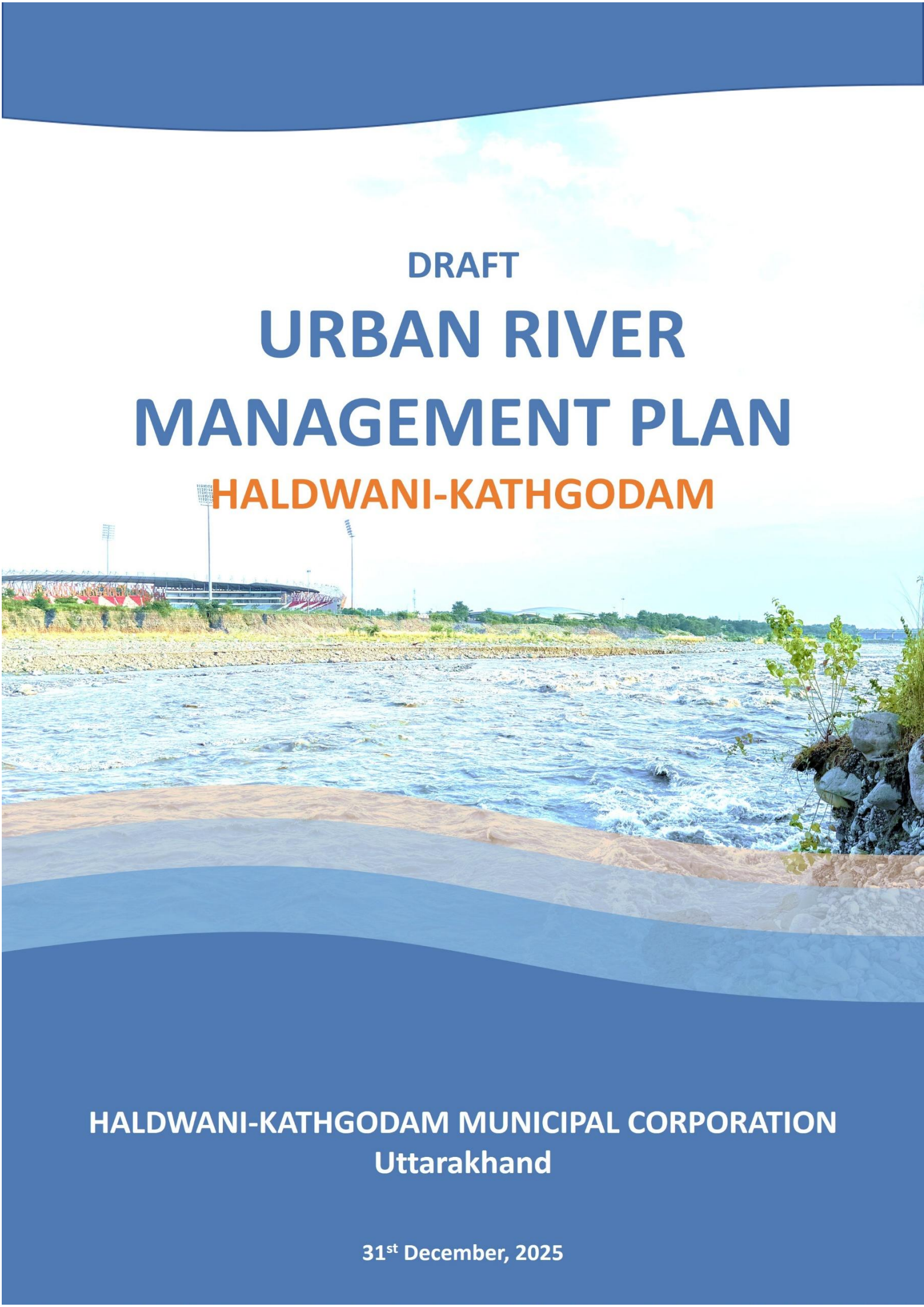


The background of the cover is a photograph of a wide river with white water rapids. In the distance, a large stadium with a red and white roof is visible on a hill. The sky is blue with some clouds. The text is overlaid on the top half of the image.

**DRAFT**

# **URBAN RIVER MANAGEMENT PLAN**

## **HALDWANI-KATHGODAM**

**HALDWANI-KATHGODAM MUNICIPAL CORPORATION**  
**Uttarakhand**

**31<sup>st</sup> December, 2025**

## TABLES OF CONTENTS

|                                                                  |            |
|------------------------------------------------------------------|------------|
| <b>EXECUTIVE SUMMARY .....</b>                                   | <b>1</b>   |
| <b>1 INTRODUCTION .....</b>                                      | <b>1-1</b> |
| 1.1 PROCESS FOR PREPARATION OF THE URMP HALDWANI-KATHGODAM ..... | 1-2        |
| 1.2 STATUS OF WORK AND CONTENTS OF THE PRESENT DELIVERABLE ..... | 1-2        |
| 1.2.1 URMP State level Steering Committee .....                  | 1-2        |
| 1.2.2 Multistakeholder Working Group .....                       | 1-3        |
| 1.2.3 Draft URMP Report .....                                    | 1-4        |
| <b>2 CITY PROFILE .....</b>                                      | <b>2-1</b> |
| 2.1 CITY ADMINISTRATIVE BOUNDARIES .....                         | 2-2        |
| 2.2 DEMOGRAPHY .....                                             | 2-2        |
| 2.3 PHYSIOGRAPHIC PROFILE .....                                  | 2-5        |
| 2.3.1 Topography .....                                           | 2-5        |
| 2.3.2 Geophysical Characteristic .....                           | 2-5        |
| 2.4 URBAN SPRAWL .....                                           | 2-5        |
| 2.5 HISTORY AND CULTURAL PROFILE .....                           | 2-7        |
| 2.6 TOURISM PROFILE .....                                        | 2-7        |
| 2.7 SOCIO – ECONOMIC PROFILE OF THE CITY: .....                  | 2-7        |
| 2.8 INSTITUTIONAL MECHANISM .....                                | 2-10       |
| 2.9 CONCLUSION .....                                             | 2-13       |
| <b>3 ECOLOGICAL PROFILE OF THE CITY .....</b>                    | <b>3-1</b> |
| 3.1 RIVER ECOSYSTEM .....                                        | 3-1        |
| 3.2 BLUE-GREEN RESOURCES IN THE CITY .....                       | 3-3        |
| 3.2.1 Blue Resources: .....                                      | 3-3        |
| 3.2.2 Green Resources: .....                                     | 3-3        |
| 3.2.3 Riparian Buffer .....                                      | 3-4        |
| 3.2.4 Biodiversity .....                                         | 3-5        |
| 3.3 ACTIVITY MAPPING ALONG THE RIVER .....                       | 3-8        |
| 3.4 FLOODING .....                                               | 3-10       |
| 3.5 EXISTING/ UPCOMING/ PROPOSED PROJECTS .....                  | 3-14       |
| 3.6 INSTITUTIONAL MECHANISM .....                                | 3-14       |
| <b>4 PHYSICAL INFRASTRUCTURE .....</b>                           | <b>4-1</b> |
| 4.1 WATER SUPPLY .....                                           | 4-1        |
| 4.1.1 Water Demand and Supply .....                              | 4-1        |
| 4.1.2 Water Quality .....                                        | 4-1        |
| 4.1.3 Groundwater .....                                          | 4-2        |
| 4.1.4 Institutional Mechanism .....                              | 4-4        |
| 4.2 SEWERAGE SYSTEM .....                                        | 4-4        |
| 4.2.1 Sewage Generation and Coverage .....                       | 4-4        |
| 4.2.2 Existing Sewage infrastructure .....                       | 4-4        |
| 4.2.3 Institutional Mechanism .....                              | 4-5        |
| 4.3 STORM WATER MANAGEMENT/ DRAINS .....                         | 4-6        |
| 4.3.1 Cleaning mechanism .....                                   | 4-7        |
| 4.3.2 Institutional Mechanism .....                              | 4-7        |
| 4.4 SOLID WASTE MANAGEMENT .....                                 | 4-7        |

|          |                                                                                                                 |            |
|----------|-----------------------------------------------------------------------------------------------------------------|------------|
| 4.4.1    | Residential Waste .....                                                                                         | 4-7        |
| 4.4.2    | Waste Processing Facilities .....                                                                               | 4-7        |
| 4.4.3    | Religious Waste .....                                                                                           | 4-8        |
| 4.4.4    | Institutional Mechanism .....                                                                                   | 4-8        |
| <b>5</b> | <b>SWOC ANALYSIS AND URM INDEXING OF THE CITY .....</b>                                                         | <b>5-1</b> |
| 5.1      | SWOT ANALYSIS .....                                                                                             | 5-1        |
| 5.2      | URM INDEXING OF THE CITY .....                                                                                  | 5-2        |
| <b>6</b> | <b>URMP VISION FOR THE CITY AND ZONING .....</b>                                                                | <b>6-1</b> |
| 6.1      | URMP VISION FOR HALDWANI-KATHGODAM .....                                                                        | 6-1        |
| 6.2      | OBJECTIVE 1: REGULATION OF ACTIVITIES IN FLOOD PLAINS .....                                                     | 6-3        |
| 6.2.1    | Intervention 1: Inclusion and strengthening of provisions in Draft Master Plan of Haldwani-Kathgodam, 2041..... | 6-3        |
| 6.2.2    | Intervention 2: Naturalised bank protection measures along the Gaula River .....                                | 6-6        |
| 6.2.3    | Intervention 3. Debris arresting and bank protection measures .....                                             | 6-10       |
| 6.3      | OBJECTIVE 2 INTERVENTIONS TO KEEP RIVER FREE FROM POLLUTION .....                                               | 6-14       |
| 6.3.1    | Intervention 4: Construction of I&D structure at Indira Nagar Nallah.....                                       | 6-14       |
| 6.3.2    | Intervention 5: Diversion of railway colony drain to constructed wetland .....                                  | 6-17       |
| 6.3.3    | Intervention 6: Hybrid treatment of Faecal Sludge in city .....                                                 | 6-19       |
| 6.3.4    | Intervention 7: Preparation of Faecal and Septage Management Plan .....                                         | 6-21       |
| 6.3.5    | Intervention 8: Creation of Bamboo Fencing & Vertical Gardens for Waste Prevention .....                        | 6-24       |
| 6.4      | OBJECTIVE 3 INTERVENTIONS TO REJUVENATE WATERBODIES AND WETLANDS IN THE CITY .....                              | 6-26       |
| 6.4.1    | Intervention 9: Catchment restoration & revitalization study of Sheetlahat spring .....                         | 6-26       |
| 6.5      | OBJECTIVE 4 INTERVENTIONS TO ENHANCE RIPARIAN BUFFER ALONG RIVERBANK .....                                      | 6-28       |
| 6.5.1    | Intervention 10: Restoration of degraded riparian stretches .....                                               | 6-28       |
| 6.5.2    | Recommendation 1: Conservation and Preservation of Natural dense riparian buffer .....                          | 6-31       |
| 6.6      | INTERVENTION FOR REUSE OF TREATED WASTE WATER .....                                                             | 6-35       |
| 6.6.1    | Intervention 11: Enhance the reuse of treated wastewater in the city.....                                       | 6-35       |
| 6.7      | INTERVENTIONS TO DEVELOP ECO-FRIENDLY RIVERFRONT PROJECTS AND ECONOMIC POTENTIAL.....                           | 6-37       |
| 6.7.1    | Intervention 12: Develop a new Gaula Riverfront Park near Gaula Barrage .....                                   | 6-37       |
| 6.8      | INTERVENTIONS TO LEVERAGE THE ECONOMIC POTENTIAL OF RIVER .....                                                 | 6-41       |
| 6.8.1    | Recommendation 2: Riverfront Tourism & Recreation .....                                                         | 6-41       |
| 6.9      | INTERVENTION TO INCULCATE RIVER-SENSITIVE BEHAVIOUR AMONG CITIZENS.....                                         | 6-42       |
| 6.9.1    | Intervention 13: Interpretive Signage and QR-Coded Storytelling Boards .....                                    | 6-42       |
| 6.9.2    | Intervention 14: Distribution of Biodegradable Offering Kits .....                                              | 6-43       |
| 6.9.3    | Intervention 15: Promotion of Electric Crematoriums .....                                                       | 6-44       |
| 6.9.4    | Intervention 16: Short Videos and Jingles on Segregation and Composting of Solid Waste.....                     | 6-45       |
| 6.9.5    | Intervention 17: Annual Celebration of “Gaula Utsav” .....                                                      | 6-46       |
| 6.10     | INTERVENTION TO ENGAGE CITIZENS IN RIVER MANAGEMENT ACTIVITIES.....                                             | 6-48       |
| 6.10.1   | Intervention 18: Formation of River Sabha Committees at City-Level.....                                         | 6-48       |
| 6.10.2   | Intervention 19: Competitions (Poster Making, Debates) on Waste-Free Rivers .....                               | 6-49       |
| 6.10.3   | Intervention 20: Street Plays (Nukkad Natak) by RWAs & local community .....                                    | 6-50       |
| 6.10.4   | Intervention 21: Engage Local Residents in River Clean-Up Drives.....                                           | 6-51       |



## List of Figures

|                                                                                                                                                                     |      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Figure 1-1: Ten Objectives of the URMP.....                                                                                                                         | 1-1  |
| Figure 1-2: National, State & City Engagement for the URMP Preparation .....                                                                                        | 1-1  |
| Figure 1-3: Process for preparation of URMP .....                                                                                                                   | 1-2  |
| Figure 2-1: Tourist footfall trend of Haldwani-Kathgodam .....                                                                                                      | 2-7  |
| Figure 4-1: DO levels in Gaula River at Rani Bagh (2015 – 2025) .....                                                                                               | 4-2  |
| Figure 4-2: BOD levels in Gaula River at Rani Bagh (2015 – 2025) .....                                                                                              | 4-2  |
| Figure 4-3: Organization Chart of Municipal Corporation .....                                                                                                       | 4-9  |
| Figure 5-1: Prioritization Matrix.....                                                                                                                              | 5-3  |
| Figure 6-1: Flexible Rockfall Barrier .....                                                                                                                         | 6-12 |
| Figure 6-2: Flow arrangement of proposed I &D Structure .....                                                                                                       | 6-14 |
| Figure 6-3: Conceptual arrangement of proposed I&D components .....                                                                                                 | 6-16 |
| Figure 6-4: Section of the Proposed riparian stretch along eastern and western bank of the river .....                                                              | 6-31 |
| Figure 6-5: Location of new Gaula Riverfront Park.....                                                                                                              | 6-37 |
| Figure 6-6: Cross section of Gaula Riverfront Park showing the three planning zones (above) and plan showing proposed activities in the planning zones (below)..... | 6-38 |
| Figure 6-7: River-sensitive practices and cultural awareness.....                                                                                                   | 6-42 |
| Figure 6-8: Citizen participation in river management .....                                                                                                         | 6-48 |

## List of Images

|                                                                                               |     |
|-----------------------------------------------------------------------------------------------|-----|
| Image 1-1: Steering Committee Meeting for Uttarakhand on 6th February 2025.....               | 1-3 |
| Image 1-2: Joint MSWG held on 5th March 2025 at Nainital .....                                | 1-3 |
| Image 1-3: 2 <sup>nd</sup> MSWG held on 8 <sup>th</sup> October 2025 at Bhimtal.....          | 1-3 |
| Image 1-4: Consultations and Site Visits.....                                                 | 1-4 |
| Image 2-1: Economic Activities along the river. ....                                          | 2-8 |
| Image 2-2: Prominent Temples along the river. ....                                            | 2-8 |
| Image 2-3: Chat Puja at Rampur Road, Haldwani.....                                            | 2-9 |
| Image 2-4: Cyclist group, Haldwani .....                                                      | 2-9 |
| Image 3-1: Cross-Section of Gaula River and its interaction with the city .....               | 3-2 |
| Image 3-2: City Forest and Biodiversity Park at Haldwani-Kathgodam .....                      | 3-4 |
| Image 3-3: Types of flora species along the Gaula River .....                                 | 3-6 |
| Image 3-4: Tiger Corridor between Corbett Tiger Reserve and Nandhaur Wildlife Sanctuary ..... | 3-6 |
| Image 4-1: Sewage from the encroached area on the railway land .....                          | 4-7 |



|                                                                                                             |      |
|-------------------------------------------------------------------------------------------------------------|------|
| Image 4-2: Indira Nagar drains near 28 MLD existing STP .....                                               | 4-7  |
| Image 6-1: Bank protection being implemented by Irrigation department at Rajpura basti.....                 | 6-6  |
| Image 6-2: No bank protection measures proposed for the riparian stretch along western bank.....            | 6-7  |
| Image 6-3: Gabion bank protection measures proposed for the riparian stretch along western bank...<br>..... | 6-8  |
| Image 6-4: Encroachment along Kalsiya Nallah.....                                                           | 6-10 |
| Image 6-5: Kalsiya Nallah during heavy rains .....                                                          | 6-10 |
| Image 6-6: Rigid steel structure .....                                                                      | 6-12 |
| Image 6-7: Gabion Check Dam.....                                                                            | 6-12 |
| Image 6-8: Bank Protection of Kalsiya Nallah with Gabion Walls.....                                         | 6-13 |
| Image 6-9: Septic tank of a household on encroached land.....                                               | 6-17 |
| Image 6-10: Pondage in the flood plain of Gaula from grey water from the settlement.....                    | 6-17 |
| Image 6-11: Schematic diagram of subsurface horizontal flow constructed wetland .....                       | 6-18 |
| Image 6-12: Desludging vehicles queued up for discharging faecal sludge in sewer manhole.....               | 6-19 |
| Image 6-13: Mobile Septage Treatment Unit .....                                                             | 6-20 |
| Image 6-14: Erection of bamboo fencing with planters on bridges to prevent throwing of solid waste<br>..... | 6-25 |
| Image 6-15: Bougainvillea hedges along stream bank roads .....                                              | 6-25 |
| Image 6-16: Sheetalahat spring .....                                                                        | 6-26 |
| Image 6-17: Staggered Contour Trenches (SCTs.....                                                           | 6-27 |
| Image 6-18: Recharge Pits / Shafts .....                                                                    | 6-27 |
| Image 6-19: Sub-surface Dykes.....                                                                          | 6-27 |
| Image 6-20: Loose boulder / Gabion Check Dams.....                                                          | 6-27 |
| Image 6-21: Dense Riparian stretches cantonment area .....                                                  | 6-28 |
| Image 6-22: Degraded Riparian stretches near international sports stadium .....                             | 6-28 |

## List of Maps

|                                                              |     |
|--------------------------------------------------------------|-----|
| Map 2-1: Contextual Setting of Haldwani-Kathgodam city ..... | 2-1 |
| Map 2-2: Administrative Map of Haldwani-Kathgodam.....       | 2-3 |
| Map 2-3: Population density map of Haldwani-Kathgodam .....  | 2-4 |
| Map 2-4: Urban Sprawl Haldwani-Kathgodam city .....          | 2-6 |
| Map 3-1: Riparian stretch within Haldwani-Kathgodam .....    | 3-7 |

|                                                                                                                  |      |
|------------------------------------------------------------------------------------------------------------------|------|
| Map 3-2: Activity mapping along the Gaula River .....                                                            | 3-9  |
| Map 3-3: Map showcasing the informal settlements within the Flood Plain Zone .....                               | 3-10 |
| Map 3-4: Flood Plain Map.....                                                                                    | 3-12 |
| Map 3-5: Areas of concerns within the flood plain .....                                                          | 3-13 |
| Map 4-1: Status of ground water in Haldwani Block .....                                                          | 4-3  |
| Map 4-2: Geological formations in Uttarakhand .....                                                              | 4-3  |
| Map 4-3: Physical Infrastructure Map .....                                                                       | 4-10 |
| Map 4-4: Solid Waste Hotspot Map.....                                                                            | 4-11 |
| Map 6-1: Spatial Division of the Gaula Riverfront – Eco-Recreational Gateway and Resilient Urban Interface ..... | 6-2  |
| Map 6-2: Proposed gabion intervention, western bank of Gaula River (Rajpura Basti – Gas Godam Road).....         | 6-9  |
| Map 6-3 : Proposed intervention locations on Kalsiya nalla for addressing issues of rock and debris flow .....   | 6-11 |
| Map 6-4: Sewered and unsewered areas along with location of Indira Nagar Nallah .....                            | 6-15 |
| Map 6-5: Proposed site for Indira Nagar I&D .....                                                                | 6-16 |
| Map 6-6 : Proposed drain diversion to constructed wetland on riverbed .....                                      | 6-18 |
| Map 6-7: Degraded Riparian Buffer .....                                                                          | 6-29 |
| Map 6-8: Existing natural dense Riparian buffer stretches .....                                                  | 6-33 |
| Map 6-9: Proposed Pipeline and pumping station for reuse of treated used water.....                              | 6-36 |
| Map 6-10: Proposed components of Gaula Park.....                                                                 | 6-39 |

## List of Tables

|                                                                                                                        |      |
|------------------------------------------------------------------------------------------------------------------------|------|
| Table 2-1: Role and responsibility of key government agencies for Haldwani- Kathgodam City .....                       | 2-10 |
| Table 3-1: Details of Riparian buffer along Gaula river.....                                                           | 3-4  |
| Table 3-2: On-going Works by Irrigation Department .....                                                               | 3-14 |
| Table 3-3: Proposed erosion and flood protection works by Irrigation Department.....                                   | 3-14 |
| Table 3-4: Roles and responsibilities of government agencies in ecological management for Haldwani–Kathgodam City..... | 3-14 |
| Table 4-1: Share of Surface and Ground water in Municipal area.....                                                    | 4-1  |
| Table 4-2: Sanitation Zones of Haldwani-Kathgodam .....                                                                | 4-4  |
| Table 4-3: Current Status of network augmentation Schemes of Peyjal Nigam .....                                        | 4-5  |

|                                                                                                                     |     |
|---------------------------------------------------------------------------------------------------------------------|-----|
| Table 4-4: Drainage network Zones .....                                                                             | 4-6 |
| Table 4-5: Proposals for Solid Waste processing .....                                                               | 4-8 |
| Table 6-1: Proposed Interventions for Flood and Water Management in Haldwani–Kathgodam Draft Master Plan 2041. .... | 6-4 |

## List Of Annexure

|                                                                                                                                   |          |
|-----------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>Annexure 1: Technical Specifications for the Gabion Structure (as per IS 14262:1995, IS 16014:2012, IRC: P:116-2018) .....</b> | <b>1</b> |
| <b>Annexure 2 : Technical Specifications .....</b>                                                                                | <b>2</b> |
| <b>Annexure 3: Calculations for controlled disposal of septage in the collection tank of 28 MLD STP ...</b>                       | <b>3</b> |
| <b>Annexure 4: Draft Scope of Work for Faecal Sludge and Septage Management (FSSM) .....</b>                                      | <b>5</b> |
| <b>Annexure 5: Draft Scope of Work for Sheetlahat Spring shed Management .....</b>                                                | <b>8</b> |



## EXECUTIVE SUMMARY

A river and a city have a symbiotic relationship. The river provides the "life" (resources, climate regulation, identity), and in return, the city acts as the "steward" (protecting the catchment, managing flow, and maintaining biodiversity). However, in recent times this relationship has devolved into parasitism, where the city extracts resources and dumps waste, slowly killing the host river. Urban River Management Plan (URMP) is a strategic framework designed to shift the urban-river dynamic from "exploitation" (parasitism) to "stewardship" (symbiosis).

The purpose of the Urban River Management Plan (URMP) Haldwani-Kathgodam is to develop a dedicated strategy for managing the Gaula River and its tributaries that flows through the city in an efficient and sustainable manner.

The purpose of this document (Urban River Management Plan, URMP of Haldwani – Kathgodam) is to develop a dedicated strategy for managing the extent of Gaula River and its tributaries that flow through the city of Haldwani-Kathgodam in an efficient and sustainable manner. The document is based on the Strategic Framework for Managing Urban River Stretches developed by the National Institute of Urban Affairs (NIUA), in association with the National Mission for Clean Ganga (NMCG).

The URMP proposes **21 tangible and practical actions in addition to several recommendations for managing the river under a ten-point agenda** (or objectives) to ensure the "Nirmal" and "Aviral" nature of the rivers in the city. The level of detail for the interventions is restricted to the concept idea for general understanding. Detailed Project Reports (DPRs) will be prepared for each intervention based on the concept ideas proposed in the document. The URMP document is a living document, which will address issues related to river management on continuous basis.

### Approach adopted for preparing the URMP for Haldwani-Kathgodam

At the start, a core Multistakeholder Working Group (MSWG) comprising eleven members from fifteen organizations, chaired by the Additional District Magistrate of Nainital district was set up to lead the development of the URMP for Haldwani-Kathgodam. The team from NIUA and NMCG helped facilitate the MSWG meeting.

This was followed by a rapid baseline assessment to understand river-related issues and challenges faced by the city and identify opportunities to enhance river-city interaction. The assessment was based on secondary data, published reports, and projects implemented / under implementation within the city. The baseline included information on planning provisions related to river, streams, drains etc; status of river pollution, groundwater status, encroachments in floodplain etc; and ongoing projects in the city on rivers, streams and drains.

A second MSWG meeting was held under the chairpersonship of Chief Development Officer (CDO), Bhimtal to seek input from different actors for the development of the URMP. On the basis of the rapid baseline assessment and discussions with MSWG members, 23 projects/interventions were identified that will be taken up in Haldwani-Kathgodam's URMP.

### Envisaged benefits of the URMP for Haldwani-Kathgodam city

It is envisaged that implementing the URMP will yield several tangible and intangible benefits, as listed below.

1. It will improve climate resilience and environmental outlook of the city, making it more appealing to residents and visitors as well as help in providing ancillary benefits such as water pollution control, thriving biodiversity, flood mitigation, and improved groundwater recharge.
2. It will improve the connect between the residents and the river by creating avenues for recreation, social bonding, and leisure thereby improving the quality of life of the residents.
3. It will boost the city’s river-related economy and provide livelihood for multiple stakeholders.
4. The URMP will create a premise for shared governance with key stakeholders and citizens and enable them to take on a more active role in managing the city’s environmental assets and instilling a sense of ownership around actionable items.

### Interventions proposed in URMP

The table on next page presents the key details of the 22 interventions that includes the agencies responsible for implementation, estimated costs, and the source of funding for each intervention.

| Sl. No. | URMP Objective                           | Intervention                                                                                              | Responsible Agency                                                 | Estimated Cost (In rupees)                                                            | Potential Financing Sources                                                                                                                                                                |
|---------|------------------------------------------|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | Regulation of Activities in Flood Plains | Intervention 1: Inclusion & strengthening of provisions in Draft Master Plan of Haldwani-Kathgodam, 2041. | Town & Country Planning, Govt. of Uttarakhand                      |                                                                                       | Town & Country Planning, Govt. of Uttarakhand                                                                                                                                              |
|         |                                          | Intervention 2: Naturalised bank protection measures along the Gaula river.                               | Irrigation Dept; Supporting Agencies: NMCG, Cantonment Board & HMC | 4.5 – 5.5 crore                                                                       | Uttarakhand Irrigation Department (integration with ongoing flood schemes), National Mission for Clean Ganga (NMCG), CSR contributions (local industries, banks, cantonment partnerships). |
|         |                                          | Intervention 3: Debris arresting and bank protection measures                                             | Irrigation Dept; Supporting Agencies: NMCG, Cantonment Board & HMC | Gabion Check Dam: 8–10 lakh<br>Flexible Rockfall Barrier: 12–15 lakh<br>Gabion Walls: | Uttarakhand Irrigation Department (integration with ongoing flood schemes), National Mission for Clean Ganga (NMCG), CSR contributions (local industries, banks, cantonment partnerships). |

| Sl. No. | URMP Objective                                     | Intervention                                                                       | Responsible Agency                           | Estimated Cost (In rupees) | Potential Financing Sources                                                                                                                                     |
|---------|----------------------------------------------------|------------------------------------------------------------------------------------|----------------------------------------------|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         |                                                    |                                                                                    |                                              | 25–28 lakh                 |                                                                                                                                                                 |
| 2       | To keep river free from pollution                  | Intervention 4: Construction of I&D at Indira Nagar Nallah                         | Pey Jal Nigam                                | 2.5 Crore                  | Namami Gange                                                                                                                                                    |
|         |                                                    | Intervention 5: Diversion of railway colony drain to constructed wetland           |                                              | 40 Lakhs                   | Jal Jeevan Urban and CSRs                                                                                                                                       |
|         |                                                    | Intervention 6: Hybrid treatment of Faecal Sludge in city                          | Lead: HMC<br>Support: Jal Sansthan Dept      | 1.5 Crores                 | State Urban Development Department (SUDA), Swachh Bharat Mission (Urban) – FSM component, Convergence with AMRUT 2.0 or National River Conservation Plan (NRCP) |
|         |                                                    | Intervention 7: Preparation of Faecal and Septage Management Plan                  | Lead: HMC<br>Support: Jal Sansthan Dept      | 50 Lakhs                   | State Urban Development Department (SUDA), Swachh Bharat Mission (Urban) – FSM component, Convergence with AMRUT 2.0 or National River Conservation Plan (NRCP) |
|         |                                                    | Intervention 8: Creation of Bamboo Fencing & Vertical Gardens for Waste Prevention | Irrigation Department, Municipal Corporation | 2.5 Lakhs                  | CSRs, SBM, AMRUT, NMCG                                                                                                                                          |
| 3       | To rejuvenate waterbodies and wetlands in the city | Intervention 9: Catchment restoration & revitalization study of                    | Jal Sansthan                                 | 36.50 Lakhs                | CAMPA                                                                                                                                                           |

| Sl. No. | URMP Objective                                        | Intervention                                                            | Responsible Agency                                                                              | Estimated Cost (In rupees) | Potential Financing Sources                                                                                                         |
|---------|-------------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
|         |                                                       | Sheetlahat spring                                                       |                                                                                                 |                            |                                                                                                                                     |
| 4       | To enhance riparian buffer along river bank           | Intervention 10: Restoration of degraded riparian stretches             | Forest Department & Irrigation department                                                       | 97 lakhs                   | CSR, Namami Gange, Forest funds, National Green Mission                                                                             |
| 5       | Reuse of treated waste water                          | Intervention 11: Enhance the reuse of treated wastewater in the city    | Jal Nigam; Supporting Agencies: NMCG and Forest dept                                            | 6 Crore                    | State Urban Development Funds, CAMPA and CSR funding                                                                                |
| 7       | To develop eco-friendly riverfront projects           | Intervention 12: Develop a new Gaula Riverfront Park near Gaula Barrage | Irrigation department                                                                           | 5 crore                    | AMRUT 2.0, SBM Urban, State Tourism Grants, CSR                                                                                     |
| 9       | To inculcate river-sensitive behaviour among citizens | Intervention 13: Interpretive Signage and QR-Coded Storytelling Boards  | Haldwani Kathgodam Nagar Nigam; Supporting Agencies: NMCG, SHGs, NGOs, educational institutions | 15–20 lakh                 | Nagar Nigam & Namami Gange, CSR: Railways, forest industries, local banks and Community: RWAs & heritage NGOs.                      |
|         |                                                       | Intervention 14: Distribution of Biodegradable Offering Kits            | HMC; Supporting Agencies: Temple committees, SHGs, NGOs                                         | 10–12 lakh                 | Municipal sanitation budget, CSR (local businesses, flower vendors, Temple trusts & SHG cost-sharing and IEC support (Namami Gange) |
|         |                                                       | Intervention 15: Promotion of Electric Crematoriums                     | HMC; Supporting Agencies: Religious Boards, SHGs, NGOs                                          | 25–30 lakh                 | SBM(U) and NMCG subsidies, CSR funds from local industries/businesses, Funding from religious boards & funeral trusts               |
|         |                                                       | Intervention 16: Short Videos and Jingles on Segregation and            | Haldwani Kathgodam Nagar Nigam; Supporting Agencies:                                            | 8–10 lakh                  | Municipal IEC budget allocation under SBM(U), CSR funds telecom/ All India Radio partners                                           |

| Sl. No. | URMP Objective                                    | Intervention                                                                | Responsible Agency                                                                                      | Estimated Cost (In rupees) | Potential Financing Sources                                                                                                  |
|---------|---------------------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|----------------------------|------------------------------------------------------------------------------------------------------------------------------|
|         |                                                   | Composting of Solid Waste                                                   | Schools, SHGs, NGOs, FM radio                                                                           |                            | &educational institutions                                                                                                    |
|         |                                                   | Intervention 17: Annual Celebration of “Gaula Utsav”                        | Haldwani Kathgodam Nagar Nigam; Supporting Agencies: Tourism and Educational Departments, RWAs and NGOs | 30–40 lakh                 | NMCG, Municipal cultural allocations, CSR contributions (industries, banks, tourism stakeholders), State Tourism Department. |
| 10      | To engage citizens in river management activities | Intervention 18: Formation of River Sabha Committees at City-Level          | Haldwani Kathgodam Nagar Nigam; Supporting Agencies: RWAs, SHGs and NGOs                                | 15–20 lakh                 | Municipal budget, CSR contributions.                                                                                         |
|         |                                                   | Intervention 19: Competitions (Poster Making, Debates) on Waste-Free Rivers | Education Department; Supporting Agencies: Schools, Colleges and NGOs                                   | 5–7 lakh                   | Education Department, Municipal IEC Budget, CSR contributions from schools, coaching institutes and NGO.                     |
|         |                                                   | Intervention 20: Street Plays (Nukkad Natak) by RWAs & local community      | Haldwani Kathgodam Nagar Nigam; Supporting Agencies: RWAs, SHGs and NGOs                                | 8–10 lakh                  | Municipal IEC Budget and SBM(U)                                                                                              |
|         |                                                   | Intervention 21: Engage Local Residents in River Clean-Up Drives            | River Sabha Committees; Supporting Agencies: RWAs, SHGs and NGOs                                        | 12–15 lakh                 | Municipal IEC budget allocation under SBM(U) and CSR funds, Community contributions (RWAs)                                   |
|         | <b>Total</b>                                      |                                                                             |                                                                                                         | <b>Approx. 28 Crore</b>    |                                                                                                                              |



# 1 INTRODUCTION

The National Institute of Urban Affairs (NIUA) and the National Mission for Clean Ganga (NMCG) have collaborated to promote river-sensitive urban development across cities in the Ganga basin and other Indian river basins. This collaboration aims to harness the role of the cities to rejuvenate and restore river health. As part of this initiative, two major support systems have been developed: Urban River Management Plan (URMP) Framework and Guidelines for creating River-Sensitive Master Plans.

The framework was prepared to help cities improve and sustain river stretches within their boundaries through holistic, ecosystem-based interventions. It underscores that healthy river are essential for urban livability and productivity, and its vision is organized around three elements—environmental, economic and social, supported by ten objectives. These objectives are translated into city-specific projects, each tied to funding sources and institutional mechanisms for effective implementation.



