopped, Encroachments on municipal drains, etc. 155. (1) The Commissioner may carry any municipal drain through, across or under any street, or any place laid out as or intended for a street or under any cellar or vault which maybe under any street, and, after giving reasonable notice in writing to the owner or occupier, into, through or under any land whatsoever within the City, or, for outfall or distribution of sewage, without the City. (2) The Commissioner may enter upon, and construct any new drain in the place of an existing drain in, any land wherein any municipal drain has been already lawfully constructed, or repair or alter any municipal drain so constructed. Applicable to all sub-projects.	AMC
Gujarat Regularisation of Unauthorised Development Act, 2011,	An Act to regularise the unauthorized development in developing areas in the State. Circumstances in which unauthorized development shall not be regularised.- (1) An unauthorized development shall not be regularised in a case where unauthorized development is carried out on any of the following lands, namely:- (a) land belonging to Government, local authority, or statutory body; (b) land acquired or allotted by the Government, local authority, or statutory body for a specific purpose; (c) land under the alignment of roads indicated in development plan or a town planning scheme or under the alignment of a public road;	AMC

Act/ Rule/ Guidelines	Relevance	Implementing/ Responsible Agency
	(d) land designated or reserved under a development plan or a town planning scheme; (e) lands till regularised as provided in section 9, (f) watercourses and water bodies like tank beds, river beds, natural drainage, and such other places; (g) areas earmarked for obnoxious and hazardous industrial development (2) An unauthorized development shall not be regularised if it is inconsistent with - (a) fire safety measures under the relevant law, or (b) structural stability requirements as per the GD C R: Applicable to sub-projects that involve works in Khaircut canal and Chandrabhaga.	
Gujarat Street Vendors (Protection of Livelihood and Regulation of Street vending) Rules, 2016	An Act to protect the rights of urban street vendors and to regulate street vending activities and for matters connected therewith or incidental thereto.Rules made under this act by Gujarat state. Applicable in case project implementation impacts street vendors operating under a certificate of vending. Applicable in the rehabilitation of existing drains and micro tunneling subprojects involving project activities being undertaken in the public road with municipal limits which have street vendors and hawkers.	
Gujarat Government-Policy for Reuse of Treated Wastewater, 2018	The concept of wastewater recycling and reuse and the need to include the same in all water supply and wastewater management programs is recognized by most of the policy frameworks and institutions in India. Gujarat Government Policy for the use of Treated wastewater is in force from May 2018 with a vision to maximize the collection and treatment of sewage generated and reuse of treated wastewater on a sustainable basis, thereby reducing dependency on freshwater resources and also promoting treated wastewater as an economic resource. The Policy has the following objectives: • To reach a minimum of 80% coverage and collection of sewage in all municipal towns • To reach a level of 100% treatment collected sewage as per the prescribed standards • To reuse at least 25% of total freshwater consumption from treated wastewater within the time limit set under the policy by every municipal body • To reuse 70%of treated wastewater by 2025 • To reuse 100% of treated wastewater by 2030 The prime responsibility for the treatment of wastewater, wastewater recycling, and reuse will be with the local body. Accordingly, the creation of wastewater management and planning and implementation of wastewater reuse infrastructure will be the responsibility of the local body depending on the availability of funds. However, the state government will seek to augment these efforts. *Applicable to all the wastewater treatment/ reuse/ recycle subprojects*	AMC
Gujarat Government-The 'Urban Sanitation and Cleanliness Policy, 2018	A comprehensive policy for solid and waste management. Under this policy, all major urban civic bodies need to ensure 100 percent waste segregation to ensure less generation of solid waste. The policy also allows civic bodies to make their laws, regulations and draw up rules concerning penalties for violators. Under the new policy, Gujarat is looking to reduce dependency on landfills and send collected waste directly to waste treatment plants. Construction waste will be recycled and reused. The main idea is to first reduce the generation of waste by encouraging segregation in households, resident welfare associations, and bulk waste generators like malls and hospitals. This policy makes it mandatory for all households to have their drainage systems linked directly to sewage treatment plants (STPs), to avoid the direct flow of sewage into lakes or rivers. *Applicable to all Drainage, wastewater treatment/ reuse/ recycle subprojects*	

Table A- 35: Essential Compliance requirements for Subprojects

SL. No.	Parameters for compliance	Details
1	Approval and consent to establish and operate STPs, and support facilities	STPs, RMC plants, DG sets, or any other unit which has the potential to release effluents require the CTO& CTE approvals from SPCB As per Section 25/26 of the Water (prevention and control of pollution) act, 1974, and Air Act, no industry or operator process or any treatment and disposal system can be established without the previous consent of the State Board Approval of work from the different departments of ULBs for: Setting up and maintaining new: • Sewerage treatment plants, RMC plant, DG Sets, Sewage pumping stations, Stormwater pumping stations • Laying drainage/ stormwater drainage networks in existing as well as newly merged areas. • Cleaning of main stormwater and drainage trunk lines with the help of advanced machinery and the work of old sewage mainline rehabilitation (strengthening) is also taken up by this department.
2	Treatment and disposal of sewage	As per Section 17 of the WPA, 1974, approval of SPCB is required for disposal of sewage and trade effluents on land if required as are necessary on account of the predominant conditions of scant stream flows that do not provide for a major part of the year the minimum degree of dilution. Approval is required for standards of treatment of sewage and trade effluents to be discharged into any particular stream taking into account the minimum fair weather dilution available in that stream and the tolerance limits of pollution permissible in the water of the stream after the discharge of such effluents
3	Monitoring requirements for STPs, DG sets, RMC	To monitor the environment quality and to ensure compliance with standards prescribed by SPCB and EP Act, 1986 and Rules Necessary precautions have to be taken to minimize the nuisance of odor, contamination of water resources.
4	Sludge Management	The Environment (Protection) Act, 1986, and the Water (Prevention and Control of Pollution) Act, 1974 provide a framework for control of effluent, sewage, and septage discharge. The SWM Rules, 2016 under the Environment (Protection) Act apply to the final and safe disposal of post-processed residual fecal sludge and septage to prevent contamination of groundwater, surface water, and ambient air. Further, the SWM Rules 2016 will also apply for disposal and treatment of faecal sludge and septage, before or after processing, at landfills, and for use as compost.
5	The work environment for the workers	For subprojects related to the sewerage network, the Manual Scavengers and their Rehabilitation Act, 2013, prohibits “hazardous cleaning” of sewers and septic tanks. As per the law manual cleaning of sewers and septic tanks, if necessary, may be carried out only in highly controlled situations, with adequate safety precautions, and following specific rules and protocols for the purpose. The BOCW Act, 1996 and Rules specify the health and safety requirements of building and construction workers in India with a purpose to safeguard them against the high risks of life that are inherent like construction, alteration, rectification, maintenance, repair, and demolition work. It applies to every such establishment in which 10 or more workers in any building or other construction work are employed or had employed on any day of the preceding twelve months. Contractors shall obtain necessary permits/ licenses regarding inter-state migrant workers.
8	Reporting to PCB	As per the WPA Act 1974, EP Act 1986, the operator of STPs should submit a report to GPCB, on the status of management of sewage. Six monthly compliance (environmental clearance/ CTE) reports are being submitted to GPCB.

Annexure C: Stakeholder Consultations

List of Stakeholders Consulted

Stakeholders	Date
Peoples Representatives; Elected members of AMC/councillors	14/06/2021
Roads Department	04/06/2021
Contractors currently responsible for STP maintenance	28/05/2021
Contractors responsible for Drainage Projects	11/06/2021
Citizens, SHGs, Ward Zone officers	10/06/2021
Vulnerable groups People staying/ shops/ others stating/ working/ doing any activity nearby Urban Poor/slum dwellers/ migrants/squatters; Shop keepers, vendors/hawkers Transporter, Auto, and Truck Government bodies, Traffic police, and other depts	
CCRS; E-governance; Ward officers/ In charge of complaints	4/6/2021
City Planning Department	04/06/2021
Heritage department	01/06/2021
AUDA	21/05/2021
GUDM	02/06/2021
GUDC	
SBM	15/06/2021
NGOs	
Meeting with Self Employed Women's Association (SEWA), Trade group	13/05/2021
Meeting with Mahila Housing Trust (NGO)	15/05/2021
Meeting with NHSRCL	19/05/2021
Panchayat Members of nearby villages – upstream, downstream: Villages/ settlement Koteswar, Gyaspur, Ropda and Chosar	June to September 2021,
Taluka Development Officer, Daskroi Taluka	09/06/2021

The key environmental and social issues were highlighted by stakeholders during consultations with AMC, NGOs, STP Operators, Consultants in the area which were conducted for ESMF and SEP preparation. are listed below:

Water and Wastewater:

- The south and east zone of the city faces water logging in some areas
- The sewage gets mixed with the water line in some networks at slum areas, Bhagwati Nagar area, and some areas of old Ahmedabad
- The problem of sewage overflow is also reported in the slum areas
- Sabarmati river water clean-up was conducted in the year 2020 so the river is clean.
- The Kharicut canal in the city does not have water for some months in the year and is facing illegal waste dumping issues.
- The STPs are functioning, however, the pollution monitoring system is not functional due to technical issues related to SCADA Systems
- STPs have on-site labs for wastewater analysis
- Due to the non-availability of the stormwater network in some areas, in the monsoon season, the stormwater gets mixed with sewerage line and dilution occurs. Though it brings down BOD load, it increases the load on the sewage pumping station which needs capacity enhancement
- The Juhapura and Fathewadi canals in the city are created to carry the treated water from STPs to the farmers in the newly added areas of AMC where the farming activities are active

- There are cases of industrial discharge into sewage lines might be taking place as reported by some of the stakeholders, which is now being curtailed through co-ordinated action of authorities as directed by Hon'ble High Court of Gujarat
- The sewage network in the old part of the city is part of earlier installations and has eroded. Whereas the newly developed areas of the city have too many underground utilities already installed. Currently, the micro-tunneling option is being explored by AMC to address this issue at some places
- Some of the piers of the new ring road bridge built over the Sabarmati river has reported corrosion issue.
- In some areas, the STP plants have reported that the pipelines and machinery parts have been damaged due to corrosion issues. To protect the STP unit, an automated system of pH monitoring and stream diversion is installed. Therefore, whenever there is a reduction in pH below certain levels, the stream is diverted to the Sabarmati river using by-pass lines. However, this leads to the addition of pollution to Sabarmati
- The villages the downstream of Sabarmati river are Vasna barrage, Ulkha village, and several other areas till Khambhat
- The drinking water plant at the North crossing of the Narmada Canal is renewed to address the high turbidity issues
- The extraction of groundwater is done in some areas of the old city and also in some recently added villages of the AMC area
- The dumping of waste into river/ canal areas is an issue at some places in the city.

