



Technical Perception Report on Pahuj River and Urban Water Systems of Jhansi



Table of Contents

Introduction	1
Scope of Assessment	2
Methodology & Approach	3
Data Availability & Assessment Limitations	4
Intended Use of the Report	5
Urban Context and Hydrological Setting	6
Drainage Systems, Catchment & River Connectivity	7
River Conditions and Water Quality Assessment	8 - 11
Wastewater Management & Urban Water Infrastructure Assessment	12 - 13
Riverfront Conditions and Public Interface	14
Integrated Assessment & Key Observations	15
Strategic Direction and Indicative Way Forward	16 - 20

Introduction



River Cities Alliance (RCA) is a dedicated collaborative platform for river-sensitive urban development in India, jointly initiated by the National Institute of Urban Affairs and the National Mission for Clean Ganga. The Alliance works toward strengthening urban river management through inter-city knowledge exchange, technical support, capacity building, river-sensitive planning approaches and institutional coordination.

The Alliance presently includes a growing network of river cities across India and supports cities through thematic workshops, technical perception visits, preparation of river management frameworks, capacity-building programs, pilot initiatives and

knowledge-sharing platforms focused on urban rivers, water bodies and water-sensitive urban development. RCA's work emphasizes integrated river basin management, ecological restoration, wastewater management, urban water resilience and strengthening of the relationship between cities and their river systems.

As a member city of the Alliance, Jhansi Municipal Corporation requested the RCA Secretariat to undertake a technical perception visit to Jhansi to develop an indicative understanding of the present condition of the Pahuj River within municipal limits and to identify broad strategic directions for issues pertaining to river management and the scope of ecological improvement.

The present assessment was undertaken with the objective of understanding key hydrological, ecological and urban water management considerations associated with the Pahuj River system and selected urban water bodies within Jhansi.

Scope of Assessment



The scope of the present perception study broadly included:

- assessment of the indicative water quality, ecological characteristics, and drainage-wastewater interactions within the Pahuj River system, including factors affecting river health and ecosystem conditions;
- baseline observation of existing wastewater, drainage, and solid waste management systems, along with ongoing sewage infrastructure interventions influencing the river environment;
- identification of key ecological, institutional, and river-edge management concerns, including

indicative intervention areas and strategic directions for integrated and sustainable river management.

Methodology and Approach



The present assessment was undertaken through a rapid technical perception approach by a two-member RCA Secretariat team over approximately one and a half days of on-ground engagement in Jhansi. The assessment methodology included:

- field reconnaissance and on-ground observations across key stretches of the Pahuj River and selected urban waterbodies;
- water quality data study and indicative assessment at selected upstream, urban and downstream locations;
- stakeholder consultations and discussions with relevant departments and agencies;
- review of available secondary data, maps, reports and planning-related information shared during the assessment period; and
- preliminary assessment of drainage interactions, wastewater pathways, riverfront conditions and hydrological characteristics through field observations and aerial imagery interpretation.

The exercise was intended as a preliminary technical perception study to identify broad hydrological, ecological and infrastructure-related trends requiring further examination through detailed investigations, longer-duration monitoring and inter-agency coordination.

Data Availability and Assessment Limitations



The observations and recommendations presented in this report are based on field visits, stakeholder interactions and the limited datasets and information made available during the assessment period. Given the rapid nature of the perception visit and the limited duration of on-ground assessment, the findings should be interpreted as indicative rather than exhaustive.

The assessment did not include detailed hydrological modelling, seasonal flow analysis, continuous water quality monitoring, comprehensive sewer network mapping or detailed ecological and socio-economic investigations.

Water quality observations represent conditions during the assessment period only and may vary seasonally depending on rainfall, flow conditions, reservoir operations and wastewater inflows.

Accordingly, the proposed intervention areas and strategic recommendations are intended as preliminary guidance to support subsequent detailed studies, prioritization exercises and coordinated planning efforts by relevant agencies and stakeholders.