Figure 1-1: Ten Objectives of the URMP

A total of sixty URMPs are planned in two phases with 25 in Phase I and 35 in Phase II, including five cities in Uttarakhand in the first phase. Funded by the World Bank under Namami Gange Mission II, this initiative is expected to guide Urban Local Bodies (ULBs) in addressing challenges such as drying rivers, poor waste management, loss of green cover, floodplain encroachment, and industrial pollution through systematic, city-level planning. The three tiers of governance and monitoring committees at the center, state and city level is depicted in Figure 1-2.

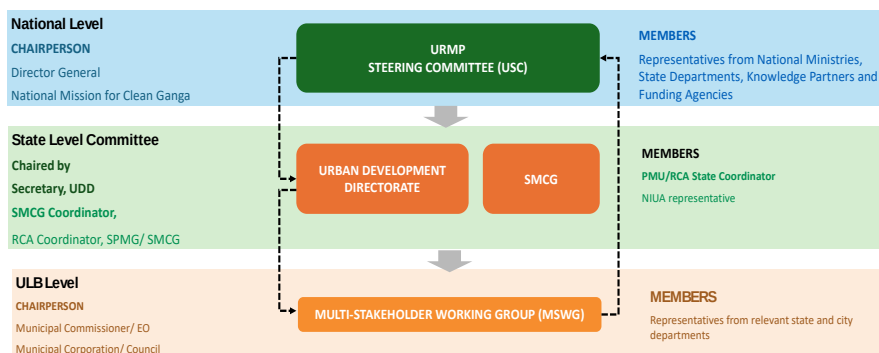


Figure 1-2: National, State & City Engagement for the URMP Preparation

## 1.1 Process for preparation of the URMP Haldwani-Kathgodam

The preparation of an URMP follows a systematic approach as per the NIUA’s URMP Components and Guidance Note 2020 and strategic guidelines for making River Sensitive Master Plans 2021 to ensure effective river conservation, sustainable management and stakeholder collaboration. The process involves multiple stages, each contributing to a comprehensive and actionable plan as depicted below.

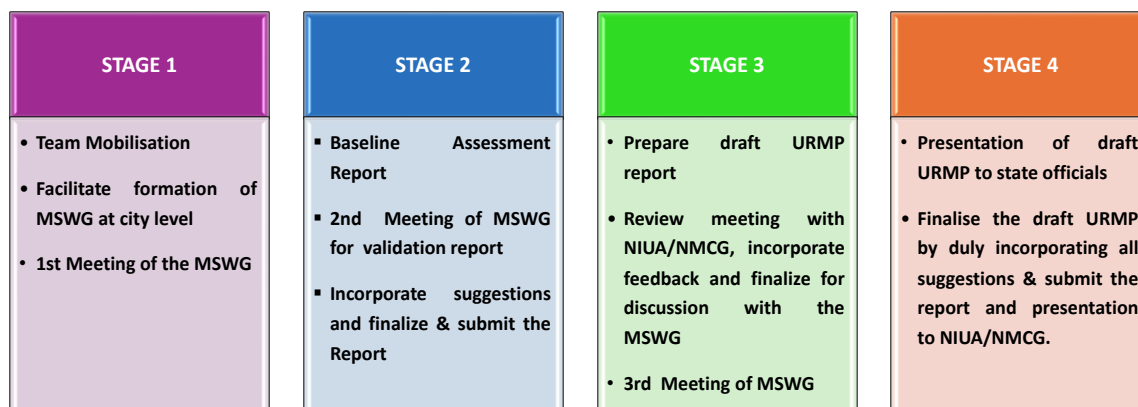


Figure 1-3: Process for preparation of URMP

In order to ensure that the plan is participatory and has involvement of concerned government agencies from the state to the city level, workshops and meetings have been carried out at all levels.

## 1.2 Status of work and contents of the present deliverable

Tasks one to three as listed in the previous section have been completed and findings are elaborated in the present deliverable of Draft URMP Report. The detailed content of the report includes the following:

- Key points discussed during URMP State level Steering Committee Meeting for Uttarakhand held on 6<sup>th</sup> February 2025 at Dehradun,
- Discussions during 1<sup>st</sup> Multistakeholder Working Group (MSWG) meeting at Nainital on 5<sup>th</sup> March 2025,
- Discussions during 2<sup>nd</sup> Multistakeholder Working Group (MSWG) meeting at Nainital on 8<sup>th</sup> October 2025,
- Analysis of the field visit, primary and secondary data available in the public domain and collected from various stakeholder departments post the MSWG meeting.

### 1.2.1 URMP State level Steering Committee

A State-level URMP Committee, chaired by the Secretary, Urban Development Department (UDD), Government of Uttarakhand has been constituted to oversee the URMP Process. The first State level Steering Committee meeting was held on 06 February 2025 in Dehradun, chaired by Director General, NMCG, with participation from Urban Development Department (UDD) Uttarakhand, State Mission for Clean Ganga (SMCG), Town and Country Planning Office (TCPO), Pey Jal Nigam, NIUA, World Bank, School of Planning and Architecture (SPA) and project consultants.

The meeting presented the guiding principles, objectives and work plan for preparing URMPs in five cities of the state. Commissioners, Executive Officers and senior officials shared the current status,

challenges and future plans for river management in their cities.



**Image 1-1: Steering Committee Meeting for Uttarakhand on 6th February 2025**

### 1.2.2 Multistakeholder Working Group

To guide the development of city URMP, a Multistakeholder Working Group (MSWG) was formed comprising of 15 representatives from Municipal Corporation, City Magistrate, Forest Department, Tourism Development Board, Uttarakhand Urban Sector Development Agency, Forest Development Corporation, Irrigation Department, Pay Jal Nigam, Jal Sansthan, TCPO, SMCG, Pollution Control Board, Hotel Association and NGO. Post the state level workshop, the first MSWG meeting was held on 5th March 2025 under the chairmanship of Additional District Magistrate of Nainital district, to notify the MSWG for the city and the nodal officer for the URMP (refer Image 1-2).



**Image 1-2: Joint MSWG held on 5th March 2025 at Nainital**

The second MSWG meeting for finalisation of the baseline report was held on 8<sup>th</sup> October 2025 under the chairpersonship of Chief Development Officer (CDO), Bhimtal (refer Image 1-3).



**Image 1-3: 2<sup>nd</sup> MSWG held on 8<sup>th</sup> October 2025 at Bhimtal**



### 1.2.3 Draft URMP Report

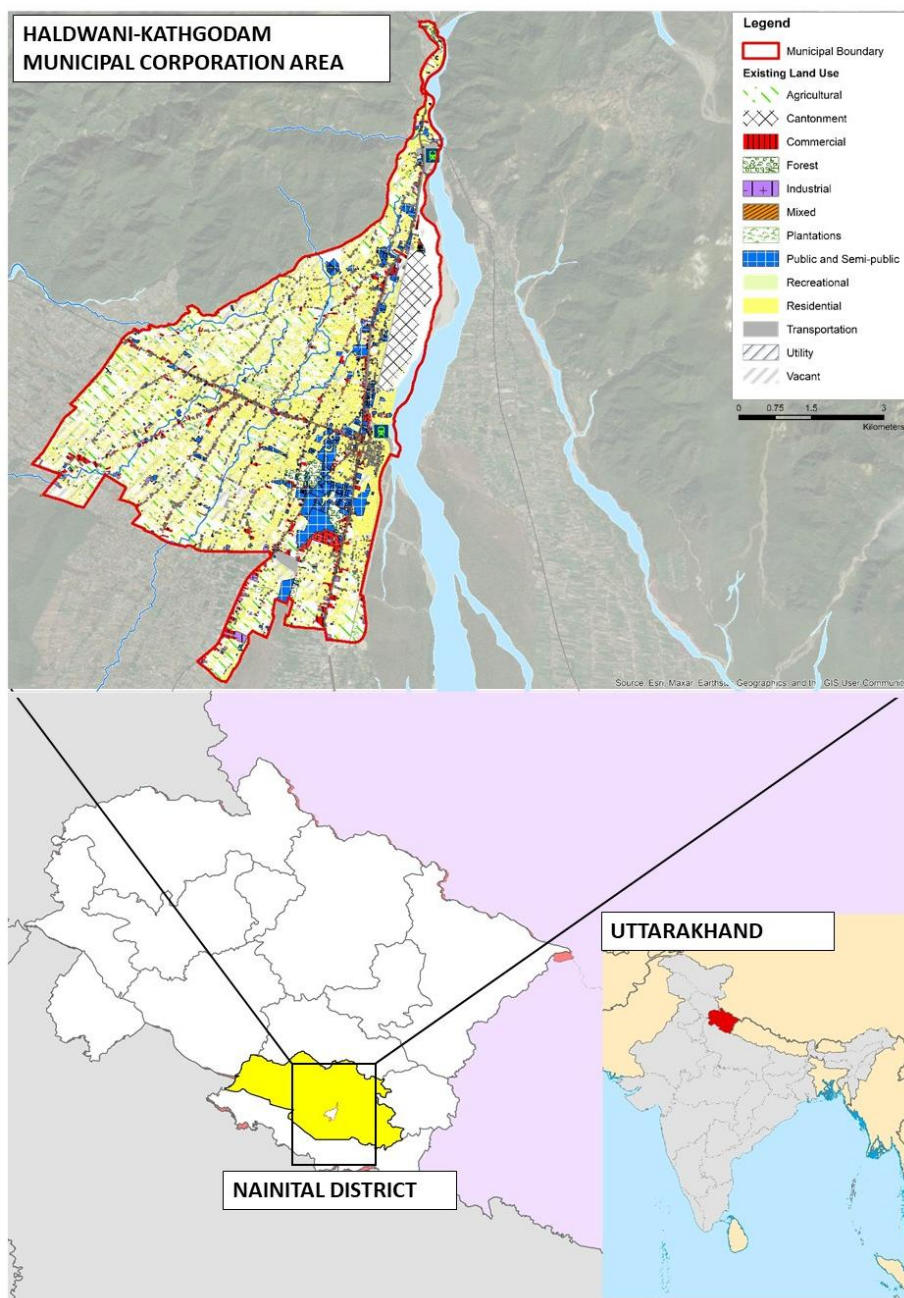
This draft URMP report includes tangible interventions for river conservation and management for each of the ten URMP objectives. Multiple meetings and consultations with all the concerned agencies along with site visits were conducted to assess the ground situation and identify opportunities for future interventions (refer Image 1-4). Based on the gaps and prioritized issues identified in the Baseline Assessment Report, this document outlines interventions and recommended actions. Each intervention is elaborated in detail, including the project rationale, conceptual framework, key components, broad cost estimates, funding source and the designated implementing agency.



Image 1-4: Consultations and Site Visits

## 2 CITY PROFILE

Haldwani–Kathgodam is a twin city, located in Nainital district of Uttarakhand State. The city is situated at the foothills of the Kumaon Himalayas, along the western bank of Gaula River. The NH-109 (formerly NH-87) connects Haldwani-Kathgodam to Nainital (40 km), Almora (89 km) and Delhi (280 km) and is the primary arterial route for both tourism and freight. NH-9 links Haldwani to Rampur, Bareilly and Lucknow, facilitating access to the Indo-Gangetic plains.



Map 2-1: Contextual Setting of Haldwani-Kathgodam city



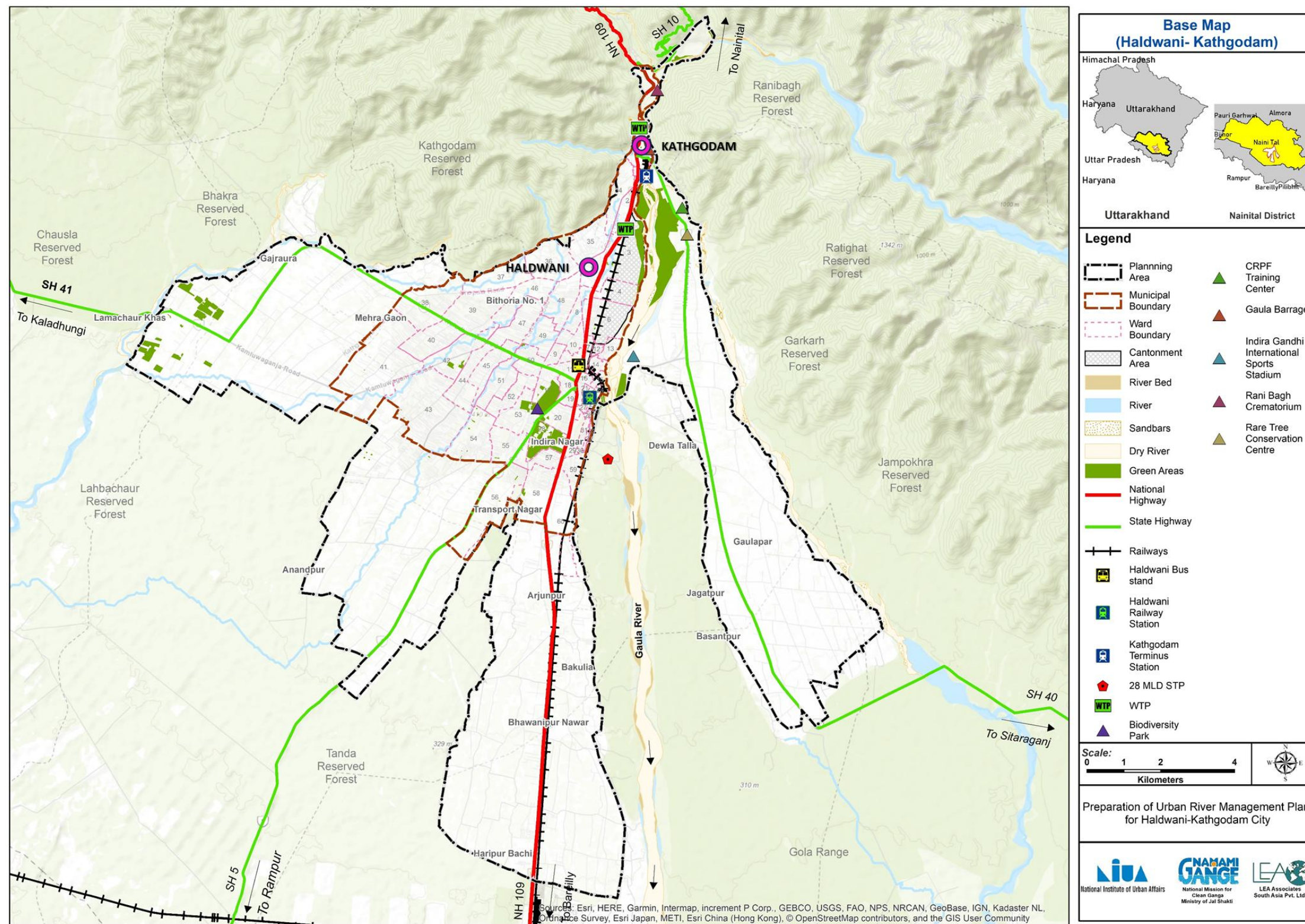
## 2.1 City Administrative Boundaries

The planning area of Haldwani-Kathgodam extends over 154 sq.km and includes the Haldwani-Kathgodam Municipal Corporation (HKMC) along with 174 Gram Panchayats across three tehsils i.e., Nainital, Haldwani and Lalkuan (refer Map 2-2). The Haldwani-Kathgodam Planning Area (HKPA) operates under the jurisdiction of the Nainital District Level Development Authority (DLDA).

The Haldwani-Kathgodam Municipal Corporation (HKMC), established in 2011, covers an area of 44.11 sq. km and comprises 60 wards. The municipal area is divided into Old City (11 sq. km) and New City (33.11 sq. km).

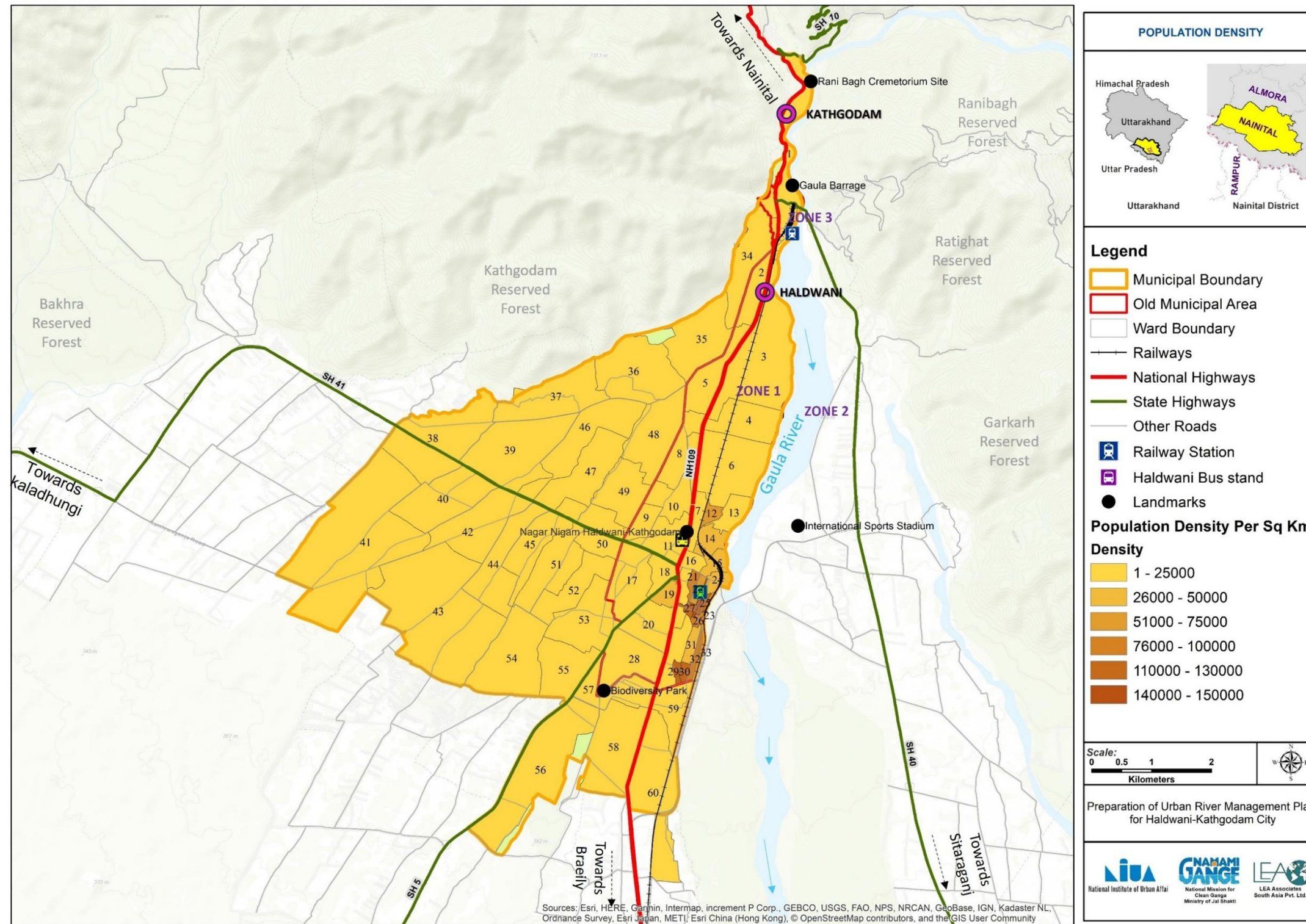
## 2.2 Demography

The total population of the municipal corporation is 2,83,153 (Census 2011) and the population in planning area is 3,74,558. Based on the current decadal growth trend, population for the year 2025 (base year) is estimated to be approximately 5.3 lakhs for the municipal area and 7.6 lakhs for the planning area. The population of Haldwani-Kathgodam city is expected to grow up to 10.54 lakhs in 2051. Over the years, expansion of the city is restricted due to presence of forest on all four sides of the city (refer Map 2-3).



Map 2-2: Administrative Map of Haldwani-Kathgodam





Map 2-3: Population density map of Haldwani-Kathgodam

## 2.3 Physiographic Profile

### 2.3.1 Topography

Haldwani-Kathgodam is characterized by alluvial plains, river terraces and forest. To the north, Kathgodam marks the transition from mountainous terrain to the plains and in the south of Kathgodam lies Haldwani in the Bhabhar Zone whose terrain consists of porous and rocky soil that allows rapid groundwater percolation. Haldwani-Kathgodam has evolved into a distinct fan-shaped pattern shaped by the surrounding mountain ranges

### 2.3.2 Geophysical Characteristic

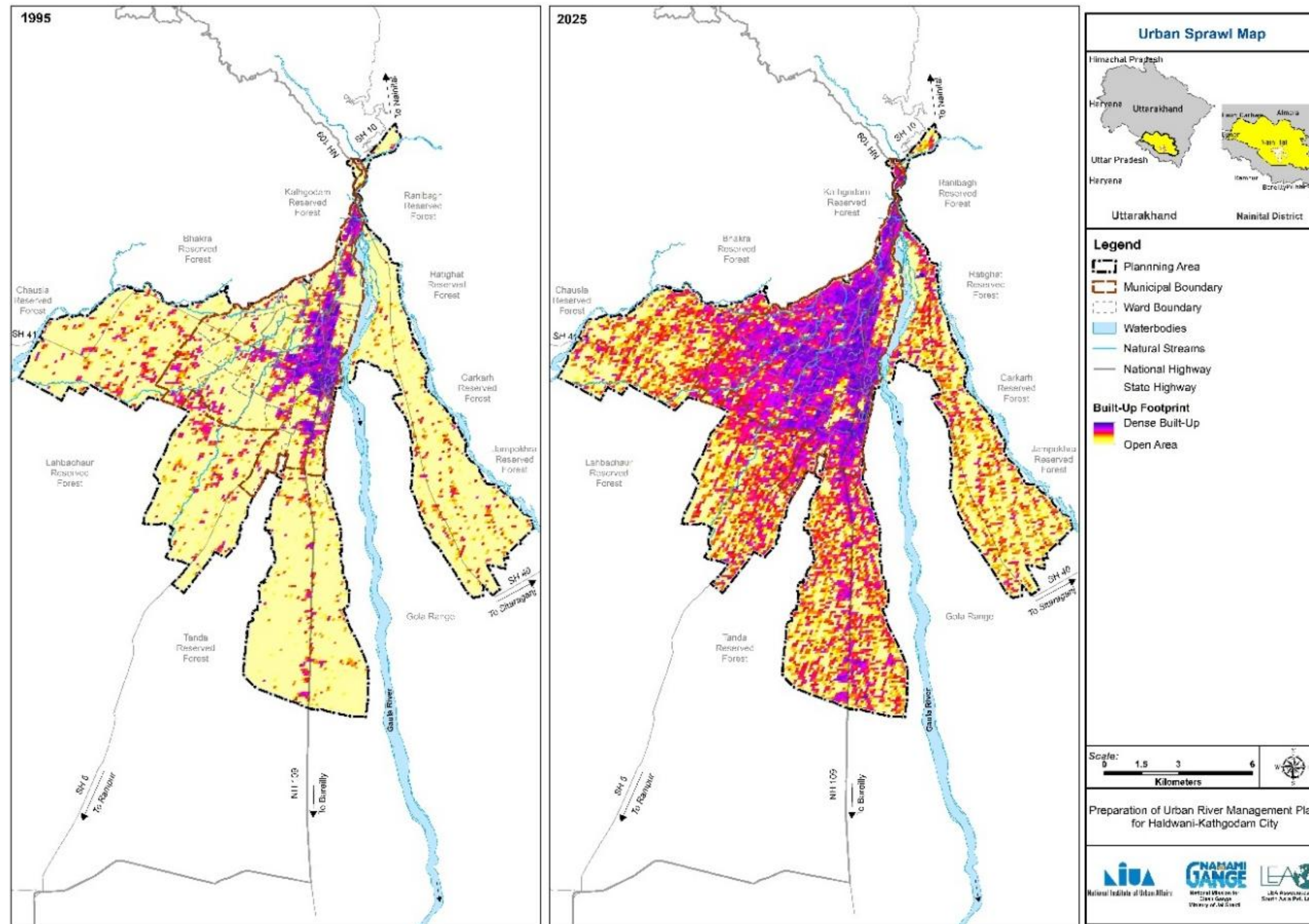
The Gaula River flowing along the eastern edge of the city influences its hydrology and landform development. The rivers here go underground to re-emerge in the Indo-Gangetic plain in the Terai zone. The city features a gradual and moderate slope from north to south. Kathgodam to the north is at a slightly higher elevation, i.e., 554 meters and of Haldwani, is 424 meters.

The soil in Haldwani-Kathgodam is predominantly coarse loamy to sandy, with high permeability from gravel and boulders that enable rapid infiltration, making the area heavily reliant on groundwater. The Gaula River transports large quantities of silt and stone, supporting the local construction industry. However, loose alluvial soils and steep upstream catchments render the city highly vulnerable to seasonal flash floods and erosion during monsoons.

## 2.4 Urban Sprawl

The mountain ranges surrounding the city acts as a natural barrier to urban expansion. Residential land use is mainly concentrated within the city center and disperses toward the periphery of the planning area. Gaula River serves as a prominent geographical feature, delineating land use patterns in the city. The western bank is primarily occupied by the Cantonment area, while the eastern bank is dominated by protected forest land. Map 2-4 depicts the comparative status of the land use/ built up area in the span of 30 years (from 1995 to 2025).





Map 2-4: Urban Sprawl Haldwani-Kathgodam city

## 2.5 History and Cultural Profile

Haldwani's transformation spans nearly two centuries, beginning in 1834 as a winter trading mart under Haldu trees. By 1850, masonry structures replaced grass-thatched huts, establishing a permanent urban footprint. The Railway Era of 1884, with dual stations at Haldwani and Kathgodam, positioned the city as the "Gateway to the Himalayas". Governance evolved from a colonial headquarters in 1901 to a unified Municipal Council by 1942, strengthening its administrative base. The creation of Uttarakhand in 2001 marked a turning point, propelling Haldwani into its current role as the "Commercial Capital" and primary growth engine of the Kumaon region.

## 2.6 Tourism Profile

Haldwani serves as a transit hub for tourists traveling to Nainital and Bhimtal with tourism potential concentrated in Kathgodam. Every year, the annual tourist footfall transiting towards Nainital<sup>1</sup> & Bhimtal from the city is 5,29,676, of which around 1% are foreign tourist. As per the Master Plan 2041, the tourist footfall in HKPA shows a gradual upward trend. It declined during Uttarakhand flood (2013) and Covid-19 pandemic (2019-20) refer Figure 2-1 . Presently, there are two tourist information centres in the municipal area and 97 hotels in the planning area with an average of 15 beds in each.

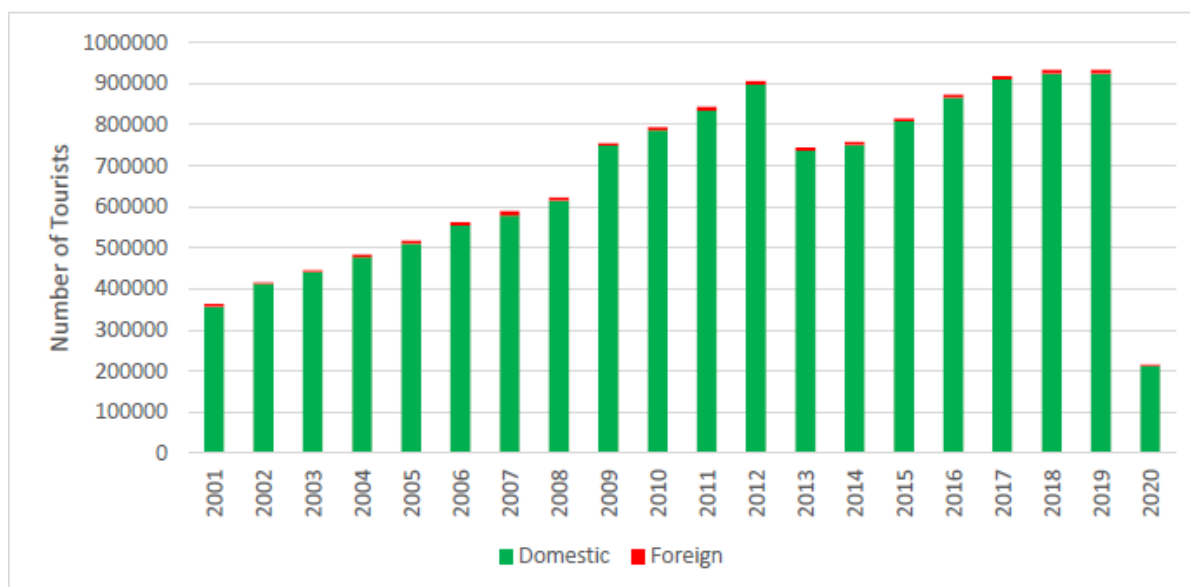


Figure 2-1: Tourist footfall trend of Haldwani-Kathgodam

Source: Department of tourism, 2021

## 2.7 Socio – Economic Profile of the City:

a. **Economic activities along the river:** The major activities along Gaula river are listed below:

<sup>1</sup> <https://nainital.nic.in/document-category/district-profile/>



- **Sand Mining:** Sand mining in HKPA supports construction projects. The Gaula River provides for the requisite materials such as sand, gravel and minerals, making it a significant hub for material distributor across the state. Environmental safety is being adhered to by following Uttarakhand Mineral (Prevention of Illegal Mining, Illegal Transport and Illegal Storage) Rules pertaining to strict rules on permits, environmental clearances, and transport monitoring. It also generates employment and contributes to the local economy. (Refer Image 2-1)
- **Gaula Barrage with Recreation Park:** The Gaula Barrage is a popular tourist spot for birdwatching and picnics. The scenic riverbanks attract tourists which helps to bolster the small-scale hospitality business located around the barrage. (Refer Image 2-1)
- **River based religious events:**
  - **Uttarayani Mela:** Celebrated across Kumaon in mid-January near Makar Sankranti, is most prominent in Bageshwar and Ranibagh. Over two to three days, thousands of devotees visit Ranibagh’s Sheetla Devi Mandir to offer puja at the ghat beside the stone idol of the goddess
  - The city is home to several other temples, the most notable of which being Kalikathan Temple and Hanuman Ghari Temple,
  - **Chatt Sthal/Ghat:** Approximately, 10,000 worshippers attend the religious event Chatt, which is organized by Chatt Puja Samiti in Haldwani in the month of October and November (according to the auspicious date) at Rampur Road. During this time, it uses water from the Gaula River's irrigation canal. (Refer Image 2-3)

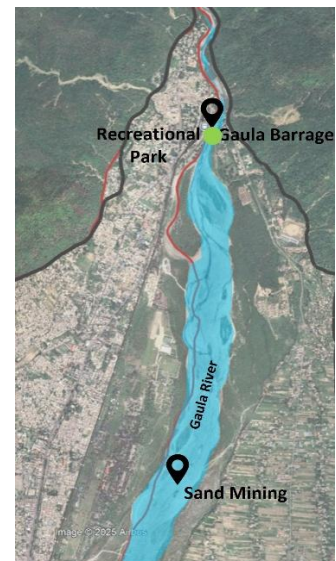


Image 2-1: Economic Activities along the river.



Image 2-2: Prominent Temples along the river.





Image 2-3: Chat Puja at Rampur Road, Haldwani



Image 2-4: Cyclist group, Haldwani

- **Recreational Events along the river:**

**Cycling:** Residents ride bicycles because of the beautiful scenery and the national roadway that runs alongside the river. (Refer Image 2-4)

**IEC and social Engagement:**

Currently, there is limited interaction between the public and the river system, since the river bed remains dry for the most of the year.

**1. IEC Activities of Haldwani Municipal Corporation:**

- The Haldwani Municipal Corporation utilises platforms such as audio messaging to raise awareness amongst citizens under Swachh Bharat Mission, with a key objective of reducing solid waste dumping in rivers. These messages are broadcast daily through municipal waste collection vehicles.
- The city also has 92 Self-Help Groups (SHGs) that support IEC initiatives on solid waste management. Out of these SHGs, one of the SHG named, Bainsi Sena has been established by the Municipal Corporation which oversees and monitors sanitation-related activities in the city. The SHG received recognition by winning the Urban Learnathon 1.0 in 2023.

**2. Stakeholder Groups:** The key stakeholder engaged in river and sanitation-related activities include the are Railways, Forest and Defence.

**3. NGO involvements:**

- Several active NGOs in Nainital District such as Bhoomi Sansthan, Lok Chetna Manch, Ek Sankalp Society, etc. contribute to river conservation efforts. Notably, Mr. Jagjit Singh Negi, known as the “River Man of Nainital”, leads initiatives primarily focused on the Shipra River.



- These NGOs also extend their activities to cleanliness campaigns across other rivers in Uttarakhand, including Gaula river.