Infrastructure Developments:

- The Sabarmati Riverfront Development is completed for about 11 km of stretch and the phase-2 development is also proposed to be commenced in near future.
- The old city is planned to be developed as Business Hub
- A new STP unit at Gandhinagar is proposed
- The metro railway construction work is ongoing at Opal, Paldi, Chandrabhaga Nagar areas. Waterlogging issues are reported in these areas.
- Recycle and Reuse treated water is the major vision of AMC.

Group	Key points raised
Urban Poor/slum dwellers/ migrants/squatters	• Loss of income and earnings due to pandemic. Income is gradually picking up. • Squatter households do not have access to municipal services. Mostly practice open defecation near highway or forest areas and other areas which are accessible to them. • Some squatters have approached concerned Government depts for addressing their concerns. • Migrants are mainly working in industries and labor work, construction, etc. • Urban poor are working as domestic workers, selling fruits and vegetables, and as hawkers and vendors. • Women hawkers and vendors support male members and do not get any income from business although they are involved in the work. Very few women were earning independent incomes. • Some of the pucca slums such as Jawahar Nagar had toilets that were constructed by AMC for individual families. • Waterlogging and gutter blockage during the rainy season. In some areas, people pay to remove solid waste from the gutter which is affecting their houses. • Mixing of wastewater with drinking water and contamination were reported in a few areas. They also reported water-borne disease as prevalent. Other reported viral fever and asthma case • In some areas in Narol Naroda, overflow from sewage drain was reported. • Some communities or occupations were more severely affected such as musicians, street vendors, hawkers, etc. • Housing is a major issue, especially for migrant squatters.

Group	Key points raised
Villages/ settlement Koteswar Gyaspur, Ropda and Chosar	• People facing health issues due to water pollution. Respiratory ailments due to GIDC/industries dumping effluents in the sewer lines or releasing them in the air. Humans and livestock have had major health issues. • Farmland is affected due to wastewater from STPs and water pollution. Farming and dairy has decreased due to water pollution and effluents • Cases of malaria and dengue were reported. • New borewells have to be constructed every two years by panchayat due to water contamination issues. • In one village alcoholism and domestic violence were common. • People want treated water to be released for STPs so that it could be used for irrigation. • Kharkuas are in the village which is cleaned as required. Community toilets were not available for the poor or were in dilapidated conditions. • Adequate water supply was not available for some villages or some households in villages. • Post pandemic, there are livelihood issues for women with little or no earnings.
Shop keepers, vendors/hawkers	• Do not have access to sanitation facilities in business areas. • In some areas have benefitted from AMC works of road repairs, tiling of the market area, and work on drains. • In some areas such as Bhadra, they are willing to cooperate to provide between 5 to 7 meters of space during implementation. In other areas, hawkers have asked for space during implementation to carry normal business. • During the pandemic, AMC has not carried out repair work or any checks. • In some areas, women said there was a public toilet they could use but mostly there were no such facilities. • Livelihood should be safeguarded during construction by making arrangements to avoid disruption of work/business. • Solid waste management services should be improved. • In some areas, people reported vehicular pollution and air pollution from industries.
Contractors	• Based on the experience with similar projects, the key constraints leading to time and cost delays are: • Bare minimum space requirements necessary for undertaking works are difficult to arrange and management especially if there are no alternatives. • There is non-cooperation from localities and the workspace is constantly challenged. • The congested and busy roads are old, and maps are not available. • New features and factors should be added, and contract documents need to be on an equal platform and have equal bearing on both parties. • Time and cost increase if there are constraints in implementing • Health issues in workers working in STP. Issues related to odor. • All policies and compliances are included in RPF and tender document • Lesser women work due to travel, remoteness of the site, etc. • Issues with old equipment, weathering of machinery and equipment. Need to assess if a modification can result in better performance of the machinery and equipment. • The collection of garbage can lead to a greater life of machinery. • Largely fewer women working in MT and STPs due to various reasons. • Provisioning of a tripartite agreement between contractors, subcontractors, and AMC to expedite payments. • There are instances of the influx of heavy chemical water into the sewage which may impact the durability of the structure and equipment. • There are instances of the influx of heavy chemical water into the sewage which may impact the durability of the structure and equipment.

Group	Key points raised
	• Participation of few woman workers owing to bad site condition i.e. remote location and availability of inadequate skilled women workers due to perceived Environment safety issues. • However, almost about 50% participation of women is in unskilled jobs as both husband and wife are usually engaged. • Usually, women candidates are engaged as Lab. Technician and Engineer. • Solar power is not used in any of the STP
Transporter, Auto, and Truck	• Issues related to parking and drainage. More of an issue for a smaller vehicle such as autos and cars than trucks • Diversion during work on roads or drains is problematic as diversion routes are not good leading to traffic congestion. • although there are more than 2.5 lakh auto-rickshaw drivers are there in the city but AMC or any other implementation authority of the city never involved them for any suggestions or any issue related to road development. • Many times stakeholders are not well informed or re-informed and these led to many problems for the traffic as well as drivers. • Time loss and money loss due to diversion and reconstruction. • Many times, traffic diversion happens because of waterlogging, new construction, or repairing, however, they are not well informed about water logging or traffic diversion. • Another issue which was brought to the notice was about flyovers and absences of service roads. During rains and waterlogging, areas under the bridge are affected and poorly designed roads and service roads create a panic situation among commuters and residents also. • Many circles have been created and many diversions have in the roads and when people raised some concern and reported to authorities to look at the matter and urge to solve the problem, they did not get any positive or promising responses from the authorities.
NGOs	• High rate of suicide due to Pandemic • Some areas are unsafe for women • Housing had been provided by Government for LIG which LIG households refused and preferred staying in shanties and encroachment on roads. • Community awareness on malaria/dengue/Covid-19, particularly because in 2020, there was a high rate of infant mortality among middle-class groups. As was reported, Drishti testified that it was due to dengue. • Issues related safety and security of workers are neglected by contractors at the field level due to the absence of a monitoring mechanism. • Construction workers need to be provided with better civic amenities at construction sites • During pandemic time health and hygiene issues were neglected • Training to vulnerable and marginal people for their livelihood, • Provision of the common facilities for women in the area where SHG are working • Support of AMC provided for livelihood and housing • Challenges after Covid and loss of job because of no mobility. • Issue of transportation • Other issues are like unavailability of raw material like yarn and increased cost of transport, time of travel because of heavy traffic and roadblocks, road diversion, etc which reduces the productivity and earning too. • There could be several settlements that are on encroached land or houses are on the drain. Some of the slums have an issue of drainage and mixing of drinking water with drain water. • In periphery slums, the individual connection of sewer lines is a problem. They have mostly soak pits. • Solid waste is collected but not recycled.

Group	Key points raised
	• Vulnerable groups do not have access to the GRM of AMC.
Government bodies, Traffic police, and other depts	• Rehabilitation work started in old lines as often major breakdowns happen there. All rehabilitation works take place with no dig technology to minimize the disruption. • No-dig technology is specialized work and requires specialized labor to come in. For this labor camps may be required. • Stormwater getting mixed up with sewage is a major problem • The machinery purchase tenders do not have a clause for energy efficiency. • There are no standard vibration limits set for works near heritage structure • If a project requires detailed impact assessment or not is decided on a project-to-project basis. • On the eastern side, a dense population especially near the Kharicut canal creates a problem. • On the Southern side main issue is that the main trunk is silted leading to breakdowns. • No systematic drainage line is there as there is a lot of encroachment. • In the central zone, lines are very old and are often choked due to silting. • Encroachment on government land on the main trunk line is a major issue. • Encroachment is a problem in narrow zones. • They have a very good GRM method. With each complaint, the respective assistant engineer is notified. Each complaint is monitored at the zonal head. • Most complaints come from residents who register their complaints at the zonal level. Some also go to the local councillors. • The majority of the complaints are on drainage issues. • In some places complaints also come because of industrial waste. • There is no provision for compensation for unauthorized structures. • The villages in the Taluka on the river bank face the problem of dirty untreated water in the river, which cannot be used for drinking. • This dirty untreated water is released from the industry which is close to the Talukas and is after the ETP. • Involvement of various bodies like traffic association, transport association, residential welfare society, and other NGO as an important stakeholder. • Signages and diversions signages are largely missing. • Traffic dept. is informed at the later stage by contractors and concerned parties making it impossible to prepare adequate traffic diversion or road closures. • Diversion is usually on service roads, the conditions of which are not good, and which affects traffic movement during implementation. • If long term work is planned on roads, adequate arrangements are needed to improve service roads for better traffic flow • The details of contractors are not displayed, preventing the traffic dept from contacting them for traffic-related issues. • For all work undertaken on roads, the traffic department should be informed at least 15 days in advance to plan for the traffic flow. • At present, there is no communication procedure with the AMC.
Associations- Chartered Accountants, Ahmedabad Medical, Water Management Forum, Gujarat Chamber of Commerce &Industry	• Property taxes are paid online and also at the concerned center. Online payment is not thorough. Sometimes receipts are not generated although amount is deducted, sometimes multiple receipts are generated. • Professional tax payment online is not satisfactory for companies with offices from location outside Ahmedabad due to which companies have a problem in making payments. • They have faced problems in property tax payments for commercial property due to issue of increase of 10 % in area as per AMC. Measurement had not been done and payment were made as per the property tax issued by AMC. There was a

