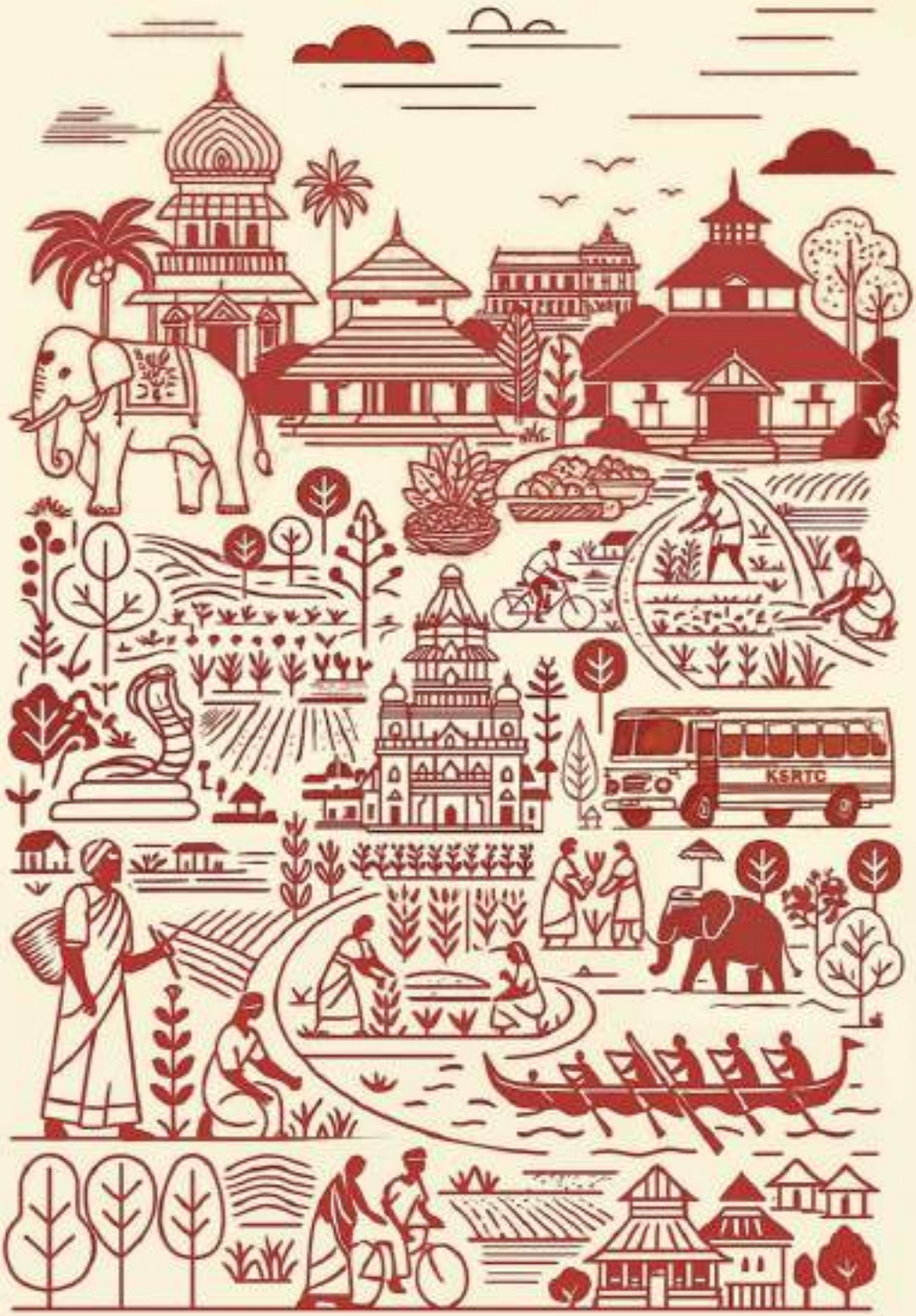
HARIPAD MUNCIPALITY

&

LOCAL SELF GOVERNMENT DEPARTMENT PLANNING, ALAPPUZHA

ഹരിപ്പാട് haripad 2045



MASTER PLAN FOR HARIPAD TOWN -2045 (DRAFT)

MARCH 2026

VOLUME - I

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&
LOCAL SELF GOVERNMENT PLANNING, ALAPPUZHA

FOREWORD

It is with great pride and responsibility that I present the Master Plan for Haripad Town-2045. This document provides a strategic and integrated framework to guide the sustainable, resilient, and inclusive growth of Haripad over the coming decades. In the face of increasing environmental risks, infrastructure demands, and evolving socio-economic needs, a comprehensive and forward-looking Master Plan is both necessary and timely.

Haripad is a town distinguished by its cultural legacy, anchored by the historic Sree Subrahmanya Swamy Temple, and by its strong agrarian and water-based economy shaped by fertile paddy fields, canal networks, fisheries, animal husbandry, and its proximity to the Kayamkulam backwaters. However, recurring floods, waterlogging, inadequate drainage, pressure on agricultural lands, limited recreational spaces, traffic concerns, and gaps in social infrastructure underline the need for structured and risk-sensitive planning.

Prepared as a Risk Informed Master Plan, this framework integrates disaster risk reduction and climate resilience into land use planning and infrastructure development. Flood mitigation, stormwater management, canal rejuvenation, protection of environmentally sensitive areas, and strengthened civic infrastructure form its core priorities - ensuring that future growth enhances safety and long-term sustainability.

The Plan builds upon Haripad's inherent strengths by safeguarding agricultural lands while promoting value addition in agriculture, fisheries, and animal husbandry. It advances heritage tourism and farm tourism, leveraging the town's cultural assets and rural landscapes to generate employment and entrepreneurial opportunities. By supporting trade, small enterprises, and service sectors, it seeks to diversify the local economy and expand livelihood opportunities for our citizens.

Equally central is the enhancement of quality of life. The Master Plan proposes improved public spaces, parks, waterfront development, and community facilities to address the shortage of recreational infrastructure. It prioritizes mobility improvements, upgraded drainage systems, better civic amenities, and strengthened health and educational facilities - delivering tangible benefits in safety, services, and liveability for the people of Haripad.

I extend my heartfelt gratitude to LSGD Planning, all stakeholders, technical experts, elected representatives, and the residents of Haripad whose contributions have shaped this Plan. Let us now work together with unity and commitment to translate this vision into action and build a resilient, prosperous, and heritage-rich Haripad for 2045 and beyond.

Haripad

Date :

Smt. Vrinda S Kumar

Chairperson

Haripad Municipality

PREFACE

The Master Plan for Haripad Town – 2045 has been prepared as a comprehensive and forward-looking framework to guide the planned, resilient, and sustainable development of Haripad over the coming decades. In the context of increasing urban pressures, climate-related vulnerabilities, and evolving economic needs, this Plan provides a structured roadmap to ensure that growth is orderly, environmentally responsible, and responsive to the aspirations of its people.

Haripad's distinct character is shaped by its historic temple heritage, expansive paddy fields, interconnected canal systems, ponds and traditional water bodies, and its strong agrarian base. Agriculture, fisheries, and allied activities such as animal husbandry continue to form the backbone of the local economy. At the same time, the town holds considerable potential for heritage tourism and farm tourism, drawing from its cultural assets, rural landscapes, and water networks. The Master Plan recognizes these strengths and seeks to protect and enhance them through spatial planning, infrastructure support, and value-addition strategies.

The Plan addresses critical concerns such as recurrent flooding, waterlogging, inadequate drainage infrastructure, encroachments affecting natural water channels, pressures on productive agricultural lands, mobility constraints, and the shortage of quality public and recreational spaces. A key feature of this Master Plan is its emphasis on risk-informed and climate-responsive development. Given Haripad's low-lying terrain and dependence on a delicate water network, disaster risk reduction has been integrated into land use proposals, infrastructure planning, and regulatory frameworks. Conservation and rejuvenation of canals and ponds, strengthening of stormwater drainage systems, and clear development controls are central to enhancing resilience and long-term sustainability.

Simultaneously, the Plan promotes economic diversification through support to agriculture, fisheries, animal husbandry, small enterprises, and tourism-related activities, including farm-based experiences that connect visitors to Haripad's rural and cultural identity. Mobility improvements, upgraded civic infrastructure, and strengthened social amenities further aim to improve the overall quality of life for residents.

The preparation of this Master Plan followed a systematic and evidence-based process involving detailed surveys, data analysis, identification of development constraints and potentials, formulation of a spatial vision, preparation of land use proposals and zoning regulations, and the design of priority projects. Stakeholder consultations and community participation were integral to ensuring that the Plan reflects both statutory requirements and local aspirations.

I place on record my sincere appreciation to Haripad Municipality, particularly to the Chairperson, Smt. Vrinda S Kumar, and the former Chairperson, Shri. K K Ramakrishnan. I would also like to take this opportunity to appreciate the Planning team at the District Office of LSGD Planning, especially former Town Planner Shri. Joseph K F, Smt. Anju W C., Town Planner, along with Deputy Town Planners Smt. Hinduja V L and Smt. Gladis William and former Assistant Town Planner Shri. Vishnu Prasad U. Their collaborative efforts, technical skills, and dedication to their roles have been crucial in the successful completion of this Master Plan.

This undertaking was quite challenging and would not have been feasible without the support of the DLI4 Project Implementation Unit (PIU) of LSGD under the Program for Results of the Rebuild Kerala Initiative, led by nodal officer Shri P N Rajesh, former Additional Chief Town Planner of LSGD Planning. The timely guidance and contributions of Shri Ramachandran A and Shri K Baiju, Consultant Town Planners of the Project Implementation Unit, is also acknowledged with appreciation. I would like to take this moment to commend the officials of the Project Implementation Unit for their proactive approach and committed efforts to complete the task within the stipulated timeframe, particularly Smt. Rini Chandra S and Smt. Rahana H, Town Planners; Smt. Archana V S, Deputy Town Planner; Smt. Indugeetha B, Planner Associate; Smt. Poornima Rajan, Geospatial Analyst and Shri Nikhil S, Disaster Management Associate of the DLI4 PIU.

Additionally, I acknowledge the team at this office, led by the Senior Town Planner Smt. Deepa V P, Smt. Raji. S S, Town Planner, Deputy Town Planner Smt. Sindhu Rani P V, Former Deputy Town Planner Shri. Kiran Chand Vayyat for their diligent work in reviewing and finalizing this Master Plan. I fondly remember the efforts of former Chief Town Planner (Planning) Smt. Sheeba Rani Y, for their efforts to initialize the plan preparation process and the guidance's offered.

It is my earnest expectation that this Master Plan will serve as a practical and strategic instrument to guide public investment and collective action towards building a resilient, agriculturally vibrant, tourism-oriented, and environmentally sustainable Haripad.

Asha Ajoy Ghosh,
Chief Town Planner (Planning),
Principal Directorate, LSGD.

Place: Thiruvananthapuram
Date:

ACKNOWLEDGEMENT

The journey to create the Master Plan for Haripad municipality started as a delightful collaboration between Haripad Municipality and the district office of the Local Self Government Department Planning. This Master Plan provides a cohesive strategy aimed at directing future development, transportation, tourism, heritage, agriculture, animal husbandry and public utility investments over the next two decades, ensuring that our town remains safe, appealing, and a lasting source of pride.

I would like to express my sincere gratitude for the invaluable guidance and participation of Municipal Chairperson Smt. Vrinda S Kumar as well as former Municipal Chairman Shri. K K Ramakrishnan, during the preparation of this Master Plan. The contributions of the former councillors are fondly remembered with gratitude for their cooperation, invaluable support, time and active involvement in various stages of the Master Plan preparation process, without which the preparation of the plan may not have been possible. The efforts of the acting council and the continued support from the council members during the finalisation of this plan is remembered with gratitude. The Master Plan committee, formed for this task, co-ordinated all the activities and their guidance was crucial in aligning the plan with community needs, and I am grateful for their technical expertise, invaluable insights and dedication in steering this plan towards completion.

The plan has been created through a participatory and collaborative approach, involving numerous consultations with stakeholders at every stage. I wish to extend my deepest gratitude to the residents, various Focus Groups, Stakeholders and to everyone who attended various meetings and seminars for investing their invaluable time and shared their insights, comments, recommendations and vision with us. The inputs received from them was instrumental in identifying the key challenges and shaping the goals. This plan belongs to the residents of the town and its success is a testament to their active involvement in the Master Plan preparation process.

I extend my sincere gratitude to KILA, CEREMA, AFD (Agence Francaise de Development) and KFW Development Bank who are partners to World Bank supported Rebuild Kerala Development Programme launched to make Kerala resilient to future disasters. I remember the visionary leadership of the District Collector and extend my heartfelt gratitude to their proactive approach and unwavering support that was instrumental in organizing the stakeholder consultations and providing necessary resources to bring this plan to fruition. I also thank the various department heads for their technical support and guidance in formulating this plan in a time bound manner. The diverse perspectives received from Stakeholder Consultations and Focus Group Discussions were crucial in developing and finalising this plan. The dedicated efforts of the Municipal Secretary deserve special recognition. Special appreciation is due to the Municipal Engineer and technical staffs whose expertise was instrumental in shaping the vision for this plan.

I am deeply indebted to the students of Govt ITI, SCDD Haripad and Govt ITI, Pallipad who were actively involved in the verification of existing land use, conducting socio – economic and Flood Prone Area survey for the town under the on-job training programme. I appreciate the professionalism and diligence shown by them during the survey and their dedication and meticulous hard work helped us in completing the process in a time bound manner.

I express my sincere gratitude for the guidance and support provided by Smt. Asha Ajoy Ghosh, Chief Town Planner (Planning), and the assistance and technical support from the Office of the Chief Town Planner (Planning). I also extend my gratitude to all departmental personnel who contributed their invaluable assistance; without their help, the compilation of this essential document would have been challenging to achieve.

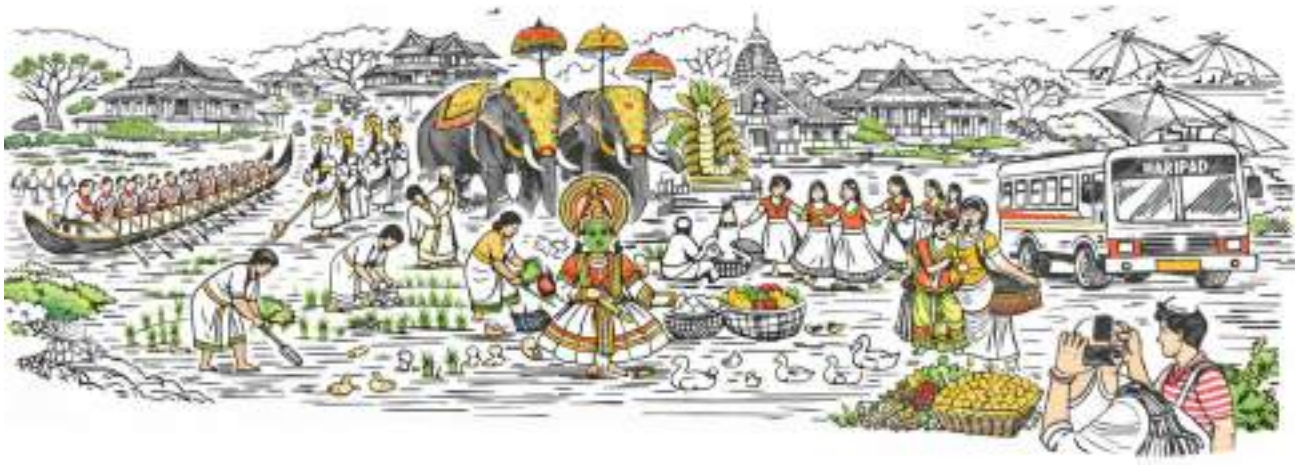
The Master Plan for Haripad has been developed by assessing the town's hazard profile, examining the risk factors, and incorporating flood-prone areas into the land use plan to mitigate the impacts of flood hazards. This undertaking was quite challenging and would not have been feasible without the support of the DLI4 Project Implementation Unit (PIU) of LSGD under the Program for Results of the Rebuild Kerala Initiative, led by nodal officer Shri P N Rajesh, former Additional Chief Town Planner of LSGD Planning. The timely guidance and contributions of Shri Ramachandran A and Shri K Baiju, Consultant Town Planners of the Project Implementation Unit, is also acknowledged with appreciation. I would like to take this moment to commend the officials of the Project Implementation Unit for their proactive approach and committed efforts to complete the task within the stipulated timeframe, particularly Smt. Rini Chandra S and Smt. Rahana H, Town Planners; Smt. Archana V S, Deputy Town Planner; Smt. Indugeetha B, Planner Associate; Smt. Poornima Rajan, Geospatial Analyst and Shri Nikhil S, Disaster Management Associate of the DLI4 PIU.

The preparation of the Master Plan represents the culmination of several months of dedicated efforts by the Planning team members. I would like to express my sincere gratitude for the hard work and commitment demonstrated by the planning team at the district office of LSGD Planning which includes Deputy Town Planners Smt. Hinduja V L and Smt. Gladis William; Assistant Town Planner Smt. Remya V; former Assistant Town Planner Shri. Vishnu Prasad U; First Grade Overseers Smt. Ansa Latheef, Shri. Saifudeen and Shri Ansar M, Consultant Town Planner Smt. Jayasree V K; Planner Associates Shri. R. Sairam, Smt. Harsha H, Miss Sandra S, Miss Veena R S, Smt. Geethika Susan Jacob, Miss Akshara Sundaresan and Smt. Archa R Raj; GIS Assistants Smt. Anju C B and Miss Namitha Vimal Raj; Surveyor Shri. Adarsh S, Smt. Priya I, Smt. Athira Das for completing all tasks in a timely and organized manner, resulting in the draft plan being produced within the designated timeframe. I am also grateful to the statistical team of this office, as well as all other members from both the technical and non-technical sections, for their co-operation and prompt actions. The contributions of former Town Planners Shri. Joseph K F and Smt. Oormila Raj U is also fondly remembered.

All personnel in this office made significant contributions at different phases of the study; without their input, this work would not have been finalized in its current format and within the designated timeline. I genuinely appreciate their dedicated efforts.

Anju W C,
Town Planner,
Alappuzha

Haripad
Date :



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MASTER PLAN FOR HARIPAD TOWN - 2045

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ABBREVIATIONS

ABC Centre	Animal Birth Control Centre
ADSs	Area Development Societies
AFD	Agence Française de Développement
AFPCNT, France	Association Française pour la Prévention des Catastrophes Naturelles et Technologiques
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
AYUSH	Ayurveda, Yoga and Naturopathy, Unani, Siddha, and Homeopathy
BDL	Below Detection Limit
BHSS	Boys Higher Secondary School
BIS	Bureau of Indian Standards
BOD	Biochemical Oxygen Demand
BOT	Build-Operate-Transfer
BPCL	Bharat Petroleum Corporation Limited
BPL	Below Poverty Line
BPO	Business Process Outsourcing
CBs	Catch Basins
CDSs	Community Development Societies
CEREMA	Centre for Studies and Expertise on Risks, the Environment, Mobility and Urban Planning
CFCs	Common Facility Centres
CNG	Compressed Natural Gas
CPHEEO	Central Public Health & Environmental Engineering Organisation
CRF	Central Road Fund
CSI	Crash Severity Index
CSR	Corporate Social Responsibility
CWRDM	Centre for Water Resources Development and Management
dB	Decibel
DDMA	District Disaster Management Authority
DLI4	Disbursement Linked Indicator 4
DMO	District Medical Officer
DoECC	Directorate of Environment and Climate Change
DPC	District Planning Committee
DPR	Detailed Project Report
DRR	Disaster Risk Reduction
DTPC	District Tourism Promotion Council
DUR	District Urbanization Report
ECS	Equivalent Car Space
ENT	Ear, Nose, and Throat
ERTs	Emergency Response Teams
EV	Electric Vehicle
EWDS	Early Warning Dissemination System
EWS	Economically Weaker Sections

FC	Faecal Coliform
FGDs	Focus Group Discussions
FFDA	Fish Farmers Development Agency
FPA	Flood Prone Area
FSTP	Faecal Sludge Treatment Plant
GDP	Gross Domestic Product
GIS	Geographic Information System
GL	Ground Level
HQ	Headquarters
HDFC Bank	Housing Development Finance Corporation Bank
IAG	Inter Agency Group
ICDS	Integrated Child Development Services
ICICI Bank	Industrial Credit and Investment Corporation of India Bank
ICT	Information and Communication Technology
ID	Identity Document
IDF	Intensity–Duration–Frequency
IAG	International Airlines Group
IL	Invert Level
IMD	India Meteorological Department
IoT	Internet of Things
IPCC	Intergovernmental Panel on Climate Change
IPT	Intermediate Public Transport
IRC	Indian Roads Congress
IT	Information Technology
ITI	Industrial Training Institute
ITC	Information Technology Centre
ITS	Intelligent Transportation Systems
IWT	Inland Water Transport
JMK	Janakeeya Matsya Krishi
KILA	Kerala Institute of Local Administration
KITCO	Kerala Industrial and Technical Consultancy Organisation Limited
KPO	Knowledge Process Outsourcing
KSDMA	Kerala State Disaster Management Authority
KSEB	Kerala State Electricity Board
KSRTC	Kerala State Road Transport Corporation
KSSM	Kerala Social Security Mission
KSWMP	Kerala Solid Waste Management Project
KTCP Act	Kerala Town and Country Planning Act
KWA	Kerala Water Authority
KWH	kilowatt-hour
LANDSAT 8 TIR OLI	LANDSAT 8 Thermal InfraRed Operational Land Imager
LANDSAT 9 TIR OLI	LANDSAT 9 Thermal InfraRed Operational Land Imager

LAPCC	Local Action Plan for Climate Change
LCV	Light Commercial Vehicle
LDMP	Local Disaster Management Plan
LIFE	Livelihood, Inclusion and Financial Empowerment
LIG	Low-Income Groups
LiDAR	Light Detection and Ranging
LISS 4	Linear Imaging Self-Scanning Sensor-IV
LPG	Liquefied Petroleum Gas
LSG DM Plan	Local Self Government Disaster Management Plan
LSGD	Local Self Government Department
LSGI	Local Self-Government Institutions
LST	Land surface temperature
LULC	Land Use Land Cover
MAT	Multimodal Accessibility Target
MCF	Material Collection Facilities
MDR	Major District Road
MDMC	Municipal Disaster Management Committee
MLA	Member of the Legislative Assembly
MLD	Million Litres per Day
MoRTH	Ministry of Road Transport and Highways
MSL	Mean Sea Level
MSME	Micro, Small and Medium Enterprises
NATPAC	National Transportation Planning and Research Centre
NDBI	Normalized Difference Built-up Index
NDMA	National Disaster Management Authority
NDVI	Normalized Difference Vegetation Index
NGO	Non-governmental organization
NHAI	National Highways Authority of India
NH	National Highway
NHED	National Health Education and Development
NHGs	Neighbourhood Groups
NIR	Near-Infrared
NMT	Non-Motorised Transport
NOCs	No Objection Certificates
NTPC	National Thermal Power Corporation
NULM	National Urban Livelihoods Mission
NW-3	National Waterway 3
OA	Office Attendant
OD Matrix	Origin-Destination Matrix
OP	Outpatient
PCB	Pollution Control Board
PCU	Passenger Car Units
PH	Potential of Hydrogen

PHC	Primary Health Centre
PIU	Project Implementation Unit
PIP	Pampa Irrigation Project
PM	Particulate Matter
PMAY	Pradhan Mantri Awas Yojana
PMEGP	Prime Minister's Employment Generation Programme
PMMSY	Pradhan Mantri Matsya Sampada Yojana
PPP	Public Private Partnership
PS	Public & Semi-public
PVC	Poly Vinyl Chloride
PWD	Public Works Department
PV² Method	Pedestrian Vehicular Volume Method
RCP	Representative Concentration Pathways
RIMP	Risk-Informed Master Plan
RKDP	Rebuild Kerala Development Program
ROBs	Railway Over Bridges
ROW	Right of Way
RRTs	Rapid Response Teams
RUB	Road Under Bridge
SABLA	Rajiv Gandhi Scheme for Empowerment of Adolescent Girls
SAI	Sports Authority of India
SBI	State Bank of India
SC	Scheduled Caste
SH	State Highway
SHGs	Self Help Groups
SSK	Samagra Shiksha Kerala
ST	Scheduled Tribe
STP	Sewage Treatment Plant
SWIR	Shortwave Infrared
SWOT Analysis	Strengths, Weaknesses, Opportunities, and Threats Analysis
TDS	Total Dissolved Solids
TC	Total Coliforms
TCPO	Town and Country Planning Organisation
TPD	Tonnes Per Day
TPN Junction	Thulaparambu North junction
TVU	Train Vehicle Unit
UHI	Urban Heat Island
UHS	Urban Heat Hotspots
URDPFI Guidelines	Urban and Regional Development Plans Formulation and Implementation Guidelines
USGS	United States Geological Survey
UWSS	Urban Water Supply Scheme

V/C Ratio	Volume-to-Capacity (V/C) ratio
WPR	Work Participation Rate
WTP	Water Treatment Plant

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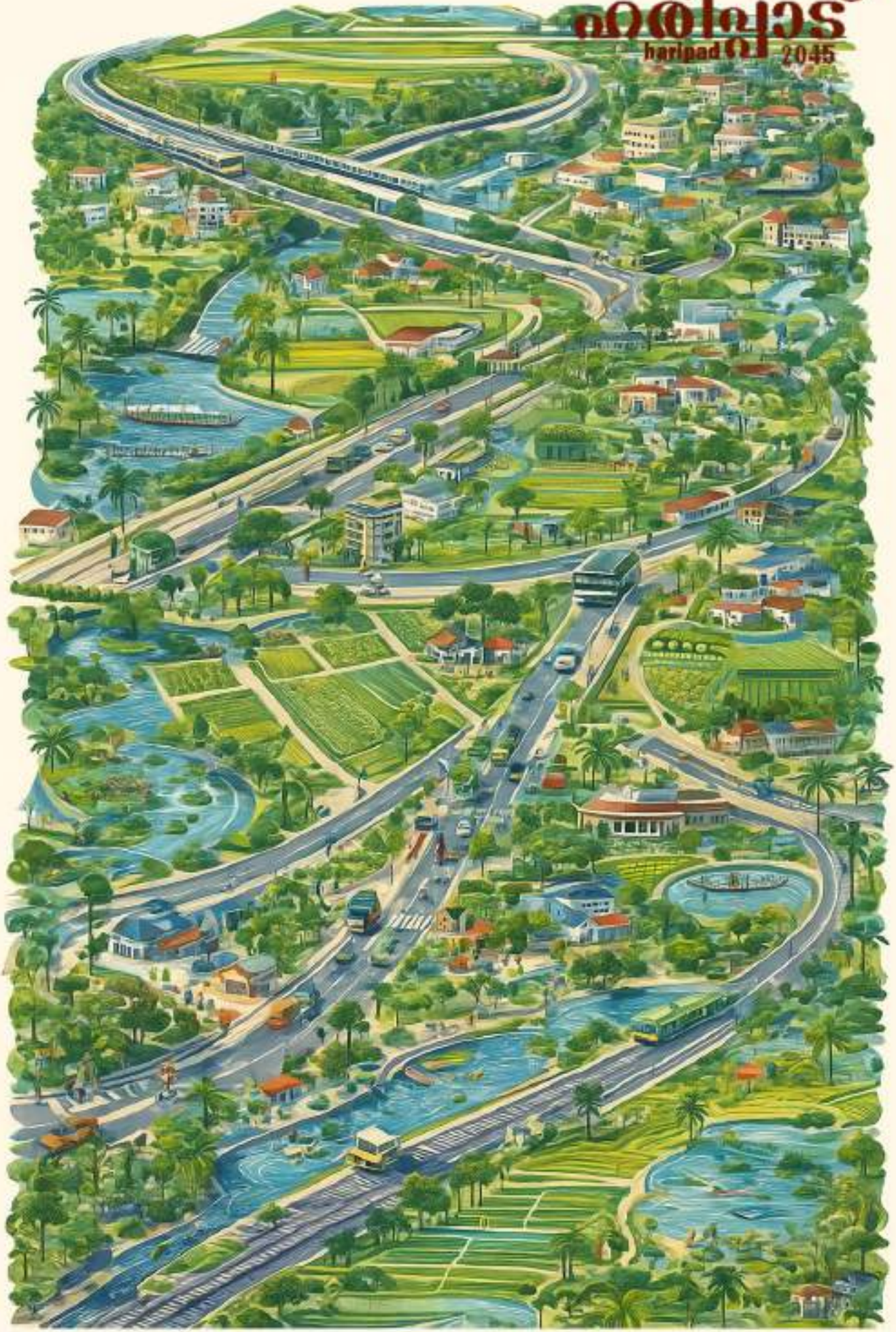
haripad 2045



EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Introduction

Kerala's urban development pattern is distinct from most Indian states, characterised by dispersed settlements, ribbon development along transport corridors, and a near-continuous rural–urban continuum. While this spatial structure has supported decentralised growth and social access, it has also intensified exposure to natural hazards, particularly floods and waterlogging. The interdependence of settlements, ecological systems, and water networks means that unregulated or risk-insensitive development in one area can trigger cascading impacts across entire regions.

The extreme floods of 2018 marked a paradigm shift in Kerala's approach to development and urban planning. The unprecedented inundation caused extensive damage to infrastructure, housing, agriculture, livelihoods, and public services, exposing long-standing weaknesses in land-use regulation, drainage management, and ecological conservation. The disaster underscored the urgent need to move beyond conventional planning approaches and adopt development frameworks that integrate disaster risk reduction, climate resilience, and environmental sustainability.

In response, the Government of Kerala launched the Rebuild Kerala Development Programme (RKDP) as a comprehensive, long-term initiative to rebuild the State in a resilient, inclusive, and sustainable manner. RKDP focuses on strengthening institutions, restoring natural systems, upgrading infrastructure, and embedding risk-informed decision-making into development planning. A critical component of RKDP is Disbursement Linked Indicator 4 (DLI 4), which emphasises the preparation of Risk-Informed Master Plans (RIMPs) for selected urban local bodies. Under this initiative, ten municipalities located along the Pamba River basin—one of the most flood-affected river systems in the State—were identified for risk-informed spatial planning. Haripad Municipality was selected as one among these towns due to its flood exposure, extensive canal and wetland systems, agrarian character, and cultural significance.

A Risk-Informed Master Plan integrates hazard and vulnerability assessment into spatial planning, ensuring that land-use decisions, infrastructure investments, and development regulations actively reduce risk rather than exacerbate it. In the Kerala context, where towns are hydrologically and functionally interconnected, such an approach is essential for achieving long-term urban resilience.

Haripad Town Profile

Haripad is a historic municipal town in Alappuzha district, renowned as *Kshetranagari*—the Town of Temples. The town is distinguished by a dense concentration of temples, vibrant religious festivals, and deeply rooted cultural traditions, giving it a unique spiritual and cultural identity within the region. Haripad functions as a key religious, cultural, and service centre for surrounding settlements, supported by strong regional connectivity.

Geographically, Haripad is situated in a low-lying coastal plain and is strongly influenced by the Achankovil River and its associated network of canals, wetlands, ponds, and agricultural lands. These water systems are structurally embedded within the town's spatial fabric and have historically supported agriculture, drainage, flood moderation, and inland navigation.

Haripad was once a prominent agricultural hub of the former Travancore region, with paddy cultivation forming the backbone of its economy. Even today, a substantial portion of the municipal area remains under agricultural use, distributed in smaller pockets across the town. The population of Haripad reflects a socially diverse and economically mixed urban structure, with livelihoods linked to agriculture, fisheries, animal husbandry, trade, commerce, services, and public employment.

During the 2018 floods, Haripad experienced widespread inundation that affected residential neighbourhoods, commercial areas, public institutions, agricultural lands, and transport infrastructure. The floods disrupted economic activity, damaged housing and social infrastructure, and disproportionately affected low-income households and vulnerable groups. These impacts highlighted the town's exposure to hydrological risks and the need for integrated water-sensitive planning

Preparation Process

The Master Plan for Haripad Town – 2045 has been prepared as per the council decision dated 12/06/2024 following a rigorous, evidence-based, and participatory planning process consistent with the principles of risk-informed urban planning. The process involved extensive primary and secondary data collection, spatial analysis, and stakeholder engagement. Key studies undertaken included flood and hazard assessments, drainage study, socio-economic profiling, household and commercial surveys, land-use analysis, transportation and mobility studies, and infrastructure assessments. These studies enabled a comprehensive understanding of existing conditions, sectoral interdependencies, and risk exposure.

Capacity building programmes for the elected representatives, line departments and LSGD Planning officials were carried as part of the plan preparation process. Stakeholder consultations formed a core component of the planning process. Multiple focus group discussions and workshops were conducted with Resident Welfare Associations, Kudumbashree units, Vyapari Vyavasaya Sanghams, self-help groups, non-governmental organisations, and representatives from various social and occupational groups. The consultations facilitated identification of ground-level issues, validation of analytical findings, and collective discussion on proposed solutions. The outcomes of these engagements were systematically analysed and integrated into the Master Plan proposals.

Town Strengths

Haripad possesses several inherent strengths that position it favourably for sustainable and resilient development. The town's rich cultural and religious heritage provides a strong foundation for religious and cultural tourism. Its extensive canal and wetland network offers

ecological value and potential for water-based tourism and climate-responsive urban design. The presence of significant agricultural land within the municipal limits is a major asset, offering opportunities for sustainable agriculture, organic farming, and floriculture. Haripad's strategic location and strong road and rail connectivity enhance its accessibility and regional importance, particularly for pilgrimage-based tourism. Socially, the town benefits from strong community networks, active local institutions, and a tradition of collective participation, which can support inclusive development initiatives.

Key Findings

The sectoral assessment for Haripad Town reveals a culturally rich and strategically well-connected urban center whose future growth is constrained by increasing environmental stress, infrastructure gaps, and climate-induced risks. While Haripad benefits from strong regional connectivity, high literacy levels, a favorable sex ratio, extensive agricultural lands, water bodies, and a distinctive identity as Kshetranagari, its development trajectory has been marked by unbalanced land use, with excessive dominance of residential areas and significant deficiencies in commercial, recreational, industrial, and public/semi-public uses. The town exhibits high vulnerability to floods, with all wards falling under moderate to high flood-risk categories, exacerbated by climate change impacts such as erratic rainfall, groundwater depletion, and saltwater intrusion. Recurrent flooding has adversely affected agriculture, fisheries, animal husbandry, housing, trade, transport, and public services, exposing the fragility of livelihoods and infrastructure systems. Despite agriculture occupying a substantial share of municipal land, cultivation remains seasonal and underutilized, while allied sectors such as fisheries and animal husbandry operate far below their potential due to water pollution, inadequate infrastructure, and disaster impacts. Economic activity is increasingly service-oriented, yet workforce participation—particularly among women—remains low, indicating untapped human capital. Tourism, anchored in Haripad's temples, heritage assets, canals, and agrarian landscapes, holds immense potential but is presently limited to short-duration pilgrim visits owing to inadequate infrastructure, poor public realm quality, and flood disruptions. The town's physical infrastructure systems—especially water supply, drainage, wastewater, and solid waste management—are critically stressed, with reliance on untreated groundwater, fragmented drainage networks, absence of sewerage and septage treatment facilities, and ineffective waste management contributing to environmental degradation and heightened disaster risk. Social infrastructure such as education and healthcare is adequate in coverage but constrained by qualitative gaps, limited specialization, and vulnerability to flooding, while recreational open spaces are almost absent, undermining urban livability and resilience. Environmental assets including wetlands, canals, paddy fields, and sacred groves are under increasing pressure from encroachments, pollution, and governance limitations, even as they offer strong potential for ecological restoration and nature-based resilience. Collectively, these findings underscore the urgent need for an integrated, risk-informed planning approach that restores and manages water systems, rebalances land use, strengthens infrastructure resilience, revitalizes agriculture and tourism, enhances youth and women's participation in the economy, safeguards cultural and environmental assets, and improves institutional and financial capacity—thereby positioning Haripad on a sustainable, inclusive, and climate-resilient development pathway towards 2045

Regional Setting and Spatial Structure	Haripad Municipality, spread over an area of 16.34 sq. km with a population of approximately 31,000, functions as a medium-sized urban centre within Alappuzha district. The town benefits from strong regional connectivity through National Highway 66, rail infrastructure, inland waterways (NW-3), and proximity to international airports. Its geographical setting—defined by paddy fields, river systems, and low-lying terrain—provides both opportunities for agriculture and tourism and heightened exposure to flood-related risks. The settlement hierarchy identifies Haripad as a third-order settlement, with Danapady emerging as a key activity node, reinforcing its role as a service and cultural centre within the region
Land Use Pattern and Urban Growth	The existing land use pattern of Haripad is predominantly residential, accounting for nearly 44% of the municipal area, followed by paddy lands occupying close to 30%. Commercial, industrial, recreational, and public/semi-public land uses are significantly underrepresented when assessed against URDPFI guidelines. Urban expansion over the past decade has resulted in a gradual conversion of agricultural lands and water bodies into built-up areas, driven largely by highway-oriented development and incremental densification. This unbalanced land use distribution has led to shortages in public amenities, open spaces, and economic-use zones, underscoring the need for rationalised and risk-sensitive spatial planning
Hazard Profile and Climate Change Vulnerability	Haripad exhibits high vulnerability to multiple hazards, with flooding emerging as the most recurrent and severe threat. All wards fall within moderate to high flood-risk categories, with the north-eastern parts of the town experiencing very high exposure. Events such as the 2018 floods and public health emergencies have demonstrated the town's sensitivity to climate-induced shocks. Climate change impacts—manifesting as erratic rainfall, rising temperatures, groundwater depletion, and saltwater intrusion—are intensifying existing vulnerabilities. The findings stress the urgent need for integrated disaster risk reduction strategies that combine resilient infrastructure, sustainable water management, and community preparedness
Demography and Social Characteristics	Haripad displays strong social development indicators, including a high literacy rate and a favourable sex ratio. However, population growth trends are declining, reflecting broader demographic transitions in the district. While household sizes and age composition indicate a balanced population structure, migration—both international and inter-district—has become a defining feature, particularly among the working-age population. This trend has implications for workforce

	availability, economic diversification, and social cohesion, necessitating targeted strategies to retain and engage local human capital
Employment and Economic Structure	The employment profile of Haripad reflects a decisive shift away from primary sector activities towards service-oriented occupations. Over 90% of workers fall within the 'other workers' category, while female work participation remains relatively low. Despite an increase in absolute workforce numbers, the overall work participation rate remains below that of neighbouring areas, pointing to underutilised economic potential. Strengthening livelihood opportunities, particularly for women and youth, emerges as a critical priority for balanced economic development
Agriculture, Fisheries, and Animal Husbandry	Agriculture continues to be a vital sector, with approximately 36% of the municipal area under cultivation, primarily paddy. However, cultivation is largely seasonal, and overall agricultural activity has declined due to urbanisation, flooding, inadequate irrigation, soil degradation, and climate variability. Local agricultural production meets only a small share of consumption demand, increasing dependence on external supply chains. Inland fisheries and aquaculture remain modest in scale but hold potential for expansion through improved water quality, modern cultivation techniques, and better market linkages. Similarly, animal husbandry faces declining productivity due to high input costs, limited veterinary infrastructure, and disaster impacts. Across these primary sectors, the findings highlight significant scope for revival through integrated water management, diversification, value addition, and climate-resilient practices
Industry, Trade, and Tourism	Industrial activity in Haripad is limited to small-scale and household units, with minimal land allocation and absence of industrial estates or large employment generators. Constraints include limited land availability, infrastructure gaps, and competition from larger urban centres. Nevertheless, linkages with agriculture and traditional industries such as coir and food processing present opportunities for niche economic growth. Trade and commerce form the economic backbone of the town but are spatially concentrated in a few congested nodes. Inadequate parking, poor waste management, flooding, and lack of pedestrian infrastructure adversely affect commercial efficiency and urban experience. Tourism emerges as a high-potential sector, anchored in Haripad's temples, cultural heritage, and water landscapes. However, tourism activity is currently limited to short-duration pilgrim visits due to inadequate accommodation, sanitation, parking, and visitor facilities.

	Flood vulnerability further disrupts access and continuity. The findings underscore the need for integrated tourism planning to unlock the town's cultural and ecological tourism potential
Transportation and Mobility	While Haripad enjoys strong regional connectivity, internal mobility is constrained by traffic congestion, lack of organised public transport infrastructure, inadequate pedestrian facilities, and unsafe junctions. A significant share of vehicular traffic is through-traffic unrelated to the town, placing undue pressure on local roads. The dominance of two-wheelers and rising accident rates indicate the need for comprehensive traffic management, public transport integration, and pedestrian-focused interventions to improve safety and efficiency
Physical Infrastructure: Water, Drainage, and Sanitation	Water supply in Haripad is heavily dependent on groundwater sources, with limited coverage of formal water supply schemes and absence of treatment facilities. Seasonal shortages, contamination risks, and flood-induced disruptions pose serious sustainability and public health concerns. The drainage system—comprising rivers, canals, and man-made drains—has been severely compromised due to encroachments, siltation, discontinuity, and waste dumping. These deficiencies have directly contributed to recurrent waterlogging and flood impacts. Wastewater management is decentralised and largely unscientific, with no centralised sewerage or septage treatment facilities, leading to groundwater and surface water pollution. Solid waste management systems remain inadequate, marked by low segregation levels, insufficient manpower, underutilised infrastructure, and improper disposal practices. Collectively, these infrastructure gaps significantly exacerbate environmental degradation and disaster risk
Energy, Social Infrastructure, and Housing	Energy consumption is increasing across all sectors, with minimal adoption of renewable energy despite strong solar potential. Power infrastructure remains vulnerable due to reliance on overhead distribution systems. Education and health sectors are quantitatively adequate but qualitatively constrained by infrastructure gaps, lack of specialised facilities, and vulnerability to flooding. Housing conditions are largely stable, with no slums and minimal shortages, though flood risk poses a threat to structural safety and habitability in low-lying areas. Recreational and open space provision is critically deficient, falling far below planning standards. The absence of public open spaces, playgrounds, and community recreation facilities adversely affects livability and disaster resilience

Environment, Culture, and Governance	Environmental assessments reveal increasing stress on water bodies, wetlands, and paddy fields due to pollution, encroachments, and climate impacts. Despite strong ecological assets and conservation potential, governance gaps and inadequate infrastructure undermine environmental sustainability. Haripad's rich cultural and heritage assets—including temples, festivals, and historic structures—form a strong identity base but face risks from neglect, flooding, and unregulated development. Governance and financial assessments indicate reliance on external grants, limited own-source revenues, and the need for improved asset management and institutional capacity to support long-term urban resilience

The key findings collectively establish that Haripad's future development must be guided by an integrated, risk-informed, and sectorally balanced planning approach. Strengthening water management systems, revitalising agriculture and tourism, improving infrastructure resilience, enhancing social inclusion, and safeguarding environmental and cultural assets are essential to transforming Haripad into a sustainable and resilient urban centre by 2045

Proposals

The Master Plan proposes a comprehensive spatial and sectoral strategy to guide Haripad's development up to 2045. Tourism and agriculture are identified as the primary economic drivers, with proposals focusing on religious tourism, canal-based tourism, farm tourism, and cultural tourism. Innovative, locally rooted tourism models are promoted to enhance livelihoods while preserving cultural and ecological assets.

Agricultural proposals emphasise crop diversification, organic vegetable cultivation, floriculture, and integration of agriculture with tourism and local markets. Targeted interventions are proposed to enhance youth and women's participation through skill development, entrepreneurship support, and livelihood diversification.

A central component of the plan is the Drainage Master Plan, which undertakes a detailed assessment of existing drains, canals, wetlands, and outfall points. The plan identifies critical stretches requiring restoration, upgrading, or new construction, and proposes a hierarchy of interventions based on functionality and risk levels. Bund regulation, canal rejuvenation, and integrated stormwater management form key resilience measures.

Haripad is envisioned as a regional hub for religious tourism, leveraging its temples, cultural corridor, and strong connectivity. The cultural corridor connecting major temples and cultural institutions is proposed as the town's defining spine, supporting identity, tourism, and public life.

The Master Plan also provides for enhanced social infrastructure, improved mobility and public spaces, and a robust zoning framework comprising environmental conservation zones, tourism promotion zones, agricultural protection areas, and mixed-use development zones.

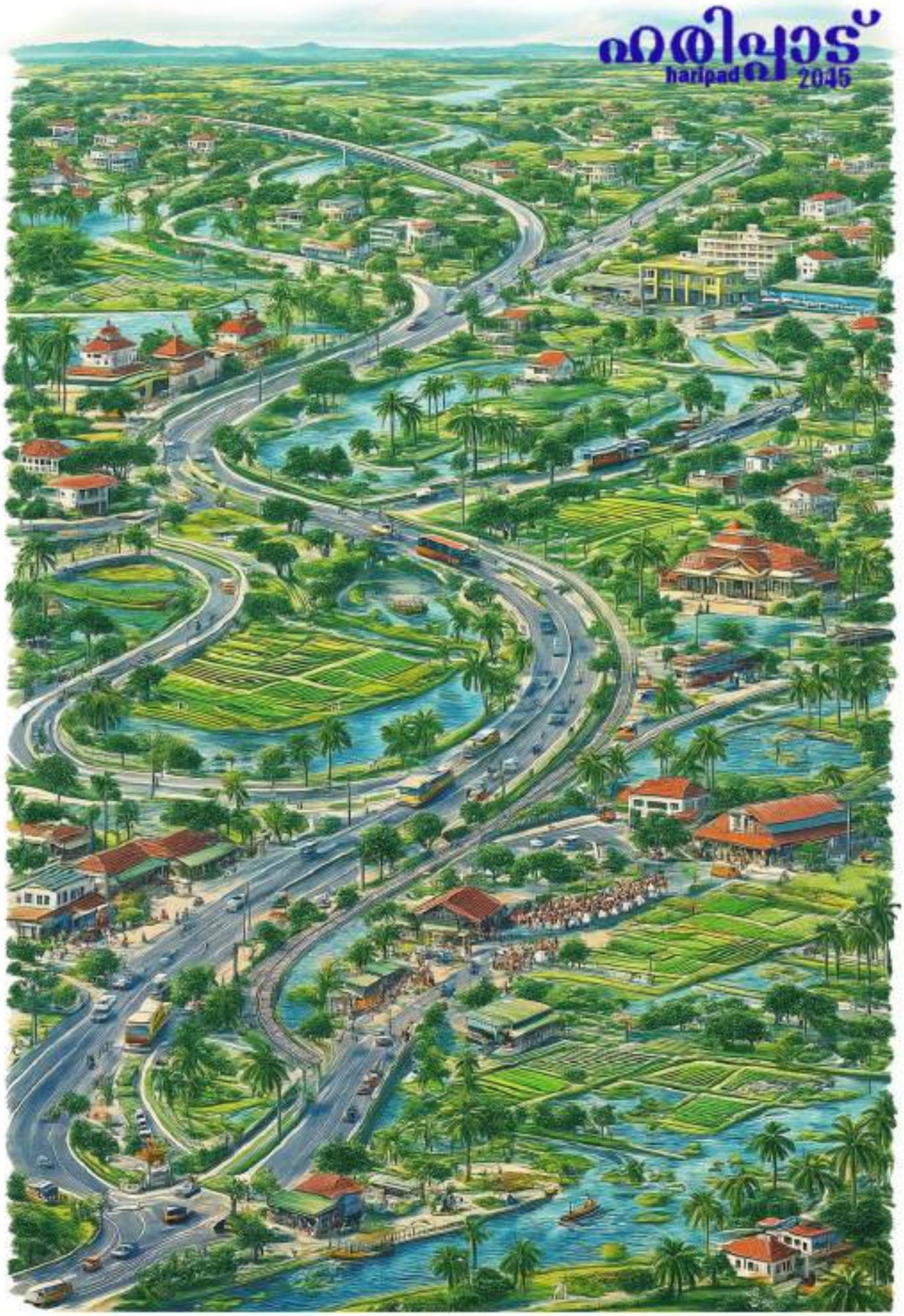
Development Control Regulations are aligned to support risk reduction, environmental protection, and sustainable urban form.

Conclusion

The Master Plan for Haripad Town – 2045 is a visionary, risk-informed, and people-centric planning document that responds to contemporary challenges while unlocking the town's long-term potential. By integrating disaster risk reduction, environmental stewardship, economic development, and social inclusion, the plan provides a clear and implementable roadmap for Haripad's future.

Positioned within the broader framework of the Rebuild Kerala Development Programme, the Master Plan not only addresses local issues but also contributes to regional resilience along the Pamba river basin. It reaffirms Haripad's role as a culturally significant, economically vibrant, and environmentally responsible town—one that is prepared to grow sustainably while safeguarding its people, heritage, and natural systems for generations to come.





BACKGROUND

BACKGROUND

1. Urbanisation in India and need for a planned development

India's urban population has witnessed rapid growth over the decades. At the time of independence, only 14% of the population lived in urban areas. According to the 2011 Census, this figure had more than doubled to 31.8%, with 377 million people living in urban settlements. Projections suggest this urban share will rise to nearly 40% by 2026 and may exceed 50% by 2051. However, this swift urbanization has brought with it significant challenges. Many urban areas—particularly smaller settlements—have developed in a haphazard and unplanned manner. These areas are often marked by non-conforming land uses, unauthorized colonies, and rampant land conversion from agricultural to urban purposes, leading to environmental degradation and a declining quality of life.

To address these challenges, it is essential to manage urban growth through informed planning. A well-conceived Master Plan is crucial for guiding the orderly development of human settlements—both urban and rural. Such plans focus on improving infrastructure, ensuring judicious use of land and natural resources, and promoting the physical, economic, and social wellbeing of communities. Moreover, a forward-looking and structured development approach not only benefits local populations but also contributes significantly to the overall economic and social progress of the state.

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Figure i: Urbanization

2. Kerala – Urban context and geographic features

Kerala stands out as one of the most urbanized and fastest urbanizing states in India. According to the Census of India 2011, the state has a population of 33,406,061, accounting for 2.76% of India's total population. Of this, approximately 47.7% live in urban areas (around 15.9 million), while 52.3% reside in rural regions (around 17.4 million). However, the boundaries between rural and urban areas in Kerala are not distinctly marked, which is unlike most other Indian states. Instead, the state exhibits a unique pattern of development, where

small and medium-sized towns are dispersed across a village-like backdrop, making it difficult to clearly identify where a village ends and a town begins.

This indistinct rural–urban divide has contributed to a unique model of urbanization. Kerala State Urbanization Report 2012 attributes the state's high urbanization levels to several interrelated factors, the most significant being the shift in the workforce from the agricultural sector to the tertiary (services) sector. Other contributing factors include Kerala's dispersed settlement pattern, a preference for homestead-type development, comparatively well-developed infrastructure in both rural and urban areas, and geographical conditions such as the availability of sub-soil water, which facilitate the easy conversion of agricultural land for other uses. If current trends continue, the percentage of Kerala's population living in urban areas is expected to surpass 50%, potentially making it a fully urban state in the future (State Urbanization Report Kerala, 2012). Kerala's distinctive approach to urbanization, shaped by both social and geographical factors, has allowed it to maintain a unique position among India's major states in terms of development indicators.

Kerala is renowned for its rich and diverse geographical features, including mountains, valleys, evergreen forests, waterfalls, and countless rivers that flow westward to meet the Arabian Sea. The state experiences a wet, maritime tropical climate with 120–140 rainy days annually, largely due to the influence of two seasonal monsoons. While these natural features make Kerala exceptionally scenic and ecologically significant, they also make the region vulnerable to various natural disasters.

Given the increasing urban population and the delicate ecological balance of the region, it is essential to implement a comprehensive development plan that guides future growth in a sustainable manner. As the world grapples with the effects of climate change, it becomes even more critical to adopt disaster risk reduction strategies. These measures are vital to minimizing the impact of natural hazards on life, property, and the environment, ensuring the safety and resilience of communities in Kerala.

3. Urban planning in Kerala

Urban planning in India is a State subject, as outlined in the 12th Schedule of the Indian Constitution, introduced through the 74th Constitutional Amendment Act of 1992. This amendment assigns urban planning responsibilities to Urban Local Bodies (ULBs) and Urban Development Authorities, contingent upon the transfer of functions by the respective State Governments. The Government of India plays an advisory role in this regard. The Ministry of Housing and Urban Affairs (MoHUA) supports States and Union Territories by issuing advisories, setting design standards, providing schematic interventions, and extending financial assistance for the preparation of master and spatial plans. The Kerala Municipalities Act of 1994 designates the preparation of development plans as a core function of local bodies, aimed at promoting planned and sustainable development across the state.

Given Kerala's unique geographical features and increasing urban population, it is essential to have a structured development framework to guide future growth effectively. Historically,

Kerala has relied on several laws for urban planning, such as the Town Planning Act of 1108, the Travancore Town and Country Planning Act of 1120, and the Madras Town Planning Act of 1920. To modernize and streamline planning efforts, the Government of Kerala enacted the Kerala Town and Country Planning Act in 2016. This legislation emphasizes scientific spatial planning and the regulation of growth in both urban and rural areas to ensure sanitary conditions, adequate amenities, and overall livability for current and future inhabitants. Section 30 of the 2016 Act empowers Municipal Corporations, Municipal Councils, Town Panchayats, and Village Panchayats to prepare and implement Master Plans. These local bodies are also tasked with regulating land use and controlling development activities within designated planning areas. The preparation of Master Plans is carried out with the technical support of the Local Self Government Department (LSGD) Planning Wing—formerly known as the Town and Country Planning Department of Kerala. Accordingly, Urban Local Bodies in Kerala are directly responsible for forming Master Plan Committees and overseeing the planning process in collaboration with LSGD Planning Kerala.

4. 2018 flood and after effects in Kerala

Kerala is highly vulnerable to a range of natural hazards and has faced a series of major disasters in recent years, beginning with Cyclone Ockhi in 2017, followed by devastating floods and landslides in 2018, 2019, and 2020. Among these, the 2018 floods are considered as the worst disaster the state has experienced in nearly a century.

In 2018, Kerala received unusually high rainfall, leading to the most severe flooding since 1924. The disaster impacted approximately 5.4 million people—about one-sixth of the state's population—causing extensive loss of life, damage to property, and economic disruption. The heavy monsoon rains triggered widespread flooding across multiple districts and led to thousands of landslides, ranging in size and impact. Seven districts were declared fully flood-affected: Alappuzha, Ernakulam, Idukki, Kottayam, Pathanamthitta, Thrissur, and Wayanad.



Figure ii: Kerala floods 2018

Water levels in many reservoirs reached critical levels, prompting the release of water from 35 dams across the state to manage the excess flood runoff. The worst-affected areas included the sub-basins of the Kabini, Periyar, Chalakudi, and Pamba rivers. Landslides were particularly severe in hilly districts such as Wayanad and Idukki. In total, nearly 341 landslides were reported from 10 districts, with Idukki alone accounting for 143 of them. Several districts remained submerged for over two weeks due to the relentless rain and resultant flooding. These recurring events have exposed the significant gaps in Kerala's disaster preparedness and the urgent need to strengthen its resilience against natural hazards and the growing impacts of climate change.

5. Rebuild Kerala Initiative (RKI)

The devastating floods of August 2018 marked an unprecedented calamity in Kerala, prompting the state to critically reassess its developmental model and disaster preparedness. The following year, 2019, also witnessed severe flooding—of even greater magnitude, though with a more limited spread. These back-to-back disasters inflicted extensive damage on both public and private infrastructure and resulted in a large-scale loss of livelihood opportunities. Recognizing that these events were not isolated natural calamities, the Government of Kerala (GoK) chose not to rely on conventional, short-term recovery methods. Instead, it seized the moment as an opportunity to reimagine the state's future. The vision was to move beyond temporary fixes and pursue a long-term, transformative agenda. From this strategic shift emerged the Rebuild Kerala Initiative (RKI), an ambitious and inclusive roadmap aimed at building a green and resilient Kerala. The RKI is the dedicated State-level institution mandated with the responsibility of formulating and coordinating the implementation of a resilient Kerala. The initiative was designed to bring about a significant improvement in the lives and livelihoods of its citizens by adopting higher standards of infrastructure and integrating ecological and technical safeguards. These efforts aim to ensure that rebuilt assets are more capable of withstanding future floods. The government have approved the comprehensive guidelines for operational strategy and Institutional Framework of RKI vide G.O.(Rt) No. 16/2018/P&EA dated 09/11/2018.



Figure iii: Rebuild Kerala Initiative

a. Rebuild Kerala Development Programme (RKDP)

By establishing the RKI, the GoK has put in place a streamlined and transparent process of decision making for the comprehensive and sustainable rebuilding from the 2018 floods. With support from UN and World Bank Agencies, RKI has developed a holistic plan to rebuild Kerala through the Rebuild Kerala Development Programme (RKDP). The RKI mandate is to

develop, coordinate, facilitate and monitor the RKDP through a participatory and inclusive process, with extensive consultation with all stakeholders.

The Rebuild Kerala Development Programme (RKDP) serves as a comprehensive framework designed to guide the Government of Kerala's (GoK) transformative shift in post-disaster recovery, rebuilding, and resilience planning. Anchored in the principles of sustainability, equity, inclusiveness, and effectiveness, the RKDP presents a forward-looking blueprint for a new development approach—one that envisions a resilient, green, inclusive, and vibrant Nava Keralam. Developed through an extensive and inclusive process of public and expert consultations, the RKDP has been vetted by government departments and sector agencies, and consolidated by the Rebuild Kerala Initiative (RKI) team with support from international partners such as the World Bank and the United Nations. This visionary roadmap is fully aligned with the State's existing priorities, programmes, and projects aimed at improving the quality of life for its citizens.

The RKDP covers critical sectors of the economy including agriculture, animal husbandry, fisheries, forestry, land, livelihoods, roads and bridges, transportation, urban services and infrastructure, water supply and sanitation, and water resource management. It also integrates cross-cutting priorities such as climate change and disaster risk management, environmental sustainability, open data, and public sector strengthening. A key objective of the RKDP is to institutionalize risk-informed programming across all sectoral recovery plans, with additional investments in disaster preparedness and response. Aligned with the vision for Nava Keralam, the programme aspires to achieve zero mortality from disasters, while minimizing economic losses and ensuring uninterrupted public services during crises. By addressing policies, institutions, and investment strategies, the RKDP aims to guide the GoK and its departments in designing actionable, ground-level projects that collectively contribute to building a stronger, safer, and more sustainable Kerala.

b. Resilient Kerala Program-for-Result Financing (PforR)

In response to the growing demand for development programs that deliver measurable results while strengthening institutional capacity, the World Bank introduced the Program-for-Results (PforR) financing instrument. Unlike traditional funding mechanisms, PforR uses a country's existing systems and institutions and links fund disbursement directly to the achievement of clearly defined and verifiable results. This results-based approach enhances efficiency, accountability, and long-term sustainability while reinforcing institutional capacity.

The Resilient Kerala Initiative (RKI) is the lead implementing agency for operationalising the Resilient Kerala Program-for-Results (PforR). RKI coordinates and drives policy reforms, institutional strengthening, and strategic investments required for Kerala's resilient recovery. The PforR provides financing-linked incentives to align stakeholders across multiple sectors within a unified resilience framework, covering the four districts of the Pamba River Basin—Idukki, Kottayam, Pathanamthitta, and Alappuzha. The program supports sustainable recovery from natural disasters and disease outbreaks through focused interventions in

disaster management, fiscal systems, urban development, health, water resource management, agriculture, and roads.

c. DLI 4

DLIs are a key component of the World Bank's Program-for-Results (PforR) financing instrument, which focuses on supporting a borrower's own programs and results. DLIs help to ensure that World Bank financing is used effectively and efficiently, leading to tangible and sustainable development outcomes. There are 11 DLIs has been set under the Resilient Kerala Program-for-Result (PforR). The fourth Disbursement Linked Indicators (DLI 4) is the development and approval of risk-informed urban master plans and priority action plans for designated municipalities. ULBs developed and sanctioned risk-informed Urban Master Plans and Priority Action Plans is considered as a Project. This Program intends to establish norms, systems and capacities for risk-informed master planning and implementation across the State, and pilot risk-informed Urban Master Plans and Priority Action Plans in a sample of urban local bodies (ULBs) in the Pamba River Basin. This intends to support better disaster preparedness from planning, service delivery and emergency response perspective.

The end target of the project is that 4 of 10 Urban Local Bodies in the districts of Pathanamthitta, Alappuzha, Kottayam and Idukki in the Pampa river basin have sanctioned the final urban master plans and priority action plans during the project period from 2021 to 2026. Kerala Institute of Local Administration (KILA) and Local Self Government Department (LSGD) are the implementing departments of DLI 4.

6. Master Plan and Risk Informed Master Plan (RIMP)

Master Plans are statutory and legally enforceable documents prepared by Local Self Governments (LSGs) to guide the long-term, sustainable future development of towns and cities, with a particular focus on spatial and land use planning. These plans outline the general direction of a town's structure, growth, and transformation, serving as a roadmap for how, where, when, and why development should occur. They include a set of policies and guidelines intended to inform decisions on building, rebuilding, and managing urban areas to achieve the town's envisioned future. In Kerala, the preparation, implementation, and modification of Master Plans are governed by the Town and Country Planning Act, 2016. As a result, Master Plans are binding on officials and must be adhered to when making specific land use decisions, ensuring that all development aligns with the town's long-term vision.

Risk-Informed Master Plan (RIMP) is a comprehensive urban or regional development framework that integrates disaster risk reduction and climate change adaptation strategies into the planning process. Its primary objective is to ensure that future development is resilient to various hazards, thereby minimizing potential losses and promoting sustainable and equitable growth. This approach involves identifying potential risks such as floods, earthquakes, droughts, and pandemics, assessing their likelihood and possible impacts, and analyzing the vulnerabilities and capacities of communities and infrastructure within the region. By embedding risk considerations into land use and infrastructure planning, Risk-

Informed Master Plans help create cities and towns that are better prepared to withstand future shocks and stresses. In Kerala, the Risk-Informed Master Plan is formally recognized under Section 2(r) of the Kerala Town and Country Planning Act, 2016 (KTCP Act, 2016). To support this initiative, the State Government approved specific guidelines in 2022 for the preparation of RIMPs. These guidelines are designed to assist Local Self Governments (LSGs) in systematically preparing such plans and to provide clear principles and directions for mainstreaming disaster risk information into the urban planning process.

7. Risk Informed Master Plan (RIMP) for Haripad Town – Departments involved

Haripad Municipality in Alappuzha district is chosen as one among the four Urban Local Bodies to prepare Risk Informed Master Plan (RIMP) under DLI 4. Supporting agencies for the preparation of RIMP for Haripad town are:

a) **Haripad Municipality**: As per the Kerala Municipalities Act of 1994, preparation of development plan is the duty and responsibility of local bodies. For this, the municipality shall take resolution for the preparation of Master plan, Appoint Special Committees & Working Groups, Arrange discussion with stakeholders and public participation, Publish the master plan, Hear objection & suggestions from public and sanction the Master Plan.

b) **LSGD Planning**: LSGD Planning plays a vital role in providing technical support for the preparation of Master Plans. Its responsibilities include collecting data from various departments, conducting sector-specific surveys, and facilitating consultations with both line departments and the public. In addition, LSGD Planning is responsible for the preparation of reports and maps, as well as making presentations before the public to ensure transparency and participation in the planning process.

c) **Kerala Institute of Local Administration (KILA)**: The Kerala Institute of Local Administration (KILA) is an autonomous institution dedicated to supporting local governments in Kerala. As part of its capacity-building efforts, KILA has provided technical consultants and conducted training programs for both the public representatives of Haripad Municipality and the technical staff of various line departments. These training sessions focused on key areas such as climate change, disaster risk reduction, and the development of a Risk-Informed Master Plan.

d) **PIU-DLI 4**: A Project Implementation Unit (PIU) was jointly established by LSGD Planning and KILA in May 2022 in Thiruvananthapuram for DLI-4, with the objective of preparing Master Plans for 10 Municipalities located in the Pampa River Basin. The PIU is responsible for providing technical support to District Offices on risk-related aspects during the preparation of Risk-Informed Master Plans (RIMPs). It also coordinates essential activities in collaboration with CTP Planning to ensure the effective integration of risk information into the planning process. Additionally, the PIU is taking key steps to develop drone surveys, build a geo-database, and

generate a digital terrain model for the municipalities in the basin—all crucial components for the successful preparation of RIMPs.



PART I: STUDY & ANALYSIS



PART I: STUDY & ANALYSIS

GENERAL

1. INTRODUCTION
2. PROFILE OF THE TOWN
3. DEMOGRAPHY
4. EMPLOYMENT
5. LAND USE AND BUILT UP DENSITY
6. HAZARD PROFILE AND CLIMATE CHANGE

CHAPTER
01

INTRODUCTION



The Master Plan for Haripad Town serves as a strategic framework to guide the town's growth and spatial development over the next 20 years. It outlines a comprehensive vision and set of policies for land use, infrastructure, transportation, housing, environment and public services. The plan aims to promote orderly and sustainable development that balances economic progress with social equity and environmental stewardship. By integrating spatial, economic and ecological considerations, the Master Plan aspires to create a resilient, inclusive and vibrant urban environment that reflects the town's cultural heritage and evolving aspirations.

- Planning Area
- Earlier Planning Efforts
- Need for Master Plan
- Legal Framework
- Methodology

1. INTRODUCTION

Master Plan is a strategic spatial planning document that provides long-term guidance for the growth and development of a town. It sets out a vision, along with clearly defined goals and policies covering key aspects such as land use, infrastructure, transportation, environmental management, and other essential elements of urban development. The aim is to ensure that urban expansion is orderly, sustainable, and responsive to community needs, while also safeguarding the cultural, environmental, and historical heritage of the area. "Master Plan for Haripad Town – 2045" is intended to serve as a comprehensive framework for guiding the economic, physical, social, and environmental development of Haripad Municipality over a 20-year period. It integrates critical elements of urban planning - such as Zoning Regualtions, land use strategies, infrastructure design, transportation systems, and climate resilience - with a focus on disaster risk reduction and climate change adaptation, supporting Haripad's long-term goals of economic prosperity, social equity, and environmental sustainability.

1.1 Planning area

The planning area for the "*Master Plan for Haripad Town – 2045"* is the Haripad Municipal Area (as shown in Figure 1.1) in Alappuzha district, covering an extent of 16.34 sq. km. Delineation of the planning area constitutes the first stage of the Master Plan preparation and is based on the extent of existing development, growth patterns, and future expansion potential. The planning area (as shown in Figure 1.2) coincides with the present municipal limits and includes five revenue villages of Karthikappally Taluk - Haripad, Karthikappally, Pallipad, Chingoli, and Veeyapuram. Haripad village is fully included within the planning area, while Karthikappally, Pallipad, and Chingoli villages are partially included. Only a limited number of survey numbers from Veeyapuram village fall within the planning area.