## 2.8 Institutional Mechanism

The list of existing agencies responsible for planning, development and service delivery within the HKPA are presented in below:

**Table 2-1: Role and responsibility of key government agencies for Haldwani- Kathgodam City**

| Sl. No.                                 | Department                      | Key role and responsibilities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Nodal Officer                                                     | Applicable for URMP Objectives                        |
|-----------------------------------------|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|-------------------------------------------------------|
| <b>A Local level agencies</b>           |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                   |                                                       |
| 1                                       | Nagar Nigam Haldwani            | <ul style="list-style-type: none"> <li>• City governance and civic administration</li> <li>• Urban services and infrastructure – solid waste management, maintenance of road &amp; drainage, management of water supply &amp; sewerage</li> <li>• Environment and public welfare activities</li> <li>• Development and planning</li> <li>• Public interface and emergency services</li> </ul>                                                                                                                                                               | Municipal Commissioner                                            | Objective 2, objective 4, objective 5 and objective 9 |
| 2                                       | City Magistrate Haldwani        | <ul style="list-style-type: none"> <li>• Maintaining law and order, coordinating civic operations, and ensuring regulatory compliance across the twin cities.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                    | City Magistrate                                                   |                                                       |
| 3                                       | Forest Department               | <ul style="list-style-type: none"> <li>• Protect wildlife habitat in nearby forest areas comprising Gaula Forest, Terai Central Forest, and buffer zones of Corbett Tiger Reserve.</li> <li>• Conserve water catchment areas, especially the Gaula River (vital for the region’s water supply).</li> </ul>                                                                                                                                                                                                                                                  | Divisional Forest Officer, Terai Central, Terai East and Haldwani | Objective 4                                           |
| 14                                      | Hotel Association               | <ul style="list-style-type: none"> <li>• Represent the hospitality industry and collaborate with government departments such as Tourism, Urban Development, Pollution Control, etc.</li> <li>• Provide input on state tourism policies, environmental regulations, pricing norms, and sustainable tourism practices.</li> </ul>                                                                                                                                                                                                                             | Presiding Officer                                                 | Objective 7 and Objective 8                           |
| 15                                      | Local NGO/ Civil Society Member | <ul style="list-style-type: none"> <li>• Educate local communities on river health, waste management, and conservation practices.</li> <li>• Organize awareness drives, clean-up campaigns, nukkad natak, school sessions, and public meetings.</li> <li>• Promote citizen participation in river protection initiatives.</li> <li>• Lead or support riverbank clean-ups, plantation drives, wetland restoration, and lake rejuvenation activities.</li> <li>• Promote volunteerism in events like River Festival, Ganga Swachhta Pakhwada, etc.</li> </ul> | Representative                                                    | Objective 9 and 10                                    |
| <b>B State/ Regional level agencies</b> |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                   |                                                       |

| Sl. No. | Department                                  | Key role and responsibilities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Nodal Officer                         | Applicable for URMP Objectives |
|---------|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|--------------------------------|
| 4       | Uttarakhand Tourism Development Board       | <ul style="list-style-type: none"> <li>Formulate state tourism policies and long-term development strategies</li> <li>Develop eco-tourism zones and nature trails with Forest Department coordination</li> <li>Monitor environmental and social impact of tourism projects</li> <li>Implement safety protocols and eco-friendly practices</li> </ul>                                                                                                                                                                                                                                                                                             | Tourism Development Officer, Nainital | Objective 7 and 8              |
| 5       | Uttarakhand Urban Sector Development Agency | <ul style="list-style-type: none"> <li>Plan and execute projects related to water supply, sewerage, sanitation, solid waste management, and drainage systems.</li> <li>Prepare city development plans (CDPs), master plans, and detailed project reports (DPRs)</li> <li>Monitor progress and ensure timely execution of projects using digital tools and MIS systems</li> <li>Mobilize and manage funds from multilateral agencies (e.g., ADB, World Bank) and government grants</li> <li>Provide technical and managerial support to Urban Local Bodies (ULBs).</li> </ul>                                                                     | Project Manager                       | Objective 2                    |
| 6       | Uttarakhand Forest Development Corporation  | <ul style="list-style-type: none"> <li>Supervise extraction of minor minerals (like sand, gravel, boulders) from forest riverbeds such as: Gaula, Kosi, Sharda, Dabka, and others</li> <li>Prevent illegal mining and support state revenue generation through transparent auctions and lease operations</li> <li>Collection and sale of medicinal herbs, resin, honey, bamboo, etc.</li> <li>Implement CAMPA and other greening projects across the state.</li> </ul>                                                                                                                                                                           | Divisional Land Management (DLM)      | Objective 4                    |
| 7       | State Mission for Clean Ganga, Uttarakhand  | <ul style="list-style-type: none"> <li>Execute centrally funded projects for sewage treatment, river rejuvenation, drainage management, and ghat development</li> <li>Ensure timely completion of STPs (Sewage Treatment Plants), I&amp;D (Interception &amp; Diversion) works, and faecal sludge management projects</li> <li>Oversee construction and beautification of ghats, crematoria, and riverfront amenities to enhance religious and tourism experiences while maintaining sanitation.</li> <li>Conduct awareness campaigns, school programs, and public outreach to encourage citizen participation in river conservation.</li> </ul> | M&E Officer                           |                                |



| Sl. No. | Department                           | Key role and responsibilities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Nodal Officer      | Applicable for URMP Objectives |
|---------|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------------------|
| 8       | Uttarakhand Irrigation Department    | <ul style="list-style-type: none"> <li>Construct and maintain embankments, spurs, check dams, and anti-erosion works along rivers</li> <li>Develop watershed projects to conserve soil and water in hilly terrain.</li> <li>Plan, design, and construct canals, dams, barrages, lift irrigation schemes, and tube wells to support agriculture</li> <li>Identify and mark the maximum flood level recorded or estimated during a major flood.</li> </ul>                                                                                                                                                                                                                                  | Executive Engineer | Objective 1                    |
| 9       | Uttarakhand Pey Jal Nigam            | <ul style="list-style-type: none"> <li>Plan, design and construct drinking water supply,</li> <li>Implement rural water schemes such as Jal Jeevan Mission,</li> <li>Install chlorination units, UV treatment, or filtration systems in contamination-prone zones,</li> <li>Prepare Detailed Project Reports (DPRs) and execute works for sewer networks, sewage treatment plants (STPs), and drainage systems in coordination with Urban Development Department or Smart City Projects.</li> </ul>                                                                                                                                                                                       | Executive Engineer | Objective 2                    |
| 10      | Uttarakhand Jal Sansthan             | <ul style="list-style-type: none"> <li>Responsible for day-to-day operation and maintenance of urban and rural water supply systems.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Executive Engineer | Objective 3 and Objective 6    |
| 11      | Uttarakhand PWD                      | <ul style="list-style-type: none"> <li>Plan, construct, and maintain state highways, district roads, rural roads, and bridges.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Executive Engineer |                                |
| 12      | Town and Country Planning Department | <ul style="list-style-type: none"> <li>Prepare Master Plans, Zonal Development Plans, and Land Use Maps for cities, towns, and notified areas,</li> <li>Prevent unauthorized constructions and encroachments,</li> <li>Conduct public consultations, hearings, and surveys before finalizing plans.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                            | Executive Engineer | Objective 1 and Objective 5    |
| 13      | Uttarakhand Pollution Control Board  | <ul style="list-style-type: none"> <li>Enforce key environmental acts including: Water (Prevention &amp; Control of Pollution) Act, 1974, Air (Prevention &amp; Control of Pollution) Act, 1981, Environment Protection Act, 1986, Plastic Waste Management Rules, 2016, Biomedical Waste Rules, E-Waste Rules, Solid Waste Rules, etc.</li> <li>Regularly monitor water quality of the rivers,</li> <li>Actively support the Namami Gange program through monitoring and enforcement,</li> <li>Ensure no untreated sewage or industrial waste is discharged into rivers,</li> <li>Conduct regular inspections of industrial units, hotels, stone crushers, mining sites, etc.</li> </ul> | Regional Officer   | Objective 2                    |

## 2.9 Conclusion

Haldwani–Kathgodam stands as a critical strategic and economic hub, serving as the "Gateway to the Kumaon Himalayas". Its urban evolution has been deeply shaped by its geography; forcing a fan-shaped growth pattern and concentrating development along the western bank of the Gaula River.

While the city faces physical limitations to its expansion and environmental challenges such as seasonal flash floods and high soil permeability, it continues to experience robust demographic growth, with a projected population exceeding 10 lakhs by 2051. Moving forward, the city's development will depend on balancing its economic activities specifically sand mining and transit tourism with proactive environmental stewardship, as seen in the increasing involvement of Self-Help Groups like the Baini Sena and conservation-focused NGOs in protecting the Gaula River ecosystem.

### 3 ECOLOGICAL PROFILE OF THE CITY

#### 3.1 River ecosystem

The Gaula River, perennial in nature, a tributary of Ramganga, originates from Paharpani region of the Lesser Himalayas. It flows southward Kathgodam, Haldwani, Kichha and Shahi before joining Ramganga about 15 km northwest of Bareilly. Within the municipal area, the length of the river is 12.26 km, extending to 23.4 km within the planning area. Gaula Barrage at Kathgodam is constructed on the river, is a critical infrastructure for irrigation and urban water supply. Water levels of the river fluctuate significantly due to seasonal variations, human activities and environmental changes. The river is fed by Gangoligad, Kalshagad, Kaligad, Balianalla and several other seasonal, perennial streams. The Gaula River, exhibits a dynamic channel pattern as it flows through the city. The river channel south of Gaula barrage has undergone significant widening, likely due to erosion and recurrent flooding events. A notable increase of 16m in the channel width has been observed from April 1999 to April.

The cross-section of the Gaula river and the adjoining city area reveals a dynamic interface between natural and urban systems. The river flows through a narrow channel upstream of Gaula barrage due to its hilly terrain. Downstream of the barrage, it presents a broad river corridor characterized by vegetated banks with shrubs and a central channel. A distinct zone of siltation, comprising accumulated sand and sediments, is observed along the banks and gradually merges into the main river channel (Image 3-1)



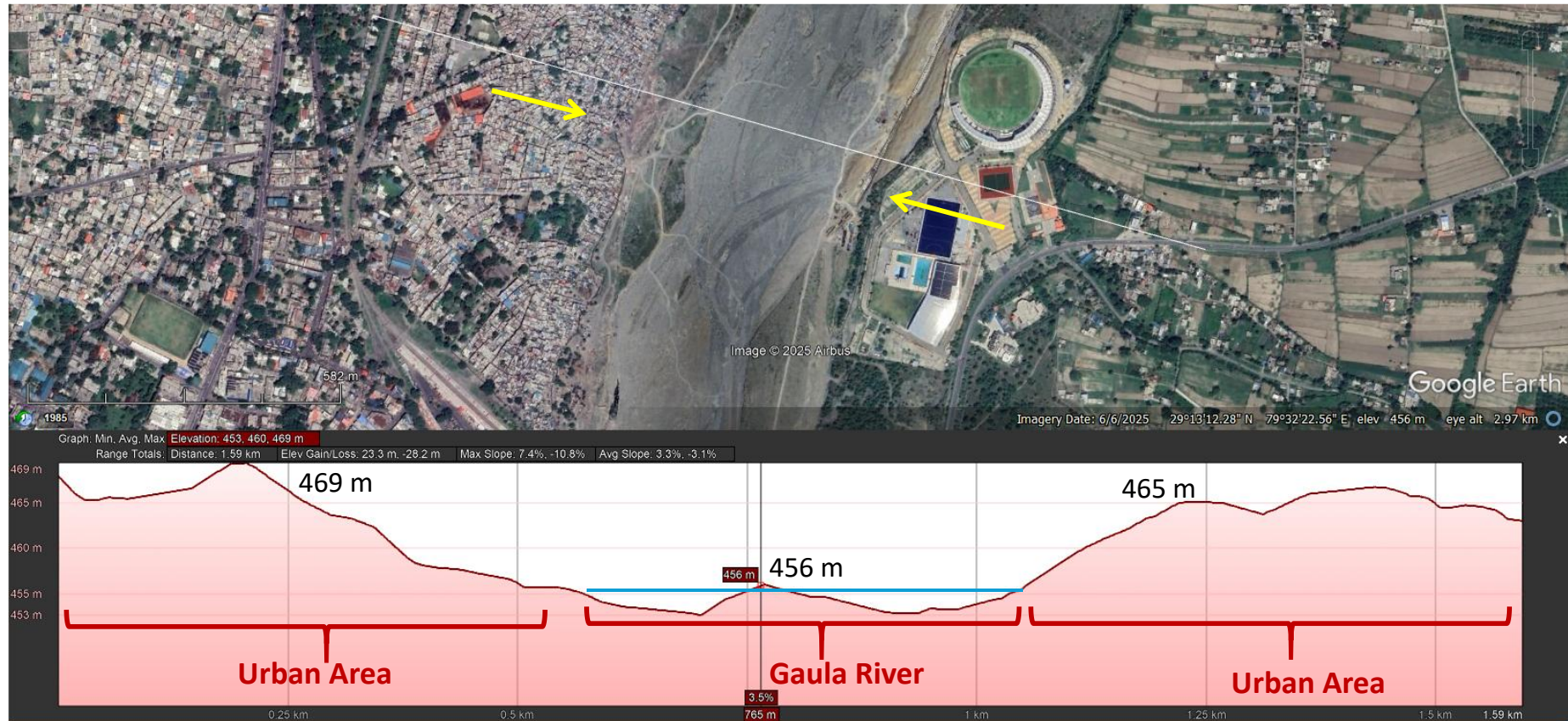


Image 3-1: Cross-Section of Gaula River and its interaction with the city

## 3.2 Blue-Green Resources in the city

### 3.2.1 Blue Resources:

Apart from Gaula River, the irrigation department have listed five major natural streams that flow through the city i.e., Kalasiya, Devkhadi, Rakasiya, Cheenpur and Paniyali nallas. These are seasonal streams which primarily flow during the monsoon season. Further, Sheetlahat spring located on Haldwani-Nainital road at Kathgodam which also contributes to the city’s water supply. On the edges of the planning boundary, the Sukhi River to the east and the Bhakra River to the west provide seasonal flows used for minor domestic and irrigation purposes.

Haldwani-Kathgodam Municipal Corporation does not have any still water bodies other than the Gaula river.

The city depends on a combination of surface water from the Gaula River and Sheetlahat spring, along with groundwater extracted through 80 tube wells for domestic use and many more for irrigation. Approximately 60% of the city’s supply is derived from surface sources, while the remaining 40% is met through groundwater.

The storm water drainage system of the city is divided into 7 zones all over the municipal area. The outfalls of the storm water drains are into the existing natural streams flowing through the city. The drains in the city are poorly managed due to solid waste being dumped into them.

### 3.2.2 Green Resources:

1. **Forest:** HKPA is surrounded by forests, primarily in the hill stretches around the city. To the northwest is Ratighat Reserve Forest whereas Baloti, Damuadunga and Kathgodam reserve forests are located to the northeast of the city. The Nandhaur wildlife sanctuary located to the east.
2. **Biodiversity:** The forests near Haldwani, particularly the Nandhaur Wildlife Sanctuary, are home to a variety of wildlife including tigers, elephants, leopards and sloth bears. The area, part of the Terai Arc Landscape, is known for its rich biodiversity, including a significant number of bird species. The Haldawni Forest Division organises curated eco-tourism safaris to the Nandhaur Wildlife Sanctuary.
- **Urban green belt/ parks:** The city has approximately 5% organised green as against 12% stated Urban and Regional Development Plans Formulation and Implementation (URDPFI) guidelines. The following are the major green belts in the city: City Forest: It is also called Nagar Van located along Rampur Road. It spans about 7.5 hectares and is jointly managed by Forest department and Municipal Corporation.
- **Biodiversity Park:** It is located near Tehri pulia. The area of this park is approximately 7.3 hectares. It features various species of plants and soils from diverse terrains of the state (refer Image 3-2)
3. **Agriculture:** Total agricultural area in HKPA is 52.11%, the region supports cultivation of cereals, vegetables, and fruits, with crops like wheat, paddy, and seasonal vegetables forming the backbone of local farming. The area is also known for horticulture, particularly mangoes, litchis, and guavas, which are marketed across Uttarakhand and neighboring states.





Image 3-2: City Forest and Biodiversity Park at Haldwani-Kathgodam

### 3.2.3 Riparian Buffer

The riverbanks of the Gaula River reflect a mix of hills and flat alluvial plains, supporting riparian vegetation plays a critical role in regulating water flow, storage and ecological balance. The eastern bank with dense vegetation, provides effective protection against flooding and erosion, while the western bank has comparatively sparse cover. This uneven riparian buffer highlights the need for conservation and restoration on both banks to sustain hydrological stability and ecological integrity. Within the planning area, out of the total length of the river, 54% of the eastern bank and 46% of the western bank has riparian buffer.

- 1. Eastern stretches of river:** On the eastern bank, ecological health is generally stronger. The stretch near Kathgodam shows good integrity, with about 64.6% dense vegetation cover. In contrast, the area around the Indira Gandhi International Sports Stadium shows visible stress, where nearly 26.2% of land is now degraded.
- 2. Western Stretches of river:** On the western bank, human pressures are more pronounced. The Cantonment area still retains around 53.3% dense forest cover, but the zones near the Railway Station and Upper Barrage are significantly disturbed, with approximately 17.2% degraded land.

The detailed spatial distribution is presented in Table 3-1 and in Map 3-1 .

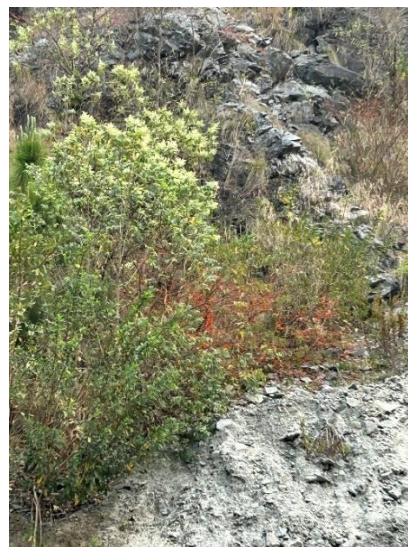
Table 3-1: Details of Riparian buffer along Gaula river

| Name     | Stretches on Western Bank | Length (in meter) | Width (in meter) | Name     | Stretches on Eastern bank | Length (in meter) | Width (in meter) |
|----------|---------------------------|-------------------|------------------|----------|---------------------------|-------------------|------------------|
| Dense    | L-1                       | 2341.10           | 30               | Built-up | R-1                       | 722.83            | 30               |
| Degraded | L-2                       | 99.52             | 30               | Dense    | R-2                       | 1392.41           | 30               |
| Dense    | L-3                       | 1354.94           | 30               | Dense    | R-3                       | 423.31            | 30               |
| Degraded | L-4                       | 57.12             | 30               | Built-up | R-4                       | 274.71            | 30               |
| Dense    | L-5                       | 902.21            | 30               | Dense    | R-5                       | 254.47            | 30               |
| Degraded | L-6                       | 569.79            | 30               | Built-up | R-6                       | 128.53            | 30               |
| Dense    | L-7                       | 1333.75           | 30               | Dense    | R-7                       | 1200.24           | 30               |
| Degraded | L-8                       | 780.84            | 30               | Degraded | R-8                       | 708.22            | 30               |
| Dense    | L-9                       | 967.97            | 30               | Built-up | R-9                       | 1328.48           | 30               |
| Built-up | L-10                      | 324.84            | 30               | Degraded | R-10                      | 1074.28           | 30               |
| Degraded | L-11                      | 1606.66           | 30               | Dense    | R-11                      | 3664.66           | 30               |
| Built-up | L-12                      | 778.77            | 30               | Degraded | R-12                      | 455.89            | 30               |
| Dense    | L-13                      | 807.17            | 30               | Built-up | R-13                      | 1379.28           | 30               |



### 3.2.4 Biodiversity

The typology of flora and fauna found along the Gaula river includes native species like Sal (*Shorea robusta*), Sheesham (*Dalbergia sissoo*), Bamboo and Ficus varieties that stabilize banks and filter runoff. Some common flora species has been listed down below:



*Rhododendron arboreum*, locally known as Buransh



*Clerodendrum trichotomum*



*Lantana camara*





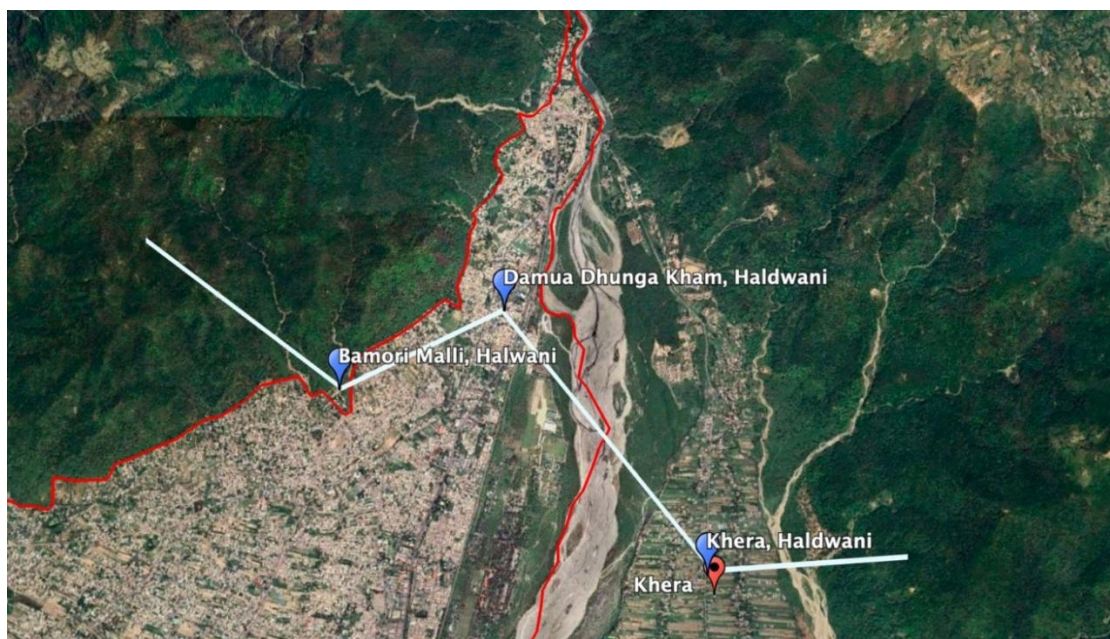
Sal (*Shorea robusta*)



Black-eyed Susan vine

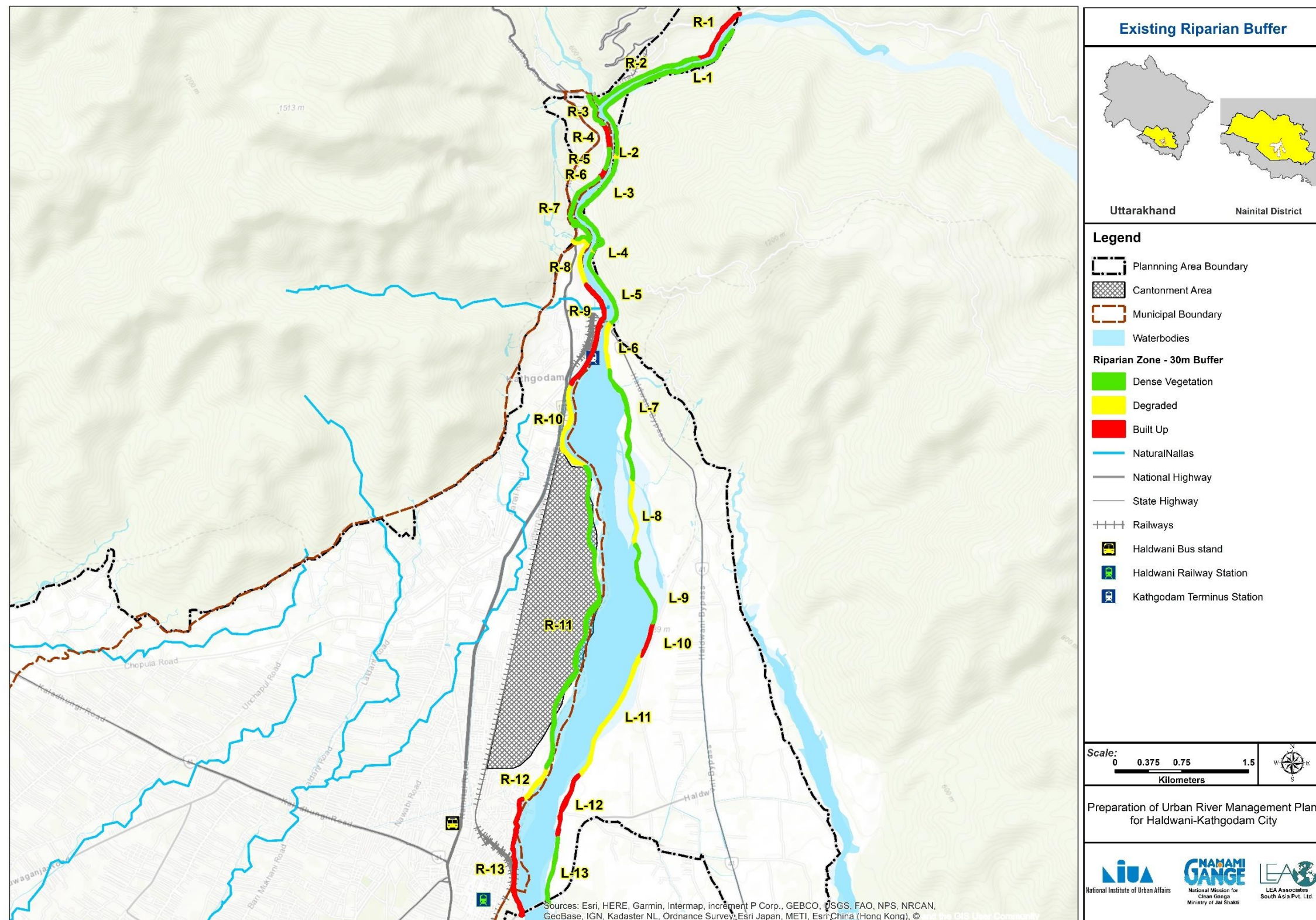
**Image 3-3: Types of flora species along the Gaula River**

The Gaula River Corridor, recognized as a tiger corridor, is one of the most ecologically sensitive bottlenecks in the Terai Arc Landscape (TAL). According to technical reports from WWF-India and the National Tiger Conservation Authority (NTCA), it serves as the only functional forest link connecting Corbett Tiger Reserve and Ramnagar (on the western side of Haldwani) with Nandhaur Wildlife Sanctuary and Terai East (on the eastern side of Haldwani). This critical corridor passes through Bamori Malli and extends behind the Cantonment area toward Khera.



**Image 3-4: Tiger Corridor between Corbett Tiger Reserve and Nandhaur Wildlife Sanctuary**





Map 3-1: Riparian stretch within Haldwani-Kathgodam

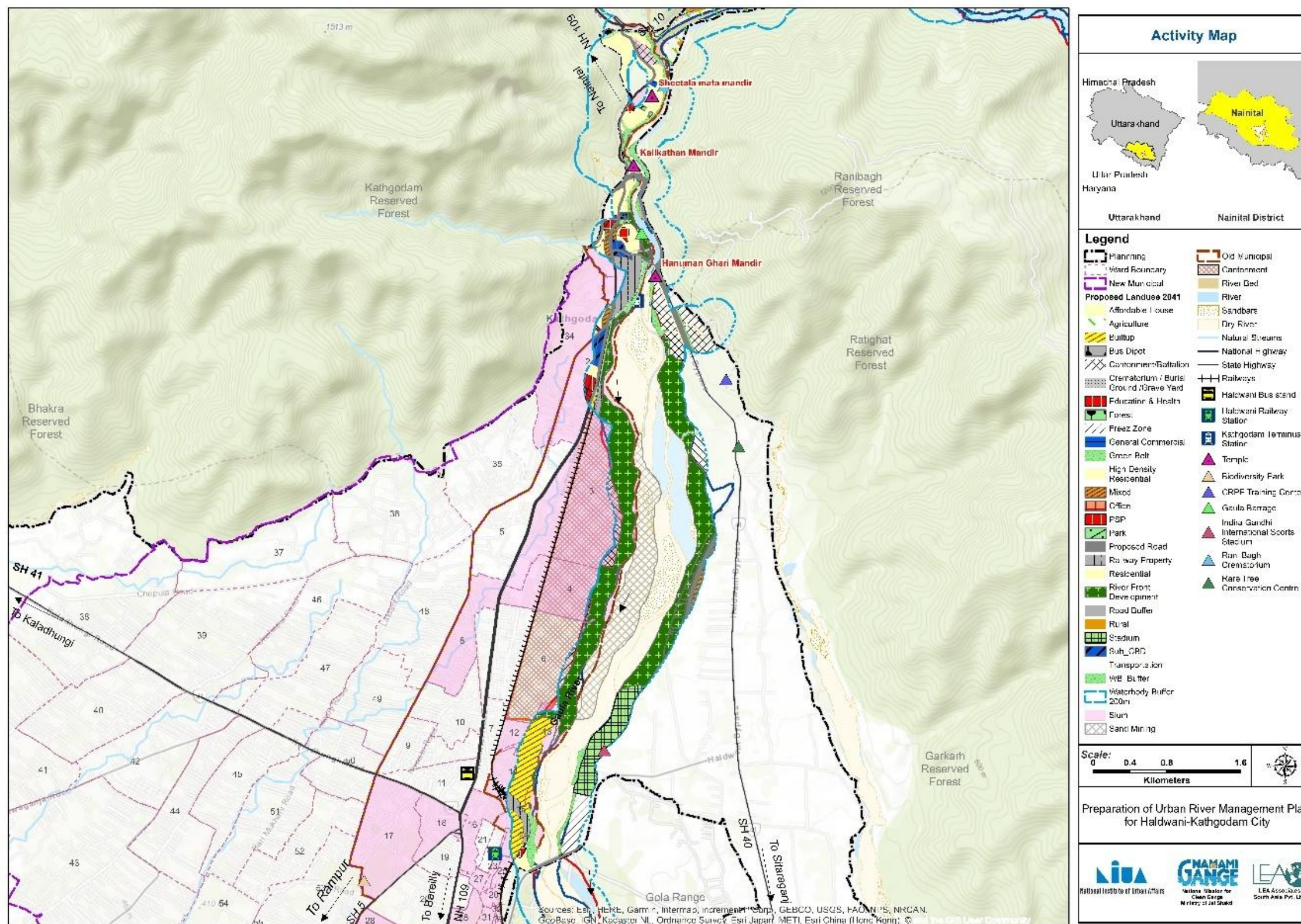


### 3.3 Activity mapping along the river

The following activities are observed along the Gaula river (refer Map 3-2).

1. **Rani Bagh Crematorium Ghat** – It is a major site for cremation activities. It also serves as a venue for cultural gatherings, particularly during the Utryani Mela, when people come together to celebrate along the ghat.
2. **Gaula Barrage** – It is a key river–city interaction point, It is a popular public space that attracts around 100 visitors daily. It features an existing children’s park, making it a recreational hub for families.
  - **Cantonment Area** - A significant portion of the river stretch passes through the cantonment zone, i.e., 8.9 kms (72% of total stretch), limiting public access and activities.
3. **Sand mining** – As mentioned in section 2.7 (a) above, it is a major economic activity in the Haldwani–Kathgodam region. While it provides important livelihood opportunities for local communities.





Map 3-2: Activity mapping along the Gaula River



### 3.4 Flooding

The Gaula River and Kalsiya Nallah are highly susceptible to fluvial flooding particularly during intense monsoon surges. This risk is further exacerbated by human activities such as riverbed mining. Flood lines have been demarcated along the river in line with NGT guidelines and the Uttarakhand Flood Plain Zoning Act, 2012. The Red Line indicates the 100-year floodplain, while the Blue Line indicates the 25-year floodplain. The Irrigation Department, Haldwani has completed identification and field validation of flood lines and is currently assessing land ownership within these zones.

- The red and blue flood lines along the eastern bank of Gaula River are in close proximity (approximately 5 meters) due to steeper slopes.
- However, on the western bank due to gentler slopes the horizontal distance between the red and blue lines varies from 30 to 240 meters. Further, a stretch of approximately 800 meters at Rajpura basti next to the Haldwani Railway station is inhabited between the blue and the red lines. This area is flood prone and was submerged during the 2021 floods at Haldwani-Kathgodam. (Refer Map 3-3)



**Map 3-3: Map showcasing the informal settlements within the Flood Plain Zone**

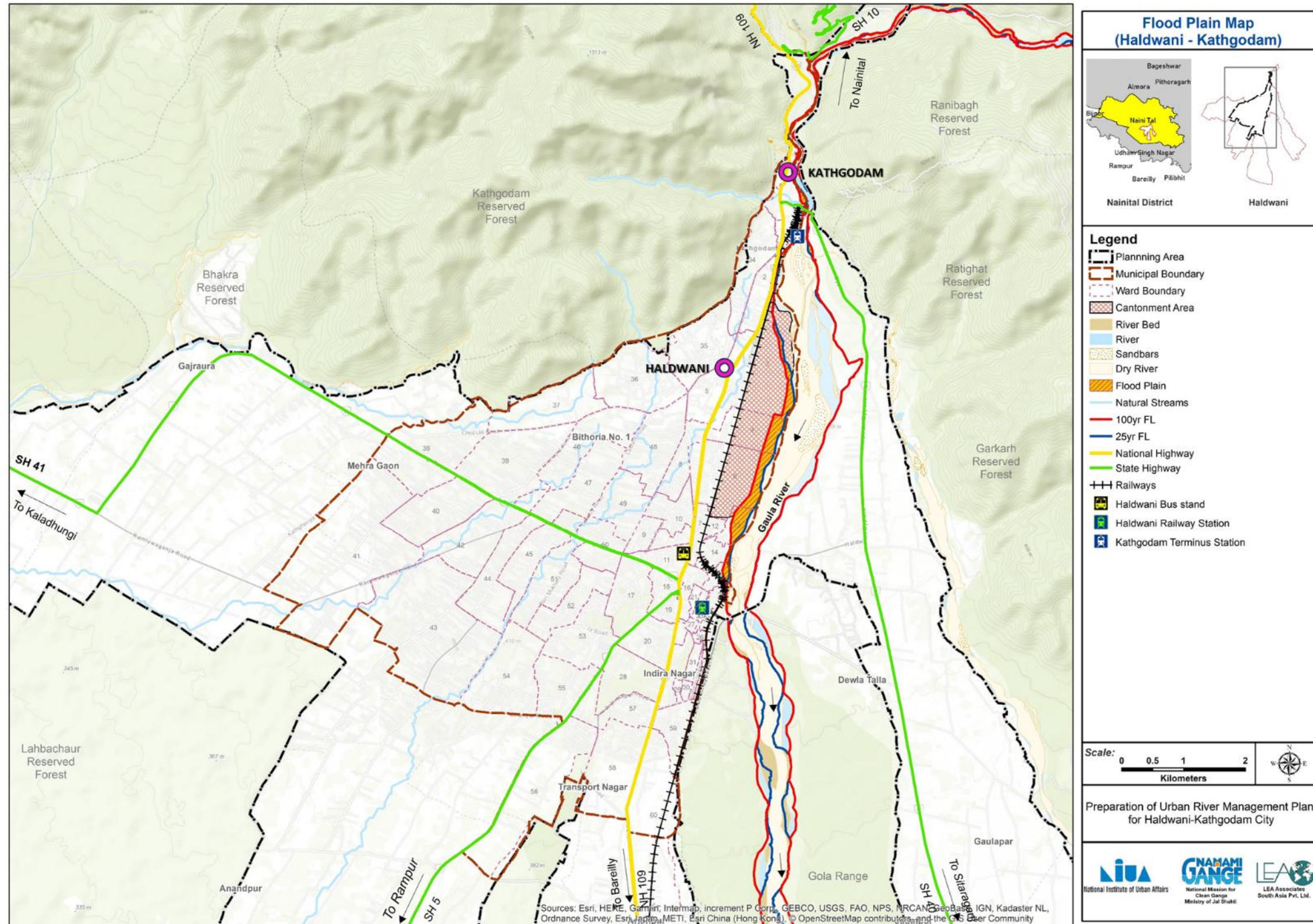
In addition to the main river fluvial flooding occurs along the Raksiya, Kalsiya, and Devkhadi Nallas in the city, particularly during periods of intense rainfall. This recurring issue can be attributed to major encroachments in the right-of-way of these streams.