Group	Key points raised
	discrepancy between the builders' data and owners' details. There was no basis given for the increase in 10 % area. • There is a lack of system for filing applications online. Current GRM, is not working. If commercial area related grievances are to be filed, aggrieved party is asked to produce Shop and Establishment certificates (Form A), which has to be procured. • If taxes are raised there have to be good services. Services are not good or satisfactory people will be reluctant to pay increased taxes. During summers, there was cuts in water supply. If taxes are increased people need to be informed on what would be the benefits given the citizens against the increased taxes. • There are also issues with respect to cleaning of gutters (internal and external for which people have to pay Rs. 2000 to Rs. 3000. This should be standardized or fixed and be disclosed or transparent so that people know how much they have to pay for the services. • There has to be a system or scheme for people who have not paid taxes in the past. AMC may charge penalty or offer indemnity against payment of pending taxes. • There should be liberalized scheme for payment of Professional tax. • The tax collection process needs to be improved substantially and AMC should have a 100% tax collection drive. • Blacklisted contractors are given government contracts. Departments should charge penalties from contractors for shoddy work and delays in implementation. • There is no planning in Ahmedabad and there should be proper planning for development. Problems are related to no planning. • Ahmedabad was the first city to get both underground sewer lines and electricity. System was started in 1950. Sadar Vallabhbhai Patel was the Mayor of the walled city. • Waterlogging is not there in the walled city despite heavy rains. But in new city areas, waterlogging is a significant problem. Storm water drainage is very poor. • Opinion from experts of IIM and NID should be taken during design of system for clearing floods and preventing floods and conduct consultations. • Problem of sewage pipes choking is mainly due to open dumping of plastic related wastes like Gutkha/ tobacco packets, Potato chips packets etc. which are not collected and disposed properly. Biodegradable waste is also wrapped in plastic bags, Food packaging, plastic bottles & paper plates, cloths are also discarded which chokes drains and cannot be cleared with the jetting machines by AMC. • In some of the old areas, communities also dispose animal wastes into the gutters and drains which get choked and can't be cleaned using the jetting machines. To address this issue IEC activities and programmes are required on a large scale to bring about behavior change in the people and users. • Manual scavengers are still being used for manual cleaning on gutters which have resulted in approx.20 deaths in last year. This should be stopped completely. Manual scavenging is not permitted by law. • All engineers do not have a vision or scope to design the city network. After construction of roads, there is digging of the roads for various purposes. There is no coordination of the activities involving roads. • Tunnels are required for connections on sides of roads. • People are not aware or informed about saving water as there is no fixed price and the current price is nominal and not the actual. Therefore, people waste it or see no gains in saving water. Once water meters are installed, people will be careful and vigilant towards their use of water. • If there are water meters for water, then control of water wastage can be done. Charges are negligible. Societies have set water meters due to which water wastage has reduced. Electricity bill has reduced for societies indicating less water being pumped. 10 % of large societies have installed water meters from funds. • Poor people want clean treated water for free. Water should not be given free.

Group	Key points raised
	• Hospitality Industry, for example: five-star hotels do not agree on putting up saving water posters as they want to give the facility of bath tubs, swimming pool etc. and unlimited use of water to their customers. • GWRDC have to give permission for bore wells. Bore wells are common in Ahmedabad. A monitoring network is required for observing ground water tables and also strict compliance to ensuring that unauthorized bore wells are not allowed to come up. • Taxes for sanitation are required on pay and use basis. Nothing should be free, there should be some charge on every services. People are used to getting free services. This should be as per political leaders will. • GRM of AMC is effective, compliant as made and issues was identified after three days and resolved. They were provided with tanker water. There may be delays. • The taxes are on par with other cities. Looking at inflation and cost of living in city, naturally taxes should be increased. There should be good facilities. Therefore, a rise of 10 % after every three years is acceptable. • Regarding AMC charges related to services. At present the charges are less as per the facilities provided. If the facilities/services are increased, then charges can be increased. Today all people need the facility. Therefore information should be given first before development activities are initiated. • Contractor management for STP has to be strengthened. • Strong action has to be taken against the offenders. • Environment Committee of GCCI/industries is willing to support/operate STP properly. if any such arrangement can be made. • The online system for tax payment is appreciated. • GRM-The system is not 100 % effective. Sometime the complainant gets message for successful resolving of complaint even though issue is not addressed. AMC Sewa Online app has been used and has been found to be effective a few times in a specific area. • People are not satisfied with sewage related issues. While population has increased exponentially the capacity of the drainage load has not increased correspondingly. • If AMC services are improved, then the taxes can be increased. • In new development areas there is no coordination or synchronization between various government depts. which is reflected in the post development. There is repeated tarring of roads as each department digs/excavate the roads for their own purpose and installation/ maintenance works, the height of new roads is more than the nearby existing older structures, During heavy rain, Its easily gets flooded/water logged in lesser time, drainage network is not properly planned and in newer areas which have wider roads, there is still an issue with floods after rains. • There were also issue of solid waste choking the drains in some areas due to disposal of wastes especially animals (chicken & meat) waste in storm water drains or gutter. • Professional tax is raised to the tune of Rs 200 crores. This is a barrier to trade development and should be removed. The same amount and more can be raised through a percentile increase in corporation taxes. This is a policy decision at the GoG level and has been discussed in the past which has not yet been addressed. • AMC taxes should be simplified, and heads should be renamed for specific charges. • Improper Sewage management in Ahmedabad is constantly damaging the city's drainage system. • CETP- pollution treatment is not present. The existing municipal lines get damage due to industrial effluents being released in municipal sewer lines, from industries. The lines are separated in Naroda, Narol, Vatva and Odhav area. While, the city also requires to separate the drainage lines for residential sewage and industrial effluents in areas like Behrampura or near Industrial clusters, Industrial estate areas.

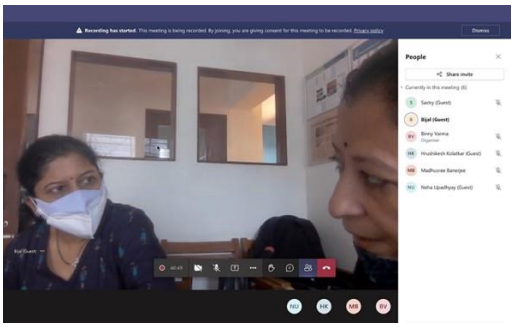
Group	Key points raised
	• Unauthorized waste water disposal from industries have corroded the sewer lines and action has to be taken by AMC to stop such unauthorized practices Also, illegal disposal of industrial effluents on barren / farm lands / river must be terminated. • There would be betterment of all members of society, when water used is treated and recycled. • Textile industries in Ahmedabad have higher water demand while, treated and recycled sewage water will benefit all. Recovery will be from industries. In the future there may be scarcity of water and recycled water will be one of the ways to address the issue
Disclosure- Vasna Urban poor, migrants, minorities, differentially abled, women, elderly etc	• Daily wage labourers, skilled and unskilled workers • Family size is between 3 to 10 children • People use AMC's health and education facilities. There is poor or no hygiene • Lack of livelihood opportunities. • Water, drainage connections are not available as it is an informal settlement. • Houses are kaccha and mostly hutments • They get water from borewell and ground water quality is very poor. • Some families have goats which fall sick due to drinking river water or washing.
Disclosure- various stakeholders	• Brief description of the existing and proposed projects for 375 MLD and 240 MLD STPs in Vasna and 180 MLD in Pirana. • Identification of risks and institutional responsibilities. Plan for monitoring impacts and implementation measures and strategy of public consultations. • The points considered for planning. • Waste water treatment and reducing pollution. NGT guidelines. • Storm water management will be dealt with separately. • Institutional framework and technical support • Monitoring and implementation • Strengthen Organization for undertaking such projects in the future. • There is no land acquisition in these projects. • Samples are collected: noise quality, sludge, air water etc. and analysed. • Findings of the project. Not ecological sensitive areas in Ahmedabad. Air pollution concerns • Baseline data described here. • Samples of 126 plants. 54 acres of land within compound wall. No structures within compound • CND wastes, improvement of water quality and sludge post implementation. • In Pirana 27 acres within plant boundary wall. No R&R issues. ESMP plans are prepared • Residential areas are more than 1 kms away. • In vasna there are some settlements nearby. • water quality in Sabarmati river will improved due to technology and NGT standards • The reports can be accessed on the AMC website[90]. AMC invites participants comments and suggestion. • PMC will be appointed for the project. Participants to give their comments, views and suggestion for the ESIA and ESMP uploaded. The Draft ESMF was disclosed both in English and Gujarati on the AMC and GUDM website for feedback from stakeholders on Feb 10, 2021, before the appraisal. This was further updated following the consultations held during Feb – March and June 2022. Sub-project-specific ESIA, ESMPs (for substantial risk subproject to be