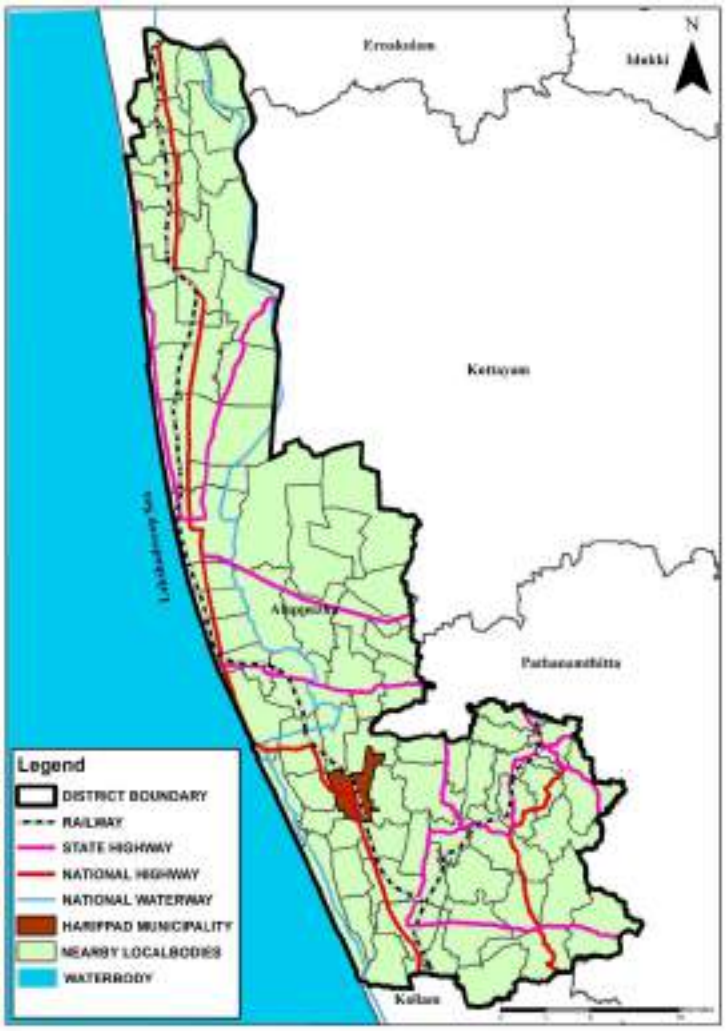


Figure 1.1: Location of Haripad Municipality in Alappuzha district

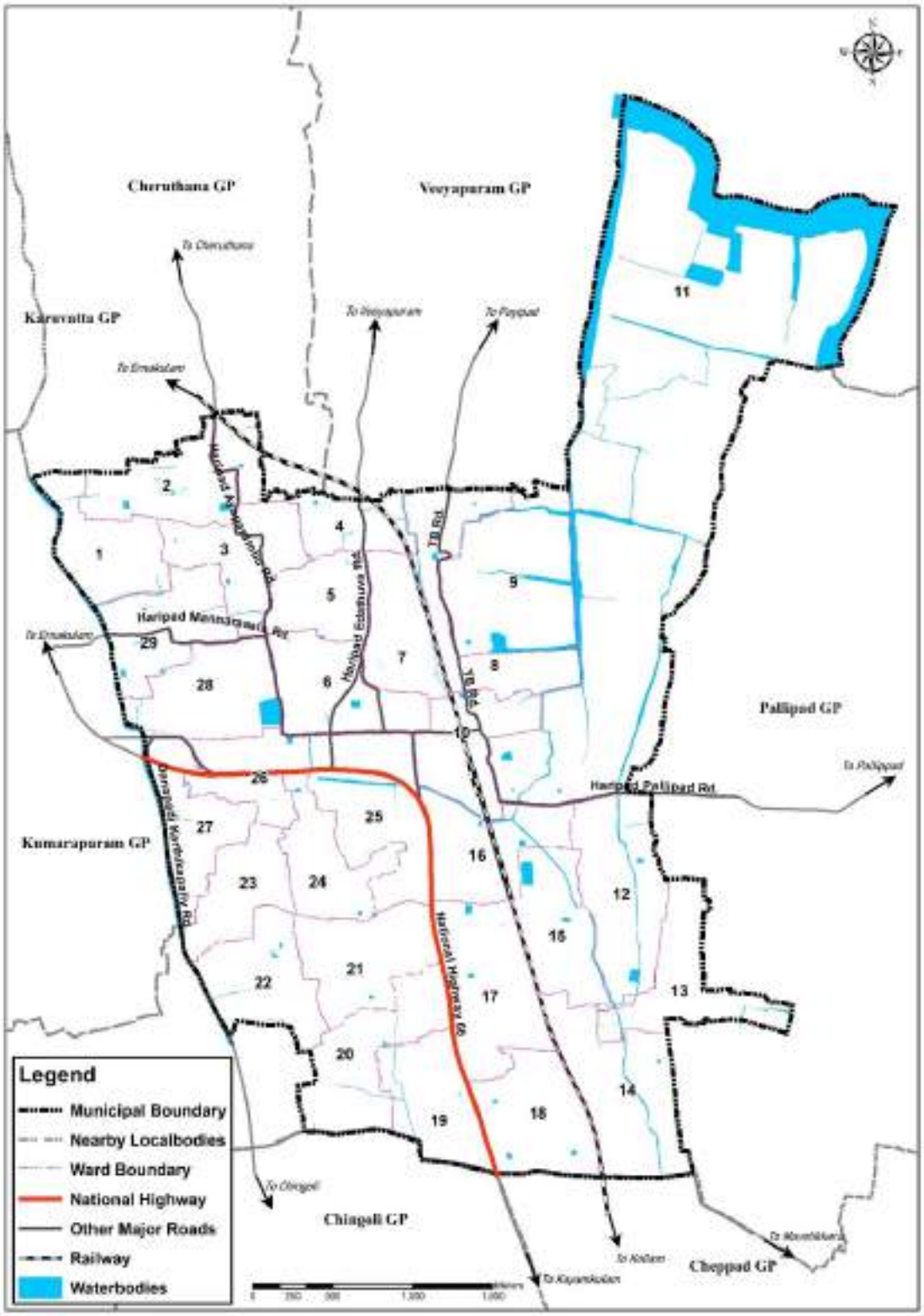


Figure 1.2: Map of planning area (Haripad Municipality)

1.2 Earlier Planning Efforts

The District Urbanization Report prepared in 2012 by the then Town and Country Planning Department (presently LSGD Planning) gives an idea about the role of the town in various aspects for the development of the district. However, no other integrated or comprehensive planning initiatives were implemented after that.

1.3 Need for the Master Plan

The need to prepare a new Master Plan arises from the shift in development planning focus introduced by the 74th Constitutional Amendment Act of 1992 and the subsequent legislation enacted across the country. In alignment with this constitutional amendment, the Kerala Municipality Act of 1994 mandates that every Municipality must prepare a Master Plan for its development, emphasizing scientific spatial planning. Furthermore, the Kerala Town and Country Planning Act, 2016 reinforces this requirement by stipulating that every Municipality shall prepare, or cause to be prepared, a Master Plan for its Local Planning Area or any part thereof. This plan must also take into account any relevant plans previously prepared under the Act. The Town and Country Planning Act currently in force in the state provide the necessary legal framework for the formulation of such Master Plans.

Haripad is one of the six municipal towns in Alappuzha District and serves as the headquarters of Karthikapally Taluk. As per District Urbanization Report 2011 for Alappuzha (DUR) Haripad has been identified as a third-order settlement within the district, which means it must cater not only to the needs of its own residents but also to those of surrounding lower-order settlements. The city enjoys excellent connectivity by road, rail, and water. National Highway 66 passes through Haripad, while the town's railway station serves as a key stop on the coastal line between Kayamkulam and Alappuzha. Additionally, National Waterway 3 runs close to the city, enhancing its strategic location. A significant portion of the municipal area is agricultural. However, traditional agriculture is currently unprofitable and unattractive to the younger generation. Despite this, Haripad holds strong potential for integrated development - by revitalizing agriculture, promoting animal husbandry, encouraging small-scale industries, and boosting tourism through the linkage of temples and cultural heritage. Realizing this potential it is essential to guide the development of the town in a well planned manner.

In light of the risks posed by the natural disasters in recent years, the Kerala State has been taking up initiatives to better its preparedness to deal with natural hazards and climate change. Risk Informed Urban Planning is one of the key components and integrating risk information with land use planning is expected to reduce impacts of hazards on life, property and environment in a community. Haripad was severely affected during the floods in 2018, and thus arises the need for a comprehensive master plan that communicated the risks that it posed to the local body and its people. A Master Plan with risk information and disaster risk reduction strategies are necessary for the town, so that it may guide the local self government to incorporate strategies, projects and actions that may lower risks in development planning and implementation and also mitigate the impact of disasters as and when they occur.

1.4 Legal framework

The Kerala Town and Country Planning Act, 2016 (KTCP Act, 2016) provides the legal framework for the preparation and implementation of Master Plans that aims at the planned development of urban and rural areas in the state. This framework outlines the rules and procedures for executing a Master Plan for ensuring that land use and development activities are carried out in a planned and regulated manner. The Kerala Town and Country Planning (Preparation and Sanctioning of Master Plans) Rules, 2021 were introduced by the

Government of Kerala to provide detailed procedural guidelines for preparing Master Plans under the Act. These rules work in tandem with the Act to ensure consistency and transparency in the planning process.

Section 61 of KTCP Act 2016 stipulates that use and development of land has to be in conformity with provisions of Master Plans and Detailed Town Planning Schemes. Once the Master Plan or Detailed Town Planning Scheme has come into operation, no person shall use or cause to use any land or carry out development in any land, or change the use of land otherwise than in conformity with or with prejudicial to the Master Plans and Detailed Town Planning Schemes.

Recognizing the need to incorporate Risk Information and Disaster Risk Reduction strategies into urban planning, the amendments have been made in the Kerala Town and Country Planning Act, 2016 Section 34 subsection (2) as "Master Plan may include situational analysis in respect of hazard, vulnerability, risk and proposals for mitigation and resilience."

As per Section 30 of the Act, the responsibility for the preparation of Master Plans lies with Local Self Governments (LSGs). According to Section 36 of the Act, Municipal Councils may prepare or adopt a Master Plan for their Local Planning Area or part thereof. To support timely and effective preparation of Master Plans, a Master Plan Committee or Special Committee must be constituted as per Section 32 of the KTCP Act, 2016, and Rule 3 of the 2021 Rules. The Municipal Council may, by resolution, delegate all relevant powers to this committee as provided under Section 32(1) of the Act and Rule 3(2) of the Master Plan Rules. The LSGD Planning Wing provides technical assistance and guidance to Local Self Governments throughout the Master Plan preparation process, ensuring that the plans are both technically sound and compliant with statutory requirements.

1.5 Delineation of the Planning Area

The first stage in the preparation of Master Plan is the delineation of planning area. It depends on the depth of growth and expansion towards the surrounding area. The planning area is the present Haripad Municipality, which comprises five revenue villages such as Haripad, Karthikapally, Pallipad, Chingoli and Veeyapuram villages of Karthikapally taluk, stretches over an area of 16.34 sq.km. Haripad village is completely included in the planning area, while Karthikapally, Pallipad and Chingoli villages are partially included. Only a few survey numbers of Veeyapuram village are included in the planning area.

1.6 Methodology

The process of preparation of Master Plan for Haripad Town - 2045 is in accordance with the Kerala Town and Country Planning Act, 2016, The Kerala Town and Country Planning (Preparation and Sanctioning of Master Plans) Rules, 2021 prepared thereunder, and the guidelines issued by the State Government in 2022 for the preparation of Risk-Informed Master Plan. The process involves extensive efforts in collecting, compiling, and analyzing both primary and secondary data to identify key issues and opportunities, ultimately leading to the development of proposals for the horizon period.

Haripad Municipal Council at its meeting held on 12/06/2024 took resolution to prepare a Risk-Informed Master Plan for Haripad town and constituted Master Plan Committee as per Section 32 of the Kerala Town and Country Planning Act, 2016. The process of preparation of Master Plan involves the following stages



1.6.1 Data Collection



Figure 1.3: Land Use Survey updating by ITI students

The primary data required for the preparation of Master Plan was collected by various surveys such as Land use survey, Socio-Economic survey, Flood prone area survey, Traffic & Transportation survey, Commercial area survey, survey in backward housing nagars, pilgrim survey during Mannarasala Ayilyam and LiDAR Survey. The land use survey updation was done in November - December 2024 under the supervision of the officials of this office, by the students of Govt.ITI, Pallipad and Govt.ITI SCDD, Haripad, under On-Job-Training programme. A training programme (Figure 1.4) has been conducted for the ITI students regarding the conducting of the land use survey.

The Socio-Economic Survey was conducted in 10% of the households in all the wards of the Municipality. The households to be surveyed were selected randomly from the voters list of all the wards. The survey was conducted by the ITI students under the supervision of officials from this office, using the questionnaire prepared in "Google Forms".

Since the Master Plan incrorporated risk information, it is necessary to collect information related to various hazards affecting the town. The main hazard that affect Haripad Municipality is flood. Flood prone areas of the town has been identified from the Return Probability maps published by KSDMA. Flood Prone area is overlaid with the building footprints of the town and then 10% of the residential buildings in the Flood Prone Area of

each ward has been surveyed. The officials of this office conducted the survey on "Google Forms" using a specially prepared questionnaire.



Figure 1.4: Training given to ITI students regarding Land Use Survey

The Traffic & Transportation survey and studies were conducted by National Transportation Planning and Research Centre (NATPAC), Thiruvananthapuram. A Commercial Area Survey was conducted in May 2025 using questionnaires to study the problems faced by the commercial sector in the city, and a survey was conducted in Nagar/ Unnathi areas of the town during June 2025 to understand the problems faced by them. In addition, a LiDAR Survey using drone was conducted to prepare a drainage management plan for Haripad town as part of DLI4. The LiDAR survey has been outsourced, following a competitive tendering process, to a technically qualified and experienced firm with proven expertise in LiDAR data acquisition and processing.



Figure 1.5: Municipal Chairman inaugurating LiDAR survey

Secondary data for the preparation of the Master Plan was gathered from multiple sources. These include the Municipality, various government departments, and public engagement activities such as focus group discussions, stakeholder consultations, public

seminars, and meetings with line departments and subject experts. Additional secondary data was sourced from government websites, published documents, and other online platforms. Details of public participation in the planning process are elaborated in the chapter "Community Involvement".

1.6.2 Data Analysis

The analytical framework for the Master Plan is carried out in four key stages: Local Level Analysis, Spatial Analysis, Vulnerability and Risk Assessment.

1. **Local Level Analysis** focuses on understanding development trends, sectoral potentials, and challenges specific to the local context, including sensitive and priority areas. It also incorporates the development aspirations of the local people. This stage is carried out by the department in collaboration with the Special Committee and the working group constituted by the Municipality.
2. **Spatial Analysis** examines the regional context of the settlement, including the distribution of population and activities, land use patterns, and infrastructure networks. It identifies sector-wise issues and opportunities within the town, providing critical input for formulating the development vision and sectoral objectives.
3. **Vulnerability and Risk Assessment** evaluates the susceptibility of communities, areas, and sectors to various hazards by identifying those most at risk. It is based on data from vulnerability surveys conducted in hazard-prone areas identified by the Kerala State Disaster Management Authority (KSDMA). This assessment determines risk levels by integrating hazard exposure with community vulnerability, and forms a key component of the Master Plan by enabling a detailed analysis of hazard and climate change impacts across all sectors.

Using data gathered from these assessments, the hazard exposure of the town has been mapped spatially through the ArcGIS platform. The insights derived from all stages of analysis serve as a foundational input for the envisioning process and the formulation of development concepts.

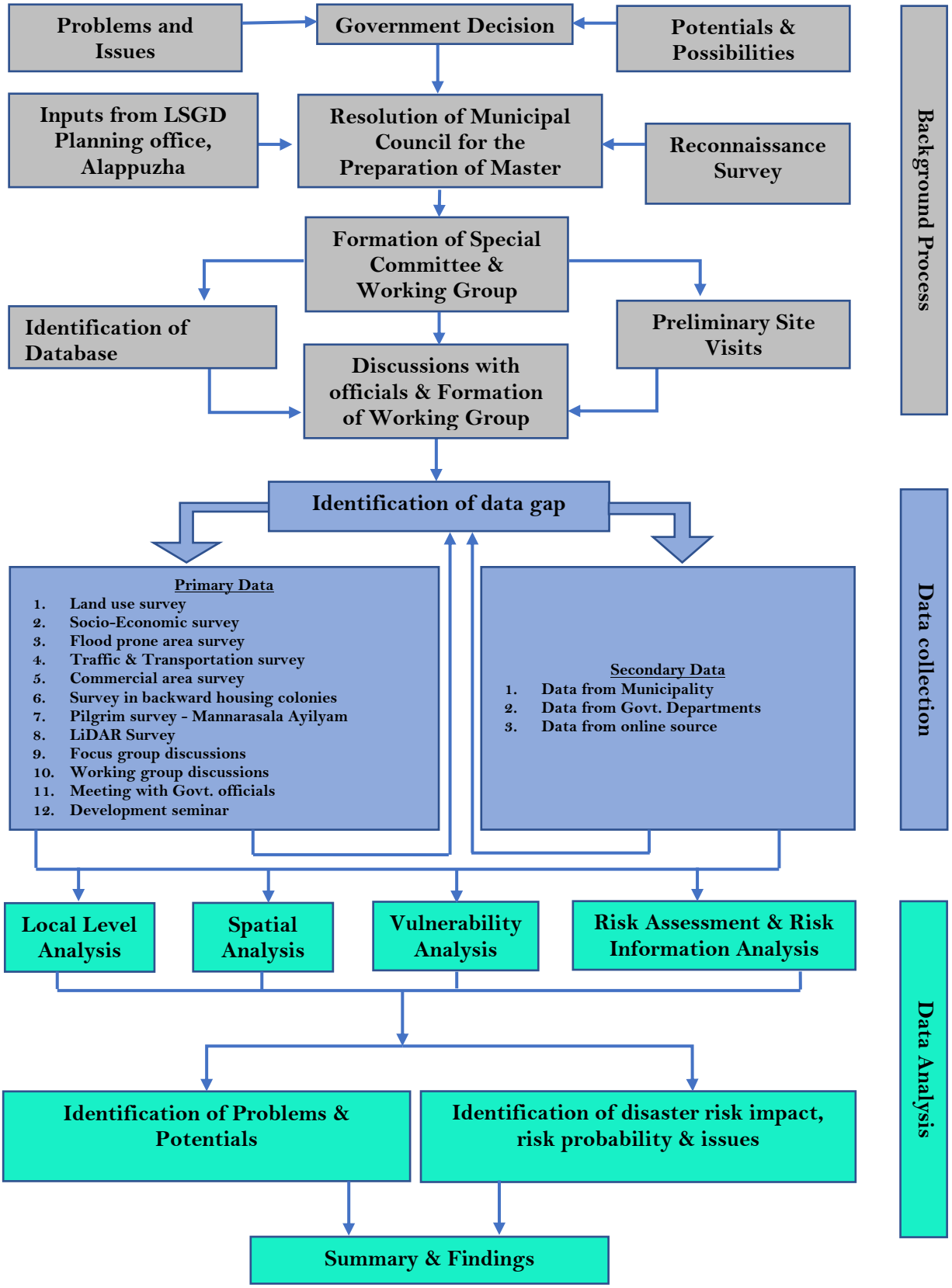
1.6.3 Envisioning Process

The envisioning process begins by identifying key development issues based on the consolidated findings of earlier studies. From these issues, development goals and objectives for the town are formulated. Once the objectives are clearly defined, appropriate policies and strategies are developed to achieve them - whether through land use policies or specific projects aimed at addressing the identified challenges. These policies and strategies then form the foundation for detailing the Master Plan.

1.6.4 Detailing

The detailing stage involves the preparation of comprehensive components essential for implementing the Master Plan. This includes sector-specific proposals to be executed during the plan period, along with a detailed land use plan that outlines the town's land use policy.

Zoning regulations are formulated to guide and control land use in accordance with the plan. Additionally, this stage covers the costing and phasing of proposed projects, as well as the framework for implementation and monitoring - including specific provisions to track the progress and effectiveness of the development plan. Figure 1.6 showcase the methodology for preparation of Master Plan for Haripad Town- 2045.



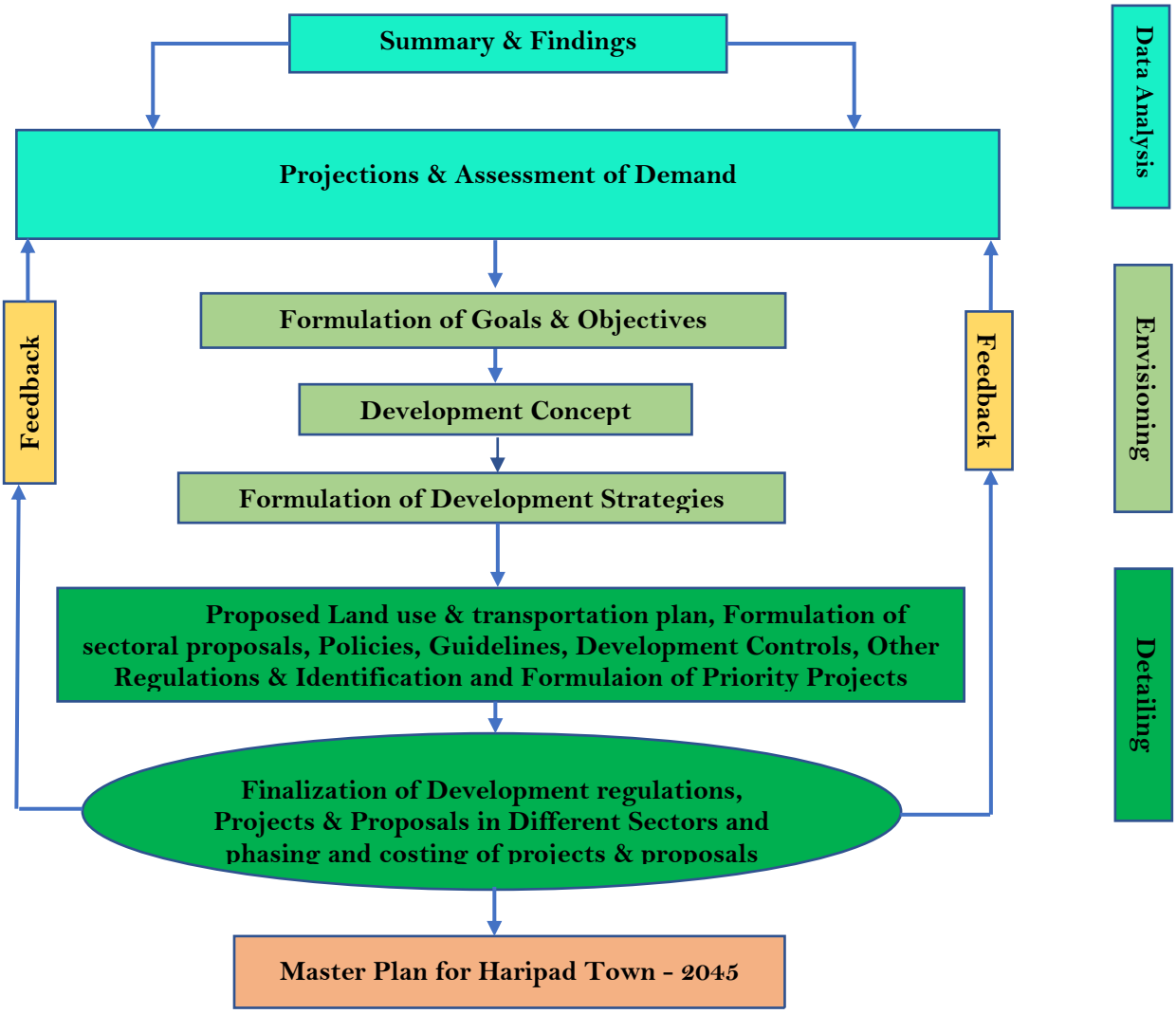


Figure 1.6 : Methodology for preparation of Master Plan

CHAPTER
02

PROFILE OF THE TOWN



Haripad, a historic town renowned for its rich religious and cultural heritage, is often called "Kshetranagari" – the Town of Temples. Known for its traditions in art, music, dance and festivals like Mannarashala Ayilyam, it reflects Kerala's vibrant cultural identity. Spanning 16.34 sq. km and a population of 30,977 (Vikasanarekha 2022–2027), Haripad serves as a key urban centre along NH 66, well-connected by road, rail and waterways. Located in the low-lying coastal plains of Upper Kuttanad, the town is defined by its paddy fields, natural drains and the Achankovil River. With an economy rooted in agriculture, commerce and services and landmarks such as the Sree Subrahmanya Swamy Temple, Mannarasala Temple etc. Haripad holds significant regional importance.

- Introduction
- Town at a glance
- Location and Regional Settings
- History
- Area and Population
- Climate
- Physiography
- Soil
- Geomorphology
- Geology
- Biodiversity

2. PROFILE OF THE TOWN

2.1 Introduction

For the effective planning and development of any town, a comprehensive understanding of the characteristics and historical planning initiatives is essential. This chapter provides an overview of the Haripad Town, which is one of the six Municipalities in Alappuzha District, detailing its geographical setting, demographic profile, economic base, and key urban features.

2.2 Town at a glance

Haripad Municipality, is a historic town renowned for its religious and cultural heritage, temples, and backwaters. This is a place where people have left their unique mark in the political, social, and cultural spheres. The town has a remarkable history in the fields of science, culture and education, and is home to invaluable heritage. Commonly referred to as "*Kshetranagari*" or the "*Land of Temples*," since it stands as a symbol of religious harmony, bearing numerous legends. This town is also known as the Land of Art, Artists, Land of Snakeboats, Land of Music, Dance and Drama.

The town acquired its Municipal status in 2015, having an area of 16.34 Sq.Km, and 29 wards. Present population of the town is 30,977 (Vikasanarekha, 2022-2027), which includes 14333 males and 16644 females. The town serves as a key urban centre along National Highway 66 (NH 66) towards south of the district headquarters and is well-connected by both road and rail networks, with Haripad Railway Station providing access to other major towns. The small town is popular for its paddy fields located towards the North Eastern edge, through where the *Achankovil River* flows and is a part of the Upper Kuttanad Region. The beauty and charm of these areas still remains untouched even after the influence of urbanization. This town is also located close to the Arabian sea.

The economy of Haripad Municipality consists of farmers, agricultural labourers, livestock rearers, daily-wage and construction workers, traders, industrial workers, small-scale vendors, government employees, private-sector employees, and expatriates. The town has a strong agricultural base, with coconut, paddy, and banana cultivation being prominent, alongside the growth of commercial and service sectors. Geographically it is a plain coastal region included in the low land area and slopes from East to West.

Haripad is home to significant religious and tourist attractions, including the Haripad Sree Subrahmanya Swamy Temple, one of Kerala's oldest temples, and the renowned Mannarasala Temple. *'Payippad Jalotsavam'* is a significant cultural festival in this region, celebrated with the escort of small boats or *Vallams*, which attracts a lot of tourists including foreigners. Kayamkulam backwater is situated towards the South - West region of the town, through which the National Waterway 3 (NW-3) passing, have a significant role in facilitating inland water transport. The Rajiv Gandhi Combined Cycle Power Plant is located near to the town.

2.3 Location and Regional Settings

Haripad town, situated in Karthikappally Taluk of Alappuzha district, is located at 9°18′0″N Latitude and 76°28′0″E Longitude, between Alappuzha and Kollam along National Highway 66 (NH 66). It is situated at a distance of 32 km South of Alappuzha Town, 54 km North of Kollam, 84 km from Kochi, and 125 km North of Thiruvananthapuram. The town is well-

connected by all means of transport, with its railway station serving as a significant transport hub. The town is situated approximately 8 to 10 km East of the Arabian Sea, with Arattupuzha being the nearest coastal area along the Alappuzha district coastline.

The town shares its borders with Pallippad Grama Panchayat to the East, Kumarapuram Grama Panchayat and Danapady- Karthikappally Thodu to the West, Veeyapuram and Cheruthana Grama Panchayats to the North, Cheppad, Chingoli and Karthikappally Grama Panchayats to the South.

Haripad is also located near the Achankovil River, which flows approximately 3 to 5 km East of the Municipality. Furthermore, the Pamba River Basin influences the region, although the main course of the Pamba River is situated about 15 to 20 km Nort-East of the Municipality.

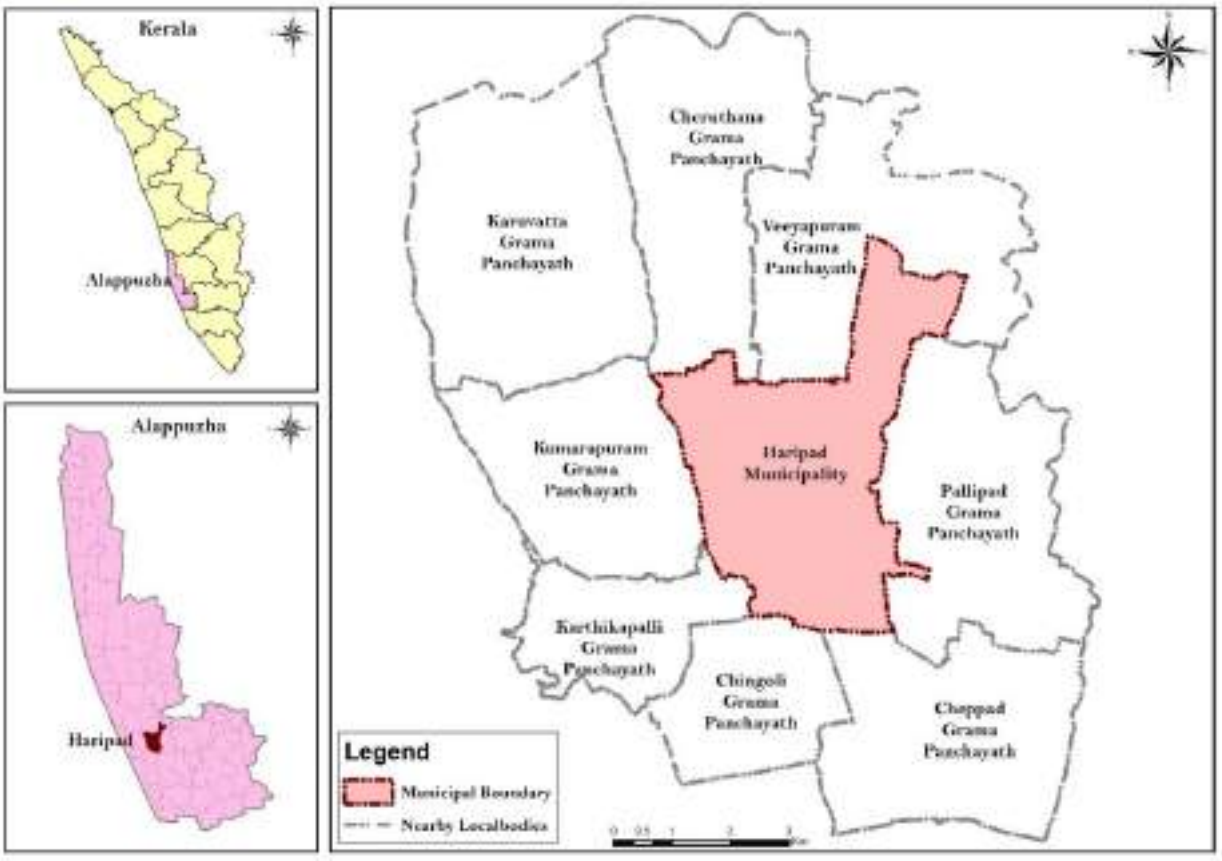


Figure 2.1 : Map showing the location & Surrounding Panchayats of Haripad Municipality

2.3.1 Regional Connectivity

Haripad town is well-connected to other towns regionally through various modes of transportation. The National Highway 66 (NH 66), passing through the town center provides seamless connectivity to major towns such as Alappuzha, Kochi, and Thiruvananthapuram, and is linked to nearby towns through well-maintained roads. The Haripad Railway Station, located on the Southern Railway line, offers connectivity to key destinations across Kerala and other parts of India. The town is in proximity to Cochin International Airport (117 km) and Trivandrum International Airport (114 km), ensuring robust air connectivity. The public transportation, including services operated by the Kerala State Road Transport Corporation (KSRTC) and private operators, further enhances the regional connectivity.

2.3.2 Road Network

The central area of Haripad is encircled by a grid-pattern of road network consisting of National Highway No. 66 (Panvel-Kochi-Kanyakumari Highway), a road branching off from Madhava Jn to Veeyapuram, another road linking from Mannarasala temple to Pallippadu via Town hall Jn, Ezhikkakathu and road from Ezhikkakathu to KSRTC Jn on NH 66. There are also several link roads connecting Haripad to various places like Veeyapuram, Pallippadu, Kollam, Karthikappally, Alappuzha and Mannarasala Temple. Four major junctions in the central area of Haripad town are (i) Taluk Hospital Jn and (ii) Madhava Jn on NH 66, (iii) Town Hall Jn and (iv)Ezhikkakathu Jn on Mannarasala – Pallippadu road. The road network in town is in the form of grid or blocks running perpendicular to each other thus forming a grid. NH acts like the centre back bone of grids and other roads forms the vertebra of the grid.

2.3.3 Railway

The Haripad Railway Station is a small railway station located within the Municipality, along the Kayamkulam–Ernakulam railway line under the Southern Railway zone of Indian Railways. Positioned near NH 66, the station provides efficient road and rail connectivity. It connects towns such as Thiruvananthapuram, Kochi, Kottayam, and Kozhikode, supporting both passenger and freight transport.

2.3.4 Air Transport

Thiruvananthapuram and Cochin International Airports are situated at a distance of 116 km and 114 km respectively from the Haripad Town.

2.3.5 Water Transport

Haripad is located near the National Waterway 3 (NW-3), also known as the West Coast Canal**,** which is a significant part of India's National Waterway network**.** NW-3 runs parallel to the Kerala coast, covering a stretch of 205 km from Kottappuram to Kollam, facilitating cargo movement and passenger transport. Haripad benefits from its proximity to the Kayamkulam–Alappuzha stretch of this waterway, providing an alternative transport mode for goods and tourism. The Kayamkulam backwaters**,** near Haripad, also connect to other inland water routes, supporting regional water transport.

2.3.6 Hierarchy of Settlements

As per the District Urbanization Report prepared by the Town & Country Planning Department in 2012, the then Haripad Panchayat is classified as a Third-Order Settlement. The hierarchy of settlements is observed to be closely associated with connectivity, as higher-order facilities tend to be established in areas with superior accessibility. Alappuzha Municipality is the First-Order Settlement in the District, since National Highway (NH-66) and State Highways (SH-11, SH-40, and SH-66) traverse through the town. All other Second-Order and Third-Order Settlements in the district are located along either the National Highway or State Highways.

2.3.7 Hierarchy of nodes

Nodes consist of junctions formed by the intersection of two or more roads, along with the surrounding activity zones. A node functions as an activity zone and holds significant importance in the physical development of a settlement. Figure 2.2 shows the hierarchy of nodes within the district, as per the District Urbanization Report. The spatial distribution pattern of nodes indicates that each Grama Panchayat contains at least one higher-order node, which serves the entire Panchayat, along with multiple lower-order nodes catering to their immediate surroundings. Danapady is the node identified as per the District Urbanization Report prepared by the Department in 2012, and it is classified as a Third-Order node.

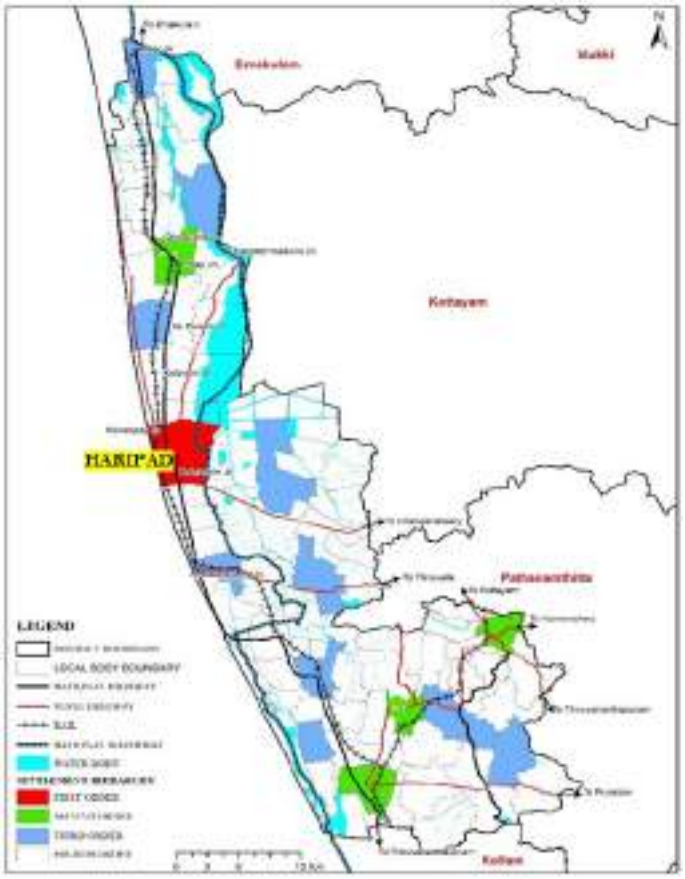


Figure 2.2 : Existing Hierarchy of Settlements in Alappuzha District
(District Urbanization Report, 2011)

2.4 History

2.4.1 Socio Cultural History

Haripad, located in the Alappuzha district (formerly part of Kollam district), is celebrated for its rich cultural, historical, and religious significance. The name "*Haripad*" is believed to have originated from two theories: one linking it to its pivotal role in rice cultivation being a major supplier of rice, thus "*Arippad*" and another suggesting it is a Malayalam adaptation of "*Harigeethapuram.*"



Figure 2.3 : Haripad Shree Subrahmanya Swamy Temple

The town is home to the Sree Subrahmanya Swamy Temple (Figure 2.3), which is one of the oldest temples in the town. It is notable as one of the few temples in India where the temple flag is hoisted three times annually for different festivals. It also houses more than 25 prominent places of worship, including the renowned Mannarasala Sree Nagaraja Temple (Figure 2.4), a major center for serpent worship. The *Payippad Jalotsavam (Figure 2.5)*, a celebrated water festival, commemorates the grand journey of the Subramanya idol from Kandalloor to Haripad, attracting both domestic and international visitors. The Aranazhika Temple, established at

Nelpurakadavu the site where the idol bearers paused during their journey stands as a tribute to this historic event.



Figure 2.4 : Mannarasaala Temple

Haripad has made immense contributions to Kerala's artistic and cultural heritage, producing legendary figures across the 64 classical arts, including Sri Kochupillai Warrier (guru of Swathi Thirunal), Sri Ramankutty Bhagavathar, Malabar Gopalan Nair, Kamalakshiyamma, Haripad Gopinath, and K.R. Haripad, who pioneered the transition from Harikatha to Kathaprasangam. Scholars like Sheshadri Iyer, who mastered over 18 languages, have further elevated Haripad's reputation nationally and internationally.

In earlier times, Haripad's society was predominantly composed of Brahmin, Ambalavasi, and other Hindu communities. During the monarchy, social hierarchies, and caste-based discrimination, including untouchability during temple feasts, were prevalent. However, Haripad was also home to progressive thinkers who challenged these barriers. Institutions like Shanmugha Vilasam High School, initially restricted to certain communities, eventually gave way to inclusive establishments such as Haripad Government High School (B.H.S.). Educational institutions like the Mannarasala Sanskrit School and the Ayurveda College attracted students from across Kerala, strengthening Haripad's role as a center of learning.



Figure 2.5: Payippad Jalotsavam

Today, Haripad continues to embody religious harmony, having historically witnessed minimal caste, religious, or political conflicts. The town's Muslim and Christian institutions historically maintained close associations with the Haripad temple, reinforcing the region's enduring tradition of unity. Palaces, temples, educational institutions, and cultural centers across Haripad stand as living monuments to its illustrious past, while its streams, paddy fields, and sacred groves preserve the timeless beauty of rural Kerala. Haripad thus remains a beacon of Kerala's cultural, historical, and social evolution, harmoniously blending tradition with progress.

2.4.2 Administrative History

The administrative prominence of Haripad dates back centuries, serving as the headquarters of Karthikappally Taluk. Key institutions such as the Taluk Office, Munsiff Court, Magistrate Court, Treasury, Police Station, Post Office, and Sub-Registrar Office were all established within a single compound - an administrative distinction that even many modern districts lack today. Haripad is often associated with names like "*Harithageethapuram*" and "*Arippadu*," as referenced in the works of Kerala Varma Valiya Koil Thampuran and Swathi Thirunal

Maharaja. Its legacy as a granary during the Travancore monarchy is evident from place names such as Nelpurakadavu, Kuttan Nellakal, and Danappadi.

Before independence, in 1921, Haripad was a Municipal Town under Travancore Regime. However, following public petitions citing heavy taxation, it was later downgraded to a Conservancy Town. The town's jurisdiction once stretched from Kumarapuram Kuttam Kaitha in the west to Pallippad Anjilimoodu in the east, and from Karichal in the north to Karthikappally Junction in the south. Over time, regions such as Pallippad and Veeyapuram emerged as separate villages. Historical records show that V. Ramakrishna Panicker served as the first Municipal President from 1928 to 1934, and several developments, including the installation of a lamp post at Nelpurakadavu, took place during his tenure. The Haripad Panchayat was eventually formed by combining Kizhakkekara and Haripad villages, with Sri M.G. Narayanan Namboothiri of Mannarasala Illam serving as its first president, in 1954.

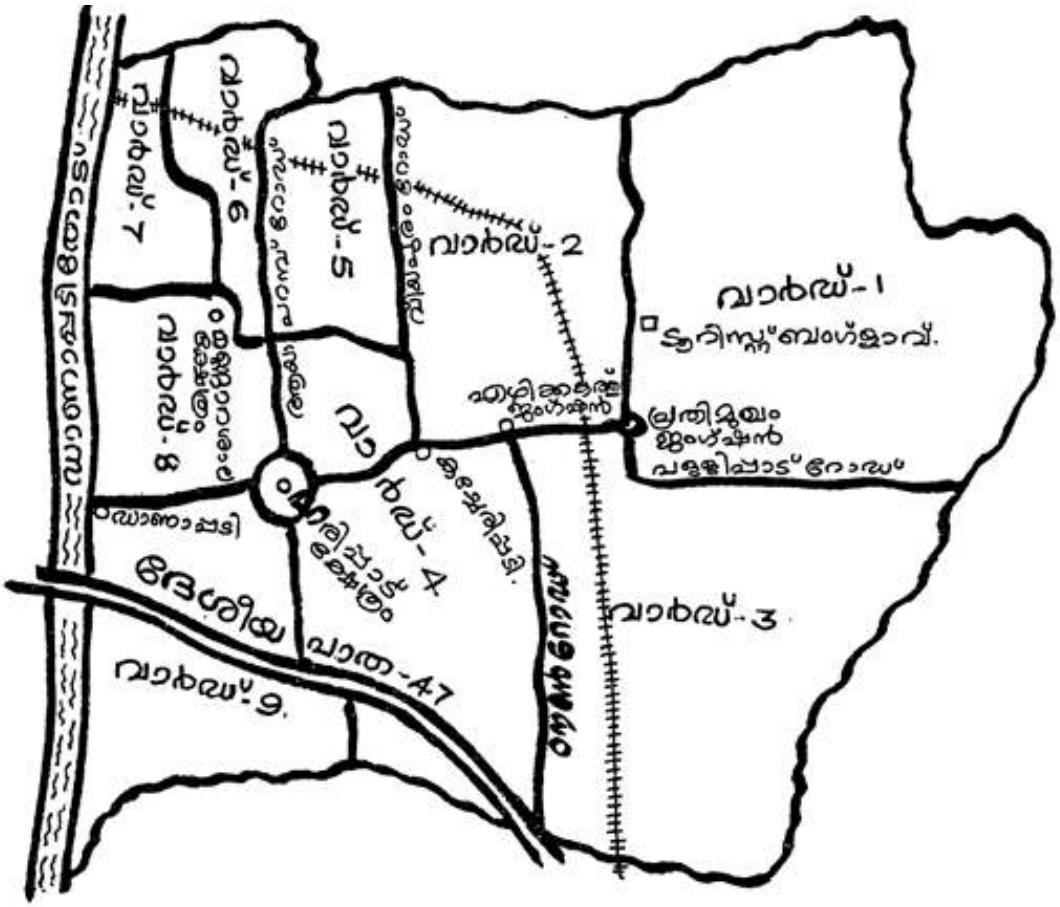


Figure 2.6 : Haripad in 1996 (Samagra Vikasana Rekha, 1996)
(Map of the Panchayath before 2015)

2.5 Area and population

Haripad Municipality have an area of 16.34 sq.km, covering Haripad, Chingoly, Pallippad, Karthikappally and Veeyapuram villages of Karthikappally Taluk (Figure 2.7). As per 2011 Census, the then Panchayth had a population of 15588 with density 1631 persons per sq.km. As per the 2011 Census-based population projection, the total population of Haripad Municipality is 31,151, comprising 14,522 males and 16,628 females. The entire Haripad village falls within the planning area, whereas only portions of Karthikapally, Pallipad, and

Chingoli villages are included. In the case of Veeyapuram village, only a few survey numbers are part of the planning area.

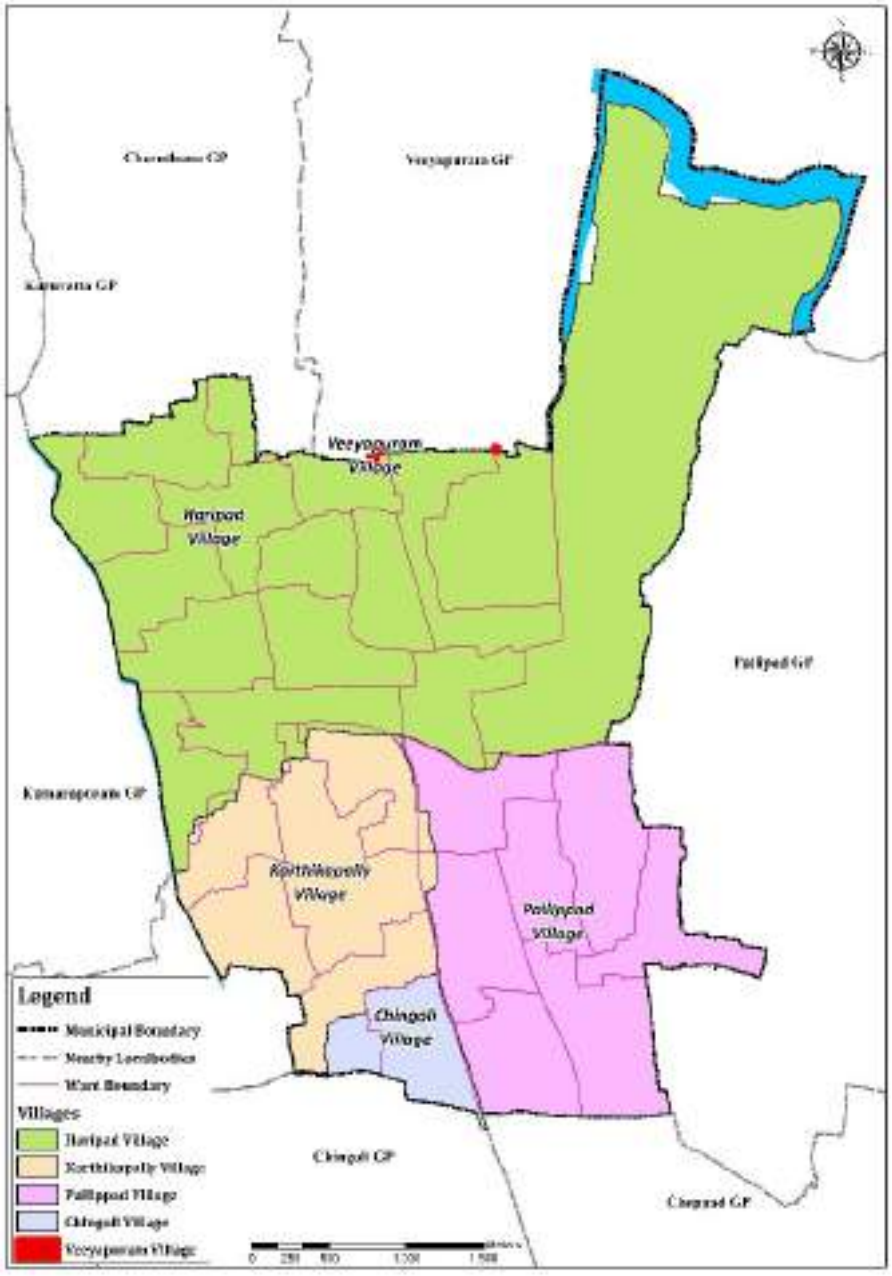


Figure 2.7 : Map Showing the Villages included in Haripad Municipality

2.6 Climate

Haripad, situated in the Alappuzha district of Kerala, has a tropical monsoon climate, characteristic of the state's coastal regions, influenced by its proximity to the Arabian Sea. Summers are hot, with temperatures ranging from 28°C to 36°C, moderated by coastal winds. Winters (December to February) are mild and pleasant, with temperatures between 22°C and 32°C. The region receives an average annual rainfall of 1,500 mm to 2,500 mm, primarily from the South -West Monsoon (June to September) and the North-East Monsoon (October to November). Generally, March, April months are hottest and December, January months are coldest. Haripad experiences two distinct seasons - wet and dry - based on monsoonal

variations. Humidity remains high throughout the year, typically ranging between 70% and 90%, with peak levels during the rainy season.

2.7 Physiography

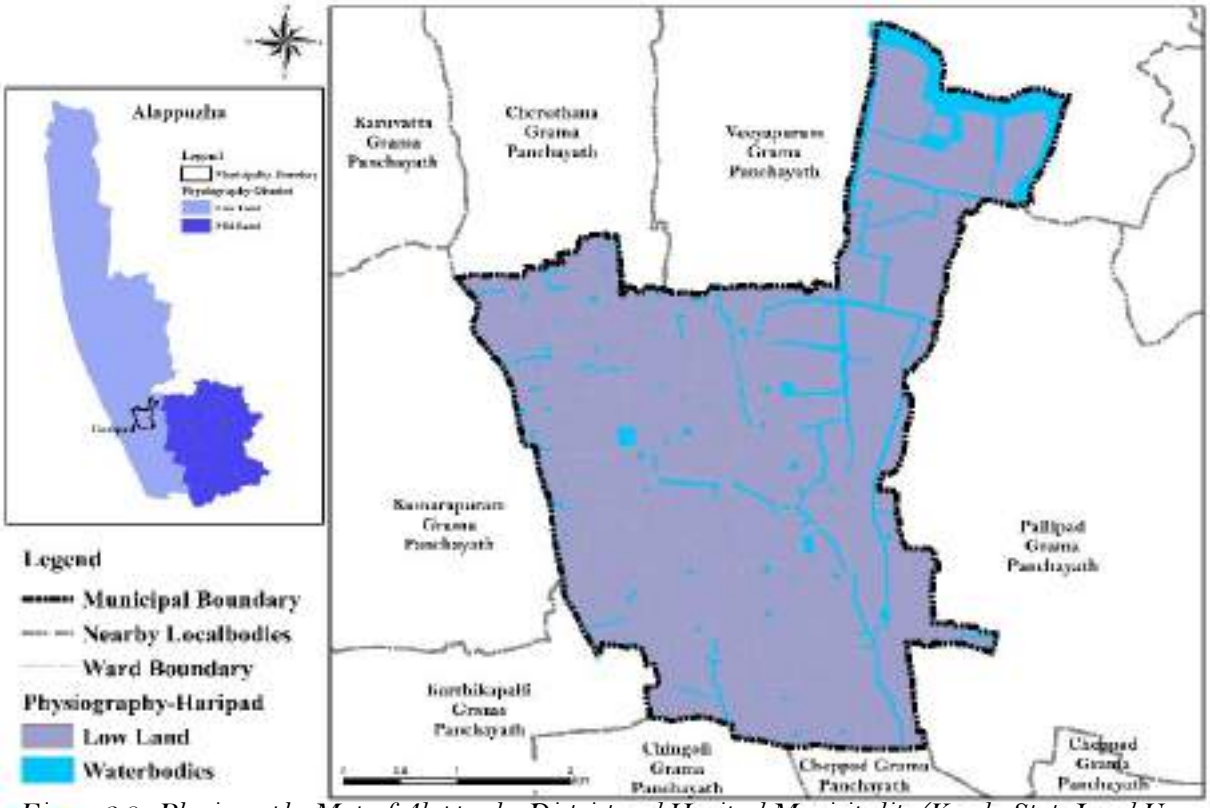


Figure 2.8 : Physiography Map of Alappuzha District and Haripad Municipality (Kerala State Land Use Board)

Even though the entire Kerala is divided into three regions, based on the physiographic nature, the Alappuzha District falls under three sub micro regions Aleppey coast, Kuttanad low lying plain and Chengannur rolling plain (kslub.kerala.gov.in). A part of the Karthikappally taluk falls under Alleppey coast region, which is a low-lying land having marshy areas in some places. In this region, the height of the land is very low even below the Mean Sea Level (MSL) in some areas. A part of the Karthikappally Taluk is also included in the Kuttanad low lying plain. This region is a basin between the coast and its eastern plain. In many places the height is lower than the MSL. These are kole lands and it is highly influenced by the Vembanad lake.

Haripad town lies within the coastal plain of Kerala, characterized by low-lying terrain and sand and silt accumulations. The region is part of the Onattukara belt, known for its fertile sandy loam soil, which supports agriculture. The town's topography is predominantly flat, with a gradual slope towards the West, leading to the Arabian Sea. The area is intersected by numerous canals and backwater systems, contributing to its hydrological significance.

2.8 Soil

The soil texture of the town is predominantly sandy, with a low water-holding capacity and a slightly acidic nature (pH < 6.5). The soil composition varies from loamy sand to sandy loam, characterized by a low organic matter content and deficiency in essential plant nutrients.

Riverine alluvium soils are found along the river valleys, exhibiting significant variations in physico-chemical properties, depending on the nature of the deposited alluvium and the

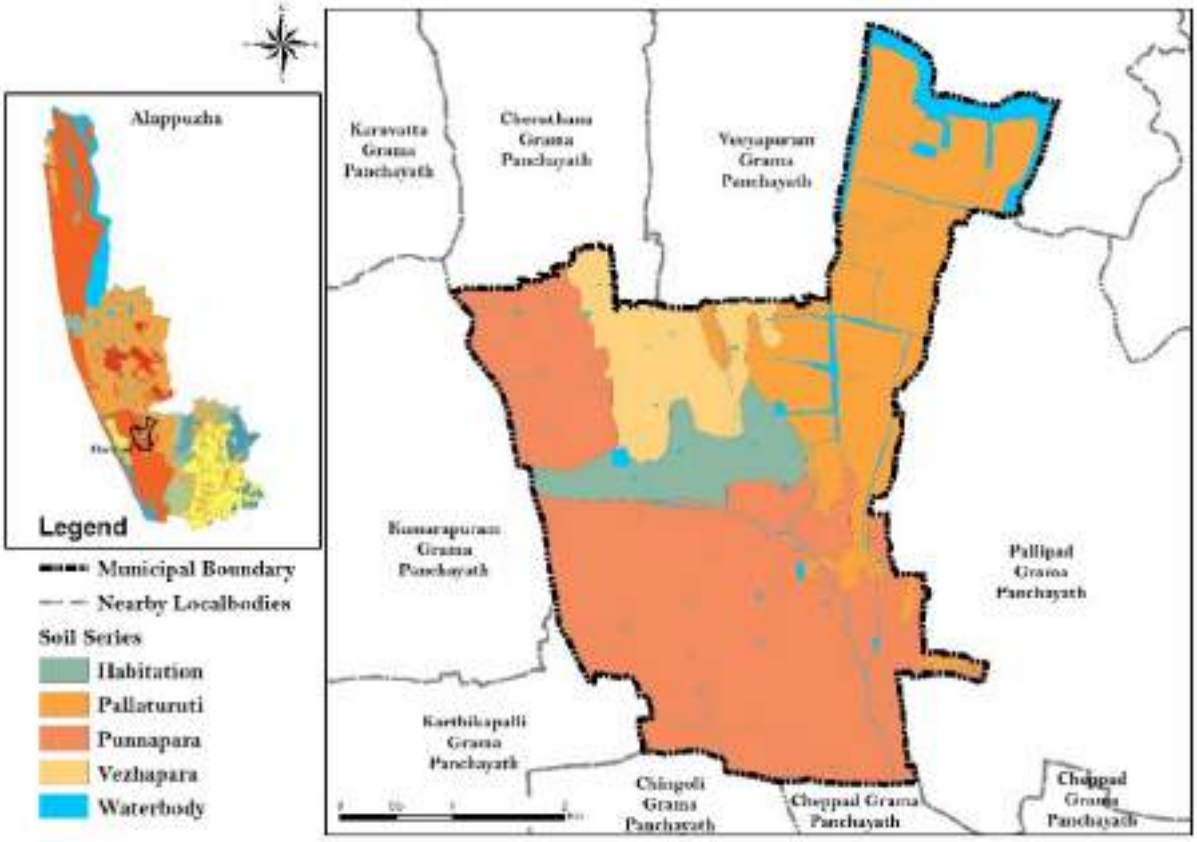


Figure 2.9 : Soil Map of Haripad Municipality (Kerala State Land Use Board)

characteristics of the catchment area of the Achankovil river. The texture of these soils' ranges from sandy loam to clay loam at the north eastern paddy fields, and they are known for their high water-retention capacity and rich nutrient content, making them suitable for agriculture. The data provided by the Kerala State Land Use Board shows the soil series for Alappuzha district from which the soil series data for Haripad town was extracted (Figure 2.9). (DPR on Comprehensive Sewerage Scheme for Haripad Municiaplity in Alappuzha - Phase I, 2022)

2.9 Biodiversity

Haripad, situated within Kerala's rich ecological zones, is a vibrant area teeming with biodiversity across its wetlands, backwaters, and paddy fields. This region's landscapes support diverse flora and fauna, each playing a critical role in maintaining environmental balance and enriching the local ecosystem.

The vegetation in Haripad includes expansive rice paddies, coconut groves, and cash crops such as banana, pepper, and cashew. Additionally, Haripad's well-known Mannarsala Nagaraja Temple, surrounded by dense groves, serves as a sanctuary for various snake species, reflecting the cultural and ecological significance of wildlife in the area.

The nearby Kayamkulam backwaters enhance the local wetland ecosystem, supporting fisheries and sustaining livelihoods. These areas also control flooding, purify water, and provide essential breeding grounds for aquatic life. Traditional paddy fields and vegetable cultivation contribute to agricultural biodiversity, preserving native seed varieties and supporting a range of organisms like frogs and insects that naturally enhance soil fertility.

Despite its ecological wealth, Haripad faces challenges from urban development, pollution, and habitat fragmentation. Protecting its wetlands, promoting organic farming, and conserving sensitive habitats are crucial to preserving its unique biodiversity. Haripad exemplifies how a region can harmonize traditional practices with biodiversity conservation, benefiting both the environment and local communities.

2.10 Geomorphology

A significant portion of the district comprises coastal plains characterized by landforms of marine, fluvial, and fluvio-marine origin. The district features the widest coastal plain in Kerala, particularly in the Ambalappuzha-Thiruvalla and Haripad-Chengannur sections, where it extends up to 35 km in width.

The low-lying region near the mouths of the Pamba and Achankovil rivers has facilitated the development of a well-defined distributary system and delta formation. In contrast, the eastern part of the district transitions into the midland region, characterized by small laterite-capped hillocks and narrow valleys.

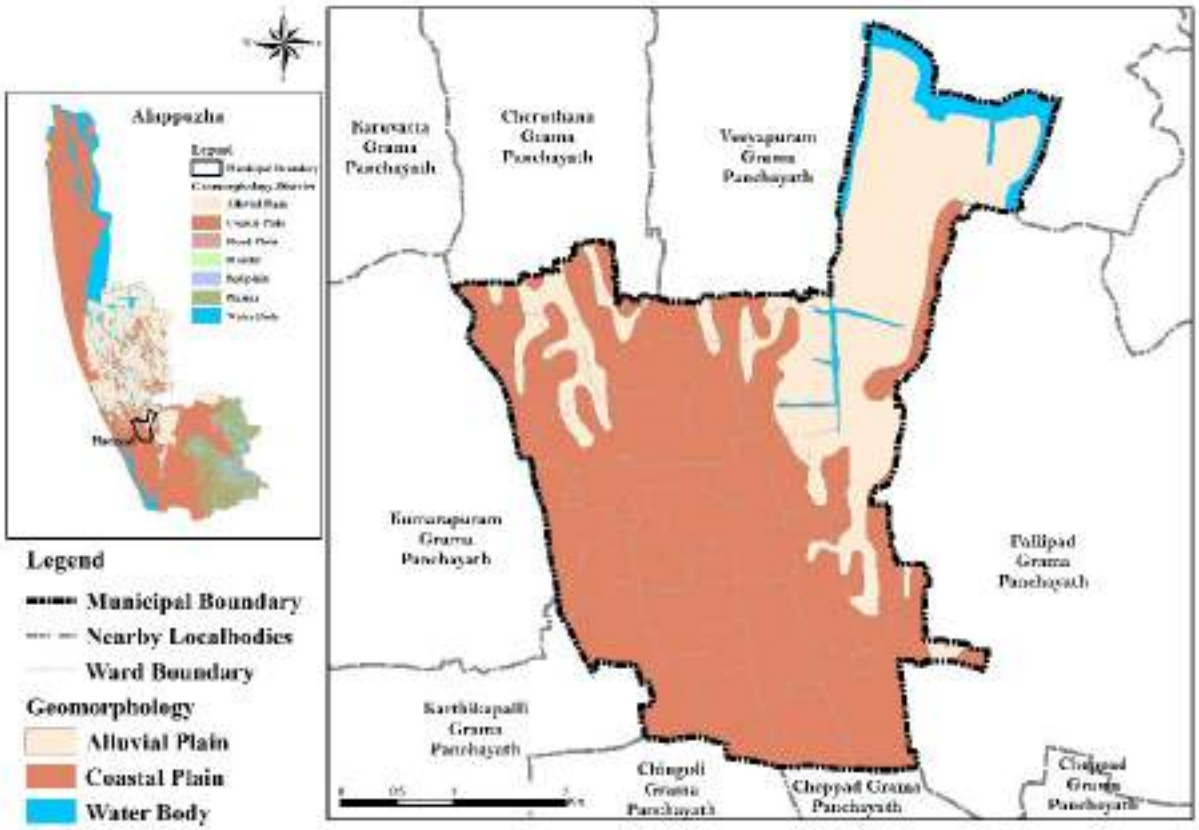


Figure 2.10 : Geomorphology Map of Haripad Municipality
(Source: Generated from the data from Kerala Land use Board, 2025)

2.11 Geology

The geology of Alappuzha district is characterized by diverse rock formations and sedimentary deposits. The oldest formations belong to the Khondalite group, comprising quartzites and garnet-biotite-sillimanite gneiss, mainly in the southeast. Charnockite rocks of acidic to intermediate varieties occur in the northeast, while small occurrences of Migmatite, represented by biotite gneiss, are found along the eastern margin. A significant granite

intrusion is present near Chengannur. The southern and western hills are capped by Tertiary Warkalli Formation sediments. The Kuttanad lowland, spanning about 100 sq. km, is notable for its semi-carbonized wood material - locally called Karipadams - embedded beneath carbonaceous clay, along with other Quaternary deposits such as paleobeach, fluvial, tidal/mudflat, and beach sediments.

According to the District Survey Report of Minor Minerals (Department of Mining and Geology, November 2016), the geology of Haripad consists of sandy to sand–silt–clay admixtures, with a gradual transition from west to east. The northeastern paddy fields are predominantly composed of this sand–silt–clay mix, which exhibits high water-retention capacity due to the presence of mudflat deposits from the Achankovil River.

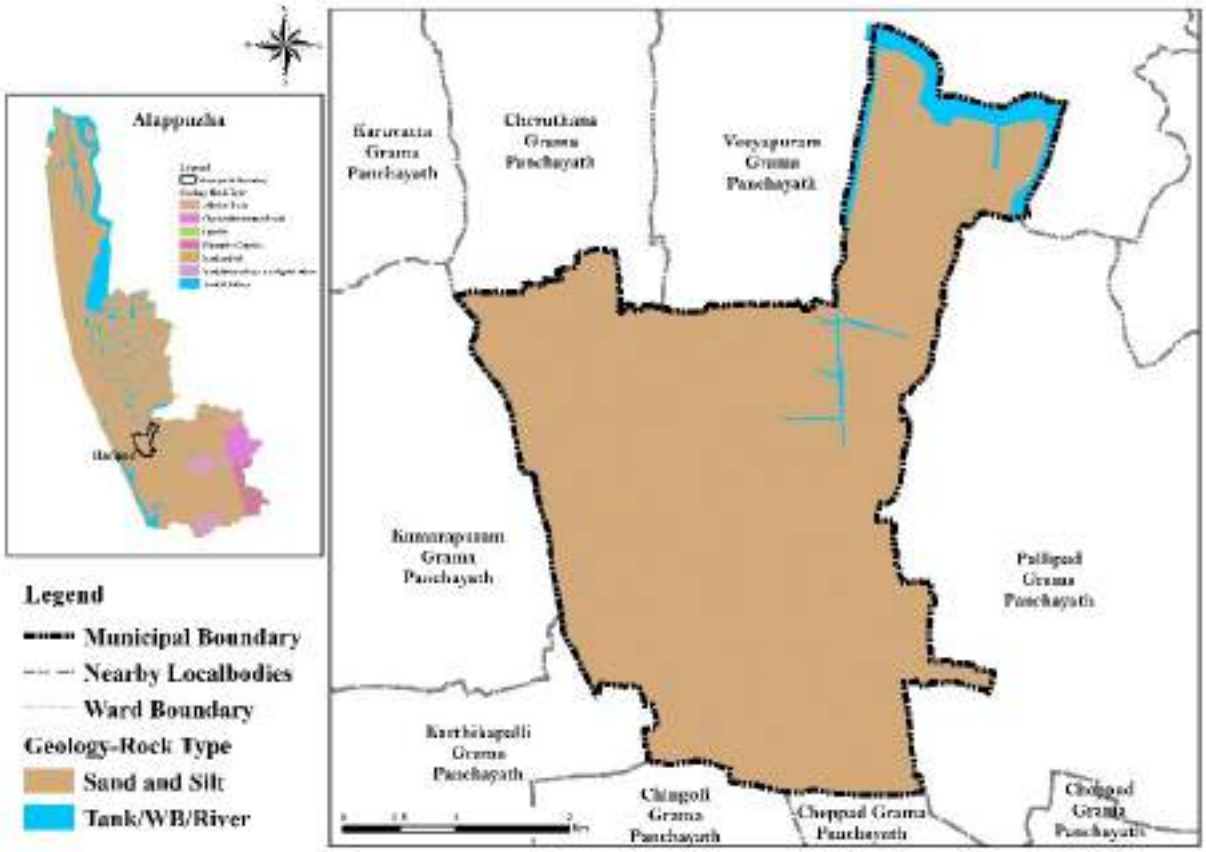


Figure 2.11 : Geology Map of Haripad Municipality
(Source: Generated from the data from Kerala Land use Board,2025)

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CHAPTER
03

DEMOGRAPHY



Demographic analysis examines the population structure, distribution and growth dynamics of Haripad, providing insights into key factors such as age composition, gender ratio, household size, income levels and migration trends. This assessment is crucial for understanding the town's evolving social and spatial characteristics and the factors influencing population change. Within the Master Plan, demographic analysis forms the basis for planning infrastructure, housing and social amenities, ensuring Haripad is equipped to meet the needs of its residents while accommodating sustainable growth in line with district and state trends.