The proposed Land Use Map 2041 shows residential land use between the blue and red lines. - NDMA Guidelines prescribes that within the red 100-year flood line (Priority 1), plinth levels of building



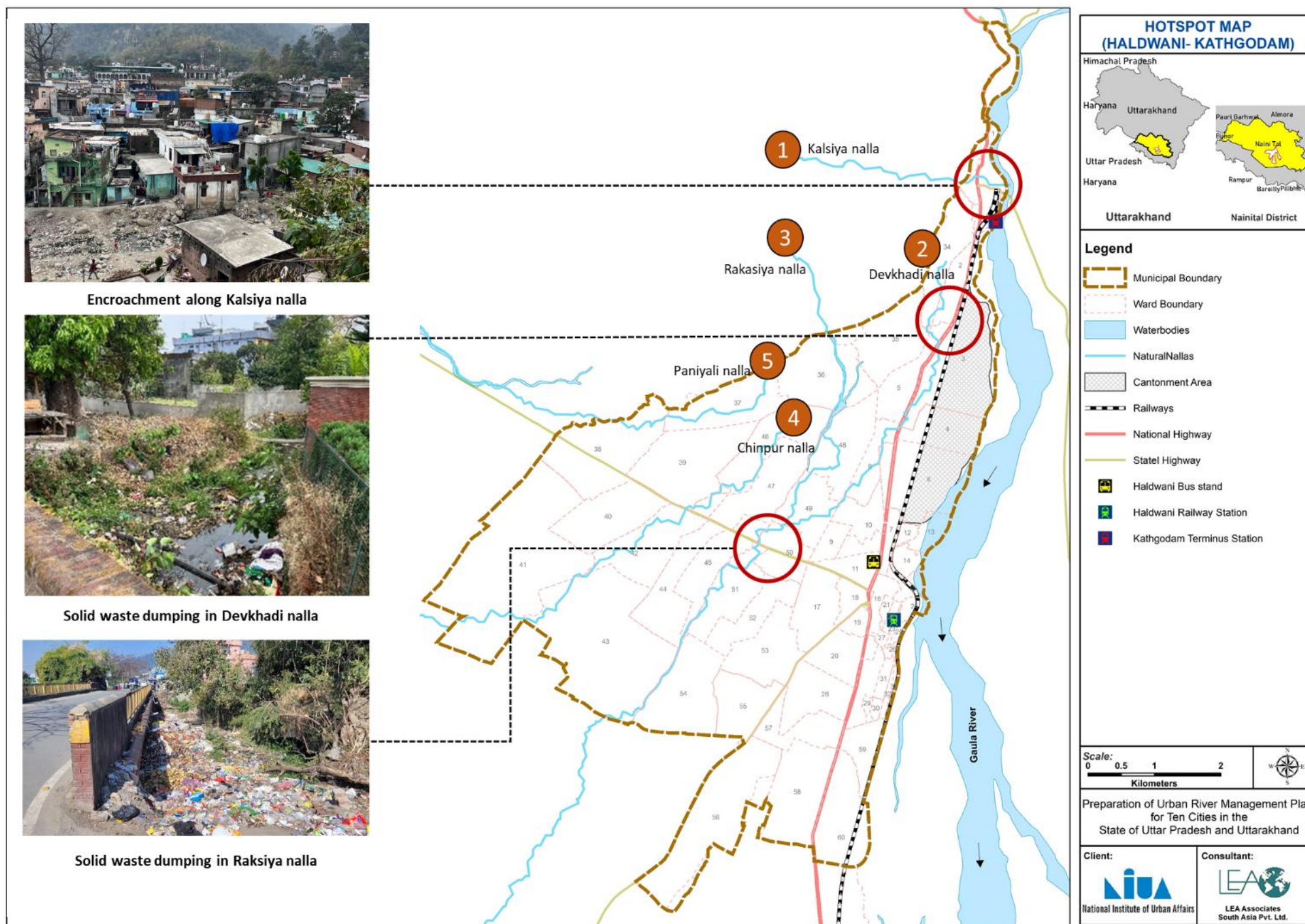
structures must be above the 100-year flood line. Further, sensitive infrastructure like residential areas, hospitals, public utilities, and government institutions are permitted in this zone only with proper flood resilience measures.

The major areas of concern in Haldwani-Kathgodam city according to the Draft Masterplan 2041 and/or consultants’ observations are mentioned in Map 3-5.



Map 3-4: Flood Plain Map





Map 3-5: Areas of concerns within the flood plain



### 3.5 Existing/ Upcoming/ proposed Projects

Presently, afforestation activities are being undertaken by the Forest Department, while the World-Wide Fund for Nature (WWF) is engaged in wildlife conservation efforts within region including the planning area. Further, in terms of flooding, the Irrigation department is presently undertaking several erosion and flood protection measures which are presented in Table 3-2 and Table 3-3.

**Table 3-2: On-going Works by Irrigation Department**

| Sl. No | Works under construction by irrigation department to prevent soil erosion from Gaula River:                                                                                                                                |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1      | Flood protection scheme for the protection of International Sports Complex (Stadium) located in Gaulapar area of Block Haldwani of Nainital district, 23 m length, (km 0.700 to km 0.723)                                  |
| 2      | Flood protection scheme of 460-meter length for the protection of International Sports Complex (Stadium) located in Gaulapar area of Village Haldwani, District Nainital, (Km 0.650 to Km 0.700 and Km 0.723 to Km 1.133). |

Source: Irrigation Department Haldwani

**Table 3-3: Proposed erosion and flood protection works by Irrigation Department**

| Sl. No. | Proposed works by irrigation department to prevent soil erosion from Gaula River:                                                                                                                                            |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | Work plan for protection of new colony Kathgodam from Gaula River in 230 m length under Haldwani development block of Nainital district.                                                                                     |
| 2       | Flood protection scheme of 216 m length for flood protection of village Indranagar (Bindukhatta) situated on the right bank of Gaula River in Haldwani development block of Nainital district under Disaster Reduction Fund. |
| 3       | Flood protection scheme of 232 m length for the protection of Chorgalia bypass motor road (near railway crossing) damaged by the Gaula River due to disaster in Haldwani development block of Nainital district.             |
| 4       | Flood protection scheme for 310 m length for the protection of International Sports Complex (Stadium) located in Gaulapar area of Haldwani development block of Nainital district. (1.133 km to 1.443 km)                    |
| 5       | For slope treatment and flood protection on the right bank of the Gaula River in village Chauhanpata in Bhimtal development block of Nainital district, in a length of 342 m.                                                |

Source: Irrigation Department Haldwani

### 3.6 Institutional Mechanism

The Forest Department oversees ecological planning, plantation and conservation activities while the Municipal Corporation handles public amenities, maintenance, and urban integration. This urban green retreat for recreation and wellness features lawns, bamboo huts, walking trails, open-air gym with a focus on native green species.

**Table 3-4: Roles and responsibilities of government agencies in ecological management for Haldwani-Kathgodam City**

| Departments           | Role                                                                                                          |
|-----------------------|---------------------------------------------------------------------------------------------------------------|
| Irrigation Department | Lead agency for river bank protection, embankment construction and flood mitigation                           |
| Municipal Corporation | Responsible for land regulation, solid waste management and informal settlement control along the river banks |
| Forest Department     | Custodian of forested riparian zones and biodiversity conservation                                            |

## 4 PHYSICAL INFRASTRUCTURE

### 4.1 Water Supply

As mentioned in section 3.2.1 above, Haldwani–Kathgodam’s water supply system is sustained through a combination of surface water (from the Gaula River and Sheetlahat Spring) and groundwater extracted through 80 tube wells for domestic use and more than 130 for irrigation. Together, these sources form the city’s core water infrastructure.

#### 4.1.1 Water Demand and Supply

At present, approximately 60% of the city’s supply is met through surface water, while 40% is derived from groundwater. This balance is expected to shift significantly with the completion of the Jamrani Dam in 2028, which will augment surface water availability and reduce groundwater’s share to just 3%. Table 4-1 outlines water resources across the municipal area, highlighting the contrasting reliance between the old and new municipal wards.

**Table 4-1: Share of Surface and Ground water in Municipal area**

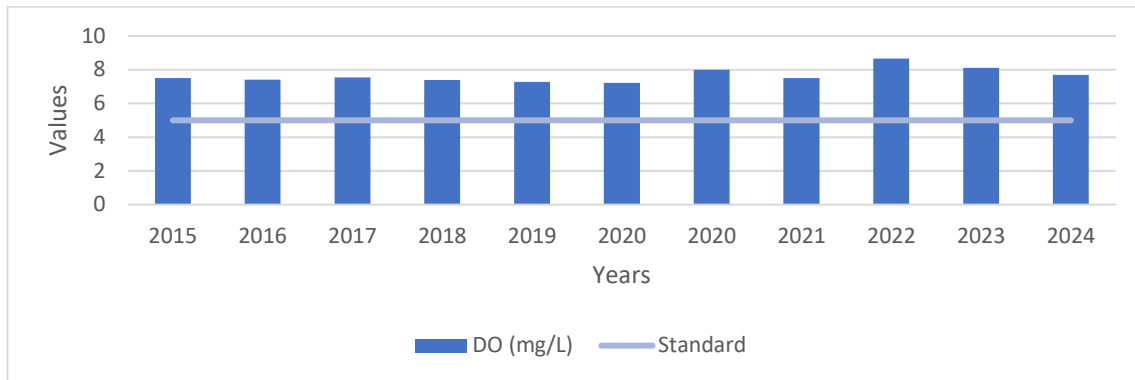
| S. No. | Area                                    | Total water availability in MLD (2024) | Type of Sources | Water availability by sources (MLD) | Nos. (GS - Gravity Source) (TW – Tube Well) |
|--------|-----------------------------------------|----------------------------------------|-----------------|-------------------------------------|---------------------------------------------|
| 1      | Old Municipal Area (Wards No. 1 to 33)  | 36.47                                  | Surface Water   | 21.88                               | GS - 4                                      |
|        |                                         |                                        | Ground Water    | 14.59                               | TW - 20                                     |
| 2      | New Municipal Area (Wards No. 34 to 60) | 33.79                                  | Surface Water   | 6.81                                | GS - 1                                      |
|        |                                         |                                        | Ground Water    | 26.98                               | TW - 60                                     |

Source: Jal Sansthan, Haldwani, 2025

While these figures demonstrate current availability, the long-term sustainability of these sources remains uncertain. The Gaula River has experienced diminishing flows due to deforestation and erosion in its catchment. The Sheetlahat Spring, historically a vital source, now contributes only 0.07MLD. Consultations with the local community also indicated that many natural streams, once perennial now flow only during the monsoon season, reflecting widespread catchment degradation.

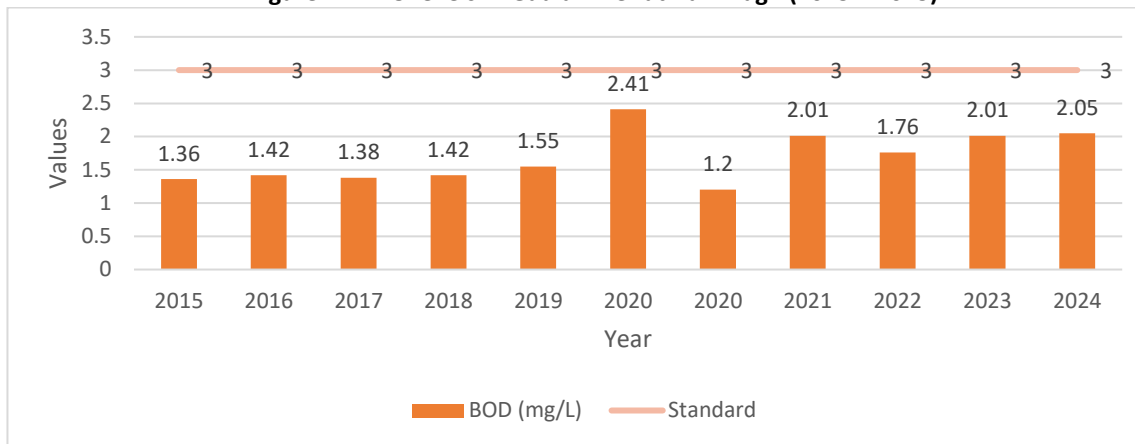
#### 4.1.2 Water Quality

Water quality monitoring is presently limited to manual testing of the Gaula at a single upstream point near Gaula barrage. Over the past decade, results indicate that Dissolved Oxygen (DO) and Biochemical Oxygen Demand (BOD) levels remain within CPCB standards. The river is classified under Category B, denoting suitability for outdoor bathing.



Source: Uttarakhand Pollution Control Board

Figure 4-1: DO levels in Gaula River at Rani Bagh (2015 – 2025)



Source: Uttarakhand Pollution Control Board

Figure 4-2: BOD levels in Gaula River at Rani Bagh (2015 – 2025)

#### 4.1.3 Groundwater

Groundwater serves as a critical buffer bridging gaps in surface water supply. However, continuous extraction without adequate recharge has led to a 20 meters meter decline in water table in elevated areas over the past decade. This has resulted in frequent tube well failures and the need for deeper drilling.

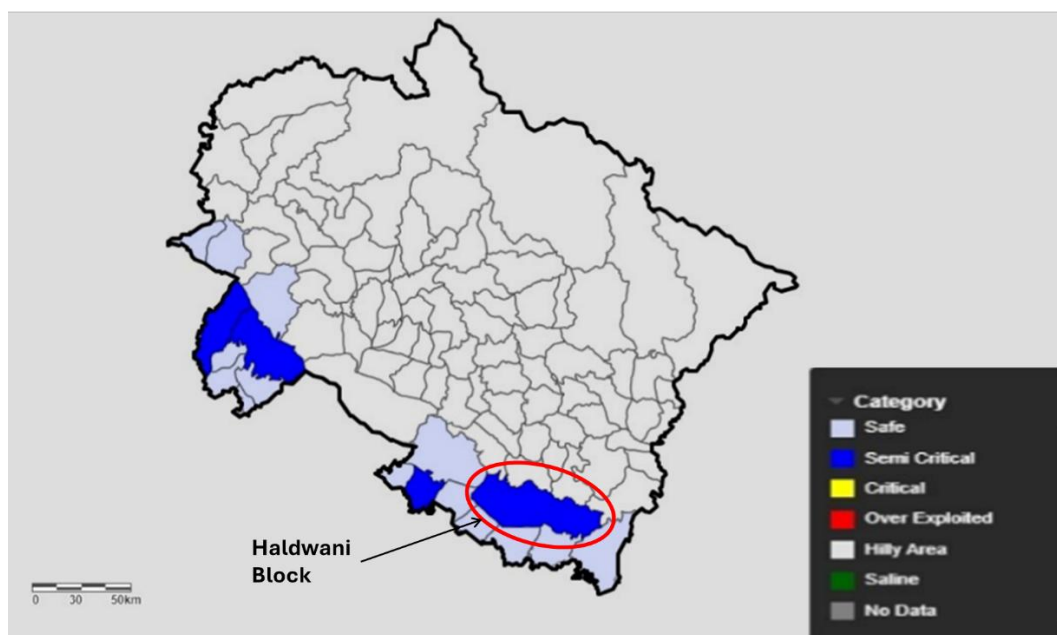
As per the Dynamic Ground Water Resources Report, 2023 of Central Ground Water Board (CGWB), Haldwani Block is in the ‘Semi-Critical’ category, with a development stage of 70–90% (refer Map 4-1).

The likely reasons for Haldwani being in the "Semi-Critical" category are as follows:

- The region sits on the porous Bhabar geological belt, where water naturally drains away quickly to the lower Tarai region rather than being retained locally.
- This natural disadvantage is compounded by rapid urbanization (concreting) that blocks rainwater recharge, alongside excessive groundwater extraction via tube wells to compensate for the declining flow of the Gaula River.

Thus, the city pumps out water faster than the unique geology and current infrastructure allow it to replenish.

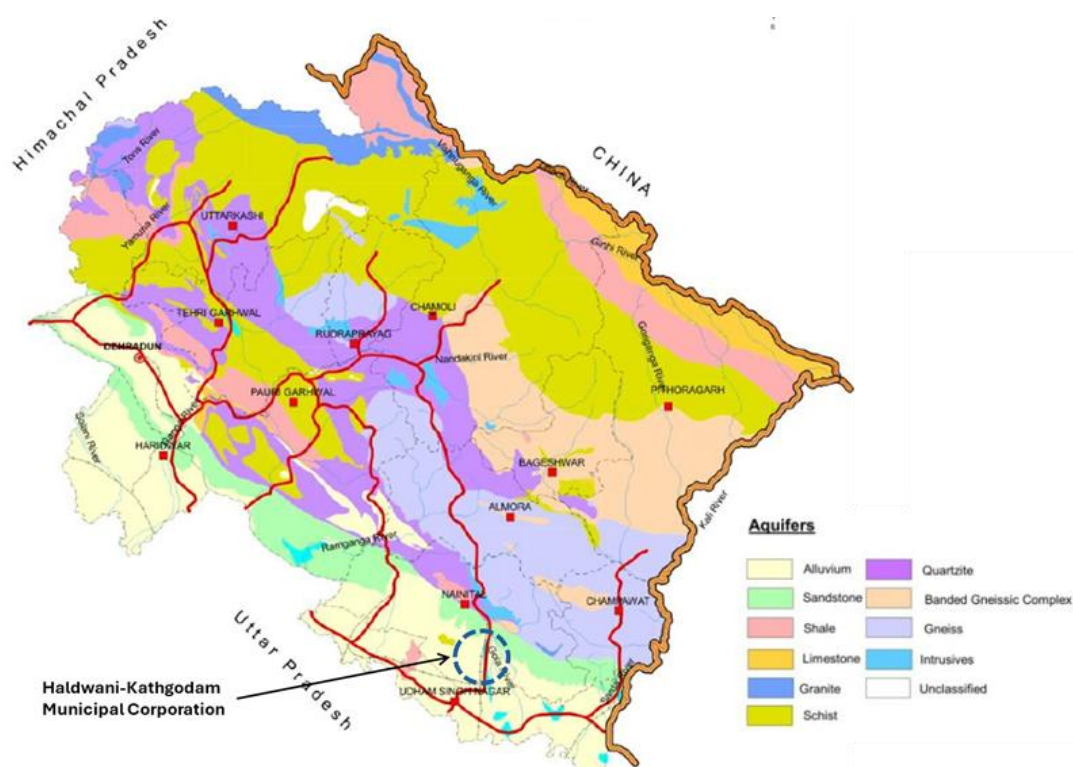




Map 4-1: Status of ground water in Haldwani Block

Source: Dynamic Ground Water Resources, 2023, CGWB

Hydrogeological mapping (Map 4-2) places the city within the alluvium belt, hosting unconfined and confined aquifers zones that remain promising but increasingly stressed.



Map 4-2: Geological formations in Uttarakhand

Source: Dynamic Ground Water Resources, 2022, CGWB

#### 4.1.4 Institutional Mechanism

| Departments                 | Role                                                                                                                          |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Jal Sansthan                | Oversees tube wells extraction, responsible for day-to-day operation and maintenance of urban and rural water supply systems. |
| Minor Irrigation Department | Oversees groundwater recharge schemes.                                                                                        |

## 4.2 Sewerage System

### 4.2.1 Sewage Generation and Coverage

The city generates an estimated 62 MLD of used water. Currently, the sewer network covers about 6,800 households (6.9% of total households), while the remaining 90,873 households (93.1%) depend on septic tanks and soak pits. This onsite sanitation produces approximately 150 KLD of faecal sludge. For management purposes, the HKMC is divided into three sanitation zones.

**Table 4-2: Sanitation Zones of Haldwani-Kathgodam**

| Sl. No.  | Sanitation zone                                                          | Conveyance                                                               | Treatment                                                                                                          | Area served                                                                              |
|----------|--------------------------------------------------------------------------|--------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| <b>A</b> | <b>Old Municipal Area</b>                                                |                                                                          |                                                                                                                    |                                                                                          |
| 1        | <b>Offsite sanitation:</b><br>(Peyjal under AMRUT 2.0 & Namami Gange)    | 186 km sewer line proposed<br>(Presently 96 km sewer line completed)     | 28 MLD STP<br>(Presently 15 MLD sewage received at STP)                                                            | Informal settlements like Rajendranagar, Rajpura and Tonkpur Road                        |
| 2        | <b>Onsite sanitation:</b>                                                | Faecal sludge from septic tanks is transported by private vacuum tankers | 20 KLD Co-treatment plant proposed at existing STP site<br>(Presently faecal sludge emptied into manhole near STP) | Kathgodam and Rajpura basti                                                              |
| <b>B</b> | <b>New Municipal Area</b>                                                |                                                                          |                                                                                                                    |                                                                                          |
| 3        | <b>Offsite sanitation:</b><br>(Sewerage & STP under ADB project)         | 122 km sewer line proposed<br>(Sewerage works under implementation)      | 14.5 MLD STP proposed at existing STP site                                                                         | Wards adjacent to old municipal area                                                     |
| 4        | <b>Onsite sanitation</b><br>(Faecal Sludge Management under ADB project) | Faecal sludge from septic tanks is transported by private vacuum tankers | 75 KLD Co-treatment plant proposed at existing STP site<br>(Presently faecal sludge emptied into manhole near STP) | Wards along western periphery - excluded from sewerage network due to budget constraints |

Source: Peyjal, UK, UUSDA and Draft Master Plan 2041

Faecal sludge is collected and transported by 30–45 private desludging vehicles, operating without registration or GPS tracking. This unregulated system poses risks of groundwater contamination, river pollution, and public health hazards.

The city also maintains 10 public toilets and 5 community toilets. Of these, 6 public toilets are connected to the sewerage system, while the remaining facilities rely on onsite treatment.

### 4.2.2 Existing Sewage infrastructure

The city currently operates a single 28 MLD Sewage Treatment Plant (STP) at Gaulapur constructed

under AMRUT. The plant, based on Sequencing Batch Reactor (SBR) technology, receives 15 MLD sewage from sewered areas and diverted nallahs, representing only 52% utilization of the installed capacity. The quality of treated used water (BOD 7–10 mg/L) meets NGT discharge standards, placing it under Category B (fit for bathing). To ensure that the STP works to its full capacity, the projects in the pipeline by the Peyjal Nigam are listed below:

**Table 4-3: Current Status of network augmentation Schemes of Peyjal Nigam**

| S. No. | Name of Scheme                                                                                      | Expected % Increase | Increase in MLD | Status                        |
|--------|-----------------------------------------------------------------------------------------------------|---------------------|-----------------|-------------------------------|
| 1.     | Sewerage and Pollution Abatement works in the catchment of Indranagar Nallah (Cost – Rs. 22.34 Cr.) | 12%                 | 4.46            | Approved / Under Construction |
| 2.     | Haripur Colonel, Awas Vikas & Subhash Nagar Sewerage Scheme (Cost – Rs. 9.12 Cr.)                   | 4%                  | 0.77            | Approved / Under Construction |
| 3.     | Ranibagh - Kathgodam Sewerage Scheme (Cost – Rs. 14.23 Cr.)                                         | 6%                  | 0.54            | Approved / LOA Issued         |
| 4.     | Haldwani Bazar, Shivpuri Bhawaniganj & Bareilly Road Sewerage Scheme (Cost – Rs. 9.71 Cr.)          | 5%                  | 0.84            | Approved                      |
| 5.     | Rajpura Sewerage Scheme (Cost – Rs. 3.58 Cr.)                                                       | 3%                  | 0.85            | Approved                      |
| 6.     | Heera Nagar, Rampur Road, Parvtiya Mohalla & Himalaya Farm Sewerage Scheme (Cost – Rs. 4.17 Cr.)    | 5%                  | 0.94            | Approved                      |
| 7.     | I&D Works of Rajpura Nallah & Golcha Compound (Cost – Rs. 12.81 Cr.)                                | 4%                  | 1.60            | Sent to NMCG, New Delhi       |
| 8.     | Haldwani Septage Co-Treatment (20 KLD) of 28 MLD STP, Scheme (Cost – Rs. 2.40 Cr.)                  | 1%                  | 0.02            | Tender Floated                |
| 9.     | Left out area due to Encroachment of Railway Land                                                   | 8%                  | 2.98            | No proposal as of now         |

Despite these projects, Wards 1, 2, 24, 25, 26 (partially), 32, and 33 remain unsewered due to land ownership of Indian Railways. Sewage from these wards flows through storm water drains, discharging untreated into rivers.

**On-site sanitation system:** Onsite sanitation remains widespread in the city. septic tanks are typically emptied every 3–5 years, but in high-density areas with small soak pits, desludging is required every 2–3 months. About 20 private service centres operate 35–40 small vacuum trucks with capacities of 3,000–5,000 litres. In the absence of a dedicated Faecal Sludge Treatment Plant (FSTP), waste is discharged into manholes near the STP or directly into streams.

The current generated 150 KLD of faecal sludge load is expected to reduce to 80KLD after completion of augmentation Schemes. However, the city still lacks a reuse system for treated wastewater. Presently, 11–12 MLD effluent is discharged into the Gaula via a 10 km pipeline near Lalkuan, representing a missed opportunity for resource recovery in agriculture, landscaping, or industry.

#### 4.2.3 Institutional Mechanism

Peyjal Nigam and Uttarakhand Urban Sector Development Agency (UUSDA) are responsible for sewerage management. Currently, they serve as the project implementing agencies for the sewerage system.

- Wards 1–33 are managed by the Peyjal Nigam department.



- Wards 34–60 are managed by UUSDA, including construction and a 15-year maintenance period, after which responsibility will be handed over to Peyjal Nigam.

### 4.3 Storm Water Management/ Drains

The storm water drainage network of Haldwani–Kathgodam spans both the old and new municipal areas. The system is divided into seven zones, each with distinct catchment areas and outfall locations, as presented in Table 4-4 .

**Table 4-4: Drainage network Zones**

| Sr. No | Zone   | Drain Network Area (km <sup>2</sup> ) | Area name                        | Number of Outfalls | Outfall Locations                                                   |
|--------|--------|---------------------------------------|----------------------------------|--------------------|---------------------------------------------------------------------|
| 1.     | Zone-1 | 0.42                                  | North of Kalsiya nalla           | 1                  | Kalsiya nalla                                                       |
| 2.     | Zone-2 | 1.98                                  | Kathgodam to Damua dunga         | 3                  | Gaula river near Cantonment and Nirmala convent school.             |
| 3.     | Zone-3 | 3.08                                  | Vaishali colony to Kidwani Nagar | 7                  | Gaula river near Tikonía cantonment and Chorgaliya road.            |
| 4.     | Zone-4 | 1.15                                  | Indira Nagar                     | 2                  | One draining in Gaula forest and another draining near sagar sweets |
| 5.     | Zone-5 | 7.00                                  | Manpur uttar to Teenpani road    | 2                  | 2 outfalls draining into Gaula forest near Amla Chowk and Hathikhal |
| 6.     | Zone-6 | 24.13                                 | Bamori Malli to Bharatpurno      | 3                  | Rakasiya nalla, Paniyali nalla, Chinpur nalla and Bhakra River      |
| 7.     | Zone-7 | 26.58                                 | Damuadhunga to Prempur losgyani  | 3                  | Rakasiya nalla and forest area                                      |

Source: Irrigation department, 2025

Instances of direct sewage discharge into drainage channels have been observed. Settlements along Rajpura Nalla and Golcha Compound Nalla release untreated sewage directly into these nallahs, which subsequently drain into the Gaula River. Water quality data from Peyjal Nigam, Haldwani indicates high organic pollution levels, as reflected in the Biological Oxygen Demand (BOD) values:

- Golcha Compound nalla: with a BOD of 90 mg/l
- Rajpura nalla: with a BOD of 107 mg/l

Another instance is the sewage from encroached area near Indira Nagar is discharged directly into the Indira Nagar Nalla (refer Image 4-1 and Image 4-2), which subsequently overflows onto the forest land adjacent to the 28 MLD.



**Image 4-1: Sewage from the encroached area on the railway land**

**Image 4-2: Indira Nagar drains near 28 MLD existing STP**

To address these issues, the Uttarakhand Urban Sector Development Agency (UUSDA), under ADB funding, is developing a 14.5 MLD STP along with a 75 KLD co-treatment facility within the existing STP complex. In addition, Peyjal Nigam has proposed a 20 KLD co-treatment plant for the Old Municipal Area to strengthen faecal sludge and currently generated faecal sludge is discharged into manhole at Gaulapar area through desludging vehicles, which adversely impacts the functioning of 28 MLD STP treatment facilities.

#### 4.3.1 Cleaning mechanism

While centralized treatment systems are absent for the Rakasiya, Kalsiya, Devkhadi, Cheenpur, and Paniyali Nallas, mechanical screens have been installed at roadside segments. These screens help segregate solid waste, preventing blockages and reducing the load of floating debris entering natural water channel.

#### 4.3.2 Institutional Mechanism

| Departments           | Role                                                |
|-----------------------|-----------------------------------------------------|
| Irrigation Department | Oversees the stormwater drainage system of the city |

### 4.4 Solid Waste management

#### 4.4.1 Residential Waste

Haldwani–Kathgodam Municipal Corporation generates approximately 150 tonnes per day (TPD) of solid waste, while Nainital, Bhimtal, and other neighboring towns contribute an additional 50 TPD. According to the Draft Master Plan and the District Environment Plan (2021–22), the waste composition is 55 percent dry waste and 45 percent wet waste. The Municipal Corporation reports 100 percent collection through door-to-door services and community bins; however, segregation at source remains limited. Field observations reveal that several areas, particularly those with restricted street access such as Rajpura Basti near Haldwani Railway Station, are underserved. In these stretches, residents often dispose of waste directly into natural streams and culverts, leading to pollution hotspots at Kalsiya, Devkhadi, and Rakasiya nallas (refer Map 4-4). Waste dumping along riverbanks further aggravates riverine pollution, underscoring the need for improved segregation and community awareness.

#### 4.4.2 Waste Processing Facilities

The city has made provisions for processing legacy waste, dry waste, wet waste and mixed waste to energy. There is also an arrangement for hazardous waste as well as e-waste. However, for construction and demolition waste there seemed to be no arrangement available. Monitoring of solid waste collection is undertaken through GPS tracked vehicles.

A trenching site covering approximately 4 hectares is located near Indira Nagar. The site contains an estimated 1.39 lakh metric tonnes of accumulated waste, for which remediation activities are currently being undertaken. Following the clearance of this land, it is proposed to be handed over to NTPC for the establishment of a torrefied charcoal plant. In the interim, the daily municipal solid waste generated by the Urban Local Bodies (ULBs) is being transported to a Material Recovery Facility (MRF) situated near the Gaula River, where it undergoes treatment and processing. The following proposals

are under consideration for processing of municipal waste;

**Table 4-5: Proposals for Solid Waste processing**

| Sl. No. | Waste Processing Units                      | Description                                      | Capacity          | Initiated/Under Installation/Proposed/ |
|---------|---------------------------------------------|--------------------------------------------------|-------------------|----------------------------------------|
| 1.      | Remediation of Legacy Waste                 | 9.51 acres at the dumping site Haldwani          | 1.39 Lakh MT      | Initiated, duration 6-9 months.        |
| 2.      | Material Recovery Facility                  | about 2 acres area at the dumping site, Haldwani | NA                | initiated                              |
| 3.      | Wet waste composting                        | 6 pits at the dumping site, Haldwani             | 10 tonnes per day | Initiated                              |
| 4.      | MoU with NTPC for torrefied charcoal plant. | Not finalized.                                   | 500 TPD           | Proposed                               |

Source: Municipal Corporation, Haldwani-Kathgodam

#### 4.4.3 Religious Waste

Religious waste in Haldwani–Kathgodam arises predominantly from activities at the cremation ghat at Ranibagh along the Gaula River. It generates distinct category of waste linked to funeral rituals and associated offerings, which includes garlands, ritual cloth, incense packaging, food offerings, ashes, and partially burnt materials. In addition, wood residues from pyres and non-biodegradable ceremonial items such as plastics and thermocol are often discarded at or near the ghats.

At present, much of this waste is directly deposited into the river or left along the banks, contributing to localized pollution and deterioration of water quality. The absence of segregated collection systems and dedicated disposal mechanisms at cremation sites has resulted in unmanaged accumulation of ritual residues. Seasonal peaks in cremation activity further intensify this issue.

#### 4.4.4 Institutional Mechanism

Solid Waste Management in Haldwani city is carried out by Municipal Corporation which is handling components of door-to-door waste collection and processing through agencies hired on PPP contracts. Under SBM 2.0 the city is availing necessary funds for waste treatment especially bio remediation.