[90]https://ahmedabadcity.gov.in/portal/web?requestType=ApplicationRH&actionVal=viewAttachment&queryType=Select&screenId=2900003&AttachmentFileName=ESMF.pdf and https://ahmedabadcity.gov.in/portal/web?requestType=ApplicationRH&actionVal=viewAttachment&queryType=Select&screenId=2900003&AttachmentFileName=ESIA-126-MLD-STP.pdf

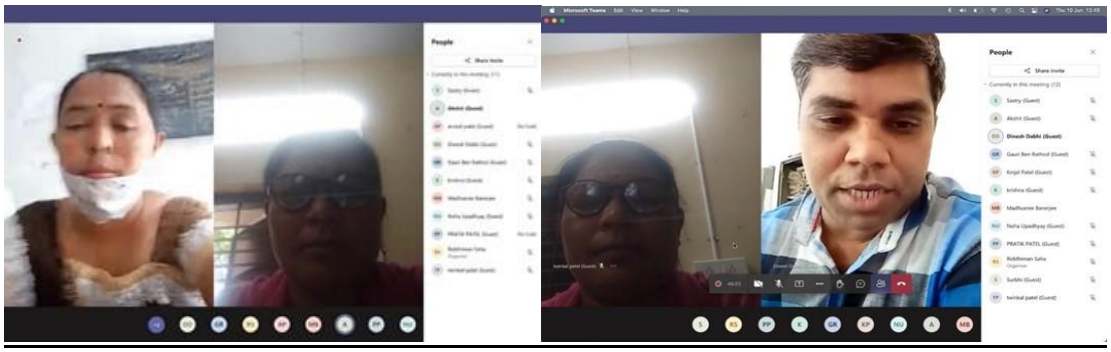
Group	Key points raised
	implemented under the project initially), were disclosed in English & summaries in Gujarati for consultations – hard copies in PIUs and the Zonal Offices of AMC, and soft copy on PIU websites. ESMF and ESIA for initial investment (substantial risk) were disclosed in the country and in-World Bank external website on Feb 10, 2022 . Public consultation was conducted on 07/06/2022 by AMC in Pandit Dindayal Upadhyaya Auditorium, Bodakdev, Ahmedabad. Invitations (in English and Gujarati) was circulated to various stakeholders such as elected representatives (Councillors), Mayor, Deputy Mayor, CSO, NGOs, Municipal Commissioner, Deputy Municipal Commissioner, heads of Committees and others. Notices were also published in the newspapers in both languages. The key concerns raised by stakeholders in all consultations post disclosure have been incorporated in the ESMF and ESIA for 375 MLD STP. The suggestions of the stakeholders include monitoring of noise, sludge, air and water and its analysis for defining the baseline and mitigation measures. The project suggests improved management of all wastes and treated water quality to confirm with latest NGT suggested standards. Labour health and safety will be given high priority and appropriate measures to follow and monitor labour regulations have been suggested in the ESMF and ESMP.

Photo presentation of Consultations

Meeting with Zonal Engineers of AMC



Consultations with Mahila Housing Trust



Consultations with SHGs

Consultations Meeting with Peoples representatives of AMC

Disclosure

Annexure D: Safety Aspects of Vasna Barrage

Vasna Barrage Details[91]

Project Identification code	GJ04MH0301
Name of the dam	WASNA BARRAGE
Year of completion	1978 (less than 50 years)
River	Sabarmati
nearest city	Ahmedabad
type	PG
Bed Rock	**Recent sandy river deposit**
Energy dissipater	**Stilling Basin**
Height above lowest foundation (m)	20.75 (Large)
Length of the dam (m)	610.00
volume content (10^3m^3)	635.00
Gross storage capacity (10^3m^3)	5350.00
Reservoir area (10^3m^3)	2959.00
Storage capacity effective (10^3m^3)	5390.00
purpose	**Irrigation**
Top of Dam R.L.(M)	**46.02**
HFL	41.76
designed spillway capacity (m3/sec) - Max Discharge	21000.00
Total Volume Content:	**Concrete 0.068 Mm3** **Masonry 0.053 Mm3** **Earthwork 0.306 Mm3**
Villages under command	a) District / b) Taluka / c) No. of villages Ahmedabad / Dholka / 33 Sanand / 45 City / 2 Daskroi / 6 Viramgam / 1 Total / 87
Type, Nos. and size of gate	Vertical, 24, (18.30 m x 3.66 m) 4, (18.30 m x 4.88 m)2, (18.30 m x 4.27 m)
Canal Discharge Capacity	Right Bank: 6.9Km long, 45.29 cumecs

Applicable Regulation

ON December 02, 2021; India passed its **Dam Safety Bill**. The bill recognizes that the ageing of dam assets warrants serious concern on their safety aspects in terms of meeting prevalent norms. Ageing dams may also serve as a cause of concern for people living in the areas nearby. The bill provides for surveillance, inspection, operation and maintenance of the specified dam for prevention of dam failure related disaster and also makes provision for institutional mechanisms to ensure their safe functioning.

There will be four layers of monitoring — two at the central level and two at the state level — to ensure dam safety. A National Committee on Dam Safety (NCDS) will be set up at the central level,

[91] http://environmentportal.in/files/National%20Register%20of%20Large%20Dams%202009.pdf

which will be headed by CWC chairman, and include 10 representatives of central government not below the rank of joint secretary, nominated by the Centre, and seven representatives of state government. A National Dam Safety Authority (NDSA) shall also be established within a period of 60 days, which will implement policy, guidelines and standards evolved by NCDS. Any decision taken by the NDSA shall be binding upon all the parties. At the state level, each state government shall establish a State Dam Safety Organisation (SDSO), which shall be constituted within a period of 180 days. The SDSO shall keep perpetual surveillance, carry out inspections and monitor the operation and maintenance of specified dams falling under their jurisdiction. States will also have to constitute a State Committee on Dam Safety within 180 days after the commencement date of the Act.

The bill will cover all dams constructed before or after the commencement of this Act, which are above 15 metres in height, measured from the lowest portion of the general foundation area to the top of the dam, or between 10 metres and 15 metres in height and satisfies at least one of the following: The length of the crest is not less than 500 m, the capacity of the reservoir formed by the dam is not less than 1 MCM (million cubic metre), the maximum flood discharge dealt with by the dam is not less than 2,000 cumec (cubic metre per second), or the dam has specially difficult foundation problems or the dam is of unusual design.

Institutional Mechanism for Dam Safety in Gujarat

GERI monitors the safety aspects of the dams in Gujarat as the Dam Safety Organization for Gujarat state and functions in coordination with the Dam Safety Monitoring Directorate (DSMD). The inspections are carried out regularly as per the norms laid down by the DSMD of the Central Water Commission (CWC), New Delhi. Most of the dams in Gujarat are owned by Water Resources Department, except the 7 associated with Water Supply schemes owned by Gujarat Water Supply and Sewerage Board or Municipal Corporations. At present pre monsoon and post monsoon inspections are carried out by the field officers of the Department and necessary checks are exercised during the inspections. The inspection reports are sent to the project authorities by Central Design Organazation Gandhi Nagar of the state Dam Safety Organization Gujarat Engineering Research Institute (GERI) for review and suggestions. Periodical inspection of major and medium dams is carried out in the phased manner by the dam safety organization. Deficiencies notice during inspections are pointed out and necessary remedial measures are suggested. The project officers arrange for the implementing the measures and try to rectify the deficiencies.

Safety Audits

Irrigation Department of the Government of Gujarat conducts annual safety checks pre- and post-monsoon and reports any issue with structural, mechanical or other aspects. These are attended to by the department at the earliest. Dam Safety Act (Dec 2021) requires the dam owner to undertake a comprehensive dam safety evaluation through the panel of independent experts and prepare an Emergency Action Plan within five years of the commencement date of the Act. Detailed guidance for a comprehensive dam safety review is provided by the Guideline for Safety Inspection of Dams (CWC, January 2018).

Dam safety Authority (CDO of GERI) had conducted a comprehensive safety analysis / Health status [92]of all Dams and Barrages in Gujarat (Report presented in 2015) and all deficiencies were addressed through Irrigation Department. Health Status of Vasna barrage reported is presented here.

https://guj-nwrws.gujarat.gov.in/downloads/health_status_report_14082015.pdf

ort_14082015.pdf 45 / 183 − 100% +

Annexure – 4A
Observation & Remedial majors as suggested by Superintending Engineer, C.D.O., Gandhinagar
DETAILS OF 22ND HEALTH STATUS

(Period 1.1.2013 to 31.12.2013)

(A) Gujarat Region

7	Vasna Barrage	7/6/2013	**Gate no.26(size 60' x 16'):**	
			* There was some trash entangled in between side seal and nose angle of pier.	* It needs to be cleared.
			* There was some problem in magnetic brakes of electrically operated hoist.	* The gate can be fully raised & lowered, but as a precaution, it was not desirable to fully raise it until repairs were made to magnetic brake systems
			Gate no. 27(size 60' x 16'):	
			* There was some trash entangled in between side seal and nose angle of pier.	* It needs to be cleared.
			Gate no. 28: (size 60' x 16'):	
			* There was some trash entangled in between side seal and nose angle of pier.	* It needs to be cleared.
			* During hoist operation, it was noted that there were slightly more vibrations on right side of gate as compared to left side.	* It is instructed to check it after filling of reservoir and take necessary measures if it persists.

[92] https://guj-nwrws.gujarat.gov.in/downloads/health_status_report_14082015.pdf

		12/12/2013	**Horizontal Girder:**	
			* The dismantled gates lying on ground allowed for a very close examination of gate components. Deposits of silt were found accumulated in horizontal girders and some other parts of gates including lifting bracket area.	* Before taking up any repair work, all gate components need to be thoroughly cleaned, examined and assessed.
			* There was rust formation on many parts of the gates, especially on upper side of web plates resulted in considerable reduction in effective thickness. Close inspection also revealed that there was corrosion under even painted surfaces, with scale formation coming off upon blow of	* Before repairing of any gate, it needs to be cleaned thoroughly and made free of any silt deposition, rust scales etc. and after scientific mapping they need to be repaired accordingly.