Intended Use of the Report



This report is intended to serve as a technical perception document to support preliminary understanding, inter-agency dialogue and future planning discussions related to urban river management and ecological restoration in Jhansi. The report is not intended to function as a statutory plan, regulatory assessment or detailed project report.

The findings may support subsequent development of:

- detailed hydrological and ecological investigations,
- river restoration and rejuvenation strategies,

- wastewater management and reuse planning,
- urban water body rejuvenation initiatives,
- river-sensitive planning frameworks, and
- integrated basin-scale management approaches for the Pahuj River system.

Urban Context and Hydrological Setting



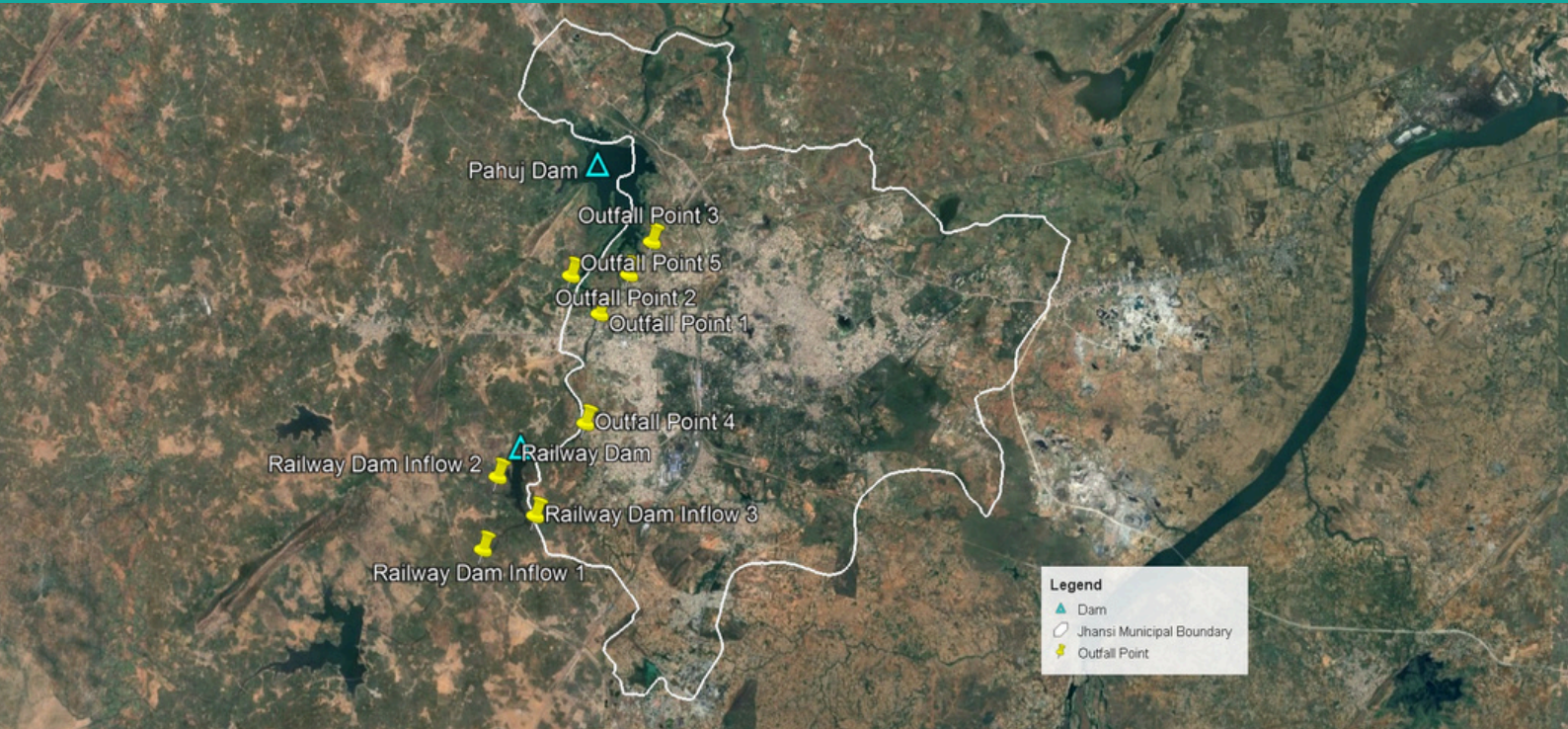
Jhansi Municipal Corporation (JMC) covers an administrative area of approximately 142 sq. km and is hydrologically influenced by two river basins: the Pahuj River along the western side and the Betwa River along the eastern side. The city's ridge-like topography, broadly aligned with the railway corridor, forms a natural watershed divide that directs runoff toward these two systems. Such dual-basin urban settings are hydrologically significant because they influence drainage pathways, wastewater movement, groundwater interactions and flood dynamics (NIUA, 2021).