- Introduction
- Population and its Growth Pattern
- Population Density
- Population Growth Rate
- Population Concentration
- Sex Ratio
- Age Structure
- Literacy
- Size of Households
- Social Composition
- Migration
- Effect of Hazard Risk
- Inference

3. DEMOGRAPHY

3.1 Introduction

The concept of decentralized planning allows people to directly engage in the development process, resulting in inclusive planning and direct benefits to the common populace. To achieve effective participatory planning, it is essential to analyse demographic factors such as population size, growth rate, density, distribution patterns, migration trends etc. Understanding these demographic characteristics is crucial in all stages of the preparation of a Master Plan. This chapter focuses on demographic analysis to assess the population dynamics by understanding the size, status, and behaviour of the population.

3.2 Population and its Growth pattern

As per Census 2011, the population of Kerala was 33,406,061, representing 2.76% of India's population, though the geographical area of the state is only around 1% of the total area of the country. Alappuzha district has a total population of 2,127,789 accounts to about 6.37% of the state's population and ranking 9th in terms of population size. Alappuzha is the smallest district in the state in terms of area (3.64% of area of the state).

Since Harippad was a Grama Panchayath during the 2011 Census, population details of only Haripad Grama Panchayath is available. The Decadal variation of population of the Haripad Grama Panchayath and Alappuzha district as per Census 2011 is shown in Figure 3.1. It is seen that there is a steady growth, with its population increasing from 14,978 in 1991 to 15,588 in 2011.

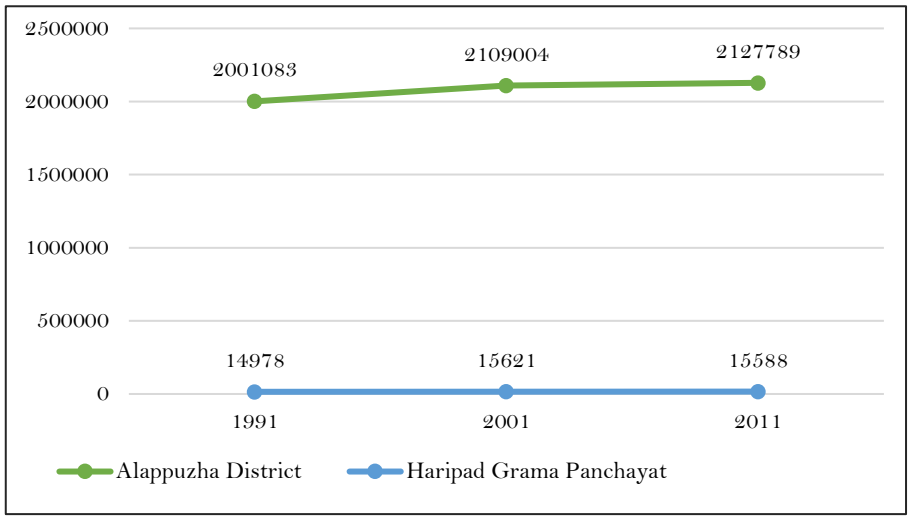

Figure 3.1 : Decadal variation of Population of Alappuzha District and Haripad Grama Panchayath
(Source: Census 2011)

As per the Government Order E.M 3/13(3)/2014/ LSGD dated 25/01/2015, Haripad Grama Panchayath having an area of 9.58sq.km was upgraded to a Municipality having an area of 16.34 sq.km with effect from November 1st of 2015 by incorporating the 6 wards (Ward no. 11,12,13,14,15,16) of Pallipad Grama Panchayath, 4 wards (Ward no. 6,7,8,9) of Karthikappally Grama Panchayath, 2 wards (Ward no. 6,7) of Kumarapuram Grama Panchayath and one ward (Ward no. 3) of Chingoli Grama Panchayath. Thus, the number of wards also increased from 9 to 29. This expansion of the town has led to a noticeable increase in the town's population and other demographic parameters.

The Grama Panchayath was upgraded to Municipality by combining some wards from the surrounding Grama Panchayaths on 2015, and there is no Census data after that. This

unavailability of census data of the whole town limits a demographic analysis of population trends in Haripad town. So, for demographic analysis, the Census 2011 population data of the newly incorporated wards are proportionately added to the population of Haripad Grama Panchayath. The population of the 29 wards of Haripad town was then calculated for the years 1981, 1991, 2001, and 2011 using the average of the population from the incremental increase method and the ratio method. As per this, the total population of the town is estimated to be 31,151 with 14522 males and 16629 females. This data is used for demographic analysis. As per the 'Vikasana Rekha of 2022-2027' published by the Municipality, the present total population of the town is shown as 30,977, comprising 14,333 males and 16,644 females.

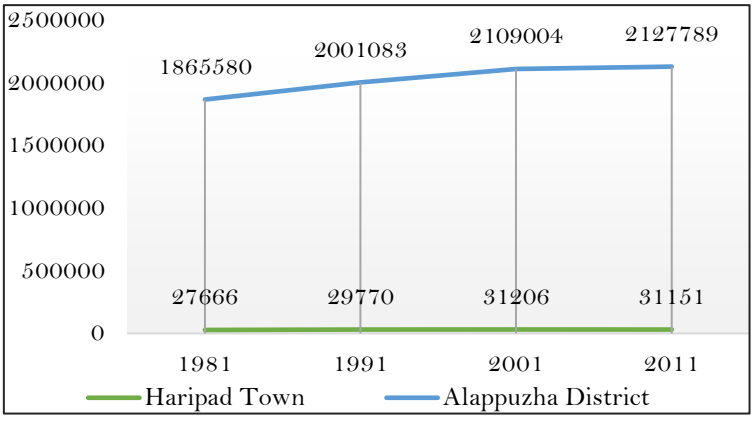

Figure 3.2 : Comparison of the Population of the Haripad Town with the District (Source – Census 2011)

The population of the town compared with the population of the district is shown in Figure 3.2. The Table 3.1 shows the population distribution of the Haripad town. The population size in the wards varies from 965 in Hospital ward to 1197 in Mambara ward. The spatial distribution is shown in Figure 3.3.

Table 3.1: Ward wise population of Haripad Town

Ward No.	Name	Population (2011)	Ward No.	Name	Population (2011)
1	Homoeo Dispensary	1134	**16**	Hospital	965
2	Thulamparambu North	1107	**17**	R K Junction	1059
3	Kilikkakulangara	1017	**18**	Nangiarkulangara	973
4	Thrippakkudam	1082	**19**	Mampara	1197
5	Thulamparambu Naduvathu	1076	**20**	Veterinary Hospital	1121
6	Nagari	1052	**21**	Thaikkoottam Lakshamveedu	1086
7	Aroor LPS	1073	**22**	Suresh Market	1065
8	Vathukulangara	1073	**23**	Vettuveni	1124
9	PHC	1072	**24**	D.K.N.M L. P School	1047
10	Mangamkulaangara	1083	**25**	KSRTC	1069
11	Pilappuzha South	1079	**26**	Town	1117
12	Nedunthara	1148	**27**	Thulamparambu South	1131
13	Triveni	1052	**28**	Danapady	1079
14	Eerickal	976	**29**	Mannarasala	1104
15	Manimangalam	990	**Total Population**		**31151**

Source: Census 2011

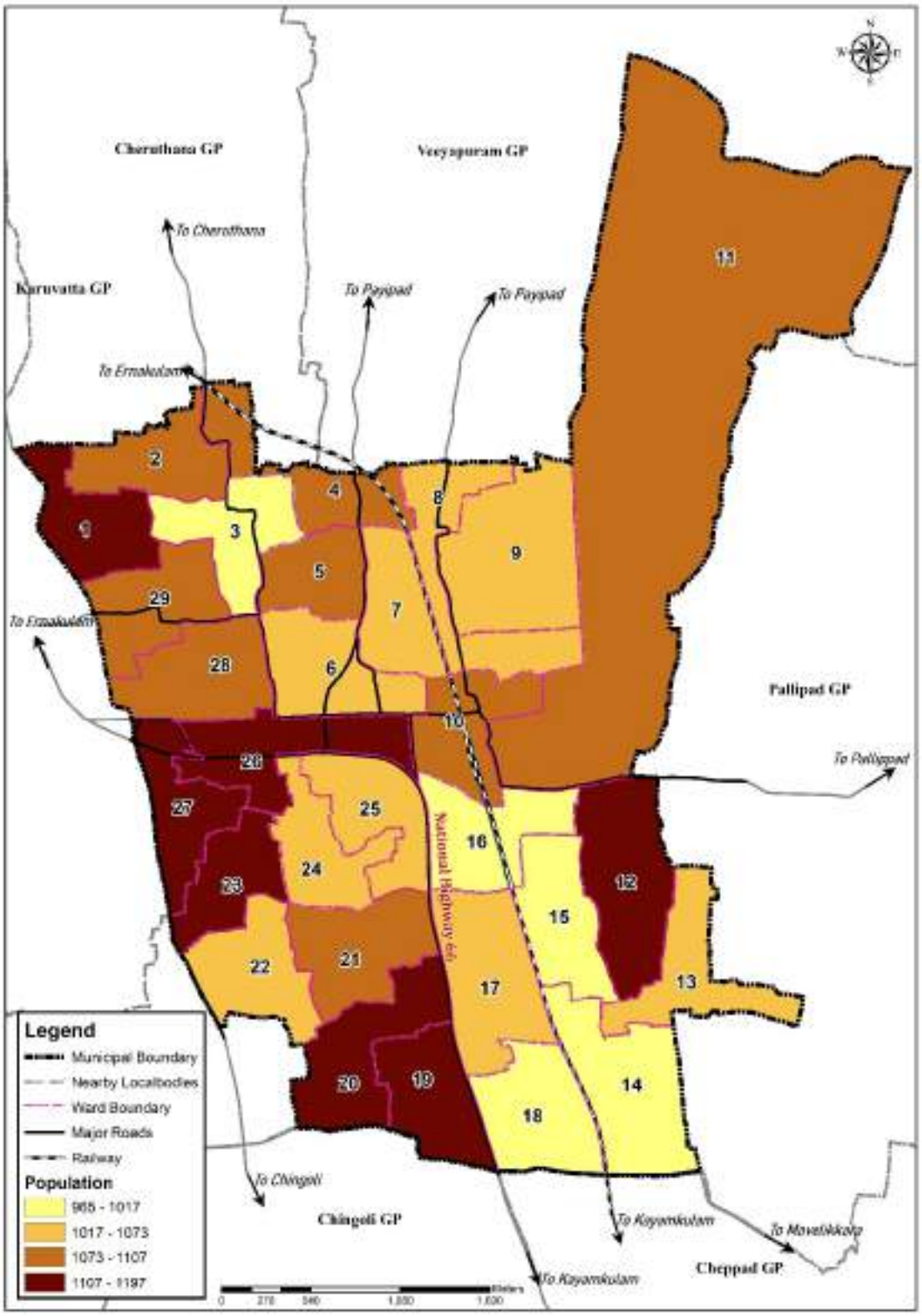

Figure 3.3 : Spatial Distribution of Population in Haripad Town

Comparison of population with surrounding Grama Panchayaths and other towns in the district are shown in Figure 3.4 and Figure 3.5 respectively. It is seen that Haripad town has higher population than Chengannur and Mavelikkara towns but lower population than Alappuzha, Kayamkulam, and Cherthala towns. Haripad town has the highest population among the surrounding Grama Panchayaths.



Figure 3.4 : Comparison of Population with surrouding Grama Panchayats



Figure 3.5 : Comparison of Population with other towns in the district

3.3 Population Density

As per Census 2011, the population density of Kerala is 860 persons per sq.km, and that of Alappuzha district is 1492 persons per sq.km. The density of Haripad town is 1916 persons per sq.km (total population is 31151 and area is 16.34 sq.km) which is more than the district and state. Compared to the state urban and district urban populations, Haripad town has a lower population density. The comparison is shown in Figure 3.6.

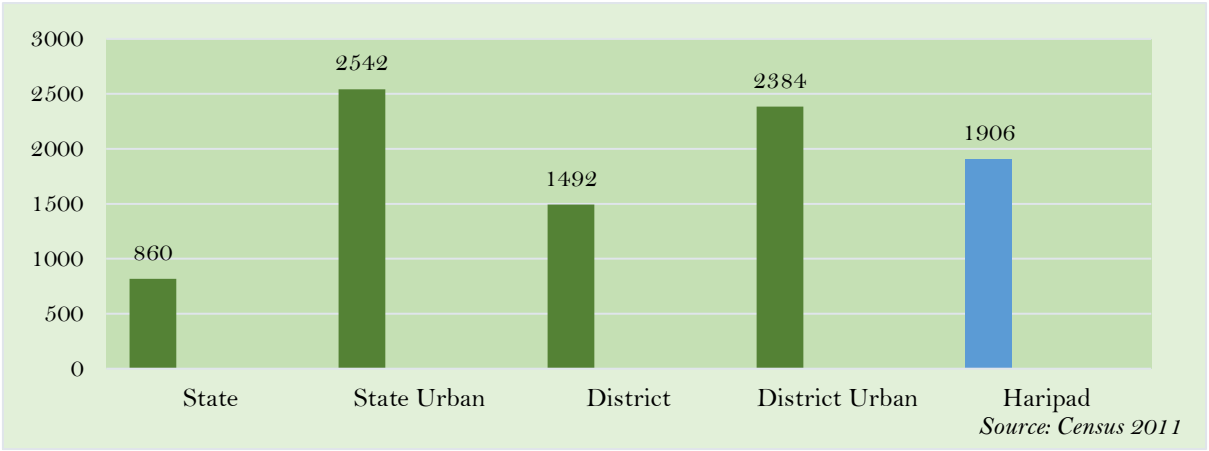

Figure 3.6 : Comparison of Population Density

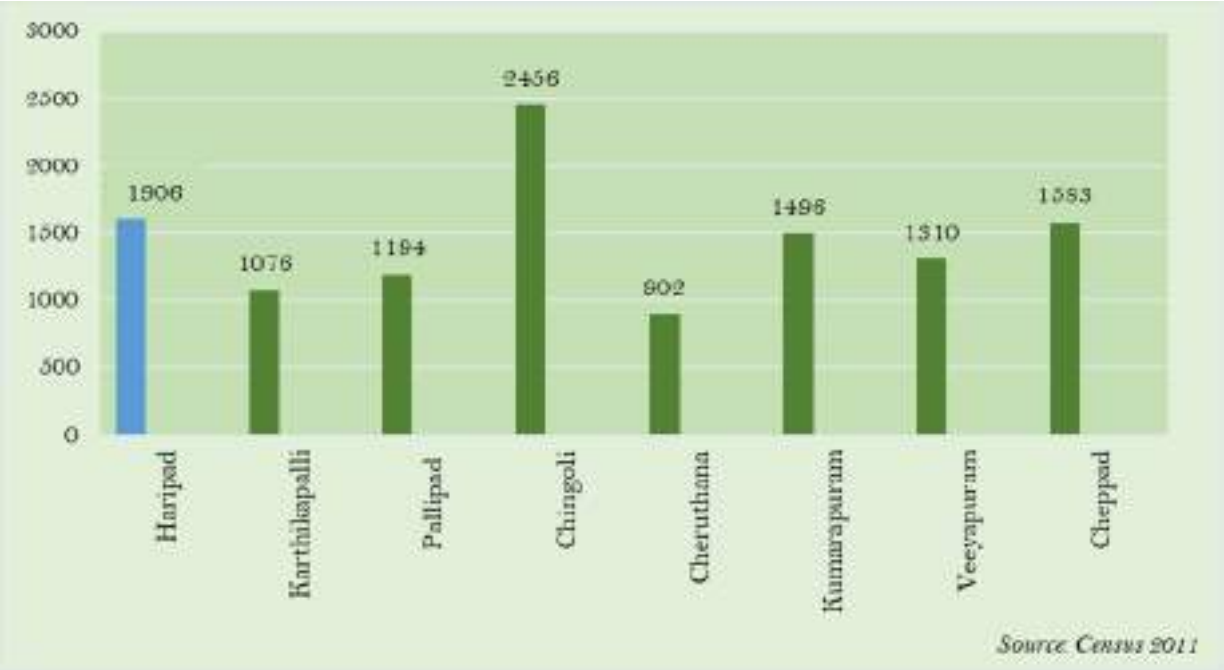

Figure 3.7 : Comparison of Population Density with surrounding Grama panchayaths

Comparison of population density of town with surrounding Grama Panchayaths and other town in the district are shown in Figure 3.7 and Figure 3.8 respectively. It is seen that town has lower population density than Chingoli Grama Panchayath but has a higher population density than other surrounding Grama Panchayaths. Haripad town has higher population density than Chengannur town and it is lower than all other towns in the district.



Figure 3.8 : Comparison of Population Density with other towns in the district

The population density of different wards of the town is shown in Figure 3.9. The ward wise population density varies from 253 to 3867 with Thulamparambu Nadavathu ward has the highest and Pillappuzha South ward has the lowest population density.

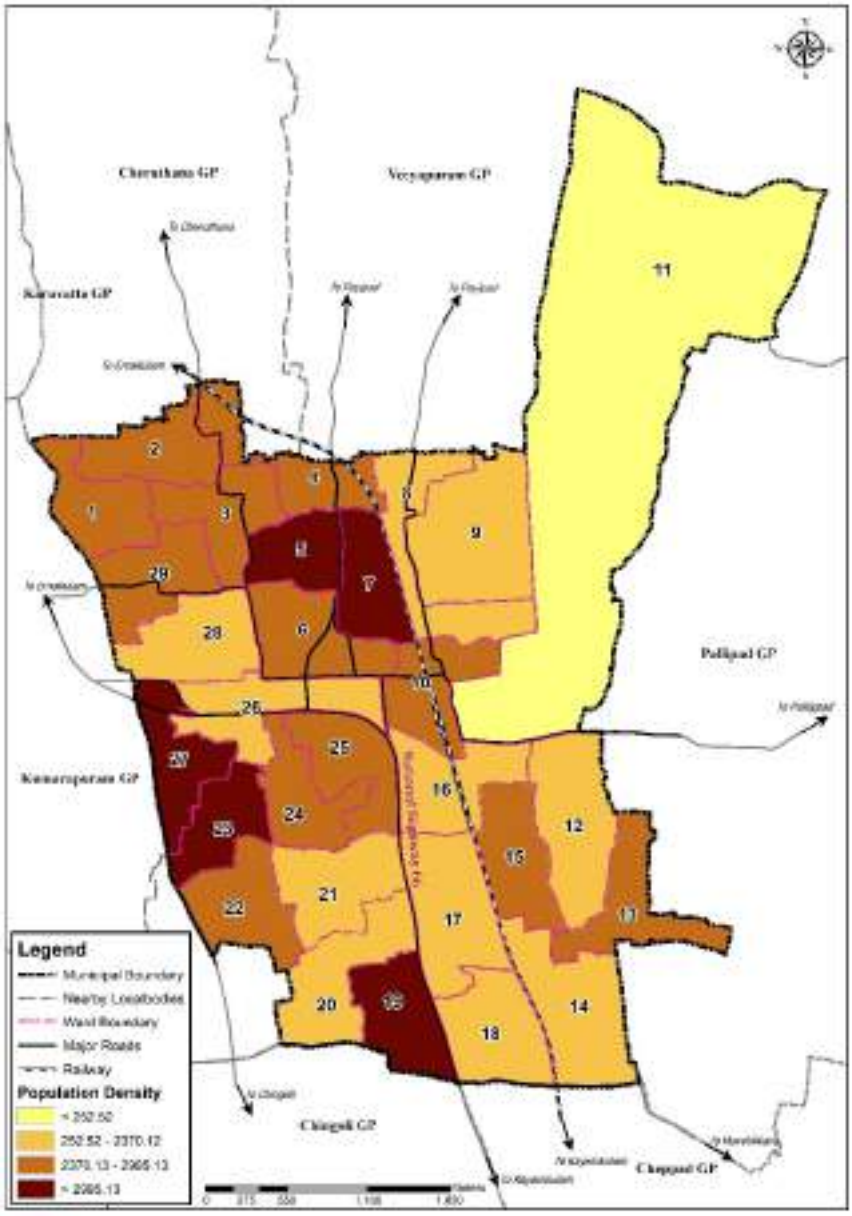

Figure 3.9 : Ward Wise Distribution of Population Density in Haripad Town

3.4 Population Growth Rate

Comparison of the population growth rate in Haripad town with Alappuzha district shows a declining trend from 1981 to 2011 as shown in Figure 3.10. Among the surrounding Grama Panchayaths, only Chingoli and Cheppad shows a positive growth rate, while all others have a declining trend as shown in Figure 3.11. All the urban local bodies in the district shows a declining population growth rate as shown in Figure 3.12.

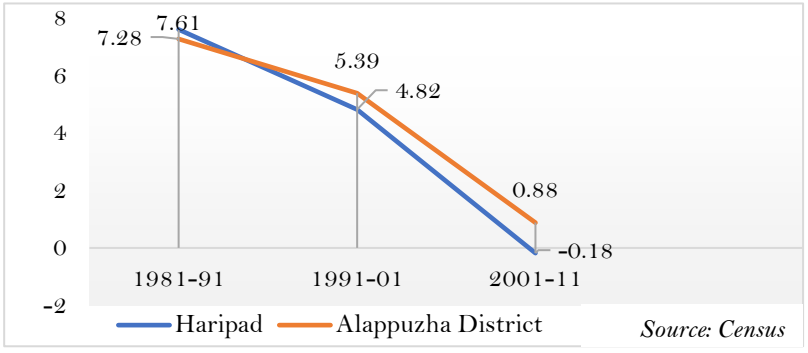

Figure 3.10 : Comparison of Population Growth Rate of Alappuzha District & Haripad Town

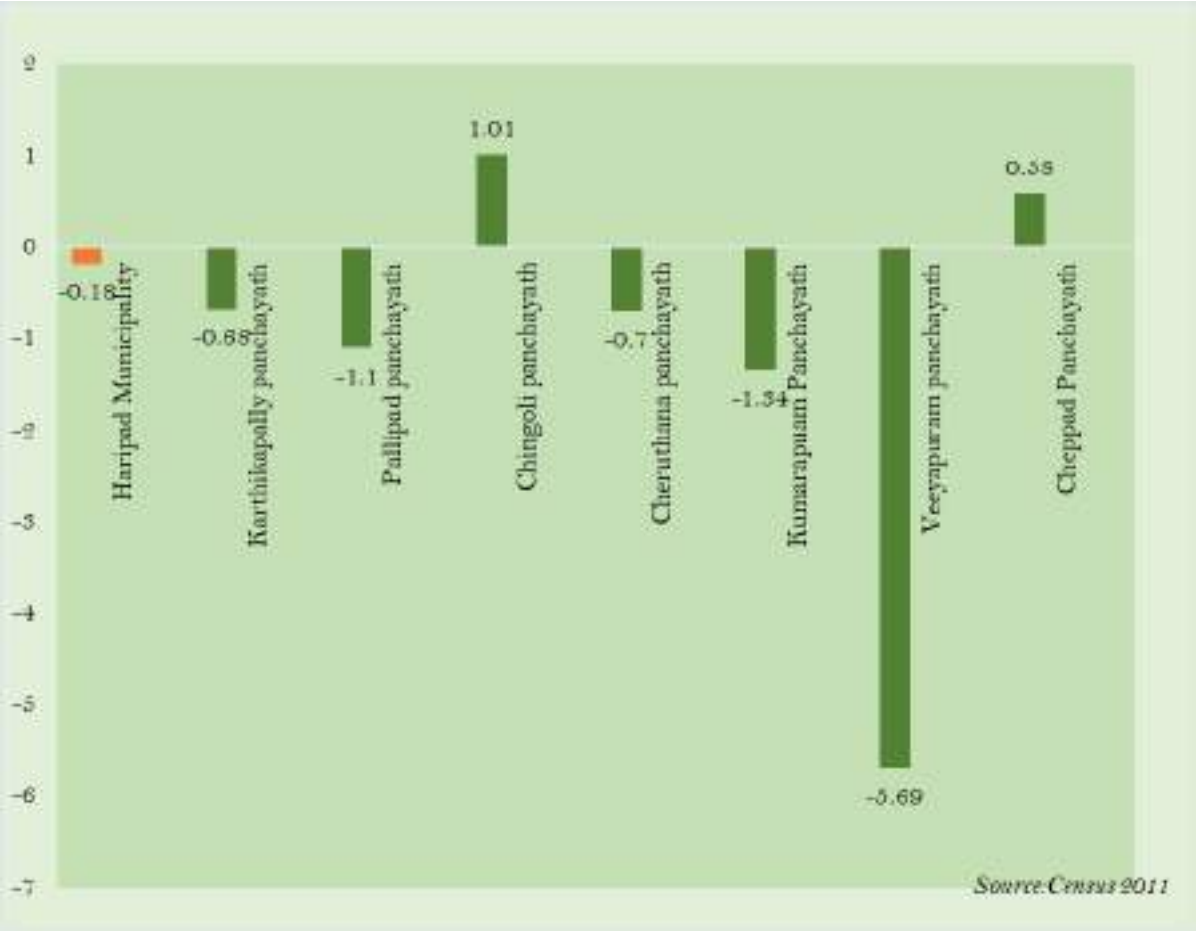

Figure 3.11 : Comparison of Population Growth Rate of Haripad Town with surrounding LSGIs

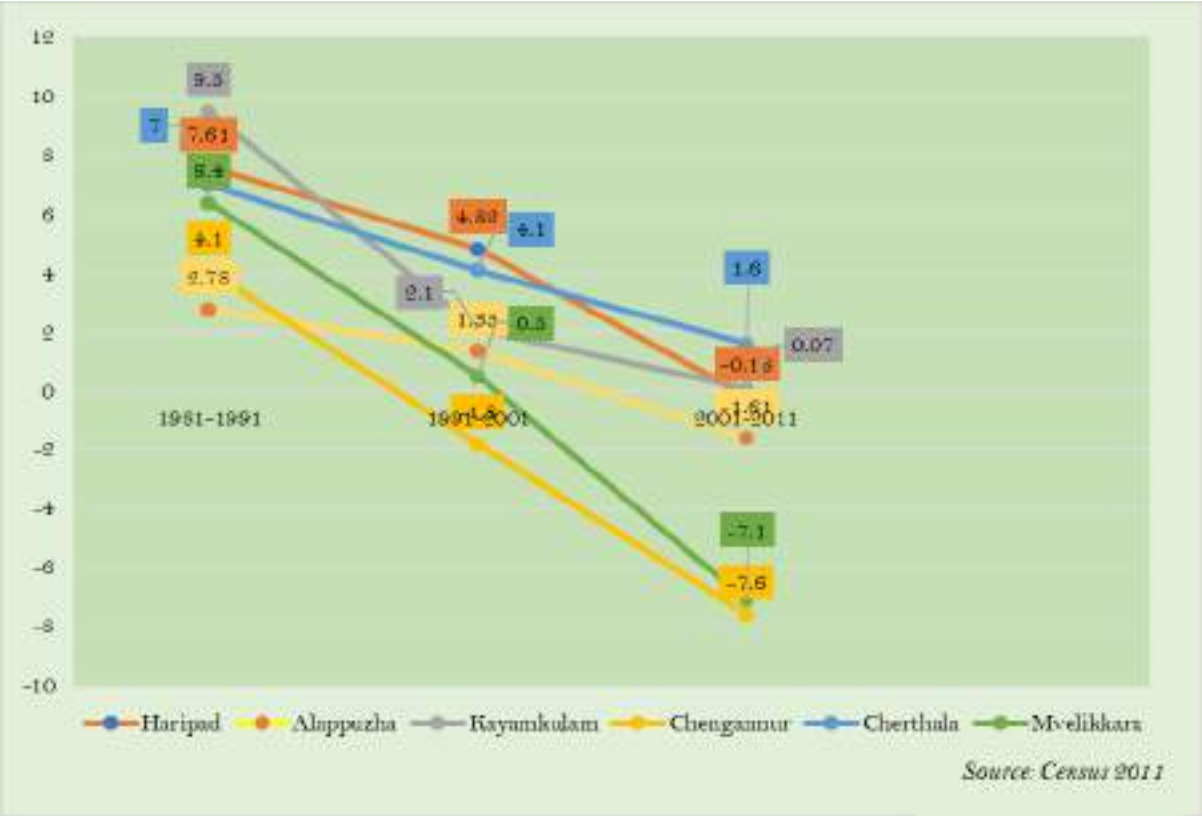

Figure 3.12 : Comparison of Population Growth Rate of Haripad Town with other urban centers in the district

3.5 Population Concentration

Population concentration maps are useful for identifying areas where the population is densely concentrated, allowing for strategic planning to divert population growth to less populated regions. The population concentration within the town is shown in Figure 3.13.

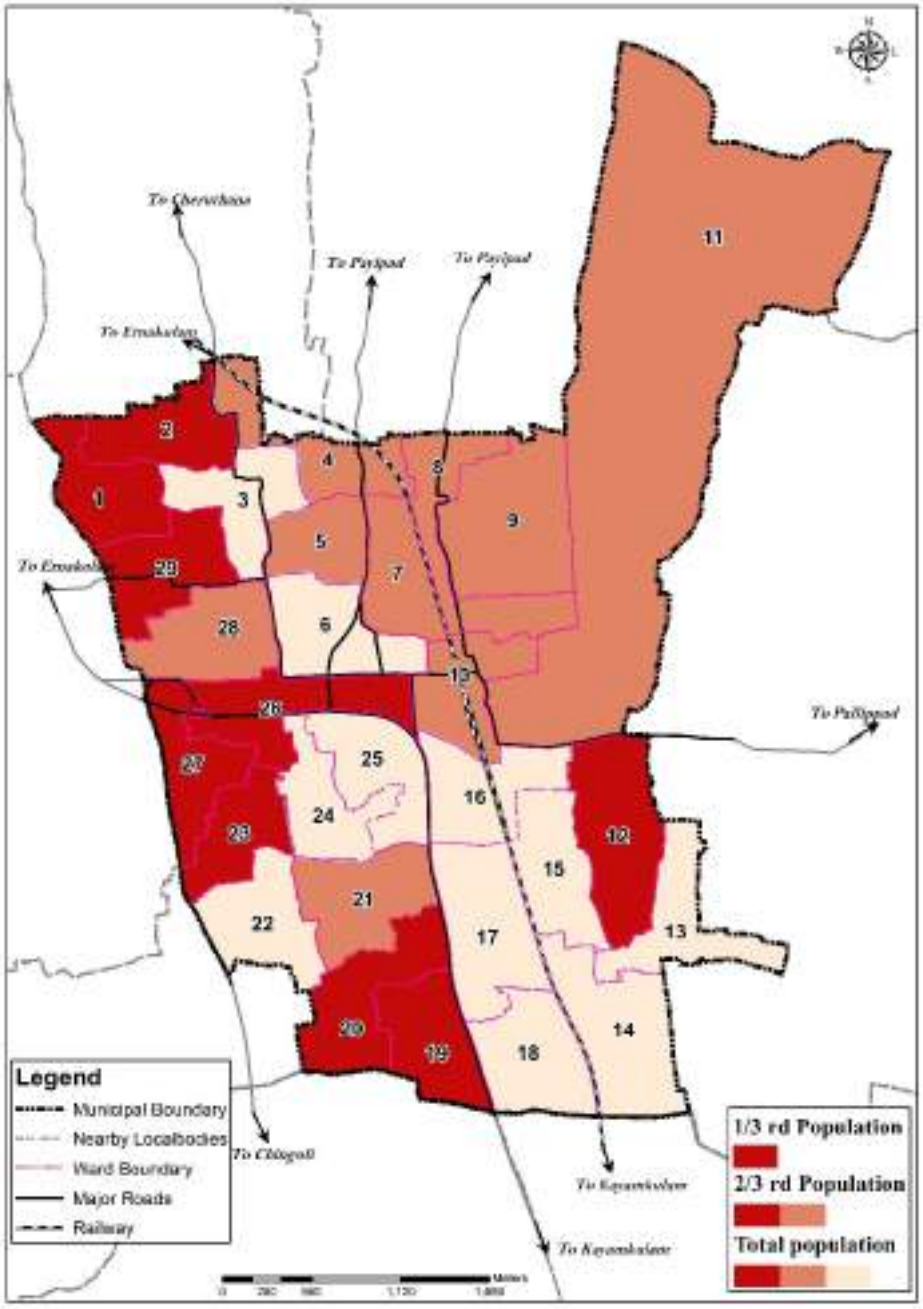

Figure 3.13 : Population Concentration of Haripad town

3.6 Sex Ratio

Sex ratio is a social indicator for measuring the extent of equity prevailing between males and females at a given point of time. It is counted for number of females per 1000 males. Kerala is the only female surplus state compared with rest of India. The sex ratio of Haripad town is 1145; whereas the sex ratio of the district is 1100. Figure 3.14 shows the decadal variation of sex ratio of Haripad Town. The sex ratio is gradually increasing from 1991 to 2011.

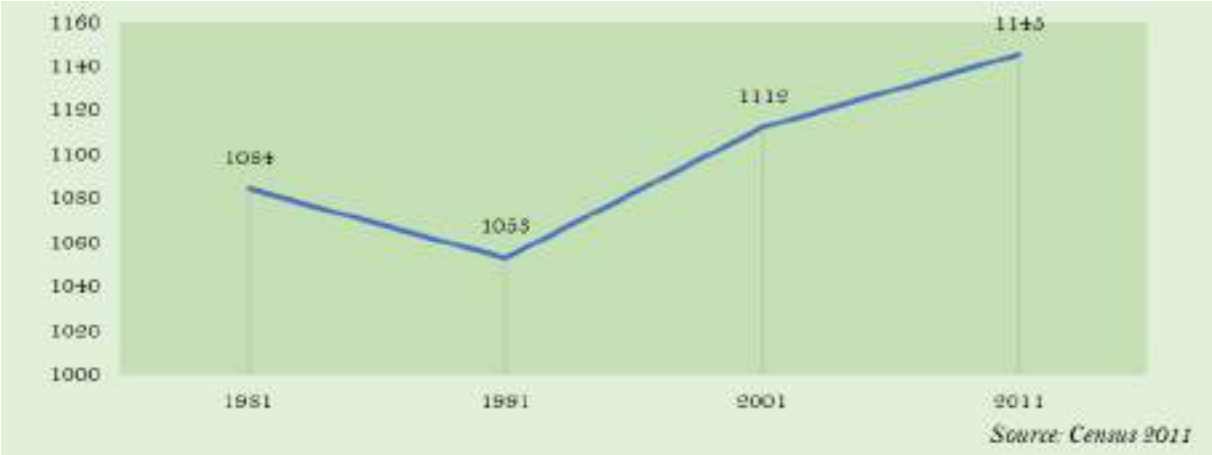

Figure 3.14 : Decadal variation of sex ratio of Haripad Town

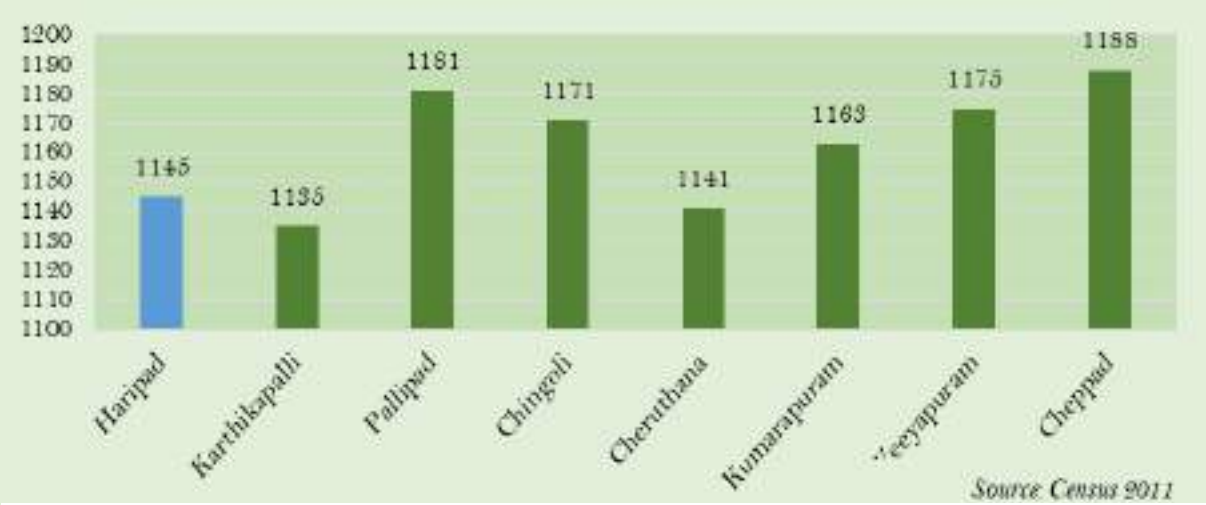

Figure 3.16 : Comparison of Sex Ratio of Haripad Town with surrounding LSGI's

Compared to surrounding LSGI's, Karthikappalli and Cheruthana Grama Panchayaths has lower sex ratio than Haripad while other LSGI's have higher sex ratio. Comparison of Sex Ratio of Haripad Town with surrounding LSGI's is shown in Figure 3.16. Compared to the other towns in the district, the sex ratio in Haripad town is higher than that of Cherthala, Kayamkulam, and Alappuzha towns but lower than that of Chengannur and Mavelikkara towns as shown in Figure 3.14.

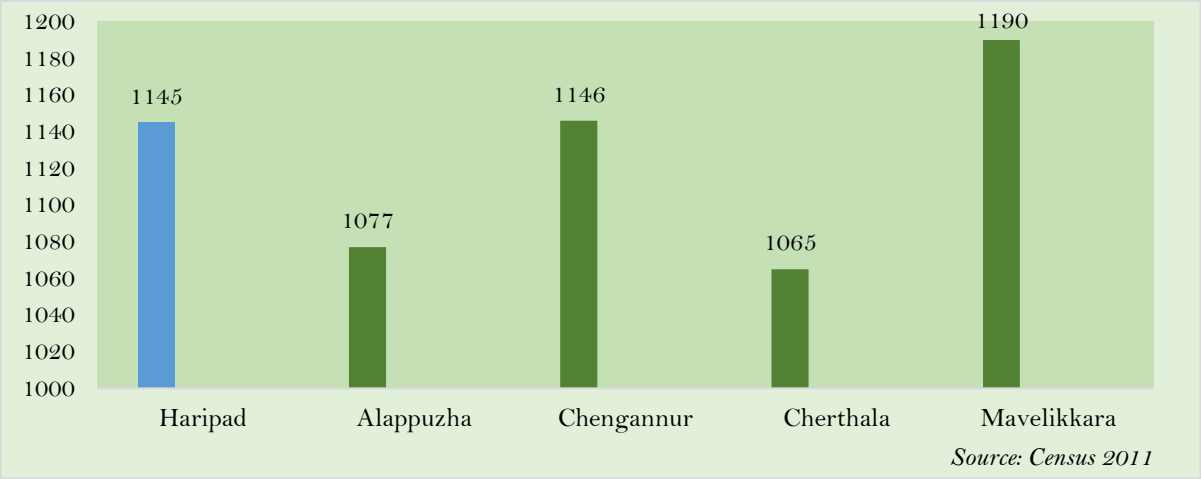

Figure 3.15 : Comparison of Sex Ratio of Haripad town with other towns in the district

3.7 Age Structure

Age structure of the population in the town as per socio economic survey conducted in the year 2024 by LSGD Planning, Alappuzha is shown in Figure 3.17. It is seen that majority population falls within the age bracket of 20-59 years.

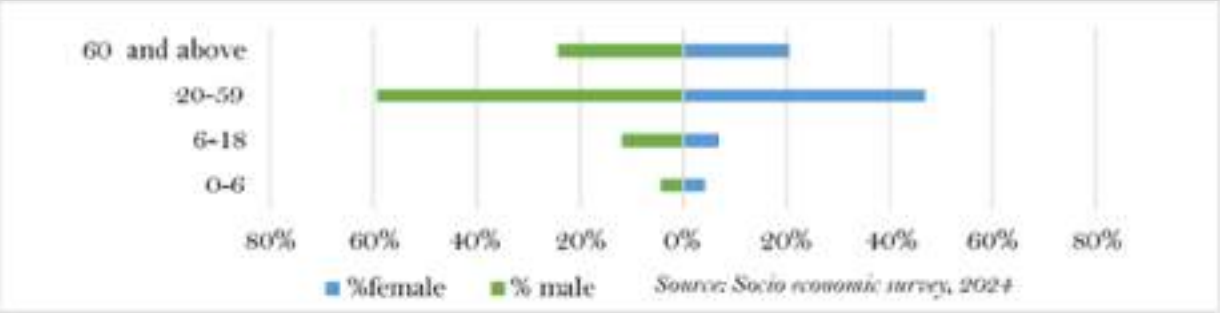

Figure 3.17 : Age structure of population in Haripad Town

3.8 Literacy

According to Census 2011, Kerala is the most literate state in India, with a literacy rate of 90.92%. The literacy rate in Alappuzha town is even higher at 96.20%, with male literacy at 97.61% and female literacy at 94.91%. Over the years, the literacy rate has shown an upward trend. The literacy rate in Haripad town is found to be 96.88% which is higher than the state average of 94%. Male literacy rate is 98.10% and female literacy rate is 95.84%.

3.9 Size of Household

Considering the data in the 'Annual plan for Haripad Town, 2024-2025,' the number of households is 8265 and total population is 31151 hence the average household size is calculated to be 3.8.

3.10 Social Composition

The social composition derived from the socio-economic survey, 2024 on 10% of total population is shown in the Figure 3.18.

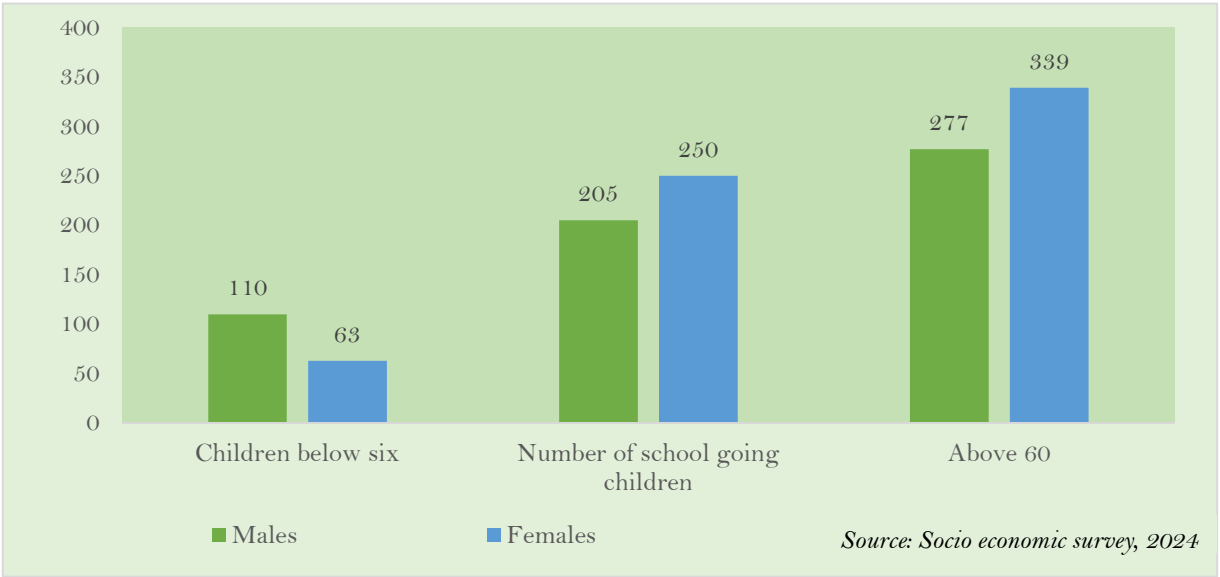

Figure 3.18 : Social Composition of Haripad Town

3.11 Migration

According to the socio economic survey, 2024 the migration trends of the people in the town is shown in Figure 3.19 and Figure 3.20. It is seen that 17.4% of people migrated to the foreign countries and 13 % of people migrated to outside the state. 13.10% seems to be migrated outside the district but within the state followed by 56.5% migrated to areas outside the town but within the district. Among these, 91.2% moved in search of better economic opportunities, while 5.9% migrated for improved educational opportunities.

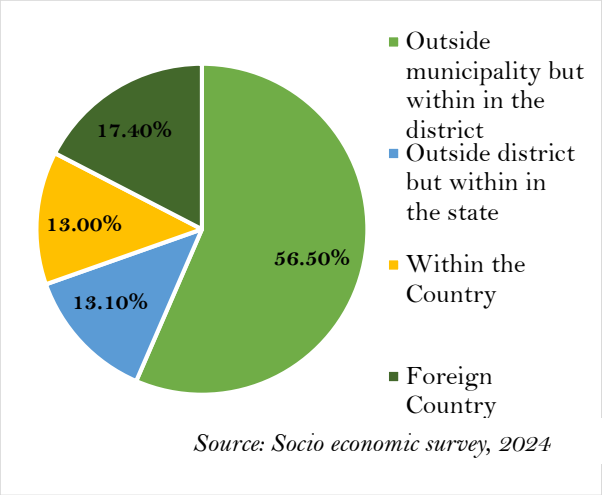

Figure 3.19 : Migration details of Haripad Town

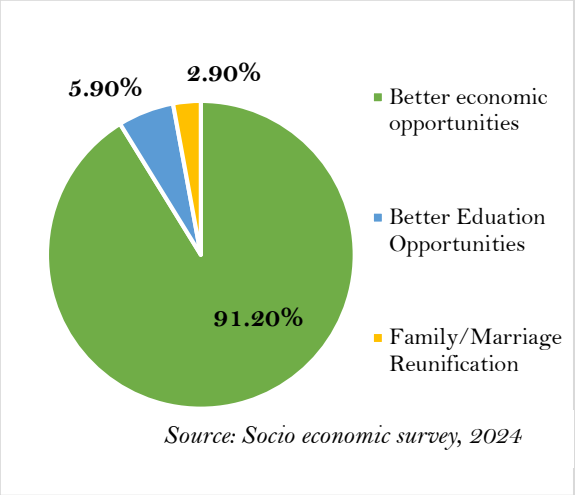

Figure 3.20 : Reason for the migration

3.12 Effect of Hazard Risk

The 1-in-50-year flood return period map published by the Kerala State Disaster Management Authority (KSDMA) was overlaid with the ward-wise spatial distribution of Haripad town to assess population exposure to flood risk (Figure 3.21). The analysis indicates that nearly 23% of the town's population - approximately 7,132 persons - reside within identified flood-prone areas, a finding that is further validated by the Haripad Municipality Disaster Management Plan 2023-24.

The assessment reveals that 14 out of the 29 wards fall partially or fully within flood-affected zones. Among these, Wards 2 and 9 are the most severely impacted, with 100% of their

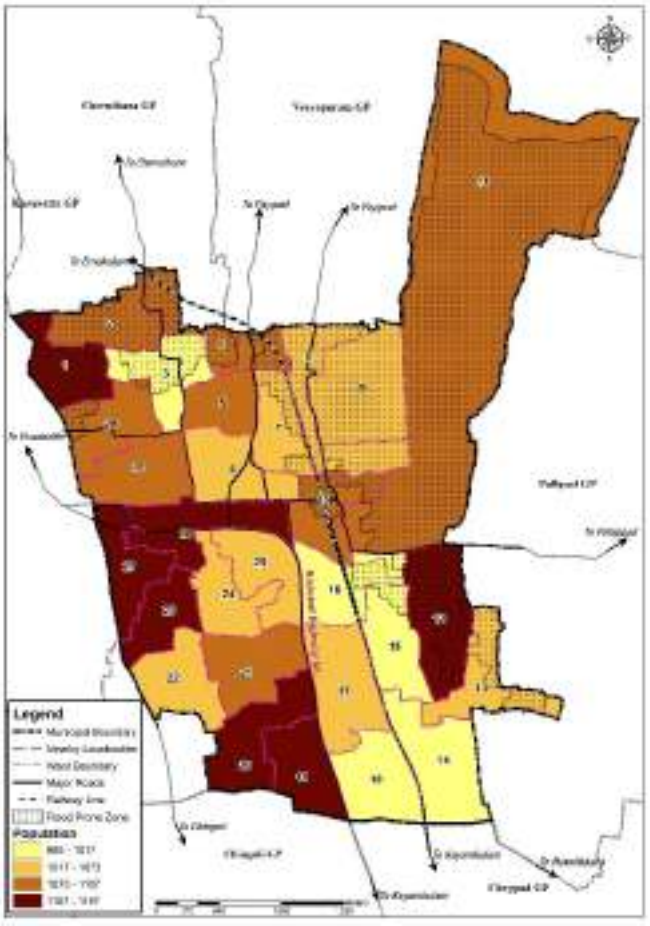

Figure 3.21 : 1 in 50-year Flood return probability map by KSDMA overlaid with ward-wise population concentration

population located in flood-prone areas. This is followed by Ward 8, where approximately 97% of the population is exposed to flood risk, Ward 11 with about 85%, and Ward 1 with nearly 81% of their respective populations residing within flood-prone zones.

As per the vulnerability rating framework prescribed in the Guidelines for Preparation of Risk-Informed Master Plan issued by the Government of Kerala, population characteristics constitute a key parameter in assessing social vulnerability. In this context, the Disaster Management Plan 2023–24 of Haripad Municipality reports that the 2018 floods resulted in partial damage to 2,611 residential buildings and complete damage to 19 residential buildings, underscoring the extent of flood-related impacts on the residential fabric of the town.

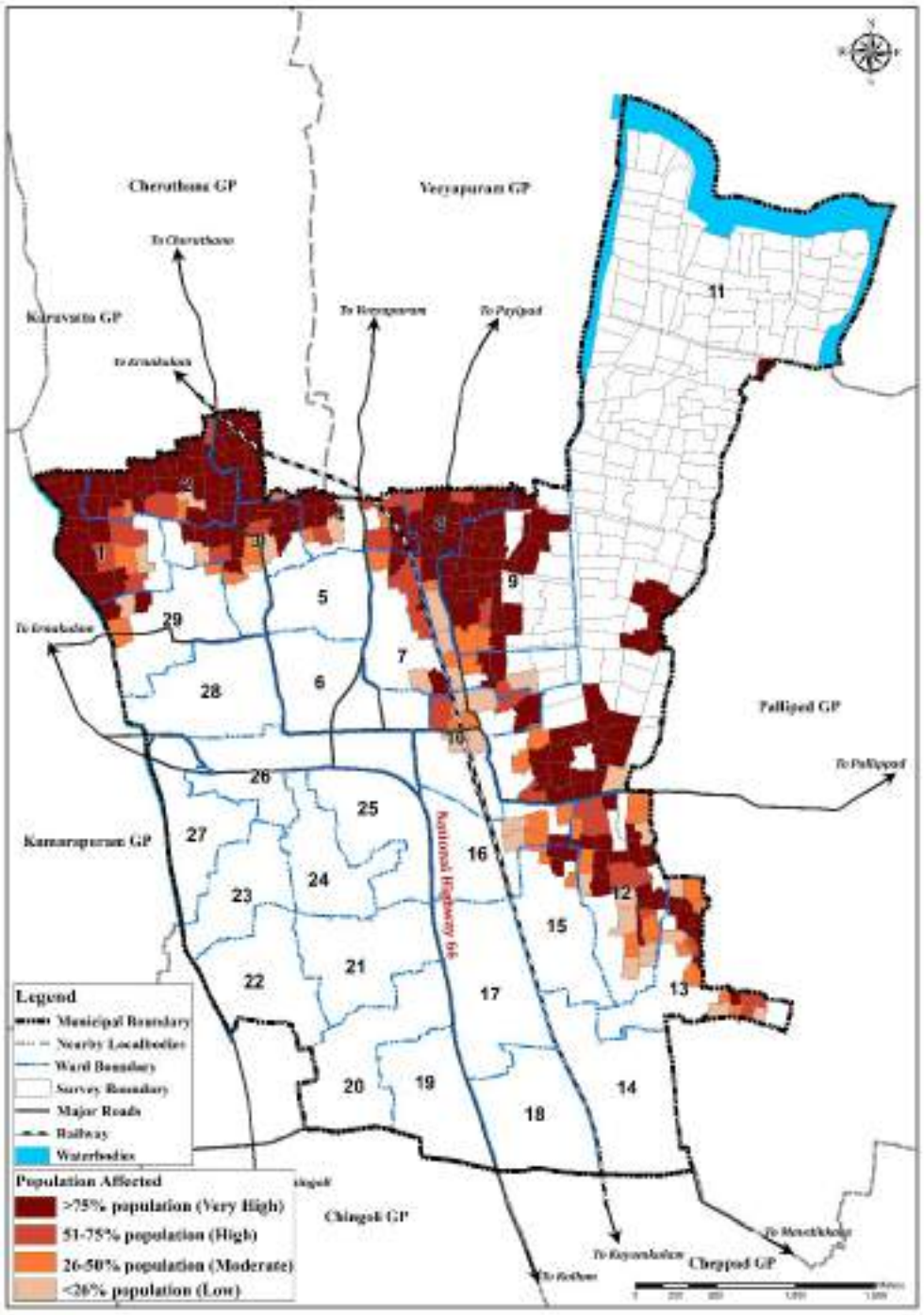

Figure 3.22 : Cadastral level degree of vulnerability in terms of population likely to be affected in FPA of the town

In line with the prescribed methodology, a detailed vulnerability assessment survey was undertaken in the flood-prone areas of Haripad. Population data were mapped at the cadastral unit level, and a cadastral-level vulnerability analysis was carried out to estimate the proportion of residents likely to be affected by flooding. Figure 3.22 illustrates the spatial

distribution and degree of population vulnerability across flood-prone areas, with vulnerability ratings assigned strictly in accordance with the approved guidelines. The detailed findings and implications of this analysis are discussed in Chapter 6 of this Master Plan.

The analysis identified 457 cadastral units falling within flood-prone areas of the town. Of the 7,132 persons residing in these flood-affected zones, approximately 20% (1,437 persons) are classified under Very High vulnerability, corresponding to 92 cadastral units. About 14% (1,027 persons) fall under High vulnerability, spread across 65 cadastral units. A further 8% (585 persons) are assessed as having Moderate vulnerability, covering 37 cadastral units, while 7% (440 persons) fall under Low vulnerability, corresponding to 28 cadastral units.

This granular assessment highlights the varying degrees of social vulnerability within flood-prone areas and provides a robust evidence base for targeted risk-reduction and resilience-building interventions under the Master Plan.

3.13 Inference

The town was a Grama Panchayath with population of 15,588 in 2011. In 2015 the Grama Panchayath was upgraded to Municipality by combining some wards from the surrounding Grama Panchayaths. As per census 2011 and its analysis, the population of the 29 wards of Haripad town is estimated to be 31,151 with 14522 males and 16629 females. Population Density of the town is 1619 persons per sq.km with wards 5,7,19,23 and 27 having high population density. Population growth rate shows a declining trend similar to all the other urban local bodies in the district. The town has a literacy rate and sex ratio better than that of Alappuzha district and the State. 23% of the town's population reside in flood prone area.

CHAPTER
04

EMPLOYMENT



Employment patterns reflect the economic vitality and social well-being of Haripad's residents. The analysis of occupational structure, workforce participation, and distribution of economic activities provides valuable insight into the town's economic base and its changing character over time. Examining factors such as the type of employment, gender participation, and spatial concentration of work areas helps identify key sectors driving growth and areas requiring policy attention. Understanding these patterns is essential for planning balanced land use, enhancing connectivity and infrastructure, and promoting inclusive, diverse, and sustainable economic development that supports Haripad's growing workforce

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- Introduction
- Workers
- Work Force Participation Ratio
- Male and Female Workforce
- Occupational structure
- Spatial Distribution of Workers
- Effect of Hazard Risk
- Inference

4. EMPLOYMENT

4.1 Introduction

This chapter analyses the economic base of Haripad Town, with a focus on the occupational structure, work participation rate, and its changes over time based on projected Census Data. During the 2011 Census, Haripad was a Grama Panchayat, and population data are therefore available only for that area. In 2015, it was upgraded to a Municipality by incorporating wards from surrounding Grama Panchayats; however, no census has been conducted since, limiting demographic analysis for the current municipal limits. To address this gap, the 2011 Census population of the newly added wards was proportionately merged with Haripad Grama Panchayat data. Using this adjusted dataset, ward-wise population for 1981, 1991, 2001, and 2011 was estimated by averaging the Incremental Increase Method and the Ratio Method. These estimates form the basis for analysis in this and subsequent chapters, unless otherwise stated as Census 2011 data.

4.2 Number of Workers

The percentage of population engaged in economic activities is an indicator of the economic development and urbanization in an area. The total number of workers in Haripad Town as per 2011 census is 10977, constituting 35% of the total population.

The total workers are further divided into main and marginal workers. As per census, those who are engaged in economic productive activity for the major part of the reference period (i.e.6 months or more in a year) are termed as main workers while marginal workers work for less than 6 months in a year.

As shown in Figure 4.1, the total number of main workers is 8,086 constituting 26% of the total population while the total number of marginal workers is 2,891, representing 9% of the population. The remaining 20,174 individuals, or 65 % of the population, are non-workers. It is seen that in the total working population, 74% are main workers and the remaining 26% are marginal workers.



Figure 4.1 : Classification of Workers

Table 4.1 and Figure 4.2 shows the decadal variation of workers and work participation rate in the town.

Table 4.1: Decadal variation of Number of Workers

Year	1981	1991	2001	2011
Main Workers	7406	7420	6279	8086
Marginal Workers	653	467	1908	2891
Total Workers	8059	7887	8187	10977
Work Participation Rate	29.13	26.49	26.24	35.24

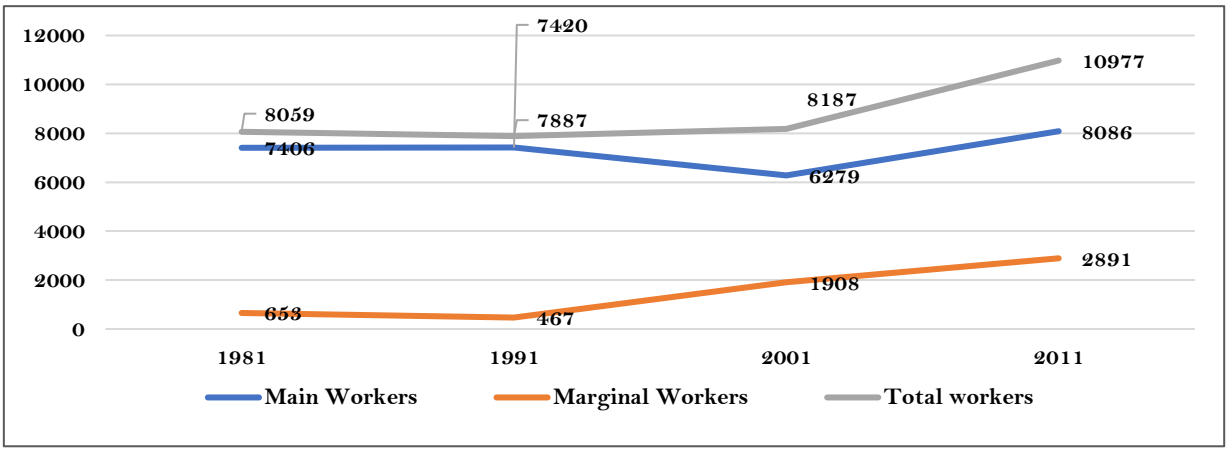

Figure 4.2 : Decadal variation of Workers

There is a significant increase in the total number of workers from 1981 to 2011, with a slight decrease seen from 1981 to 1991. The number of main workers decreased from 1991 to 2001 and then increased in 2011.This slight decrease of main workers may be due to the decrease in the number of cultivators and agricultural labourers.

4.3 Work Force Participation Rate

The work participation rate (WPR), which is a key indicator of the workforce in a given area, represents the ratio of total workers (both main and marginal) to the total population of the area. It reflects the proportion of people who are engaged in economically productive activities. According to the data projected from Census 2011, the work participation rate of Haripad town is 35.24%. The decadal variation in the work participation rate of town is given in Table 4.1 and in Figure 4.3. The total number of workers and the WPR of town has a slight decline until 2001, followed by an increase in 2011.

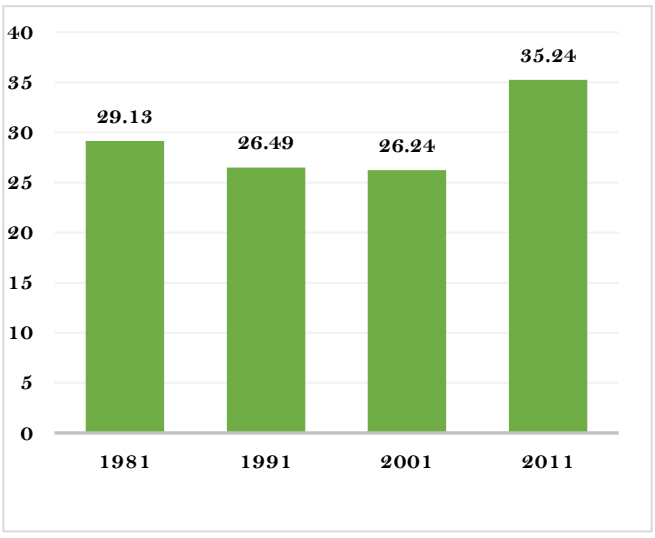

Figure 4.3: Decadal Variation of Work Participation Rate

Figure 4.4 illustrates the comparison of the WPR of town with its surrounding LSGIs. It shows that Haripad town has higher WPR than Veeyapuram, Chingoli, Cheppad and Pallippad

gramapanchayats and has lower WPR than Kumarapuram, Cheruthana and Karthikappally gramapanchayats. The WPR of town indicates a scope for enhancing economic engagement of the working-age population.

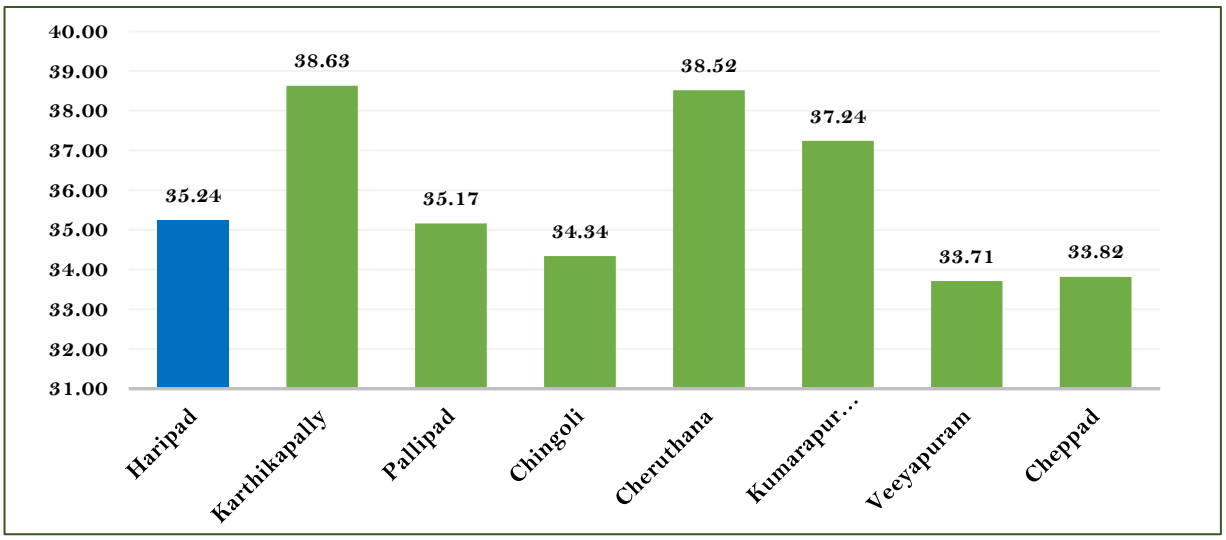

Figure 4.4 : Comparison of the Work Participation Rate

Figure 4.5 illustrates the growth rates of both the population and the workforce. Although the population growth rate declined during the 1981–2001 period, the growth rate of workers showed an increasing trend. Despite a negative population growth rate between 2001 and 2011, the workforce continued to exhibit a positive growth rate.

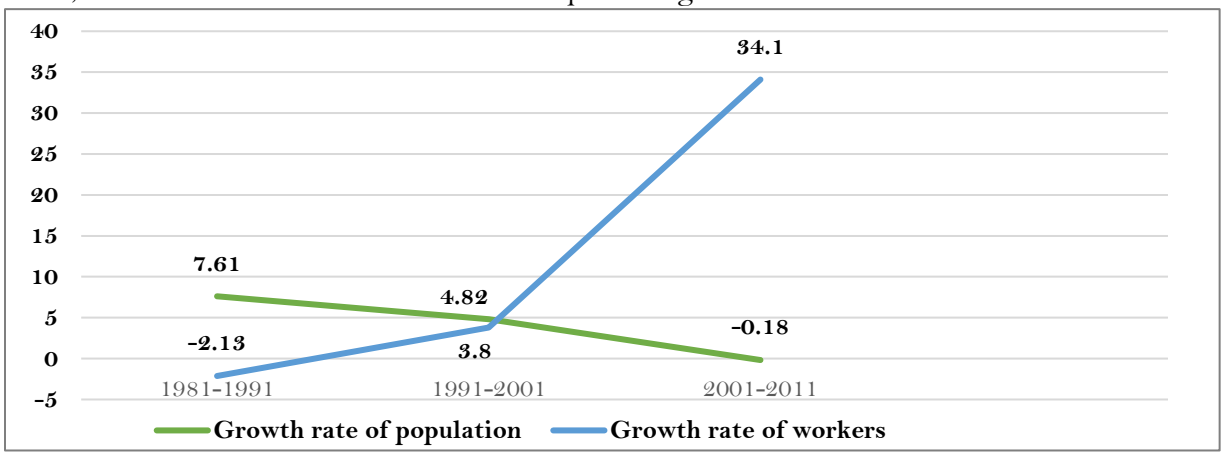

Figure 4.5 : Comparison of growth rate of population and workers

4.4 Male and Female Workforce

As per the data projected from 2011 Census, the total number of workers in Haripad town is 10,977, of which 7,303 are male and 3,674 are female. Figure 4.6 shows the percentage share of male and female workers. The male workers constitute 66.5% of the total workers. The proportion of female workers in the town is comparatively low considering the population share.