Sr. No.	Name of Scheme	Date of Visit	Observations	Remedial Measures
			hammer.	
			* The stiffeners of horizontal girder were found corroded. In many cases, corrosion was severe. Strengthening of the same was carried out by providing intermediate stiffners. In some cases it was observed that the additional stiffners was not cut to as per required length exactly leaving large gap with flanges of the girder.	* Take necessary actions.
			* After providing the additional stiffners in horizontal girders, it must be checked that they will not obstruct water flow to drainage holes in the girder web.	* Additional new drain holes need to be povided at appropriate locations.
			* It is extremely important and necessary that strengthening of any component is carried out with thoroughly cleaned surface. It was also observed that new stiffners were welded on the corroded surfaces and with insufficient kength. This would require very larg size of welding.	* No additional stiffners need to be fixed on the corroded surface, without proper cleaning.
			* According to details of mapping, it is observed that the thickness of the following girders are observed to have been reduced considerably due to corrosion/rusting. 1) Gate No.1: Top Horizontal	* The Corroded web portion is suggested to be replaced with the plates of design thickness. Such replacement need to be carried out after taking into consideration the surrounding area and joints.

Sr. No.	Name of Scheme	Date of Visit	Observations	Remedial Measures
			Girder 2) Gate No.6: Top & Bottom Horizontal Girder 3) Gate No.7: Top & Bottom Horizontal Girder 4) Gate No.8: Bottom Horizontal Girder 5) Gate No.9: Top & Bottom Horizontal Girder 6) Gate No.11: Bottom Horizontal Girder 7) Gate No.12: Top & Bottom Horizontal Girder 8) Gate No.13: Bottom Horizontal Girder 9) Gate No.14: Bottom Horizontal Girder 10) Gate No.15: Bottom Horizontal Girder 11) Gate No.16: Bottom Horizontal Girder	
			5) Gate No.9: Top & Bottom Horizontal Girder 6) Gate No.11: Bottom Horizontal Girder 7) Gate No.12: Top & Bottom Horizontal Girder 8) Gate No.13: Bottom Horizontal Girder 9) Gate No.14: Bottom Horizontal Girder 10) Gate No.15: Bottom Horizontal Girder 11) Gate No.16: Bottom Horizontal Girder 12) Gate No.19: Bottom Horizontal Girder 13) Gate No.21: Bottom Horizontal Girder 14) Gate No.29: Bottom Horizontal Girder 15) Gate No.30: Bottom Horizontal Girder	

			Skin Plate & T-Vertical:	
			* Skin plates of most of the gates is found having more or less degree of rusting/corrosion. Generally the corrosion is more severe at the end portion & bottom of the gates. In case of gate no. 29 & 30, skin plate was highly corroded at the bottom and the sides. the skin plate of gate no. 30 was found damaged and bent at many places.	* All the places where the thickness is less than 7 mm (against the design thickness of 10 mm), the same shall have to be replaced. * The field officiers are requested to follow original design drawing and the drawing furnished vide this office vernacular letter no. CDO/B/Vasna Barrage/2 dtd.21/1/2013 to carry out the repairing.

Sr. No.	Name of Scheme	Date of Visit	Observations	Remedial Measures
			Lifting Bracket Assembly:	
			* Rusting is found at lifting bracket connection with girder in almost all the gates. Also connection of the bracket plates with top girder flanges are also rusted in many cases.	* It is suggested that the lifting bracket connection area need to be cleaned thoroughly , thickness measured. * Excessively corroded components need to be replaced (as per the original drawing of respective gate). * These connection need to be restored as per the original drawing (considering the respective gate). * while replacement, the web plate need to be examined and the same must be of 12mm thickness, as this connection has a strong reliance on the web and flanges of the girder.
			Rubber Seals:	
			* The plate fixing for rubber seals were found damaged at many place.	* The damaged portoins need to be replaced.
			Vertical Bracing:	
			* Vertical bracings in many gates were found deteriorated and also their welded connections also found rusted.	* This needs to be attended and repaired/strengthened immediately.
			Other Observations:	
			* At many places cutting. Fitting and welding of end workmanship found deficient. It was observed that pieces of plates, stiffners etc were not cut as per required shape/dimension and if falling short, the resulting gap was being filled with packing plates and welded.	* This needs to be resulted in very weak connection and will not take design load. This needs never be allowed.

Discussions on Vasna Barrage and Flooding

Project investments include developing new Sewage Treatment Plants (STPs), Rehabilitating existing STPs, Improving Sewerage and Drainage networks in the city of Ahmedabad, Gujarat State, India.

Among identified investments during preparation, around 780MLD discharges downstream of Vasna Barrage, while 60 MLD, upstream of Vasna Barrage. Currently, this quantity of wastewater (sewage) is still reaching Sabarmati upstream / downstream of the barrage without treatment directly or indirectly. During project implementation, new subprojects may be added including discharge of stormwater upstream/downstream of the barrage (eg: proposed STP at Koteswar). It is not possible to estimate the complete volume of discharges at the preparation stage.

Sabarmati River bifurcates Ahmedabad into the East and West parts. It has a (Large) Dam upstream 133 km at Dharoi. There are many barrages including Vasna 132 km (last one) downstream of Dharoi. Some barrages are under construction / proposed between Vasna and Dharoi Dam, which are not part of the project.

Vasna Barrage is located to the south of the city, across river Sabarmati, aimed at irrigating areas downstream of Ahmedabad city. (87 villages – Gross Command area: 129500 Ha, Culturable Command area: 96883 Ha, Max Irrigated: around 30000-40000 Ha). The barrage was constructed in 1976. [93]It is marked as a Medium High Large Dam in the National Register of Large Dams, India. The Barrage retains water diverted from Narmada Canal at the Sabarmati Riverfront for aesthetics and tourism (depth of 2 to 6m along the riverfront, for around 10 km all-round the year, width averaging around 300m) and releases water for irrigation through Fatehwadi Canal, which originates from the Vasna barrage. River downstream of the barrage has a water depth of 0.5m or less for most of the year, except monsoons/rains when flooding occurs for a few days. During 2017, discharge was 86597 cusecs from the barrage. As discussed, there is coordination between Dharoi and Vasna barrage operations as any delay in opening the barrage would cause flooding in Ahmedabad, which is an economic/industrial/high dense city. Safety of the barrage is checked by GERI, the Dam Safety Organisation of Gujarat in 2013, and Post and Pre-monsoon inspection is carried out by Irrigation Department annually.

Depths of water available downstream of Barrage

Reach: Vautha Gauge (at Ch 75.4 m) to Wasna Barrage (Ch 135.7 km). This stretch starts from Downstream of Wasna Barrage.
Depths of 0.5 – 1.0 m (above C.D.) are available for around 170 days.
Depths above 1.0 m are available for around 75-90 days during monsoon.
Depths above 0.5 m (from 0.5 to above 1 m) are available for a period of 170-200 days. Details of HFL at the barrages is as below.

LIST OF GAUGE STAIONS FOR INFORMATION
List showing the Danger Level and Warning Level in Mt. (Ft)

SR No.	NAME OF GAUGE STATION	DANGER LEVEL/ HFL IN Meter	DANGER LEVEL/ HFL IN Feet	"0" Gauge R.L. IN Meter	"0" Gauge R.L. IN Feet
1	2	3	4	5	6
1.	NORTH GUJARAT REGION				
A.	SABARMATI RIVER				
1.	Derol Bridge (R. G)	100.23*	328.85	89.00	292.00
2.	Hathmati Weir-Balochpur (R.G.)	146.40	480.34	142.50	467.54
3.	Wasana Bridge (R.G.)	41.75	137.00	38.09	125.00

"*" Before Const. of Dharoi Dam, **{95.83 mt. (314.42 ft.) After Const. of Dharoi Dam}**

Links with project activities

1. Failure or non-operation / delay in operations/malfunctioning of the Barrage could potentially impact the project investments (rehabilitation of existing STPs) which are immediately downstream, right on the river edge.
2. Ahmedabad Municipal Corporation is discharging treated sewage to Fatehwadi Canal currently, and would like to continue this, as the area is water-scarce, and Irrigation Department has requested AMC for this. During floods, the rush of water through barrage in addition to discharge of treated water might

[93] https://guj-nwrws.gujarat.gov.in/showpage.aspx?contentid=1869&lang=English.

aggravate floods especially if barrage gates (separate gates leads to canal, others to the River) leading to the canal will not close to let flood water through the river, or due to any other eventuality.

3. Discharged treated sewage from the proposed Koteswar STP (60 MLD) upstream of the barrage, may have to be released to the riverfront. This will get mixed with water at the riverfront and will be retained and released by barrage operation. Even currently, this wastewater reaches the river directly or indirectly, from various sources but is untreated as there is no treatment system. Net-net there is not much increase in quantity reaching the riverfront; but quality is expected to be much better compared to the baseline.