The Pahuj River traverses nearly 7.5 km within and along the municipal boundary. The river system includes the Railway Dam upstream, the downstream Pahuj Dam Reservoir and several intermediate

stop dams and hydraulic structures. Field observations and water quality assessments indicate that the river currently exhibits characteristics of low-flow and impounded water conditions across several stretches, with portions functioning more like interconnected reservoirs than a continuously flowing river system.

Scientific literature and CPCB restoration studies indicate that low-flow or stagnant hydrological conditions may reduce assimilative and self-cleansing capacity, thereby increasing the potential for accumulation of pollutants, nutrients and microbial contaminants within reservoirs and slow-moving stretches (CPCB, 2021). These hydrological characteristics are therefore important for understanding the present ecological condition of the Pahuj River system.

Drainage Systems, Catchment & River Connectivity



Preliminary assessment through aerial imagery and field observations indicates the presence of multiple inflow streams and urban drains connected to the Pahuj River system. Three inflow channels appear to contribute upstream toward the Railway Dam, while several drains appear to outfall into or interact with the river system within or adjacent to municipal limits.

The drainage network demonstrates hydrological linkages between the river and:

- peri-urban agricultural catchments,
- urban runoff systems,
- wastewater conveyance infrastructure,
- localized settlement drainage, and
- impounded reservoir systems.

Urban river studies indicate that rivers in rapidly urbanizing regions often function as cumulative receivers of upstream runoff and distributed wastewater inflows (Walsh et al., 2005). Observations in Jhansi indicate similar basin-scale interactions.

Several built-up areas were also observed in close proximity to the river edge. No clearly demarcated floodplain boundaries or riparian buffer systems were visibly identifiable during the limited field assessment. In this context, more information has been sought from the Jhansi Development Authority regarding floodplain delineation, ecological buffers and river-sensitive planning provisions within statutory planning frameworks.



River Conditions and Water Quality Assessment

Basin-Scale Water Quality Trends

Water quality sampling by JMC and testing by UPPCB was conducted for five locations across the Pahuj River system:

- Baidora (uppermost upstream location),
- Dongri Dam,
- Railway Dam,

- Dhobighat within municipal limits, and
- Pahuj Dam downstream.

The sampling sequence provided insight into the progressive evolution of water quality conditions from upstream peri-urban stretches to downstream urban reservoirs.





Upstream Catchment Conditions

The upstream location at Baidora indicates signs of moderate ecological stress despite limited dense urban influence. Elevated total and fecal coliform levels, moderate nutrient concentrations and measurable BOD suggest diffuse pollution inputs before the river enters Jhansi city. CPCB studies indicate that agricultural runoff, livestock activity, localized domestic discharge and settlement runoff can contribute to microbial contamination in peri-urban river systems (CPCB, 2021).

Observations at Dongri Dam suggest increasing ecological pressure through elevated BOD, microbial contamination and iron concentrations, indicating cumulative upstream pollution loading within the peri-urban catchment itself.

Upstream of the Municipal Area

The Railway Dam is particularly significant because it suggests that the river

appears to enter the municipal stretch under environmentally stressed conditions. Elevated total and fecal coliform concentrations, increased BOD and dense aquatic weed growth indicate eutrophic stagnant-water characteristics before the river enters the urban stretch. Scientific literature on stagnant reservoirs and impounded river systems indicates that aquatic weeds and water hyacinth can reduce oxygen transfer, trap organic matter and promote nutrient recycling, thereby contributing to ecological degradation over time (Wetzel, 2001).