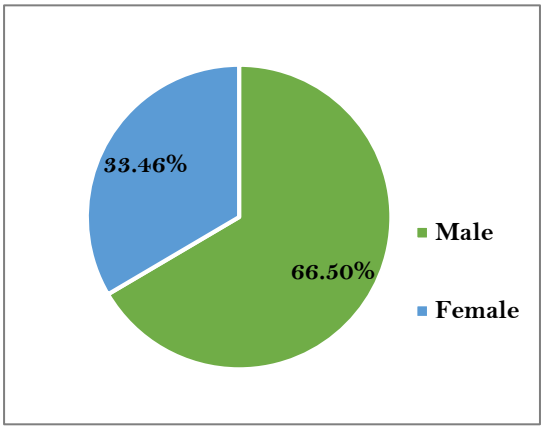

Figure 4.6 : Male -Female Working Population

Figure 4.8 illustrates the comparison of the Work Participation Rate (WPR) of Haripad Municipality with that of the state and district. The district records a higher male and female WPR compared to both the state and the Municipality. Haripad Municipality has a higher female WPR than the state average but a lower male WPR than the state.

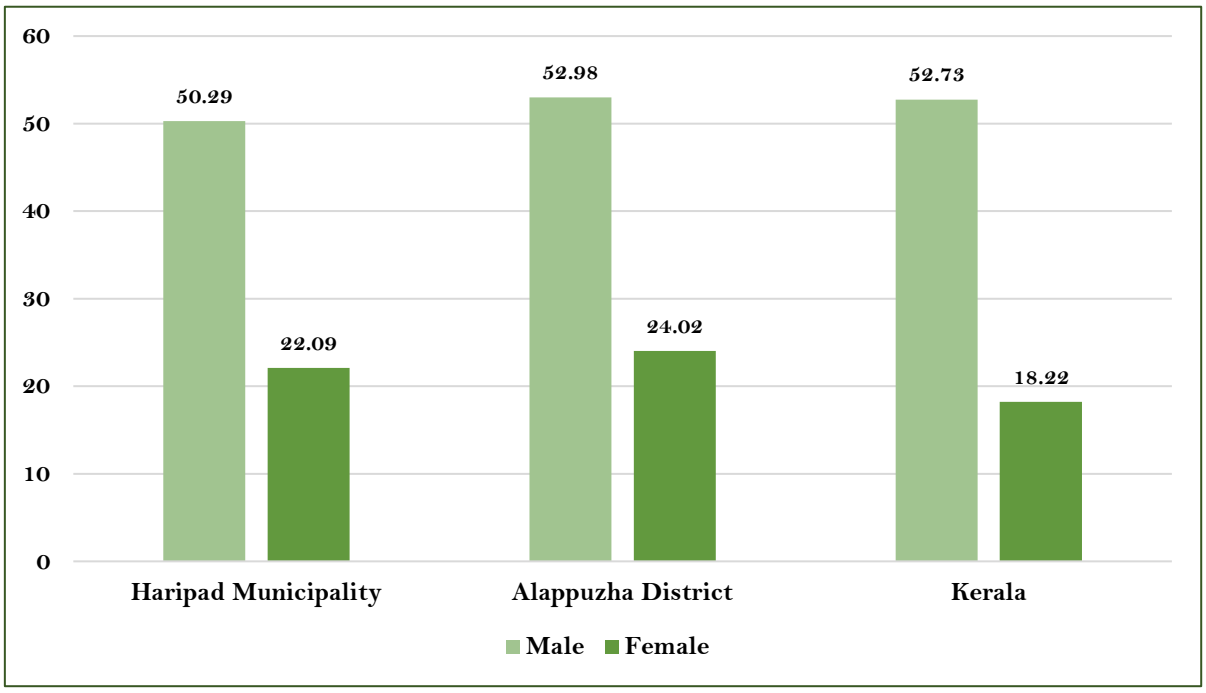

Figure 4.8 : Comparison of Male and Female Work Participation Rate

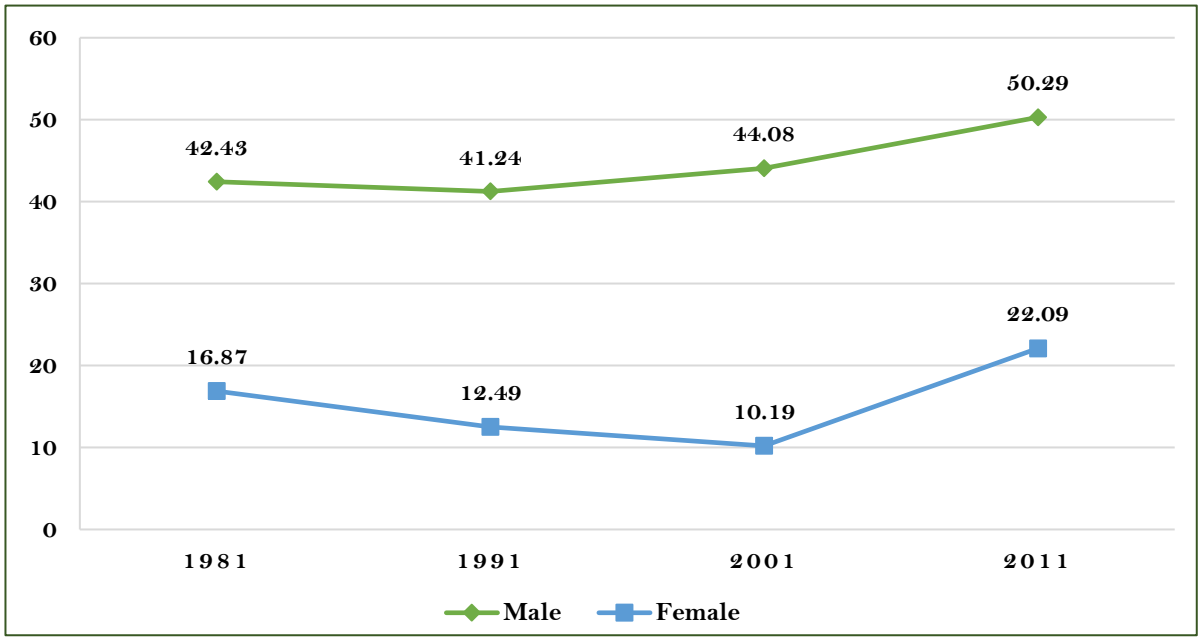

Figure 4.7 : Decadal variation of male and female Work Participation rate

Figure 4.7 illustrates the decadal variation in male and female Work Participation Rates (WPR). The male WPR shows a decline in 1991, followed by a steady increase in the subsequent years. The female WPR declined between 1991 and 2001 but showed an increase in 2011.

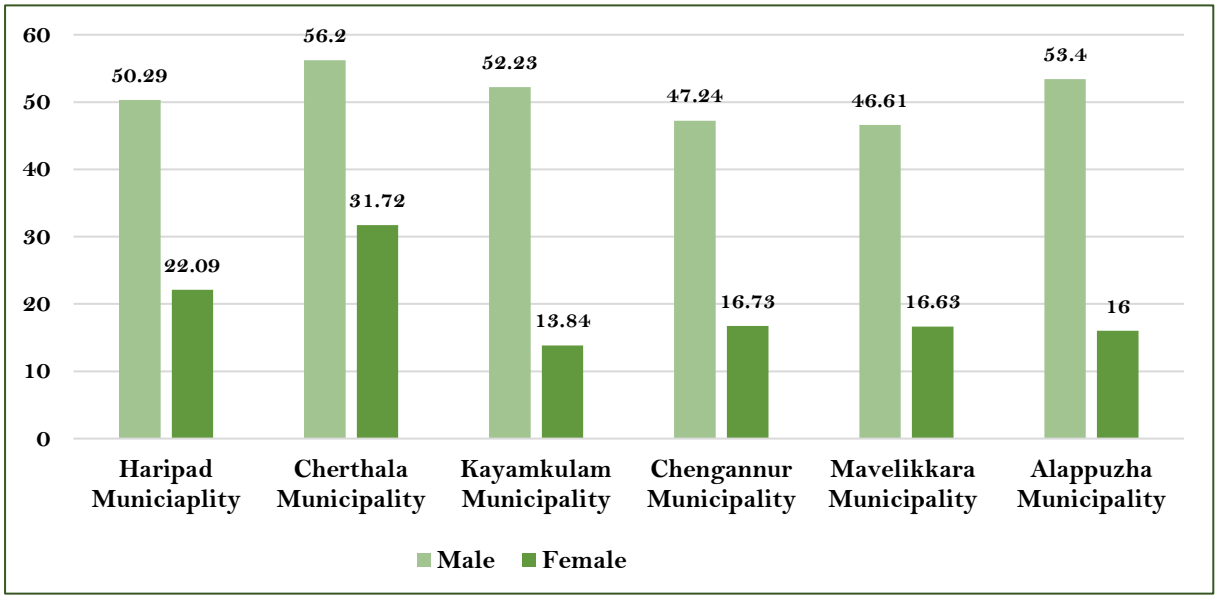

Figure 4.9 : Comparison of Male and Female Work Participation Rate with other Municipalities

Figure 4.9 illustrates the comparison of male and female Work Participation Rates (WPR) of Haripad Municipality with those of other municipalities in the district. The male WPR is higher in Cherthala, Kayamkulam, and Alappuzha Municipalities, and lower in Chengannur and Mavelikkara Municipalities compared to Haripad. The female WPR is higher in Cherthala Municipality, while it is lower in Kayamkulam, Chengannur, Mavelikkara, and Alappuzha Municipalities compared to Haripad.

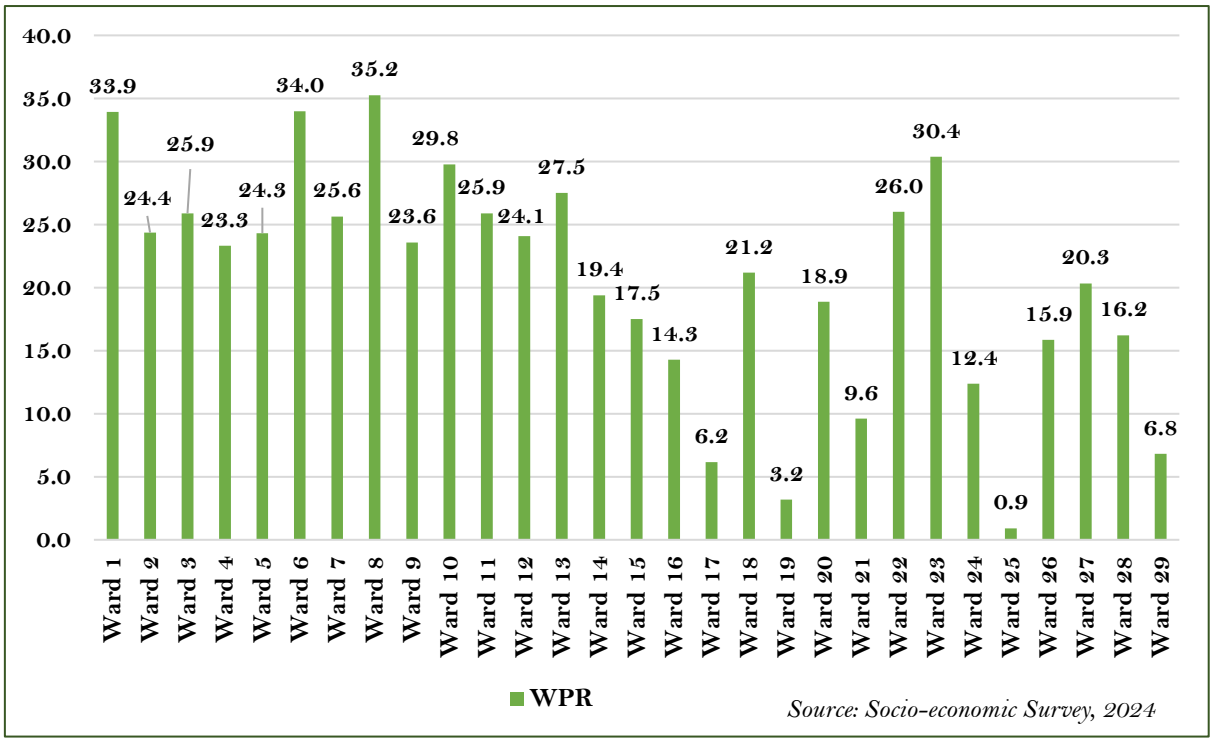

Figure 4.10 : Ward-wise Work Participation Rate of primary workers

Figure 4.10 depicts the ward-wise Work Participation Rate (WPR). As per the Socio-Economic Survey- 2024, the town has an average WPR of 21.41. It is seen that participation from female population is less in the town.

4.5 Occupational Structure

The Census 2011 categorizes the main workers into four groups: cultivators, agricultural labourers, household industrial workers, and other workers. The occupational structure of the town is shown in Figure 4.11. It shows that 90.61% of the workforce is classified under the other workers category, 5.18% are agricultural labourers, 1.32% are cultivators, and the remaining 2.80% are household industrial workers.

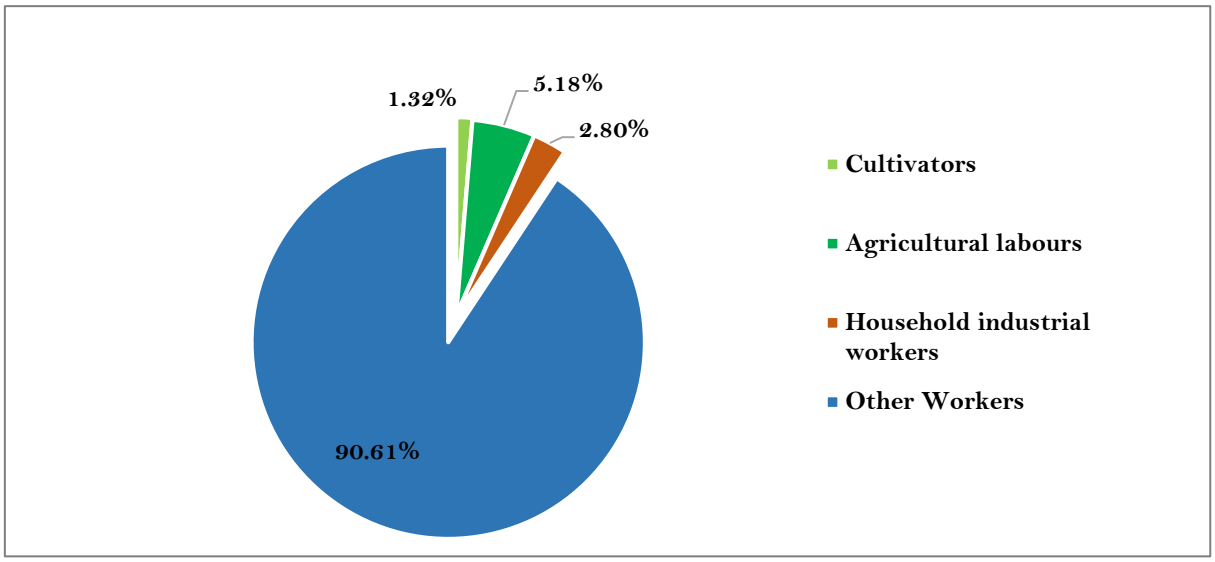

Figure 4.11 : Occupational structure

The temporal variation of occupational structure in town is shown Figure 4.12. The workforce engaged in the primary sector (cultivators and agricultural labourers) seems decreasing over the years. The category of household industrial workers shows decrease from 1981 to 1991 and increased in 2001 and thereafter it stabilizes by 2011. Majority of the workers are coming under 'Other workers' category and seems increasing over the years. This shows an inclination of people towards service sector.

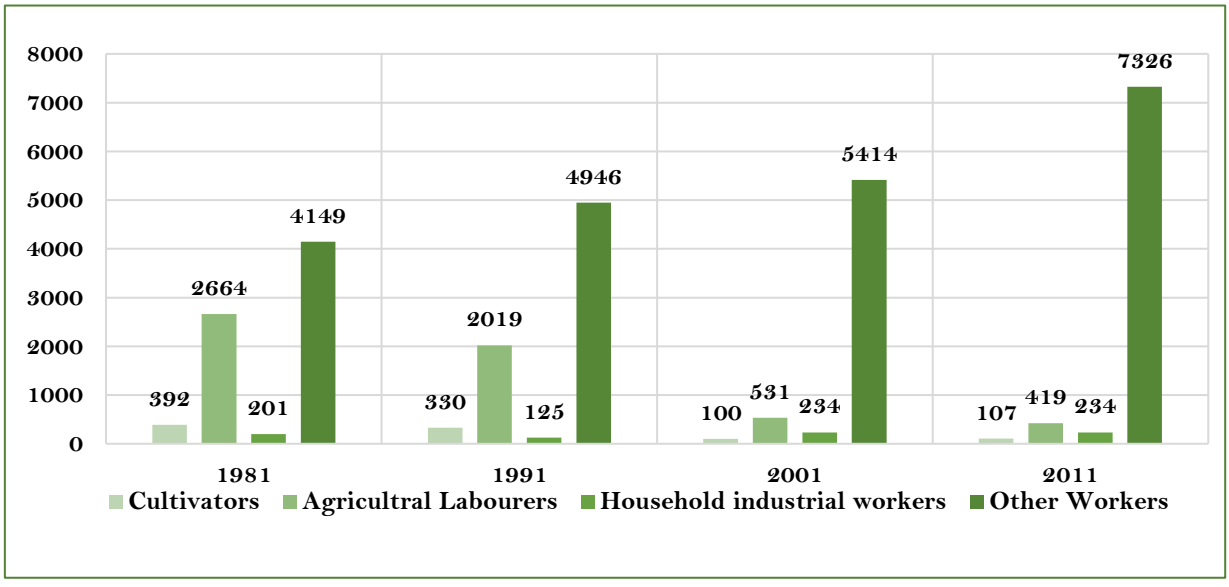

Figure 4.12 : Temporal Variation of Occupational structure

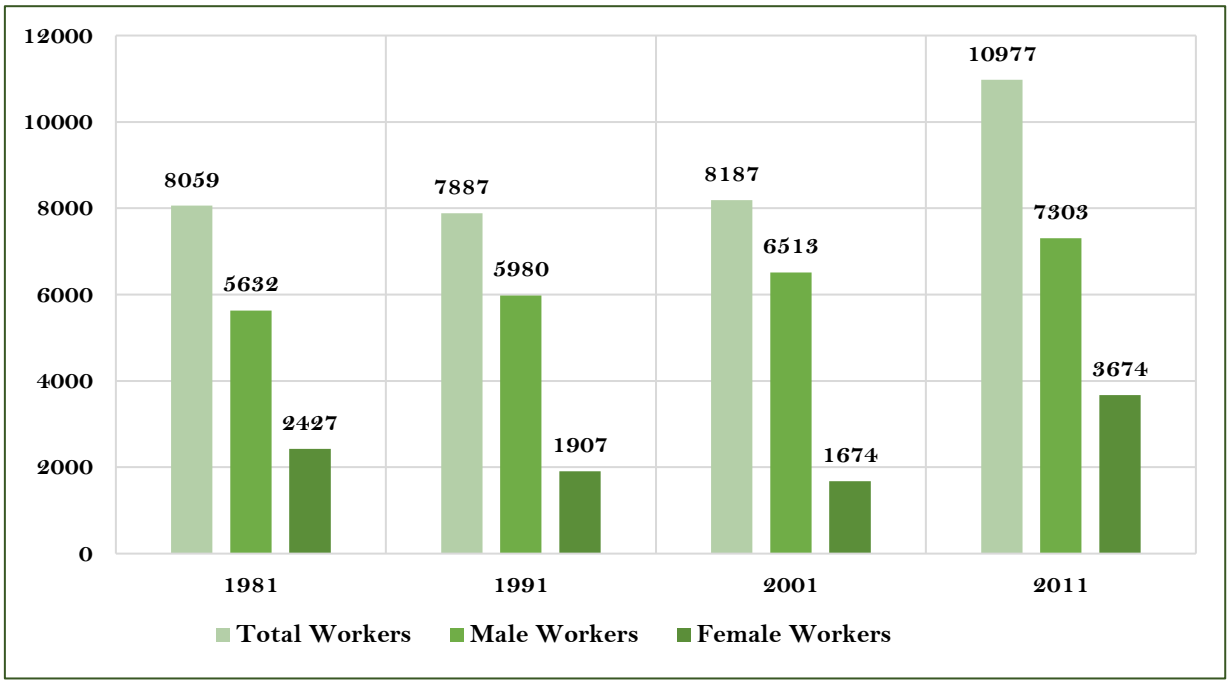

Figure 4.14 : Temporal Variation of Workers

Figure 4.14 illustrates the temporal variation in the workforce of the town. The number of female workers declined between 1981 and 2001, followed by an increase in 2011. The number of male workers exhibited a steady rise throughout the period. The total workforce showed a decline in 1991, but showed an upward trend thereafter.

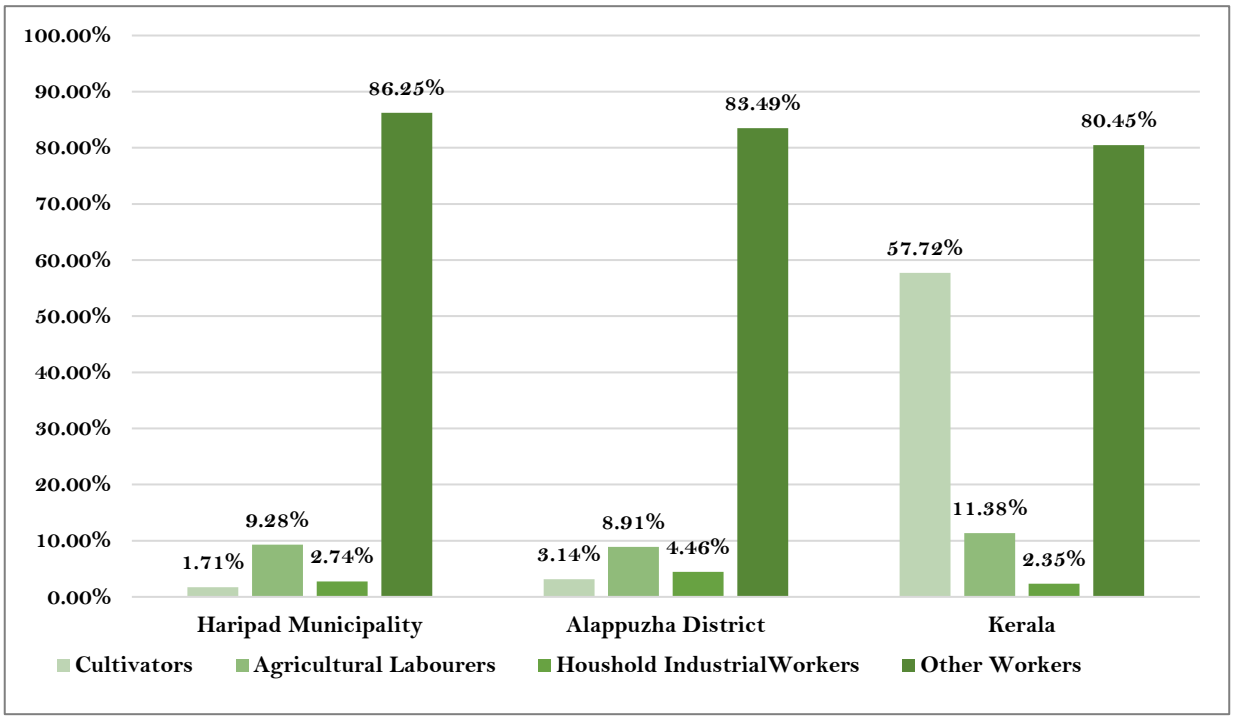

Figure 4.13 : Comparison of Occupational Structure with state and district

Figure 4.13 presents a comparison of the occupational structure of Haripad Municipality with that of the state and district. The proportion of cultivators in the Municipality is lower than that of both the state and district. The proportion of agricultural labourers is also lower than

the state average. The proportion of household industrial workers is lower than that of the district, while the percentage of other workers is higher compared to both the state and district.

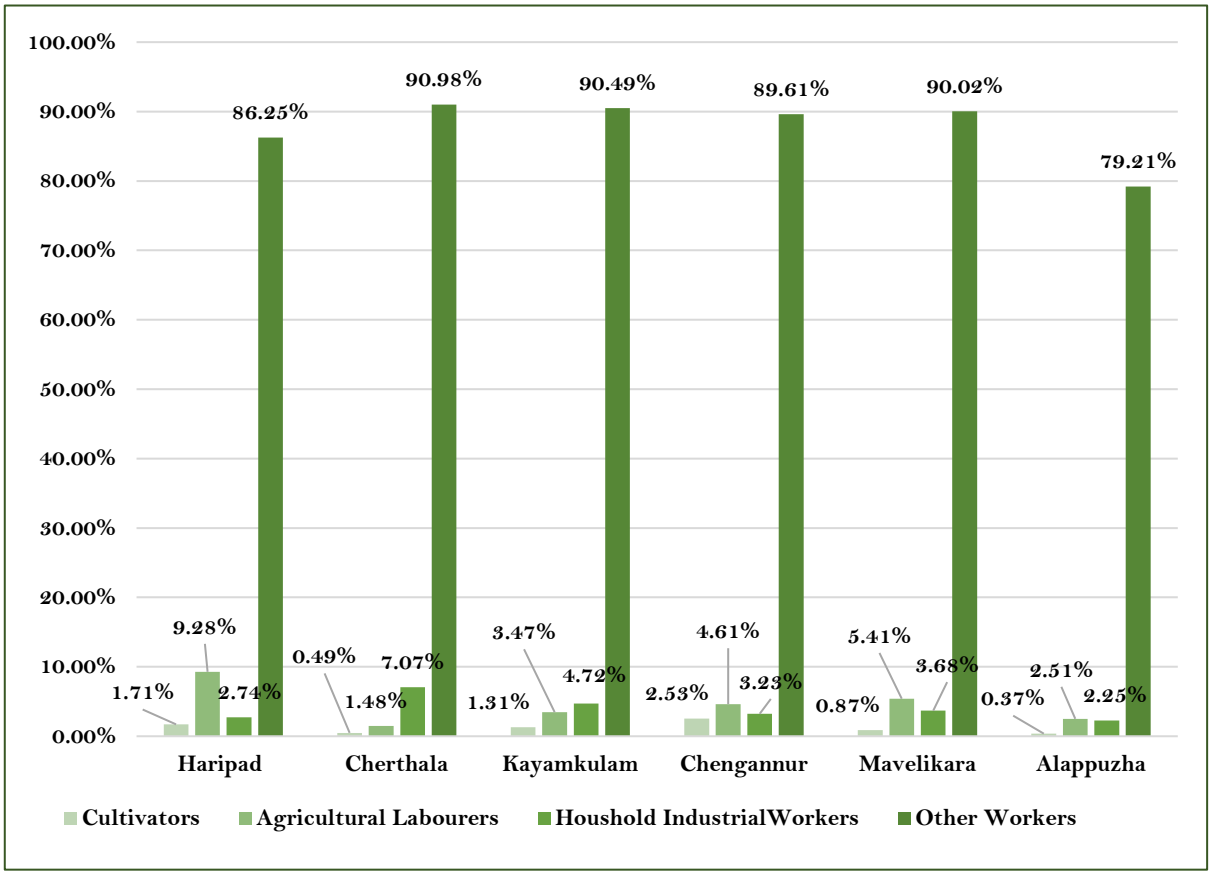

Figure 4.15 : Comparison of Occupational Structure with other municipalities in the district

Figure 4.15 illustrates the comparative analysis of the occupational structure of Haripad Municipality with other municipalities in the district. The proportion of cultivators in Haripad Municipality is lower than that of Chengannur Municipality but higher than those of Cherthala, Kayamkulam, Mavelikkara, and Alappuzha Municipalities. The proportion of agricultural labourers is comparatively higher in Haripad than in other municipalities of the district. The proportion of household industrial workers is lower than that of Cherthala, Kayamkulam, Chengannur, and Mavelikkara Municipalities, but higher than that of Alappuzha Municipality. The percentage of other workers is higher compared to Alappuzha Municipality, while it remains lower than that of Cherthala, Kayamkulam, Chengannur, and Mavelikkara Municipalities.

4.6 Spatial distribution of Workers

Haripad Grama Panchayath having an area of 9.58sq.km with 9 wards was upgraded to a Municipality having an area of 16.34 sq.km with 29 wards by combining some wards from the surrounding Grama Panchayaths in 2015. Harippad was a Grama Panchayath during the 2011 Census, and there is no Census done after that. The absence of ward-wise census data for the entire town limits the analysis of the spatial distribution of workers and other population characteristics. Therefore, the spatial distribution has been derived from the Socio-Economic Survey 2024.

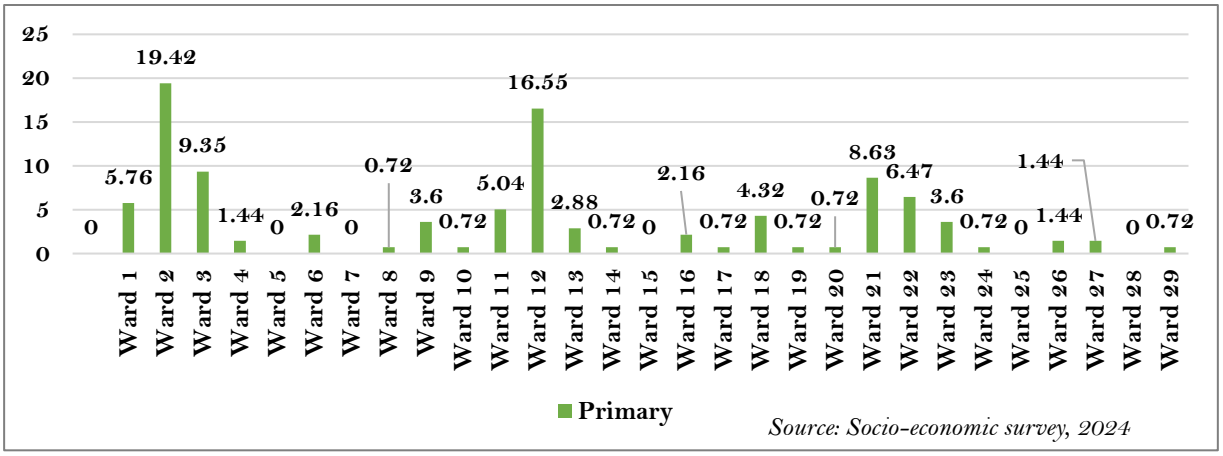

Figure 4.16 : Ward wise percentage of spatial distribution of primary workers in the town

Figure 4.16 depicts the ward-wise spatial distribution of primary workers in the town as per the Socio-Economic Survey, which shows that Ward 2 records the highest percentage of primary workers.

The ward-wise Concentration Index was calculated for three worker categories - primary, secondary, and tertiary - using the ratio of a worker class's share within a ward to its corresponding share at the town level. This analysis enables the identification of wards where specific classes of workers are relatively over- or under-represented. The spatial distribution of these indices was examined to understand the distribution patterns and concentration of different worker groups across the town.

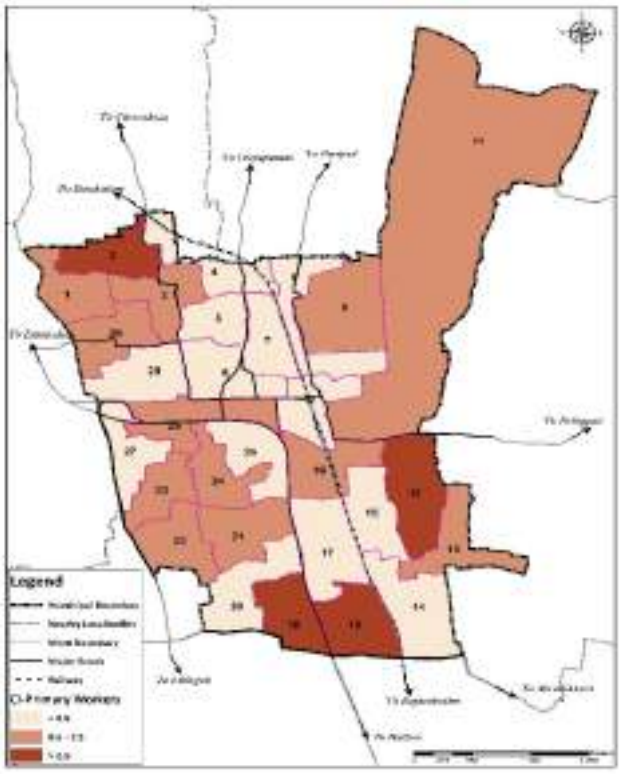

Figure 4.17: Ward wise concentration of primary workers

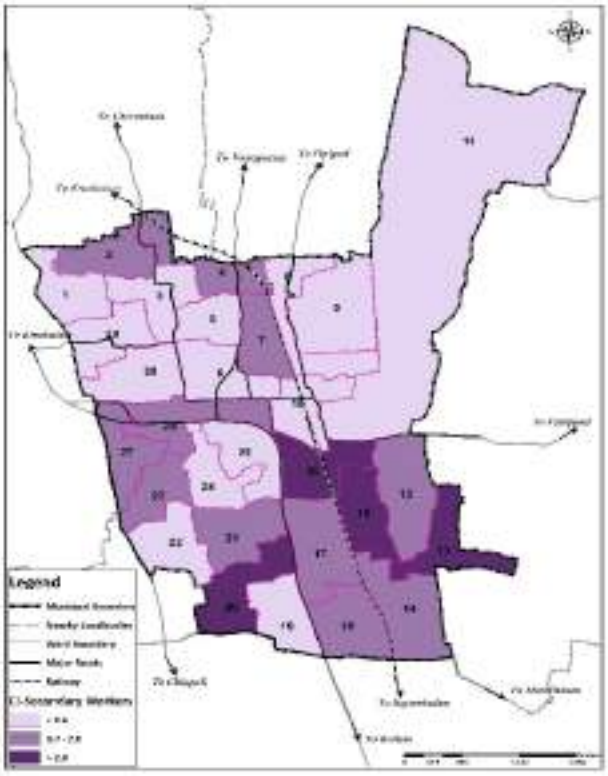

Figure 4.17 : Ward wise concentration of secondary workers

Figures 4.17, 4.18, and 4.19 depict the ward-wise distribution of workers across primary, secondary, and tertiary sectors in Haripad Municipality. Primary workers show a higher concentration in Wards 12, 2, 19, and 18, indicating the continued importance of agriculture and allied activities in these areas. Secondary sector employment accounts for only 14.54% of the total workforce and is relatively limited, with notable concentrations in Wards 13, 15, 16, and 20, reflecting pockets of industrial and manufacturing activity. In contrast, tertiary workers are more evenly distributed across most wards, highlighting the widespread presence of service-sector activities throughout the town.

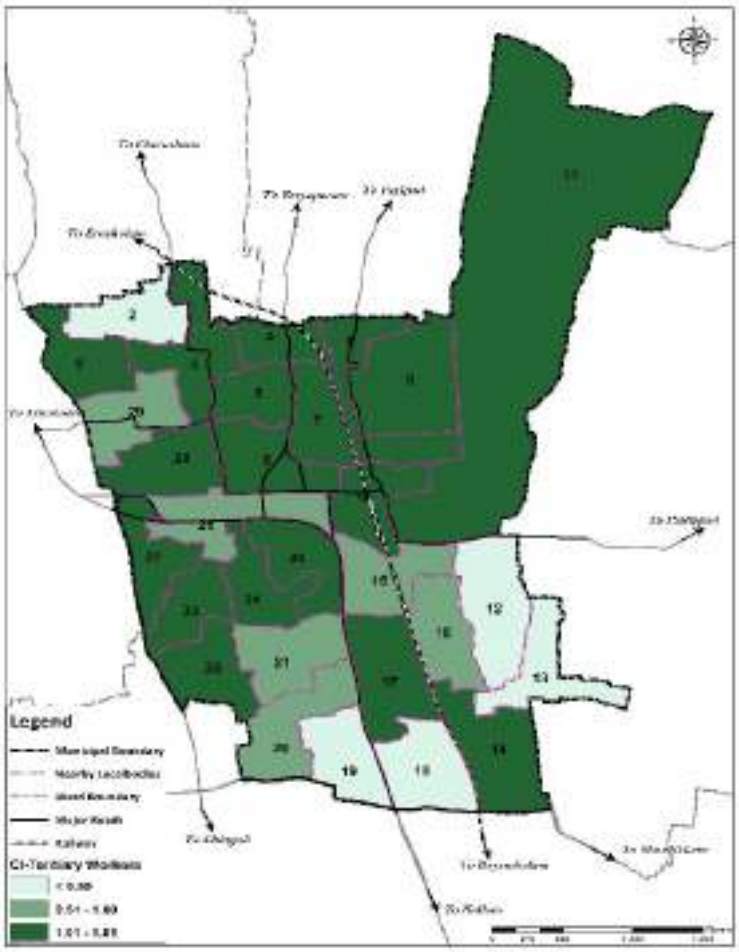

Figure 4.18 : Ward wise concentration of tertiary workers

4.7 Effect of Hazard Risk

As per the vulnerability rating framework outlined in the Guidelines for Preparation of Risk-Informed Master Plan issued by the Government of Kerala, population characteristics constitute a key parameter in assessing economic vulnerability, particularly within hazard-prone areas. In accordance with these guidelines, a detailed vulnerability assessment survey was conducted across the flood-prone areas of Haripad town. The analysis reveals that approximately 2686 persons out of 7132 residents living in flood-affected zones are engaged in informal and climate-sensitive occupations, including daily wage labour, agricultural labours, farmers, unskilled workers and other local-level economic activities that are directly disrupted by flooding. This accounts to 37% of people residing in flood prone area and at the town level it accounts to 8% of the town's population. Table 4.2 illustrates the number of employees residing in flood prone area who are employed in various informal and climate sensitive occupations.

Haripad Municipality comprises eight Padasekharams (as discussed in Chapter 10 of this Master Plan), and nearly 87.55% of the town's agricultural land lies within flood-prone areas (refer Chapter 6 and Table 6.4). Despite this high exposure, only about 15% of the population residing in flood-prone zones is directly dependent on agriculture for livelihoods. At the municipal scale, this corresponds to approximately 3.5% of the total town population (1,111 out of 30,977 persons) being directly affected in terms of primary employment due to flooding.

This relatively low proportion is largely because a substantial share of the agricultural and informal workforce operates within the municipal limits but resides in adjacent panchayats

outside the town boundary. Consequently, while the number of residents directly affected within Haripad Municipality appears limited, the economic impacts of flooding extend beyond municipal boundaries, influencing livelihoods across Haripad and its neighbouring panchayats that are functionally linked to the town's agricultural and informal economy.

Table 4.2 : Number of people engaged in informal employment activities

Informal employment	Number of employees
Farmers	441
Agricultural Labour	670
Fishermen	1
Traditional Occupation	36
Daily Wage Earners	1010
Unskilled Workers	94
Construction Workers	365
Small Scale Shopkeepers	69
Total	**2686**

Source : Data from Disaster Management Plan for Haripad 2023-24

Despite the smaller absolute numbers, the affected livelihood groups remain highly vulnerable. Recurrent flooding disrupts work continuity, reduces income security, damages tools and crops, and increases economic uncertainty, thereby compounding long-term livelihood risks. In this context, addressing economic vulnerability - particularly for climate-sensitive occupations - forms a critical component of Haripad's risk-informed planning approach.

Accordingly, the Master Plan underscores the importance of promoting alternative and diversified employment opportunities for populations exposed to flood risks. Emphasis is placed on facilitating access to safer, climate-resilient livelihoods through skill development, sectoral diversification, and support for non-farm, service-based, and value-added economic activities. Such interventions are essential to strengthening economic

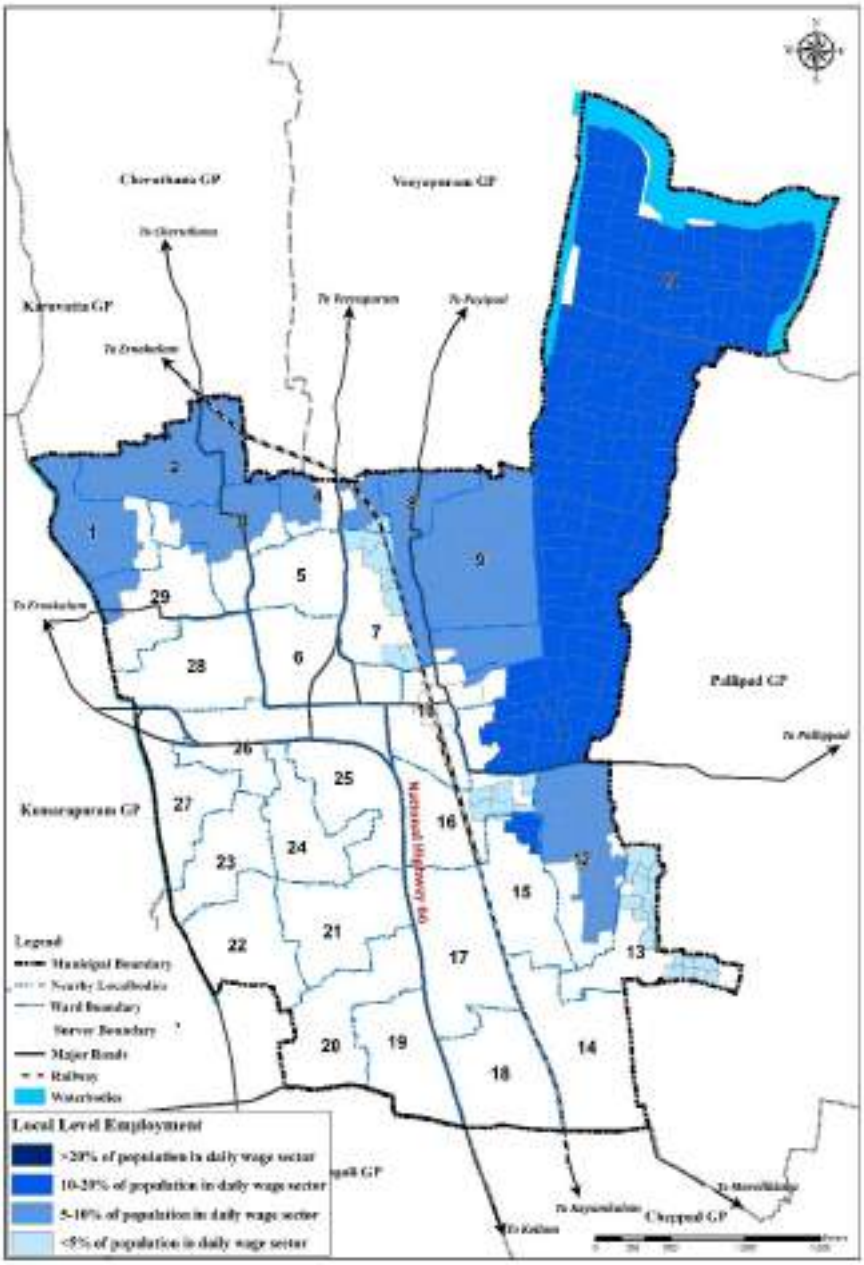

Figure 4.19 : Local level employment vulnerability in flood prone area

resilience, reducing dependency on flood-vulnerable occupations, and improving long-term livelihood security for affected communities.

4.8 Inference

The projected workforce data based on Census 2011 indicates that Haripad town has undergone a structural shift in employment, with a predominant concentration of workers in non-primary sectors and a marked decline in the primary sector workforce, including cultivators and agricultural labourers. This decline is largely attributable to hazard-related vulnerabilities affecting the agricultural sector, particularly recurrent flooding of farmlands, inadequate bund management, and unreliable irrigation infrastructure. These persistent risks have increased uncertainty in agricultural livelihoods and reduced their economic viability, prompting a gradual transition of the workforce towards non-farm and alternative forms of employment. It is also observed that a significant share of persons engaged in primary and informal employment operate within Haripad but reside in nearby panchayats outside the municipal boundary, further influencing local workforce patterns.

The challenges facing the agricultural sector and their implications for employment are discussed in detail in Chapter 10 of this Master Plan. Given the hazard-induced decline in primary sector employment, it is essential for the Master Plan to proactively address livelihood vulnerability by planning for diversified and alternative employment opportunities, particularly those that are less sensitive to climatic and environmental risks.

The workforce composition further indicates that the majority of workers fall under the "Other Workers" category, a trend that has continued to increase over the years. Despite a declining population growth rate, Haripad exhibits a positive workforce growth trend, with a Work Participation Rate (WPR) of 35.24%, highlighting untapped potential for economic expansion. However, workforce participation remains gender-skewed, with male workers accounting for 66.5% of the total workforce and female participation remaining relatively low. This underscores the need for inclusive employment strategies that enhance women's participation and strengthen the town's overall economic resilience.

CHAPTER
05

LANDUSE AND BUILTUP DENSITY



Land use reflects the spatial organization of activities within Haripad, encompassing residential, commercial, institutionnal, agricultural, recreational and ecological zones. Analyzing existing land use patterns helps identify the town's functional character, economic base, growth direction and availability of land for future development. It also provides insights into spatial concentration, activity distribution and urban expansion trends. Effective land use planning plays a vital role in guiding sustainable growth, optimizing resource utilization and mitigating risks from natural hazards such as flooding by aligning development with environmental sensitivity and resilience objectives for Haripad.

- General Analysis of Land use
- Temporal changes in the land use
- Direction of growth
- Ward Wise Land Use Analysis
- Built Density - temporal changes
- Inference

5. LAND USE AND BUILT-UP DENSITY

5.1 Introduction

Land Use is a fundamental component of spatial planning, as planning interventions are primarily aimed at regulating, guiding, or protecting the way land is utilized over time. A clear understanding of existing Land Use - such as agricultural, residential, commercial, industrial, and recreational uses - is essential to identify dominant activities, development pressures, and the availability of land for future growth. Land Use patterns continuously evolve due to urban expansion, economic activities, and changes in agricultural practices, often influencing environmental quality, natural resources, microclimate, and social conditions. Therefore, a detailed analysis of existing Land Use and Built-Up Density provides a critical basis for informed, sustainable, and balanced planning decisions, ensuring that future development aligns with environmental capacity and community needs.

5.2 General Analysis of Land Use – Land Use breakup and spatial distribution

A detailed Land Use survey was undertaken in 2024-25 to assess the existing pattern of land utilization within the municipal limits of Haripad and to prepare the Existing Land Use map. The survey covers the entire geographical extent of Haripad Municipality, measuring 16.34 sq. km, and provides a comprehensive understanding of how land is currently used across different sectors such as residential, commercial, agricultural, institutional, and ecological uses. The Existing Land Use map (Figure 5.1) illustrates the spatial distribution of these categories across the town (Figure 5.2). A detailed area-wise land use distribution and the corresponding percentage share of each land use category relative to the total municipal area are presented in Table 5.1. This analysis forms a critical base for identifying development trends, spatial imbalances, and opportunities for future land management and planning interventions.

Table 5.1 : Existing Land Use Breakup of the town in 2024-25

Land Use	Area (sq.km)	% of total area
Residential	7.18	**43.94**
Commercial	0.31	**1.84**
Public and Semi-public	0.58	**3.55**
Industrial	0.03	**0.18**
Transportation	0.88	**5.35**
Dry Cultivation	1.01	**6.18**
Sacred Groves	0.02	**0.12**
Paddy	4.69	**29.93**
Marshy	0.42	**1.35**
Recreational	0.01	**0.06**
Vacant Land	0.30	**1.90**
Waterbodies	0.92	**5.57**
Total	**16.35**	**100**

Source: Existing Land Use Survey 2024-25

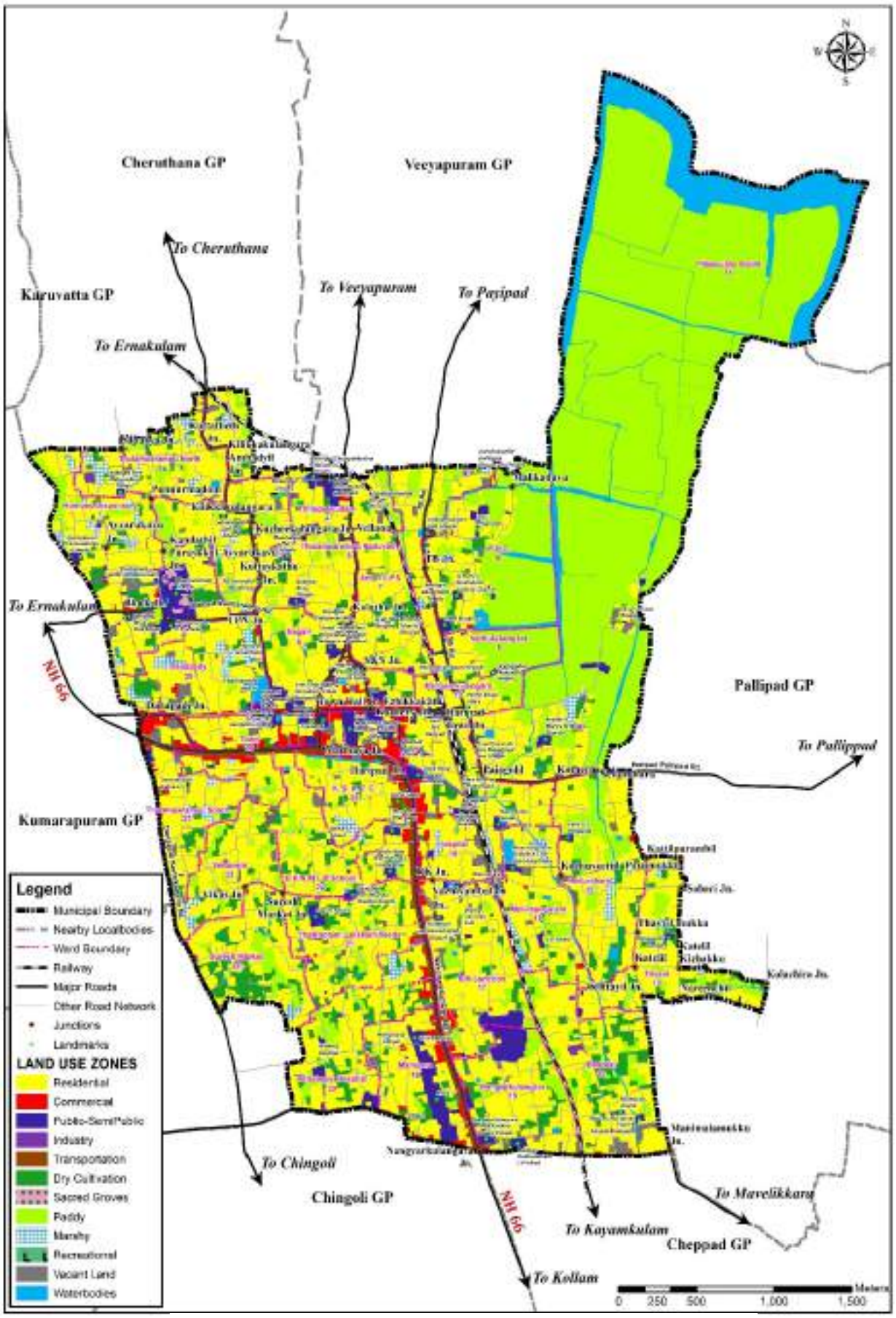

Figure 5.1: Existing Land Use Map of Haripad Town, 2024-25

Source: Generated from the Database of Haripad Town

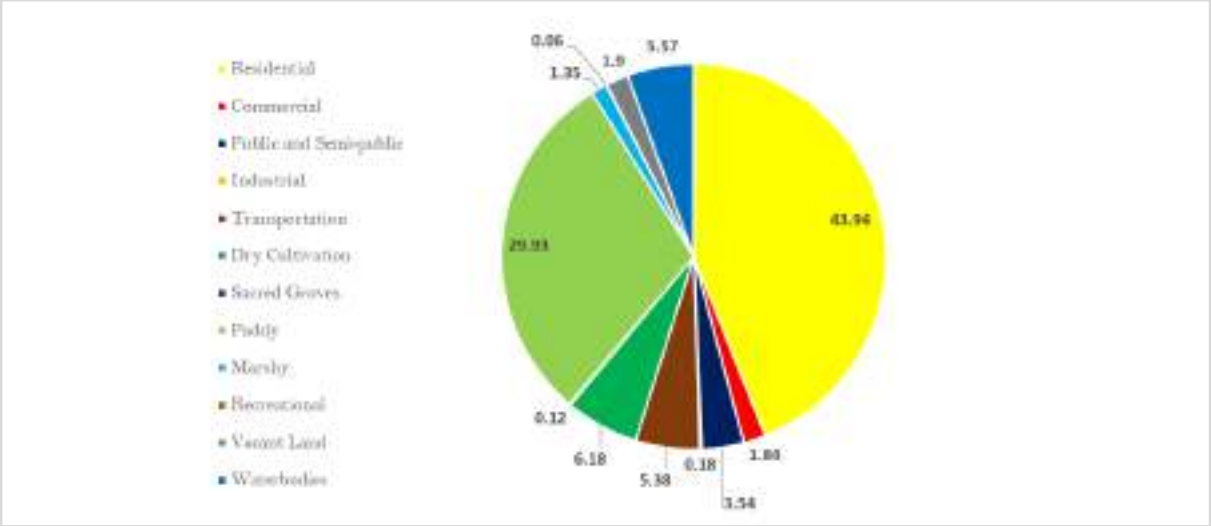

Figure 5.2 : Existing Land use breakup of the town, 2024-25

5.2.1 Residential Land Use

Residential Land Use constitutes 43.94 % of the municipal area. While analysing the concentration pattern of Residential Land Use, higher concentration is seen in majority of the wards. The density in the already developed residential areas is not high, providing scope for accommodating more population. The spatial distribution and concentration index pattern of Residential Land Use is shown in Figure 5.3.

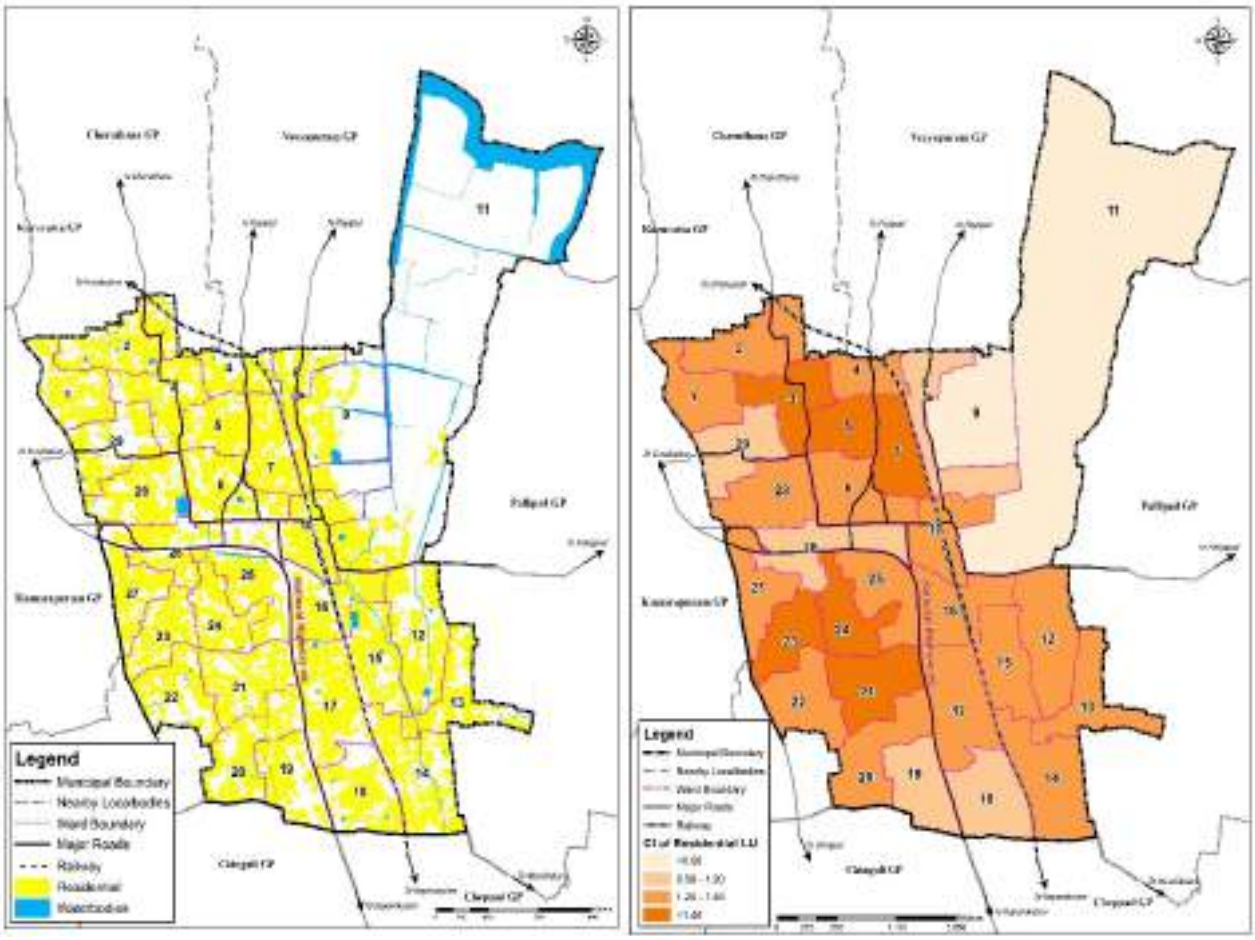

Figure 5.3: Spatial distribution and ward wise concentration index pattern of Residential Land Use

Higher concentration of residential land use is seen in Kilikkakulangara, Thulamparambu Nadavathu, Aroor LPS, Thaikootam Laksham Veedu, Vettuveni, D.K.N.M LP School wards. Higher concentrations of residential land use above mentioned wards can be attributed to established settlements, availability of developable land, and internal road networks, which support residential growth. Lower concentration of residential land use is seen in PHC and Pilappuzha South wards. Above mentioned wards exhibit lower residential concentration due to the presence of environmental or land-related constraints, limited suitable land for housing, and the dominance sensitive areas that restrict residential development.

5.2.2 Commercial Land Use

Commercial area constitutes only 1.84 % of the municipal area. The spatial distribution and concentration index pattern of Commercial Land Use is shown in Figure 5.4. The figure shows that the commercial nodes are concentrated in the central area of the town and towards the major transportation corridors. Most important commercial areas are Town hall junction to Ezhikkakathu junction, Ezhikkakathu junction to Taluk Hospital and Danapady market.

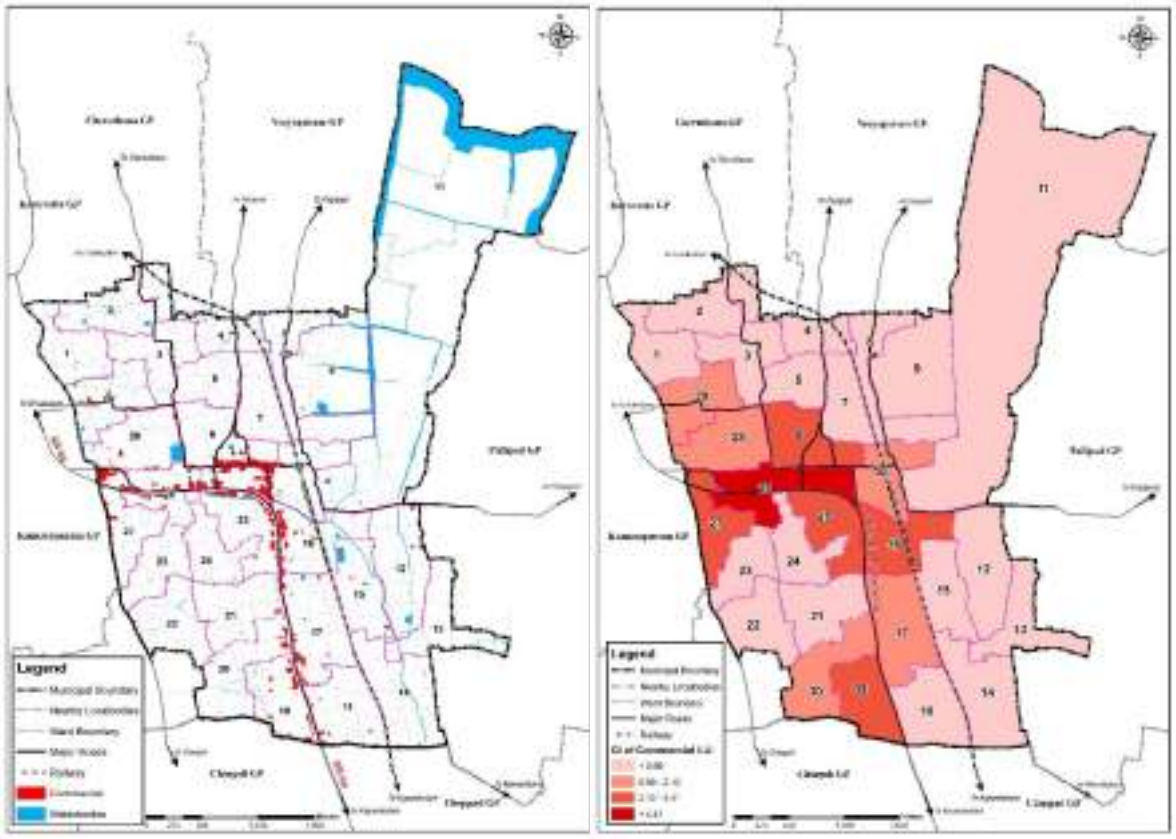

Figure 5.4: Spatial distribution and ward wise concentration index pattern of Commercial Land Use

5.2.3 Industrial Land Use

Industrial land accounts for only 0.18% of the total municipal area, reflecting the limited industrial base of Haripad, as the town does not host any major industrial establishments. The spatial distribution and concentration pattern of industrial land use are illustrated in Figure 5.5, which indicates relatively higher concentrations in Thulamparambu North, Thrippakkudam, and Eerickal wards.

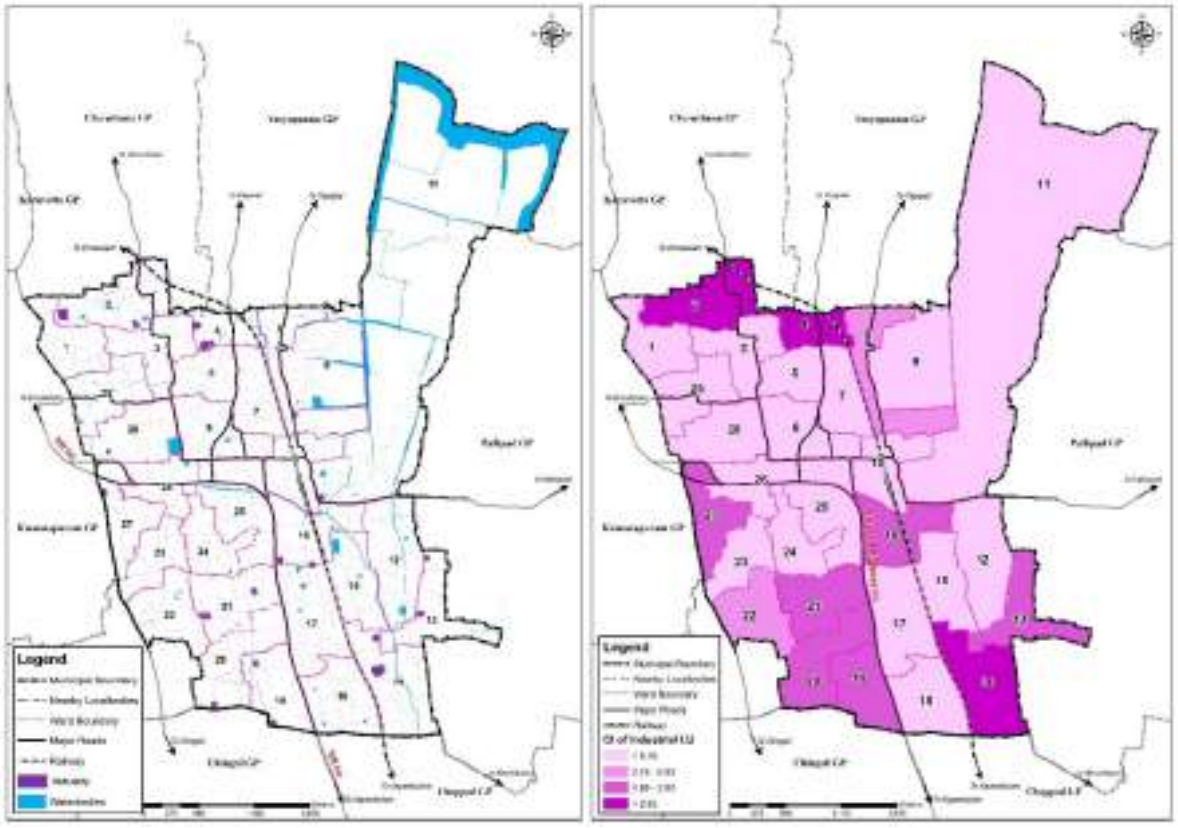

Figure 5.5: Spatial distribution and concentration index pattern of Industrial Land Use

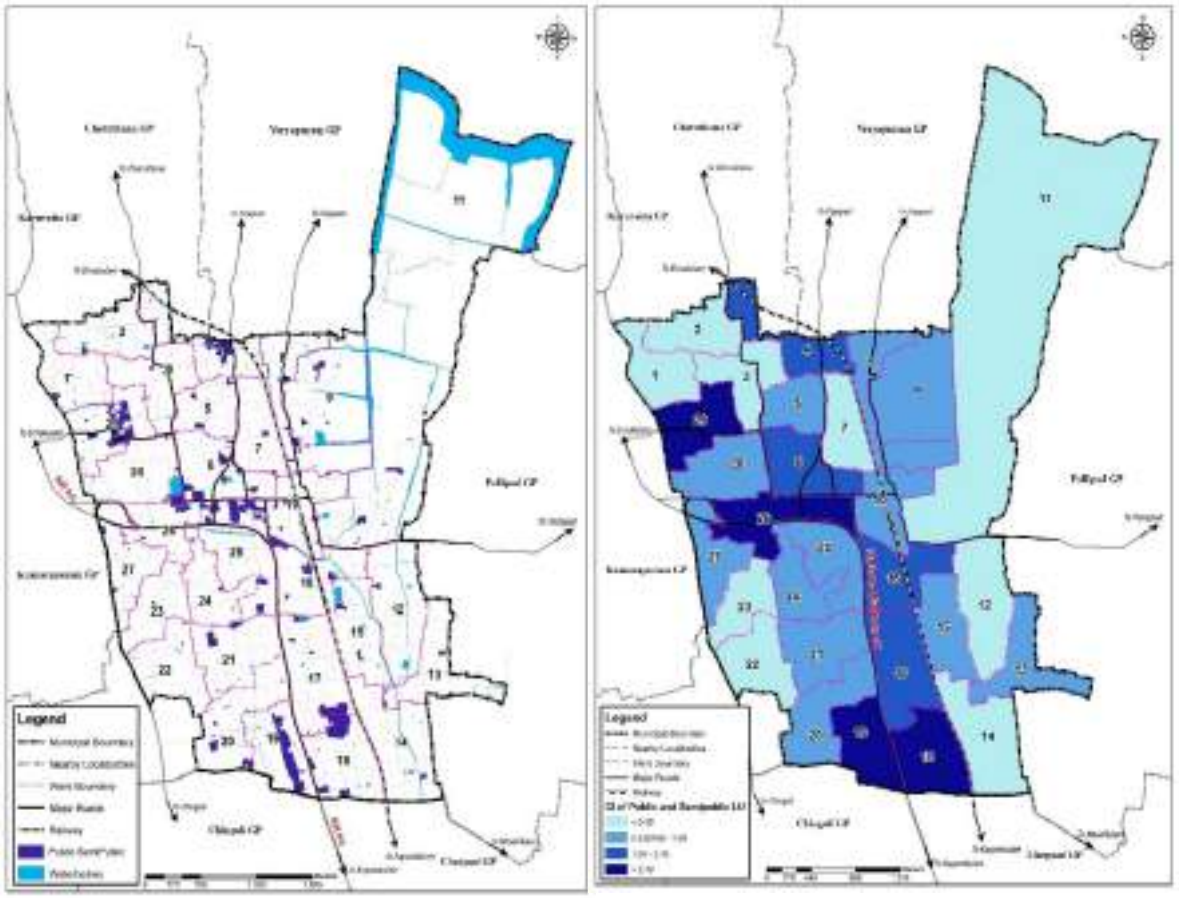

Figure 5.6: Spatial distribution and ward wise concentration index pattern of Public & Semi-

5.2.4 Public & Semi-public Land Use

Public and Semi-Public land use includes government offices, educational institutions, hospitals, and religious and cultural facilities, with a significant concentration of government offices in the town centre. This category occupies 3.55% of the total municipal area. The spatial distribution and concentration pattern of Public and Semi-Public land use are presented in. Figure 5.6.