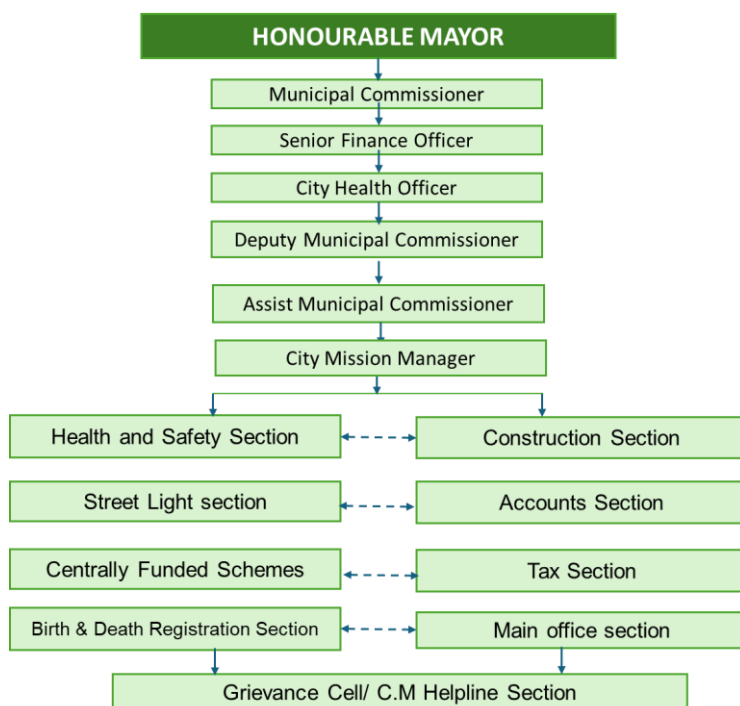
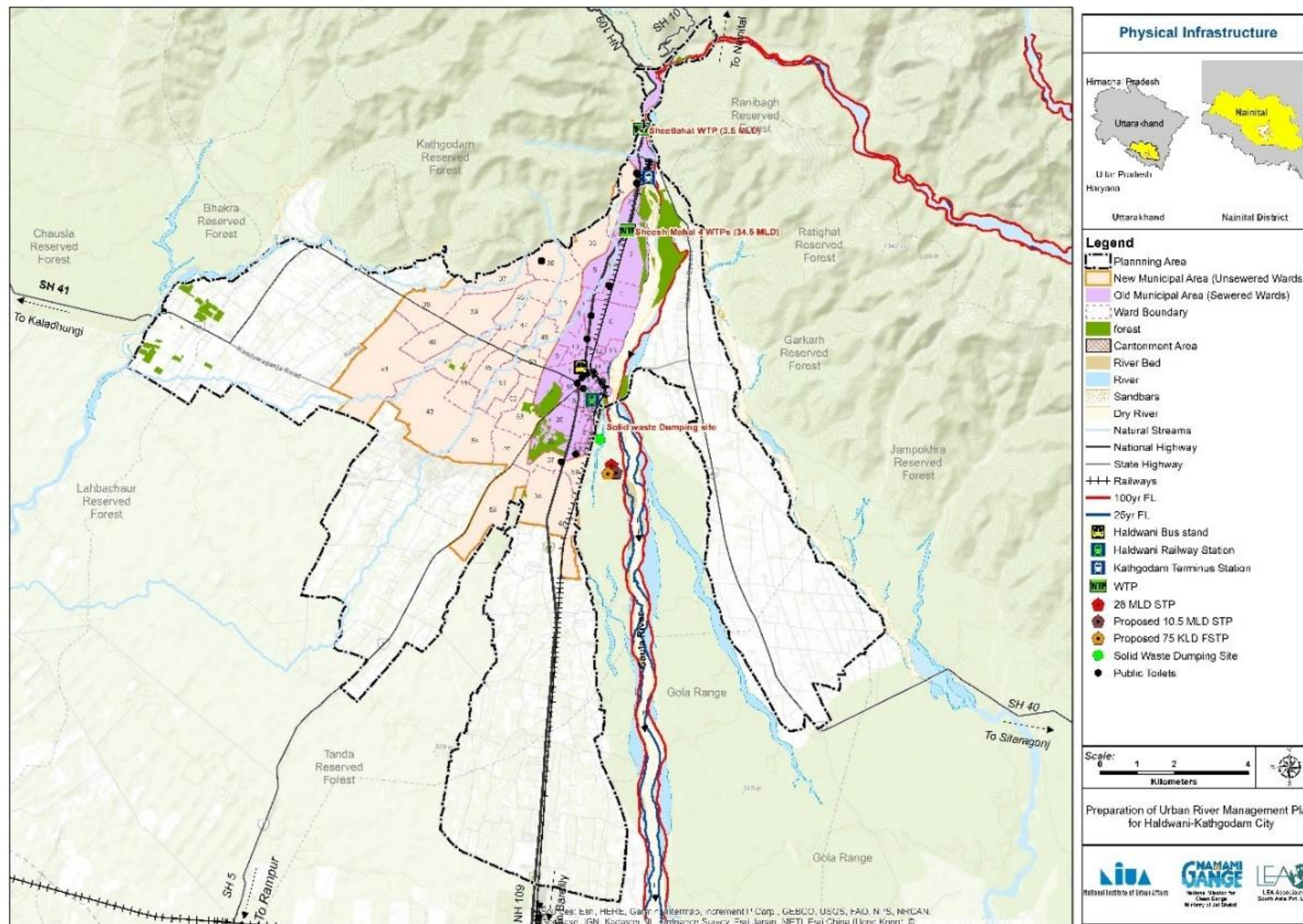
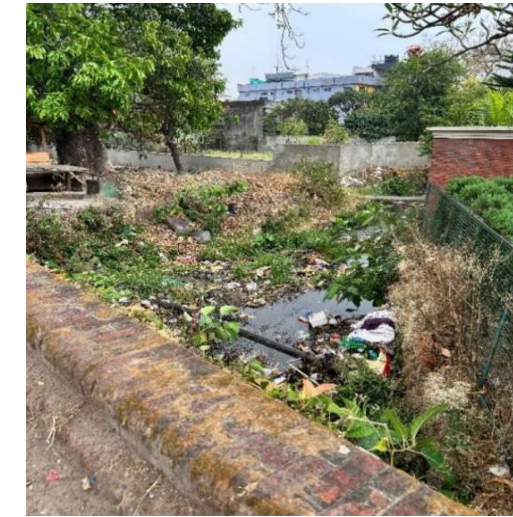
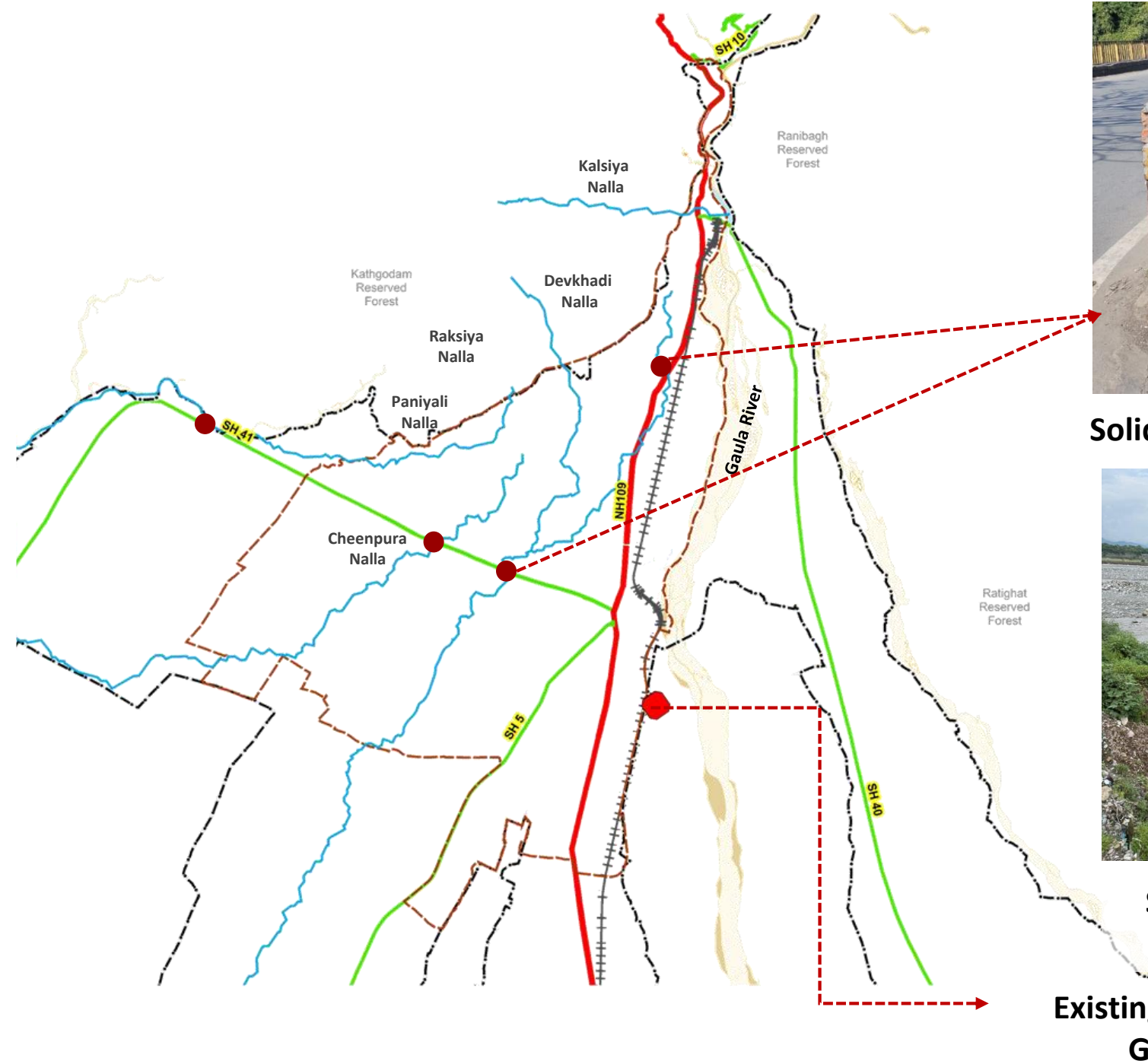


Figure 4-3: Organization Chart of Municipal Corporation



Map 4-3: Physical Infrastructure Map





Solid waste being dumped in Raksiya Nala and Devkhadi nala



Solid waste along Rajpura Nala, Compound Golcha and Kalsiya Nala

Existing Trenching Ground

Map 4-4: Solid Waste Hotspot Map



## 5 SWOC ANALYSIS AND URM INDEXING OF THE CITY

### 5.1 SWOT Analysis

Based on the baseline assessment of Haldwani-Kathgodam city, various issues and gaps have been identified. Based on this, a SWOC analysis has been done and presented below:

#### STRENGTHS



- The draft masterplan incorporates a clearly designated ‘No Development Zone’ along the Gaula river.
- 100% door-to-door waste collection is being done in the city.
- The river water quality meets the CPCB permissible standards for bathing.
- Dense vegetation along the eastern bank acts as a natural shield against erosion, enhances biodiversity, and contributes to the city’s environmental resilience.
- Ongoing sewerage initiatives are expanding conveyance systems and driving maximum treatment utilization.
- 92 Self-Help Groups (SHGs) actively support the Municipal Corporation in Information, Education, and Communication (IEC) initiatives on Solid Waste Management (SWM), strengthening participatory governance and grassroots awareness.

#### WEAKNESS



- The 5,25 & 100-years flood lines are not notified and integrated in the draft Master Plan.
- Presence of informal settlements along river and stream floodplains (notably Kalsiya Nallah) increases exposure to flood risks.
- Rapid extraction of ground water has resulted in the Haldwani block being categorized under semi-critical zone as per CGWB, posing challenges for long-term water security.
- Though perennial, it acts as a seasonal river, limits year-round water availability and reduces ecological stability.
- 93% households remain unconnected to the sewer network, resulting in untreated used water being discharge into stormwater drains and ultimately flowing into the river.
- Persistent dumping of solid waste along streams and riverbanks.
- Rajpura, Golcha Compound Nallah, and Indira Nallah are untapped and carry sewage directly into the Gaula river.

#### OPPORTUNITIES



- The master plan being in draft stage provides an opportunity to integrate river & its natural streams, flood zoning and climate resilience measures.
- Upcoming Jamrani Dam project is poised to significantly enhance water supply reliability while simultaneously mitigating flood risks, strengthening both urban resilience and regional water security.
- The existing nature of slope is ideal for designing of gravity-based infrastructure like water supply, drainage etc.
- Land parcels near the barrage offer prime opportunities for riverfront development, enabling eco-friendly public spaces, tourism infrastructure, and improved urban aesthetics.
- Expanding awareness and training programs on water quality management, afforestation, and eco-tourism can foster stronger community stewardship, generate livelihood opportunities.

### CHALLENGES



- The areas along the Gaula River are subjected to flash floods during the rainy season. It results in massive erosion of the river banks and dumping of boulders impacting critical infrastructure,
- Problem of silting / High turbidity in rainy season,
- There is an absence of existing demand for reuse of treated water,
- Limited tourist engagement specifically riverine spots/activities,
- Several parts of Kathgodam area are vulnerable to landslides

## 5.2 URM Indexing of the city

The URMP framework provides a clear indexing/ scoring mechanism to monitor progress of project implementation recommended under URMP vis-à-vis its objectives. The implementation of the URMP is monitored through 10 indicators, one for each objective of the URMP framework. The  $URM_{index}$  is measured on a scale of one to five, and is useful to paint a snapshot of the situation, which can be used to monitor the implementation of the URMP, and develop overall strategies and policies for enhancement.

In order to understand the present status of water resources in the city, an assessment has been made using the  $URM_{index}$ . With a score of 2, Haldwani-Kathgodam is at elementary level of urban river management. This score shall improve upon implementation of proposed interventions against each objective. The figure below shows the current status of the city against each of the objectives of urban river management.

Haldwani-Kathgodam’s URM<sub>index</sub> has come out to be 2 (Figure 5-1), which interprets as elementary-level urban river management.

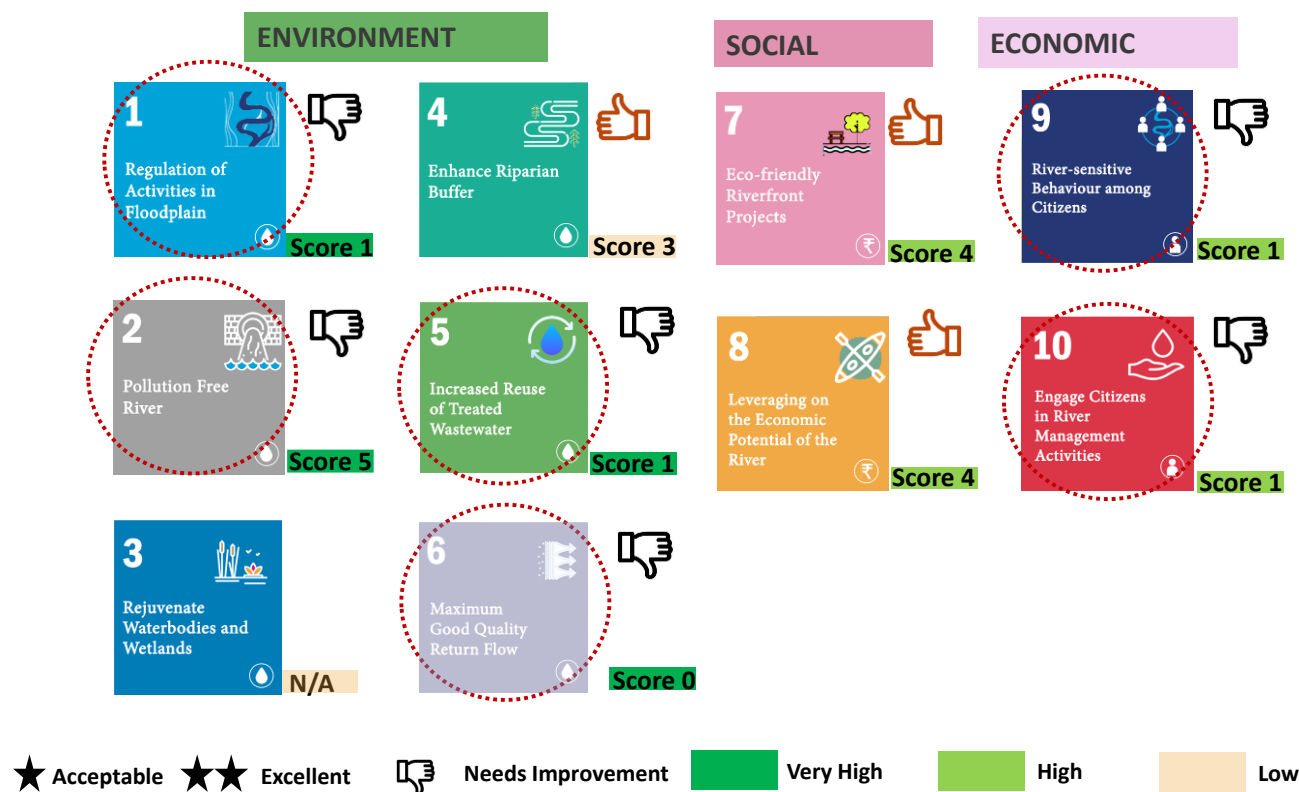


Figure 5-1: Prioritization Matrix



## 6 URMP VISION FOR THE CITY AND ZONING

### 6.1 URMP Vision for Haldwani-Kathgodam

The URMP vision for the city of Haldwani-Kathgodam is to transform the Gaula River into a living corridor that balances economy, ecology, recreation and resilience, ensuring the riverfront becomes both a community asset and a protective buffer against climate risks.

#### River front zoning – Haldwani-Kathgodam Municipal Corporation

The Gaula River, a classic Bhabhar river, shapes both the economic and ecological character and urban fabric of Haldwani–Kathgodam city. The city’s dependency on the river and its dynamic behaviour demands differentiated planning approaches across distinct stretches of the Gaula riverfront.

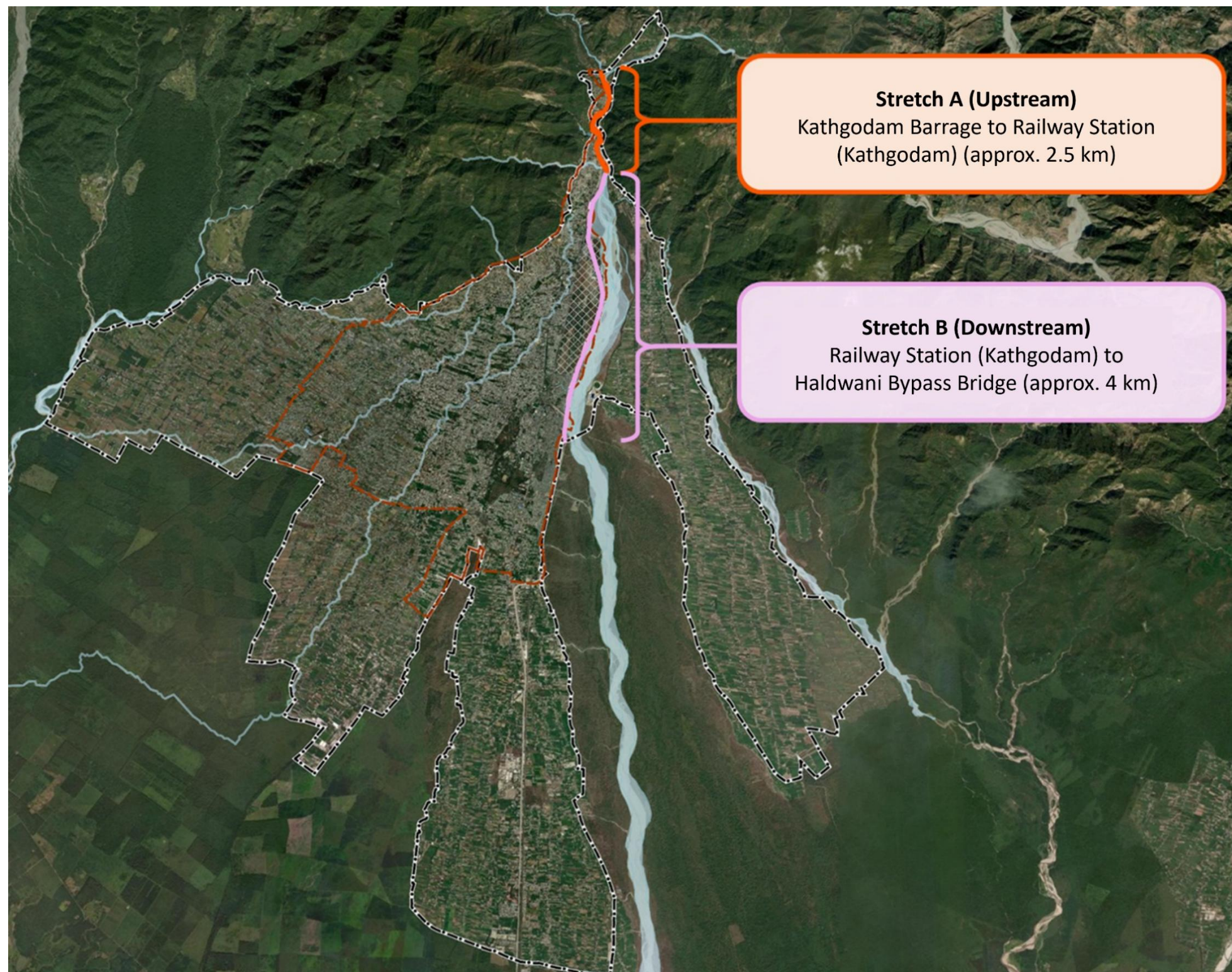
Based on the river characteristics and nature of river city interaction the entire stretch of Gaula River along the Municipal Corporation limits has been divided into two stretches as stated below:

- A. **Eco-recreational Gateway:** Northern stretch from Gaula Barrage (Kathgodam) to the Railway Line Crossing.
- B. **Resilient Urban Interface:** Southern stretch from Railway Station (Kathgodam) to Haldwani Bypass Bridge (Gora Parao area).

Details of the two stretches are presented in the following table and Map 6-1).

| Stretch A (Up Stream): The Eco-recreational Gateway    |   |                                                                                                                                                                                                                                                                                                                                                |
|--------------------------------------------------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Location                                               | : | Gaula Barrage (Kathgodam) to the Railway Station (Kathgodam)                                                                                                                                                                                                                                                                                   |
| Theme                                                  | : | Leisure & Gentle Interaction                                                                                                                                                                                                                                                                                                                   |
| Description                                            | : | This upstream stretch, with perennial water flow regulated by the barrage and high scenic value, is the “face” of the river. It already attracts visitors but lacks structured ecological management. The vision is to formalize recreation while safeguarding the riparian edge.                                                              |
| Key Strategies                                         | : | Develop additional riverfront park stretches in eco-sensitive manner to increase river-city interaction through leisure, creation of quiet zones to leverage migratory bird activity to promote eco-tourism and explore establishment of native botanical gardens to stabilize soils and enhance ecological resilience.                        |
| Stretch B (Down Stream): The Resilient Urban Interface |   |                                                                                                                                                                                                                                                                                                                                                |
| Location                                               | : | Railway Station (Kathgodam) to Haldwani Bypass Bridge (Gora Parao area).                                                                                                                                                                                                                                                                       |
| Theme                                                  | : | Pollution Control and Flood Buffers – The “Sponge Zone”                                                                                                                                                                                                                                                                                        |
| Description                                            | : | These southern stretch faces intense urban pressure, pollution inflows, solid waste dumping, and flood risks. The riverbed is wide, often dry, and heavily mined, making it a critical zone. Here, the city must reconnect with the river, safeguarding itself against floods while restoring the river from sewage and solid waste pollution. |
| Key Strategies                                         | : | Interception and divert polluted drains to the STP for treatment, strengthen faecal sludge management systems, remove accumulated solid waste at hotspot locations along the river and natural streams and protect and enhance the green buffers and barriers along with the ongoing riverbank protection measures                             |





Map 6-1: Spatial Division of the Gaula Riverfront – Eco-Recreational Gateway and Resilient Urban Interface



## 6.2 Objective 1: Regulation of activities in flood plains

Interventions under Objective 1 are designed to strengthen the Draft Master Plan 2041 of Haldwani–Kathgodam by embedding flood resilience, ecological restoration and sustainable water management into core planning of the city’s planning area. Measures such as validated flood lines, encroachment free flood plains, river and stream buffer conservation, naturalized bank protection, ground water recharge will enhance resilience, reduce disaster risks, safeguard communities, and protect critical infrastructure. Aligned with national floodplain zoning and climate adaptation guidelines, these planning interventions will ensure balanced urban growth with long term sustainability.

### 6.2.1 Intervention 1: Inclusion and strengthening of provisions in Draft Master Plan of Haldwani-Kathgodam, 2041

The Haldwani-Kathgodam Draft Master Plan 2041 has the following provisions for river centric planning:

- Provision of 30 m from the riverbank, 10 m buffer from stream banks and 5 m buffer along the edge of Nallahs. These buffers have been designated as a “No Development Zone”.
- Water bodies are designated as a separate land use category
- Delineation of Riverfront along both banks of the Gaula River

The following key issues and gaps have been identified with respect to inclusion of river-centric planning measures in the Draft Master Plan 2041:

- The Uttarakhand Irrigation Department has delineated 25-year and 100-year return period flood lines in accordance with the Uttarakhand Flood Plain Zoning Act, 2012 and NGT guidelines. These are yet to be included in the Master Plan.
- Upon inclusion of the above-mentioned flood lines, modification of proposed land uses is necessary to exclude prohibited activities in the Flood plains as per as per Technical Guidelines of Flood Plain Zoning, CWC, Ministry of Jal Shakti, July 2025
- Modification of Building byelaws are necessary in the Master Plan to include flood-resilient designs such as higher plinth levels, floodproofing, etc. as applicable to the various flood plain zones as recommended in the Technical Guidelines of Flood Plain Zoning, CWC, Ministry of Jal Shakti, July 2025
- The Gaula River system is sustained by springs and rainfall runoff. Further, the city is partly dependent on Sheetlahat spring which has seen a drastic reduction in its discharge capacity. There is no systematic inventory or ecological assessment of streams and springs in the region. For long term water security of the city, Spring shed management and other studies for conjunctive use of water needs to be undertaken and planning measures for their protection and enhancement should be incorporated in the Master Plan.
- The city is in highly porous Bhabar region and is also facing ground water scarcity. However, the Master Plan does not have mandatory rainwater harvesting provisions as recommended in the Model Building Bye-Laws, 2016 (MoHUA). The Draft Master Plan does not mandate rainwater harvesting provisions for new constructions or public buildings, nor does it integrate



Model Building Bye-Laws, 2016 (MoHUA),

- The eastern riverbank of the river has steeper slopes, less development and a healthy riparian habitat. The Master Plan has designated this stretch for River front development. Since this stretch is adjacent to the Nandhaur Wildlife Sanctuary and serves as a bridge to the Corbett National Park across the Gaula River to the west it is prudent to minimize human intervention in this stretch and retain the natural riparian habitat.
- There is reported existence of a tiger corridor connecting Corbett National Park to Nandhaur Wildlife sanctuary which is currently threatened at the Gaula River crossing point to the north of the city due to urban activities. The same may be identified with the Forest and Wildlife Department and if found appropriate "No-Activity Zones" or "Dark Zones" (no artificial lighting) may be delineated in the Master Plan to allow wildlife movement at night.

The following priority interventions are proposed for inclusion in the revised Master Plan 2041:

**Table 6-1: Proposed Interventions for Flood and Water Management in Haldwani–Kathgodam Draft Master Plan 2041.**

| S.no. | Aspects                | Section Name & Reference in Master Plan                                 | Current Vision                                                                                                  | Recommendation                                                                                                                                                                                                                                                                                                                   | Rationale/Justification                                                                                                                                                                              |
|-------|------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | Flood Management       | Ch.10, section 10.2 – Disaster Management & Ch. 14 – Zoning regulations | No explicit mention of flood returns periods, flood zoning, or delineation of flood lines                       | Integrate baseline hydrological assessment covering flood lines for 100, 25, and 5-year return periods. Adopt Guidelines for Flood Plain Zoning (MoJS, July 2025 – Sec. 7, para 7.2, pp. 23–24). Incorporate GIS-based flood hazard mapping. Define regulatory zones (prohibited, restricted, regulated use) within floodplains. | Provides scientific delineation of flood-prone areas along Gaula River (near Rajpura basti).                                                                                                         |
| 2     | Land Use Plan Revision | Ch. 13 – Proposed Land Use                                              | Waterbodies designated as a separate land use category, but natural streams and springs not explicitly included | Explicitly include natural streams, springs, and riparian corridors. Relocate informal/slum settlements along Gaula River banks to safer resettlement zones.                                                                                                                                                                     | Protects ecological integrity of streams/ Gadheras and springs in the city such as Kalsiya, Raksiya, Devkhadi, Cheenpur, panyali and sheetlahat. Reduces flood vulnerability of informal settlements |

| S.no. | Aspects                                     | Section Name & Reference in Master Plan         | Current Vision                                                                    | Recommendation                                                                                                                                                                                                                                                                                                                                                | Rationale/Justification                                                                                                                                                                                                            |
|-------|---------------------------------------------|-------------------------------------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       |                                             |                                                 |                                                                                   | Establish riparian buffer zones (7.5-30m width) along eastern bank of Gaula River and other waterbodies. Define institutional arrangements for floodplain and buffer management. Introduce encroachment control mechanisms and pollution abatement measures.                                                                                                  | (near Kalsiya Nallah, Haldwani and Kathgodam railway station). Maintains hydrological connectivity and biodiversity corridors. Provides governance framework for long-term conservation. Aligns with MoEFCC Wetlands Rules (2017). |
| 3     | Baseline Study of Natural Streams & Springs | Ch.10, section 10.1- Environment and pollutions | No systematic inventory or hydrological assessment of natural streams and springs | Conduct comprehensive baseline study of all-natural streams and springs. Map catchment areas, recharge zones, and flow regimes using GIS. Assess water quality, ecological status, and anthropogenic pressures. Integrate findings into Master Plan zoning and conservation strategies. Establish monitoring framework with periodic updates (every 5 years). | Provides scientific evidence base for planning. Supports biodiversity conservation and eco-sensitive planning. Enables adaptive management and compliance with National Water Policy (2012).                                       |
| 4     | Rainwater Harvesting (RWH)                  | Ch. 14, section 14.11- Zoning Regulations       | No mandatory provisions for RWH in Draft Master Plan                              | Mandate RWH structures for all new constructions on plots $\geq 300$ sq. m. Require RWH installations in all public buildings, schools, hospitals, and open spaces.                                                                                                                                                                                           | Enhances groundwater recharge in Gaula River recharge belt and peri-urban wards. Reduces urban flooding in high-density areas majorly the wards in the old municipal area starting from ward no. 15-33).                           |

| S.no. | Aspects                     | Section Name & Reference in Master Plan | Current Vision               | Recommendation                                                                                                                                                                                             | Rationale/Justification                                                                                                                                                |
|-------|-----------------------------|-----------------------------------------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       |                             |                                         |                              | Integrate recharge pits, percolation tanks, and bioswales in parks and institutional campuses. Link RWH compliance to building plan approval process. Establish municipal monitoring cell for enforcement. | Aligns with Model Building Bye-Laws, 2016 (MoHUA). Promotes sustainable water management and climate adaptation. Provides long-term resilience against water scarcity. |
| 5     | Inclusion of Tiger corridor | Ch.13, section 13.4 Proposed Land use   | No mention of tiger corridor | Inclusion of Tiger corridor which connects Corbett tiger reserve with Nandhaur wildlife sanctuary                                                                                                          | Status of Tigers Co predators, Prey in India, 2010                                                                                                                     |

### 6.2.2 Intervention 2: Naturalised bank protection measures along the Gaula River

Over the past 25 years, the Gaula River has widened from 62 meters in 1999 to 78 meters in 2024 due to repeated flooding and erosion. This river widening has particularly impacted the developments on western bank of the river particularly near Haldwani railway station and informal settlements adjacent to it (Rajpura Basti) on the western bank in addition to stretch along International Sports Stadium on the eastern bank.

The Irrigation Department has proposed and are implementing riverbank protection through mass concrete stepped retaining walls north of the cantonment area and south of the Rajpura Basti.



**Image 6-1: Bank protection being implemented by Irrigation department at Rajpura basti**

However, there are no riverbank protection proposals for the intermediate stretch of approx. 4 km which primary consists of riparian stretch to the east of cantonment area.





**Image 6-2: No bank protection measures proposed for the riparian stretch along western bank**

The high-velocity flows of the Gaula River, debris loads and high seismicity (Seismic Zone 4) of the region may require choice of Soft/Flexible Engineering (Gabions & Geotextiles) proposals over Hard Engineering (Concrete/Masonry Walls) for the following reasons:

- **Handling Hydrostatic Pressure:** Concrete is impermeable and vulnerable to hydrostatic pressure when water level in the river drops after flood and water trapped in the soil behind the wall cannot escape quickly. This may lead to concrete wall collapse (toppling or sliding). Gabions on the other hand are highly permeable and less susceptible to build up of hydrostatic pressure.
- **Flexibility and Settlement:** Concrete structures are rigid and settling of soil beneath them due to scouring leads to cracks and breaks, thereby compromising the entire structural integrity. Gabion structures are flexible the wire crates or geotextile bags "bend" or settle into the new shape without breaking in such a situation. Thus, they continue to provide protection even after significant deformation.
- **Energy Dissipation vs. Acceleration:** Smooth concrete surfaces accelerate river flow which leads to severe scouring at the "toe" (bottom) of the wall and transferring the flood risk downstream to the next vulnerable area. In contrast, the rough surface of stone-filled gabions acts as a brake and creates friction that dissipates the energy of water and reduces the erosive power of river.
- **Ecological Impact:** Concrete structures create a "dead edge" since no plants can grow on it. Further, it severs the link between the river and the land. Gabion structures allow for "green" engineering as over time, silt fills the voids between the stones, allowing vegetation to grow through the structure. This eventually binds the structure even tighter to the earth and restores the natural habitat.
- **Cost and Maintenance:** Concrete structures have high initial carbon footprint due to high cement content and are difficult to repair. However, if a gabion wire breaks it can be patched or a new crate can be wired on the top. Their use of locally available river stones also reduces transportation costs significantly.

#### **Proposed Intervention:**

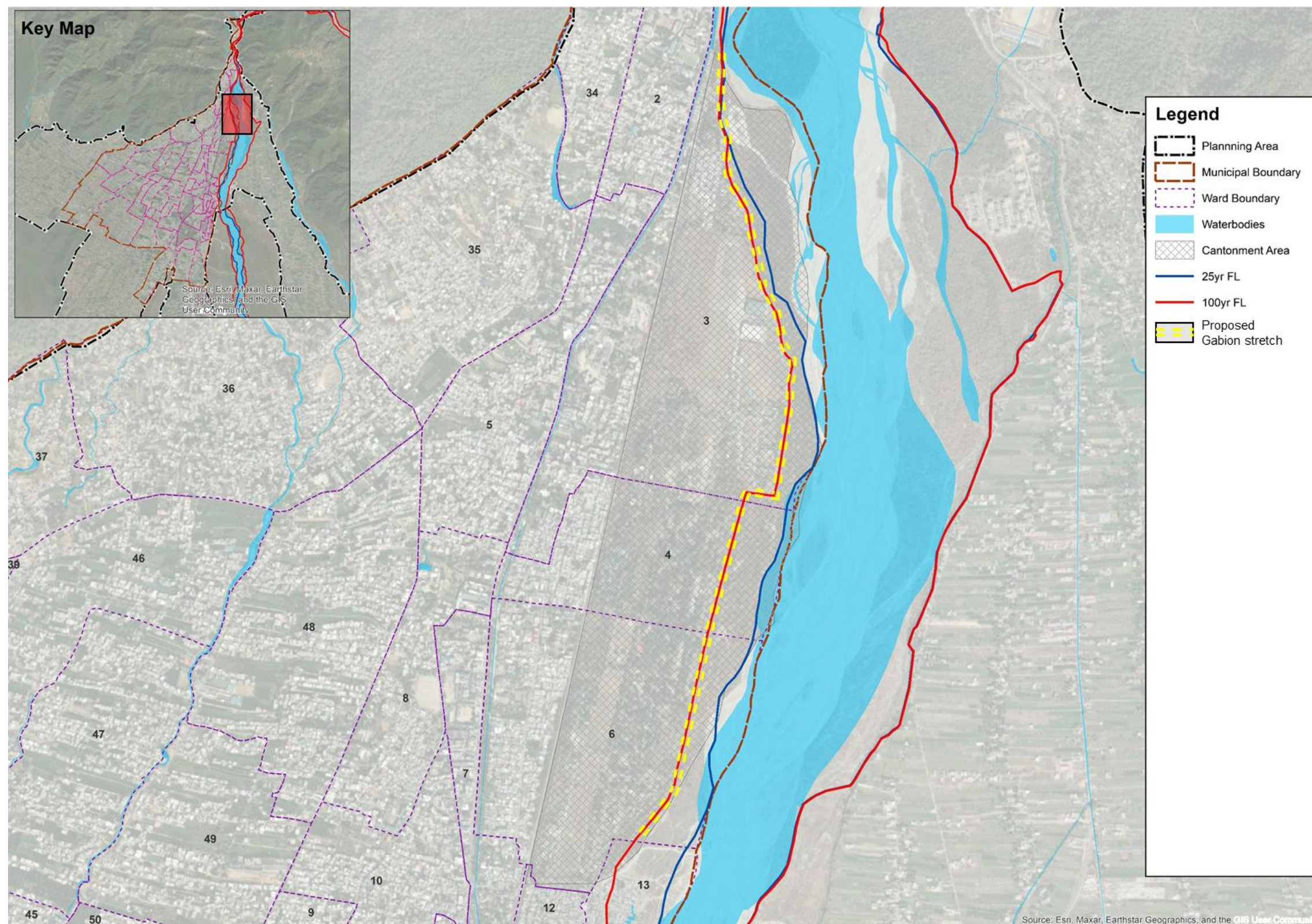
It is proposed that bank protection measures along the 4 km riparian stretch be undertaken with gabion structures along with gabion aprons at the toe for scour protection. Details of the proposed gabion structure is presented in Image 6-1 and the technical specifications are presented in Annexure 1.



**Image 6-3: Gabion bank protection measures proposed for the riparian stretch along western bank**

This section for intervention starts from Gas Godam Road where concrete bank protection works are ongoing at Kathgodam to the upstream of Rajpura Basti near cantonment area, where concrete retaining walls are already in place. (Refer Image 6-1).