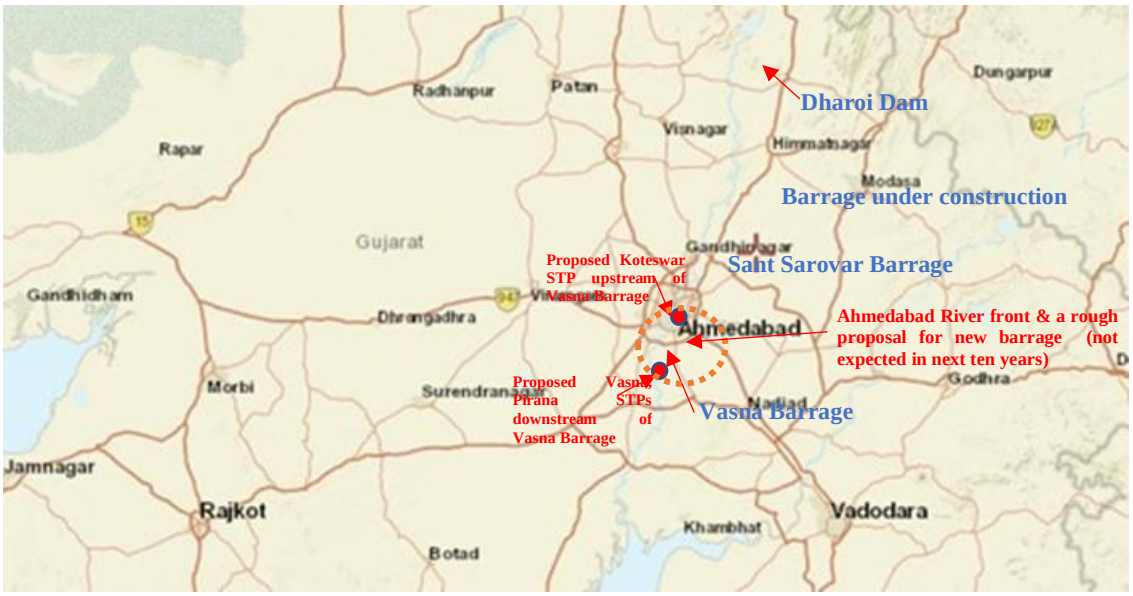


Figure A: Locational Context

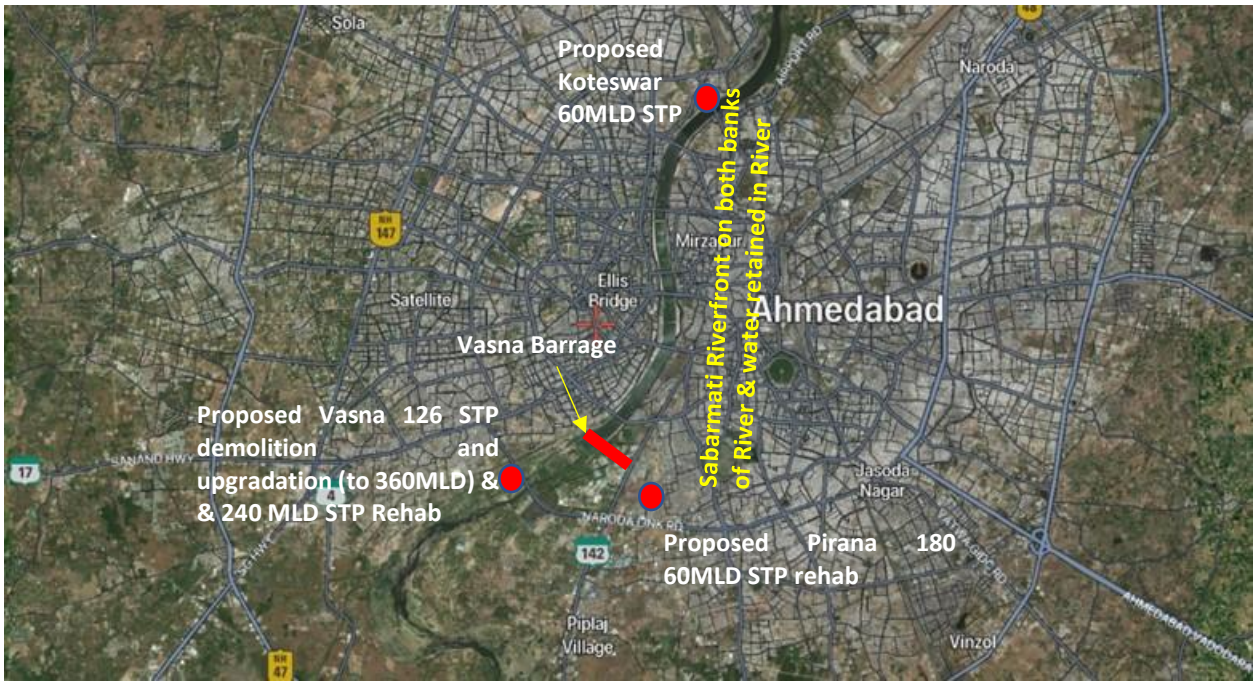


Figure B: Ahmedabad City, Proposed Initial investments, Barrage & the Riverfront

Figure C: Vasna Barrage, Fatehwadi Canal, and STPs proposed for Rehabilitation/Demolition downstream

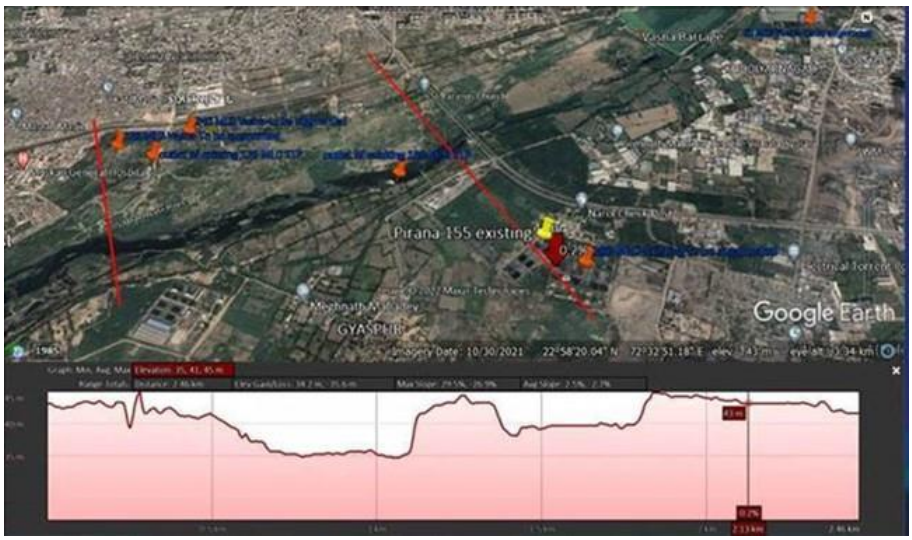
NATIONAL REGISTER OF LARGE DAMS (updated as on MARCH'2015) **STATE : GUJARAT**

Sl.No.	Project Identification Code	Name of Dam	Operated & Maintained by	Location of Dam		Year of completion	River Basin	River	Nearest City	Seismic zone	Type of dam	Height above lowest foundation (m)	Length of dam (m)	Volume content of dam (10^3 m^3)	Gross Storage capacity (10^3 m^3)	Reservoir Area (10^3 m^2)	Effective Storage capacity (10^3 m^3)	Purpose	Designed Spillway capacity (m 3 /sec)
				Longitude of dam	Latitude of dam														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
271	GJ04LH0283	Dhareshi	Govt of Guj.			1976		Local Stream	Dayapar	V	TE	10.73	1570.00	371.30	2450.00	370.00	1850.00	I	715.00
272	GJ04LH0284	Godechi	Govt of Guj.	71-20 E	22-15 N	1976		T/Sukhbhadar	Chotila	IV	TE	14.00	685.00		1909.00		1660.00	I	341.00
273	GJ04MH0285	Gokhalana	Govt of Guj.	71 - 20 E	21 - 59 N	1976		Local Vangha	Rajkot	IV	TE	19.00	635.00		510.00		510.00	I	131.00
274	GJ04LH0286	Halara	Govt of Guj.			1976		Local Stream	Bhachau	V	TE	13.45	586.00	85.40	411.00	5781.00	317.00	I	96.84
275	GJ04LH0287	Kakari Mahudi	Govt of Guj.	73-34-00	21-23-00	1976	Mahi	Kotar	Khanpur	IV	TE	13.97	810.00	340.20	688.00	455.00	611.00	I	159.44
276	GJ04LH0288	Kankaweati	Govt of Guj.	71-20 E	23 - 03 N	1976		Godra	Surendra Nagar	III	TE	14.00	2982.00	3910.00	2447.00		1907.00	I	642.00
277	GJ04MH0289	Kaswati	Govt of Guj.	69-56 E	23-23 N	1976		Kaswati	Bhuj	V	TE	15.74	1454.50	54.00	8200.00	2130.00	7960.00	I	933.90
278	GJ04LH0290	Koriyani	Govt of Guj.			1976		Local River	Dayapar	V	TE	13.40	1150.00	331.00	2700.00		N.A.	I	388.00
279	GJ04LH0291	Lafni	Govt of Guj.	73-52-30 E	22-42-00 N	1976	Mahi	Kotar	Ghoghmba	III	TE	14.83	236.00	130.78	1107.00	175.00	693.00	I	83.03
280	GJ04HH0292	Madhuvanti	Govt of Guj.	70-20E	21-15 N	1976		Madhuvanti	Mendarda	IV	TE	30.48	1219.32	412.50	11655.00	2268.00	11300.00	I	750.00
281	GJ04MH0293	Manjal- Reladia	Govt of Guj.			1976		Local River	Naliya	V	TE	15.80	1200.00	440.00	770.00		770.00	I	250.00
282	GJ04LH0294	Morchbana	Govt of Guj.			1976		Local River	Dayapar	V	TE	13.87	580.00	252.00	680.00		680.00	I	224.00
283	GJ04MH0295	Nyari-1	Rajkot Munci.Corp.	70-42 E	22-15 N	1976		Nyari	Rajkot	IV	TE	18.00	4206.00	3532.00	35350.00	218.20	33840.00	S	396.00
284	GJ04MH0296	Rupen	Govt of Guj.	70 - 11 E	20 - 57 N	1976		Rupen	Una	IV	PG	5.32	201.23	146.24	3839.40	956.90	3412.70	I.	55.91
285	GJ04LH0298	Savdi	Govt of Guj.	70 - 40 E	22 - 34 N	1976		T/Demi	Tankara	IV	TE	13.00	13.00	218.00	1730.00		1360.00	I	470.34
286	GJ04MH0300	Surjumi	Govt of Guj.			1976		River	Limkheda	III	TE	19.00	453.00	219.48	610.00	219.00	516.00	I	92.00
287	GJ04MH0301	Wasna Barrage	Govt of Guj.	72-33-00 E	22-59 N	1976		Sabarmati	Ahmedabad	III	PG	20.75	610.00	635.00	5350.00	2959.00	5390.00	I	21000.00
288	GJ04MH0302	Zanzarwa	Govt of Guj.	72-33 E	24-20 N	1976		T Of Banas	BK	III	TE	23.00	335.00		1663.00	3459.00	1533.00	I	320.58
289	GJ04MH0303	Ambakui	Govt of Guj.	70 - 28 E	21 - 07 N	1977		Ambakui	Maliya	V	TE	21.00	1620.00	190.95	1720.00		1520.00	I	323.00
290	GJ04MH0305	Anida	Govt of Guj.	70 - 36 E	22 - 06 N	1977		Local Stream	Gondal	IV	TE	15.00	760.00	41.00	824.00		651.00	I	116.00
291	GJ04MH0306	Bhekhado	Govt of Guj.			1977		Local River	Dayapar	V	TE	15.55	531.87	278.00	1180.00			I	272.00
292	GJ04LH0307	Dangra	Govt of Guj.	70-28 E	22-23 N	1977		Local Vehla	Dhrol	IV	TE	14.00	1980.00		2185.00		2185.00	I	535.00
293	GJ04MH0308	Devsar	Govt of Guj.			1977		Local River	Nakhatrana	V	TE	15.77	1430.00	933.00	1110.00		1110.00	I	240.00
294	GJ04MH0310	Fulzar II	Govt of Guj.	69-50 E	22-10 N	1977		Fulzar	Lalapur	IV	TE/PG	17.07	1660.00	286.00	3823.00	1440.00	3228.00	I	1076.00