5.2.5 Agricultural Land Use

Agricultural land within the municipality is broadly classified into Wet Agriculture and Dry Agriculture based on cultivation practices and water availability. Wet Agriculture primarily comprises paddy fields that depend on standing water and seasonal monsoon flows, while Dry Agriculture includes cultivation on relatively dry land, supporting crops such as coconut, banana, and other mixed crops that require comparatively less water and rely mainly on rainfall or limited irrigation.

5.2.5.1 Dry Agriculture

Dry land accounts for 6.18% of the total municipal area in Haripad. Dry cultivation is predominantly concentrated in the Suresh Market Ward, which shows the highest concentration index for this land use, as illustrated in Figure 5.7. Coconut cultivation forms the backbone of dry agriculture in the municipality, reflecting its suitability to local soil and climatic conditions. Other crops such as banana, tapioca, and tuber crops are cultivated only to a limited extent and largely as supplementary activities. The spatial pattern indicates that dry agriculture remains localized and concentrated, with Suresh Market Ward continuing to function as the primary zone for such agricultural practices within Haripad.

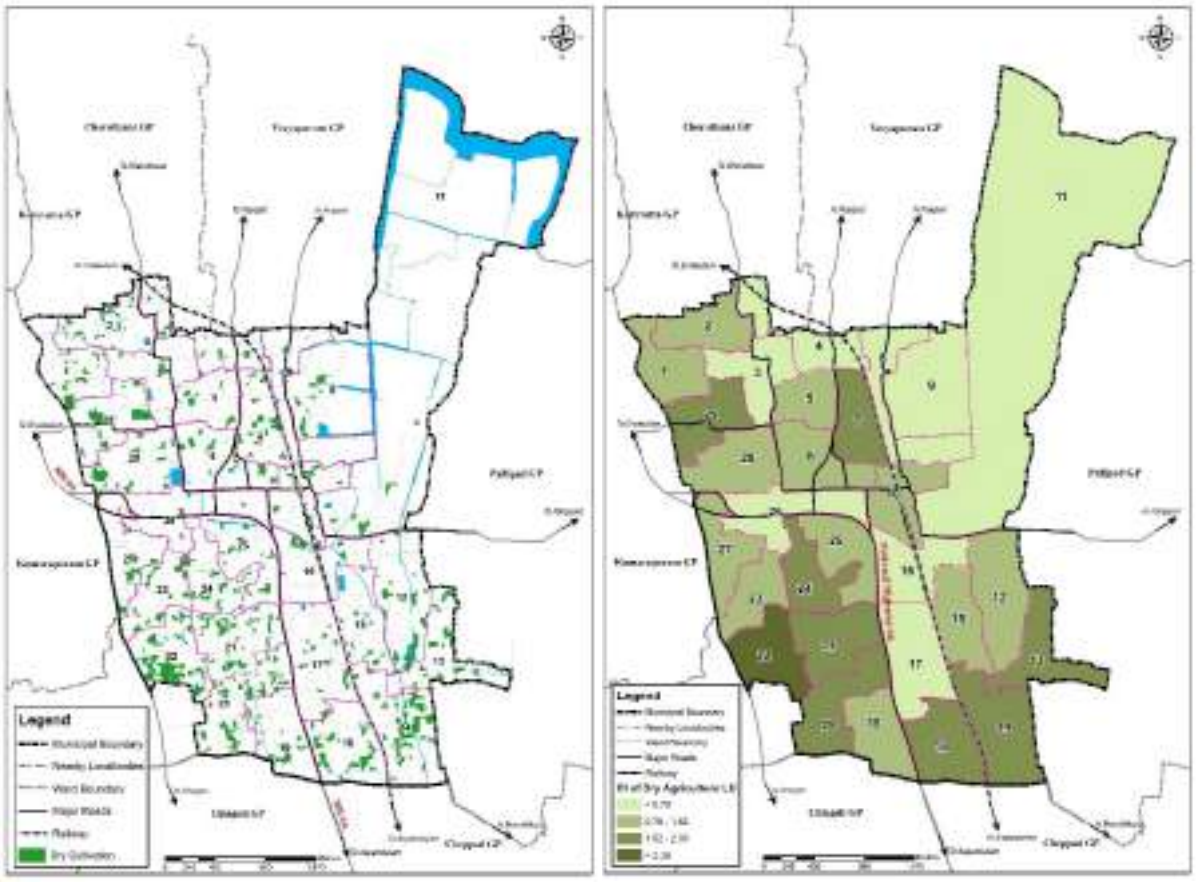

Figure 5.7: Spatial distribution and ward wise concentration index pattern of Dry Agriculture Land Use

5.2.5.2 Paddy

Paddy cultivation, constitutes 29.93% of the total municipal area, covering an extent of 4.69 Sqkm. These paddy fields form a dominant component of Haripad's agrarian landscape and are mainly concentrated in the Vathukulangara, P.H.C, and Pilappuzha South wards. Among these, P.H.C and Pilappuzha South wards exhibit the highest concentration of wet agricultural land, reflecting the presence of large, contiguous paddy tracts and traditional padasekharams. The spatial distribution of paddy fields and their concentration index pattern are illustrated in Figure 5.8, highlighting the uneven but agriculturally significant distribution of wet cultivation across the municipal area.

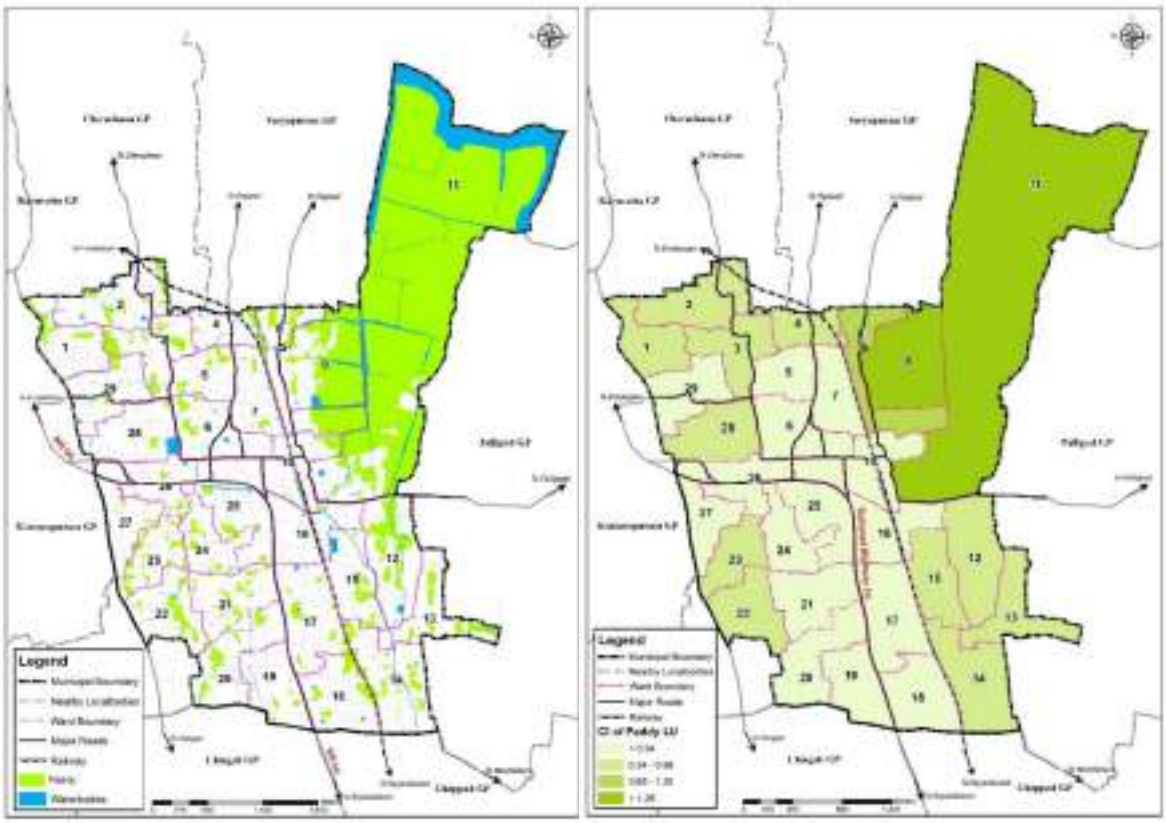

Figure 5.8: Spatial distribution and wardwise concentration index pattern of Paddy Fields

5.2.6 Transportation

Transportation land use accounts for 5.35% of the total municipal area, comprising the town's road network and railway infrastructure. In addition to local roads, National Highway 66 and a State Highway 80 traverse the town, significantly enhancing its strategic connectivity along the coastal corridor and linking



Figure 5.9 : KSRTC Bus Stand- Haripad

Haripad to major urban centres in Kerala. Haripad is well served by a mix of state-operated and private public transport systems, ensuring strong intra- and inter-regional connectivity. Long-distance and inter-district services are primarily operated by the Kerala State Road Transport Corporation (KSRTC) from the KSRTC Bus Station (Figure 5.9) located adjacent to NH 66, which functions as a major regional transport node. In the absence of a dedicated private bus stand, private bus services operate mainly from the Taluk Hospital Junction, serving local and short-distance routes within and around the town.

The railway line passes through the central part of the municipality, with the Haripad Railway Station (Figure 5.10) located close to the town centre, further strengthening regional accessibility and supporting daily commuter movement. The spatial distribution of transport infrastructure and its concentration pattern across the municipal area are depicted in Figure 5.11, illustrating the centrality of transport facilities within the urban structure of Haripad..



Figure 5.10 : Haripad Raiwlay station

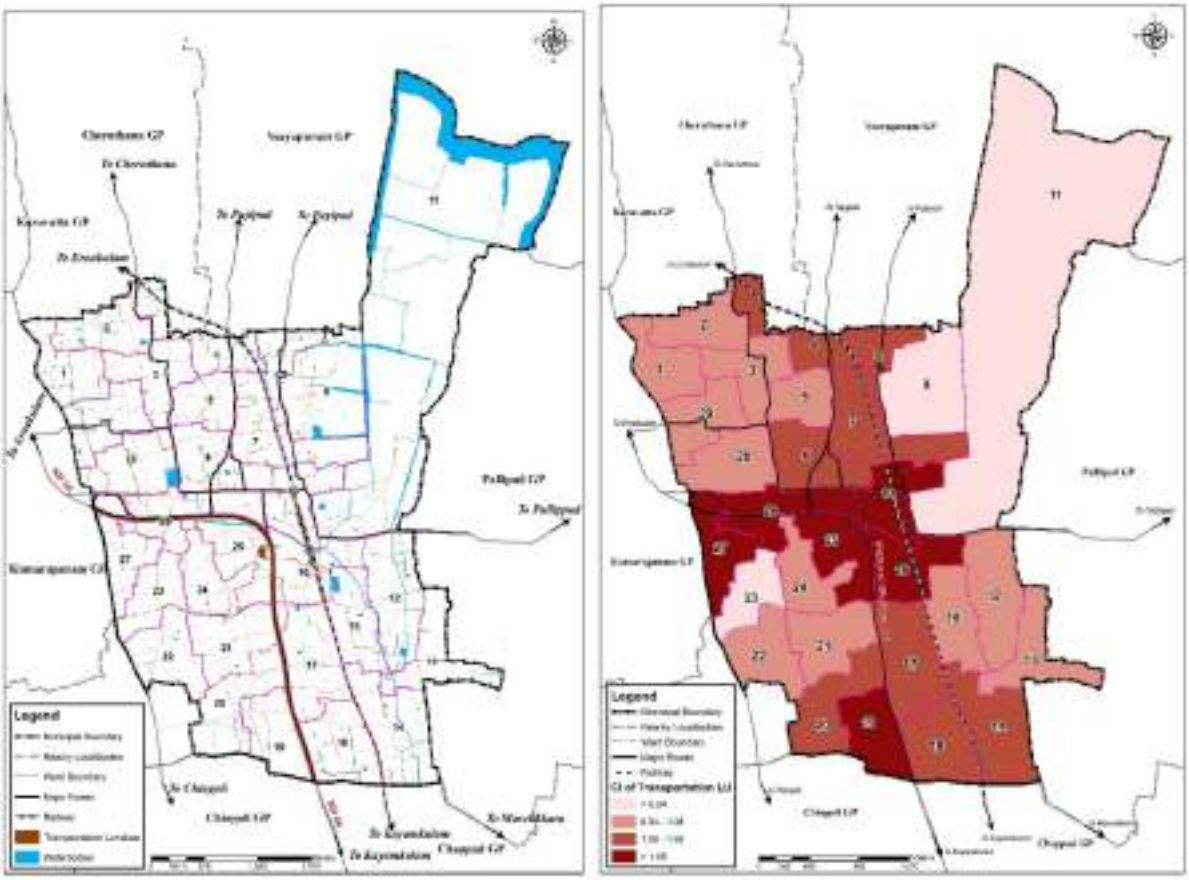

Figure 5.11: Spatial distribution and ward wise concentration index pattern of Transportation Land Use

5.2.7 Recreational Land Use

Recreational land use in Haripad accounts for only 0.06% of the total municipal area, indicating an acute deficiency in public open spaces and leisure infrastructure. Existing recreational facilities are limited to community halls, public libraries, and cinema halls, while essential urban amenities such as a stadium and an open-air theatre are currently absent. As shown in Figure 5.12, recreational uses are unevenly distributed across the municipality, with relatively higher concentrations in Kilikkakulangara and Thulamparambu Naduvathu, leaving large parts of the town underserved.

When compared with national planning standards, the shortfall becomes more pronounced. As per the URDPFI Guidelines (2014), small towns are required to allocate approximately 12–14% of their total area for recreational use, encompassing parks, playgrounds, sports facilities, and open spaces. Haripad's existing provision of 0.06% is therefore far below the recommended benchmark, reflecting a critical gap in urban social infrastructure. This deficit has implications for public health, social interaction, child development, and overall quality of life, especially in a town facing increasing climate stress and limited informal open spaces. The analysis clearly underscores the urgent need for a planned, equitable, and phased enhancement of recreational infrastructure to meet statutory norms and support inclusive urban well-being in Haripad.

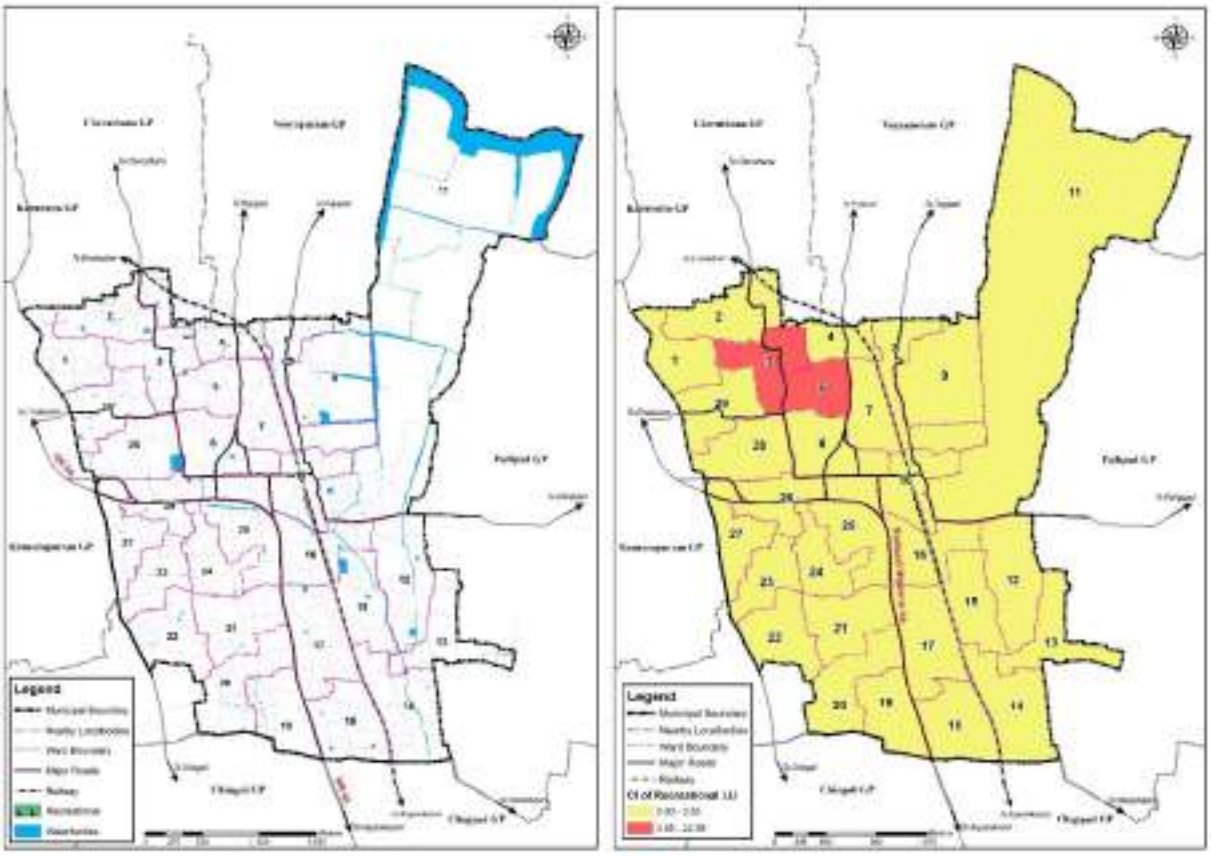

Figure 5.12: Spatial distribution and ward wise concentration index pattern of Recreational Land Use

5.2.8 Undeveloped area /vacant lands

Vacant land constitutes 1.90 % of Municipal Area. The spatial distribution of Vacant Land Use and its concentration pattern is shown in Figure 5.13. The higher concentration is in Mannarasala, Danapady, Thulamparambu South, Town, Hospital and RK Junction wards.

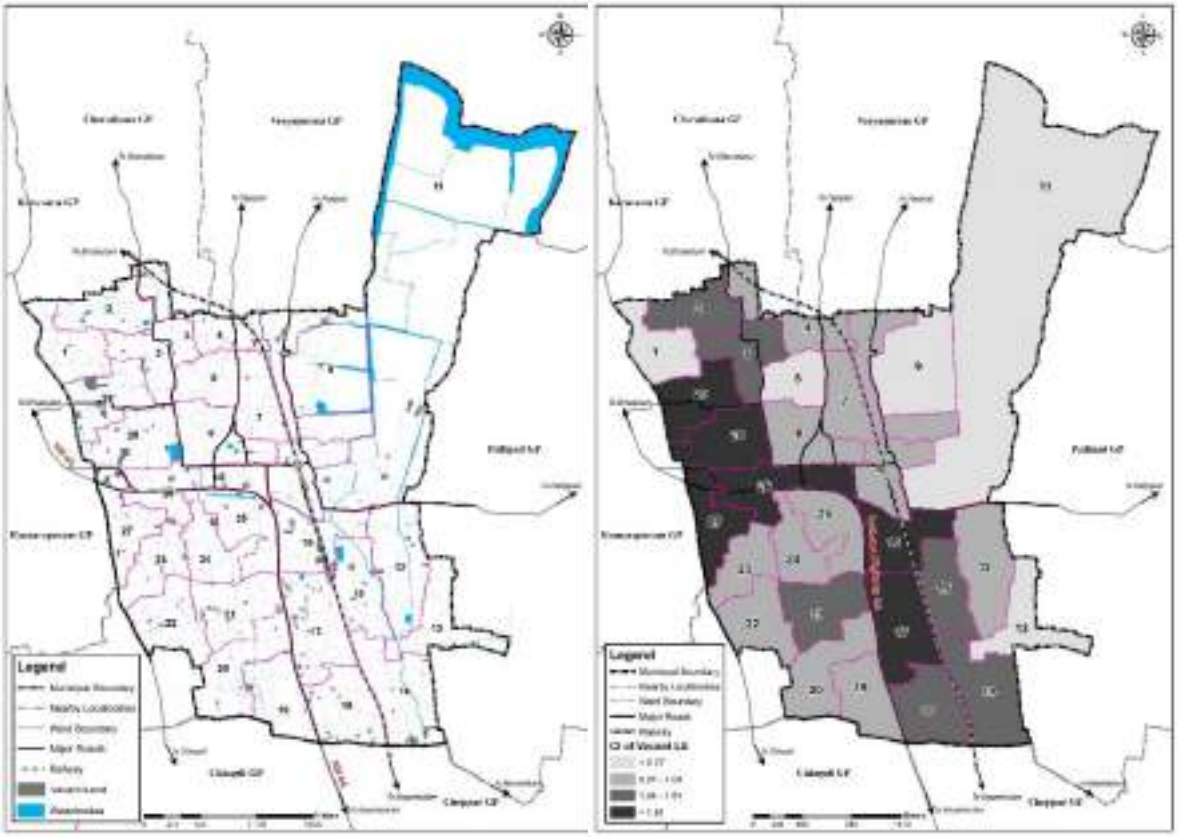

Figure 5.13: Spatial distribution and ward wise concentration index pattern of Vacant Land Use

5.2.9 Other uses – Marshy, Water body & Sacred Groves

Marshy lands in Haripad comprise low-lying, waterlogged areas, many of which were formerly agricultural lands but are now unproductive due to prolonged inundation and natural succession. These areas cover 0.22 sq. km (1.34%) of the municipal area and function as natural water retention zones.

Sacred groves account for 0.12% of the municipal area and are mainly located within the Mannarasala Nagaraja Temple premises, serving as ecologically preserved and culturally significant landscapes.

Water bodies cover 5.57% of the municipal area and include rivers, canals, irrigation channels, drains, and ponds that are vital for irrigation, drainage, flood moderation, and ecological balance, though increasingly affected by pollution and siltation. The spatial distribution of these land uses shown

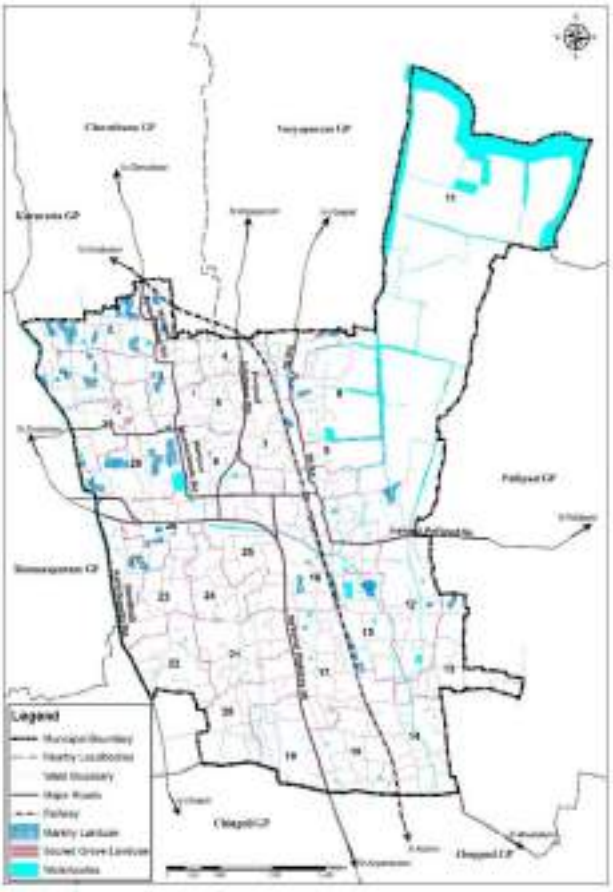

Figure 5.14: Spatial distribution of Marshy, Water body & Sacred Groves Land Uses

in (Figure 5.14) highlights Haripad's strong ecological character and the need for careful environmental protection in future planning.

5.3 Temporal changes in the Land Use and direction of growth

Over the past decade, the Haripad municipal area has undergone significant land use changes, marked primarily by rapid urbanization. One of the most notable developments is the sharp increase in the number of buildings and a corresponding rise in built-up density. This urban expansion has come at the cost of agricultural land, which has seen a marked decline. Alongside this, water resources have also diminished. Another key transformation within the municipal limits is the development of the national highway, further shaping the region's evolving landscape.

The growth in residential, commercial, and mixed-use developments has altered the traditional spatial structure of the town, gradually transforming formerly open and peri-urban areas into consolidated urban zones. Increased infrastructure investments, particularly along major corridors, have accelerated ribbon development and intensified land values in adjacent areas. These changes have implications not only for land availability but also for environmental sustainability, local livelihoods, and drainage patterns. The cumulative effect reflects a clear transition from an agrarian-dominated landscape to a more urbanized and infrastructuredriven municipal fabric.

Figure 5.15 illustrate the changes in various parts of the city over the last 10 years (2015 to 2025).

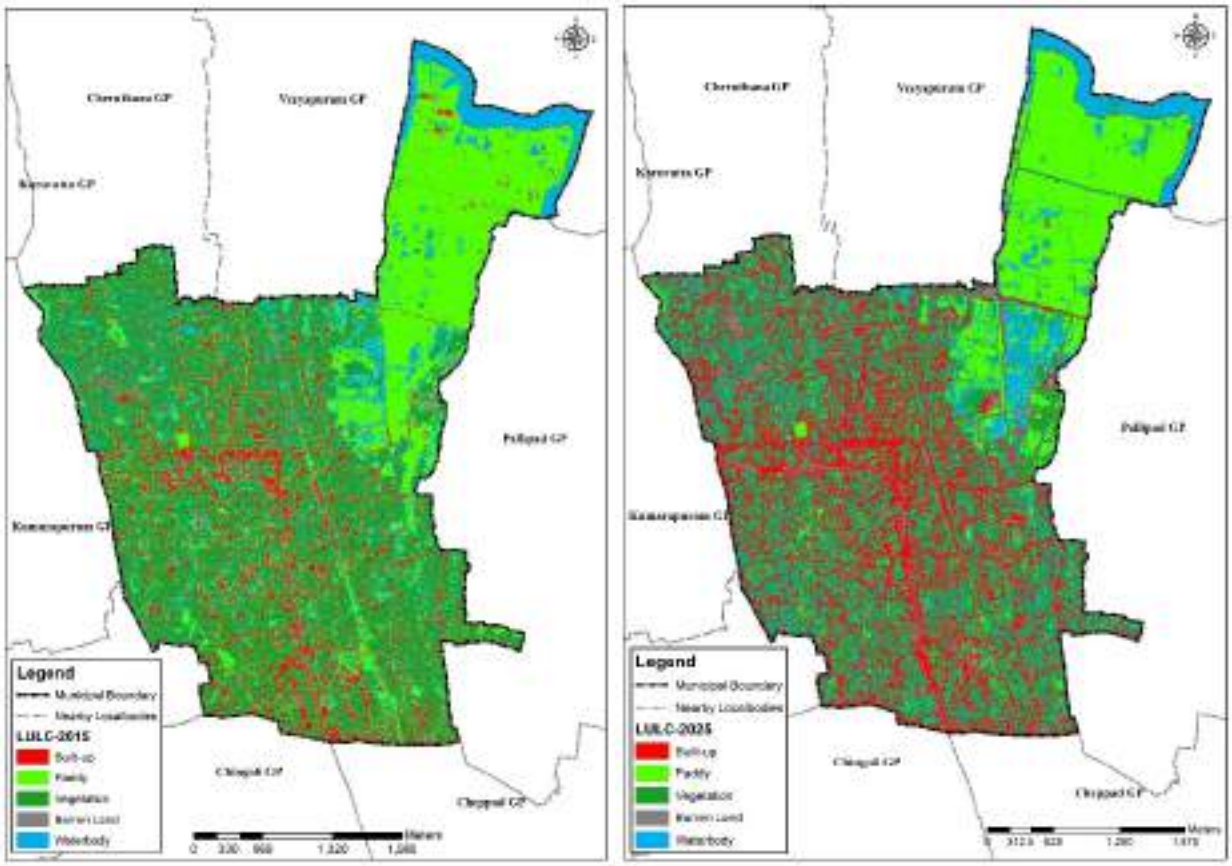

Figure 5.15: Decadal change from 2015 to 2025 - Town Centre

5.4 Ward Wise Land Use Analysis

The existing Land Use map of the municipal area has been prepared by classifying present land use into 12 categories: Residential, Commercial, Industrial, Public and Semi-Public, Transportation, Dry Cultivation, Paddy, Marshy, Water Bodies, Recreational Areas, Sacred Groves, and Vacant Land. These land use categories vary in extent across all 29 wards of the Municipality, with ward-wise details presented in Table 5.2.

Table 5.2: Ward wise Land Use break-up, 2024-25

Ward No.	Area (Sq.Km)											
	Residential	Commercial	Industrial	Public & Semi Public	Vacant Land	Recreational	Transportation	Sacred Grooves	Paddy	Marshy	Dry Agriculture	Water body
1	0.248	0.000	0.000	0.006	0.001	0.000	0.017	0.000	0.053	0.029	0.029	0.003
2	0.236	0.001	0.004	0.003	0.010	0.000	0.016	0.000	0.024	0.039	0.026	0.008
3	0.265	0.002	0.000	0.002	0.009	0.004	0.017	0.000	0.068	0.008	0.016	0.003
4	0.223	0.004	0.006	0.033	0.007	0.000	0.030	0.000	0.042	0.007	0.017	0.006
5	0.206	0.002	0.000	0.011	0.001	0.002	0.013	0.002	0.026	0.000	0.017	0.000
6	0.256	0.036	0.000	0.037	0.005	0.000	0.036	0.000	0.027	0.001	0.030	0.005
7	0.255	0.001	0.000	0.005	0.004	0.000	0.023	0.000	0.015	0.000	0.039	0.001
8	0.227	0.001	0.000	0.010	0.008	0.001	0.032	0.003	0.189	0.007	0.005	0.017
9	0.173	0.002	0.000	0.019	0.002	0.000	0.016	0.001	0.410	0.005	0.022	0.053
10	0.234	0.015	0.000	0.012	0.007	0.000	0.051	0.000	0.031	0.000	0.026	0.005
11	0.220	0.000	0.000	0.019	0.015	0.000	0.023	0.000	3.282	0.011	0.019	0.681
12	0.349	0.004	0.000	0.004	0.007	0.000	0.024	0.000	0.123	0.001	0.050	0.020
13	0.248	0.002	0.001	0.008	0.002	0.000	0.022	0.000	0.071	0.004	0.044	0.005
14	0.346	0.003	0.006	0.004	0.018	0.000	0.037	0.000	0.072	0.000	0.086	0.009
15	0.236	0.003	0.000	0.010	0.012	0.000	0.022	0.000	0.039	0.022	0.022	0.019
16	0.265	0.027	0.001	0.028	0.022	0.000	0.056	0.001	0.004	0.011	0.019	0.009
17	0.354	0.021	0.000	0.030	0.028	0.000	0.049	0.000	0.039	0.001	0.027	0.003
18	0.245	0.006	0.000	0.064	0.011	0.000	0.038	0.000	0.050	0.000	0.052	0.003
19	0.202	0.023	0.001	0.068	0.005	0.000	0.043	0.000	0.010	0.000	0.026	0.004
20	0.289	0.010	0.001	0.018	0.006	0.000	0.035	0.000	0.051	0.000	0.067	0.004
21	0.305	0.004	0.002	0.012	0.012	0.000	0.023	0.000	0.045	0.000	0.059	0.001
22	0.228	0.002	0.001	0.001	0.004	0.000	0.015	0.000	0.051	0.000	0.098	0.003
23	0.223	0.000	0.000	0.001	0.004	0.000	0.009	0.000	0.057	0.000	0.031	0.001
24	0.246	0.001	0.000	0.011	0.006	0.000	0.018	0.000	0.038	0.000	0.037	0.002
25	0.217	0.026	0.000	0.010	0.007	0.000	0.060	0.000	0.024	0.000	0.026	0.009
26	0.214	0.066	0.000	0.079	0.023	0.001	0.075	0.000	0.016	0.007	0.009	0.003
27	0.209	0.025	0.001	0.006	0.016	0.000	0.037	0.000	0.009	0.011	0.025	0.001
28	0.269	0.010	0.000	0.008	0.021	0.000	0.023	0.000	0.010	0.050	0.040	0.023
29	0.190	0.006	0.000	0.067	0.037	0.000	0.017	0.014	0.015	0.003	0.047	0.007

5.4.1 Functional Character of the Town

Functional character is determined based on population distribution, average plot size and land use. Functional character of different wards of municipality is determined and is shown in Figure 5.16. It shows that wards 5, 19, 23, 26, 27, 28, and 29 form the urban area with high-density built-up areas, intense commercial activity, and strong connectivity along NH-66 and the railway corridor. Surrounding them, wards 1, 2, 3, 4, 6, 7, 8, 10, 12, 13, 14, 15, 16, 17, 18, 20, 21, 22, 24, and 25 function as semi-urban transition zones characterised by moderate residential density, emerging commercial pockets, and expanding built-up areas influenced by urban expansion. In contrast, wards 9 and 11 remain distinctly rural, dominated by agricultural lands, wetlands, and scattered low-density settlements, forming environmentally sensitive peripheral areas that act as ecological buffers to the rapidly urbanising central region.

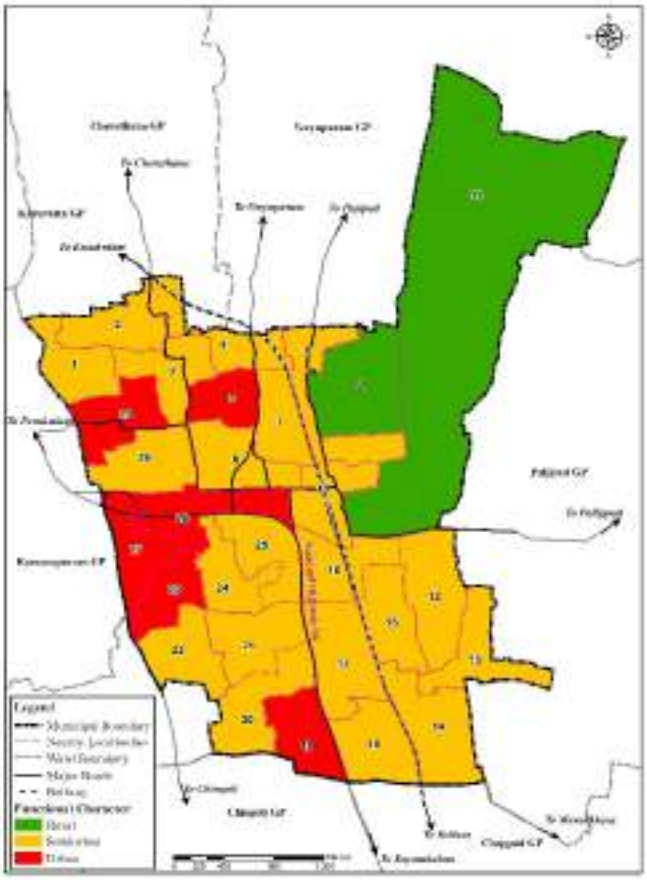

Figure 5.16: Functional Character

5.4.2 Activity Pattern of the Town

The activity pattern map (Figure 5.17) indicates that wards 9 and 11 function predominantly as primary activity zones, characterised by extensive agricultural lands and low-intensity development. Wards 1, 2, 3, 4, 6, 7, 8, 10, 12, 13, 14, 15, 16, 17, 18, 20, 21, 22, 24, and 25 exhibit secondary activity patterns, dominated by small-scale industries, allied activities, and mixed residential uses, reflecting moderate land-use diversity and emerging economic functions. In contrast, wards 5, 19, 23, 26, 27, 28, and 29 represent the tertiary activity zones, forming the commercial and service-oriented core with higher concentrations of trade, retail, transportation, and institutional functions along major road corridors such as NH-66 and key urban nodes. This ward-wise distribution highlights a clear hierarchy wherein the northeastern part remains agriculturally dominant, the central and southwestern areas form the commercial service nucleus, and the remaining wards

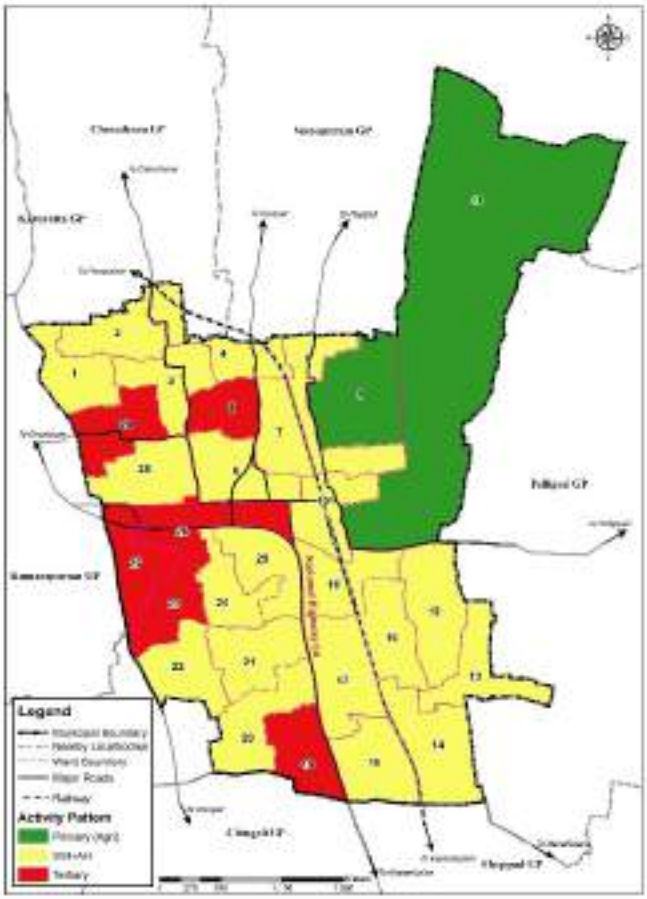

Figure 5.17: Activity Pattern

serve as intermediate zones supporting a mix of residential, industrial, and service-related activities.

5.5 Built Density - Temporal changes

The built-up area analysis for Haripad town for the period 2005–2025 has been carried out using data from the Scientific Information Systems and Databases report of the Joint Research Centre (JRC), European Commission, based on the Global Human Settlement Layer (GHSL) Data Package 2023. The assessment of temporal changes in built-up area for the years 2010, 2015, and 2020 indicates a clear and consistent trend of increasing urbanisation and spatial densification within the town. Built-up extent has been quantified using pixel-based analysis, where each pixel represents an area of 100 m × 100 m (1 hectare or 10,000 sq. m), enabling a standardised and comparable assessment of urban growth over time

Variation in built density in the municipal area over the 20-year period from 2005 to 2025 is shown in Figure 5.18. In 2005, the non-built-up area was 4.9 sq.km. However, this is decreased to 4 sq.km by 2025. There has also been a significant increase in the total built up area and built density.

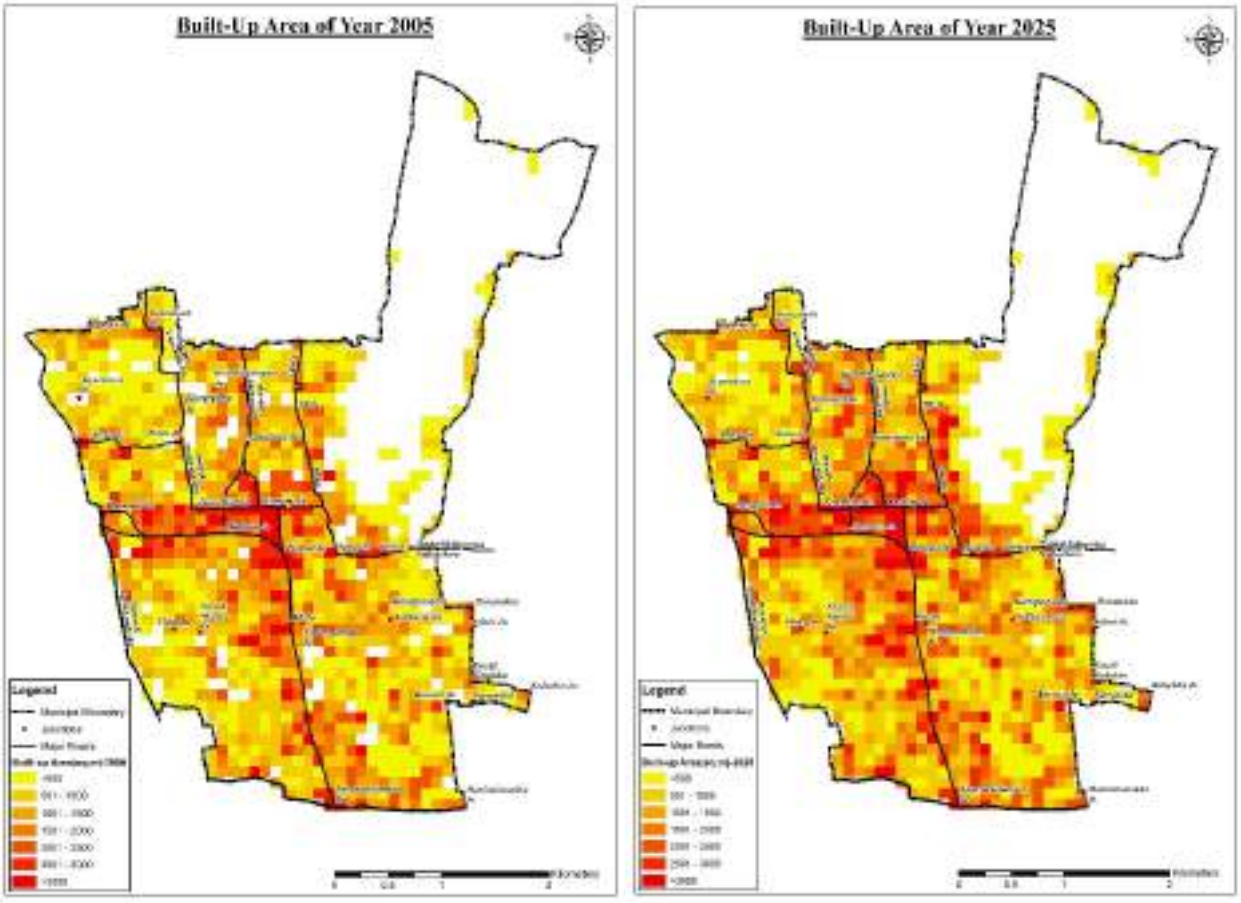

Figure 5.18: Built density variation from 2005 to 2025

The comparison of built density from 2005 to 2025 indicates a steady outward expansion of built-up areas within the Municipality. In 2005, development was largely concentrated around the central core and major road corridors, whereas by 2025, built-up areas have extended significantly into peripheral locations. The increasing presence of higher-intensity grids over time reflects greater land conversion for residential, commercial, and mixed-use functions. These changes suggest growing urbanization pressure, higher population concentration, and

the progressive transformation of low-density or undeveloped areas into urban land. The pattern of growth closely follows major transport corridors, highlighting the role of accessibility in guiding development. Overall, the temporal changes indicate a shift from a relatively compact urban form to a more dispersed and expansive development pattern.

5.6 Comparison of Existing Land Use with URDPFI Guidelines

URDPFI Guidelines (Urban and Regional Development Plans Formulation and Implementation Guidelines) are a set of comprehensive planning norms issued by the Ministry of Housing and Urban Affairs (MoHUA), Government of India. They serve as a framework for the preparation and implementation of development plans at various urban and regional levels. It guide urban planners, municipalities, and state governments in creating structured, inclusive, and sustainable urban and regional development plans. As per URDPFI Guidelines, 2014, town with population 20000 – 50000 is termed as "Small Town II". Hence, as per this, Haripad is a Small Town. A comparison between the percentages of major land use categories required for a town as per the URDPFI Guidelines and what is available in Haripad town is given in Table 5.3.

Table 5.3: Comparison of Existing Land Use with URDPFI Guidelines

Land Use	URDPFI Standard (% of total area)	% of total area for Haripad town
Residential	45 - 50	43.94
Commercial	02 - 03	1.84
Industrial	08 - 10	0.18
Public & Semi-public	06 - 08	3.55
Recreational	12 - 14	0.06
Transport & Communication	10 - 12	5.35
Agriculture, Water bodies and Special areas	Balance	

A comparison of Haripad's existing land use distribution with the URDPFI Guidelines highlights key imbalances and planning priorities across sectors:

- Residential (43.94%): Slightly below the URDPFI norm of 45–50%, indicating relatively compact residential development with limited horizontal expansion, but scope exists for planned housing growth.
- Commercial (1.84%): Marginally lower than the recommended 2–3%, reflecting limited formal commercial spaces and a need to strengthen local economic and service hubs.
- Industrial (0.18%): Significantly below the guideline range of 8–10%, confirming the absence of major industrial activity and underscoring Haripad's non-industrial, service- and agriculture-oriented character.
- Public & Semi-Public (3.55%): Considerably lower than the desired 6–8%, suggesting inadequate land allocation for institutions such as education, health, administration, and civic facilities.

- Recreational (0.06%): Extremely deficient compared to the recommended 12–14%, highlighting a critical shortage of open spaces, parks, and recreational infrastructure.
- Transport & Communication (5.38%): Below the URDPFI norm of 10–12%, indicating constrained road and transport infrastructure relative to planning standards.
- Agriculture, Water Bodies & Special Areas (Balance): Occupy a substantial share of land, reflecting Haripad's strong agrarian base and ecological character, but also limiting the availability of land for urban functions.

The analysis indicates that while Haripad retains a strong ecological and agricultural identity, key urban land uses—particularly industrial, recreational, public, and transport-related—are significantly below URDPFI standards, pointing to the need for strategic land use rebalancing in the Master Plan.

5.7 Effect of Hazard Risk

Hazard vulnerability related to land use and land cover refers to the susceptibility of different land use or land cover types to the impacts of natural hazards. The nature of land use whether urban, agricultural, or forested etc significantly influences its level of exposure and sensitivity to hazards.

The flood hazard return probability map for Haripad town has been prepared using the return period maps published by the Kerala State Disaster Management Authority (KSDMA). The analysis indicates that out of the 29 municipal wards, 14 wards fall within identified flood-prone areas. The total flood-affected area covers approximately 7.13 sq. km, accounting for

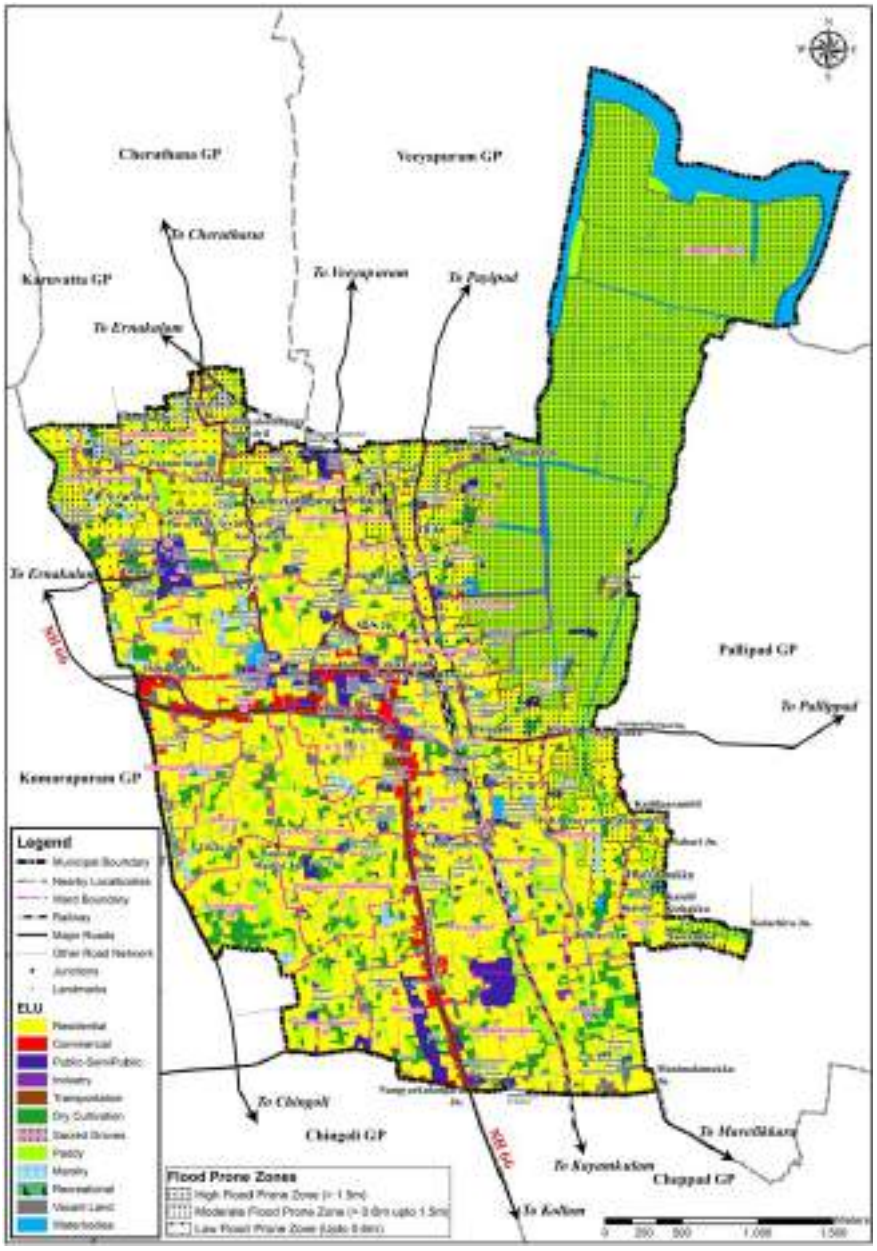

Figure 5.19 : Existing Landuse Map with Flood Prone Areas in the town

43.63% of the total municipal area of 16.34 sq. km. Figure 5.19 shows the existing land use map of the town with Flood Prone Areas.

Flood susceptibility is particularly pronounced in the north-eastern part of the town, which lies along the Achankovil River and comprises extensive low-lying paddy fields. Table 5.4 presents a comparative assessment of the overall land use distribution in Haripad and the proportion of each land use category located within flood-prone zones. The analysis reveals that wet agriculture (paddy fields) is the most affected land use, occupying about 60.48% of the total flood-prone area. Residential land use is the next most affected category, with approximately 20.78% of the town's total residential area falling within flood-prone zones. This pattern highlights the significant exposure of both agricultural and residential land uses to flood risk and underscores the need for risk-informed land use planning and mitigation strategies in the Master Plan.

The analysis of land use distribution within the flood-prone area indicates that paddy fields constitute the largest share, accounting for more than 60 percent of the affected land, reflecting the predominance of low-lying agricultural zones in these vulnerable locations. Marshy areas and dry cultivation also exhibit moderate exposure, whereas commercial and industrial uses form only a negligible portion of the flood-affected land. Overall, the findings highlight that the flood-prone area is primarily characterized by agricultural and wetland categories, while major built-up activities remain largely outside these zones.

Table 5.4: Land Use breakup in flood prone area

Land Use	Area in	% of	Area in FPA (sq.km)	% of Respective
Paddy	4.69	29.93	4.11	87.55
Waterbodies	0.92	5.57	0.72	77.92
Residential	7.18	43.94	1.41	19.63
Dry Cultivation	1.01	6.18	0.17	16.76
Marshy	0.42	1.35	0.11	25.08
Transportation	0.76	4.65	0.11	14.18
Railway	0.11	0.70	0.03	26.80
Commercial	0.31	1.84	0.01	3.16
Industrial	0.03	0.18	0.01	23.73
Public-Semi Public	0.58	3.55	0.06	10.35
Vacant Land	0.30	1.90	0.06	20.11
Recreational	0.01	0.06	0.00	54.07
Sacred Groves	0.02	0.12	0.004	16.95
Total area of LU in FPA			**7.13**	**100**

Key Observations from LandUse Distribution and Flood Exposure

- **Paddy Lands (4.69 sq.km, 29.93% of municipal area |4.11 sq.km/87.55% in FPA)** Paddy cultivation shows the **highest level of exposure**, with nearly 88% of its area under FPA. This highlights the dual challenge of safeguarding both livelihoods and ecological functions, as paddy fields also act as natural flood retention basins. Recurrent crop losses weaken farmer resilience, discourage agricultural activity, and risk accelerating the decline of paddy cultivation in the region.

- **Waterbodies (0.92 sq.km, 5.57% of municipal area|0.72 sq.km/77.92% in FPA)**
  Around 78% of waterbodies in the municipality are situated in flood-prone zones, reflecting their natural role as buffers during inundation. However, their degradation or encroachment reduces carrying capacity and increases flooding intensity. Protecting and rejuvenating these ecosystems is critical to restoring natural resilience.
- **Residential (7.18 sq.km, 43.94% of municipal area |1.41 sq.km/19.63% in FPA)**
  Nearly one-fifth of the residential area is located in flood-prone zones, making housing one of the most affected sectors. This indicates the vulnerability of large portions of the population, especially in low-income neighbourhoods where structural resilience is weak. Flooding here not only threatens lives and property but also places pressure on evacuation, shelter, and post-disaster rehabilitation mechanisms.
- **Marshy Lands (0.42 sq.km, 1.35% of municipal area| 0.11 sq.km/25.08% in FPA)**
  Nearly half of the marshy areas fall in FPA. These act as natural sponges but are increasingly under threat from land conversion. Their loss would further intensify flooding impacts across Haripad.
- **Transport Infrastructure – Roads & Railways (combined area of 0.87 sq.km. 5.35% of municipal area| 0.14 sq.km/40.98% in FPA)**
  While their land share is relatively small, the strategic significance of transport infrastructure is critical. Even modest levels of exposure disrupt mobility, evacuation, and supply chains, directly affecting emergency response efficiency and local economic stability. It is seen that 17.2 kms out of 145.53 kms of total LSGD roads in the municipality are flood prone.
- **Commercial (0.31 sq.km; 1.84% of municipal area| 0.01 sq.km/3.16% in FPA) and Industry (0.03 sq.km; 0.18% of municipal area| 0.01 sq.km/23.73% in FPA)**
  Although commercial and industrial land uses occupy small proportions of the municipal area, their flood exposure can cause disproportionate impacts on employment, trade, and small-scale economic activities. Local businesses are particularly vulnerable to even short-duration flooding.
- **Public/Semi-Public (0.58 sq.km; 3.55% of municipal area| 0.06 sq.km/10.35% in FPA)**
  Institutions such as schools, health centres, and administrative facilities, though limited in area, are critical to disaster response. Their exposure disrupts essential services, particularly in times when they are most required.
- **Other Categories – Vacant Land (20.11% in FPA), Recreational Areas (54.07%), and Sacred Groves (16.95%)**
  While relatively small in extent, these areas hold ecological and social importance. Vacant land within FPA offers potential for conversion into flood retention basins or green buffers, while sacred groves and recreational lands provide micro-level ecological services.

As per the Guidelines for Preparation of Risk-Informed Master Plans for Towns, the assessment of land cover vulnerability is a critical component of physical vulnerability analysis. Physical vulnerability is assigned a weightage of 20% in the overall risk assessment framework and comprises three sub-parameters: buildings (50%), transportation networks (35%), and land cover (15%). This chapter specifically addresses the land cover vulnerability of Haripad town,

recognising its importance in influencing flood behaviour, drainage performance, and overall disaster impacts. Land cover vulnerability has been assessed by analysing the extent and type of land uses affected by flood and landslide hazards, with particular emphasis on how existing land use patterns either exacerbate or mitigate hazard impacts. The details of the analysis has been explained in Chapter 6 of this Master Plan. The analysis draws on primary data collected through a 10% sample, door-to-door socio-economic survey conducted in identified flood-prone and landslide-prone areas of the town. This data was spatially analysed using GIS tools to map hazard exposure and assess land cover impacts with greater accuracy. Based on the prescribed guidelines, cadastral units were categorised into low, moderate, and high vulnerability classes.

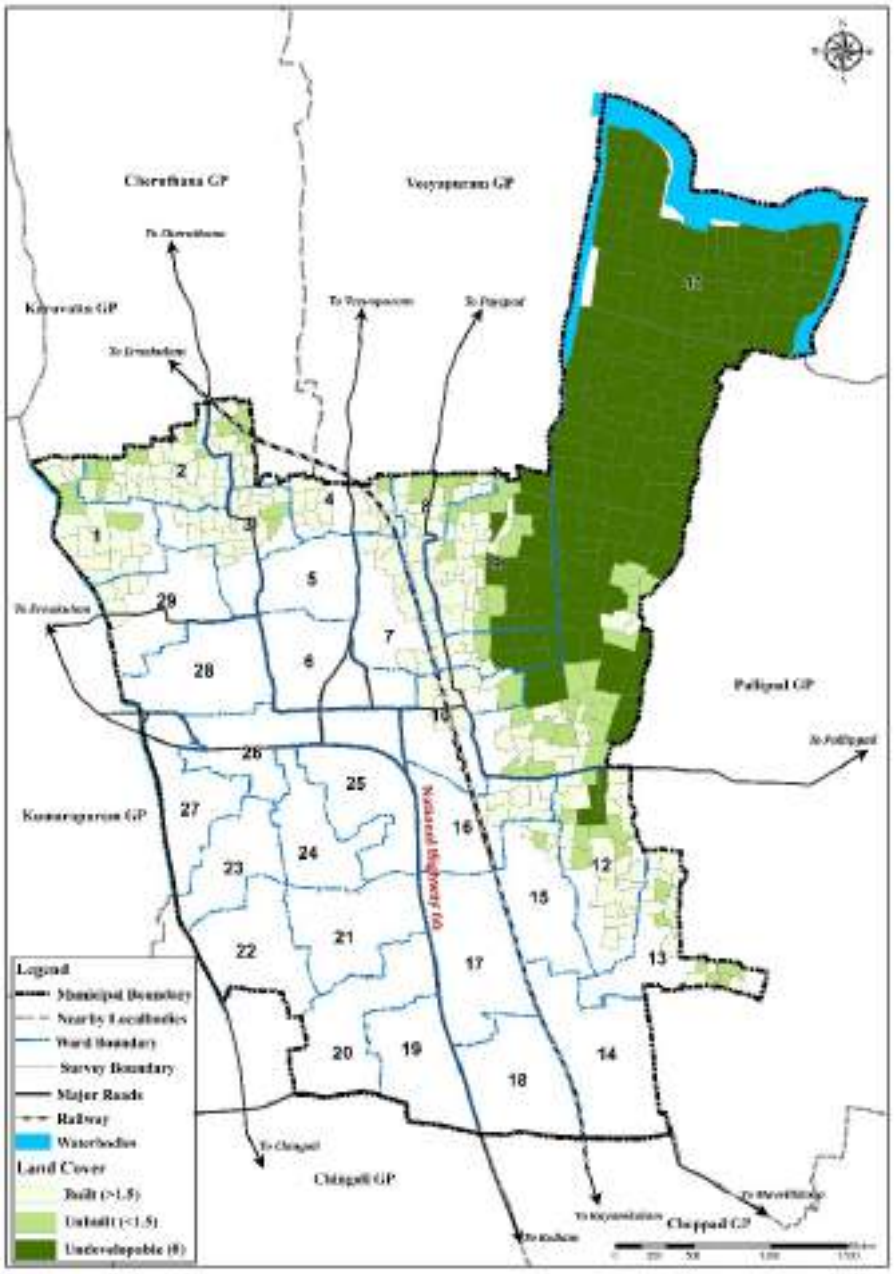

Figure 5.20: Landcover vulnerability in flood prone area

The assessment reveals that areas dominated by built-up land uses exhibit high land cover vulnerability. The prevalence of impervious surfaces such as buildings, paved roads, and hardscaped plots restricts natural infiltration, accelerates surface runoff, and leads to water accumulation during intense rainfall events, thereby increasing the risk of property damage and disruption of daily activities. In contrast, agricultural lands, open spaces, paddy fields, wetlands, and other undeveloped areas demonstrate comparatively low vulnerability, as they enable water retention, slow runoff, and facilitate natural drainage processes.

These low-vulnerability land cover types are largely concentrated in the northern and eastern parts of Haripad, where extensive low-lying agricultural tracts and open spaces act as natural flood buffers, reducing downstream flood intensity and duration. This spatial pattern highlights the critical role of land cover in shaping flood risk and reinforces the need to protect and manage open, agricultural, and ecologically sensitive areas. Overall, the land cover vulnerability assessment underscores the importance of integrating risk-sensitive land use planning, conservation of natural drainage systems, and controlled urban development as key strategies for strengthening Haripad's long-term flood resilience.

5.8 Inference

Haripad Municipality exhibits a predominantly residential land use pattern, with about 44% of its area under residential use. Agricultural land constitutes approximately 36%, of which nearly 30% is wet agriculture (paddy fields) and 6% dry agriculture. Commercial activities are concentrated in the town core and along major transport corridors, while industrial land use remains minimal at 0.18%. Recreational land use is extremely limited at 0.06%, and sacred groves account for about 0.12%, largely within the Mannarasala Temple precinct.

Flood hazard analysis indicates that 7.13 sq. km (43.63%) of the municipal area lies within flood-prone zones, affecting 14 of the 29 wards, with the highest exposure in the north-eastern parts along the Achankovil River. Paddy lands are the most affected, with 87.55% of their area falling within flood-prone zones, accounting for about 60.48% of the total flood-affected area. While these lands function as natural flood buffers, recurrent inundation undermines agricultural livelihoods. Water bodies also show high exposure (77.92%), reflecting both their buffering role and vulnerability to degradation.

Residential land use shows significant exposure, with about 19.63% of residential areas located in flood-prone zones, increasing risks to life and property. Transport infrastructure has nearly 41% exposure, affecting mobility and emergency response during flood events. Although commercial, industrial, and public/semi-public uses occupy smaller areas, flooding causes disproportionate economic and service disruptions. Marshy lands, vacant plots, recreational areas, and sacred groves—though limited in extent—play important ecological roles in flood mitigation.

As per the Guidelines for Preparation of Risk-Informed Master Plans for Towns, land cover vulnerability forms part of the physical vulnerability assessment with a 20% weightage in overall risk evaluation. In Haripad, cadastral-level GIS analysis indicates higher vulnerability in built-up areas due to impervious surfaces, and lower vulnerability in agricultural lands, wetlands, and open spaces that enable water retention. This pattern highlights the strong relationship between land use and flood behaviour, underscoring the need for risk-sensitive land use planning, conservation of natural buffers, and controlled urban expansion to enhance flood resilience.

CHAPTER
06

HAZARD PROFILE & CLIMATE CHANGE



In response to increasing climate impacts and recurring natural disasters, the Government of Kerala emphasizes building resilience through risk-informed urban planning. The Master Plan integrates these principles in line with the Guidelines for the Preparation of Risk-Informed Master Plans. This chapter analyses the town's hazard profile by identifying key risks such as flooding, waterlogging and coastal vulnerabilities, along with the broader effects of climate change on the region. It serves as a framework to guide sustainable, resilient and adaptive planning strategies for Haripad's future development.

- Introduction
- Hazard profile
- Hazard profile of town
- Major Hazard events and impacts
- Mitigation measures undertaken
- Climate change impacts
- Vulnerability and risk assessment
- Existing disaster response system
- Inference

6. HAZARD PROFILE AND CLIMATE CHANGE

6.1 Introduction

Understanding hazard profiles and conducting risk assessments are fundamental to proactive disaster management in urban areas. The primary objective is to mitigate disaster risks and minimize their impacts through early hazard identification and strategic planning. This approach prioritizes preparedness and resilience over post-disaster response, ensuring the reduction of vulnerabilities and the enhancement of community safety.

The increasing frequency and intensity of disasters due to climate change have resulted in significant global consequences, with Kerala identified as one of the most vulnerable regions in India. The state faces severe socio-economic and environmental impacts from hazards such as floods, droughts, and biodiversity loss.

The Kerala State Action Plan on Climate Change (2022), prepared by the Directorate of Environment and Climate Change (DoECC), designates districts such as Alappuzha as climate hotspots. For municipalities such as Haripad, conducting a comprehensive risk analysis is imperative for the implementation of targeted interventions aimed at safeguarding residents, preserving biodiversity, and promoting sustainable urban development in response to escalating climate challenges.

6.2 Hazard profile of Kerala

Kerala State, nestled in the southwestern tip of India, showcases a unique hazard vulnerability profile owing to its diverse geographical features and climatic patterns. Blessed with lush greenery, expansive coastlines, and towering Western Ghats, Kerala is prone to a myriad of hazards ranging from floods and landslides to cyclones and tsunamis. The state's monsoon season, characterized by heavy rainfall, often leads to devastating floods, exacerbating vulnerabilities in its densely populated regions. Additionally, Kerala's unique socio-economic fabric, with a significant population dependent on agriculture and tourism, amplifies the impacts of these hazards, making comprehensive risk management strategies imperative for resilience and sustainable development in the region.

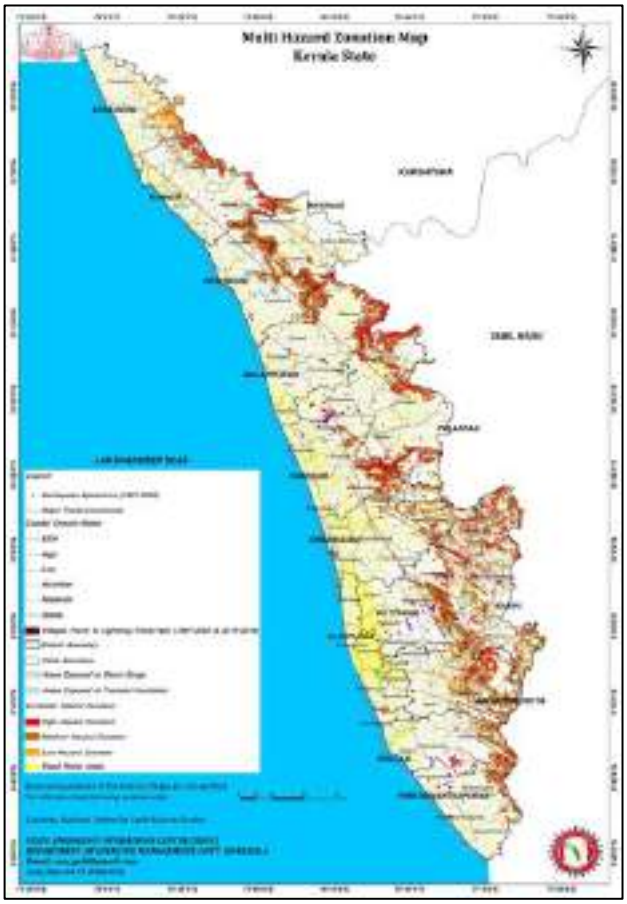

Figure 6.1: Multi Hazard Zonation Map of Kerala
Source: KSDMA

The state is mainly prone to eight natural hazards which were analysed for each district in the state. The multi hazard zonation map of Kerala is given in the

Figure 6.1. Further Figure 6.2 illustrates the district-wise multi-hazard susceptibility scale that depicts the susceptibility of exposed hazards in each district and classifies the hazards into four categories as Very Highly, Highly, Moderately and Least Susceptible. Each district has a very unique hazard profile.