Map 6-2: Proposed gabion intervention, western bank of Gaula River (Rajpura Basti – Gas Godam Road)



### Implementation Framework:

#### Responsible agencies:

Irrigation Dept; Supporting Agencies: NMCG, Cantonment Board & HMC

#### Estimated budget:

Construction cost: ₹18–22 crore (₹4.5–5.5 crore/km).

Annual O&M cost: ₹1.5–2 crore

#### Timeline:

Short term

1-5 months

#### Funding sources:

1. Uttarakhand Irrigation Department (integration with ongoing flood schemes).
2. National Mission for Clean Ganga (NMCG).
3. CSR contributions (local industries, banks, cantonment partnerships).

### 6.2.3 Intervention 3. Debris arresting and bank protection measures

Kalsiya Nallah flows through Haji Mohallah, a densely populated corridor located in the northern part of the city before joining the Gaula River (Refer Image 6-4 ). It originates in the forested foothills and descends rapidly into urban settlements, exhibiting high-energy flow during monsoon and carrying heavy boulders and debris downstream.

During peak rainfall turbulent water along with rockfall and debris flow causes damage to adjacent buildings and infrastructure that have encroached upon its banks (Refer Image 9.3.1 & Image 9.3.2).

The key issues identified are listed below:

- Encroachments along the Nallah restrict flow and increase flood risk to the adjacent settlements and downstream urban areas.
- Heavy debris and rock fall during rain cause structural damage and bank erosion.



Image 6-4: Encroachment along Kalsiya Nallah

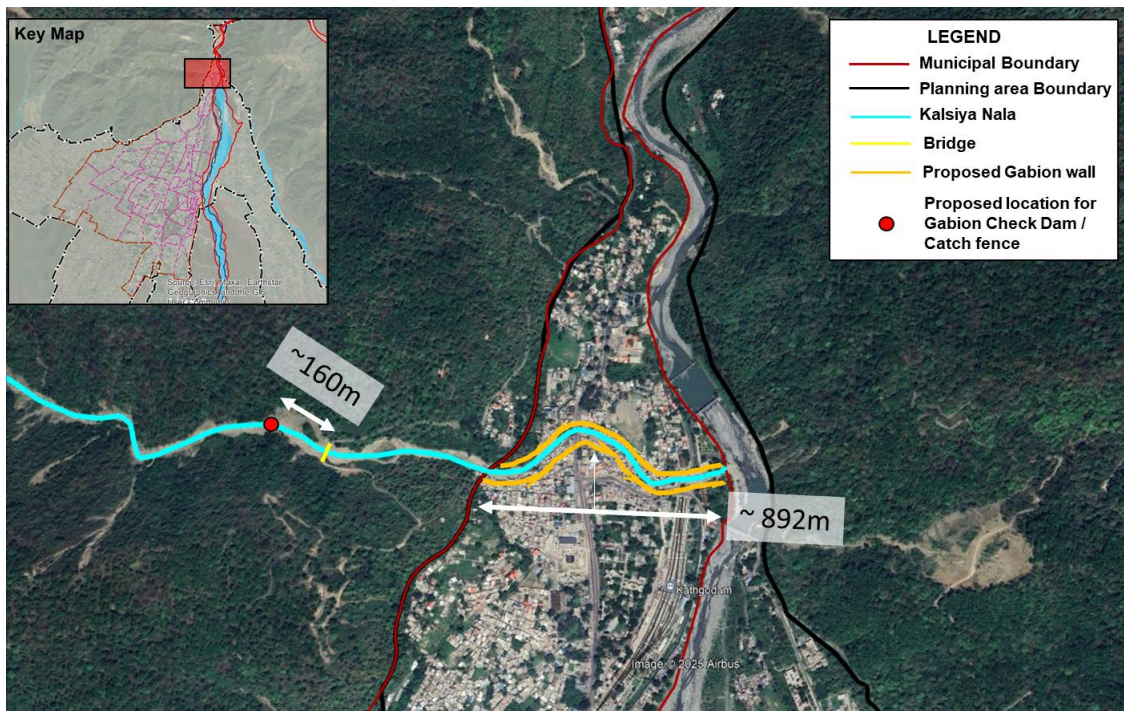


Image 6-5: Kalsiya Nallah during heavy rains

### Proposed Intervention:

The proposed intervention measures are presented below, and the intervention locations are shown in Map 6-3:

- i. **Rock and debris arresting measures:** To prevent the flow of rock and debris from the catchment areas of Kalsiya nallah it is proposed to erect / construct an arresting arrangement on the Kalsiya nallah 160-meter upstream of the bridge crossing outside the Municipal boundary. The site has been chosen close to an existing road for ease of removal of debris after monsoons. Three alternatives have been suggested for rock and debris arresting measures.
- ii. **Bank protection measures:** To prevent damage to the properties adjacent to the Kalsiya nallah within the Municipal area from flowing rock and debris during monsoons gabion bank protection measures have been proposed for a stretch of approximately 890 meters.



Map 6-3 : Proposed intervention locations on Kalsiya nalla for addressing issues of rock and debris flow

The three options for arresting rock and debris flow are presented below in increasing order to strength.

#### Option 1: Rigid steel rockfall protection nets:

Rigid steel rockfall protection net comprises heavy-duty, stiff engineering systems such as reinforced steel-panel walls or structural steel frames designed to act as a "passive" shield. They rely on mass and structural rigidity to stop debris instantly upon impact, transferring the entire force directly into their concrete foundations.

#### Option 2: Gabion Check Dam

Gabion check dams comprises check dam constructed out of gabions laid across the width of the stream to regulate flow velocity, trap sediments, and intercept debris before it reaches the downstream areas. This measure reduces downstream scouring and complements other protective structures (Refer Image 6-7). Technical specifications of gabion check dams are presented Annexure 2.





Image 6-6: Rigid steel structure



Image 6-7: Gabion Check Dam

### Option 3: Flexible Rockfall Barrier (Catch Fence)

Flexible rockfall barrier consist of a high-tensile steel ring net suspended across the channel by support cables and anchored deeply into the banks to catch large debris while letting water pass through. The system utilizes specialized energy-dissipating "brake elements" on the cables that allow the net to stretch and deform under impact, absorbing the kinetic energy of the flow without the structure failing.

These are considered superior to rigid concrete dams for arresting debris flow because unlike a rigid wall that must be massive enough to withstand the direct impact of tons of moving rock and mud, a flexible barrier uses a "Soft" approach to dissipate that energy.

The below figure shows the illustration of flexible rockfall barrier at Kalsiya Nallah and the technical specifications are mentioned in the Annexure 2.



Figure 6-1: Flexible Rockfall Barrier

Bank protection measure in the 890-meter stretch within municipal zone comprises provision of gabion walls along either side of the Kalsiya nallah after removal of encroachments by the Municipal authorities. The bank protection measures shall help guide the storm water flow during monsoons and protect the adjacent properties from flowing rock and debris that escapes the arresting mechanism proposed in the upstream catchment.

The figure below shows before and after images of implementation of gabion bank protection measures. refer Image 6-8





Image 6-8: Bank Protection of Kalsiya Nallah with Gabion Walls

### Implementation Framework:



## 6.3 Objective 2 Interventions to keep river free from pollution

Interventions under Objective 2 comprise measures to keep the Gaula River, its tributaries and the nallahs flowing into the river free from liquid and solid waste pollution. Major source of liquid waste pollution at Haldwani-Kathgodam is from raw sewage disposed of into the streams and drains from houses. Similarly, disposal of municipal solid waste into streams and drains is a major cause of solid waste pollution.

### 6.3.1 Intervention 4: Construction of I&D structure at Indira Nagar Nallah

Indira Nagar Nallah (a storm water drain) originates from Indira Nagar and receives about 2.98 MLD used water from densely populated and encroachments on railway land. The nallah spills into the adjacent forest land near the 28 MLD STP of the city. The 28 MLD STP, commissioned in 2022 under AMRUT designed to meet demand up to 2049, has Indira Nagar’s load factored into its design capacity. However, since Indira Nagar lies on encroached lands of railways there are no proposals for laying sewer lines in this area. Map 6-4 below shows the sewered and unsewered areas along with the location of Indira Nagar Nallah and the 28 MLD STP.

#### Proposed Intervention:

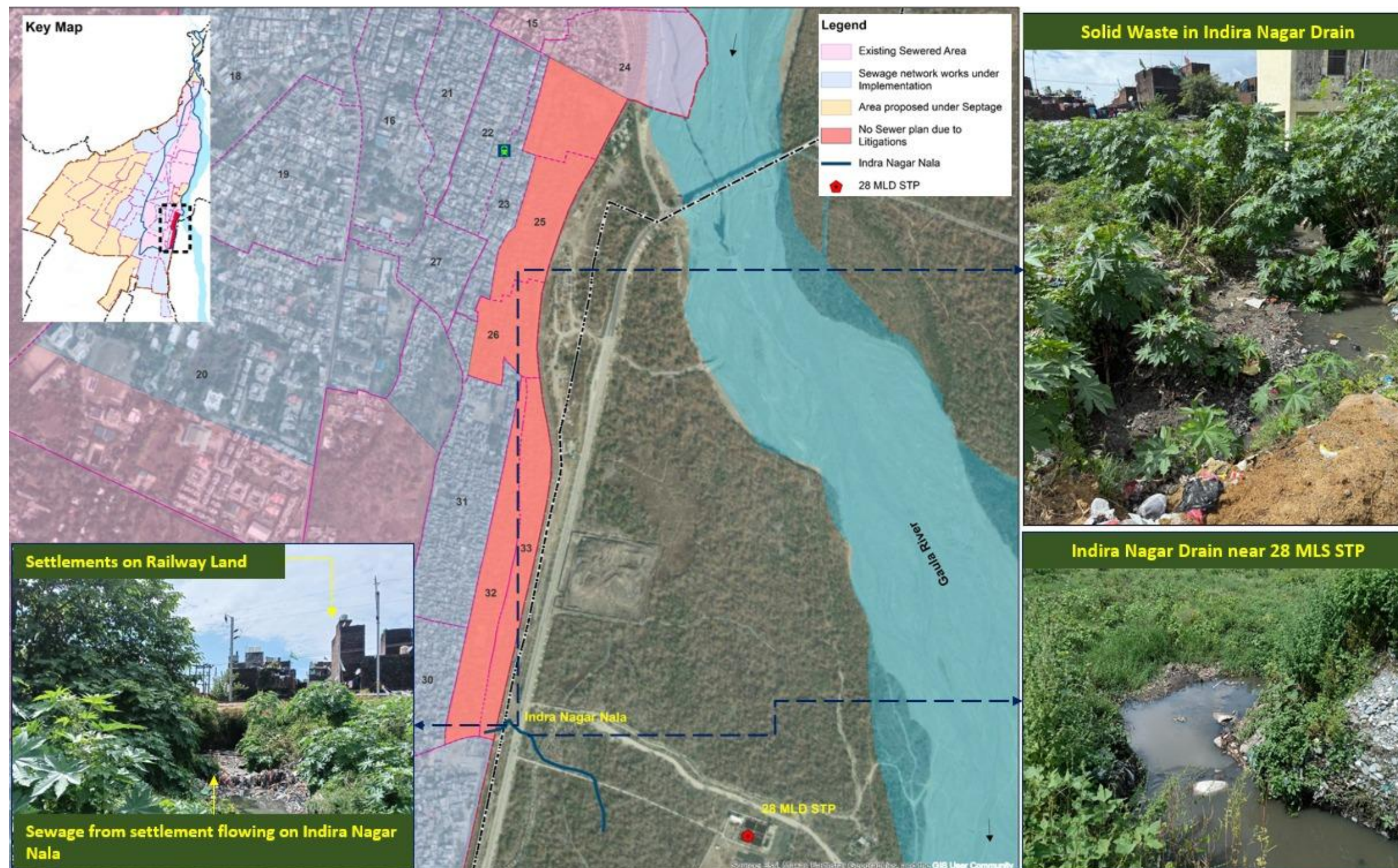
In the absence of a dedicated sewer system that prevents the sewage from reaching the STP, it is proposed to construct a 3 MLD Interception and Diversion (I&D) structure on this nallah after it crosses the Haldwani Bypass Road to the east (refer Map 6-5).

The proposed I&D structure may be constructed outside the road right of way in the forest land with an area requirement of approximately 15x15 m. The outlet of the I&D structure shall be connected to the adjacent trunk sewer line of the 28 MLD STP that runs along the eastern edge of Haldwani Bypass Road. The flow arrangement is presented in Figure 6-2 and the conceptual arrangement of the I&D components is presented in Figure 6-3.



Figure 6-2: Flow arrangement of proposed I & D Structure





Map 6-4: Sewered and unsewered areas along with location of Indira Nagar Nallah





Map 6-5: Proposed site for Indira Nagar I&D

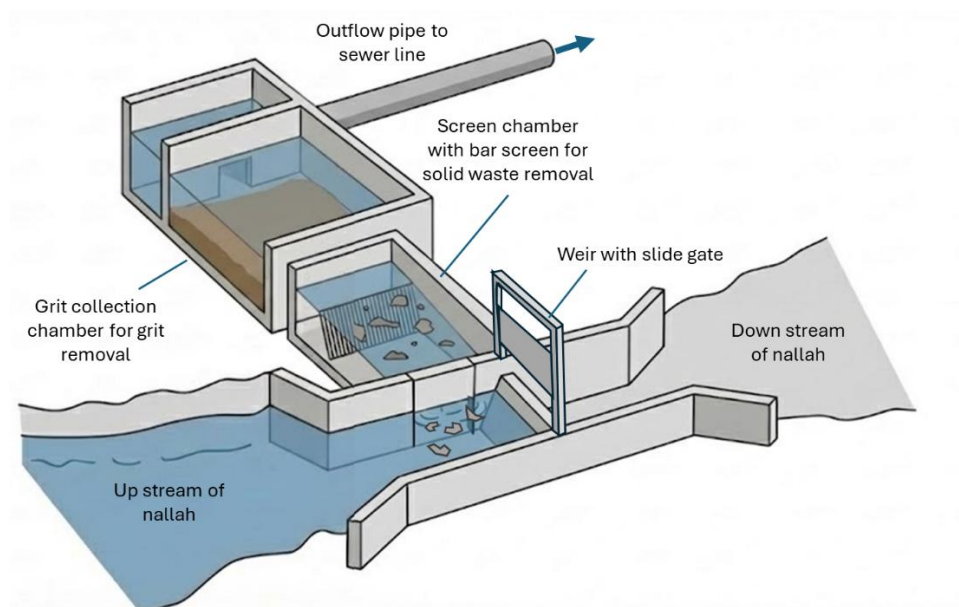


Figure 6-3: Conceptual arrangement of proposed I&D components

#### Implementation Framework:

**Responsible agency:**

Peyjal Nigam

**Estimated budget:**

₹2.5 Crore

**Timeline:**

Short term  
9-12 months

**Funding sources:**

Namami Gange

### 6.3.2 Intervention 5: Diversion of railway colony drain to constructed wetland

As stated in section 4.2.2, there are no sewerage provisions for encroached settlements on railway land to the east of Kathgodam Railway Station along the western bank of Gaula River. Few households here have septic tanks but sullage and sewage from others flow into the kutchha drains directly into the Gaula River. Out flow from the drains form stagnant ponds in the dry riverbed as shown in figure 1.3 and figure 1.4.



Image 6-9: Septic tank of a household on encroached land



Image 6-10: Pondage in the flood plain of Gaula from grey water from the settlement

#### Proposed Intervention A: Interception of the drains

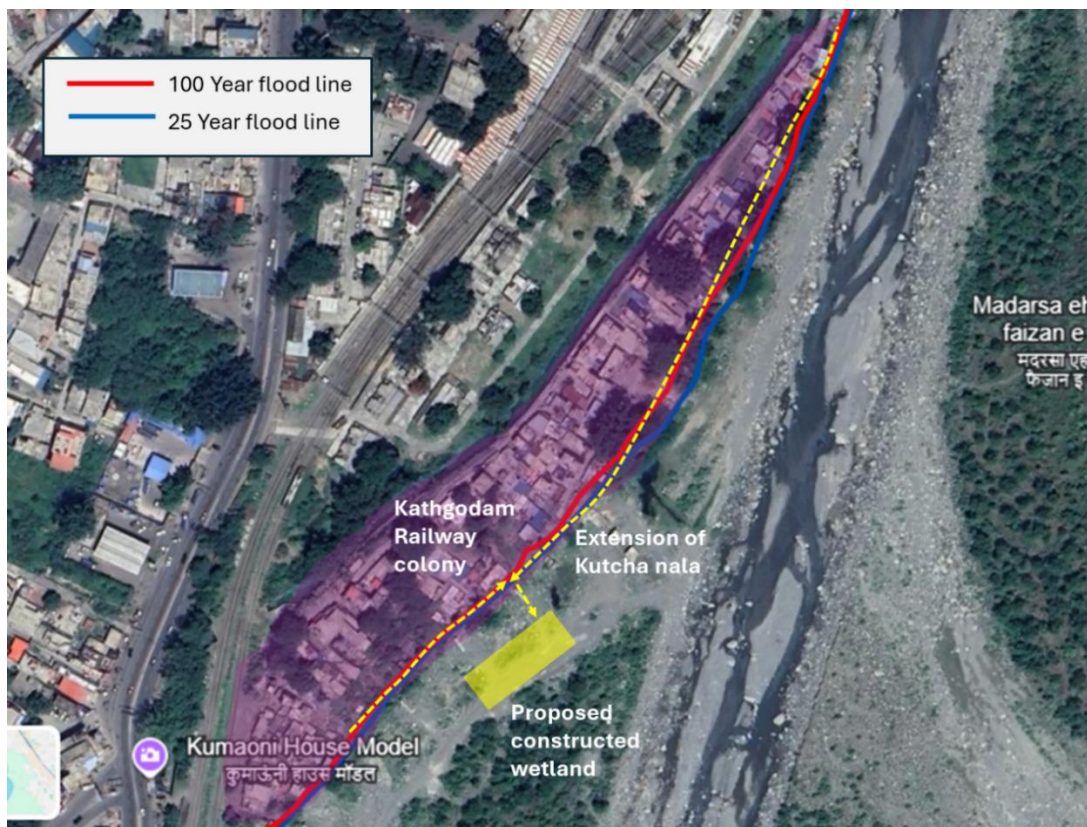
- Extension of the kutchha drains parallel to the riverbank along the edge of the settlement till the proposed constructed wetland and joining it to the wetland down the slope of the riverbank (refer Map 6-6)
- Closure of all kutchha drains flowing into the river bed at other locations.

#### Proposed Intervention B: Construction of ‘Constructed Wetland’<sup>2</sup>

<sup>2</sup> Links for more details about constructed wetlands:

[https://sswm.info/sites/default/files/reference\\_attachments/UN%20HABITAT%202008%20Constructed%20Wetlands%20Manual.pdf](https://sswm.info/sites/default/files/reference_attachments/UN%20HABITAT%202008%20Constructed%20Wetlands%20Manual.pdf)

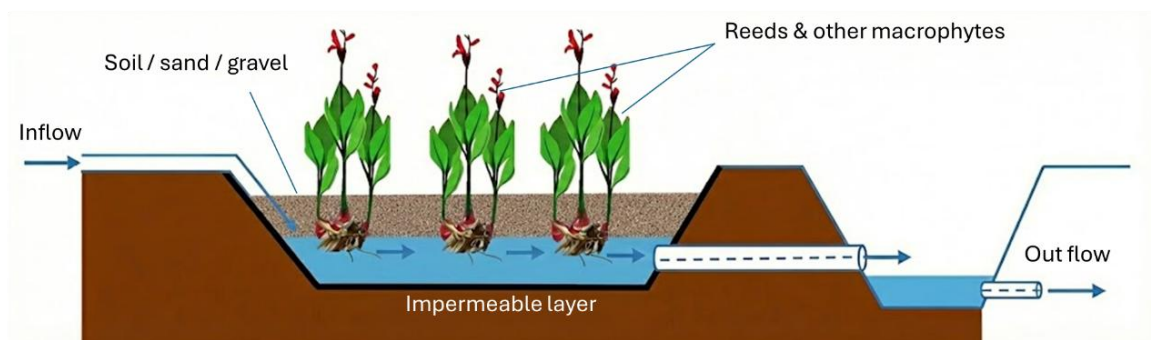




**Map 6-6 : Proposed drain diversion to constructed wetland on riverbed**

Construct a constructed wetland of roughly 800 sqm on the riverbed to the west of the river island. Apart from high floods the river flows away from this area of the riverbed (refer Map 6-6).

To prevent issues of mosquito breeding next to the settlement, subsurface horizontal flow constructed wetlands have been proposed (refer Image 6-11). Robust emergent plants like Common Reed (*Phragmites australis*), Cattails (*Typha* species like *T. latifolia*, *T. angustifolia*), and Bulrushes (*Scirpus* species), along with ornamental options like *Canna indica* have been proposed in the gravel substrate. These native species are very effective with regards to wastewater treatment, nutrient uptake and aeration.



**Image 6-11: Schematic diagram of subsurface horizontal flow constructed wetland**

**Responsible agency:**

Peyjal Nigam

**Estimated budget:**

₹40 Lakhs

**Timeline:**

Short term  
6-9 months

**Funding sources:**

Jal Jeevan Urban and CSRs

### 6.3.3 Intervention 6: Hybrid treatment of Faecal Sludge in city

Presently, faecal sludge collected from septic tanks by the desludging vehicles is directly discharged into a manhole on trunk sewer like near 28 MLD STP. The queued-up vehicles were observed to be discharging faecal sludge into the manhole continuously. Such a method of faecal sludge disposal results in shock loading at the STP and poses risk of sewer choking, reduced treatment efficiency and contamination.



**Image 6-12: Desludging vehicles queued up for discharging faecal sludge in sewer manhole**

The city presently generates approximately 150 KLD faecal sludge. Once the ongoing sewerage network construction is completed, the daily faecal sludge generation is expected to reduce to approximately 80 KLD. Under this scenario, the commissioning of 20 KLD co-treatment plant shall only provide partial increase in faecal sludge treatment capacity. Implementation of the proposed 75 KLD will bring the total capacity to 95 KLD, ensuring a comprehensive and sustainable long-term solution that fully accommodates the 80 KLD load.

#### Proposed Intervention

To address the above challenges a combined intervention is proposed:

- A. Procurement of Mobile Septage Treatment Unit to provide onsite treatment and reduce load at the STP.
- B. Controlled disposal of faecal sludge into the 28 MLD STP collection tank through regulated supervision till co-treatment facilities are fully operational.



### Intervention A: Procurement of Mobile Septage Treatment Unit

A Mobile Septage Treatment Unit will provide additional onsite treatment capacity (refer Image 6-13). Vacuum trucks will discharge sludge into this unit, where solids and liquids are separated and treated effluent is released in a controlled manner. The Mobile Septage Treatment Unit with a 10 KL (10,000-litre) capacity, is based on the operational model successfully implemented in Gorakhpur city, ensuring proven feasibility and adaptability for Haldwani–Kathgodam. Mounted on a truck chassis, it will be equipped with mechanical separation, dewatering, and safe effluent discharge systems for flexible use across wards and peri-urban areas.



Image 6-13: Mobile Septage Treatment Unit

### Intervention B: Controlled disposal of septage in the collection tank of 28 MLD STP

Until the Co-Treatment Plants proposed in Table 4.2 are operational, mobile FSTPs will be used according to Intervention 6 (A). However, if the load exceeds 10 KLD, controlled disposal of septage is recommended. In such cases, certain tankers could be permitted to discharge directly into the STP inlet in a regulated manner. To assess the feasibility of ongoing direct discharge, the unused capacity of the STP has been evaluated. Based on this analysis, the permissible number of septage truckloads has been calculated:

| Parameter | Designed Value | Influent Value | Septage    |
|-----------|----------------|----------------|------------|
| Flow      | 28 MLD         | 9.3 MLD        |            |
| BOD       | 230 mg/l       | 209 mg/l       | 18372 mg/l |
| COD       | 450 mg/l       | 518 mg/l       | 30370 mg/l |
| TSS       | 400 mg/l       | 176 mg/l       | 28308 mg/l |

Source: Consultants’ Estimates, 2025

Preliminary calculations (refer Annexure 3) indicate that around 40 truckloads of septage can be discharged daily into the collection tank of the 28 MLD STP, with COD as the constraining parameter. Although this is similar to the number of vehicles discharging daily, disposal must be staggered with a minimum gap of 30 minutes to avoid shock loading in the influent. The controlled discharge of septage and its impact on plant performance should be continuously monitored to determine the optimum number of tankers that can safely discharge without compromising the treatment capacity of the STP. The direct disposal of septage into the STP may be continued in a controlled manner until the 20 KLD co-treatment plant is fully commissioned at the 28 MLD STP.

### Implementation Framework

**Responsible agency:**

Lead: HMC

Support: Jal Sansthan Dept

**Estimated budget:**

₹1.5 Cr

**Timeline:**

Short term

6-9 months

**Funding sources:**

State Urban Development Department (SUDA)

Swachh Bharat Mission (Urban) – FSSM component

Convergence with AMRUT 2.0 or National River Conservation Plan (NRCP)

#### 6.3.4 Intervention 7: Preparation of Faecal and Septage Management Plan

Haldwani–Kathgodam is experiencing rapid and largely unplanned urbanization, while sewerage connections remain limited. Although municipal projects are underway to expand the sewerage network, around 64% of the population still depends on septic tanks and soak pits.

Many of these containment systems are poorly designed and inadequately maintained, posing serious risks of groundwater contamination and environmental pollution. Furthermore, desludging of septic tanks is demand based and the city does not have scheduled desludging. The desludging vehicles of the city are owned by private operators and are not registered under the municipal corporation. This scenario creates a broken sanitation value chain that leads to severe environmental, health, and administrative consequences. Specific gaps identified during field visits and stakeholder consultations are as follows.

1. **Containment:** Around 93% households depend on septic tanks due to lack of sewer lines. Many tanks are not watertight and lack baffles, with no municipal registry of tank size or desludging history.
2. **Storage:** No mechanism exists to measure sludge volume or effluent quality, and manual access points pose safety risks.
3. **Transport:** The city has around 35–40 private desludging vehicles (3,000–5,000 L). However, trucks discharge into manholes without controlled inlets and GPS/digital tracking is absent. Trucks also serve Rudrapur, raising risks of unmonitored dumping.
4. **Treatment:** Currently no separate faecal sludge treatment facility is available in the city.
5. **Reuse:** Currently 0% of faecal sludge is reused, with no composting, fertilizer production, or market linkages established.

#### Proposed Intervention

To bridge the identified gaps in containment, storage, transport, treatment, and reuse, the city must



adopt a structured Faecal Sludge and Septage Management (FSSM) Plan. The plan should be anchored in clear municipal bylaws, licensing of service providers and ring-fenced O&M funding, ensuring accountability and sustainability is aligned with the Faecal Sludge and Septage Management in Urban Areas of India – Standard Operating Procedures (SOPs). The interventions below combine the baseline findings with SOP-mandated best practices to ensure technical compliance, environmental safety, and institutional accountability.

## Intervention in Detail

### 1. Safe Containment

- Retrofit septic tanks to watertight standards with baffles, venting, and inspection ports.
- Ensure tanks are accessible for periodic desludging and designed to prevent leakage into drains or groundwater.
- Mandate a household registry capturing tank size, desludging history and effluent pathway.

**Best practices:** Tiruchirappalli (Tamil Nadu) has successfully implemented watertight septic tank retrofits and household registries under its citywide FSSM program.

**City Application:** Require immediate retrofitting and a centralized geo-tagged database of all onsite containment systems.

### 2. Scheduled and Regulated Desludging

- Establish bylaws mandating desludging cycles: 3–5 years
- Use licensed service providers operating GPS-equipped desludging vehicles to minimize illegal dumping

**Best practices:** Navi Mumbai (Maharashtra) has implemented a regulated desludging schedule with licensed operators and municipal monitoring.

**City Application:** Current practice is reactive desludging, with trucks discharging into manholes near the 28 MLD STP. A regulated schedule will ensure safe handling of faecal sludge generated.

### 3. Transport and Tracking

- Deploy a digital tracking system (GPS + mobile app) for all desludging vehicles with trip logs integrated into municipal dashboards.
- Require geo-tagged proof of discharge at designated treatment points.

**Best practices:** Bhubaneswar (Odisha) has adopted GPS-based tracking of desludging vehicles, ensuring transparency and accountability.

**City Application:** Trucks currently discharge into manholes without controlled inlets, creating risks of **shock loading** at the STP. GPS-based tracking will prevent illegal dumping into drains and open lands.

### 4. Treatment Infrastructure

- Establish decentralized FSTPs at strategic locations to intercept untreated sludge before it enters drains and rivers. These units will reduce transport distances, minimize illegal dumping, and provide localized treatment capacity.
- Integrate faecal sludge into existing sewage treatment plants through co-treatment, with controlled inlet dosing to prevent shock loading and maintain stable performance. This

approach optimizes resource use and reduces capital expenditure by leveraging existing infrastructure.

## 5. Reuse and Resource Recovery

- Convert treated sludge as compost, with compliance to Fertilizer Control Order (FCO) standards.
- Establish MoUs with horticulture, forestry and municipal parks for offtake.

**Best Practices:** *Indore (Madhya Pradesh)* has pioneered reuse of treated sludge as compost for municipal parks and agriculture.

**City Application:** The entire sludge is discharged untreated. Without reuse, the city loses potential recovery of 15–20 tons/month of compostable material.

## 6. Operation & Maintenance (O&M)

- Ensure continuous funding through ring-fenced municipal budgets dedicated to FSSM operations.
- Engage trained staff with quarterly refresher courses on SOPs, PPE use, and emergency response.
- Establish service contracts with private operators for plant operation, desludging and transport, tied to performance indicators.
- Institute preventive maintenance schedules for pumps, screens, drying beds, and mobile FSTPs, with independent audits.

**Best Practices:** *Warangal (Telangana)* has successfully ring-fenced O&M budgets and contracted trained operators for its FSTPs, ensuring >95% uptime.

**City Application:** Haldwani–Kathgodam currently lacks dedicated O&M funding and trained staff for faecal sludge treatment. To sustain proposed 20 KLD co-treatment at the 28 MLD STP and decentralized FSTPs, the city must adopt ring-fenced budgets, operator training, and service contracts to ensure long-term viability.

## 7. Policy, Regulation & Institutional Framework

- Draft and notify clear municipal bylaws regulating desludging frequencies, service standards, licensing, and fines for illegal disposal.
- Establish a dedicated FSSM Cell within the municipality to coordinate containment, desludging, transport, treatment, and reuse.
- Launch citizen dashboards for service requests, compliance monitoring, and grievance redressal.

**Best Practices:** *Devanahalli (Karnataka)* has adopted municipal bylaws for desludging cycles and established a dedicated sanitation cell, ensuring compliance and transparency.

**City Application:** Haldwani–Kathgodam currently operates without enforceable bylaws, leading to informal desludging and uncontrolled disposal into manholes and drains. Adoption of bylaws regulating 3–5-year desludging cycles, licensing of the private desludging vehicles and penalties for illegal dumping will institutionalize accountability and align with national SOPs.

Draft Scope of Work for Faecal Sludge and Septage Management (FSSM) is presented in Annexure 4.

## Implementation Framework



**Responsible agency:**

Lead: HMC

Support: Jal Sansthan Dept

**Estimated budget:**

₹50 L

**Timeline:**

Short term

6-9 months

**Funding sources:**

State Urban Development Department (SUDA)

Swachh Bharat Mission (Urban) – FSSM component

Convergence with AMRUT 2.0 or National River Conservation Plan (NRCP)

### 6.3.5 Intervention 8: Creation of Bamboo Fencing & Vertical Gardens for Waste Prevention

It is commonly observed that residents dispose of garbage in the natural streams flowing through the city. The first flush of rainwater carries this solid waste into the river. Since streams are accessible mostly at bridge locations and roads along stream banks, presence of solid waste in streams was mostly observed at these locations (refer Image 6-14).

**Proposed Intervention:**

To dissuade people from throwing garbage in streams the following interventions are proposed:

1. **Bamboo fencing with vertical gardens at bridges:** Aesthetically pleasing bamboo fencing with vertical gardens along inner face are proposed at the bridge locations to prevent disposal of garbage from bridges into streams.
2. **Bougainvillea hedges along stream bank roads:** Roads that are located along stream banks also provide access to the streams. Hence, bougainvillea hedges are proposed at these stretches to dissuade people from approaching the stream for disposal of solid waste.



Image 6-14: Erection of bamboo fencing with planters on bridges to prevent throwing of solid waste



Image 6-15: Bougainvillea hedges along stream bank roads

**Responsible agency:**

Irrigation Department,  
Municipal Corporation

**Estimated budget:**

2.5 lakhs for one culvert

**Timeline:**

Immediate

**Funding sources:**

CSRs,SBM, AMRUT, NMCG



## 6.4 Objective 3 Interventions to rejuvenate waterbodies and wetlands in the city

There are no major static water bodies or wetlands in Haldwani-Kathgodam. Apart from the Gaula River, which serves as the primary hydrological lifeline for the city other water bodies include the Sheetlaghat spring, seasonal streams, and the Gaula canal.

The Sheetlahat spring and other such springs that feed the Gaula River are reported to be facing severe hydrological crisis due to degradation of "spring sheds". Reduction in flow has also been observed in other streams flowing through the city. Further, the city is in Bhabar region with very high soil porosity and faces ground water stress. Hence, rejuvenation of the springs and streams in the region by rejuvenating their catchment areas shall improve surface and ground water availability for the city in future.

### 6.4.1 Intervention 9: Catchment restoration & revitalization study of Sheetlahat spring

Sheetlahat Spring, a vital groundwater discharge point in Haldwani-Kathgodam, has experienced declining flow and increased seasonal variability. The original discharge of approximately 3.5 MLD is currently reduced to 2 MLD. These changes are primarily attributed to upstream catchment degradation, rapid urbanization and reduced infiltration capacity. As a perennial source with ecological and domestic significance, the spring plays a critical role in sustaining water security, especially in fringe and peri-urban communities of Haldwani-Kathgodam city.

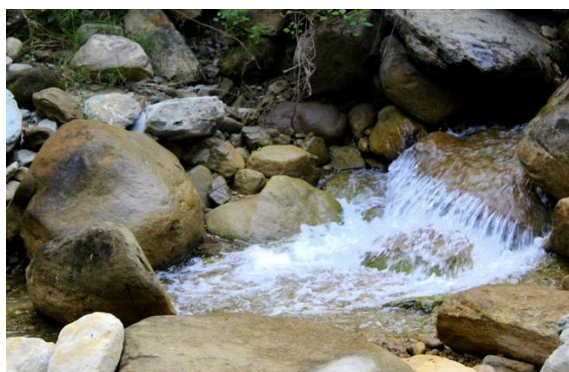


Image 6-16: Sheetlahat spring

The intervention comprises preparation of Sheetlahat Spring shed Management Plan to identify hard and soft measures needed for rejuvenation of the spring and its catchment areas. The objectives of the study are as follows:

- **Delineate the Spring shed:** Scientifically identify the "Recharge Area" (Aquifer recharge zone), which may differ from the surface topographic watershed.
- **Diagnostic Analysis:** Establish the precise correlation between recent road construction/land-use changes and flow reduction.
- **Augmentation Strategy:** Design site-specific artificial recharge structures to restore discharge to near-historical levels (Target: >3 MLD).
- **Sustainability Plan:** Establish a community-institutional governance model involving the Temple Trust and Nagar Nigam.