Figure D: Details of Vasna (Wasna) Barrage

Cross section Profiles:

From the figures and data below, it is understood that the STP 240 MLD and STP 126 MLD are located on the foundation at around EL 44 masl and 42 masl respectively.



High Water Level During Large Floods

1) The top elevation of the barrage and HFL are indicated as 46.02 masl and 41.76 masl as per the salient features of the Barrage.
2) The high-water level was around 42 masl during a flood in 2006 when the upstream Dharoi Dam discharged 8,800 m3/s.
3) The high-water level at the Vasna Barrage at 135.7 km chainage was higher than 50 masl, which indicates that a large portion of both banks were overflowed by the flood.

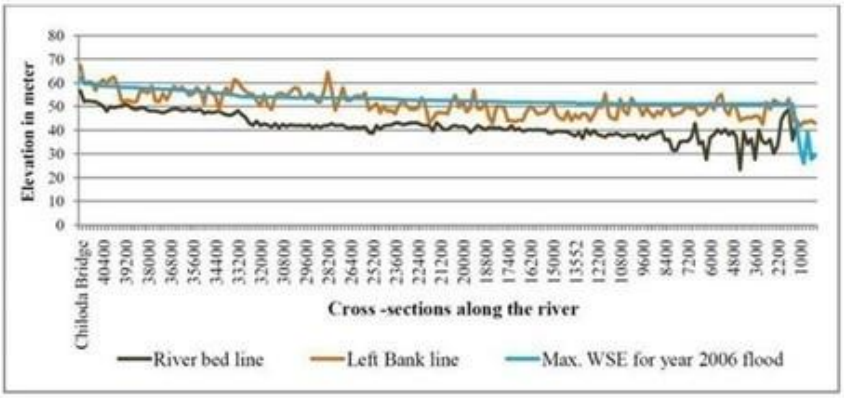


Fig. 5 Comparison of simulated water surface elevation with left bank for year 2006 flood

The IWAI report indicates the longitudinal section of the river. The survey was done in April – May 2016 when the water level was low. During large floods, such as 8,800 m3/s in 2006, all gates must have been opened to discharge all inflow to downstream in order to prevent the u/s water level rising.

Historical Flood Discharge Records

At Vautha, the historical max flood discharge was *1008.805 cumecs* and the max discharge was indicated as 7,201.6 m3/s.

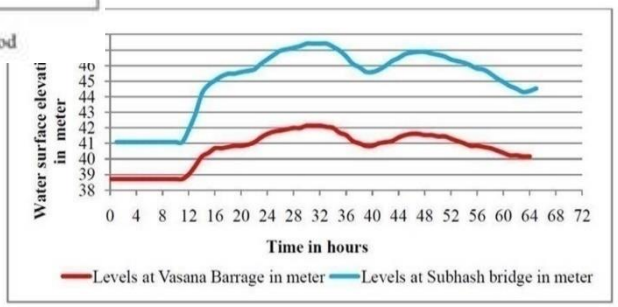


Fig. 1 Hydrographs at Subhash Bridge and Vasana Barrage for flood event of year 2006

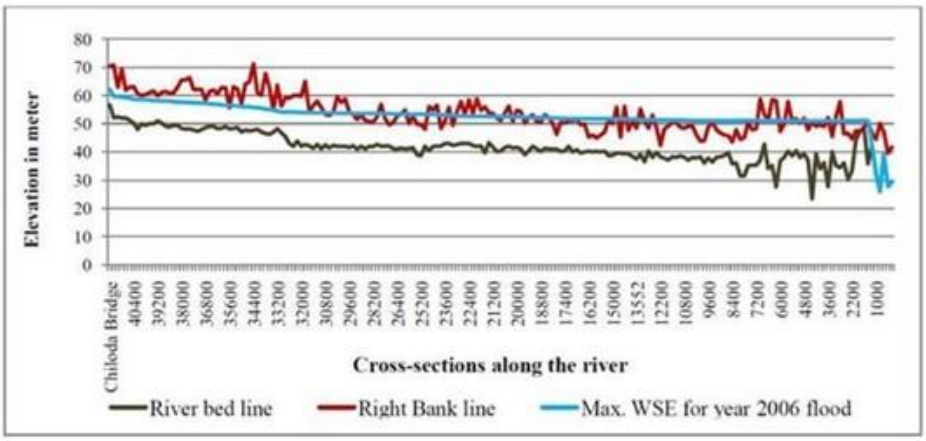


Fig. 6 Comparison of simulated water surface elevation with right bank for year 2006 flood

4.20 Monthly minimum and maximum Discharges

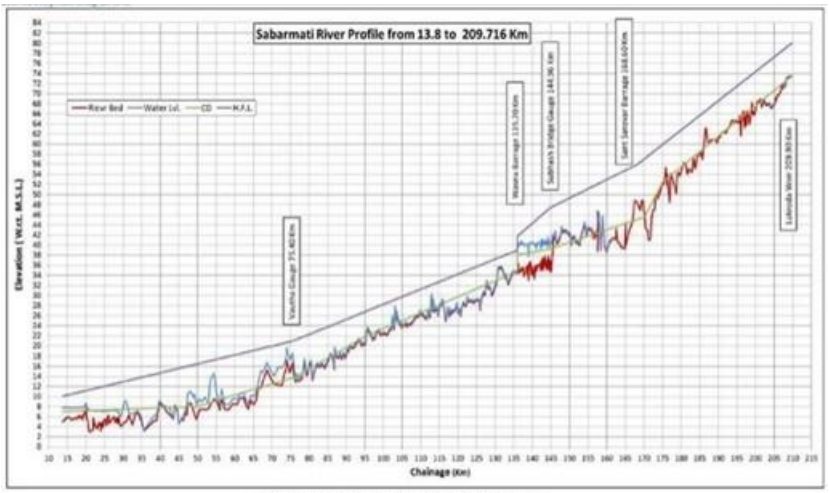
Table 25: Monthly Minimum and Maximum Discharges in Cumecs at Vautha gauge station (Cumecs)