A Disrict wise hazard profile of eight natural hazards, shown in Table 6.1, provides a comparative overview of the susceptibility of the district wise multi hazards. It gives susceptibility outline for all fourteen districts carrying eight natural hazards (Figure 6.2)

Thiruvananthapuram								
Kollam								
Alappuzha								
Pathanamthitta								
Kottayam								
Idukki								
Ernakulam								
Thrissur								
Palaghat								
Malappuram								
Kozhikhode								
Wayanad								
Kannur								
Kasarghode								
Scale	Very Highly Susceptible		Highly Susceptible		Moderately Susceptible		Least Susceptible	

Figure 6.2: District-wise Multi Hazards Susceptibility scale
Source: A geographic analysis of natural hazard profile of Kerala, India, Volume VI Number I December 2016

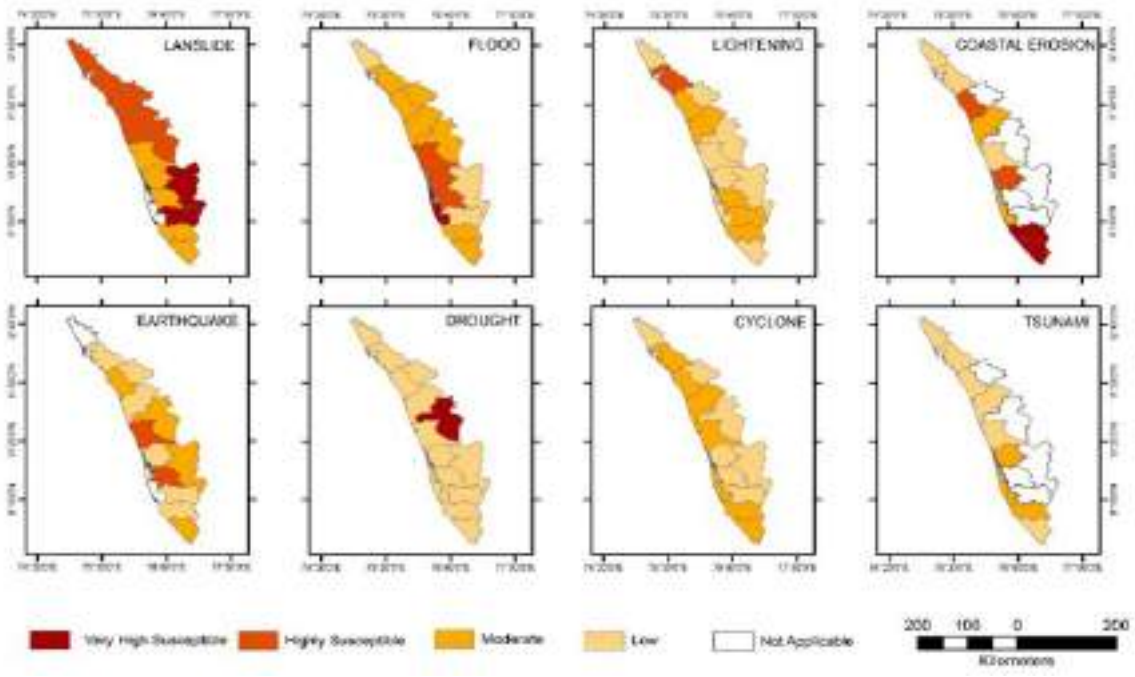

Figure 6.3: Hazard susceptibility map
Source: A geographic analysis of natural hazard profile of Kerala, India, Volume VI Number I December 2016

Table 6.1: District wise hazard profile of eight natural hazards

Districts	Natural Hazards							
	Flood (in% of prone area)	Drought(in intensity)	Landslide(in% of prone area)	Coastal erosion(% of coastline	Earthquake (number of past occurences)	Lightning (number of past events)	Tsunami (severity of 2004 Tsunami	Cyclone (in proneness)
Trivandrum	12.23	A*	7.32	77.85	9	59	MA*	MP*
Kollam	11.41	A*	11.09	81.78	4	257	SA*	MA*
Alappuzha	53.77	A*	0	42.51	-	51	SA*	MA*
Pathanamthitta	8	SA*	22.45	-	2	125	-	LA*
Kottayam	20.89	SA*	11.46	-	28	218	-	LA*
Idukki	0.89	A*	28.92	-	9	92	-	LA*
Ernakulam	23.5	A*	9.5	69.02	7	104	SA*	LA*
Thrissur	22.65	A*	10.71	24.46	41	36	A*	Ma*
Palakkad	12.66	A*	15.44	-	14	83	-	LA*
Malappuram	16.93	VSA*	13.11	44.86	6	249	A*	LA*
Kozhikode	123	A*	13.44	55.37	10	242	A*	Ma*
Wayanad	10.11	A*	14.05	-	1	19	-	LA*a*
Kannur	11.45	A*	14.89	26.34	1	353	Ma*	LA*
Kasaragode	9.99	A*	12.04	22.03	0	108	A*	
A-Affected, S-Severly Affected, VSA- Very Severely Affected, MA-Moderately Affected, LA- Least Affected								

(Source: A geographic analysis of natural hazard profile of Kerala, India, Volume VI Number I December 2016)

The Hazard Susceptibility Map (Figure 6.3) outlines the susceptibility and spatial distribution of different types of natural hazard events and it also describes that to what degree they are relevant compared to other hazards. It is to be noted that flood is another most susceptible natural hazard where all the 14 districts are exposed. In this, Alappuzha is the only district in the state which is very highly susceptible to flood while Kottayam, Ernakulam, and Thrissur come under highly susceptible category. At the same time all remaining districts were also vulnerable to the floods but its susceptibility varies between moderate to low category. Thus, among all natural hazards, it can be considered that floods and landslide are the most recurrent natural hazards.

6.2.1 The Kerala State Disaster Management Plan (KSDMP) 2016:

The Kerala State Disaster Management Plan (KSDMP) 2016, developed by KSDMA under the Disaster Management Act, 2005, is Kerala's roadmap for disaster management, aligning with the Sendai Framework, focusing on vulnerability assessment, preparedness, response (rescue, relief, rehab), and reconstruction, integrating community efforts and establishing structures like Civil Defence for resilience, as seen in its detailed chapters and annexures covering floods, landslides, and human-induced hazards.

Key components of the KSDMP include the State-level Hazard, Vulnerability, and Risk Assessment (HVRA), along with comprehensive strategies for preparedness, mitigation, response, and relief. The plan emphasizes capacity building, public awareness, and education to promote a culture of safety and resilience. It also underscores the importance of robust communication systems, effective early warning mechanisms, and efficient resource mobilization during emergencies. Further, the KSDMP defines financial provisions for disaster management activities and highlights the need for periodic monitoring, evaluation, and updating of the plan to respond to evolving risks and incorporate lessons learned from past events.

6.2.2 Kerala State Action Plan on Climate Change (SAPCC)

Kerala's State Action Plan on Climate Change (SAPCC) is a comprehensive strategy by the state government (led by the Directorate of Environment & Climate Change) to tackle climate impacts, focusing on adaptation and mitigation, integrating climate action into development, and aiming for carbon neutrality by 2050. The revised version, SAPCC 2.0 (2023-2030), identifies vulnerable districts, sets sector-specific goals (like renewable energy targets), and structures implementation through dedicated bodies to build resilience, reduce emissions, and protect vulnerable populations, aligning with national goals and SDGs.

Rising temperatures and extreme rainfall adversely impact agriculture and heighten public health risks, while biodiversity loss and economic disruptions - particularly in the tourism and farming sectors - remain major concerns. To address these challenges, the SAPCC promotes mitigation measures such as emission reduction and the adoption of renewable energy, alongside adaptation strategies including climate-resilient infrastructure, disaster preparedness, natural resource conservation, and climate-smart agriculture. The plan emphasizes the need for coordinated action among government agencies, local communities, and other stakeholders.

6.3 Hazard Profile of Alappuzha District

Alappuzha District is highly vulnerable to natural disasters due to its unique geo-climatic conditions and extensive coastline, with floods and droughts occurring frequently. Manimala, Pamba and Achankovil are the major rivers in the district along with the Vembanad kayal, Karthikappally kayal, Vayalar kayal and Vatta kayal constituting some of the prominent back water bodies. According to data from the Land Use Board, water bodies account for approximately 11.25% of the total area of the district. In addition, there exists a distinct low-lying region situated below mean sea level (approximately 0.5–1.0 m below MSL) that remains persistently waterlogged. This area corresponds to the Kuttanad region located south of Vembanad Lake and is a major factor that accentuates flood probability of the district. During the summer months, these water bodies become brackish in nature. The Thanneermukkom Barrage across Vembanad Lake and the Thottappally Spillway play a partial role in regulating and limiting seawater intrusion during periods of high tide.

In accordance with the Disaster Management Act, 2005, the District Disaster Management Authority (DDMA), chaired by the District Collector, has been established to reduce disaster risks and coordinate recovery efforts. The District Disaster Management Plan Alappuzha 2015

was prepared by the District Disaster Management Authority, Alappuzha and published by the Kerala State Disaster Management Authority. The District Disaster Management Plan is designed to provide essential inputs to enhance the efficiency and effectiveness of real-time disaster management. It seeks to institutionalize disaster management policies, plans, and guidelines required for timely and effective response to disasters. The plan also facilitates the identification of disaster risk reduction measures at various levels and supports preparedness for mitigation and recovery activities. Figure 6.4 illustrates the multi hazard map of Alappuzha district.

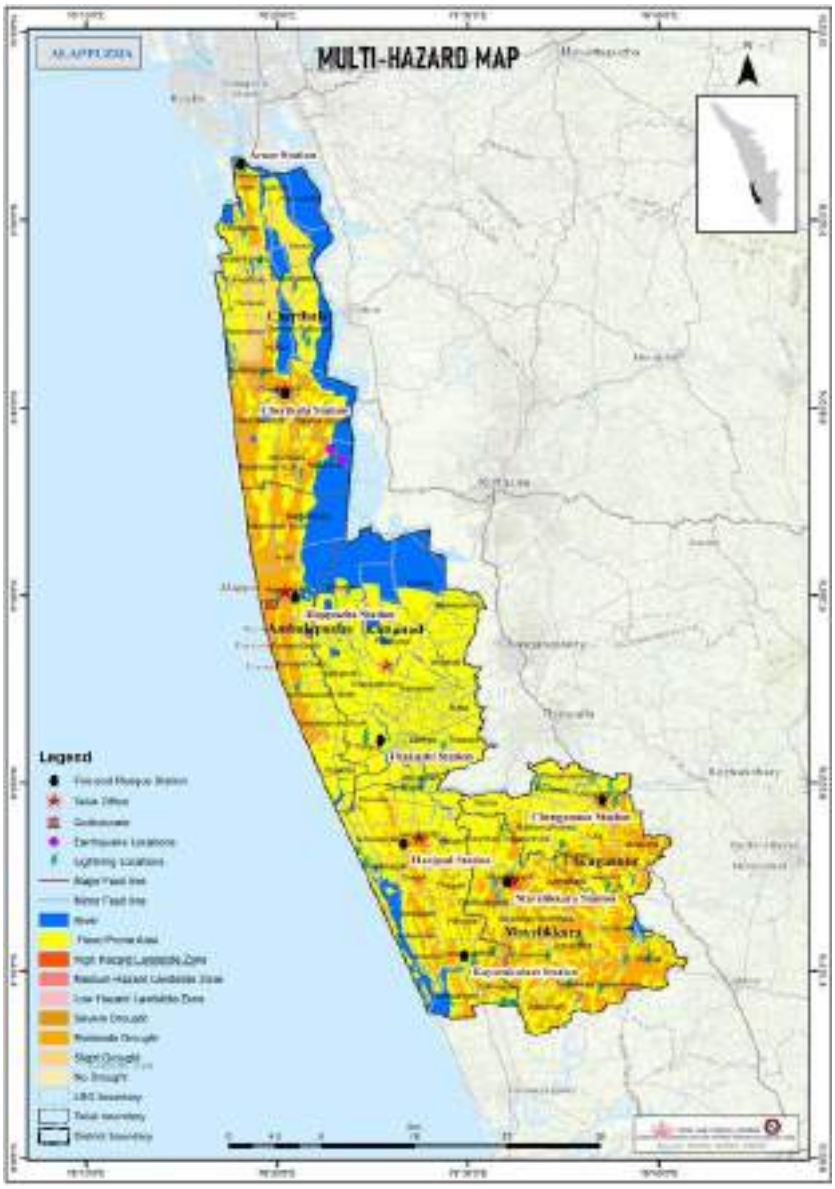

Figure 6.4: Multi-Hazard Map of Alappuzha (Source: KSDMA)

Table 6.2: Hazard Profile of Alappuzha District

Sl.No.	Classification	Types of Disaster
1.	Naturally Triggered/ Weather Related	Flood
		Coastal, Tsunami, Coastal erosion Kallakadal, Storm surge
		Thunder and lightning
		Cyclone
		Drought, Salt water intrusion
2.	Geological	Earthquakes
		Landslides
3.	Biological	Epidemics
		Cattle epidemics
		Food poisoning
		Pest attack, Bird Flew
4.		Industrial explosions Petro-chemical transportation accidents

Sl.No.	Classification	Types of Disaster
	Anthropogenically/ Technologically triggered	Fireworks accidents
		Road accidents
		Human triggered forest fire
		Stampede
		Short circuit and related fire
		Building collapse
		Boat capsizing Tourism related drowning
		Rail accidents
		Hooch accident

(Source: District Disaster Management Plan – Alappuzha 2015)

Flooding is the most significant natural disaster affecting Alappuzha District due to its low-lying coastal terrain, dense network of rivers and backwaters, and heavy monsoon rainfall. As indicated in the District Disaster Management Plan (2015), extensive areas of the district are identified as flood-prone, as shown in Figure 6.5. . These areas experience recurrent inundation during the monsoon season, leading to damage to agriculture, infrastructure, and livelihoods, as well as disruption of essential services. Identifying these flood-prone zones is crucial for disaster preparedness, risk mitigation, and resilient planning at the district and local levels.

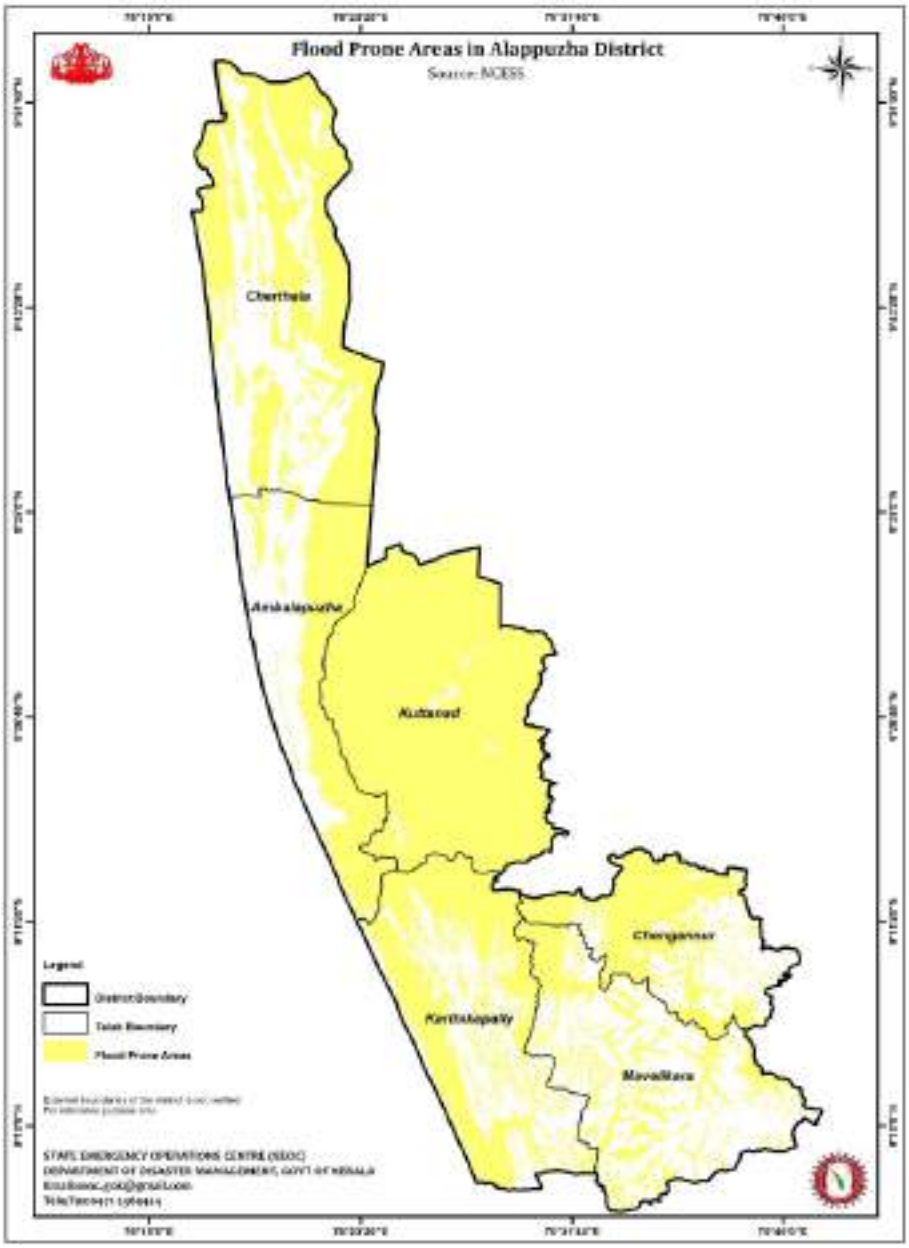

Figure 6.5: Flood Susceptibility Map of Alappuzha District
(Source: The District Disaster Management Plan, Alappuzha, 2015)

Apart from natural hazards, Alappuzha district is also exposed to risks arising from anthropogenic activities, particularly those associated with industrial operations. The presence of major chemical and process-based industries within and around Haripad contributes to potential industrial hazard scenarios that warrant careful planning and risk management. Notable among these are the National Thermal Power Corporation (NTPC) facility located near Haripad town, the Bharat Petroleum Corporation Limited (BPCL) installation at Karthikappally, and Extra Weave, a manufacturing unit engaged in the production of rugs, carpets, and matting materials. These industries involve the handling, storage, and transportation of fuels, chemicals, and other industrial materials, which may pose risks such as chemical leaks, fire, explosions, and air or water contamination in the event of accidents or system failures. Given the proximity of some of these facilities to residential areas and transport corridors, any industrial incident could have significant implications for public health, environmental quality, and infrastructure. Figure 6.6 shows the location of the major districts in Alappuzha along with the minimum and maximum probable extend of threat zones.

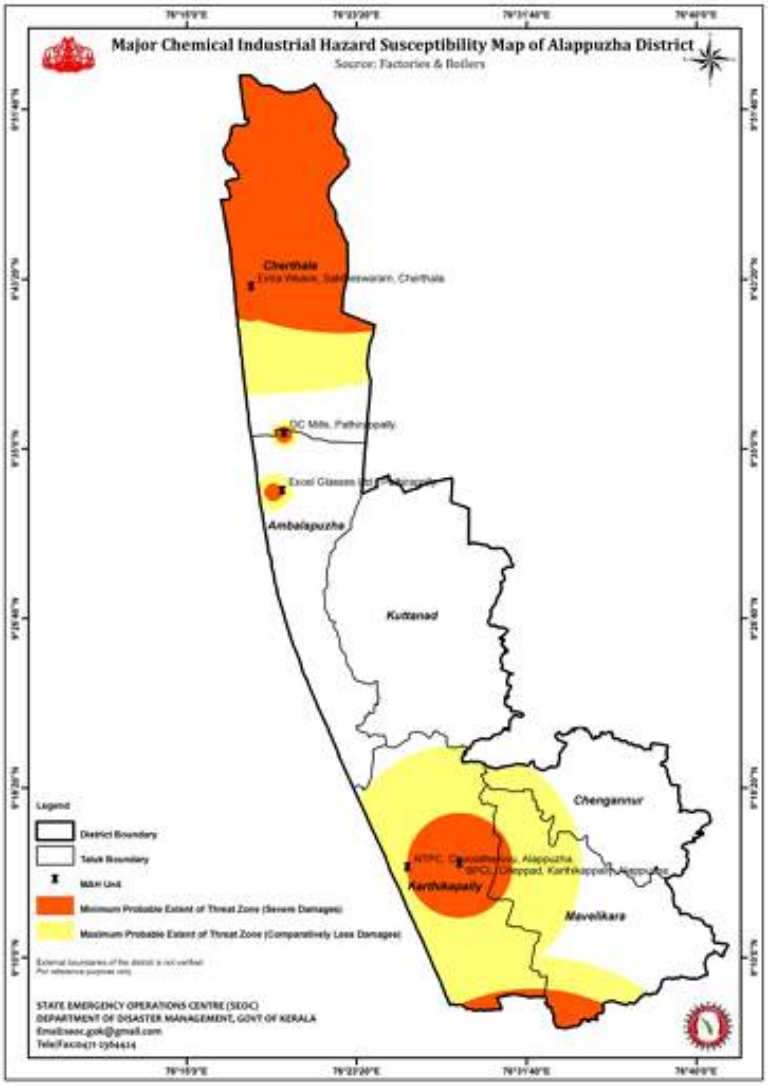

Figure 6.6: Major Chemical Industrial Hazard Susceptibility Map of Alappuzha

Source: District Disaster Management Plan – Alappuzha 2015

Table 6.3: Hazard Seasonality Mapping of Alappuzha

Disaster/ Month	J	F	M	A	M	J	J	A	S	O	N	D
Drought			✓	✓	✓							
Storm						✓	✓					
Lightning				✓	✓					✓	✓	
Flood						✓	✓			✓	✓	

(Source: District Disaster Management Plan – Alappuzha 2015)

The Table 6.2 and Table 6.3 present the Hazard Profile and Hazard Seasonality Mapping of Alappuzha District, highlighting clear seasonal patterns of disaster occurrence. Drought conditions are most prevalent during the pre-monsoon summer months from March to May, marked by high temperatures and reduced rainfall. Floods and storm surges are primarily associated with the southwest monsoon period between June and September, driven by intense rainfall and coastal influences. Lightning incidents exhibit a broader seasonal spread, with higher frequency during both the pre-monsoon and post-monsoon periods. The multi-hazard map of Alappuzha District prepared by the Kerala State Disaster Management Authority (KSDMA) is illustrated in Figure 6.4.

6.4 Hazard Profile of the Town

Haripad town, located in Karthikappally Taluk, covers an area of 16.34 sq. km and comprises 29 wards with a population of 31,151. The taluk is highly vulnerable to multiple natural hazards such as floods, droughts, lightning, and coastal erosion, with floods causing the most severe impacts. Flood events have affected about 12,550 people, damaged 2,365 houses across 70 villages, resulted in an estimated loss of ₹6,258,600, and caused seven fatalities. Droughts have also impacted the region, affecting 2,997 people across 29 villages (District Disaster Management Plan, Alappuzha, 2015). These recurring events underline the area's environmental vulnerability. Accordingly, the hazard profile of Haripad town has been analysed using hazard zonation maps prepared by KSDMA, the Disaster Management Plan (Nammal Namukkai), and the Local Action Plan on Climate Change (LAPCC) prepared by the Municipality.

This multi-source assessment enables a comprehensive understanding of spatial risk patterns, vulnerable zones, and exposure of critical infrastructure, thereby forming the basis for integrating disaster risk reduction and climate resilience strategies into the Master Plan.

6.4.1 Types of Hazards

a) Flood

Flooding is the most significant hazard affecting Haripad town, frequently resulting in severe loss of life and property. KSDMA published taluk wise flood inundation level map (Flood return probability over different years (10, 25, 50, 100, 200 and 500) based on historic data. As per the guidelines for the preparation of Risk Informed Master Plans in Kerala 2022, 1 in 50-year return probability is considered as design event for flood hazard exposure calculation and risk assessment of a town. Figure 6.7 shows the flood inundation map of Karthikappally Taluk (1 in 50-year probability).

A detailed LIDAR survey was conducted as part of the preparation of a Drainage Plan exercise for Haripad (Drainage Plan is discussed in detail in Chapter 33 of this Master Plan). Based on this the Flood hazard return probability map for Haripad Town was generated for 2 years, 5 years, 10 years, 25 years , 50 years and 100 years. This has been shown in Figure 6.8. However as per the Risk Informed Master Plan Guidelines document mandated by the Government of Kerala, the Flood hazard return probability map published by KSDMA has been used in this study for analysis and eventual proposals. Figure 6.9 shows the Flood hazard return probability map of Haripad town (50 Years Return Probability) as generated from the return probability maps published by KSDMA.

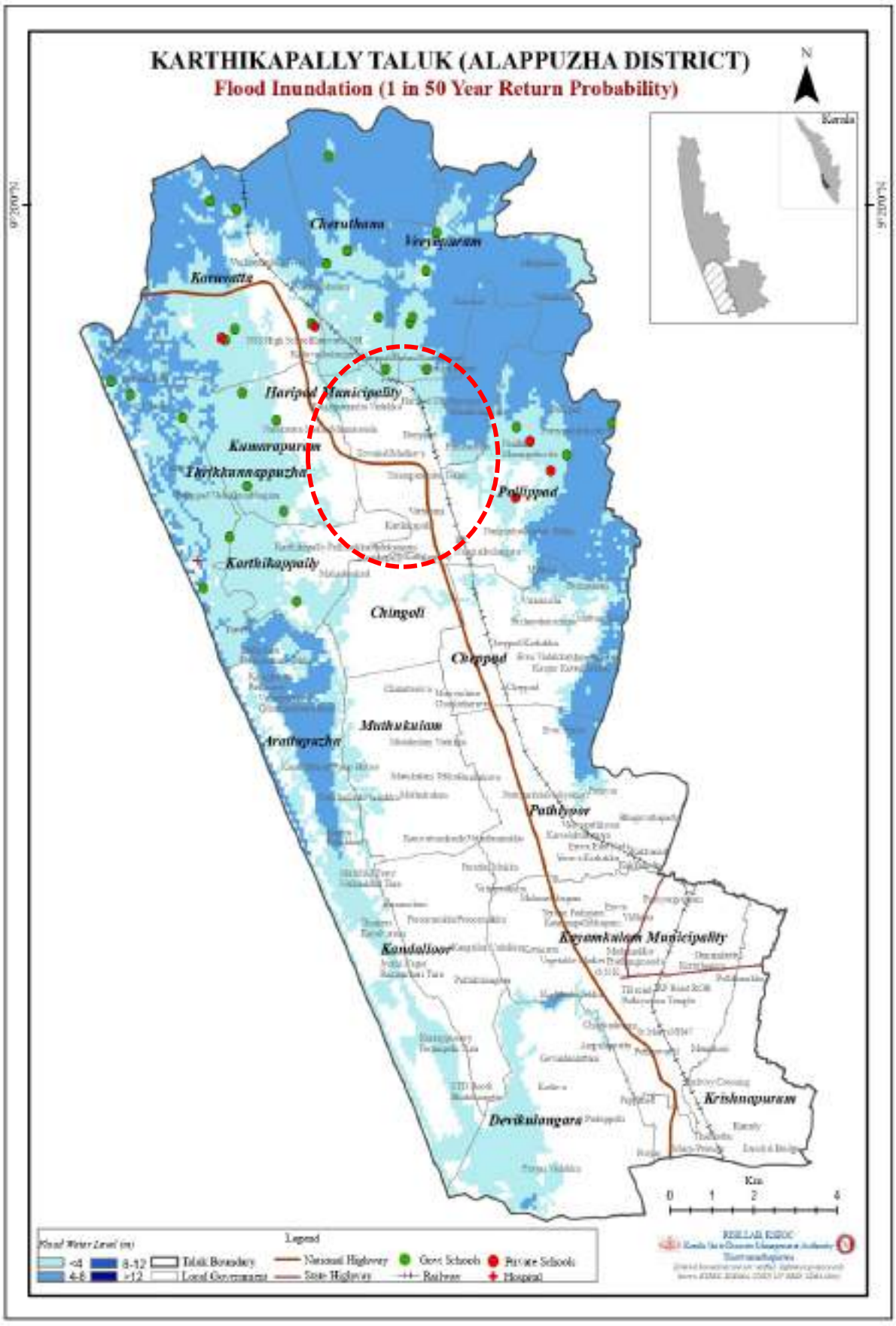

Figure 6.7 : Map showing the location of Haripad Municipality in the Flood inundation map of Karthikappally Taluk (1 in 50-year return probability) (Source: KSDMA)

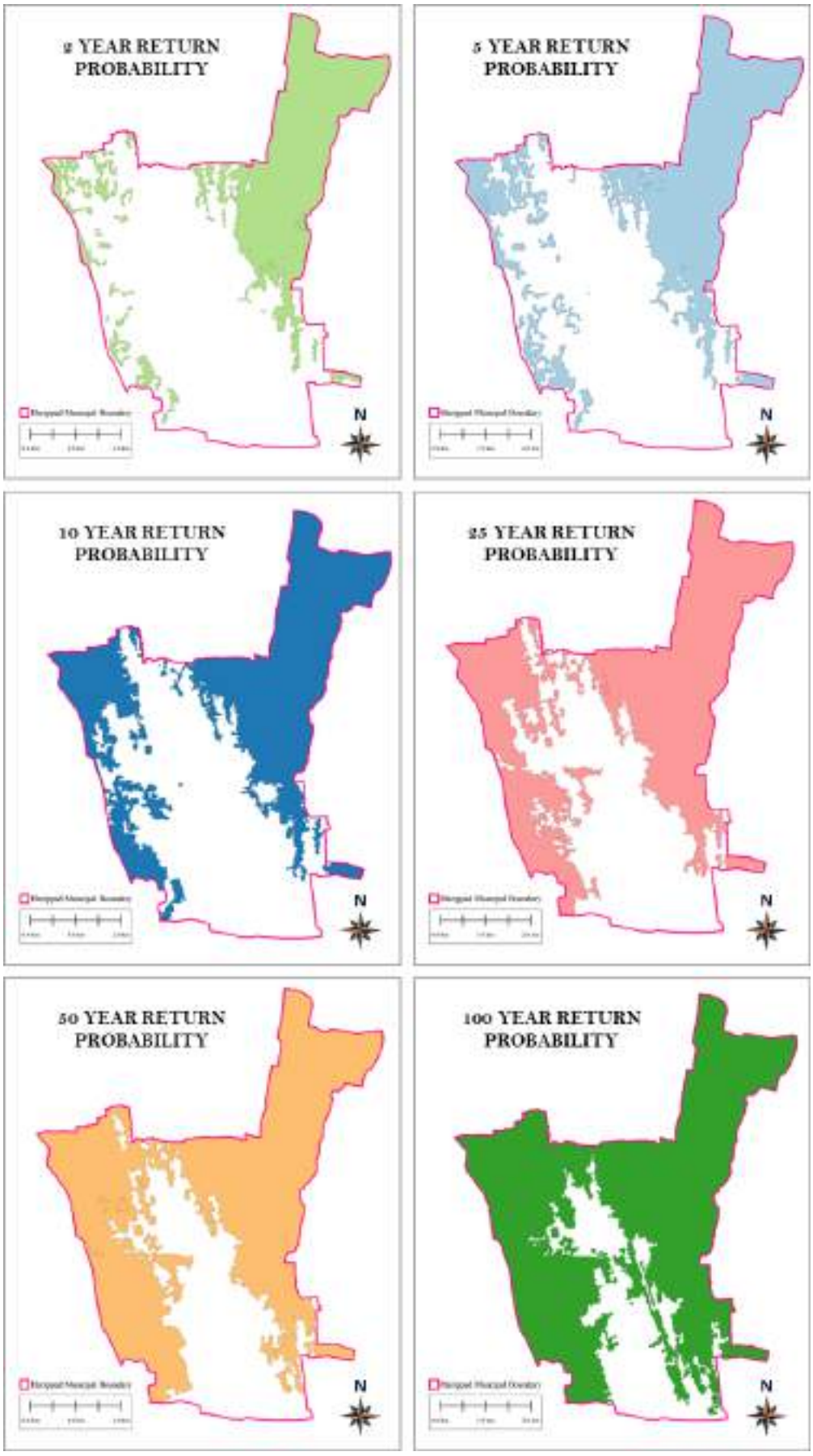

Figure 6.8 : Flood inundation map of Haripad Town (2-100-years return probability)

(Source: LIDAR Surbey Conducted as part of Drainage Plan preparation for Haripad Twon, 2025)

Figure 6.9 shows the Flood Hazard Return Probability Map of Haripad town (50-Year Return Probability) generated from the return probability maps published by KSDMA. Out of the 29 wards of the Municipality, 14 wards lie in the flood-prone area. The total flood-prone area is 7.13 sq.km, constituting 43.63% of the total municipal area (16.34 sq.km). Almost the entire north-eastern part of the town is prone to floods, particularly along the Achankovil River and the adjoining low-lying paddy fields. The percentage of various land use types within the flood-prone area is listed in Table 6.4 and illustrated in Figure 6.10. The major land use affected is paddy, covering about 60.48% of the flood-prone area, followed by residential use, which constitutes about 19.63% of the total residential area of the town.

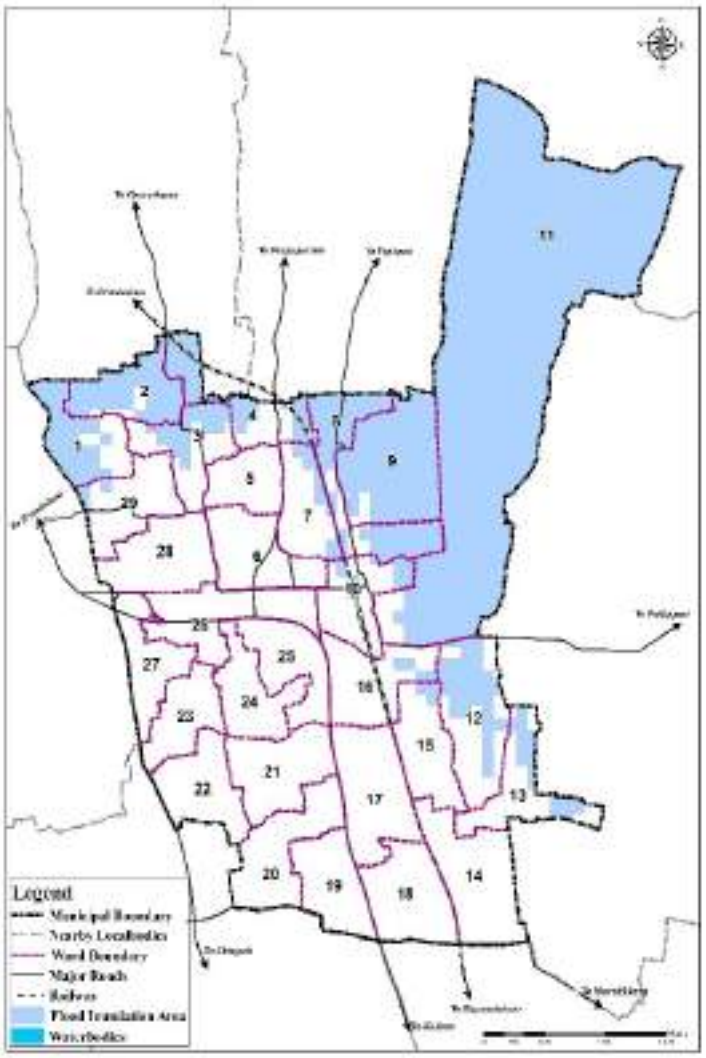

Figure 6.9: Flood Inundation Map of Haripad Town (1 in 50-year return probability) (Source: KSDMA)

Table 6.4: Percentage of various land use in the flood prone area

LU Type	Area in FPA (sq.km)	% of LU in FPA	Area of LU in town(sq.km)	% of LU in FPA to that of town
Paddy	4.11	60.48	4.69	87.55
Residential	1.41	20.75	7.18	19.63
Waterbodies	0.72	10.55	0.92	77.92
Dry Cultivation	0.17	2.49	1.01	16.76
Transportation	0.11	1.59	0.76	14.18
Marshy	0.11	1.56	0.42	25.08
Public-SemiPublic	0.06	0.89	0.58	10.35
Vacant Land	0.06	0.89	0.30	20.11
Railway	0.03	0.45	0.11	26.80
Commercial	0.01	0.14	0.31	3.16
Industrial	0.01	0.09	0.03	23.73
Recreational	0.00	0.06	0.01	54.07
Sacred Groves	0.00	0.06	0.02	16.95

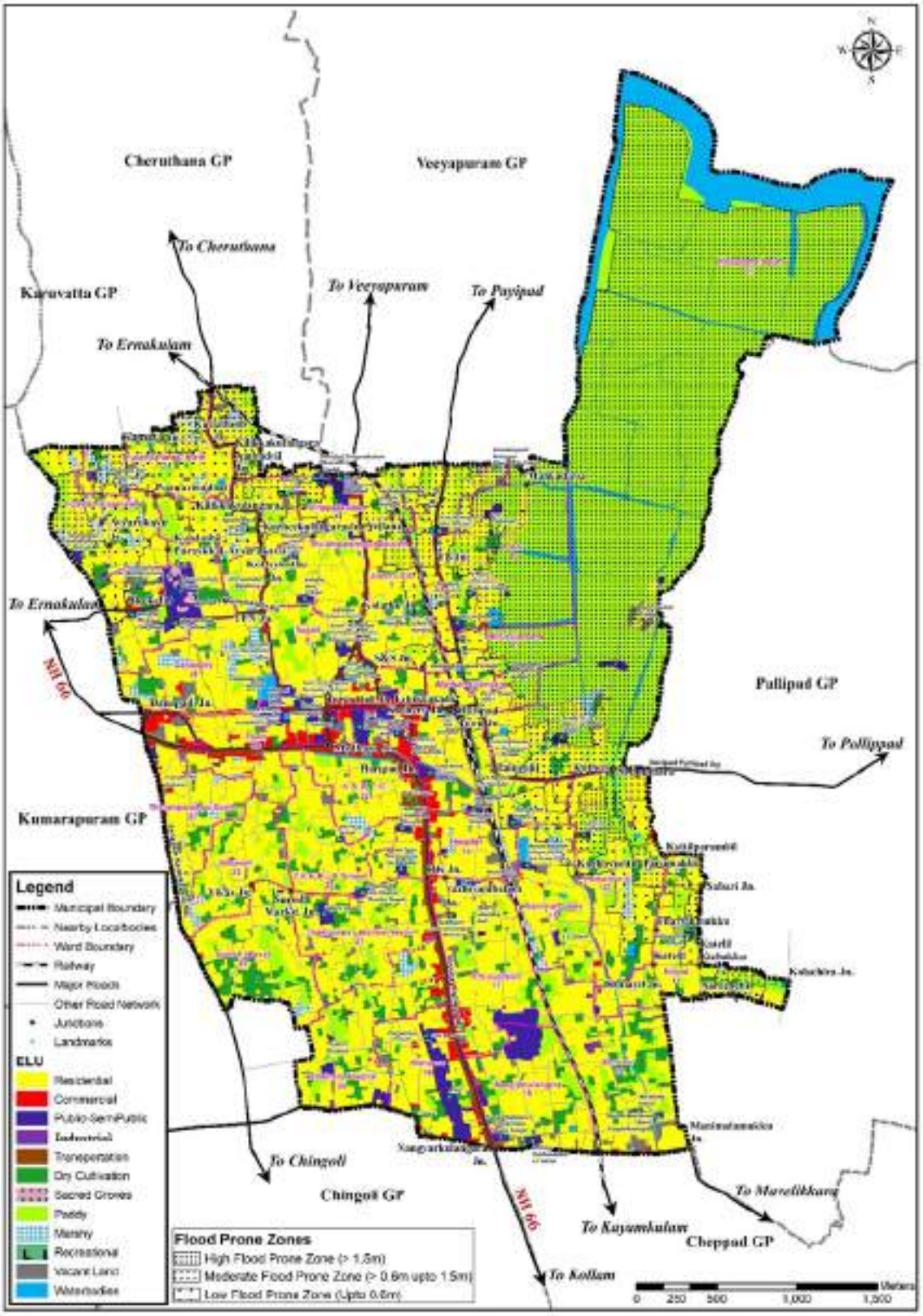

Figure 6.10: Land use map of Haripad with flood prone area overlay

b) Drought

The 2015 District Disaster Management Plan categorizes Karthikapally Taluk as moderately drought-prone (Figure 6.11), impacting 29 villages and a population of 2,997. This

classification is attributed to irregular rainfall patterns, increasing groundwater extraction, declining vegetation cover, and rapid urbanization. Collectively, these factors have progressively increased the Taluk's susceptibility to drought. It is also observed that the wards from 9 to 29 experiences drought during the months of February to March in Haripad Municipality. Figure 6.11 shows the drought susceptibility of Alappuzha District and Figure 6.12 shows the drought prone areas in Haripad Town.

Drought in Haripad is closely associated with high summer temperatures and is primarily hydrological in nature, marked by reduced availability of water for drinking and irrigation. The Haripad Municipality Disaster Management Plan 2023–24 identifies drought as a potential risk affecting all 29 wards of the town. As a mitigation measure, the renovation of Pillathodu has been proposed, including desilting, removal of obstructions, channel deepening, and bank stabilization, to improve water retention and strengthen local water resource management.

The Drought Situation Assessment Report by KSDMA (2017) indicates that Haripad town exhibits slightly higher-than-low groundwater depletion values in its southern region, while the remaining areas demonstrate low levels of groundwater departure from the mean ground level. According to the 2013 Groundwater Information Booklet for Alappuzha District, pre-monsoon groundwater depths range from 0.50 to 12.00 meters below ground level (mbgl), with post-monsoon levels displaying similar variations. In Haripad, groundwater levels are generally shallow, ranging from 0 to 2 mbgl, with deeper levels recorded between 2 and 10 mbgl.

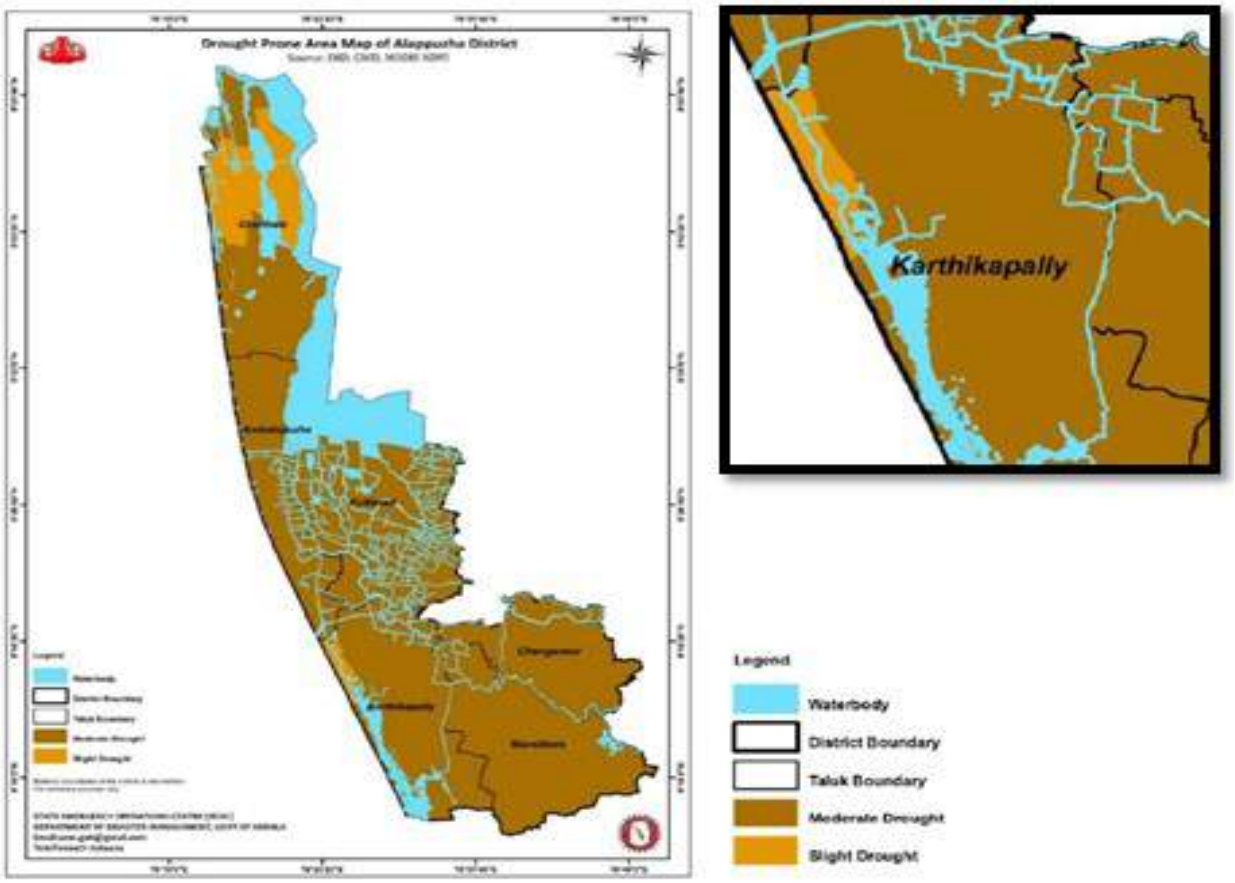

Figure 6.11 : Drought susility map of Alappuzha District
Source: Kerala State Disaster Management Authority, 2017

The water level hydrograph of the Karthikapally piezometer, which taps into the Warkali formation, reveals a consistent decline in both pre-monsoon and post-monsoon piezometric levels over the past two decades. In Alappuzha, groundwater depths during pre-monsoon and post-monsoon periods typically range from less than 2.00 mbgl to 2.00–5.00 mbgl, as illustrated in Figure 6.13. Studies conducted by the Groundwater Department indicate a significant decline in groundwater levels following the 2018 floods, primarily due to the deposition of impermeable clay, which has further exacerbated groundwater scarcity. Haripad Municipality lies within the catchment area of the Achankovil River, and as a result, its groundwater levels are observed to be close to the mean groundwater levels of Alappuzha district.

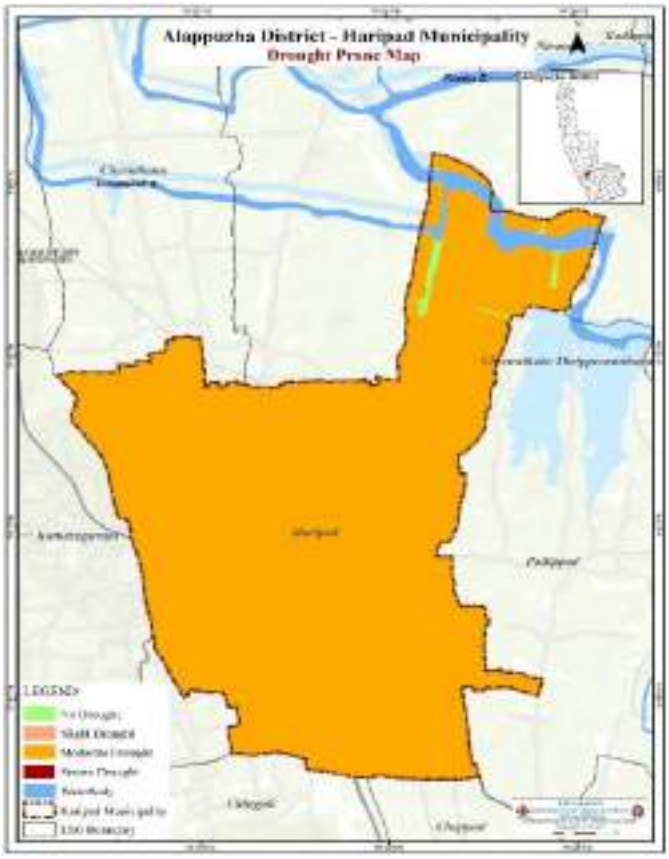

Figure 6.12 : Drought prone areas in Haripad town

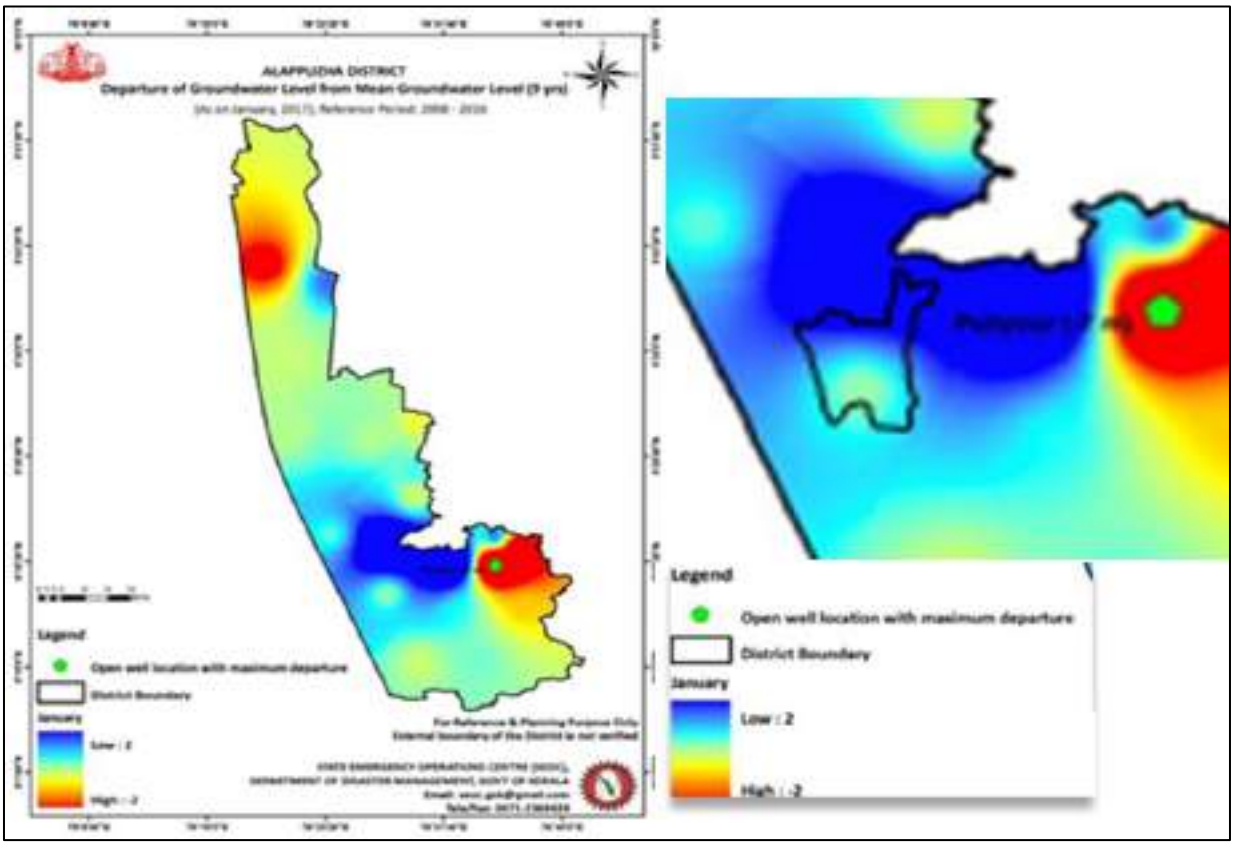

Figure 6.13 : Departure of Groundwater Levels from Mean Groundwater level of Alappuzha district

Source: Drought - Situation Assessment Report, 2017

c) Lightning

Alappuzha district experiences frequent lightning incidents, especially in its South-Eastern and Northern regions, during April, May, October, and November. The district's lightning frequency map highlights the South-Eastern region as highly vulnerable, with most occurrences linked to summer showers and the North-East monsoon. Casualties are commonly reported during the monsoon season, underscoring the district's susceptibility to this hazard.

The National Disaster Management Authority (NDMA) has identified groups that are vulnerable to lightning strikes. These groups include people who work outdoors, such as farmers, labourers and grazers. Even though lightning is identified locally as a moderate hazard in the LSG DM Plan, the data collected from KSDMA on lightning strikes shows an average of 17 lightning strikes per year which is considerably low to consider as a serious hazard in Haripad municipality. Figure 6.14 shows the lightning frequency map of Alappuzha district.

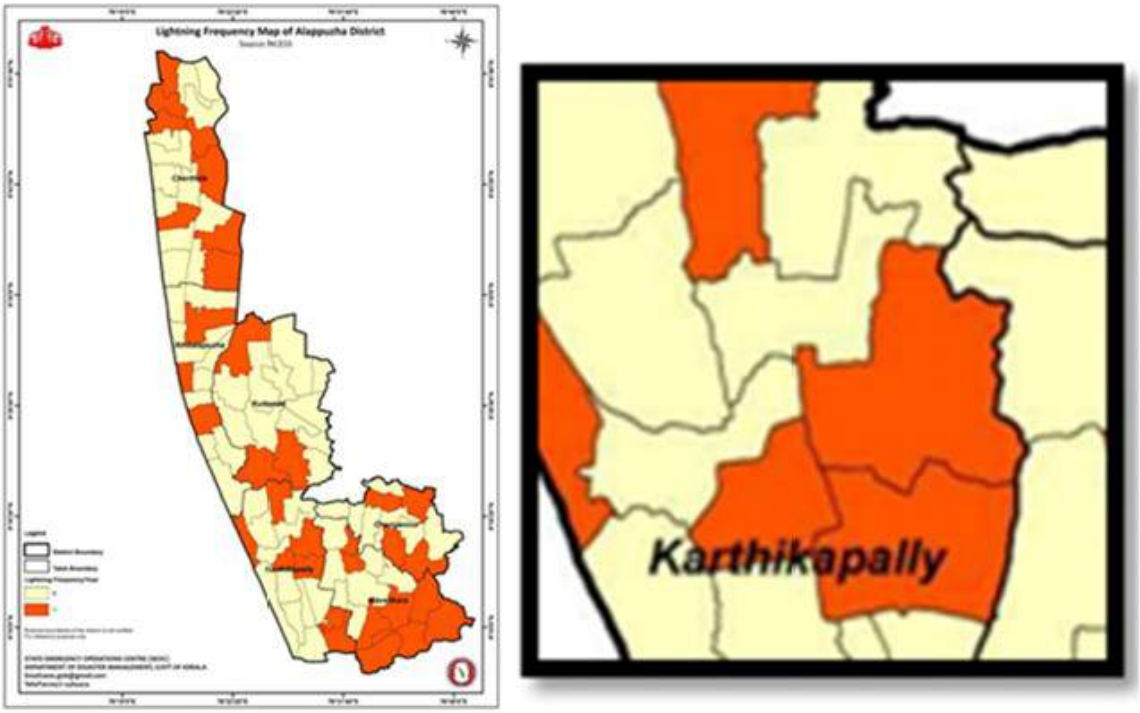

Figure 6.14 : Lightning Frequency Map of Alappuzha district

Source: The District Disaster Management Plan, Alappuzha, 2015

d) Heat

The local Disaster Management Plan identifies the abnormal rise in atmospheric temperatures during the summer season as a high-risk hazard. In the context of global warming and projected climate change impacts, such heat stress events are expected to become more frequent and intense in the future. Rising temperatures can adversely affect public health, water availability, energy demand, and overall liveability, particularly in dense urban areas and vulnerable communities. Therefore, addressing heat-related risks through climate-responsive planning, increased green cover, improved water management, and heat-mitigation strategies is essential for ensuring long-term resilience and sustainable development.

6.4.2 Local Disaster Management Plan of Haripad Municipality

The Disaster Management plan of Haripad Municipality is prepared by the local body itself as part of the 'Nammal Namukkai' programme under Government of Kerala, aimed at bringing stakeholders together for building a resilient Kerala. Technical support to local bodies for the preparation of the Disaster Management plan was provided by KILA.

The Disaster Management Plan deals with how a municipality prepares for, responds to, and reduces the risks of disasters. It includes hazard identification and analysis in the municipality. Flood, drought, lightning and heat related disasters are said to have threats in the Municipality. The report mentions about the impact of floods that occurred in 2018 and 2019. It also discusses the impact of climate change in disasters, environment and livelihood of people. The details of vulnerable population with gender wise numbers, list of critical infrastructure in hazard prone area and susceptibility maps of various hazards are also provided.

The local Disaster Management Plan outlines the disaster response system and details of ERTs, EWDS, volunteers, shelter management team, first aid team etc are provided. The preparedness, mitigation measures and capacity building measures, number of location specific mitigation activities, human resources, heavy machinery, communication devices, waste disposal centres, medical shops, climate specific disaster risk reduction proposals at the local level etc. are also listed.

Table 6.5: Hazard Seasonality Diagram of Haripad Municipality

Disaster | Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Earthquake	■	■	■	■	■	■	■	■	■	■	■	■
Drought		■	■	■	■							
Heat Stroke/ Sun burn		■	■	■	■							
Lightning			■	■	■					■	■	
Flood						■	■	■	■	■		

(Source: LSGDMP 2022, Haripad Municipality)

According to the Hazard Seasonality Diagram shown in Table 6.5, Haripad municipality is slightly prone to earthquake round the year. In fact, the seismic hazard map of India was updated in 2000 (11) by the Bureau of Indian Standards (BIS). All districts in Kerala lie in Zone III. The town is highly susceptible to flooding. The flood prone period is identified from June to October. The months from February to May is vulnerable to drought. Heat related disasters such as heat stroke, sun burn/ sun stroke is also highly possible during this period. The number of lightning strikes are very high during the months of April and May and moderately during March, October, and November months in Haripad.

Climate change is predicted to make the scenario of natural disasters worse. The IPCC report on Climate change is predicting drastic changes in the maximum and minimum mean temperature and rainfall in the State. Haripad municipality won't be any different in this regard.

Table 6.6 presents an overview of the disaster profile of Haripad town, emphasizing its susceptibility to various hazards. The data indicates that the town experiences a high frequency of floods, droughts, heat waves, and epidemics, reflecting significant exposure to both natural and public health-related risks. These recurrent events highlight the necessity of proactive measures to mitigate their impact on the community. Beyond these primary hazards, the town also encounters moderate occurrences of lightning strikes and other disasters, including road and rail accidents. These incidents pose substantial risks to public safety and infrastructure. The disaster profile underscores the critical need for the implementation of comprehensive disaster management strategies to effectively address both frequent and sporadic hazards.

Table 6.6: Disaster profile of Haripad town

Earthquake	Landslide	Coastal Related	Flood	Lightning	Drought	Cyclone	Epidemics	Heat Related Stress	Forest Fire	Other
Low	NIL	NIL	High	Moderate	High	NIL	High	High	NIL	Moderate

Source: The Disaster Management Plan, Haripad Municipality, 2023-2024

6.4.3 Major Hazard events in the past and their impacts

A comprehensive matrix of past disasters in Haripad town as per the Local Disaster Management Plan is presented in Table 6.7.

Table 6.7: Matrix of Past Disasters in Haripad Town

Disaster	Flood	Covid - 19
Number of casualties	0	40
Number of deaths due to infectious diseases	0	40
Number of Livestock affected	218	0
Number of houses damaged partially	2611	0
Number of houses damaged fully	19	0
Number of roads affected	0	0
Number of bridges/culverts affected	0	0
Year of occurrence	2018 August	2020-2023

Source: The Disaster Management Plan, Haripad Municipality, 2023-2024

As per the state and central disaster records, the historical analysis of past disasters in the town indicates that only two major events have occurred since January 2015: the 2018 flood and the COVID-19 pandemic. The COVID-19 pandemic had a more profound human impact, resulting in 40 fatalities between 2020 and 2023, comprising 21 males and 19 females. In contrast, the 2018 flood primarily caused extensive damage to houses and livestock, with no reported human casualties.

Table 6.8 presents the disaster cycle of Haripad town, illustrating a recurring pattern of flooding in 2018 and 2019, predominantly during the months of June, July, and August. This

recurrence highlights the town's increased vulnerability to flooding during Kerala's monsoon season, emphasizing the critical need for strengthened preparedness and mitigation measures during this period.

Table 6.8: Disaster Cycle of Haripad town

Disaster	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Flood 2018						✓	✓	✓				
Flood 2019						✓	✓	✓				

Source:The Disaster Management Plan, Haripad Municipality, 2023-2024

6.4.3.1 Flood affected areas in 2025

During rainfall in May 2025, field visits were conducted on 30/05/2025 to analyze the situation of the town during heavy rainfalls. As per the Kerala Water Resource Information system data for Haripad for the period for the days of 28-30th May 2025, it is seen that the town received an actual rainfall of 146mm against the normal expected rainfall of 100mm on the day. Ward numbers 8, 9, 10 and 11 were affected and out of which ward 11 is severely affected and almost all roads within the ward were flooded. In ward 8, the flood affected area include Aranazhika Madathil temple road and the area near North municipal boundary. In ward 9, the houses near Nelpurakkadavu, the road and the houses to the east of the Vathukulangara Temple are flooded. The boundary road of ward 8 and ward 10 near Aranazhika temple is also flooded. The images taken during the field visit are shown in Figure 6.17.

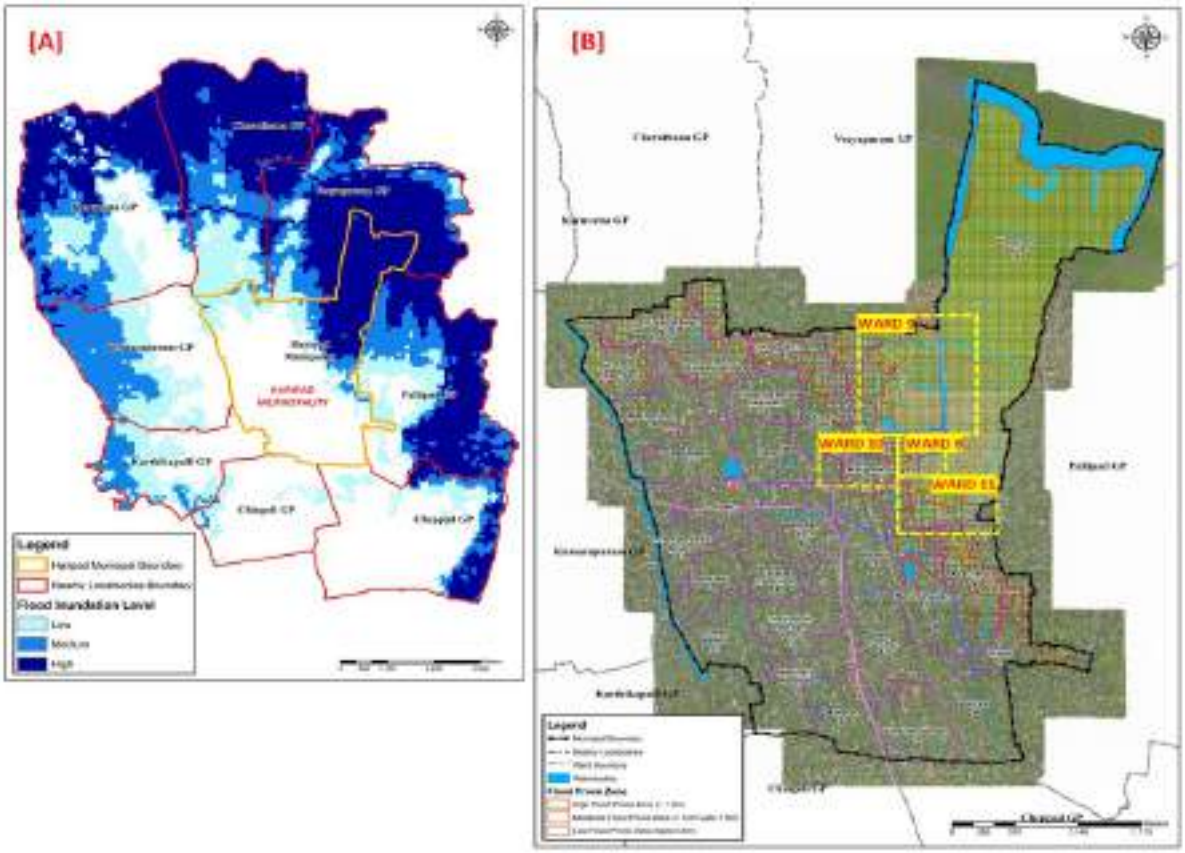

Figure 6.15 : [A] Key map showing Flood Prone areas of Haripad Municipality and surrounding Panchayats
[B] Map showing flood affected areas in town during May 2025



Figure 6.16 : Google Earth images of Flood affected areas in Haripad- May 2025



Figure 6.17 : Photographs of Flood affected areas in Haripad- May 2025

6.4.3.2 Areas prone to Urban Flooding outside Flood Prone Area

Apart from the various wards that fall within the flood prone area (details are discussed in Table 6.13), it is a also reported by residents and ward counsillors that during rainy days areas in Ward 16, 18, 21, 25 and 26 also face localized urban flooding. Eventhough these disrupt the functioning of normal activites, the duration of the water remaining stagnant is less when compared to the wards in the FPA. Poor conditions of storm water drains, irregular cleaning of the drains, improper alignment of NH 66 without taking the disruption of drainage into considertation etc can be understood as reasons for this. Figure 6.18 shows the location of these reported urban flooding spots

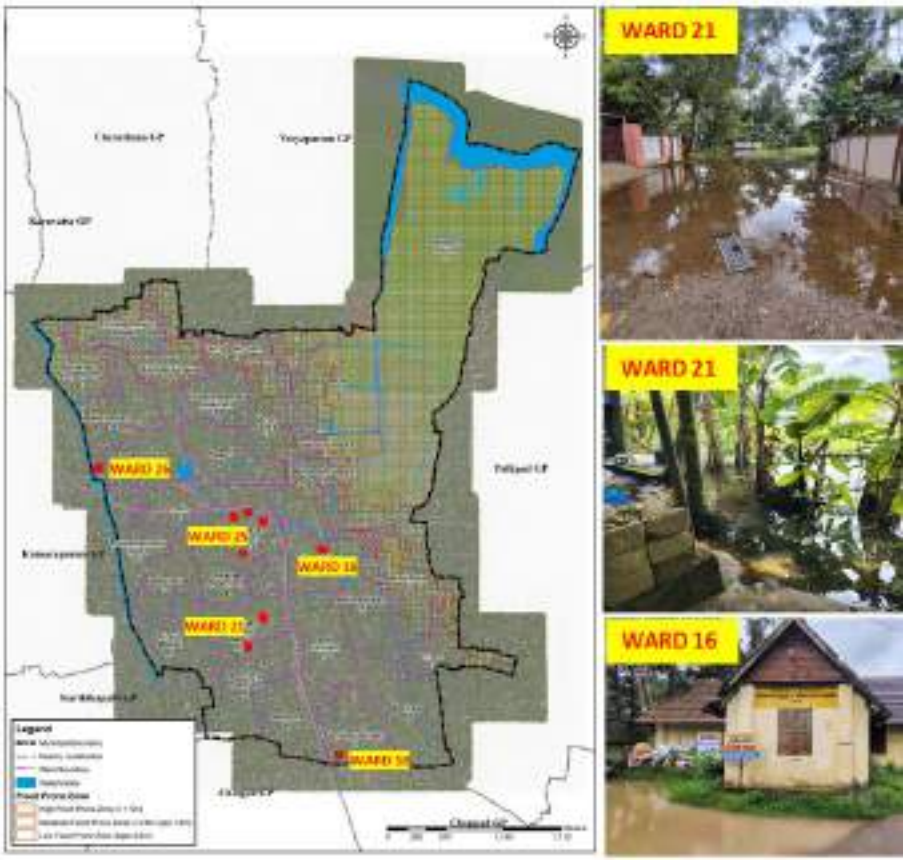

Figure 6.18 : Map showing locations of reported urban flooding areas outside the FPA

6.5 Climate Change Impacts

Over the past three decades, Haripad town has experienced noticeable climatic changes, particularly in temperature patterns, reflecting broader regional and global climate trends. Scientific projections indicate that global temperatures may rise by 1.5 to 2°C by 2050, which is expected to significantly influence local climatic conditions, including temperature, humidity, wind intensity, and rainfall behaviour. These changes are already becoming evident in Haripad, with residents observing higher humidity levels, stronger wind events, and increasing thermal discomfort during summer months.