Draft Scope of Work for the Spring shed Management study is presented in Annexure 5.

The hard and soft interventions recommended by the study should be implemented through the respective stakeholder agencies to rejuvenate the spring. Typical catchment area treatment measures are presented in the following images.



Image 6-17: Staggered Contour Trenches (SCTs)



Image 6-18: Recharge Pits / Shafts



Image 6-19: Sub-surface Dykes



Image 6-20: Loose boulder / Gabion Check Dams

### Estimated budget

The estimated cost of preparation of Spring shed Management Plan for Sheetlahat spring is approximately ₹ 15 lakhs. Cost of hard and soft interventions shall be based on recommendations of the study.

**Responsible agency:**  
Jal Sansthan

**Estimated budget:**  
₹ 15 lakhs

**Timeline:**  
Mid term  
6-9 months

**Funding sources:**  
CAMPA



## 6.5 Objective 4 Interventions to enhance riparian buffer along riverbank

Riparian stretches comprising vegetated strips alongside rivers and natural drains are essential "living infrastructure" in cities because they perform critical services that cannot be provided by concrete edges. These include:

- **Flood Control:** Riparian stretches absorb excess rainwater and slow down runoff, preventing downstream flooding.
- **Water Purification:** The soil and roots filter out toxic urban pollutants and sediments before they reach the river.
- **Climate Regulation:** They cool the surrounding area thereby combating "Urban Heat Island" effect.
- **Biodiversity and Recreation:** They serve as the primary corridors for wildlife movement and provide valuable green space for human mental health and recreation.

The riparian stretch on both banks of Gaula River was analysed and differentiated between degraded and healthy stretches. Interventions have been proposed for restoration of degraded stretches whereas conservation and preservation recommendations have been proposed for the relatively healthy stretches in the following paragraphs.



Image 6-21: Dense Riparian stretches cantonment area



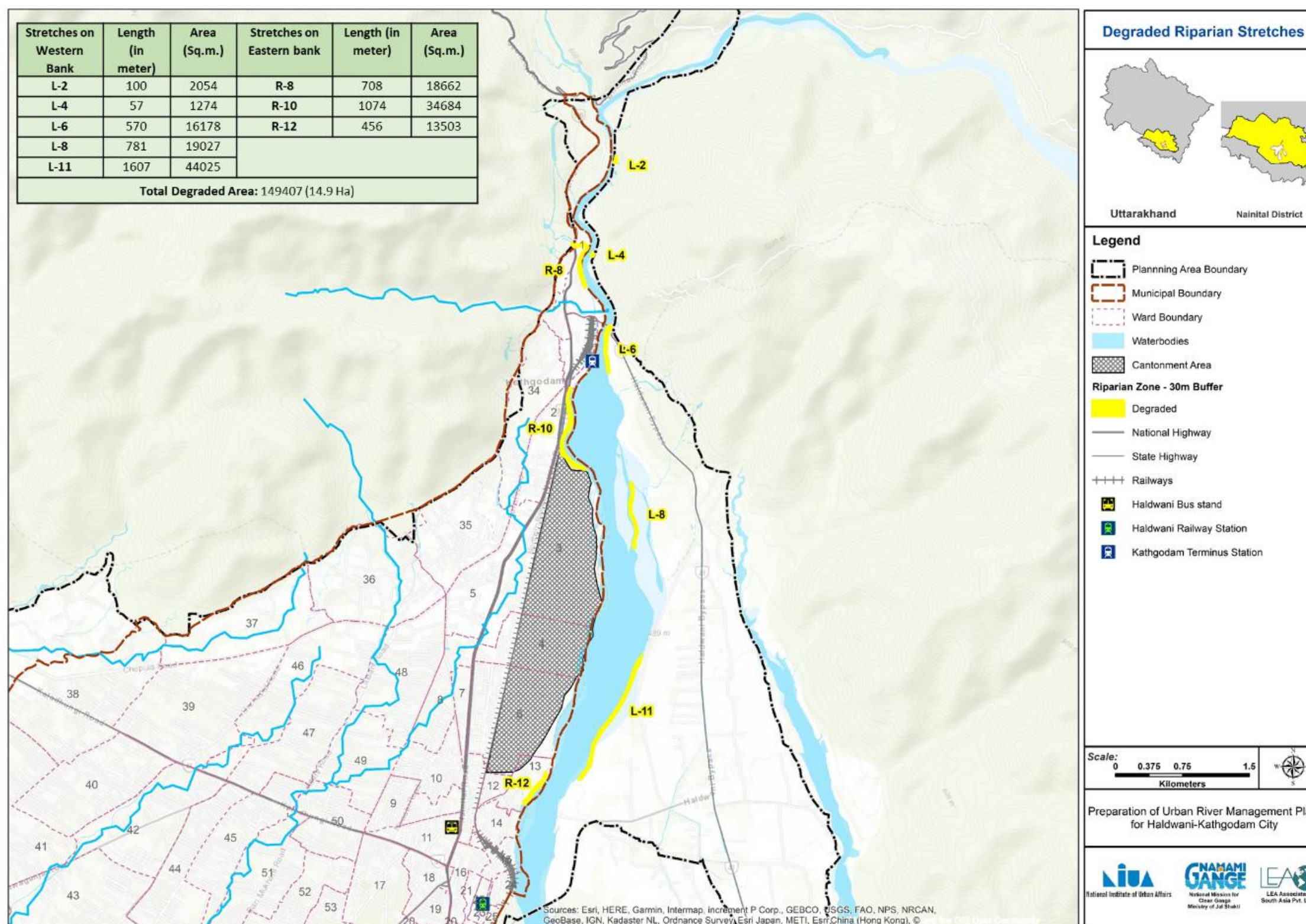
Image 6-22: Degraded Riparian stretches near international sports stadium

### 6.5.1 Intervention 10: Restoration of degraded riparian stretches

To address the localized degradation, bank erosion and declining structural stability were observed along the Gaula River as shown in Map 6-7. A Three-Zone Riparian Buffer Restoration Strategy is proposed on both banks across the identified degraded stretches. This approach systematically restores vegetation in layers based on proximity to the river channel, ensuring that ecological and hydraulic functions are strengthened in a coordinated manner.

| Name                                  | Stretches on Western Bank | Length (in meter) | Area (Sq.m.) | Name     | Stretches on Eastern bank | Length (in meter) | Area (Sq.m.) |
|---------------------------------------|---------------------------|-------------------|--------------|----------|---------------------------|-------------------|--------------|
| Degraded                              | L-2                       | 100               | 2054         | Degraded | R-8                       | 708               | 18662        |
| Degraded                              | L-4                       | 57                | 1274         | Degraded | R-10                      | 1074              | 34684        |
| Degraded                              | L-6                       | 570               | 16178        | Degraded | R-12                      | 456               | 13503        |
| Degraded                              | L-8                       | 781               | 19027        |          |                           |                   |              |
| Degraded                              | L-11                      | 1607              | 44025        |          |                           |                   |              |
| Total Degraded Area: 149407 (14.9 Ha) |                           |                   |              |          |                           |                   |              |





Map 6-7: Degraded Riparian Buffer



### Proposed key actions for restoration

The proposed riparian restoration measures along the Gaula River focus on strengthening bank stability, improving ecological health, and replacing invasive vegetation with resilient native species. The strategy combines targeted structural works with bio-engineering and native plantation, ensuring long-term stabilization, improved habitat quality and enhanced river corridor resilience.

| Component                                                               | Description                                                                                                                  | Key Actions / Species                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Western Bank – Restoration and Slope Stabilization Measures</b>   | Sections of the western bank show erosion and localized degradation requiring structural and bio-engineering interventions.  | Structural: Gabion bank protection along stretches vulnerable to erosion.<br>Bio-engineering:<br><ul style="list-style-type: none"> <li>Linear plantation of Vetiver grass (<i>Vetiveria zizanioides</i>) for soil binding and slope stability.</li> </ul>                                          |
| <b>2. Replacement of invasive species by Native Species Integration</b> | Invasive species along the western edge to be replaced with ecologically compatible native vegetation to enhance resilience. | Recommended native species: <ul style="list-style-type: none"> <li><i>Anisomeles indica</i> (Lamiaceae)</li> <li><i>Leucas aspera</i></li> <li><i>Achyranthes aspera</i></li> <li><i>Saccharum spontaneum</i></li> <li><i>Vetiveria zizanioides</i></li> <li><i>Bothriochloa pertusa</i></li> </ul> |

### Multi-zonal approach for riparian stretches design

A 30m wide riparian buffer zone from the edge of river is proposed to be implemented in the identified stretches. The buffer will have three zones as shown in Figure 6-4.



Figure 6-4: Section of the Proposed riparian stretch along eastern and western bank of the river

### Zone wise proposed species and its ecological benefits

The riparian buffer is structured into functional zones, with species selected based on hydrological tolerance, rooting depth and ecological performance. Zone-specific plantings are intended to optimize bank stabilization, nutrient filtration and habitat functioning across the river corridor. The native plant species recommended for each riparian zone are summarized in the table below.

| Zone                                                | Width   | Vegetation Type                                         | Proposed Species with Ecological Benefits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------------------------------|---------|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Inner Zone</b><br>Closest to water (stream edge) | 5–10 m  | Dense grasses & sedges (soil binding, scour resistance) | <ol style="list-style-type: none"> <li><b>Vetiveria zizanioides (Vetiver):</b> Extremely strong root network (3–4 m deep), excellent erosion control, traps sediments, absorbs nitrates &amp; phosphates, tolerates flooding and pollutants</li> <li><b>Saccharum spontaneum (Kans):</b> Binds loose alluvial soils, stabilizes sand bars, reduces bank erosion, provides habitat for birds and insects</li> </ol>                                                                                                                                                                                                                                                                |
| <b>Middle Zone</b><br>Mid-slope bank                | 10–15 m | Shrubs (stability + habitat)                            | <ol style="list-style-type: none"> <li><b>Adhatoda vasica:</b> Strong root system stabilizes slopes, improves soil structure, medicinal plant supporting biodiversity</li> <li><b>Pyracantha crenulata (Ghigharu):</b> Thorny shrub prevents trampling and grazing near bank, excellent bird food source (berries), controls erosion</li> <li><b>Rubus ellipticus (Hisalu):</b> Dense canopy prevents soil drying, root mat binds soil, provides fruit for wildlife</li> <li><b>Urtica dioica (Kandali / Bichhu Ghass):</b> Improves soil organic matter, supports insects and pollinators, natural barrier against livestock disturbance</li> </ol>                              |
| <b>Outer Zone</b><br>Higher bank / upland           | ≥ 15 m  | Deep-rooted native trees (long-term stability)          | <ol style="list-style-type: none"> <li><b>Shorea robusta (Sal):</b> Deep roots stabilize slopes, strong timber species, improves microclimate, leaf litter enriches soil</li> <li><b>Pinus spp.:</b> Anchors shallow rocky slopes, intercepts rainfall, reduces runoff intensity</li> <li><b>Rhododendron spp.:</b> Tolerates poor mountain soils, enhances biodiversity, supports pollinators</li> <li><b>Acacia catechu (Khair):</b> Nitrogen-fixing, improves soil fertility, drought tolerant, strong erosion control</li> <li><b>Adina cordifolia (Haldu):</b> Large canopy reduces surface runoff, improves soil moisture retention, shade and habitat for fauna</li> </ol> |

### 6.5.2 Recommendation 1: Conservation and Preservation of Natural dense riparian buffer

Strict conservation measures are recommended for the ecologically intact stretches of the Gaula River corridor, where riparian vegetation remains largely undisturbed. These areas currently support approximately 64.6% dense vegetation on the western bank and 53.3% on the eastern bank, reflecting high-functioning riparian systems. These priority conservation zones are illustrated in the accompanying Map 6-8 These zones provide critical reference conditions (baseline or “benchmark” sites) against which restoration outcomes in degraded reaches can be evaluated and therefore should be protected from clearing, encroachment, grazing and unnecessary disturbance.



| Name                               | Stretches on Western Bank | Length (in meter) | Area (Sq.m.) | Name  | Stretches on Eastern bank | Length (in meter) | Area (Sq.m.) |
|------------------------------------|---------------------------|-------------------|--------------|-------|---------------------------|-------------------|--------------|
| Dense                              | L-1                       | 2341              | 67190        | Dense | R-2                       | 1392              | 36601        |
| Dense                              | L-3                       | 1355              | 40250        | Dense | R-3                       | 423               | 12107        |
| Dense                              | L-5                       | 902               | 22640        | Dense | R-5                       | 254               | 5974         |
| Dense                              | L-7                       | 1334              | 38501        | Dense | R-7                       | 1200              | 32486        |
| Dense                              | L-9                       | 968               | 22445        | Dense | R-11                      | 3665              | 109676       |
| Dense                              | L-13                      | 807               | 19732        |       |                           |                   |              |
| Total Dense Area: 407602 (40.7 Ha) |                           |                   |              |       |                           |                   |              |





The table below presents the key management actions proposed for the existing riparian buffer along the Gaula River. These measures prioritize conservation of healthy stretches, restoration of degraded banks and targeted interventions to maintain ecological stability and long-term river resilience.

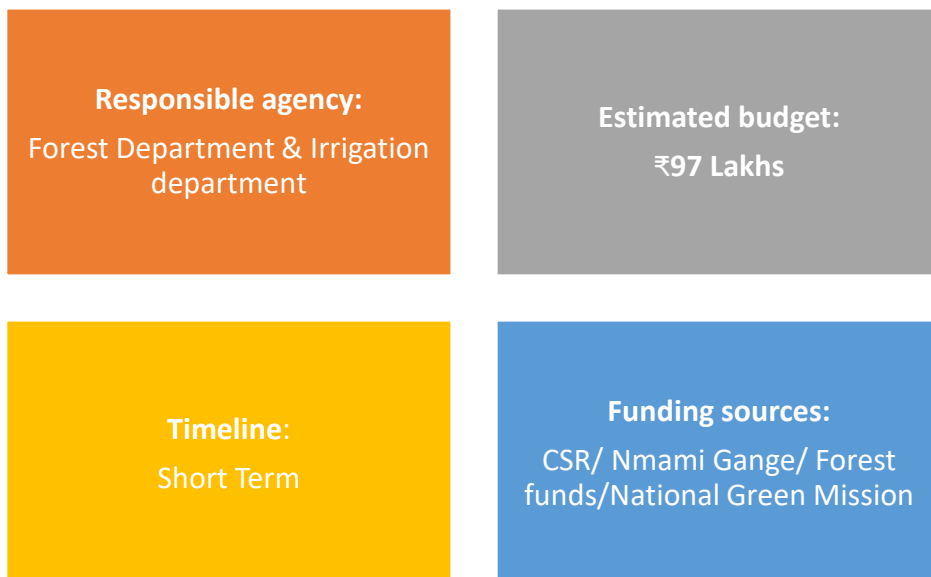
#### Recommendation for existing riparian stretch conservation and preservation

**Well-developed, ecologically functional riparian vegetation that must be preserved in its current state. The key recommended actions are given below:**

- Integration of buffer width into flood plain zoning regulations.
- Prohibited Permanent construction mining, dumping and river bank encroachment.
- Control grazing and fencing in sensitive stretches.
- GIS based demarcation and geo fencing of buffer stretches.
- Periodic drone and satellite monitoring.
- Formation of Community level protection committee.
- Penalty, restoration liability and compensatory plantation for violation.

#### Implementation Plan

The implementation of the riparian buffer restoration along the Gaula River will be guided by a clearly defined management framework to ensure effective execution, accountability and resource utilization. Key elements of the framework include:



This framework provides a structured approach to restoration, integrating technical measures with administrative coordination and financial planning. By clearly defining responsibilities, budget, timeline and funding mechanisms, it ensures that the riparian buffer restoration is implemented efficiently, sustainably and in alignment with broader environmental and river management objectives.

## 6.6 Intervention for reuse of treated waste water

### 6.6.1 Intervention 11: Enhance the reuse of treated wastewater in the city

Haldwani–Kathgodam presently has no operational system for reuse of treated wastewater. The city’s 28 MLD Sewage Treatment Plant (STP) generates approximately 11–12 MLD of treated wastewater daily, which is currently discharged without beneficial utilization. The treated effluent consistently achieves Biological Oxygen Demand (BOD) levels below 10 mg/L, meeting the CPHEEO recommended norms for reuse in irrigation, landscaping, horticulture and certain industrial applications.

A reuse commitment exists from the upcoming NTPC charcoal plant, which has proposed to utilize 500 KLD of treated wastewater once commissioned. Beyond this industrial demand, significant potential remains for reuse in agricultural irrigation and horticultural development. 10.9 hectares of forest land near the cantonment area is identified that can be irrigated using treated wastewater, thereby supporting afforestation and ecological restoration. Few identified gaps are mentioned below:

- Absence of reuse infrastructure
- Limited demand mapping: Only NTPC’s industrial requirement is formally documenting; agricultural and horticultural demands remain unquantified.
- Underutilization of treatment capacity: Despite producing 11–12 MLD of reusable water daily, only 500 KLD has a committed end-use.

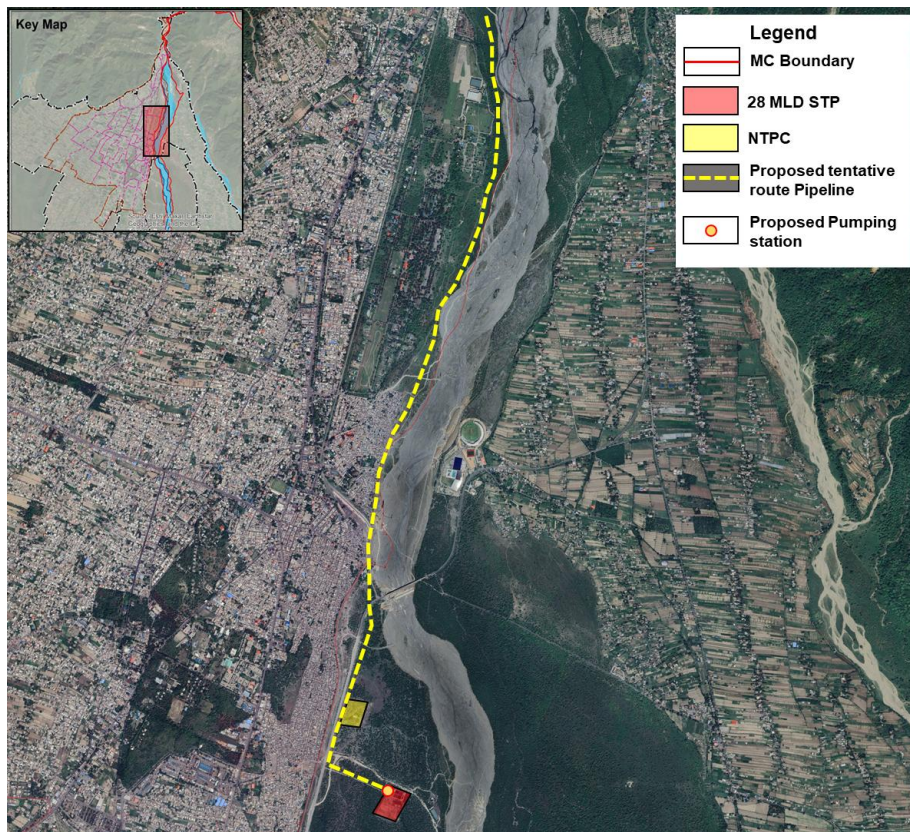
#### Proposed Intervention:

To initiate reuse, the most feasible and immediate option is horticultural irrigation of forest land near the cantonment area, covering 10.9 hectares. The estimated daily water requirement for this area is approximately 0.7 MLD, calculated at around 6 litres per sqm per day. In the immediate term, this demand can be met through tanker-based supply until the proposed 7 km pipeline of 200 mm diameter is laid (Refer Map 5.1).

Simultaneously, the upcoming NTPC charcoal plant has committed to utilize 0.5 MLD of treated wastewater through its dedicated pumping station with a capacity of 1.2 MLD, connected to the same proposed of 7 km pipeline. By integrating horticultural demand with NTPC’s infrastructure, a combined flow of approximately 1.2 MLD can be managed.

As per CPHEEO guidelines, horticultural and landscaping applications require treated wastewater with BOD  $\leq 10$  mg/L, turbidity  $< 2$  NTU, nil faecal coliform and absence of foul odour all of which are achievable with the current treatment level. This dual-use strategy leverages NTPC’s planned pumping system while extending benefits to ecological restoration in the forest land, thereby maximizing resource efficiency and ensuring compliance with national reuse standards.





Map 6-9: Proposed Pipeline and pumping station for reuse of treated used water

### Implementation Framework

#### Responsible agencies:

Jal Nigam; Supporting Agencies:  
NMCG and Forest dept

#### Estimated budget:

₹6 Cr

#### Timeline:

Short term  
1- 1.5 Years

#### Funding sources:

State Urban Development Funds  
CAMPA  
CSR funding

## 6.7 Interventions to develop eco-friendly riverfront projects and economic potential

### 6.7.1 Intervention 12: Develop a new Gaula Riverfront Park near Gaula Barrage

**Rationale:** Haldwani is the "Gateway to Kumaon," but tourists rarely stop here. A developed riverfront in the city apart from other attractions can increase tourist foot falls. However, Gaula River below the Gaula barrage remains dry for most of the year since the barrage diverts water for drinking and irrigation and the river passes through highly porous riverbed of Bhabar region. Areas around the barrage have more surface water and hold the best potential for riverfront. The irrigation department has developed a 1.3 acres park just downstream of the Gaula barrage but has poor access due to narrow roads and absence of a bridge across the Kalsiya Nallah.

A 3-acre mostly vacant site with better accessibility, adjacent to the Haldwani bypass and Gaula bridge has been identified for development of a new Gaula Riverfront Park. The site is presently under Project Implementation Unit (PIU) Jamrani of the Uttarakhand Irrigation Department. Few storage rooms of PIU can be relocated next to the 1.5-acre park site of the Irrigation department across the Kalsiya Nallah. An area of 15m by 20m has to be reserved within the site for construction of sewage pumping station (SPS) of the Uttarakhand Pey Jal Nigam. Location of exiting barrage park and the new Gaula Park is show in the following Figure 6-5.

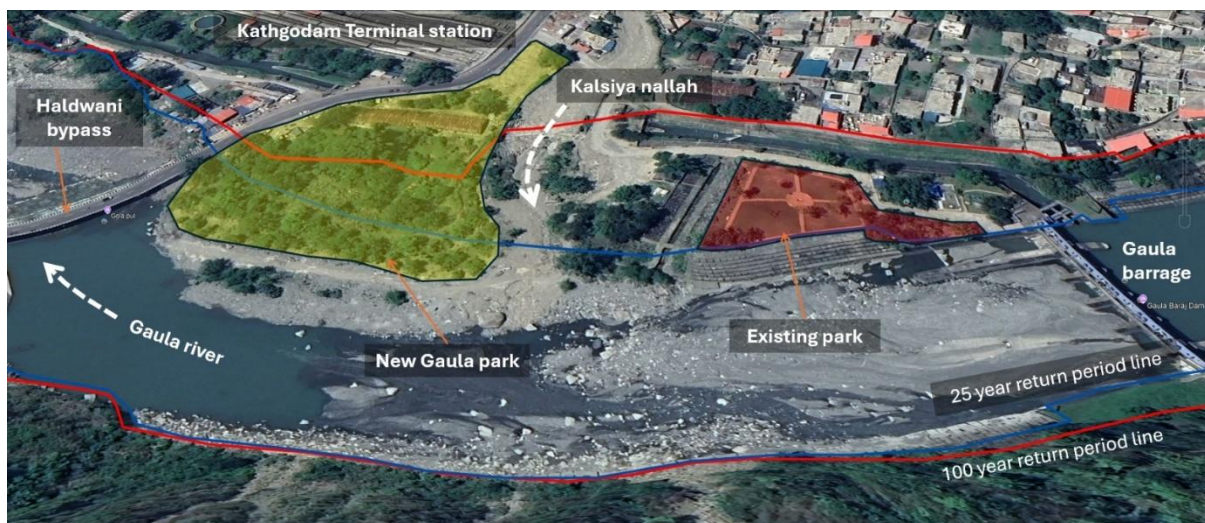


Figure 6-5: Location of new Gaula Riverfront Park

The riverfront park has been divided into three zones based on frequency of submergence from Gaula river Figure 6-6 Further, construction materials have been proposed considering the balance of ecological sensitivity with durability. The suggested construction materials survive inundation without degrading, while also allowing water to retreat.

- **Zone A:** Riverward Zone (below the 25-year return period flood line) comprising features that are resilient to more frequent flooding such as rock garden, board walk, bird watch tower, etc. Suggested materials include gabions for retaining edges; riprap with interplanted vegetation and simple stabilized gravel or stepping stone paths that can be easily cleaned of silt and no fixed furniture other than those with a cast-in-place concrete base.



- **Zone B:** Intermediate Zone (between the 25 and 100-year return period flood line) comprising features that can withstand occasional flooding such as picnic area, open air theatre with green terraces, etc. Suggested materials include Resin-bound gravel or Permeable Interlocking Concrete Pavers (PICP) for paths, recycled HDPE furniture anchored to concrete pads and concrete or stone blocks for structures like the amphitheater that are easy to hose after a flood.
- **Zone C:** Upland Zone (above 100-year return period flood line) comprising more permanent infrastructure such as cafeteria with toilets, utilities such as proposed Sewage Pumping Station, artisans haat, vehicle parking, etc. Suggested materials include porous asphalt for the parking lot and permeable paver blocks for entry plaza and market stalls to manage local stormwater.

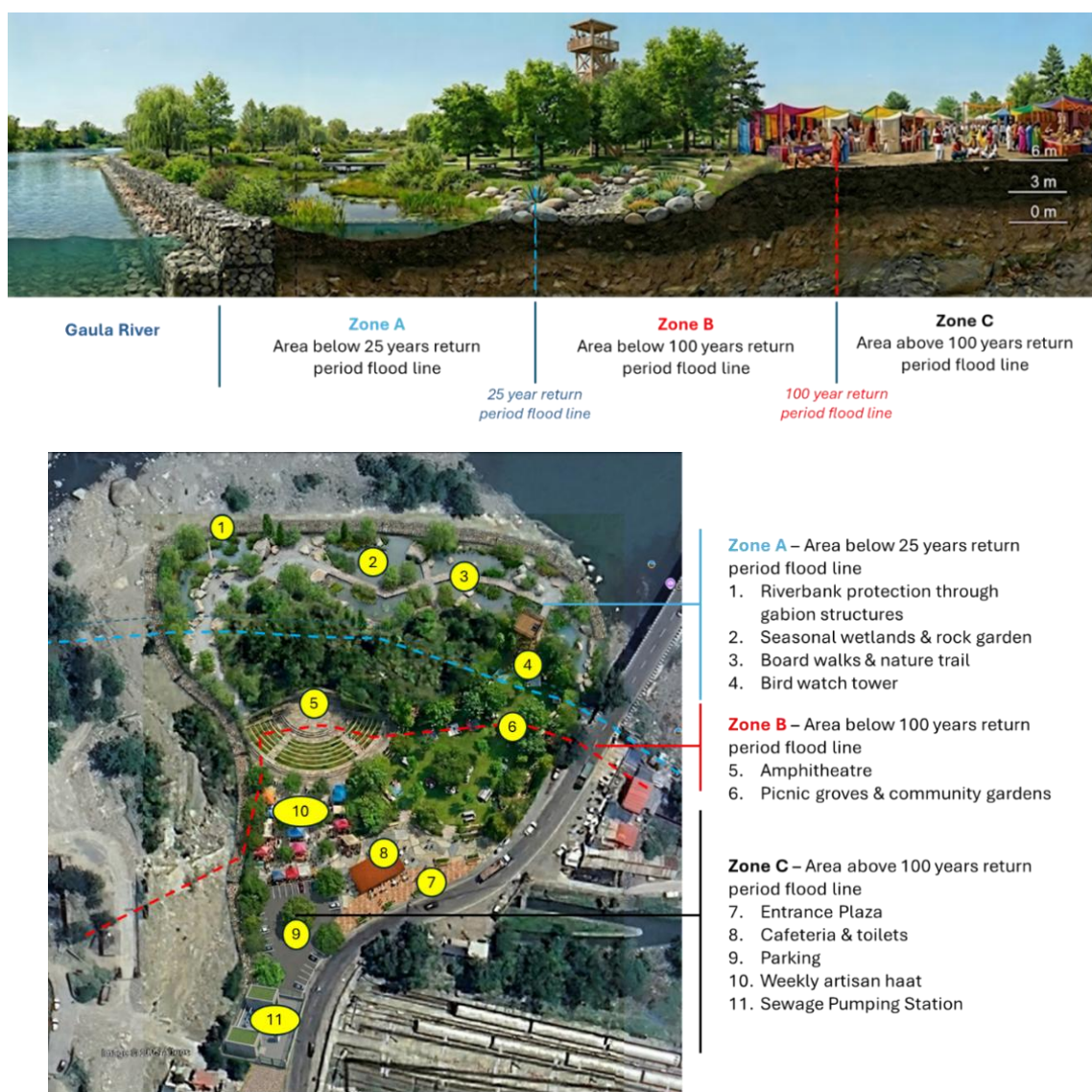


Figure 6-6: Cross section of Gaula Riverfront Park showing the three planning zones (above) and plan showing proposed activities in the planning zones (below)





Rock garden



Green terraces of open-air theatre



Gaula Artisans Haat



Bird Watch tower in steel & wood



Ecofriendly gazebos in picnic area



Permeable pavers in parking area

Map 6-10: Proposed components of Gaula Park



Funding Sources: District Mineral Foundation (DMF), AMRUT 2.0, NMCG, Uttarakhand Tourism Development Board (UTDB), CSR

**Responsible agency:**  
Irrigation department

**Estimated budget:**  
₹13-14 crore (subject to DPR)

**Timeline:**  
Short term  
12-18 months

**Funding sources:**  
AMRUT 2.0, SBM Urban, State  
Tourism Grants, CSR

## 6.8 Interventions to leverage the economic potential of river

### 6.8.1 Recommendation 2: Riverfront Tourism & Recreation

Leverage the proposed Gaula Riverfront Park to generate tourism centric economy for the local people such as:

1. **Craft Bazaar:** Organising a "Kumaoni Haat" where local artisans sell Aipan art, copperware, and woolen goods to tourists waiting for trains or heading up to Nainital.
2. **Birdwatching Eco-Tours:** The Gaula catchment is a biodiversity hotspot for migratory birds. Local youth can be trained as birding guides with the help of Forest Department to lead morning tours along the barrage and upstream forest areas near Rani Bagh.
3. **Adventure Sports:** During the dry season when the riverbed is wide and rocky, the dry channels can be utilized for ATV (All-Terrain Vehicle) tracks and rock-crawling courses, creating a unique "off-road" adventure park that creates jobs for local mechanics and instructors.
4. **Weekly Flea Market:** The municipal corporation can designate a safe, flat zone on the dry riverbed during winter/summer for a weekly flea market. This requires minimum investment which includes waste management but can create trade volume for several small vendors.

#### Recommendation: Value addition to the riverbed mining

One of the major sources of revenue from the Gaula River at Haldwani is mining of Riverbed Material (RBM) like sand, boulders and gravel. However, this is often exported from the city raw and without any value addition. The following strategies may be adopted for enhancing the economic returns from riverbed mining:

1. **Stone Processing Hubs:** Instead of selling raw boulders to crushers who ship them out, local stone masonry and tile manufacturing units may be encouraged. The excavated river stones can be processed into high-value landscaping pavers, tiles, and wall claddings for the construction market in the hills and NCR.

#### Recommendation: Train the local workforce for new economic activities

ITI Haldwani and other local colleges should offer courses in Adventure Tourism Guiding, Stone Crafting/Masonry, Spring shed Management Services, etc. to align the workforce with new river related economic opportunities.

1. **Spring shed Management Services:** A specialized workforce skilled in "spring recharge" comprising digging trenches, planting oak, etc. to sell services to upstream resorts and villages that are losing water, ensuring the Gaula flows longer in the year. Lessons learnt from implementation of proposed Sheetlahat Spring shed management can be used to train the locals.
2. **Scientific "Dredging-for-Safety":** Mining may be framed not just as extraction but as "Flood Management." Locals may be trained and employed in scientific dredging cooperatives to clear silt and prevent damage to riverside infrastructure during floods while legally selling the silt and sand. This shall help in stabilizing income as well as help save costly river side infrastructure.



## 6.9 Intervention to inculcate river-sensitive behaviour among citizens

The interventions under Objective 9 are designed to embed ecological awareness and cultural pride into everyday practices, ensuring citizens adopt river-sensitive behaviours. From interpretive signage and biodegradable ritual kits to electric crematorium promotion, digital IEC content and annual river festivals, these measures collectively strengthen emotional, cultural and behavioural ties with the Gaula river. The detailed interventions are listed in the sections below.



Figure 6-7: River-sensitive practices and cultural awareness

### 6.9.1 Intervention 13: Interpretive Signage and QR-Coded Storytelling Boards

The Gaula river has a limited presence in daily urban life due to its intermittent flow and limited cultural touchpoints. Current IEC initiatives are confined to audio broadcasts under the Swachh Bharat Mission, with no dedicated river-focused signage or digital platforms. As a result, several critical gaps have been identified:

- Absence of river-centric IEC infrastructure such as interpretive signage, kiosks, or digital channels.
- Lack of cultural and biodiversity storytelling platforms to highlight the river’s heritage and ecological significance.
- Minimal citizen engagement beyond sanitation campaigns, leaving broader participation and stewardship opportunities untapped.

#### Proposed Intervention:

- Installation of Interpretive Boards:** Approximately 20–25 multilingual boards shall be placed at strategic public locations, including ghats, bridges, parks, bus stand approach roads, temple riverfronts, the Gaula Barrage and railway bridge crossings.
- Visual Storytelling:** Each board shall integrate visual storytelling elements such as folklore, biodiversity, river history, enabled with QR codes that shall be linked to digital content like heritage stories, conservation tips, citizen pledges platforms, etc. The content material shall be refreshed annually to maintain relevance and encourage repeat engagement.
- Participation Tracking:** QR code analytics will be monitored by HMC to assess levels of citizen interaction and participation.

- **Community Engagement:** Local schools, Resident Welfare Associations (RWAs), and NGOs shall be actively involved in developing content, fostering community ownership and sustained engagement.

#### Implementation Framework:



#### 6.9.2 Intervention 14: Distribution of Biodegradable Offering Kits

Ritual practices along the Gaula River, such as flower offering during Gaula Aarti & Puja as well as immersion of ashes following cremation, contributes notably to the degradation of water quality, especially during lean period. In addition to this, ritual activities often involve the use of plastic-based materials, synthetic fabrics and non-biodegradable packaging, which accumulate along the riverbanks. Seasonal peaks during festivals intensify the inflow of such materials, creating visible waste deposits and pollution.