YEAR	JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER		JANUARY		FEBRUARY		MARCH		APRIL		MAY	
	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1999-2000	NA	NA	NA	NA	26.97	7.309	17.112	9.047	20.639	10.683	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2000-2001	3.5	3.5	165	1.5	5.5	0.703	1.9	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2001-2002	18.5	0	47.5	3.2	167.996	2.429	5.285	0	0	0	0	0	0	0	0	0	0	0	1.8	0	1.9	1.7	1.7	0.95
2002-2003	10.805	2.5	33.958	0	62.567	0	145.304	5.131	5.718	2.7	26.5	3	9.6	5.559	9.387	1.821	19.6	5.2	8.327	4.25	4.856	3.33	3.33	0
2003-2004	13.405	0	1379.265	5.025	2220	334.96	995.349	42.424	230	50	128.184	28	55	5.687	9.158	3.359	38	3	97.5	4.5	40	4.878	30	3.25
2004-2005	84.48	0	82.646	2.5	1205	4.113	259.3	6.116	502.5	28	165	11	135	14.5	111	15.5	56.5	10.5	95.826	10	11	4.163	7	4.358
2005-2006	1008.805	3.857	7201.6	16.323	1919	13.897	1770	25.43	154.101	10.4	79	10.4	73.834	18.306	60.087	8.854	32.197	10.448	49.789	12.174	54.593	5.384	44.98	10.471
2006-2007	50.96	5.343	1893	3.565	3350.93	179.97	2907	74.866	140.7	31.32	58.322	12.1	132.8	5.647	144.304	10.39	93.113	20.98	123.2	22.56	53.15	16.834	27.091	15.23
2007-2008	32.081	6.546	5359.97	16.859	2498.53	184.246	615.57	79.049	355.192	51.117	201.031	22.635	198.362	66.669	93.585	10.424	74.057	13.657	149.381	9.938	78.699	12.019	30.295	5.683
2008-2009	52.023	11.794	141.761	9.093	704.216	18.249	357.087	16.157	99.965	25.469	40.301	14.789	32.033	16.67	29.976	9.882	75.415	7.516	103.946	24.256	37.89	15.248	32.925	19.729
2009-2010	38.827	22.023	972.868	22.694	375.231	15.99	116.186	18.921	50.38	21.9	32.21	10.189	39.845	11.279	53.4	13.91	38.99	15.4	46.27	11.45	26.86	10.46	43.98	12.48
2010-2011	89.2	8.715	147.564	5.275	880.074	20.35	380.936	14.814	23.328	11.283	60.795	11.26	24.69	14.025	45.134	14.107	33.347	14.74	26.759	7.337	43.569	12.423	43.08	12.172
2011-2012	15.926	6.296	69.514	6.868	439.466	10.71	1744.056	297.3	424.832	54.55	79.63	53.103	104.88	58.68	94.19	11.9	33.421	11.61	33.092	7.492	18.16	7.458	43.28	13.45
2012-2013	31.958	9.337	39.273	7.72	288.01	17.377	2223	83.841	147	20.748	23.9	7.106	15.572	8.706	20.66	10.341	22.25	8.001	34.98	14.21	20.66	9.324	14.2	12.3
MAX	1008.805	22.023	7201.6	22.694	3350.93	334.96	2907	297.3	502.5	54.55	201.031	53.103	198.362	66.669	144.304	15.5	93.113	20.98	149.381	24.256	78.699	16.834	44.98	19.729
MIN	3.5	0	33.958	0	5.5	0	1.9	0	0	0	0	0	0	0	0	0	0	0	1.8	0	1.9	1.7	1.7	0

NA : - Stands for DATA NOT AVAILABLE

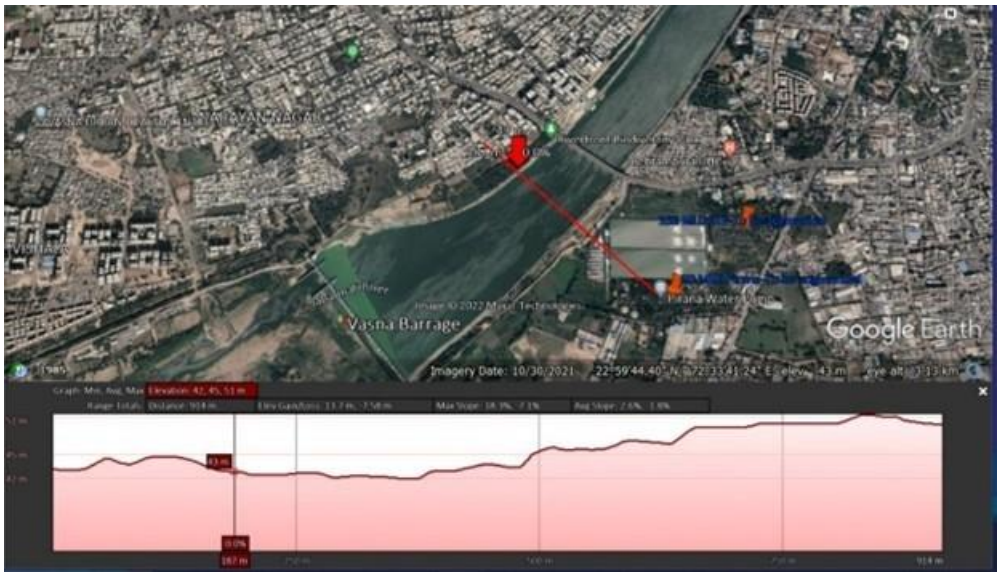
Table 26: Yearly minimum and maximum Discharges at Vautha gauge station

YEAR	MAXIMUM DISCHARGE (m3/sec)	MINIMUM DISCHARGE (m3/sec)
1999-2000	26.97	7.309
2000-2001	165	0
2001-2002	167.996	0
2002-2003	145.304	0
2003-2004	2220	0
2004-2005	1205	0
2005-2006	7201.6	3.857
2006-2007	3350.93	3.565
2007-2008	5359.97	5.683
2008-2009	704.216	7.516
2009-2010	972.868	10.189
2010-2011	880.074	5.275
2011-2012	1744.056	6.296
2012-2013	2223	7.106
MAXIMUM	**7201.6**	**10.189**
MINIMUM	**26.97**	**0**



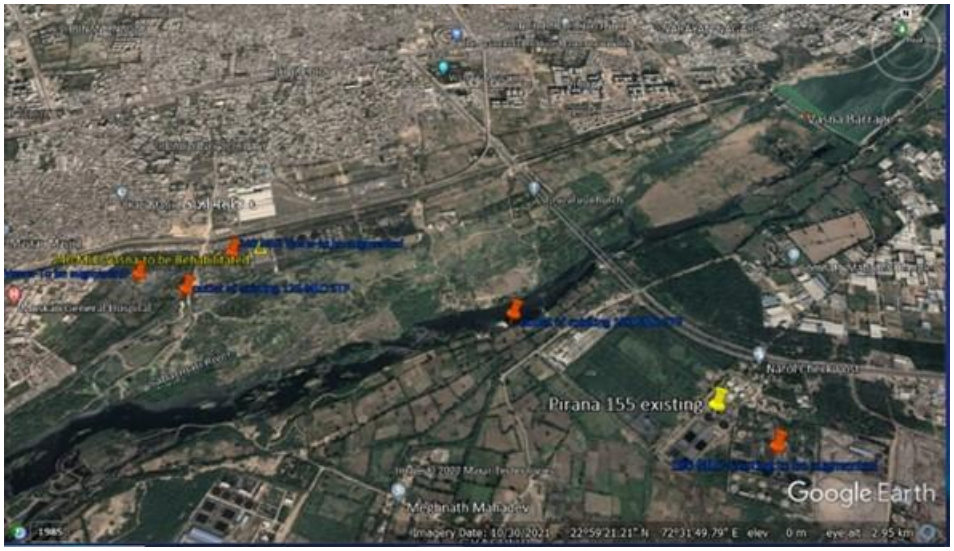
Sections across the river are presented below.

Cross-sectional profile of Sabarmati : At Riverfront, Ahmedabad city



Cross-sectional profile of Sabarmati: At Vasna barrage, Ahmedabad city

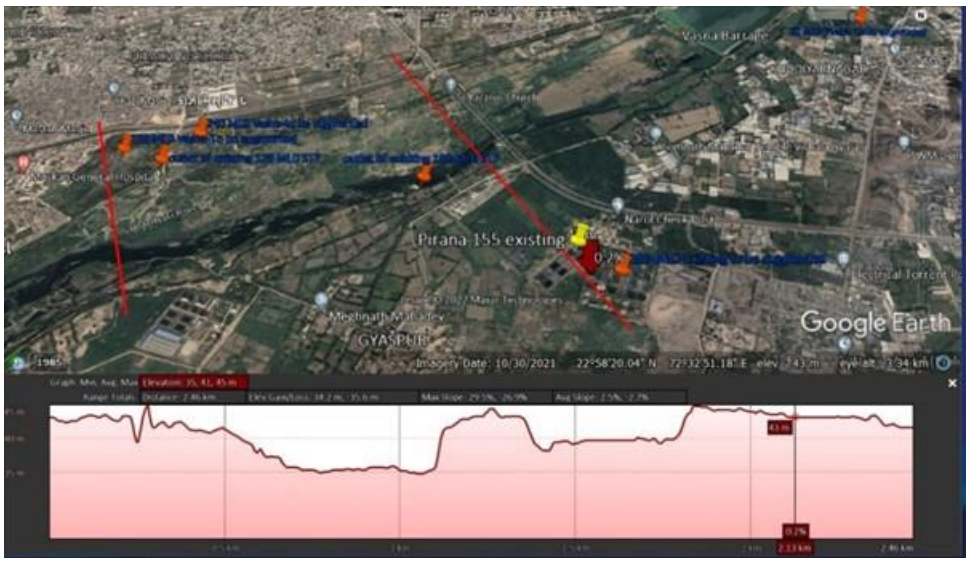
Location of barrage and two STP sites downstream of barrage



Vasna 240 MLD STP: cross section of river downstream of barrage

Cross-sectional profile of Sabarmati: *at Vasna 126 downstream of Barrage*

Cross-sectional profile of Sabarmati: *Pirana STP*



Both plants seem to be located in the flood plain in-between both river dikes. During dry months, both STPs are safe away from the narrow river course, but in case of large floods, it is required to check the high-water level in the d/s river vis-à-vis the elevation of the STPs by the cross sections.

In addition, STPs at / near Pirana are near around the Barrage, (and some among these may be taken up under the project) also gets impacted by floods. Possible dam break scenario and flood assessment for return flood periods become important considering the locational aspects.

Hence, it is suggested to undertake hydrological and flood assessment, including a dam break analysis, return flood assessments (for various return flood periods) and prepare Emergency Action Plan prior to the design of the investments (STPs) and associated structures.

Outcome/output of this assessment shall be incorporated in the design of all STPs which might be impacted and subsequently assessed in C-ESIA & mitigation measures if required included in C-ESMP. Emergency Preparedness and Response Plan and Disaster Management Plan shall be part of all ESIAs.