Although the overall availability of rainfall has increased, its seasonal distribution has become more erratic, affecting both monsoon and summer rainfall patterns. Alappuzha district experiences a tropical humid climate, dominated by the South-West Monsoon from June to September and the North-East Monsoon from October to November, followed by relatively dry conditions for the rest of the year. The hottest period extends from March to May, during which heat stress is increasingly reported, while the average annual rainfall remains around 3,000 mm.

Insights from focus group discussions further confirmed these trends, highlighting significant fluctuations in temperature, wind flow, and rainfall over the last 30 years. Rising temperatures have contributed to growing public health concerns, increased energy demand, and emerging

drought-like conditions during prolonged dry spells. These observed and projected climatic changes underline the need for climate-responsive planning measures to enhance Haripad's resilience and safeguard livelihoods, public health, and environmental sustainability.

The KSDMA has made projections in regard to climatic variables based on Representative Cocnentration Pathways (RCP)8.5 scenario. The deviation from long term average for the parameters in Haripad municipality is provided in the Table 6.9 below.

Table 6.9: Climate Change projections for Haripad Municipality (RCP 8.5 Scenario)

Climate variables	Seasonal deviation from daily average in near term (2021-2040)				Seasonal deviation from daily average in medium term (2041-2060)				Seasonal deviation from daily average in long term (2061-2099)			
	JF	MAM	JJAS	OND	JF	MAM	JJAS	OND	JF	MAM	JJAS	OND
Maximum temperature (°C)	1	0.6	0.7	1	1.5	1.5	2.6	1.6	2.6	3.1	3.2	2.7
Minimum temperature (°C)	0.5	0.8	0.9	0.9	1.5	1.4	1.4	1.6	3.2	2.9	2.4	2.8
Precipitation (mm/day)	-0.1	-0.3	1.4	0	0	0	2.8	0.5	0	0.6	5.1	2

Source: KSDMA Flood Data

**JF – January- February *MAM- March-April-May *JJASS – June-July-August- September *OND-October-November-December*

As per the downscaled climate data deviations in precipitation during south-west monsoon can possibly create extreme rainfall events leading to floods. Increase in temperatures and reduction in precipitation during summers indicates the possibility of drought also. This can also lead to increase in number of heat-related stress diseases. The potential deviation of climatic variables from long term average can create disasters and they can lead to various impacts. The Table 6.10 below shows such impacts of climate change.

Table 6.10: Summary of Climate Change Variables

Climate Change Variables	Change in variables	Climate Change effects	Climate Change impacts
Temperature	Increase	Longer period of droughts	Decline in crop production
		Warmer days and nights	Heat related stresses on health
Seasonal rainfall	Increase	Frequent flooding	Damage to agriculture, livelihood etc.
	Decrease	Drought	Decline in water supply, crop production etc.
Climate extremes	Increase in extreme rainfall events	Potential changes in frequency and severity of flooding events	

Heavy rainfall often results in flooding, primarily due to inadequate drainage systems and encroachments on natural waterways. Furthermore, rising temperatures and unpredictable weather patterns pose serious challenges to agriculture and water resources, impacting environmental stability in the region.

6.5.1 Impact of Climate change in key sectors

Climate change has profound impacts across various sectors. In agriculture sector, changing rain and heat reduce crops and food supply. For health, hotter weather causes heat sickness and spreads diseases like malaria and dengue.. Table 6.11 shows the effects of climate change in various sectors.

Table 6.11: Summary of Climate Change effects and impacts in various sectors

System	Climate Variables	Change in variables	Climate Change effects	Climate Change impacts
Health	Temperature	Increase	Hotter days	▪ Heat related stress among vulnerable population
	Rainfall	Increase	Flooding	▪ Increase in vector borne diseases
Agriculture	Temperature	Increase	Drought	▪ Increased demand for irrigation ▪ Disruption of cropping cycle ▪ Decrease in product quality
	Rainfall	• Too little rain • Too much rain • Early onset of monsoon • Late onset of monsoon	• Drought • Flooding	▪ Wilting of crops ▪ Decrease in crop yields ▪ Reduction in farmer's income ▪ Increased risk of pest outbreak
Water Resources	Rainfall	Decreases	Drought	▪ Increased competition for Water ▪ Changes in water quality
	Extreme rainfall	More events	Flooding	▪ Changes in water quality, aquatic life, sedimentation etc.
Infrastructure	Extreme rainfall	More events	Flooding	▪ Damages to roads, bridges, public buildings etc.

6.6 Vulnerability and Risk Assessment

Haripad town is highly susceptible to multiple hazards, including floods, droughts, lightning, and heat related stress. The town's geographical location and climatic conditions make it particularly vulnerable to recurring floods, with significant damage recorded during the 2018 and 2019 monsoon seasons. Developing Risk Informed Master Plan for Haripad town requires

a comprehensive assessment of the risks and hazards faced by the town. As an initial step, the potential hazards have been identified in earlier sections. The subsequent sections analyse in detail the impacts of these hazards and climate change on different sectors of the town, and vulnerability rating is spatially mapped. This section evaluates the overall impact and vulnerability of the existing hazards in Haripad town and considers how they may affect various sectors under the growing challenges of climate change.

As per Government Order (Ms.) No. 120/2022/LSGD, Guidelines for the Preparation of Risk Informed Master Plans was issued by the Local Self Government (EWB) Department, with the express purpose of supporting Local Self Governments across the State to prepare Risk Informed Master Plans (RIMPs) in a structured manner, starting with the 10 Municipalities in the Manimala–Pampa–Achankovil river basin. Though hazards cannot be completely avoided, the vulnerability of people and assets to various hazards can be substantially and sustainably reduced through planned prevention, mitigation and preparedness measures. The focus is on risk reduction at the interface between societies and the natural environment, and integrating risk reduction into the land use planning process. Integrating risk information with land use planning is expected to reduce impact of hazards on life, property and environment in a community. A master plan with risk information and disaster risk reduction strategies will provide a template for the Municipality to incorporate strategies, projects and actions that can lower risk in development planning and implementation and also mitigate the impact of disasters as and when they occur. The vulnerability and risk assessment, prepared using hazard susceptibility maps published by KSDMA, provides a crucial basis for effective risk informed planning in Haripad town.

6.6.1 Methodology for risk assessment

As per the Guidelines for preparation of Risk-Informed Master Plans, Risk Assessment of a hazard consists of two major components: Hazard Impact Assessment and Vulnerability Rating. Hazard risk is conceptualized as the combined function of hazard impact and the vulnerability of the exposed population. To assess this, hazard impact and vulnerability are rated independently, and then plotted on a risk matrix, where hazard impact is represented on one axis and vulnerability on the other. The intersection of these values within the matrix provides the overall risk grading for the area.

The hazard impact rating is a measure of the potential damage or destruction that a hazard (such as a flood) can cause in a particular area. This rating involves assessing the severity of the hazard and its potential consequences on life, property, the environment, and the economy. Key factors generally influencing hazard impact rating are Severity of the Hazard, Frequency of Occurrence, Exposure and Duration.

Vulnerability rating refers to the susceptibility of people, infrastructure, and systems to the effects of a hazard. A vulnerability rating evaluates how likely an area, community, or asset will be affected by a hazard and how severe the effects will be. Generally, vulnerability ratings are based on types of vulnerabilities like Physical Vulnerability, Social Vulnerability, Economic Vulnerability and Environmental Vulnerability. Assessing overall risk requires integrating hazard impact with vulnerability ratings for a specific area. This combined approach enables prioritisation and the development of targeted strategies to effectively reduce disaster risks.



Since floods have been identified as the most significant of the four hazards in the town, risk assessments have been carried out specifically for flood hazards in accordance with the prescribed guidelines. To address heat stress, a study was undertaken to examine temperature trends over time and to identify heat hotspots. However, mitigation measures have been developed for all identified hazards to ensure a comprehensive and balanced approach to risk management.

6.6.2 Flood Risk Assessment for Haripad Town

Flood hazard impact assessment is done based on return probability map published by KSDMA and vulnerability rating is carried out by the 10% sample socio economic survey in the flood prone areas of the town as per return probability map.

a. Hazard Impact Assessment:

As per the Guidelines for the preparation of risk informed master plans, the methodology assigns values to three sub-components, namely, Hazard Intensity, Hazard Return Probability, and Hazard Duration. But in the case of Hazard Duration, a complete dataset was unavailable for Haripad Town. So, this sub-component was excluded and its weightage was redistributed between the remaining two subcomponents to maintain the accuracy of the risk assessment.



i. Hazard (Flood) Return Probability

A Flood Return Probability Map is a visual representation that shows the probability of a flood that may occur in a particular area over a given period of time. The return period is the average time between events of a certain magnitude or greater. A return period probability map provides the estimated time interval between events of a similar size or intensity. Data for the return probability was taken from maps published by the Kerala State Disaster Management Authority (KSDMA), which takes historical rainfall trends into consideration. In this analysis, return probabilities have been calculated only for 10, 25 and 50-year return periods, with 10-year return being assigned the highest value and 50-year return the least. As per the Guidelines for preparation of Risk-Informed Master Plans, 1 in 50-year return probability map is to be considered for flood hazard assessment. Hazard (Flood) Return Probability map of Haripad town is shown in Figure 6.19.

For the analysis of spatial distribution of flood-prone areas, ward wise cadastral data of Haripad town is overlaid with 1 in 50- year return period maps. Flood return probability score has been assigned for 10, 25, 50 years as per guideline at cadastral level and the flood return

probability map for Haripad town has been generated (Figure 6.19). Out of the 29 wards of the Municipality, 14 wards lie in the flood prone area. Among these wards, around 457 cadastral units lies within the flood prone area. The total flood prone area is 7.13 sq.km, which is 43.61% of the total municipal area (16.34 sq.km). Table 6.13 shows the percentage of flood prone area in 14 wards. It is found that more than 75% of the total area of Wards 2, 8, 9 and 11 are flood prone. In which 95% of the ward Number 11 – Pilappuzha South is found to be flood prone. On comparing with the existing land use of the town, 60.48% of the Low-lying Paddy fields, 20.75% of the residential areas and 10.55% of waterbodies falls within the flood prone area. All other land use categories are found to be less than 1% in the flood prone area.

Table 6.12: Percentage of Flood prone area as per Hazard Return probability Maps by KSDMA

Hazard return probability	Total Flood Prone Area (Sq Km)	% of Flood Prone Area	Number of Cadastral Units Affected
1 in 10yr (High)	5.74	80.48	343
1 in 25yr (Moderate)	0.71	9.98	61
1 in 50yr (Low)	0.68	9.50	53
Total	7.13	100	457

Table 6.13: Percentage of flood prone area in 14 wards (1 in 50-year RP map by KSDMA)

Sl. No	Ward No.	Ward Name	Total area of ward (sq.km)	Flood prone Area in ward (sq.km)	% of Flood Prone Area
1	1	Homoeo Dispensary	0.38	0.37	97.4
2	2	Thulamparambu North	0.38	0.38	100.0
3	3	Kilikkakulangara	0.40	0.22	55.0
4	4	Thrippakkudam	0.36	0.29	80.6
5	7	Aroor L.P.S	0.37	0.15	40.5
6	8	Vathukulangara	0.50	0.48	96.0
7	9	P H C	0.68	0.68	100.0
8	10	Mangamkulangara	0.37	0.15	40.5
9	11	Pilappuzha South	4.30	3.76	87.4
10	12	Nedunthara	0.58	0.38	65.5
11	13	Triveni	0.41	0.18	43.9
12	15	Manimangalam	0.39	0.04	10.3
13	16	Hospital	0.44	0.09	20.5
14	29	Mannarasala	0.40	0.07	17.5
		TOTAL	**9.95**	**7.13**	**71.65**

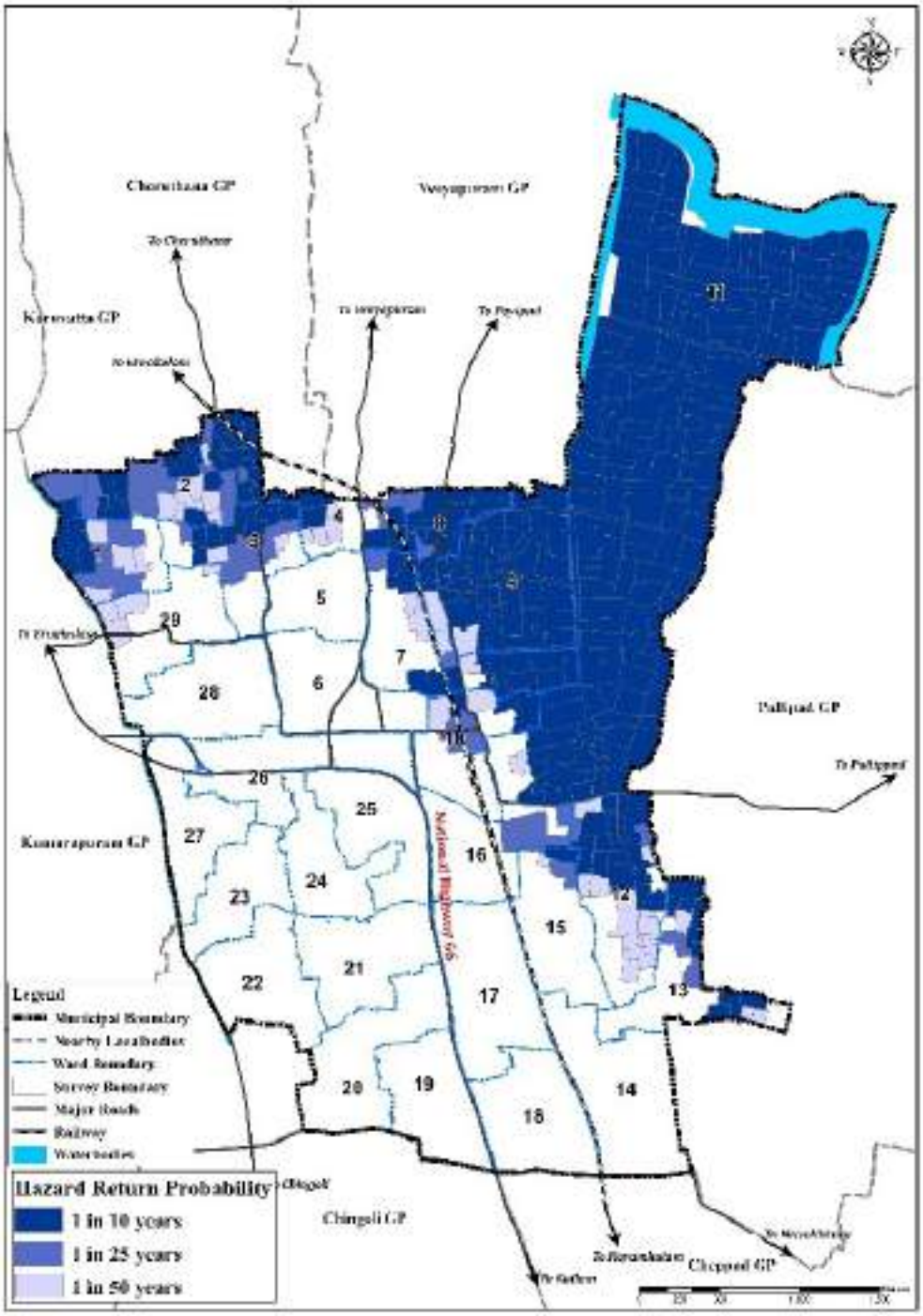

Figure 6.19: Hazard (Flood) Return Probability Map
Source: Generated from the Hazard return probability map of KSDMA

ii. Hazard (Flood) Intensity

The flood hazard intensity refers to the severity or magnitude of the flood event in terms of its extent, depth (inundation) and duration. Depth of flood inundation was taken to indicate the intensity of hazard. Cadastral data of Haripad town is superimposed on 1 in 50-year return probability map published by KSDMA, to analyse the spatial distribution of flood intensity. Cadastral level flood intensity score has been assigned and flood intensity map is prepared. Flood inundation is classified into three categories based on depth. i.e. areas with inundation depth above 1.5m (High), 0.6 to 1.5m (Moderate) and below 0.6m (Low). Map generated based on the intensity of flood is shown in the Figure 6.20.

Haripad town experiences a predominantly high flood hazard in its Northeastern portion of the town, with 59% of the flood-prone area subject to inundation depths exceeding 1.5 meters, based on a 50-year return period. However, a significant portion of this high intensity flood zone comprises ecologically sensitive or low-density use areas, including 58.48 % of water bodies and wetlands, and 25.78% of agricultural or open land. These areas are also close to the Achankovil river. The flood inundation above 1.5 meters poses serious threat to the agricultural paddy fields. Strategic flood management interventions and land use planning are to be put forwarded to prevent the hazard risks and also to conserve the ecologically sensitive areas of the town.

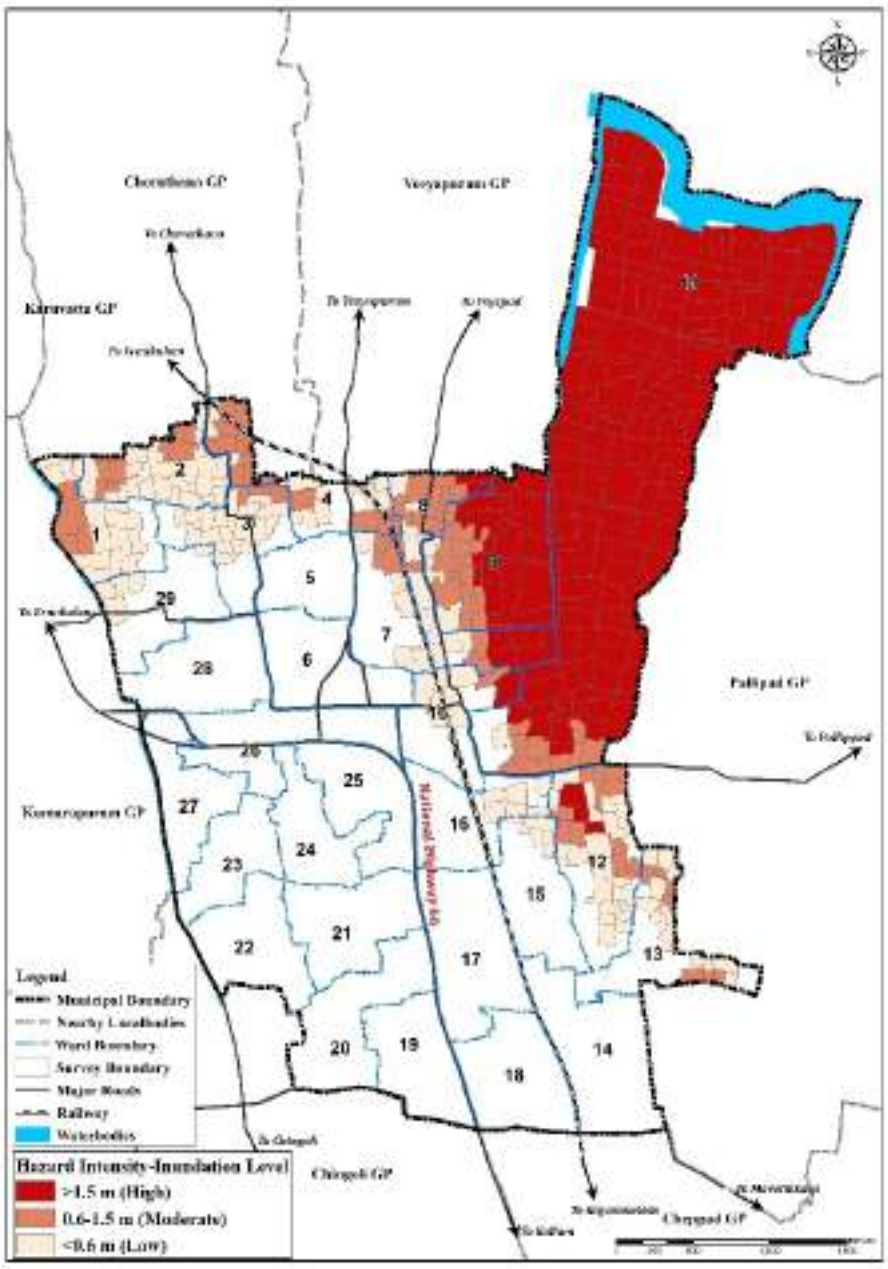

Figure 6.20 : Hazard (Flood) Intensity map

Source: Generated from the Hazard return probability map of KSDMA

iii. Hazard Impact

The term hazard impact refers to the consequences or effects of a hazard event on people, property, infrastructure, and the environment. It measures the severity of the hazard's effect on a given area. The hazard impact was calculated by adding up return probability and hazard intensity values and the map generated is shown in the Figure 6.21. Obtained values of Hazard impact varies from 4.5 to10 and is categorised into four: low, moderate, high, and very high. However, only three of these categories - moderate (2.5 to 5), high (5 to 7.5) and very high (7.5 to 10) - are present in the Haripad town.

- Very High Hazard Impact (Hazard Impact value varies from 7.5 to 10): It includes 74.08% of the total flood prone area. This zone spread across 11 wards on the North - Eastern region of the town, which include Ward Numbers 1(Homoeo Dispensary), 2 (Thulamparambu North), 3 (Kilikkakulangara), 4 (Thrippakkudam), 7(Aroor L.P.S), 8 (Vathukulangara), 9(P H C), 10 (Mangamkulangara), 11 Pilappuzha South, 12 (Nedunthara), and 13 (Triveni). It covers more than 50% of the total area of the wards 9 and 11 (Pilappuzha South).

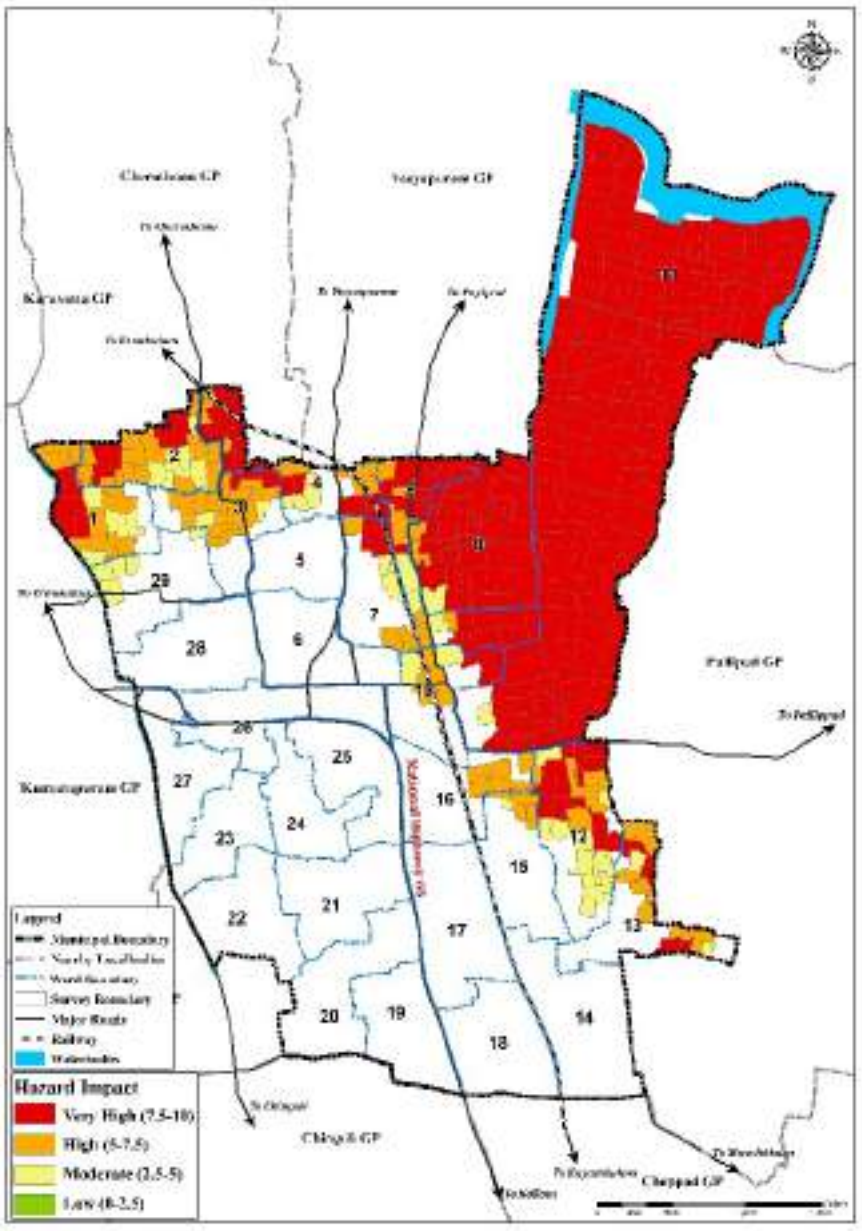

Figure 6.21 : Hazard Impact Map
Source: Generated from the Hazard return probability map of KSDMA

- High Hazard Impact (Hazard Impact value varies from 5 to 7.5): It includes 16.48% of the total flood prone area of the town and is spread across the flood prone area. Percentage of the high hazard impact area is less when compared to very high hazard zone.
- Moderate Hazard Impact (Hazard Impact value varies from 2.5 to 5): This zone is scattered across the flood prone area of the town and accounts to 9.40% of the total flood prone area.
- The town does not have any Low Hazard Impact.

A very high hazard impact value of a flood-prone area indicates the potential for a flood event to cause severe and extensive negative consequences to the natural environment, human population, infrastructure, and economy of that region. These hazard impact zones will assist, guide, and prioritize and put forward proactive disaster relief measures and investments in these areas by the local self-government and institutions or departments.

b. Vulnerability Assessment

Vulnerability ratings show how susceptible areas or assets are to flood damage, and are crucial for flood management, developing infrastructure projects and informing policy for disaster risk reduction. As per the Guidelines for the preparation of Risk Informed Master Plans, 6 parameters are considered for Vulnerability assessment. The parameters include social vulnerability, Physical vulnerability, Vulnerability of essential/Basic services, Economic vulnerability, Environment/ Heritage vulnerability, and Coping capacity. Each of these parameters have their own sub parameters tabulated at ward or cadastral level to provide a detailed and localized assessment. Vulnerability Assessment is carried out in the flood affected wards as per the 1 in 50-year return probability map of KSDMA as described in the previous section. Data from 10% household survey conducted within the flood prone area is considered for vulnerability assessment.

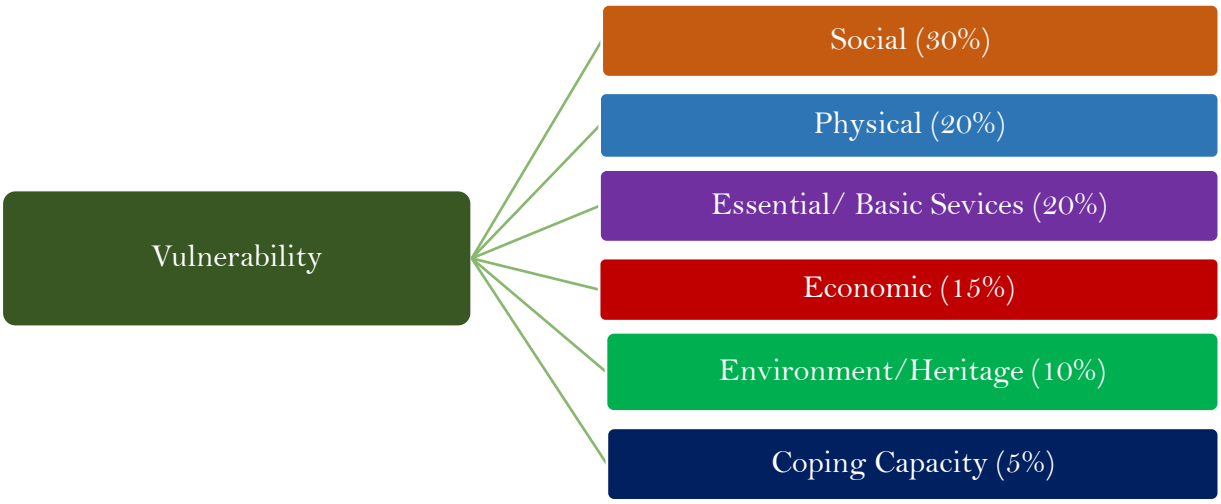

Figure 6.22 : Vulnerability Assessment Parameters

i. Social Vulnerability

Social vulnerability refers to the ability of individuals, households, and communities to prepare for, respond to, and recover from floods based on their social characteristics. Here social vulnerability evaluates the demographic vulnerabilities within flood prone area of Haripad town, contributing 30% to the overall vulnerability rating. It includes eight sub parameters focusing on the demographic characteristics of the affected population (Figure 6.23). The vulnerability analysis of each of these sub parameters is separately studied as per the Guidelines for preparation of Risk-Informed Master Plans.

Total social vulnerability map is generated at cadastral level by adding each vulnerability scoring of these eight sub parameters and is shown in Figure 6.24. Around 53% of the flood prone area is low socially vulnerable. High vulnerability values are seen in ward numbers 1(Homoeo Dispensary), 3(Kilikkakulangara), 4 (Thrippakkudam), 7(Aroor L.P.S), 8 (Vathukulangara) and 9(P H C), which accounts for about 14.36% of the flood prone area. Also, 30% of the flood prone area have moderate social vulnerability values. High social vulnerability values are attributed to the presence of children below 6 years, economically backward population, senior citizens, and women headed family who might need more assistance during a flood event. Identifying these socially vulnerable groups before a hazardous event may help

local body in such a way that during the time of the occurrence of a hazard, priority must be given to these wards so that casualties of the vulnerable groups can be reduced.

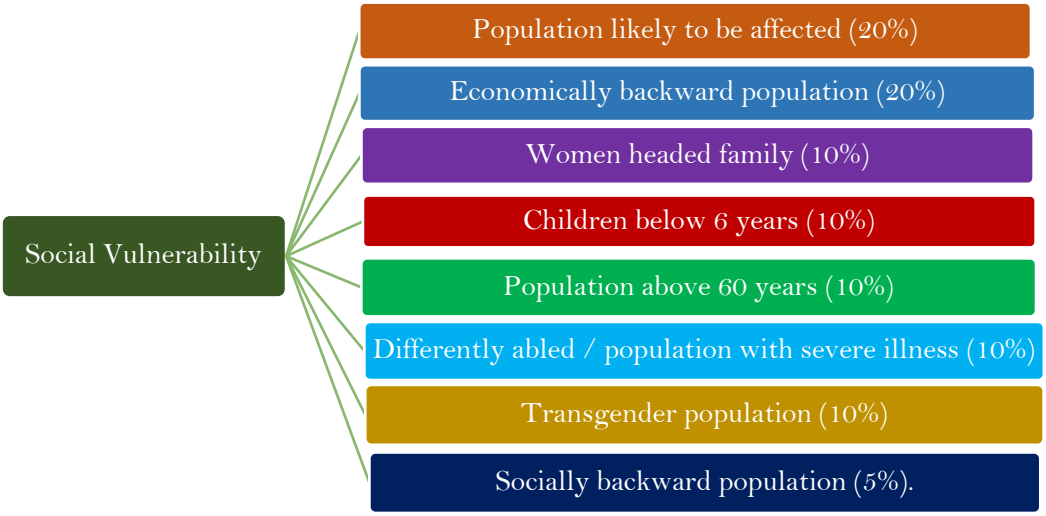

Figure 6.23 : Sub Parameters for the assessment of Social Vulnerability

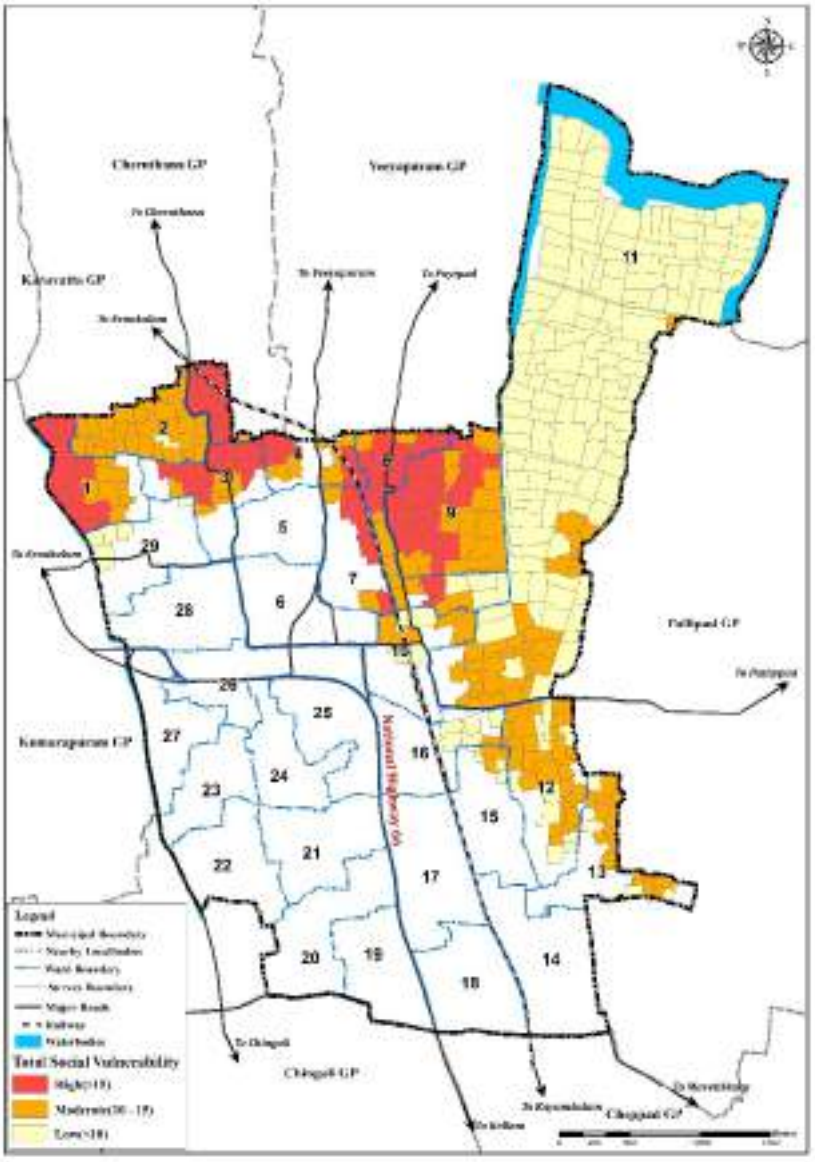

Figure 6.24 : Social Vulnerability in flood prone area of Haripad Town

ii. Physical Vulnerability

Physical vulnerability refers to the susceptibility of the built environment, transportation infrastructure, and land cover within the town. It contributes to 20% of the overall vulnerability rating and is found out by three parameters each comprising specific sub-parameters. Data for assessing physical vulnerability are collected at both the ward and cadastral levels.

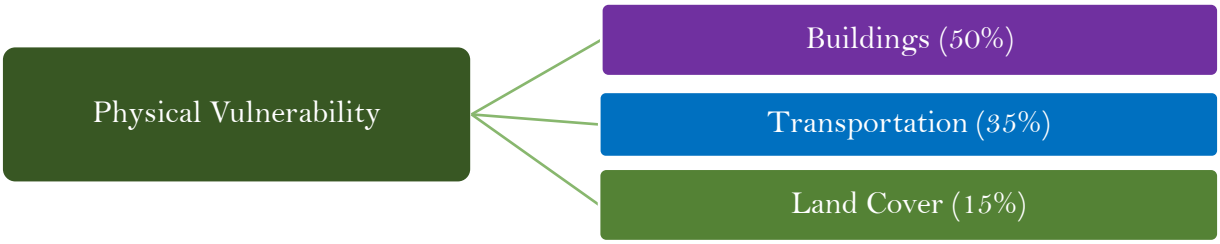

Figure 6.25 : Sub Parameters for assessments of Physical Vulnerability

The sub parameters used to assess the building vulnerability are: access to the building (30%), age (15%), type (40%) and number of floors (15%) of the building. The vulnerability of buildings was evaluated at the cadastral level, with the highest rating given to single-story kutcha structures lacking road access, while the lowest vulnerability was assigned to multi-story pucca buildings with access roads at least 7 meters wide and the generated map is shown in Figure 6.26. It is seen that building vulnerability is high in ward number 3 (Kilikkakulangara).

Transportation vulnerability encompasses the susceptibility of roads and railways at the cadastral level. The sub parameters include Roads

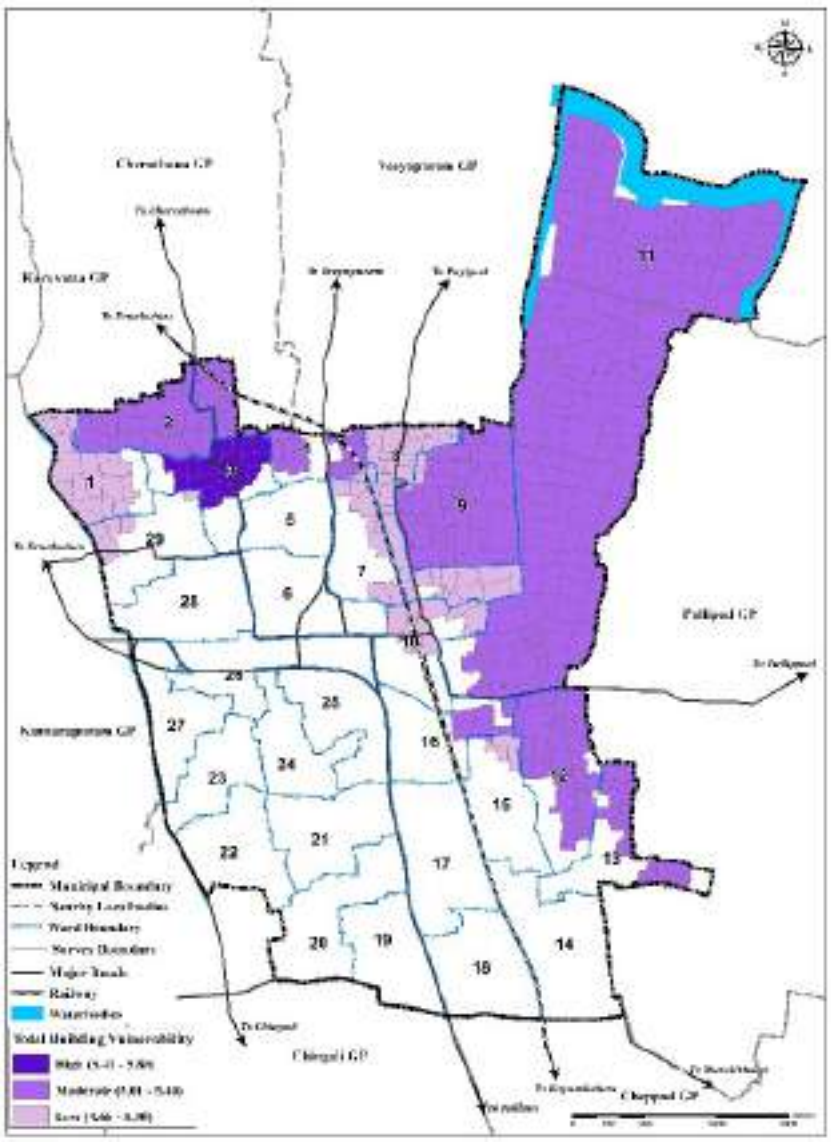

Figure 6.26: Building Vulnerability in the flood prone area of Haripad town

(60%) and Railways (40%). The transportation vulnerability map is shown in Figure 6.26 1.59% of the total flood prone area is covered by roads and it contribute to the higher values of transportation vulnerability. The part of the major roads such as Cheruthana road, Veeyapuram road, Road from Prathimukham junction to Payippad and pallippad are passing through the flood prone area of the town. During a flood event, these roads may be submerged, it can delay rehabilitation work, make it harder for people to evacuate safely, and disrupt essential services like police, fire, and ambulance, slowing down emergency relief efforts. Railway line is passing through the flood prone areas of Thrippakkudam (4), Aroor.L.P.S (7), Vathukulangara (8) and Mangamkulangara (10) wards.

Land Cover vulnerability was also assessed at cadastral level, based on whether the land under consideration falls under built, unbuilt, or undevelopable areas. Built area includes the areas under residential, commercial, industrial and public- semipublic land use as per the existing land use map of the town. Un built area includes road, railway, dry cultivation and vacant lands as per the existing land use map. Undevelopable areas like paddy, marshy and sacred groves are also considered. The land cover vulnerability map generated using these sub parameters are shown in Figure 6.28. While the North-Eastern part of the town is highly prone to flood hazard, majority of this land falls under paddy or wetland and vulnerability is found to be low. The built-up zones in the flood prone area are highly vulnerable.

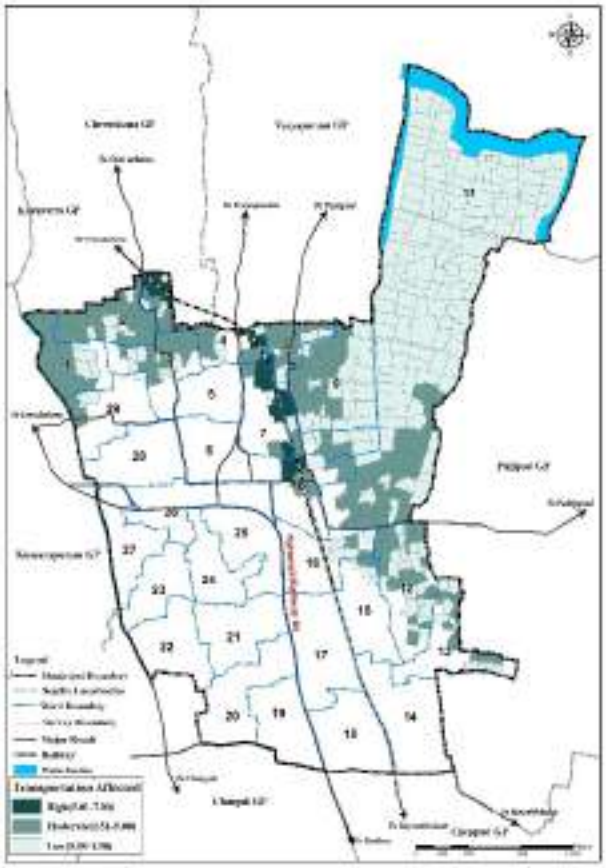

Figure 6.27: Transportation Vulnerability Map

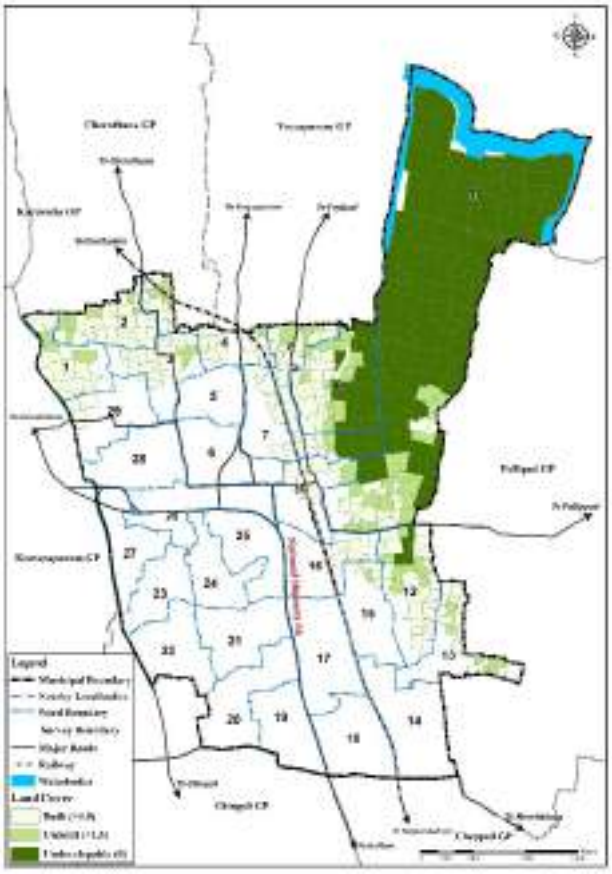

Figure 6.28: Land Cover Vulnerability Map

Building, Transportation and Land cover vulnerability scores are added up to get the physical vulnerability map of the town and is shown in Figure 6.29. 53% of the flood prone area have low physical vulnerability values. The undevelopable areas like paddy fields towards the North-Eastern part of the town, which is bordering the Achenkovil river seems to have low

physical vulnerability. Only 3.27% of the flood prone area have high physical vulnerability values and are seen along the transportation corridors and in built up areas. About 43.47% of the Flood prone area have moderate physical vulnerability.

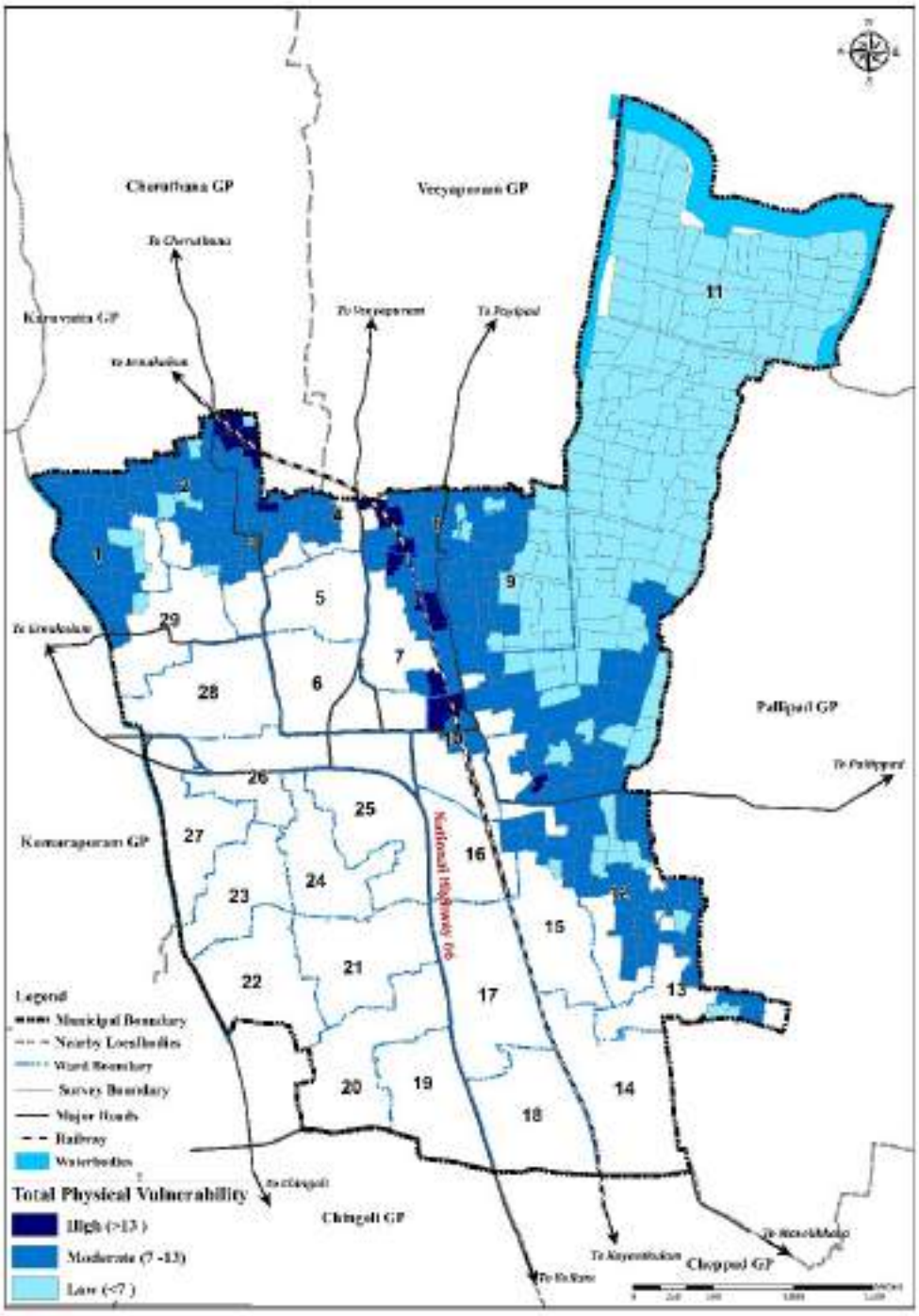

Figure 6.29: Physical Vulnerability in the flood prone area of Haripad town

iii. Vulnerability of Essential / Basic Services

Basic services and critical infrastructure are assets that are crucial to disaster response, mitigation, and recovery. Basic Service Vulnerability value contributes to 20% of the total vulnerability rating with sub parameters social infrastructure, water supply, and sanitation facilities, which are aggregated at ward-level. This assessment evaluates the vulnerabilities of

essential services during disasters and examines their ability to facilitate efficient response and recovery operations.

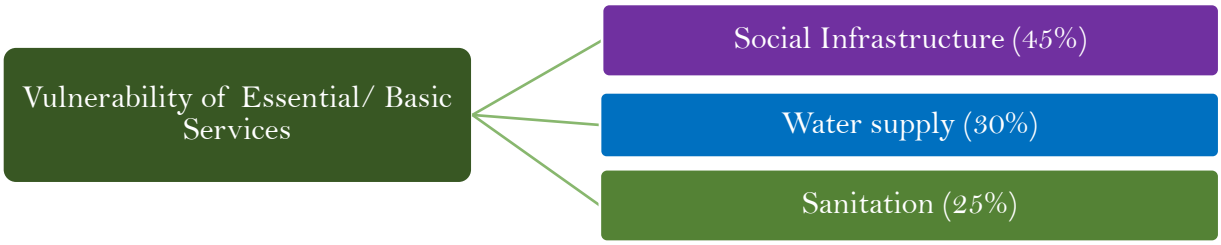

Figure 6.30 : Sub Parameters for the assessment of Vulnerability of Essential/ Basic Services

The social infrastructures that are located within the flood prone wards that may affect during a hazardous event is considered and the impact of these infrastructures is assessed here. The critical infrastructure which has impact on the whole Municipality or >75% of the Municipality likely to be affected has given higher weightage and the map generated is shown in Figure 6.31. Critical infrastructures in the floods prone wards include 2 Hospitals, 1 College, 2 Schools and 15 transformers. The identified critical infrastructures in the flood prone area include Govt. ITI in ward 12 (Nedunthara), Govt. Homeo dispensary in ward 1 (Homeo dispensary), PHC Pilappuzha in ward 9 (PHC), Amritha Vidyalayam in ward 4 (Thrippakkudam), Sabarmathi special school in ward 3 (Killikkulangara). Health institutions are indispensable to the social and economic functioning of society and serve as the primary lifelines for life-saving and life-sustaining activities during or after a disaster and these are assumed to have high vulnerability. It is found that wards 1 and 9 highly vulnerable in terms of critical infrastructures.

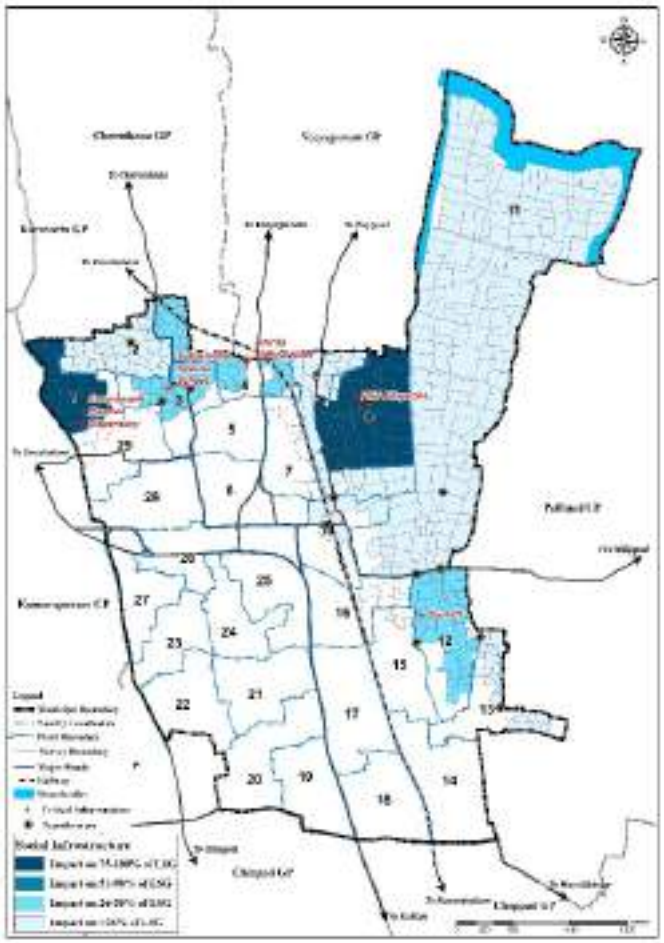

Figure 6.31 : Social Infrastructure Vulnerability Map

Water supply and sanitation data was collected through field surveys. In the assessment, groundwater-dependent sources like dug wells are considered vulnerable, as they are more likely to be affected during floods. On the other hand, piped water supply is regarded as not affected during floods, as it is less susceptible to inundation or contamination in such events. The map thus generated is shown in Figure 6.33. Water supply in wards PHC (9) and

Mannarasala (29) is found to be moderately affected while other wards in the flood prone area are highly affected.

The lack of a sewerage system in the town is evident that nearly all households rely on septic tanks or soak pits. Therefore, sanitation is impacted throughout the entire flood prone area and hence same value is distributed throughout the wards for vulnerability assessment.

Map showing the Basic services vulnerability (Figure 6.32) in the flood prone area of the town is generated at cadastral level by adding each vulnerability scoring of these three sub parameters. 95% of the flood prone area of the town have high and 5% have moderate vulnerability values in terms of basic services. Areas that have high vulnerability to basic services could lead to more severe, long-lasting impacts on functioning during and after a flood event. But basic services in the moderate vulnerable areas might face temporary disruptions, but overall, recovery and continued access would be possible. Measures must be put forwarded to reduce the effect of flood event on these infrastructures.

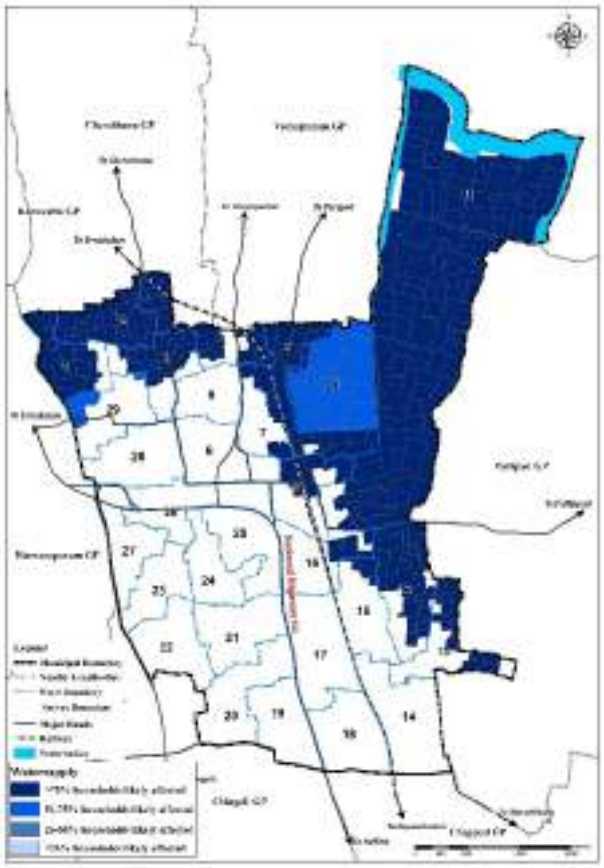

Figure 6.33 : Water Supply Vulnerability Map

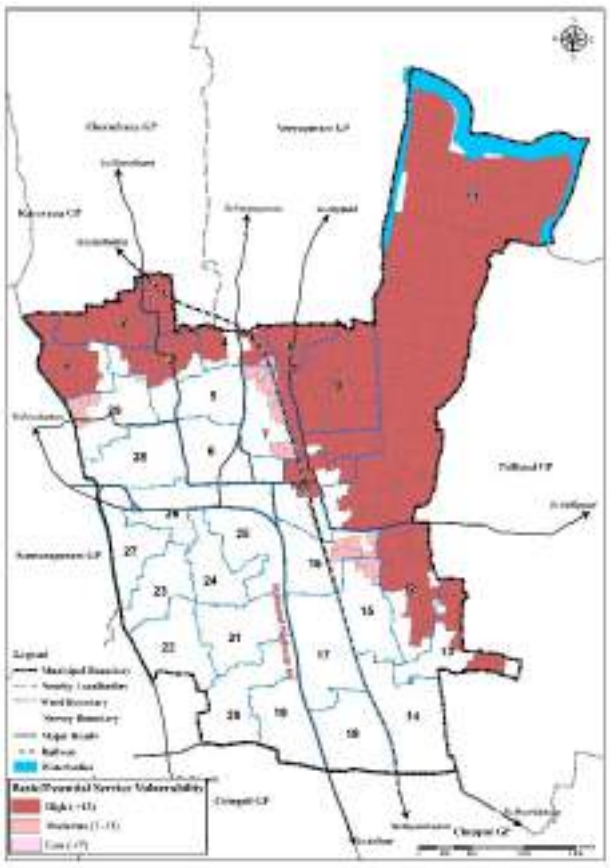

Figure 6.32: Essential or Basic Service Vulnerability in flood prone area of the town

iv. Economic Vulnerability

Economic diversification is a crucial factor influencing disaster resilience. The economy accounts for 15% of the total vulnerability rating and is evaluated based on two sub-parameters: the percentage of local level employment within the ward and the extent of the economic zone likely to be flooded (Figure 6.33). Data for the sub parameters were collected at the ward-level through socio-economic surveys and geospatial analysis to provide a detailed understanding of the economic vulnerability.

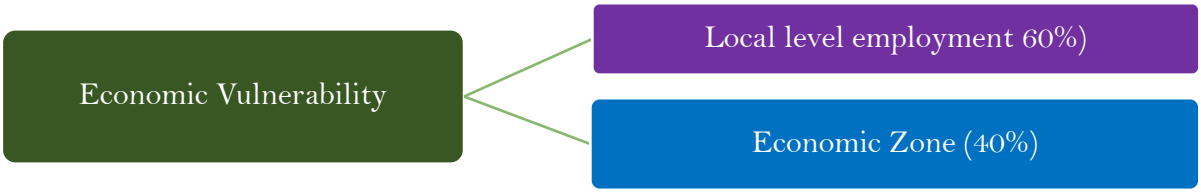

Figure 6.34 : Sub Parameters for assessment of Economic Vulnerability

Local level employment is considered as the population employed in informal sector, daily wages, local level economic sector, or agriculture. The map generated from the analysis of local level employment is shown in Figure 6.35. It is seen that 10 to 20 % of the population in the flood prone wards work on daily wages and is more concentrated in Pilappuzha South (11) and Manimangalam (15) wards. It may be due to the presence of agricultural labourers and paddy cultivators.

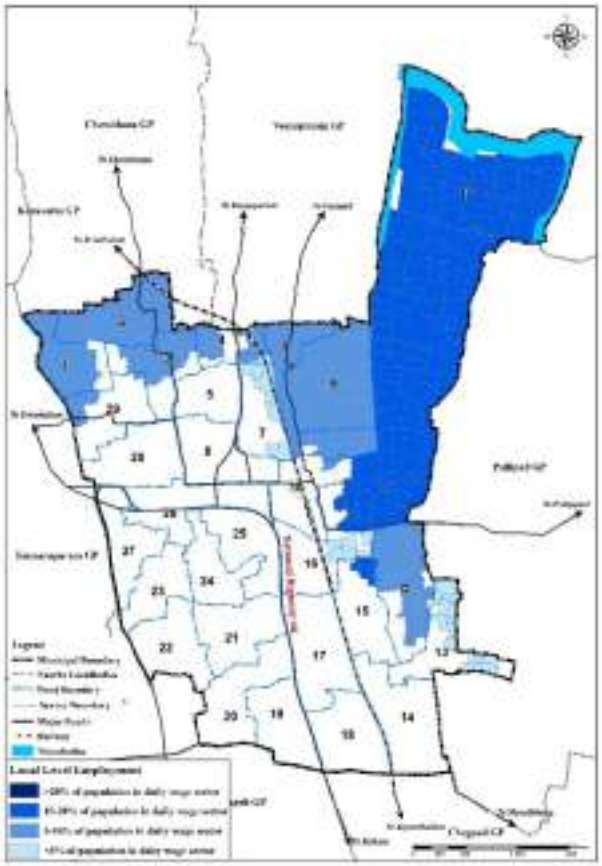

Figure 6.35: Local -Level Employment Vulnerability Map

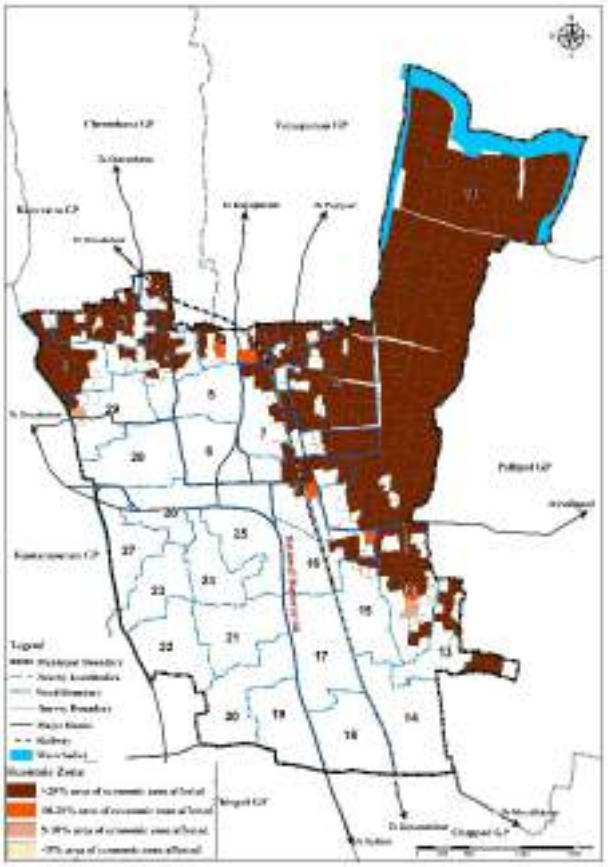

Figure 6.36: Economic Zone Vulnerability Map

The economic zone comprises land uses associated with livelihood and income-generating activities, including tourism, commercial establishments, industrial units, agriculture, fisheries, animal husbandry, and other primary and tertiary sector activities that are susceptible to disruption during flood events. To assess vulnerability, ward-wise data from the existing land use map were combined with inputs from the socio-economic survey, enabling a detailed understanding of how economic activities are spatially distributed within flood-prone areas. Figure 6.36 illustrates the ward-wise economic vulnerability of zones located within flood-affected areas, indicating that a majority of wards contain significant economic assets

that are highly exposed to flood risk. At a finer scale, a comprehensive economic vulnerability map was prepared at the cadastral level by aggregating the vulnerability scores of the relevant sub-parameters, as presented in Figure 6.37. The analysis reveals that approximately 78% of the total flood-prone area falls under high economic vulnerability, reflecting the concentration of livelihoods and economic activities in risk-prone locations. In contrast, about 10% of the area exhibits moderate economic vulnerability, while the remaining 12% shows low vulnerability. These findings highlight the substantial potential for economic disruption during flood events and underline the need for targeted, risk-informed planning measures to protect livelihoods and enhance economic resilience..

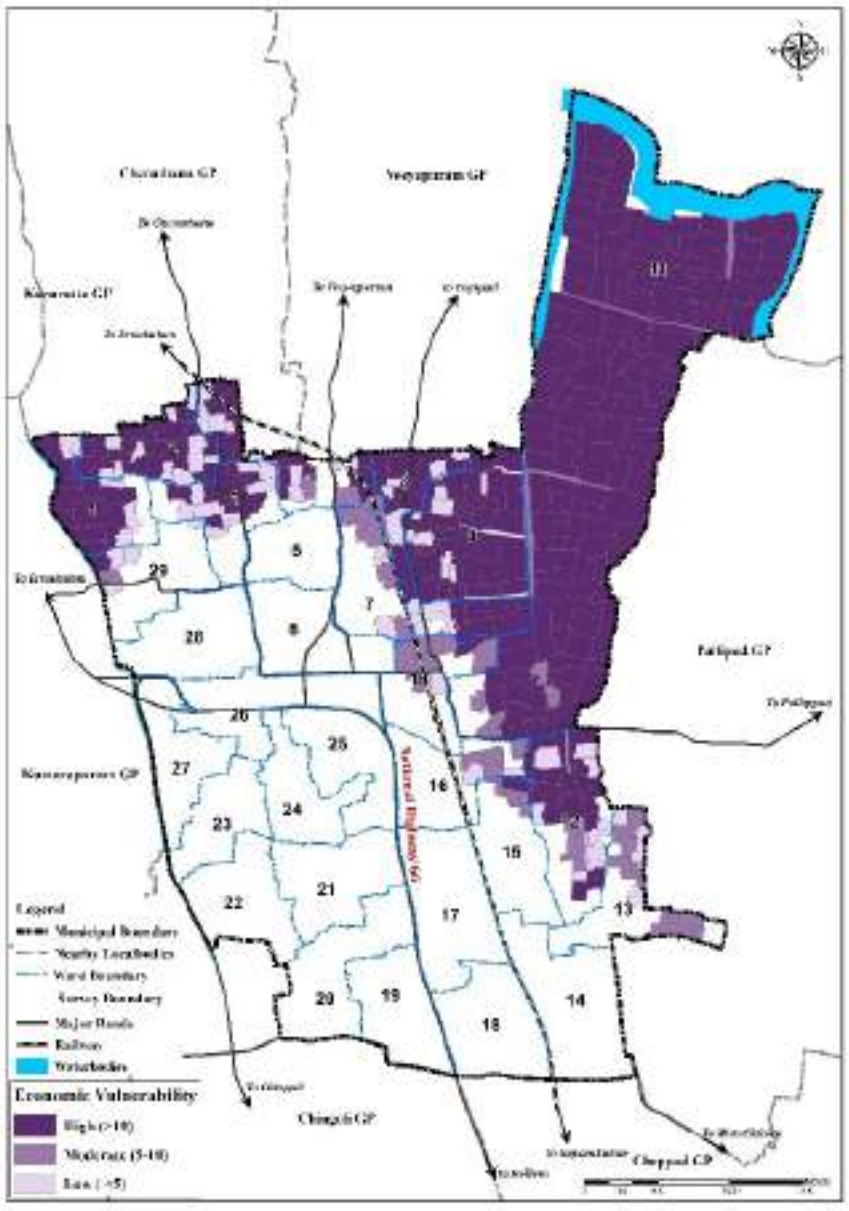

Figure 6.37 : Economic Vulnerability in the flood prone area of the town

v. Environment and Heritage Vulnerability

Environment and heritage vulnerability contributes 10% to the total vulnerability and includes two sub-parameters: Areas of ecologic importance (60% weightage) and Heritage area (40% weightage).