Urban Stretch Conditions

The Dhobighat stretch within municipal limits indicates comparatively stronger urban wastewater influence among the sampled locations. Elevated BOD, COD, phosphate, conductivity, TDS and microbial contamination suggest concentrated wastewater and greywater influence. Such conditions are commonly associated with detergent-rich discharge, localized sewage inflows and nutrient enrichment under low-flow conditions (CPCB, 2021).



At the same time, the broader spatial trend suggests that the urban stretch may be intensifying an already stressed river system rather than acting as the sole source of ecological pressure.

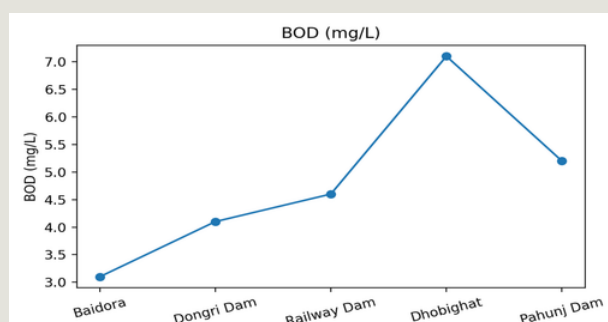
Downstream Reservoir Conditions

The downstream Pahuj Dam appears to reflect cumulative basin-scale ecological conditions across the river system. Elevated BOD, high coliform concentrations, turbidity, nutrient enrichment and extensive water hyacinth infestation indicate eutrophic reservoir characteristics under ecological stress.

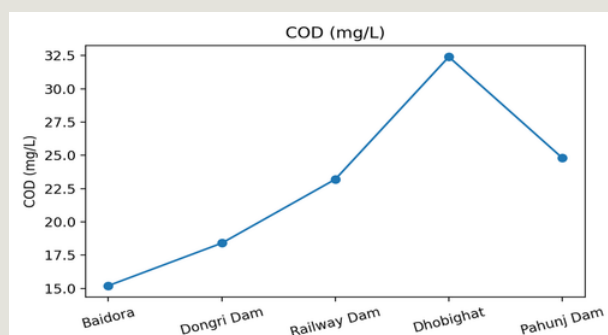
The nearby STP outfall may further influence downstream water quality because, under prolonged low-flow conditions, treated or partially treated effluent may constitute a notable component of available water within the reservoir. At the same time, downstream conditions also appear to reflect cumulative upstream pollution loads and prolonged hydraulic retention within the reservoir system.

Water Quality Testing Results

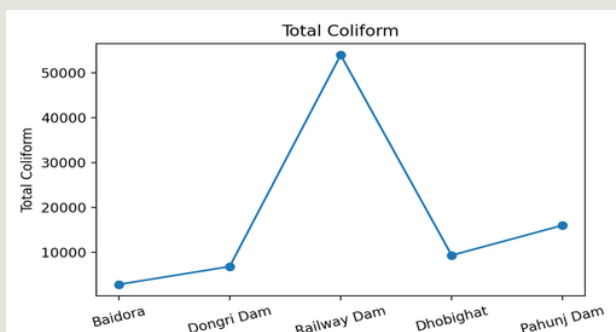
The following graphs present the water quality assessment results based on samples collected by Jhansi Municipal Corporation on 09/04/2026 and subsequently analysed by Uttar Pradesh Pollution Control Board. These results form the basis for the subsequent water quality analysis and interpretation presented in this report.