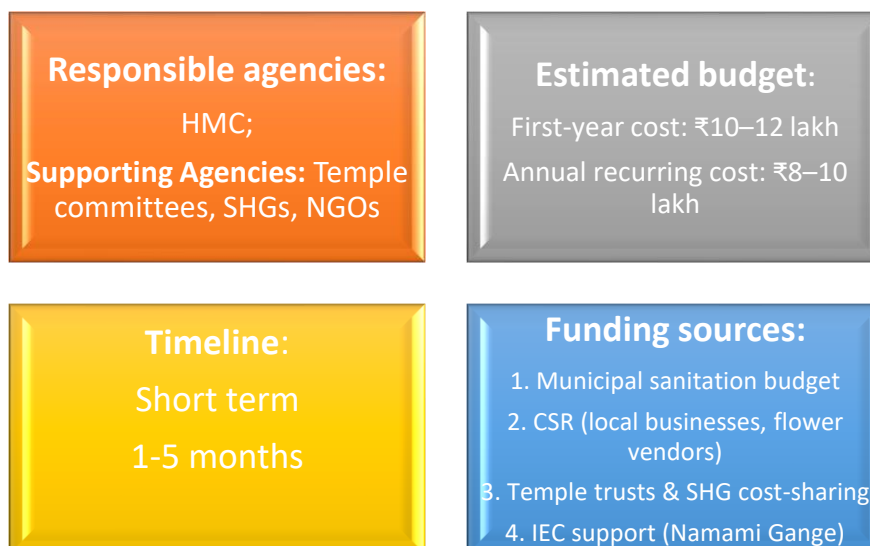
#### Proposed Intervention:

- **Biodegradable Ritual Kits:** Introduce kits comprising dried flowers, tulsi leaves, and compostable containers as sustainable alternatives to plastic-based offerings.
- **Distribution Channels:** Ensure availability through temples, Self-Help Group (SHG) kiosks, municipal counters, cremation ghats and in major festival congregation points such as the Uttarayani Mela grounds and Chhath Puja sites.
- **IEC Activities:** Promote ecological values embedded in religious practices through targeted Information, Education, and Communication (IEC) campaigns, with slogans prominently displayed at distribution points.
- **Awareness and Advocacy:** Conduct awareness drives in collaboration with priests and temple committees to encourage adoption among devotees.
- **Community Participation:** Train SHGs to prepare and package kits, thereby fostering livelihood opportunities and strengthening community ownership.



- **Monitoring and Evaluation:** Municipal staff will monitor kit usage during festivals to assess reductions in plastic waste and track behavioral change.

#### Implementation Framework:



#### 6.9.3 Intervention 15: Promotion of Electric Crematoriums

The Haldwani–Kathgodam Municipal area currently operates one crematorium Rani Bagh located within the planning area. The crematorium is located on the river bank. This facility is equipped with electric cremation units. However, due to prevailing religious beliefs and long-standing traditions, majority of the local community continues to prefer traditional wood-based cremations conducted along the riverbank.

Post-cremation remains such as ashes, flowers and ritual offerings are routinely deposited into the river, contributing to water pollution. Despite the availability of electric cremation facilities, citizens remain largely unaware of the subsidies offered and the ecological benefits associated with their use.

#### Proposed Intervention:

- Promote electric crematoriums as sustainable alternatives to traditional wood-based practices, emphasizing their ecological and health benefits.
- Establish formal MoUs with religious boards and cremation committees to secure institutional support and foster wider community acceptance.
- Organize quarterly workshops with priests, elders, and funeral service providers to build awareness and dialogue around environmental and public health impacts.
- Implement targeted IEC campaigns using posters, short videos, and testimonials from families who have adopted electric cremation, to normalize and humanize the practice.
- Conduct awareness drives to disseminate clear information on available subsidies, municipal support schemes, and long-term cost savings.
- Recognize and empower community leaders as “Eco-Cremation Champions” to serve as trusted advocates and role models for sustainable practices.

#### Implementation Framework:

### Responsible agencies:

HMC;

### Supporting Agencies:

Religious Boards, SHGs, NGOs

### Estimated budget:

First-year cost: ₹25–30 lakh

Annual recurring cost: ₹12–15 lakh

### Timeline:

Mid term

5-7 Years

### Funding sources:

1. SBM(U) and NMCG subsidies
2. CSR funds from local industries/businesses
3. Funding from religious boards & funeral trusts

#### 6.9.4 Intervention 16: Short Videos and Jingles on Segregation and Composting of Solid Waste

Refer Intervention \_\_\_\_ on solid waste management. It was observed that resident/local community were disposing their garbage onto the kalsiya Nallah and Devkhdi Nallah near walkway mall.

Further, the IEC activities are limited to audio broadcasts, with no use of digital or social media platforms. At present, there is an absence of sensitization of school children and awareness among youth and homemakers continues to be low, leaving these audiences untapped.

#### Proposed Intervention:

- Develop bi-monthly short videos (2–3 minutes) and jingles (30 seconds) in Hindi and Kumaoni.
- The content shall focus on segregation & composting of solid waste and river-sensitive practices, tailored for youth and homemakers.
- Utilize diverse dissemination channels including WhatsApp groups managed by the Nagar Nigam, radio channels, school assemblies, SHG centers, and municipal service counters
- Encourage participatory content creation by Youth clubs and schools promoting river-themed videos.
- Airtime slots and digital forwards will be tracked to measure audience reach and engagement.
- Institutionalize annual competitions to recognize impactful citizen-created jingles and videos, integrating winning entries into official IEC campaigns

#### Implementation Framework:



#### Responsible agencies:

Haldwani Kathgodam Nagar Nigam IEC cell;

**Supporting Agencies:** Schools, SHGs, NGOs, FM radio

#### Estimated budget:

First-year cost: ₹8–10 lakh

Annual recurring cost: ₹6–8 lakh

#### Timeline:

Short term

1-5 Years

#### Funding sources:

1. Municipal IEC budget allocation under SBM(U)
2. CSR funds telecom/ All India Radio partners & educational institutions

### 6.9.5 Intervention 17: Annual Celebration of “Gaula Utsav”

Festivals such as Uttarayani Mela and Chhath Puja nurture deep emotional and cultural ties with rivers, underscoring their central role in community life. However, Haldwani lacks a dedicated ‘River Day’ or localized celebration that could institutionalize this connection, promote ecological stewardship, and provide a platform for sustained citizen engagement. At present, there is no institutionalized cultural anchor for river awareness. River is absent from the mainstream cultural identity and the integration of schools & RWAs is limited in river-centric IEC efforts.

#### Proposed Intervention:

| Interventions                                                                                                                                                                                                                                                                     | Implementation Roadmap |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| <ul style="list-style-type: none"> <li>Organizing “Gaula Utsav” aligned with Uttarayani Mela (Jan–Feb) to institutionalize cultural pride around the river</li> </ul>                                                                                                             | 1 Year                 |
| <ul style="list-style-type: none"> <li>Launching of activities such as river walks, folk performances, eco-art exhibitions, school competitions and IEC booths to.</li> </ul>                                                                                                     |                        |
| <ul style="list-style-type: none"> <li>Showcasing river-themed initiatives by schools, SHGs, RWAs and NGOs.</li> <li>Initiate annual documentation of the festival will be shared with schools and community groups to sustain visibility.</li> </ul>                             |                        |
| <ul style="list-style-type: none"> <li>Expansion of participation by formalizing partnerships with schools, RWAs, SHGs and NGOs.</li> </ul>                                                                                                                                       | 2-3 Years              |
| <ul style="list-style-type: none"> <li>Institutionalization of annual competitions for citizen-created jingles, videos, and art, integrating winners into IEC campaigns.</li> </ul>                                                                                               |                        |
| <ul style="list-style-type: none"> <li>Introduce youth-led storytelling and digital campaigns to foster peer-to-peer awareness.</li> </ul>                                                                                                                                        |                        |
| <ul style="list-style-type: none"> <li>Establish monitoring mechanisms to track reach, participation and ecological pledges.</li> </ul>                                                                                                                                           | 4-5 Years              |
| <ul style="list-style-type: none"> <li>Formalize ‘River Day’ as an annual municipal event, embedded in Haldwani’s cultural calendar.</li> </ul>                                                                                                                                   |                        |
| <ul style="list-style-type: none"> <li>Scale up venues to include municipal parks and riverfront spaces for exhibitions and performances.</li> </ul>                                                                                                                              |                        |
| <ul style="list-style-type: none"> <li>Position Gaula Utsav as a <b>regional cultural anchor</b>, attracting visitors and reinforcing river identity.</li> <li>Publish annual impact reports documenting participation, ecological outcomes, and cultural integration.</li> </ul> |                        |

| Interventions                                                                                                                                                        | Implementation Roadmap |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| <ul style="list-style-type: none"> <li>Recognize schools, RWAs, and community leaders as “<b>River Guardians</b>”, sustaining visibility and stewardship.</li> </ul> |                        |

#### Implementation Framework:





## 6.10 Intervention to engage citizens in river management activities

Objective 10 focuses on active citizen participation and structured stewardship of the river. Through River Sabha Committees, creative competitions, street plays and clean-up drives, these interventions institutionalize community involvement, empower youth & residents and ensure accountability in river governance. Together, they transform citizens into custodians of river health and resilience. The detailed interventions are outlined in the following sections.



Figure 6-8: Citizen participation in river management

### 6.10.1 Intervention 18: Formation of River Sabha Committees at City-Level

Community participation in river governance is fragmented, with limited institutional platforms for collective decision-making. Existing RWAs and SHGs lack structured roles in river monitoring, resulting in weak citizen engagement. The baseline assessment highlights the following key concerns:

- No formalized citizen-led body for river stewardship exists to coordinate community efforts or provide continuity in monitoring.
- Weak accountability and transparency in reporting violations such as dumping of solid waste in Nallahs and rivers.
- Sporadic and unrecognized youth participation.

#### Proposed Intervention:

- Establish democratically selected River Sabha Committees at city and ward levels with defined roles and responsibilities.
- The committee shall comprise of SHGs, youth leaders, RWAs and ward officials to ensure diverse representation.
- Committees shall integrate reporting into SBM/URMP dashboards for transparency and accountability.

- Volunteers shall be trained as “Gaula Guardians” to conduct awareness drives, monitor violations and report issues.
- NSS/NCC units shall be mobilized for monthly riverbank clean-up campaigns, coordinated through the committees.
- Committees shall hold quarterly meetings to review progress, share updates with municipal authorities and recommend corrective actions.

#### Implementation Framework:



#### 6.10.2 Intervention 19: Competitions (Poster Making, Debates) on Waste-Free Rivers

Schools and colleges conduct sporadic eco-competitions, but river-specific themes are absent. Students lack structured platforms to express creative ideas on river health. The baseline assessment highlights the following key concerns:

- Limited institutionalization of river-centric competitions.
- Winning entries not showcased to wider audiences.
- Weak linkage between education and IEC campaigns.

#### Proposed Intervention:

- Conduct quarterly competitions (poster-making, debates, essay writing) on themes such as “Waste-Free Gaula” and “River is Life.”
- Institutionalize competitions through Education Department circulars to ensure participation across schools and colleges.
- Winning entries will be displayed at Gaula Utsav, municipal parks and public spaces to maximize visibility.
- Teachers and RWAs will be engaged as mentors to guide students in preparing entries.
- Annual compilation of best entries will be published as a booklet or digital showcase for wider dissemination.

#### Implementation Framework:

**Responsible agencies:**

Education Department;

**Supporting Agencies:** Schools, Colleges and NGOs

**Estimated budget:**

Annual cost: ₹5–7 lakh

**Timeline:**

Short term

1-2 years

**Funding sources:**

Education Department, Municipal IEC Budget, CSR contributions from schools and coaching institutes and NGO.

### 6.10.3 Intervention 20: Street Plays (Nukkad Natak) by RWAs & local community

Street plays are a popular medium in Haldwani markets and temple areas, but river issues are rarely dramatized. The baseline assessment highlights the following key concerns:

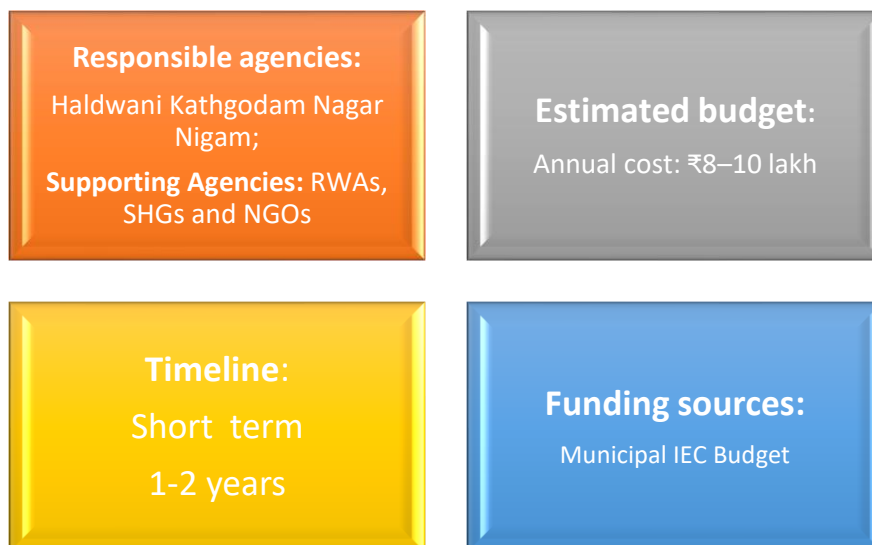
- IEC campaigns rely heavily on posters and rallies, with limited cultural resonance.
- Lack of trained community performers for river-centric themes.

**Proposed Intervention:**

- Train SHGs and RWAs to perform monthly Nukkad Nataks in dense settlements, markets and temple areas.
- Scripts will highlight river pollution, waste segregation and eco-spiritual values.
- Performances will be rotated across different wards to maximize reach.
- Plays will be aligned with festivals and market days for greater visibility.
- Municipal IEC cell will provide logistical support such as costumes, sound systems and publicity.
- Annual recognition will be given to the most impactful community performers to sustain motivation.



#### Implementation Framework:



#### 6.10.4 Intervention 21: Engage Local Residents in River Clean-Up Drives

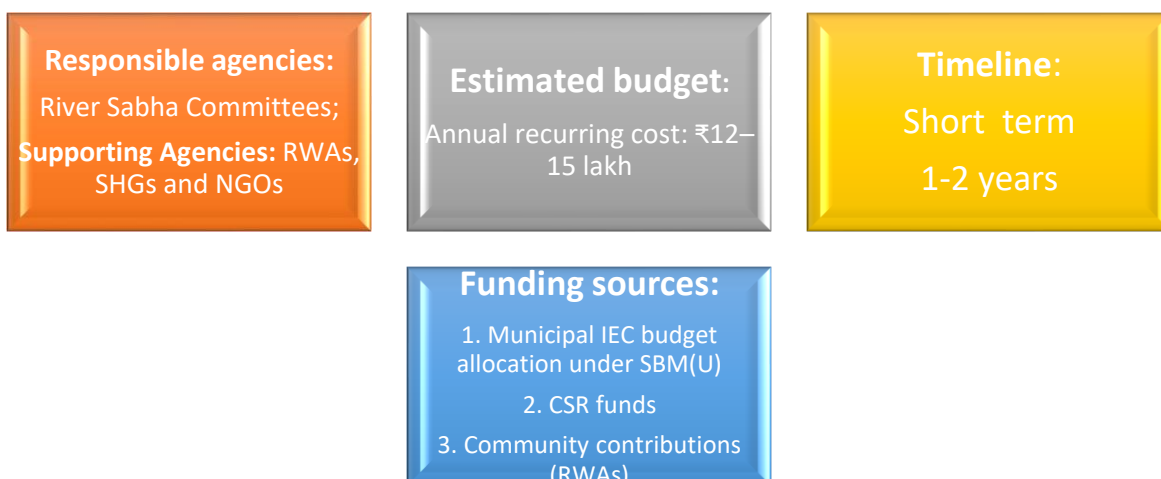
Riverbank clean-up interventions were not undertaken, limiting opportunities for community involvement. The baseline assessment highlights the following key concerns:

- Lack of regularity and institutional recognition.
- Poor integration with municipal reporting systems.
- Limited visibility of citizen contributions.

#### Proposed Intervention:

- Conduct monthly clean-up drives led by River Sabha Committees, SHG and youth clubs.
- Activities will be reported through the SBM Swachhta App for visibility and accountability.
- Participants will be recognized through eco-leadership badges and certificates.
- RWAs and schools will be encouraged to adopt specific stretches of the riverbank for sustained engagement.
- Clean-up drives will be showcased during Gaura Utsav to highlight citizen contributions.
- Municipal staff will ensure collected waste is properly segregated and disposed of through official channels.

#### Implementation Framework:



### Intervention 1: Recommendations under both objective 9 and objective 10

The IEC activities proposed under Objectives 9 and 10 are intended to complement the Urban River Management Plan by fostering river-sensitive behavior and strengthening citizen participation. While not core engineering interventions, they function as supportive measures within the Swachh Bharat Mission (SBM) framework, addressing recurring urban challenges along streams and corridors. By integrating awareness campaigns, community engagement, school and youth programmes and technology-enabled outreach, these activities reinforce the behavioral change and participatory mechanisms outlined in the URMP, ensuring that sensitization remains continuous, structured and impactful.

### IEC Activities for Solid Waste Management (as per SBM Guidelines)

#### 1. Awareness Campaigns

- Door-to-door IEC on segregation of waste at source (wet/dry/hazardous), supported by SBM-branded posters and wall paintings near railway stations, markets and schools.
- Street plays (nukkad natak) in dense settlements such as Rajpura Basti.

#### 2. Community Engagement

- Formation of ward-level Swachhta Committees with structured reporting formats to monitor segregation compliance and outreach.
- SHG-led awareness drives targeting women and youth groups.
- Incentive schemes for households practicing segregation.

#### 3. School & Youth Programs

- Institutionalization of eco-club activities on ‘No Plastic’ campaigns, with quarterly monitoring indicators.
- Competitions (poster making, debates) on waste-free rivers.
- Student volunteer initiatives for monitoring litter hotspots.

#### 4. Technology & Media

- Moderated WhatsApp groups for ward-level waste alerts, complemented by FM campaigns under the brand Swachh Gaula, Swachh Haldwani.
- Short videos and jingles promoting segregation and composting.



## Annexure 1: Technical Specifications for the Gabion Structure (as per IS 14262:1995, IS 16014:2012, IRC: P:116-2018)

### 1. Gabion Boxes

- **Dimensions:** 2.0 m × 1.0 m × 1.0 m
- **Material:** Double-twisted hexagonal wire mesh, PVC/zinc coated, 4 mm dia (IS 14262:1995)

### 2. Fill Material

- **Angular stones**, size range **100–250 mm**
- **Source:** Locally available rockfill (IS 16014:2012)

### 3. Gabion Aprons

- **Thickness:** 0.23–0.30 m
- **Width:** 6–8 m (equivalent to 1.5–2 × expected scour depth, per IRC:SP:116-2018)

### 4. Wall Height

- **2–3 tiers** of gabion boxes
- Total structural height: **2–3 m**

### 5. Foundation Depth

- Minimum embedment: **1.0 m below bed level** (IRC:SP:116-2018)

### 6. Alignment and Extent

- Continuous gabion structure stretches: **3.79 km** along the **western riverbank**
- Alignment: **Critical upstream section**, designed in accordance with floodplain zoning and river training guidelines

## Annexure 2 : Technical Specifications

### Option 2: Technical Specifications for Gabion check dam (as per IS 14262:1995, IS 16014:2012, IRC:SP:116-2018)

- **Structure height:** 1.5–2.0 m; **crest width:** 3–4 m (IRC:SP:116-2018, Guidelines for River Training Works).
- **Gabion boxes:** 2.0 m × 1.0 m × 1.0 m, double-twisted hexagonal wire mesh, PVC/zinc coated, 4 mm dia (IS 14262:1995 – Gabion Wire Mesh).
- **Fill material:** Angular stones 100–250 mm, locally sourced (IS 16014:2012 – Rockfill).
- **Foundation depth:** Minimum 1.0 m embedment below bed level (IRC: SP:116-2018).
- **Spacing:** Single structure at critical upstream point, aligned with 25-year flood line (NDMA Guidelines on Floodplain Zoning, 2008).

### Option 3: Technical Specifications for Flexible Rockfall Barrier - Catch Fence (as per IRC: SP:123-2017, BIS IS 16014:2012)

- **Barrier length:** 160 m, installed along slope upstream of bridge crossing.
- **Material:** Galvanized steel wire rope mesh, 6–8 mm dia, corrosion-resistant (IS 16014:2012 – Steel Wire Rope).
- **Anchoring:** Rock bolts/grouted anchors, spacing 2–3 m, tested as per IRC: SP:123-2017 (Guidelines for Rockfall Protection).
- **Energy absorption capacity:** Designed for 500–1000 kJ impact (IRC: SP:123-2017).
- **Height of barrier:** 3–4 m, depending on slope profile.

### Annexure 3: Calculations for controlled disposal of septage in the collection tank of 28 MLD STP

- Feasibility Check for disposal of Septage in Existing STP.
- In order to dispose septage in existing STP, the following conditions were evaluated as a pre-feasibility assessment: -
  1. Current Utilization of the volumetric capacity of the STP
  2. Current Utilization of the loading capacity with respect to BOD, COD and TSS.
  3. Volume of septage feasible for direct disposal."

**Table 1 Influent Sewage Characteristics at 28 MLD STP**

| Parameters | Average Influent Concentration (mg/l) | Designed Concentration (mg/l) |
|------------|---------------------------------------|-------------------------------|
| BOD        | 209                                   | 230                           |
| COD        | 518                                   | 450                           |
| TSS        | 176                                   | 400                           |

**Table 2 Faecal sludge and septage characteristic collected in the city**

| Parameters | Average Concentration (mg/l) |
|------------|------------------------------|
| BOD        | 18372                        |
| COD        | 30370                        |
| TSS        | 28308                        |

Source: DPR co Treatment Plant Haldwani

- **2.Load Utilization**
- Using the data provided in table 1, the design load was calculated

**Table 3 Design load of the STP**

| Parameters | Design Capacity (MLD) | Design Concentration (mg/l) | Design load (kg/d) |
|------------|-----------------------|-----------------------------|--------------------|
| BOD        | 28                    | 230                         | 6440               |
| COD        |                       | 450                         | 12600              |
| TSS        |                       | 400                         | 11200              |

**Table 4 Load Utilization of the STP**

| Parameters | Design Capacity (MLD) | Influent Concentration (mg/l) | Load Utilization (kg/d) |
|------------|-----------------------|-------------------------------|-------------------------|
| BOD        | 9.3                   | 87                            | 809                     |
| COD        |                       | 184                           | 1711                    |
| TSS        |                       | 123                           | 1144                    |

**Table 5 Load Utilization (%) of STP**

| Parameters | Design Capacity (MLD) | Load Utilization (kg/d) | Load Utilization (%) |
|------------|-----------------------|-------------------------|----------------------|
| BOD        | 6440                  | 809                     | 12.56%               |
| COD        | 12600                 | 1711                    | 13.58%               |
| TSS        | 11200                 | 1144                    | 10.21%               |

**Table 6 Unutilized load of the STP**

| Parameters | Design load (kg/d) | Load Utilization (kg/d) | Unutilized load (kg/d) |
|------------|--------------------|-------------------------|------------------------|
| BOD        | 6440               | 809                     | 5631                   |
| COD        | 12600              | 1711                    | 10889                  |



| Table 3 Design load of the STP                                 |                        |                                 |                         |
|----------------------------------------------------------------|------------------------|---------------------------------|-------------------------|
| TSS                                                            | 11200                  | 1144                            | 10056                   |
| Table 7 faecal sludge and septage handling capacity of the STP |                        |                                 |                         |
| Parameters                                                     | Unutilized load (kg/d) | Concentration of Septage (mg/l) | Handling Capacity (KLD) |
| BOD                                                            | 5631                   | 18372                           | 306                     |
| COD                                                            | 10889                  | 30370                           | 359                     |
| TSS                                                            | 10056                  | 28308                           | 355                     |

- We must choose the least of the Handling Capacity, as If we choose COD as the constraining parameter, it might handle COD parameter up to 359 KLD but will surely introduce more BOD and TSS along with it. Therefore, BOD is considered as contracting parameter.

| Table 8 Design and Actual flow rate at the STP |                              |  |  |  |
|------------------------------------------------|------------------------------|--|--|--|
| Parameter                                      | Quantity (m <sup>3</sup> /h) |  |  |  |
| Design flow rate                               | 1167                         |  |  |  |
| Actual flow rate                               | 388                          |  |  |  |

| Table 9 Organic and solids loading rate at STP |                     |        |                           |        |
|------------------------------------------------|---------------------|--------|---------------------------|--------|
| Parameter                                      | Flow Rate (m3/h)    |        | Concentration (mg/l)      |        |
|                                                | Design              | Actual | Design                    | Actual |
| BOD                                            | 1167                | 388    | 230                       | 209    |
| COD                                            |                     |        | 450                       | 518    |
| TSS                                            |                     |        | 400                       | 176    |
|                                                |                     |        |                           |        |
| Parameter                                      | Loading Rate (kg/h) |        | Unutilized loading (kg/h) |        |
|                                                | Design              | Actual |                           |        |
| BOD                                            | 268                 | 34     | 234                       |        |
| COD                                            | 525                 | 71     | 454                       |        |
| TSS                                            | 467                 | 48     | 419                       |        |

| Table 10 Faecal Sludge and Septage Load |                      |                     |                   |  |
|-----------------------------------------|----------------------|---------------------|-------------------|--|
| Parameter                               | Concentration (mg/l) | Truck Capacity (KL) | Truck Load (kg/h) |  |
| BOD                                     | 18372                | 4                   | 73                |  |
| COD                                     | 30370                | 4                   | 121               |  |
| TSS                                     | 28308                | 4                   | 113               |  |

|                       |     |        |
|-----------------------|-----|--------|
| Per day decanting     | 38  | Trucks |
| 1 truck load at every | 0.6 | hours  |

- If direct addition of FSS is to be done in the receiving well sump, then feasible load that can be added is 1 truckload in 0.6 hours with BOD as the constraining parameter. An arrangement of removing silt before direct disposal to inlet tank is recommended.

## Annexure 4: Draft Scope of Work for Faecal Sludge and Septage Management (FSSM)

### Scope of Work for Faecal Sludge and Septage Management (FSSM) study for Haldwani-Kathgodam Planning Area

**Objective:** To undertake Sanitation Value Chain Assessment and evaluate the adequacy of ongoing sanitation infrastructure projects in the Haldwani-Kathgodam Planning Area and formulate a supplementary plan to bridge the gap between committed capacity and projected future demand.

#### Scope of works:

#### 1. Sanitation Value Chain Assessment (The "As-Is" Analysis)

- **A. Containment (The Capture):**
  - Structural Audit: Survey a representative sample (5-10%) to determine the percentage of "Properly Built Septic Tanks" vs. "Single Pits" vs. "Direct Discharge to Nala."
  - Terrain-Specific Checks: Specifically, for Kathgodam (Rocky/Hilly terrain), assess if soak pits are failing due to low soil permeability or high-water table, leading to groundwater contamination.
- **B. Emptying (The Service):**
  - Accessibility Mapping: GIS mapping of road widths to quantify households that are "Inaccessible" to standard 3000L vacuum trucks (often a major issue in older unplanned colonies).
  - Mechanization Index: Determine the ratio of mechanical emptying (vacuum trucks) vs. manual emptying.
- **C. Transport (The Logistics):**
  - Illegal Dumping Surveillance: Identify "Hotspots" where private operators dump sludge illegally (e.g., banks of the Gaula River or forest edges) to save fuel.
  - Travel Time Analysis: Measure the turnaround time from the furthest peripheral ward to the designated disposal site to determine if "Transfer Stations" are needed.
- **D. Treatment & Disposal (The Endgame):**
  - Effluent Quality: Test the final output of current disposal methods (if any) against NGT/CPCB discharge standards.
  - Reuse Potential: Specific assessment of the local market for treated biosolids (co-compost) in the nearby Terai agricultural belt.

#### 2. Review of Ongoing Initiatives (Infrastructure Audit)

- **Review of Active Tenders & Contracts:**

- Analyze the Detailed Project Reports (DPRs) of ongoing sewerage/STP works (specifically UUSDA/ADB Package-2 or Package-3) to determine the committed Faecal Sludge Co-treatment capacity.
- Key Check: Specific design parameters of the "Septage Receiving Stations" in currently under-construction STPs (e.g., screening mechanism, holding tank volume).
- **Technology Compatibility Check:**
  - Assess if the ongoing STP technology (e.g., SBR/MBBR) is chemically and biologically compatible with the projected characteristics of septage from the un-sewered peripheral wards.
- **Timeline Synchronization:**
  - Map the "Commissioning Timeline" of ongoing plants against the immediate sludge disposal needs of the city to identify interim bottlenecks.

### 3. Demand Forecasting & Gap Analysis

- Future Generation Scenarios (Horizon Years: 2030, 2040, 2055): Forecast population growth for the Core City vs. Peri-urban outgrowth (Kathgodam/Bhotia Parao areas).
- Estimate the "Shift Factor": Assess of the number of households likely to move from septic tanks to the sewer network once ongoing sewerage projects are complete.
- Net Residual Septage Load: Calculate the volume of sludge that will *remain* outside the sewer network (the true FSSM demand).
- Determine if the ongoing STP augmentations are sufficient or if a Satellite FSTP (new standalone plant) is required for distant wards.

### 4. Strategic Planning for Future Capacity

- **Scenario A: Augmentation of Ongoing Projects (Retrofitting)**
  - If the gap is small (<10-20 KLD): Propose specific "Retrofits" to the current STP designs (e.g., adding a larger equalization tank or a specialized dewatering unit) before construction is finalized.
- **Scenario B: Decentralized Expansion (New Nodes)**
  - If the gap is large or spatially disconnected: Identify land parcels for Decentralized FSTPs in growth corridors (e.g., towards Lalkuan or Kaladhungi road) to reduce truck travel time.
- **Phasing Plan:**
  - **Phase 1 (Immediate - 0 to 2 Years):** Operationalize co-treatment at existing/upgrading STPs.



- **Phase 2 (Medium Term - 2 to 5 Years):** Commission satellite FSTPs for peri-urban gaps identified in the analysis.
- **Phase 3 (Long Term):** Transition FSSM infrastructure to handle "sewer mining" or specialized industrial sludge if sewerage coverage hits 100%.

## Annexure 5: Draft Scope of Work for Sheetlahat Spring shed Management

Scientific Hydrogeological Assessment and Springshed Management Planning for the Rejuvenation of Sheetlahat Spring, Haldwani

The Sheetlahat Spring, located near the Sheetla Devi Temple (Ranibagh/Kathgodam belt), acts as a critical gravity-fed source for Haldwani city. Historical records indicate a lean season discharge of ~3.5 MLD. However, recent infrastructural developments (NH-109 widening), urbanization, and catchment degradation have severely impacted its flow.

It is recommended that a technical agency or consultancy be hired to scientifically assess and rejuvenate the spring. The following scope of works aligns with the NITI Aayog Framework for Springshed Management and Jal Jeevan Mission (JJM) protocols. The current approach requires shifting from "Source Exploitation" to "Aquifer Recharge". The scope of works is presented below.

### 1. Objectives

- **Delineate the Springshed:** Scientifically identify the "Recharge Area" (Aquifer recharge zone), which may differ from the surface topographic watershed.
- **Diagnostic Analysis:** Establish the precise correlation between recent road construction/land-use changes and flow reduction.
- **Augmentation Strategy:** Design site-specific artificial recharge structures to restore discharge to near-historical levels (Target: >3 MLD).
- **Sustainability Plan:** Establish a community-institutional governance model involving the Temple Trust and Nagar Nigam.

### 2. Detailed Scope of Work

#### Module A: Hydrogeological Investigation (The "Science")

- **Geological Mapping (1:5000 scale):**
  - Map the lithology (rock types) and structural features (faults, fractures, lineaments) of the Ranibagh-Kathgodam hill face.
  - Identify the **dip and strike** of rock beds to understand groundwater flow direction.
- **Aquifer Delineation:**
  - Determine if the spring is a **Fracture Spring, Contact Spring, or Karst Spring**.
  - Conduct an **Isotope Study (Stable Isotopes  $\delta^{18}O$  and  $\delta D$ )** to determine the altitude of the recharge area whether from the immediate hill or higher ridges.
- **Inventory & Monitoring:**
  - Install V-Notch weirs to record discharge fortnightly for one full hydrological cycle (Monsoon, Post-Monsoon, Winter, Summer).
  - Test water quality parameters: pH, TDS, Bacteriological (E. coli), and Nitrate levels (crucial due to nearby settlements).

#### Module B: Catchment Treatment Planning (The "Engineering")

- **Recharge Area Interventions:**
  - Design **Staggered Contour Trenches (SCTs)** and **Percolation Pits** specifically aligned with rock fractures to maximize ingress.
  - Plan **Gabion Check Dams** and **Loose Boulder Structures** for gully plugs in the upper catchment.
- **Spring Head Protection:**
  - Design a sanitary **Spring Box** to prevent surface contamination at the outlet.
  - Propose "Spring Sanctuary" measures (fencing) to prevent cattle grazing near the eye of the spring.

#### Module C: Social & Institutional Framework

- **Stakeholder Analysis:**
  - Map land ownership in the recharge zone (Forest Dept vs. Revenue Land vs. Private/Temple Land).
  - Conflict resolution strategy for land designated for trenches.
- **Formation of Springshed Management Committee (SMC):**
  - Draft bylaws for an SMC comprising representatives from Uttarakhand Jal Sansthan (UJS), Sheetla Devi Temple Trust, and local ward members.

#### Module D: Preparation of Detailed Project Report (DPR)

- Bill of Quantities (BoQ) for all civil and vegetative works.
- Cost-Benefit Analysis comparing the cost of spring revival vs. the cost of pumping equivalent groundwater (electricity costs).
- GIS Maps showing the overlay of the Recharge Zone, proposed structures, and LULC.

Responsible institutions for undertaking the study and implementing the project are presented in the following table.

| Role                 | Recommended Agency                    | Responsibilities                                                               |
|----------------------|---------------------------------------|--------------------------------------------------------------------------------|
| Client (Asset Owner) | Uttarakhand Jal Sansthan (UJS)        | Ownership of the spring, tendering civil works, and maintenance.               |
| Technical Consultant | NIH Roorkee or ACWADAM                | Scientific study, recharge zone mapping, and supervising construction quality. |
| Funding Body         | AMRUT 2.0 (State Mission Directorate) | Releasing funds against milestones (e.g., submission of Hydro-geological Map). |

Alternatively, SARRA (Spring and River Rejuvenation Authority), a State Nodal Agency can act as the "Project Management Unit," for hiring technical agencies like Advanced Centre for Water Resources Development and Management (ACWADAM) and channelling funds from the state budget or external donors (like KfW or World Bank).