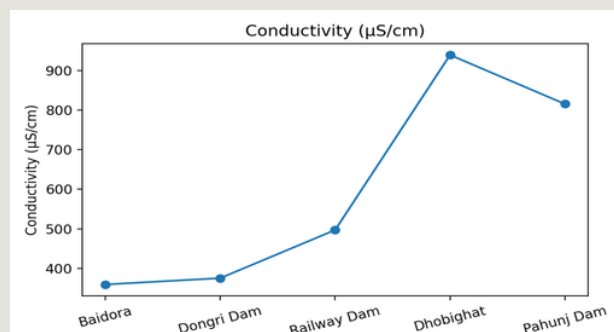
Data showing BOD levels at monitored locations in Jhansi



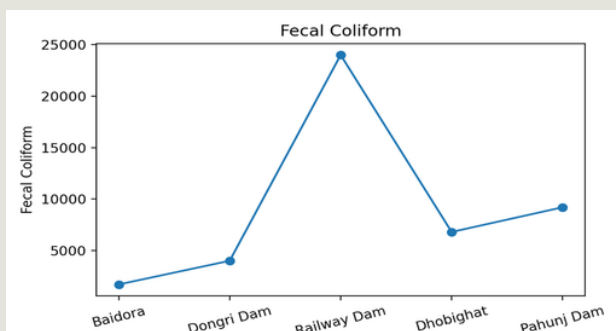
Data showing COD levels at monitored locations in Jhansi



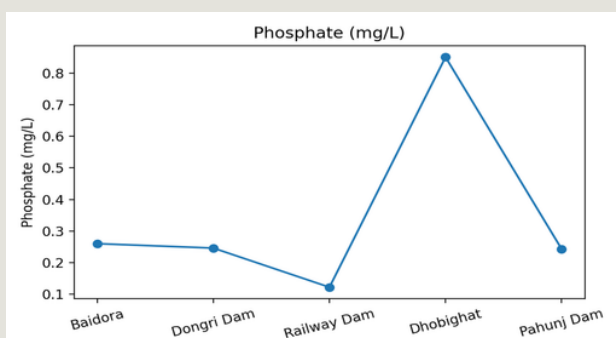
Data showing Total Coliform levels at monitored locations in Jhansi



Data showing Conductivity at monitored locations in Jhansi



Data showing Fecal Coliform levels at monitored locations in Jhansi



Data showing Phosphate levels at monitored locations in Jhansi



Wastewater Management and Urban Water Infrastructure Assessment

Field observations indicate that Jhansi has initiated important wastewater interception and conveyance interventions through drain tapping systems, pumping stations and sewage diversion infrastructure across multiple urban drains.

The city presently has identified sewage treatment infrastructure of approximately:

- 26 MLD at Lahargird STP, and
- 26 MLD at Narayanbagh STP,

representing a combined identified treatment capacity of nearly 52 MLD.

At the same time, reported urban water supply ranges between approximately 85-125 MLD depending on the service area and agency considered. As per CPHEEO planning norms, approximately 70–85% of supplied water is typically converted into wastewater or sewage (CPHEEO, 2013).

Based on these norms, overall wastewater generation within the city may potentially exceed the currently identified centralized treatment capacity. This does not necessarily indicate direct untreated discharge into the river at all locations; however, it suggests that the sanitation system may presently operate through a combination of:

- centralized sewer systems,
- septic tanks,
- soak pits,
- open drains,
- localized wastewater disposal pathways, and
- partially connected sewer networks.

Drain flow observations further indicate that wastewater generation appears spatially distributed across multiple catchments rather than concentrated at a single location.



Major drains such as Kasai Mandi Nala, Lahar Gird Drain, Allaghat Nalla and Badagaon Nala collectively indicate distributed wastewater movement through the urban drainage network.

National sanitation assessments also indicate that in cities with partial sewer connectivity, fecal sludge from septic systems may reach open drains and nearby water bodies through overflow conditions, informal desludging practices or gaps in fecal sludge management systems (MoHUA, 2017). Such diffuse wastewater pathways may become particularly significant under low-flow river conditions where dilution and flushing are limited.



Riverfront Conditions and Public Interface

The Pahuj River ghat and adjoining riverfront stretches indicate opportunities for strengthening solid waste management and routine maintenance systems. Accumulation of municipal waste, religious offerings and general refuse was observed along several river-edge and riverbed locations.

Such conditions not only affect aesthetics and public usability but may also contribute to localized organic loading, nutrient enrichment and river-edge degradation. Studies on urban riverfront systems indicate that inadequately managed river-edge waste can contribute to long-term ecological degradation and weaken public engagement with urban rivers (NIUA, 2021).



Ongoing efforts towards interception and diversion of drains discharging into the Pahuj River



Sections of the Pahuj River within municipal limits showing reduced environmental flow and instances of solid waste deposition along the riverbed



Integrated Assessment and Key Observations

The present condition of the Pahuj River system appears to be influenced by multiple interconnected basin-scale factors, including:

- limited active flow,
- prolonged low-flow and impounded conditions,
- aquatic weed proliferation,
- distributed wastewater inflows,
- cumulative upstream pollution loading, and
- nutrient enrichment.

Water quality analysis suggests that ecological pressures are visible upstream of Jhansi Municipal Corporation limits and appear to intensify through peri-urban and urban stretches before accumulating within downstream reservoirs.

At the same time, the city has initiated several important wastewater interception and sewage management measures. However, available water supply and sanitation data suggest that wastewater generation may potentially

Scientific literature and CPCB restoration studies consistently indicate that under prolonged low-flow and impounded hydrological conditions, even moderate wastewater inflows can disproportionately influence water quality because pollutants may remain retained within reservoirs and slow-moving stretches for extended durations with limited dilution and flushing (CPCB, 2021).

The findings therefore highlight the importance of an integrated basin-scale river management approach alongside localized interventions, with emphasis on hydrology, wastewater management, ecological restoration, urban planning and institutional coordination.

Strategic Direction and Indicative Way Forward

Based on the site observations, preliminary ecological assessment, drainage interactions, and review of existing wastewater and solid waste management systems, the following broad strategic directions emerge for the Pahuj River system and associated urban water bodies within Jhansi Municipal Corporation limits. The interventions indicated below are intended to be pragmatic, phased, and implementation-oriented, with emphasis on visible short-term improvements alongside medium- and long-term institutional and ecological strengthening measures.

Solid Waste, Riverfront Cleanliness and Public Interface

One of the immediate concerns observed along portions of the Pahuj River corridor and at the Pahuj Ghat relates to accumulation of solid waste, including religious waste and floating debris. Such conditions not only affect the ecological condition of the river but also influence public perception and usability of riverfront spaces.

In the short term, priority may be given to identifying solid waste deposition hotspots and establishing routine cleanliness and waste collection mechanisms along the river edge, drains, and ghat areas. Low-cost, high-visibility interventions such as dedicated religious waste collection points, regular desilting

and cleaning drives, and installation of river-sensitivity signages at strategic locations can significantly improve the public interface of the river. IEC campaigns and signages involving local communities, educational institutions, and riverfront users may further support behavioral change and reduce indiscriminate dumping.

In the medium term, strengthening of scientific solid waste management systems, including leachate control at waste dumping locations and improved waste processing infrastructure, may be considered to reduce pollutant inflows into the river system.

Potential Stakeholders: Jhansi Municipal Corporation, Jhansi Smart City Limited, Uttar Pradesh Pollution Control Board (UPPCB), Irrigation Department, Tourism Department, District Administration, NGOs/CBOs, Relevant Academic Institutions.

Strategic Direction and Indicative Way Forward

Water Quality Monitoring and Hydrological Understanding

The assessment indicated limited river flow conditions, significant stagnation in impounded stretches, and proliferation of invasive aquatic vegetation, highlighting the need for improved understanding of hydrological and ecological processes within the urban river system.

As an immediate step, establishment of basic water quality and flow monitoring stations at strategic locations such as major drains, the Railway Dam, and downstream stretches of the Pahuj River can support informed decision-making. IoT- and sensor-based monitoring systems integrated with a simple decision-support framework may improve real-time tracking of river conditions.

Simultaneously, a GIS-based micro-catchment assessment covering the Pahuj and Betwa systems within municipal boundaries may be undertaken to map drainage patterns, hydrogeological conditions, inflow channels, urban water bodies, and wastewater interactions. Such an exercise

would provide a stronger scientific basis for prioritization of future interventions and infrastructure investments. Over the medium term, coordinated environmental flow management between the Railway Dam and downstream stretches may be explored to improve ecological conditions and reduce stagnation-related impacts.

Potential Stakeholders: Jhansi Development Authority, Jhansi Municipal Corporation, UP Irrigation Department, UP Jal Nigam (Urban), UPPCB, State Ground Water Department, Relevant Academic Institutions, GIS/Remote Sensing Agencies.

Strategic Direction and Indicative Way Forward

Wastewater Management and Treated Water Reuse

Encouraging progress was observed with respect to ongoing drain interception and sewage diversion works. However, continued untreated inflows into certain locations and urban water bodies indicate the need for strengthening system coverage and operational efficiency.

In the short term, emphasis may be placed on improving the effectiveness of drain interception systems, ensuring operational reliability of pumping stations, and minimizing untreated discharge into the Pahuj River and associated lakes. Regular monitoring of intercepted drains and inflow points would support better operational management.

Medium-term efforts may focus on developing treated wastewater reuse systems for horticulture, landscaping, and other non-potable urban applications. Such measures may help reduce freshwater dependency while improving reuse efficiency of existing STP infrastructure. Capacity-building programs for city officials and implementing agencies on treated

wastewater reuse planning, standards, and operational practices may also be beneficial.

Over the longer term, decentralized and nature-based wastewater treatment systems at selected drainage and pumping locations may be explored to supplement centralized treatment infrastructure and improve resilience.

Potential Stakeholders: UP Jal Nigam (Urban), Jhansi Municipal Corporation, Jhansi Smart City Limited, State Ground Water Department, Relevant Academic Institutions, National Institute of Urban Affairs.

Strategic Direction and Indicative Way Forward

Heritage Conservation and Riverfront Revitalization

Several heritage structures associated with riverfronts and water bodies were observed to be in deteriorated condition, particularly around Laxmi Talab and adjoining areas. These structures represent an opportunity for integrating cultural continuity with ecological rejuvenation and public space improvement.

In the medium term, documentation and conservation assessment of heritage water structures, ghats, and associated cultural landscapes may be undertaken. Adaptive reuse approaches linked with interpretation spaces, cultural programming, tourism-oriented activities, and public waterfront improvements may contribute to both economic activation and long-term stewardship of urban water systems.

Integrated riverfront revitalization approaches combining ecological restoration, public access improvements, and heritage-sensitive and eco-sensitive design interventions may further

strengthen the social and cultural relationship between the city and its water bodies.

Potential Stakeholders: Jhansi Development Authority, Jhansi Municipal Corporation, Department of Tourism, Department of Culture, Archaeology Department, Jhansi Smart City Limited, Heritage Experts, Relevant Academic Institutions.

Strategic Direction and Indicative Way Forward

Institutional Strengthening and River-Sensitive Urban Planning

The assessment also highlighted the importance of long-term institutional coordination and integration of river-sensitive principles within planning frameworks. The absence of clearly identifiable floodplain delineation and riparian buffer mechanisms indicates the need for strengthened planning integration.

In the medium term, establishment of a dedicated interdepartmental coordination mechanism or River Management Committee may support integrated planning, monitoring, and implementation across agencies.

Capacity-building initiatives on river-sensitive urban planning, floodplain management, ecological restoration, treated wastewater reuse, and river-oriented IEC strategies may further support institutional strengthening.

Over the longer term, review of Master Plan provisions related to floodplain protection, riparian buffers, ecological

corridors, and river-sensitive zoning may be undertaken to improve long-term resilience of the urban river system. River-sensitive urban design elements such as ecological signages, buffer markers, public information systems, and heritage-linked waterfront guidelines may also be integrated into future planning and redevelopment initiatives.

Potential Stakeholders: Jhansi Development Authority, Jhansi Municipal Corporation, Town & Country Planning Department, District Administration, UP Irrigation Department, UP Jal Nigam (Urban), National Institute of Urban Affairs, Relevant Academic Institutions.