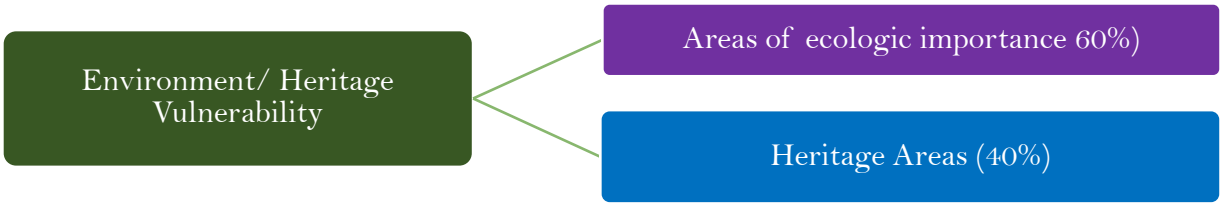

Figure 6.38: Sub parameters of Environmental Vulnerabiltiy

Ecologically sensitive areas were taken from existing land use map which include paddy land/ wetlands, marshy land, sacred groves, and water bodies. 4.93% of the flood prone area is found to be ecologically sensitive as shown in Figure 6.39. Haripad town is abundant in eco-sensitive areas, with its vast stretches of paddy fields concentrated on the north-eastern side of the town. Paddy fields with active cultivation are more concentrated at north-east of the town because of the presence of paddy at that region. But other wards also show significant amount of eco-sensitive areas. However, there is no significant heritage sites or buildings within the flood prone area and hence, heritage vulnerability is zero. The consolidated map indicating Environmental Vulnerability is indicated in Figure 6.40.

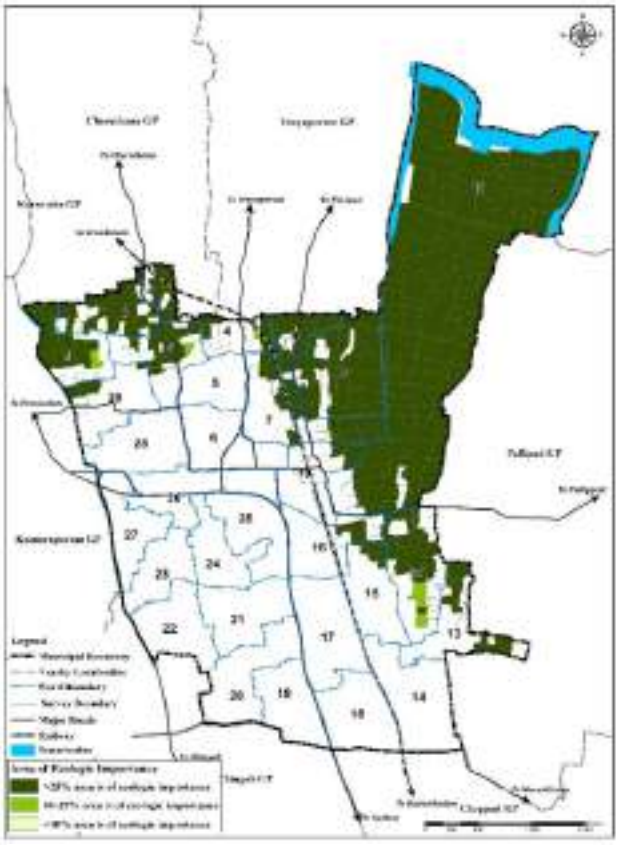

Figure 6.39: Map Showing Areas of Ecological Importance

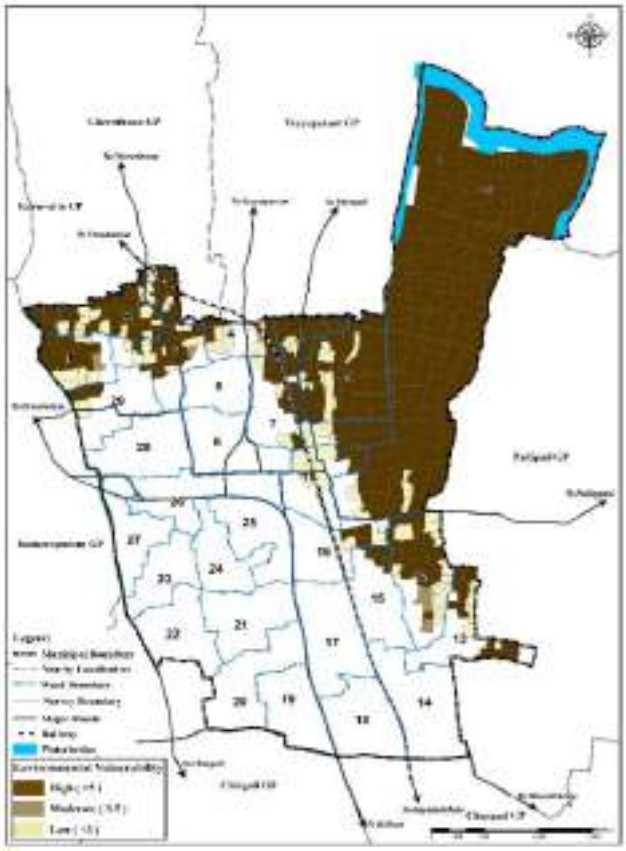

Figure 6.40: Environmental Vulnerability Map

vi. Coping Capacity

The coping capacity factor assesses the ability of organizations and systems to use available skills and resources to manage adverse conditions, risks, or disasters. Key elements include an updated Local Disaster Management Plan (LDMP) at the town level, a well-structured evacuation plan, committees to oversee LDMP implementation, and the status of various Disaster Risk Reduction (DRR) activities. Unlike other factors, vulnerability is inversely related to coping capacity; therefore, the presence of any sub-parameter was assigned a null value. Values for the above parameters were obtained through primary methods, including consultations with ward councillors and a definitive status update gathered via a telephonic interview with the current LSG Disaster Management Coordinator.

Although the town excels in many aspects of the Disaster Response System, the absence of an evacuation plan can impede risk reduction and mitigation efforts during a disaster. Prioritizing the identification of relief infrastructure, routes, and areas suitable for alternative housing,

rehabilitation, and relocation of affected populations is essential. Service Level Benchmarking of relief and road facilities can help the town identify where to focus additional DRR efforts within this parameter. The coping capacity vulnerability map of Haripad town is shown in Figure 6.41.

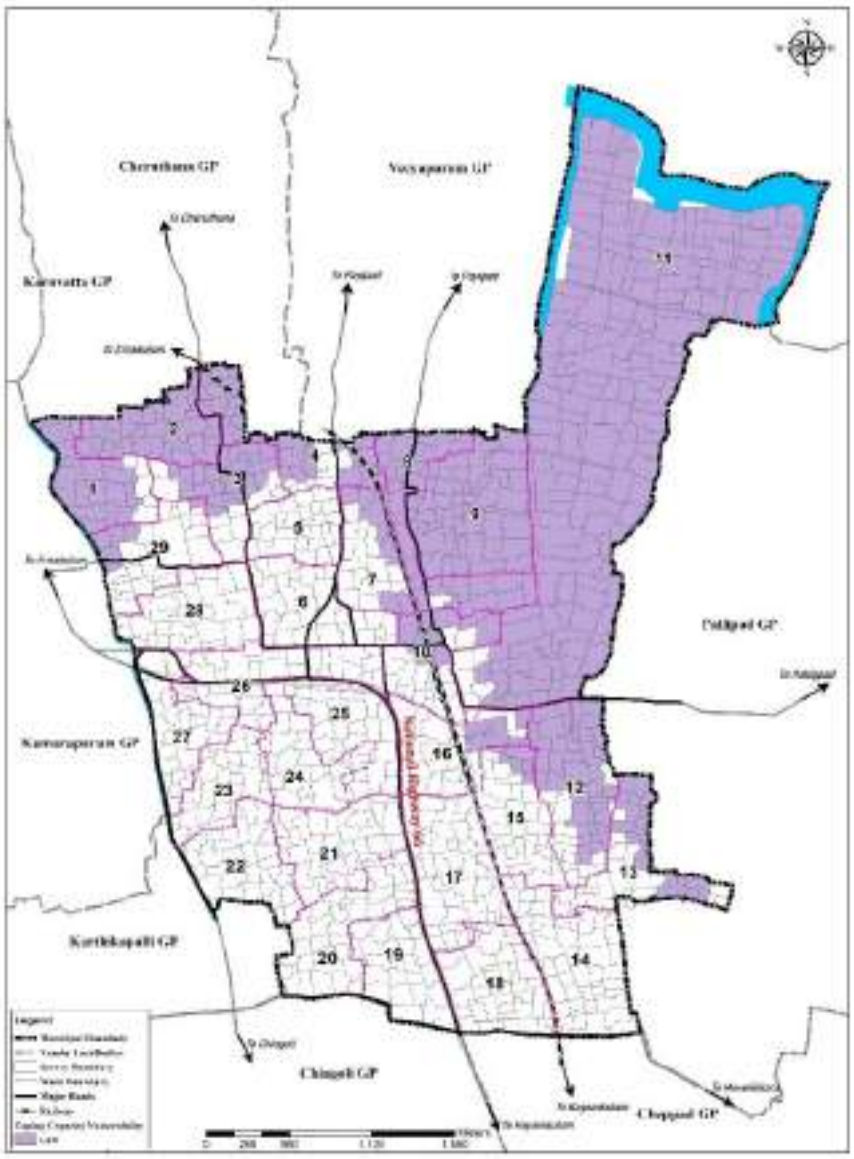

Figure 6.41: Coping Capacity Vulnerability Map

vii. Total Vulnerability

Cadastral level total vulnerability in a flood prone area refers to an assessment that evaluates the overall vulnerability of cadastral units to flood-related risks in a specific area. The goal is to identify which land areas are most vulnerable to flooding, considering the 6 vulnerability factors analysed above. Total vulnerability map is generated at cadastral level by adding each vulnerability scoring of these six components (Figure 6.42). Total vulnerability value ranges from moderate to high values.

34% of the flood prone area of the town shows high vulnerability and faces significant exposure to flooding. These areas are more at risk, and even moderate flood events could cause severe damage to infrastructure, property, and human life. These areas require immediate and focused intervention to prevent or mitigate the impact of floods.

A large portion of the flood prone area of the town (65%) is moderately vulnerable to flooding. These areas may experience some flood risks, but they are not as exposed to catastrophic

damage as high vulnerability areas. While the impacts of flooding are more likely to be localized and manageable, this large area still faces substantial risk, which means proactive flood management strategies are crucial.

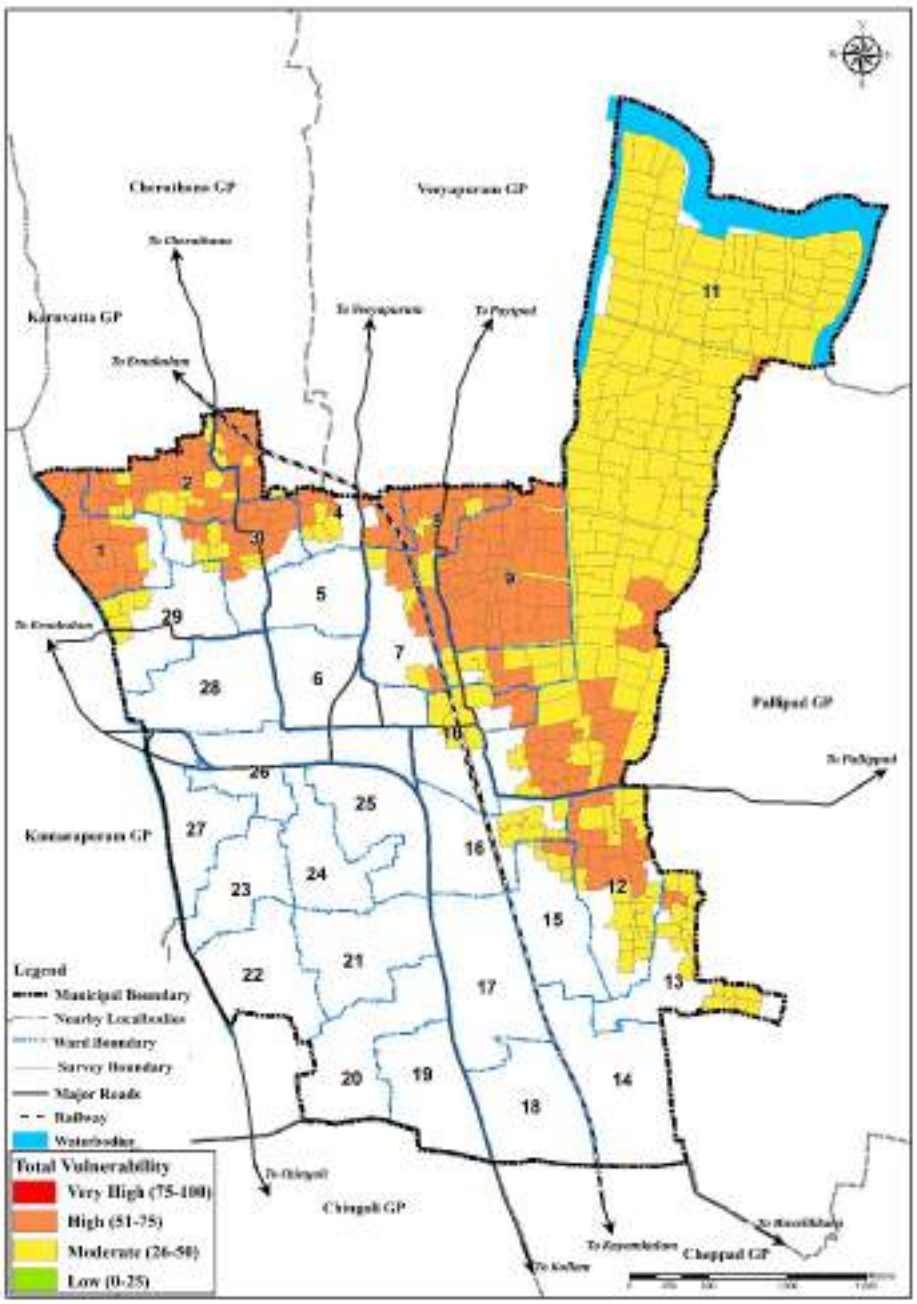

Figure 6.42: Total Vulnerability Map

c. Flood Risk

Risk is defined as "a measure of the probability (likelihood) and severity of an adverse effect to health, property, the environment, or other things of value" (EMBC, 2004). The risk analysis is, thus, not a definitive measure of damage; instead, it primarily meant to convey the exposure of various cadastral plots to a future flood inundation event. It is a tool for citizen awareness, and meant to serve as a guide for individual plot-level actions to manage flood inundation in the town.

Final risk is calculated as per the risk matrix provided in the guideline for the preparation of Risk Informed Master Plan. The Risk Matrix as per the guidelines is shown in the Table 6.14. Taking into consideration of the hazard impact value and Total vulnerability value as mentioned in the previous section, risk matrix is used to get the flood risk map of Haripad town. However, the real power of such a map lies in its ability to spread risk information, and make citizens aware of their possible exposure to flooding events. A tool like this is extremely important because, when applied properly, it may encourage mitigation efforts at the plot level, guide future investments, promote economic diversification, and facilitate the emergence of contextual solutions. Flood risk map of Haripad Town is shown in Figure 6.43.

Table 6.14 : Risk Matrix as per the guidelines for the preparation of Risk Informed Master Plans

			Hazard Impact			
			Low	Moderate	High	Very High
			0-2.5	*2.5-5*	*5-7.5*	*7.5- 10*
Vulnerability	Low	*0 - 25*	L1	L2	M3	M4
	Moderate	*26 - 50*	L2	M3	M4	H5
	High	*51 - 75*	M3	M4	H5	H6
	Very High	*76 -100*	M4	H5	H6	VH7

82% of the total flood prone area high risk areas includes Homeo Dispensary (1), Thulamparambu North (2), Kilikkakulangara(3), Thrippakkudam(4), Vathukulangara(8), PHC (9), and Pilappuzha South (11) and Nedunthara(12) wards. Out of which the entire flood prone area in the ward 11 is under high risk. These areas face the highest exposure to flooding, with the potential for severe flooding events during even moderate storms. Catastrophic damage is possible, including displacement of residents, destruction of homes, damage to critical infrastructure, and long-lasting economic disruption. Recovery in high-risk areas could take much longer compared to moderate risk areas, and the long-term impacts could create social and economic challenges for the town and their vulnerability must be addressed with urgent attention. To effectively reduce this risk, implementing targeted hazard mitigation measures in these areas is essential.

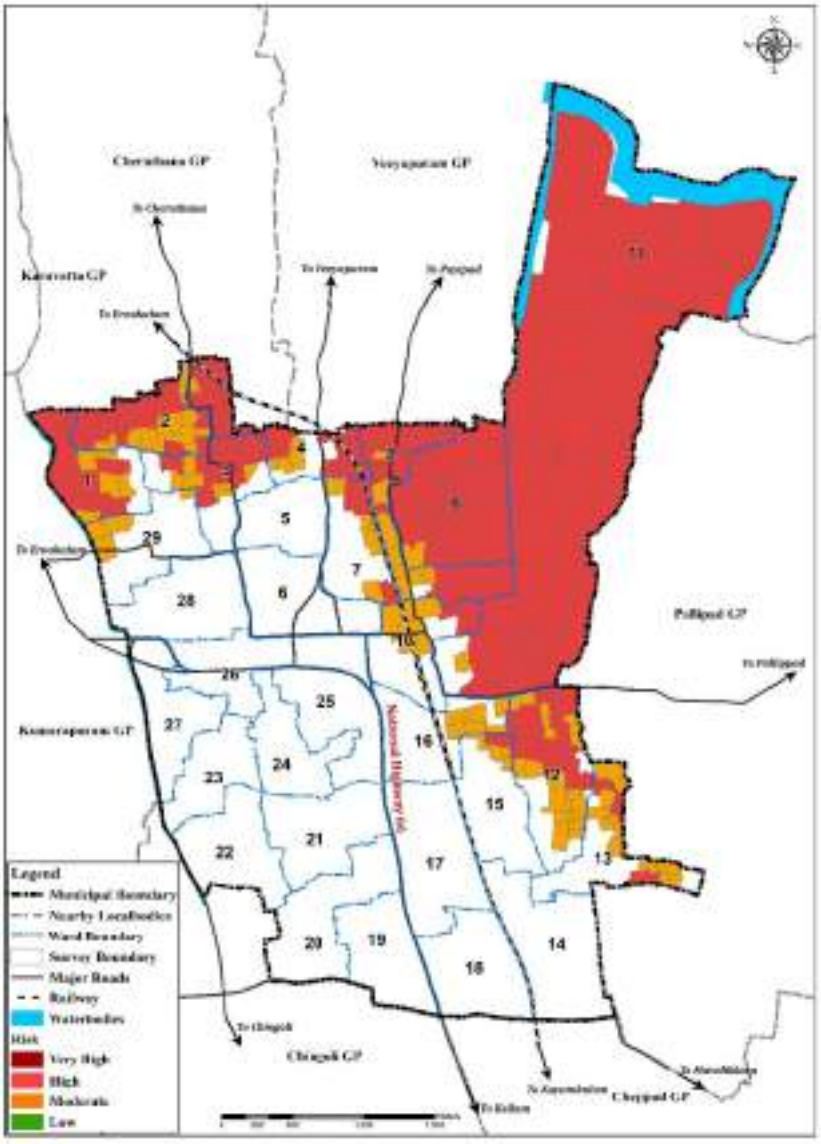

Figure 6.43: Flood Risk Map of flood prone area in Haripad Town

18% of the flood prone area have moderate risk to flooding. These areas may experience frequent or moderate floods, leading to localized disruptions such as road flooding, property damage, and waterlogging. People living in moderate flood-risk areas may have to deal with temporary evacuations and flood-induced inconveniences, but overall, these areas are somewhat resilient if proper flood risk management strategies are in place. The Municipality does not have any Very High and Low risk areas for flood.

6.7 Heat Stress

The Disaster Management (DM) Plan and the Local Action Plan for Climate Change (LAPCC) report of Haripad town has identified heat stress as a critical environmental hazard affecting urban sustainability. With increasing temperatures, deforestation, rapid urbanization and climatic variations, cities are experiencing worsening thermal conditions, largely driven by the Urban Heat Island (UHI) effect. Given the ongoing global warming scenario and future climate projections, addressing this issue is crucial in atmospheric urban planning. Reducing through microclimate creation and integrating green techniques across sectors such as transport, construction, and urban design can significantly reduce the impact of heat stress on human health and well-being. To identify the areas for intervention, a study on urban heat island effects in the town has been carried out.

The UHI phenomenon is characterised by elevated air and land surface temperatures (LST) in urbanised regions compared to their rural surroundings. Over the past several decades, this temperature disparity has intensified, driven by increased human activities, the expansion of built-up areas, and the decline of natural landscapes such as vegetation and water bodies. Understanding these changes is essential for developing effective mitigation strategies.

To address this issue, a study on the Urban Heat Island (UHI) effect in Haripad town has been undertaken, focusing on both historical and present-day temperature patterns and their contributing factors. The study analyses Land Surface Temperature (LST) during the summers of 2014 and 2024, identifies urban heat hotspots (UHS) in 2024, and examines variations in the Normalised Difference Built-up Index (NDBI) and the Normalised Difference Vegetation Index (NDVI). In addition, correlations between LST, NDBI, and NDVI are assessed to better understand the drivers of rising temperatures. The study also evaluates land use and land cover (LULC) changes over the past five years (2019–2025) to capture recent urban development trends.

6.7.1 Methodology

Land Surface Temperature (LST) is a critical indicator for assessing urban heat patterns, environmental stress, and the Urban Heat Island (UHI) effect. Comparing satellite-derived LST data with ground-based temperature records from the India Meteorological Department (IMD) provides a more comprehensive understanding of thermal variations over time.

To ensure the accuracy and reliability of this study, high-resolution satellite data from the LANDSAT 8 TIR OLI and LANDSAT 9 TIR OLI sensors were utilised to calculate Land surface Temperature. These datasets were obtained from the United States Geological Survey (USGS) Earth Explorer platform. The analyses of temperature patterns for the years 2014 and 2024 highlight both maximum and minimum temperatures derived from LST measurements.

To validate the findings, temperature data recorded by the India Meteorological Department (IMD) for the same years were incorporated.

6.7.2 Land Surface Temperature (LST) Analysis (Satellite Data)

Satellite-derived Land Surface Temperature (LST) data (Table 6.15) illustrate the thermal behaviour of different land surfaces, which generally exhibit higher temperatures than ambient air due to their heat absorption and radiative properties. Since LST data for 2014 were available only for mid-February, corresponding mid-February data from 2024 were also used to ensure temporal consistency in the analysis.

Table 6.15 : Maximum & minimum Land Surface Temperature of Haripad Town using LANDSAT data of 2014 & 2024

Year	Max LST (°C)	Min LST (°C)
11-02-2014	32.0	24.84
15-02-2024	33.17	25.3

Figures 6.44 below shows a satellite-derived Land Surface Temperature (LST) profile of Haripad town, indicating a clear warming trend in Haripad Town between 2014 and 2024. The maximum LST increased from 32.0 °C to 33.17 °C, while the minimum LST rose from 24.84 °C to 25.3 °C, reflecting an overall intensification of surface heating over the decade.

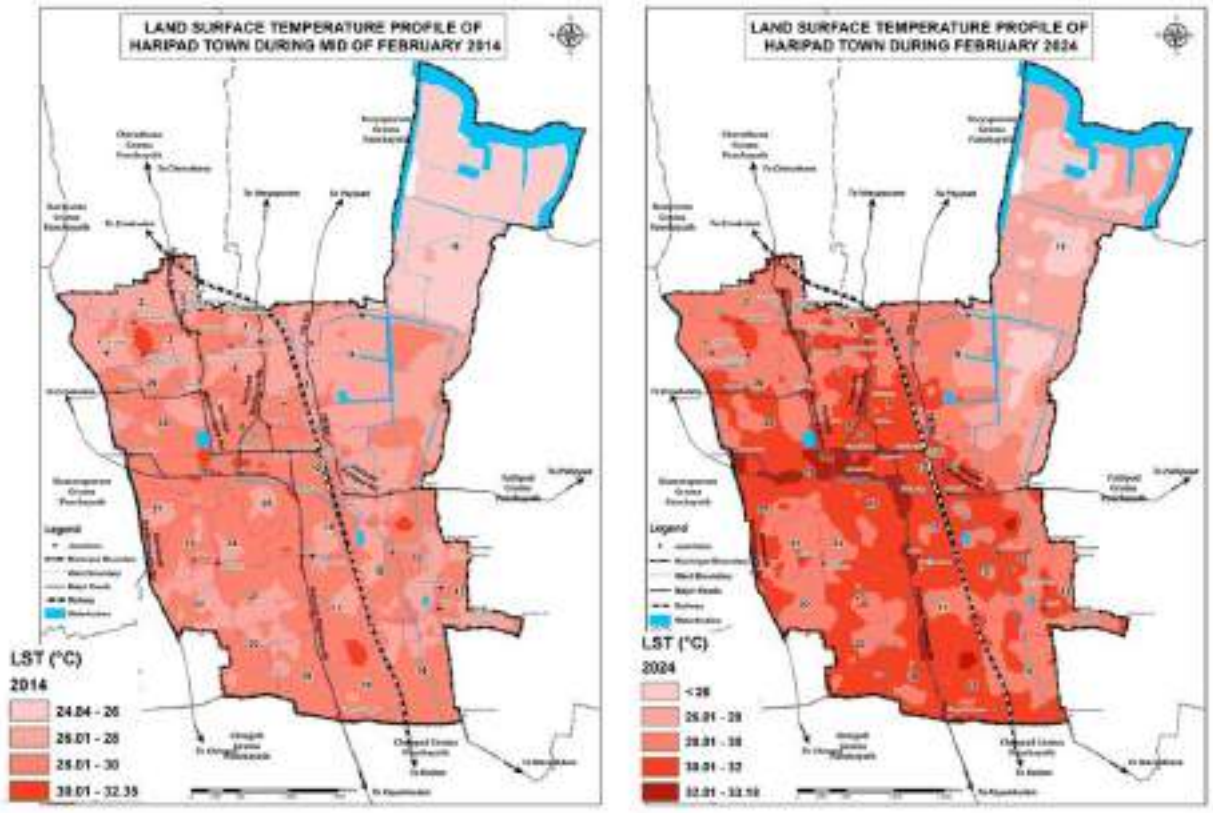

Figure 6.44 : Land Surface Temperature profile of Haripad town during February 2014 and February 2024

The increase in maximum LST suggests enhanced heat absorption by urban surfaces such as buildings, roads, and other impervious materials, which have high thermal inertia and limited

cooling capacity. More importantly, the rise in minimum LST points to reduced nocturnal cooling, a characteristic feature of a strengthening Urban Heat Island effect. This indicates that stored heat is retained and slowly released during nighttime, leading to prolonged thermal stress

6.7.3 IMD Temperature Analysis (Ground-Measured Air Temperature)

IMD data shown in Table 6.16 represent atmospheric air temperatures, which are typically lower than surface temperatures, providing ground truth for thermal assessments. The IMD ground-based air temperature data indicate a noticeable increase in both maximum and minimum temperatures in Haripad Town between 2014 and 2024. The maximum air temperature shows a marginal rise from 32.4 °C to 33.0 °C, suggesting an overall warming of daytime atmospheric conditions. More pronounced, however, is the increase in minimum air temperature, which rose from 20.4 °C to 22.6 °C, indicating significantly warmer nights over the decade.

Table 6.16 : Maximum & minimum Atmospheric temperature of Haripad Town from Indian Meteorological Department (IMD) data of 2014 & 2024

Year	Max Temp (°C)	Min Temp (°C)
11-02-2014	32.4	20.4
15-02-2024	33.0	22.6

Although air temperatures recorded by IMD stations are generally lower than satellite-derived land surface temperatures, the consistent upward trend observed in both datasets confirms the presence of intensifying urban warming. The IMD data, therefore, provide robust ground validation for the satellite-based LST analysis and reinforce the conclusion that Haripad Town is experiencing increasing heat stress associated with urbanisation and land use changes.

6.7.4 Comparative Assessment: LST vs IMD Data

A comparison shown in Figure 6.45 of satellite-derived Land Surface Temperature (LST) and ground-measured air temperature from IMD reveals consistent warming trends in Haripad Town between 2014 and 2024, while also highlighting the inherent differences between surface and atmospheric thermal responses.



Figure 6.45 : Comparison of maximum and minimum temperature between LST & IMD data for 2014 & 2024

In both years, LST values are higher than IMD air temperatures, particularly for minimum temperatures. This difference is expected, as land surfaces—especially built-up materials such as concrete and asphalt—absorb and store solar radiation during the day and release heat slowly at night, whereas air temperatures respond more rapidly to atmospheric processes.
From 2014 to 2024, the maximum LST increased by 1.17 °C, while the maximum IMD air temperature increased by 0.6 °C, indicating intensified surface heating relative to atmospheric warming. More notably, the minimum LST rose by 0.46 °C, whereas the minimum air temperature increased sharply by 2.2 °C, pointing to significantly warmer nights. This convergence between minimum LST and minimum air temperature suggests reduced nocturnal cooling and enhanced heat retention within the urban environment. Overall, the close agreement in temporal trends between LST and IMD data validates the reliability of the satellite-based analysis.

6.7.5 NDVI (Normalised Difference Vegetation Index)

The Normalised Difference Vegetation Index (NDVI) is a widely used remote sensing index that measures vegetation health and density using satellite imagery. It helps in monitoring plant growth, assessing drought conditions, and analysing land cover changes. As shown in Figure 6.46 in order to enhance the accuracy of the analysis, LISS 4 data with a higher spatial resolution of 5.8 meters for the same period (2014 and 2024) are incorporated to calculate NDVI.

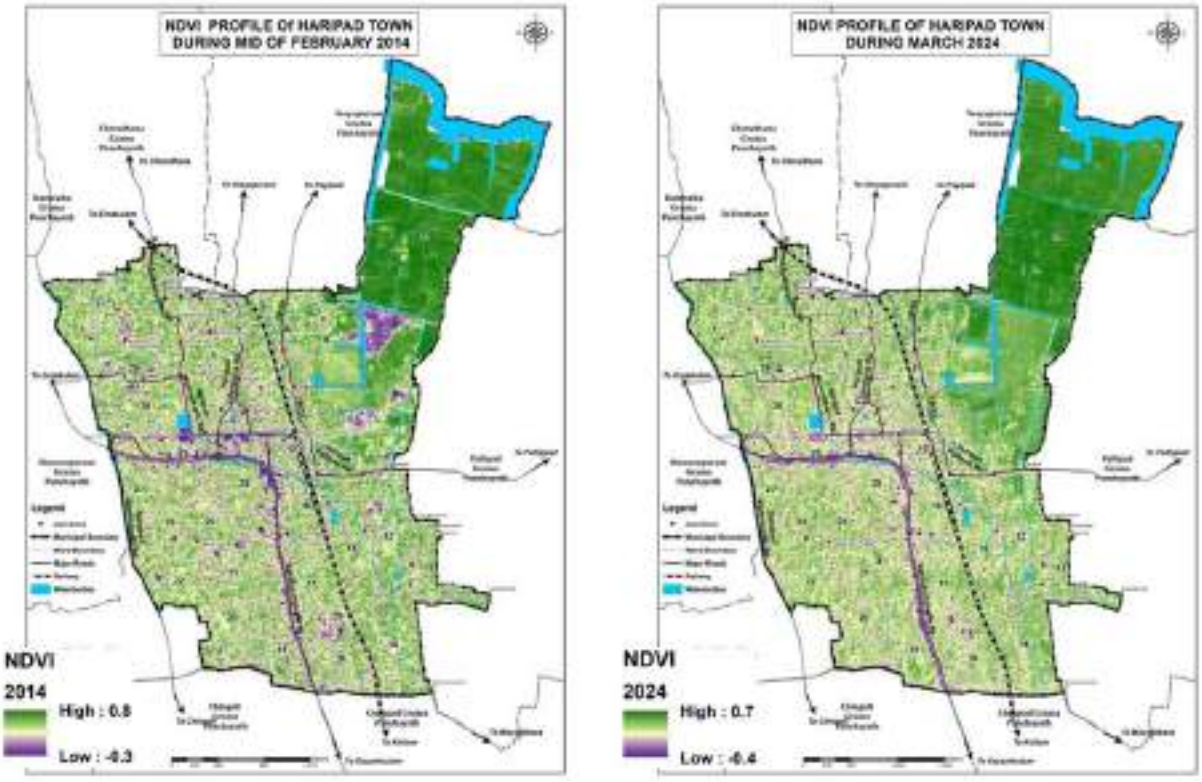

Figure 6.46 : The temporal change in the NDVI profile of Haripad town using LISS IV data for 2014 and 2024

- **High NDVI (> 0.5)** → Dense, healthy vegetation.
- **Moderate NDVI (0.2 – 0.5)** → Sparse or stressed vegetation.
- **Low NDVI (< 0.2)** → Bare soil, urban areas, or water bodies.

Table 6.17 : The change in the minimum, maximum and mean values of NDVI in Haripad town for 2014 and 2024

Year	2014	2024
Min	-0.292	-0.429
Max	0.816	0.739
Mean	0.522	0.484

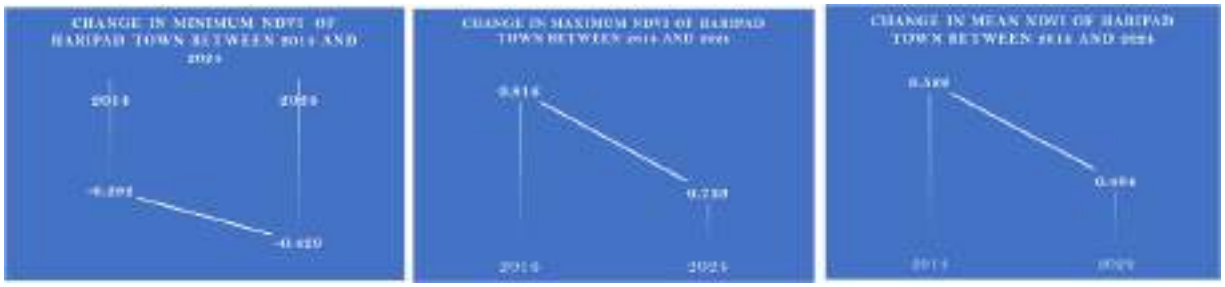

Figure 6.47 : Change in the maximum, minimum & mean values of NDVI profile of Haripad town obtained from LISS4 data between 2014 & 2024

The NDVI analysis shown in Table 6.17 and Figure 6.47 for Haripad Town reveals a discernible decline in vegetation health and density between 2014 and 2024. The maximum NDVI value decreased from 0.816 to 0.739, indicating a reduction in dense and healthy vegetation cover, while the mean NDVI declined from 0.522 to 0.484, reflecting an overall decrease in vegetative greenness across the town.

The minimum NDVI value became more negative, changing from –0.292 in 2014 to –0.429 in 2024, which suggests an expansion of non-vegetated surfaces such as built-up areas, bare soil, or water bodies. This shift is indicative of increasing urbanisation and land cover transformation.

The observed reduction in NDVI implies diminished evapotranspiration and shading effects, both of which play a critical role in regulating surface temperatures. Consequently, the decline in vegetation cover directly contributes to rising Land Surface Temperatures and the intensification of the Urban Heat Island effect in Haripad Town.

These findings underscore the importance of targeted urban greening initiatives to mitigate heat stress and strengthen climate resilience in Haripad town. At the same time, the observed trends highlight the urgent need for sustainable urban planning, reforestation, and the integration of green infrastructure to counter vegetation loss, restore ecological balance, and promote long-term environmental sustainability in the region.

6.7.6 NDBI (Normalised Difference Built-up Index)

It is a remote sensing index that detects and analyses built-up areas in satellite imagery. It is calculated using the Near-Infrared (NIR) and Shortwave Infrared (SWIR) bands, typically from sensors like Landsat. A higher NDBI value indicates more built-up areas, while lower values suggest vegetation or water bodies. It is often used alongside NDVI to differentiate urban and vegetated regions.

Calculating Built-Up Area from NDBI Analysis : The total built-up area within a specific region can be estimated by extracting built-up pixels from NDBI raster data. NDBI values range from **-1 to +1**, with positive values typically indicating built-up areas and negative values representing vegetation, water bodies, or bare soil. A suitable NDBI threshold must be chosen to classify built-up areas.

- **Common threshold: NDBI > 0** is a widely used baseline for detecting urban surfaces.

Results of NDBI analysis in Haripad Town

Table 6.18 : Change in the Built-up area in Haripad town from NDBI calculation for 2014 and 2024

Year	2014	2024
Area sq. km	0.2511	0.399

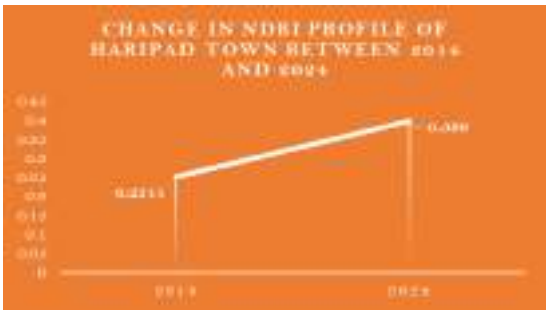

Figure 6.48 : Graphical representation of the increase in built-up area in Haripad Town between 2014 & 2024

The NDBI analysis (Table 6.18 and Figure 6.48) for Haripad Town indicates a substantial increase in built-up intensity between 2014 and 2024. The NDBI value increased from 0.2511 in 2014 to 0.399 in 2024 (Figure 6.49), reflecting significant urban expansion and densification over the decade.

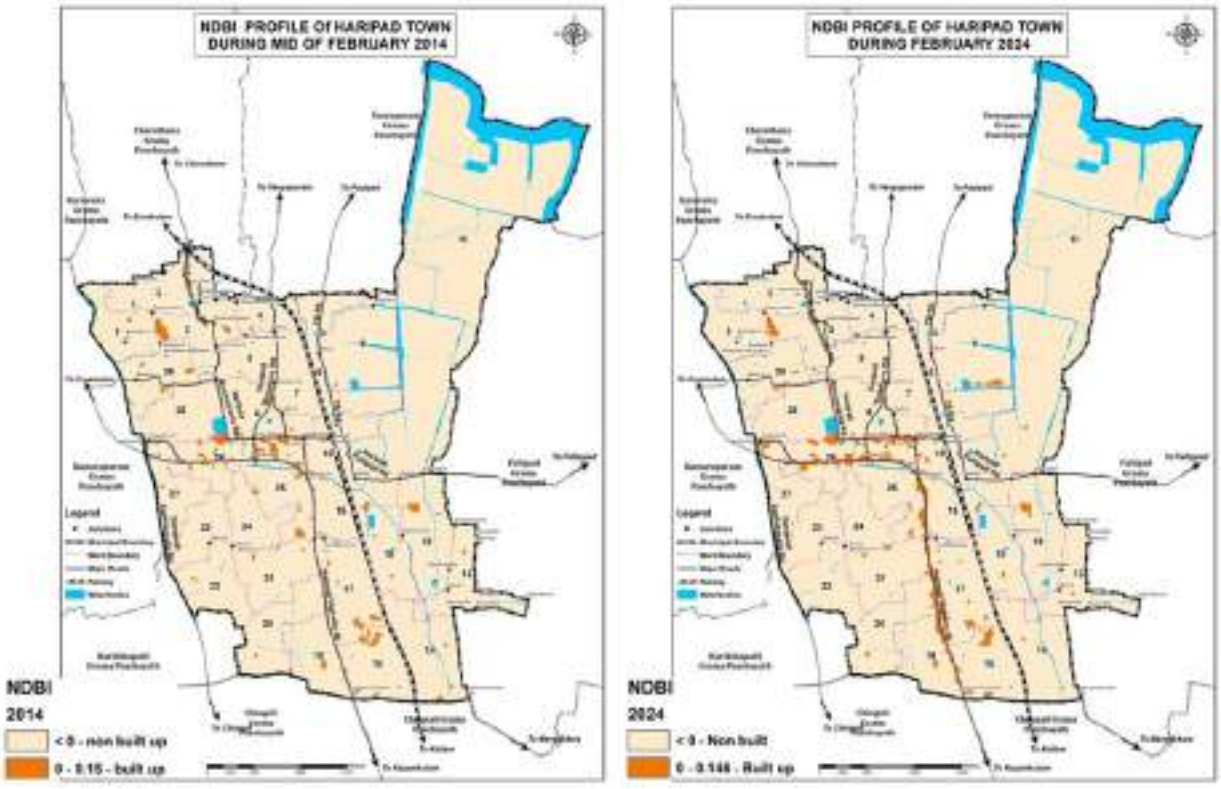

Figure 6.49 : Temporal change in the NDBI profile of Haripad town using LISS IV data for 2014 and 2024

Higher NDBI values are characteristic of impervious surfaces such as buildings, roads, and paved areas, which possess high heat absorption and storage capacities. The observed increase, therefore, signifies a growing dominance of built-up land cover within the town. This expansion of impervious surfaces directly contributes to elevated Land Surface Temperatures by reducing surface permeability, limiting evaporative cooling, and enhancing heat retention.

Spatially, areas exhibiting high NDBI values are likely to coincide with zones of elevated LST (Figure 6.48), confirming a strong positive relationship between built-up density and surface heating. The NDBI results, when interpreted alongside the declining NDVI trends, clearly demonstrate that urban growth at the expense of vegetated land is a primary driver of the intensifying Urban Heat Island effect in Haripad Town

6.7.7 Land Use and Land Cover (LULC) Changes (2019–2025)

Table 6.19 : LULC Changes in Haripad Town between 2019 and 2025

Land use	2019 (sq km)	2025 (sq km)	Difference (sq km)
Paddy +marshy	**4.19**	**2.99**	**-1.20**
Fallow paddy	**1.42**	**1.26**	**-0.16**
waterbody	**1.50**	**1.00**	**-0.50**
Mixed trees	**6.24**	**7.95**	**1.71**
Built - up	**2.30**	**3.46**	**1.17**

The land use and land cover analysis (Table 6.19 and Figure 6.50) for Haripad Town between 2019 and 2025 reveals significant landscape transformation driven by urban expansion and changing land management practices. The most notable change is the substantial increase in built-up area, which expanded from 2.30 sq. km to 3.46 sq. km, registering a net increase of 1.17 sq. km. This rapid growth reflects intensified urbanisation and infrastructure development within the town. Concurrently, in Figure 6.51, there has been a marked decline in agriculturally and ecologically important land covers. Paddy and marshy lands decreased by approximately 1.20 sq. km, indicating conversion to urban or other non-agricultural uses. Water bodies also declined by nearly 0.50 sq. km, which is particularly concerning as these features play a critical role in local climate regulation and surface cooling. Fallow paddy land showed a moderate reduction, suggesting continued pressure on traditional agricultural landscapes.

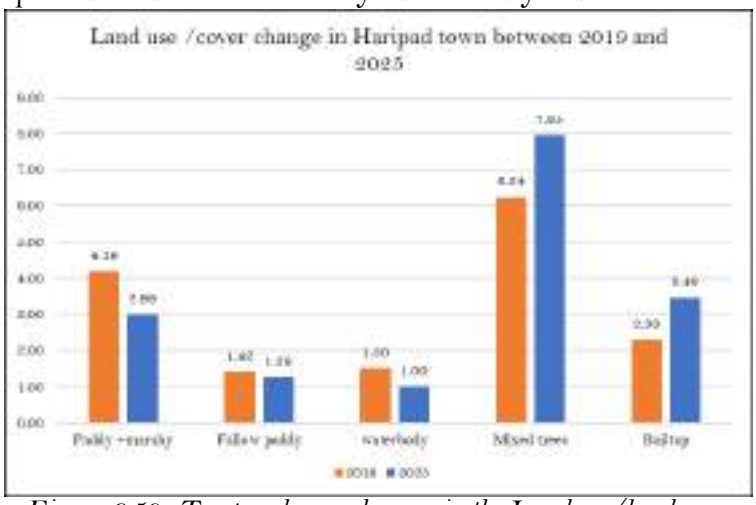

Figure 6.50 : Temporal area changes in the Land use/landcover profile of Haripad town between 2014 & 2024

In contrast, mixed tree cover increased by about 1.71 sq km, which may reflect plantation expansion, homestead vegetation growth, or afforestation initiatives. However, this increase is spatially fragmented and does not fully compensate for the loss of wetlands, paddy fields, and water bodies in terms of thermal regulation. The LULC changes indicate a shift towards a more impervious and heat-prone urban landscape. The expansion of built-up areas, coupled with the reduction of water bodies and agricultural land, has likely contributed to increased land surface temperatures and the intensification of the Urban Heat Island effect in Haripad Town. These findings emphasise the need for integrated land use planning that prioritises the protection of blue–green infrastructure to enhance urban climate resilience

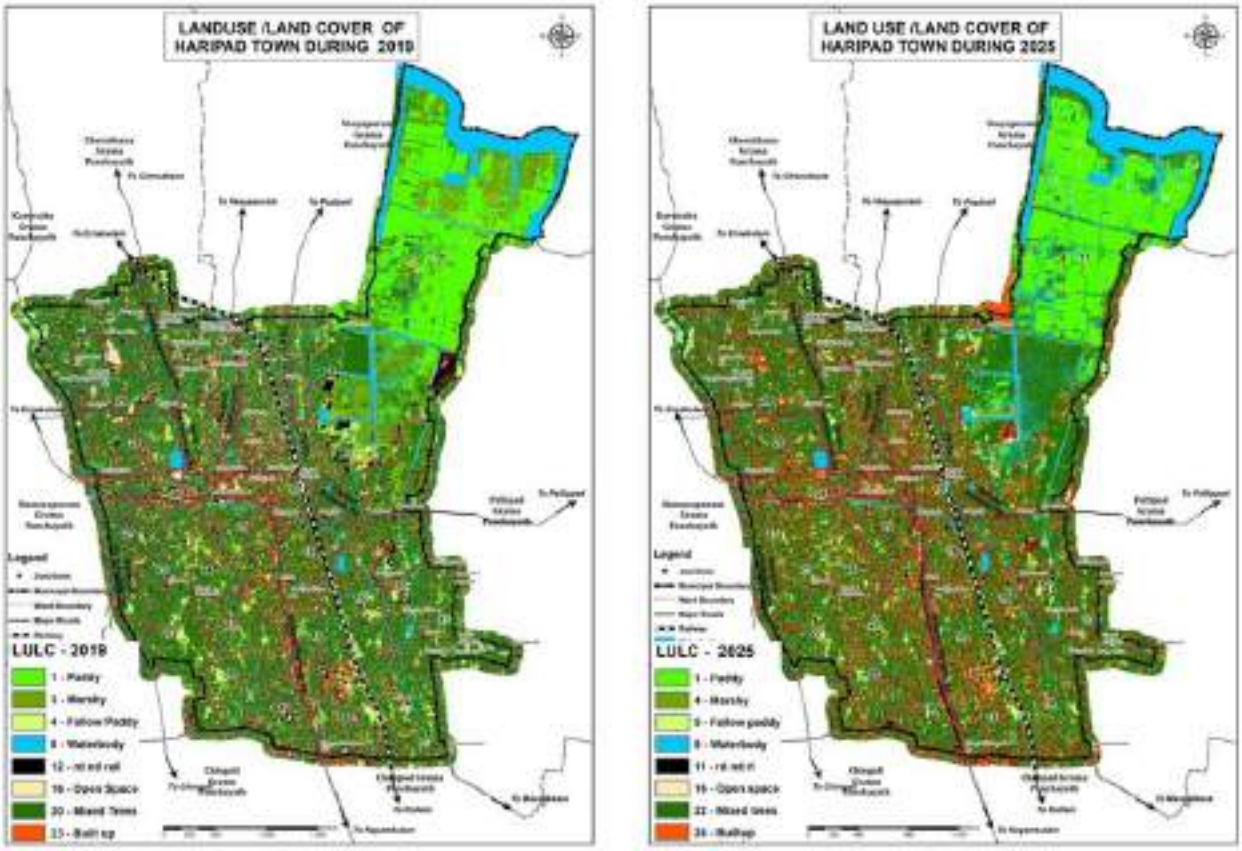

Figure 6.51 : Temporal changes in the Land use/landcover profile of Haripad town using Google Earth image classification for 2014 & 2024

6.7.8 Urban Heat Island (UHI) Effect

In Haripad town, mapping the UHI effect and identifying urban heat hotspots (UHS) provide spatial insights into thermal stress, enabling targeted interventions. These findings support data-driven strategies such as urban greening, green infrastructure, and sustainable land use planning to mitigate rising temperatures and strengthen climate resilience.

To analyse UHI effects in Haripad in 2024, UHI zones based on the LST data were computed.

$$\text{UHI zones} = \text{LST} > \text{LST}_{\text{Mean}} + 0.5 \times \text{LST}_{\text{SD}}$$

$$\text{Non UHI zones} = 0 < \text{LST} \leq \text{LST}_{\text{Mean}} + 0.5 \times \text{LST}_{\text{SD}}$$

Where UHI = Urban Heat Island; LST = Land Surface Temperature; LST mean = Mean of LST; LST SD = Standard Deviation of LST.

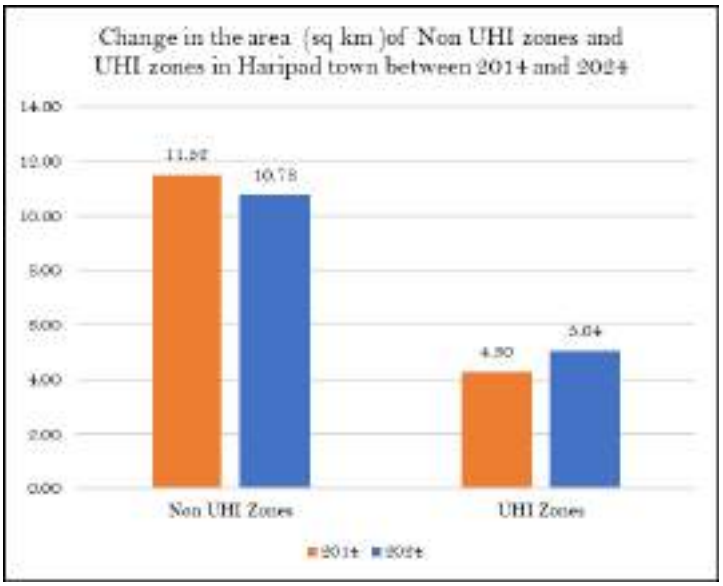

Figure 6.53 : Temporal changes in the area of various UHI-related zones in Haripad town between 2014 and 2024

The comparison shown in Figure 6.52 of Non-UHI and UHI zone areas in Haripad Town between 2014 and 2024 indicates a noticeable shift in the thermal landscape. The extent of Non-UHI zones decreased from 11.52 sq km in 2014 to 10.78 sq km in 2024, reflecting a reduction of relatively cooler areas. In contrast, UHI zones expanded from 4.30 sq km to 5.04 sq km during the same period. This increase in UHI extent highlights the intensification of urban heat island effects, likely driven by increased built-up areas, loss of vegetation, and land-use transformations over the decade.

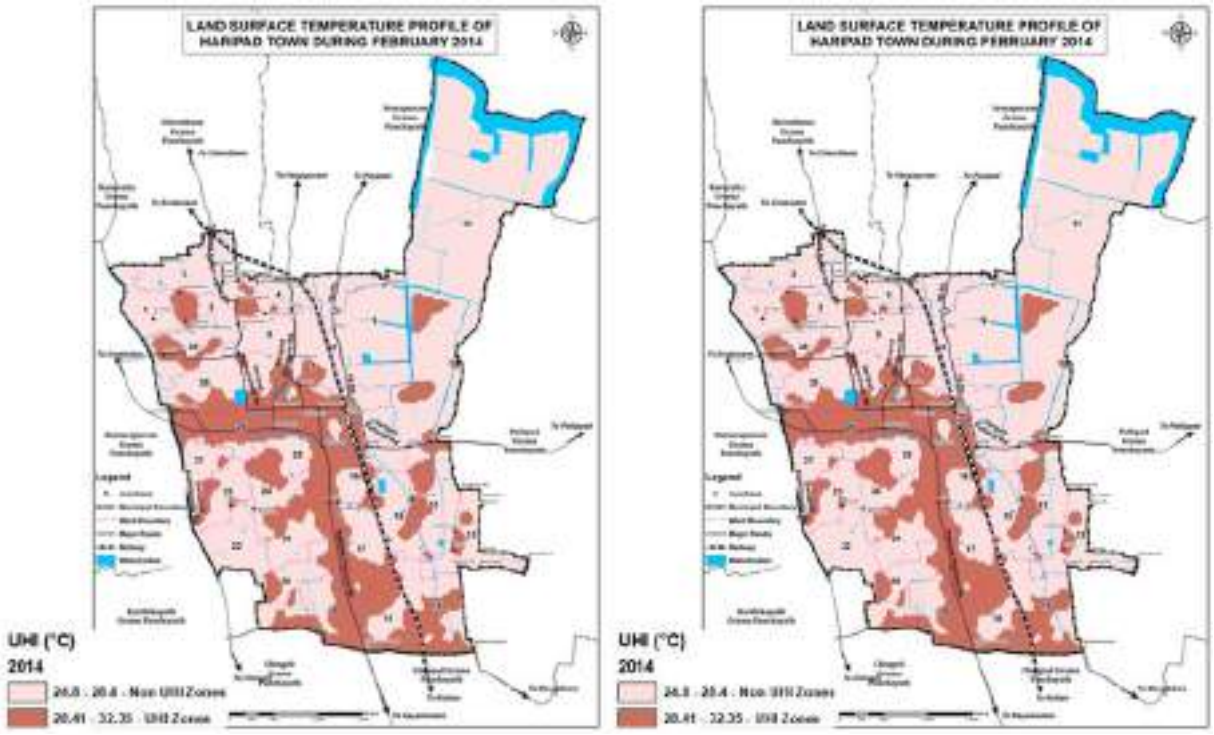

Figure 6.52 : The area changes UHI zones in Haripad town between 2014 and 2024

The UHI classification maps in Figure 6.53 for 2014 and 2024 clearly illustrate the spatial expansion and intensification of urban heat conditions in Haripad Town over the decade. Also the change in areas

In 2014, Non-UHI zones were characterised by surface temperatures ranging from 24.8 °C to 28.4 °C, largely corresponding to areas with vegetation cover, paddy fields, wetlands, and water bodies. UHI zones, with temperatures between 28.41 °C and 32.35 °C, were primarily

confined to built-up areas, commercial centres, and major transport corridors, indicating localised heat accumulation associated with impervious surfaces.

By 2024, a noticeable upward shift in both temperature ranges and the spatial extent of UHI zones is observed. Non-UHI zones recorded higher temperatures, ranging from 25.3 °C to 30.2 °C, indicating an overall warming of the landscape, including areas that previously exhibited relatively cooler conditions. UHI zones intensified further, with temperatures increasing to a range of 30.21 °C to 33.18 °C, reflecting enhanced heat absorption and retention within dense urban fabric.

The comparison reveals three key trends:

1. **Expansion of UHI zones**, suggesting that areas previously classified as Non-UHI have transitioned into thermally stressed zones due to urban growth.
2. **Increase in UHI intensity**, evidenced by the higher upper temperature limits in 2024.
3. **Reduction in effective cooling zones**, likely resulting from the loss of vegetation, wetlands, and water bodies.

Overall, the observed shift in UHI patterns between 2014 and 2024 confirms a strengthening Urban Heat Island effect in Haripad Town. This intensification is closely linked to increasing built-up density and land use changes and underscores the urgent need for targeted heat mitigation measures, such as the protection of blue–green infrastructure and climate-sensitive urban design interventions.

6.7.9 Urban Heat Hotspots (UHS)

To identify areas experiencing heat stress, Urban Hot Spots (UHS) have been identified using the equation

$$UHS = LST > LST_{Mean} + 2 \times LST_{SD}$$

The most critical category, Urban Heat Hotspots, shown in Figure 6.53, is characterised by temperatures ranging from 32.7 °C to 33.18 °C. These hotspots are concentrated in densely built-up commercial cores, major transportation corridors, and areas with extensive impervious surfaces and minimal vegetation. The presence of UHS indicates intense heat accumulation, reduced night time cooling, and heightened exposure to thermal stress.

The emergence and spatial concentration of Urban Heat Hotspots in 2024 signify an advanced stage of UHI intensification in Haripad Town. These areas represent priority zones for heat mitigation interventions, as they pose elevated risks to public health, infrastructure

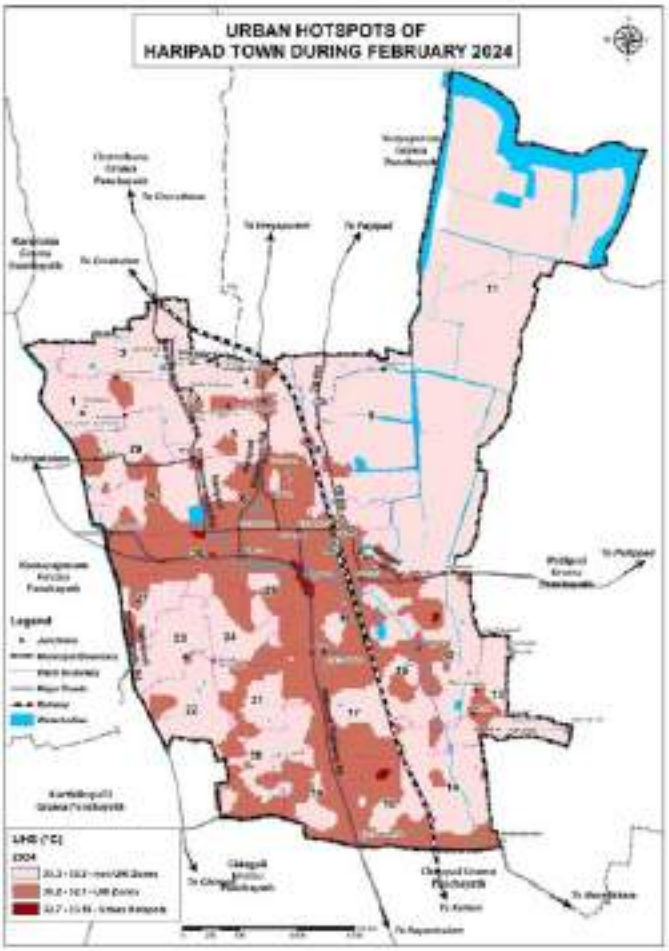

Figure 6.54 : Urban hotspots of Haripad town during 2024

performance, and overall urban livability. The results strongly reinforce the link between high built-up density, low vegetation cover, elevated LST, and extreme urban heat conditions, highlighting the urgent need for targeted blue–green infrastructure and climate-responsive urban design strategies. Areas experiencing extreme heat stress were classified as UHS. The types of UHS identified in Haripad town are shown in Figure 6.55.

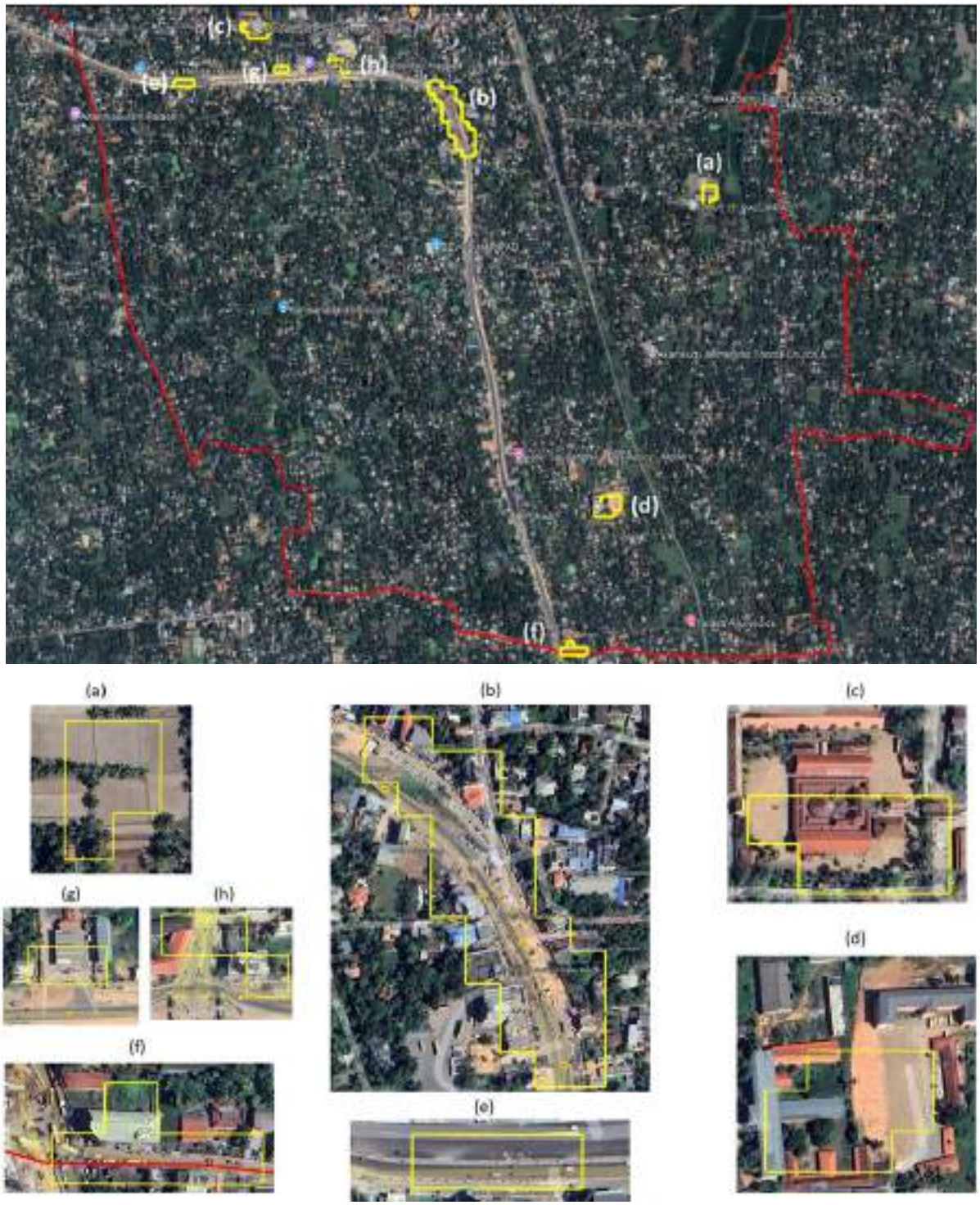

Figure 6.55 : Areal view and detailed view of Urban Hotspots in Haripad Town

(a) Open space; (b), (f), (g), and (h) - Dense built-up areas & Road stretch; (c) and (d) - Open areas & Built up spaces; and (e) - Road stretch

Urban hotspots shown in Figure 6.54 are areas within cities that experience significantly higher temperatures due to various land surface characteristics. The following factors contribute to the formation of UHIs and temperature hotspots in different ways:

1. **Dense Built-up Areas & Roads (Concrete, Asphalt, Infrastructure)**
   - Urban Heat Island Effect: Dense built-up areas are major contributors to urban hotspots due to their high thermal mass and low reflectivity.
   - Reduced Green Cover: Limited vegetation decreases the cooling effects of evapotranspiration.
   - Heat Retention: Materials like concrete and asphalt absorb heat throughout the day and release it slowly at night, prolonging elevated temperatures.
   - Anthropogenic Heat: Human activities, such as vehicular emissions, air conditioning, and industrial operations, further intensify heat build-up
2. **Open spaces (Barren Land, Non-Vegetated Spaces)**
   - Direct Solar Exposure: Open spaces without vegetation absorb and retain heat, increasing surface temperatures.
   - Low Shading Effect: The absence of trees or built structures allows for unfiltered solar radiation, enhancing heat accumulation.
   - Wind Influence: While open spaces may have better air circulation, in the absence of greenery, they still contribute to localised heating.
3. **Combination of Open Areas & Built-up Spaces**
   - Heat Amplification: Open areas with sparse vegetation combined with built-up surfaces create mixed heating patterns, intensifying localised temperature variations.
   - Fragmented Green Spaces: If green spaces are scattered or insufficient, cooling effects are minimal, and heat hotspots remain dominant.
   - Complex Microclimates: Depending on the ratio of open land to built-up areas, localised temperature variations can range from moderate to extreme, influencing urban thermal comfort.

The study demonstrates a clear intensification of the Urban Heat Island effect in Haripad Town over the past decade. Rising land-surface and air temperatures, declining vegetation indices, increasing built-up density, and significant land-use transformation collectively drive urban heat stress. Strong correlations between LST, NDVI, and NDBI confirm that land cover change is the dominant factor influencing the town's thermal environment. Integrating these findings into municipal planning and climate action frameworks is essential for ensuring sustainable and heat-resilient urban development

6.8 Existing Disaster Response System

Haripad town has established a disaster response system to mitigate the impacts of natural and human-induced hazards, focusing on preparedness, response, and recovery measures. The town operates under the framework of the District Disaster Management Plan (DDMP) and follows guidelines set by the Kerala State Disaster Management Authority (KSDMA) to coordinate emergency response efforts.

A Municipal Disaster Management Committee (MDMC) has been constituted to oversee disaster preparedness and response activities. The committee includes municipal officials,

emergency responders, healthcare representatives, and local community leaders. Early warning systems are in place for hazards such as floods and lightning, utilizing alerts from the India Meteorological Department (IMD) and KSDMA. Emergency shelters and relief camps are designated in schools and community halls to accommodate displaced residents, with food, water, and medical supplies stocked for rapid deployment.

Despite these efforts, challenges remain, including insufficient resources, gaps in inter-agency coordination, and the need for advanced early warning and response mechanisms. Strengthening the town's disaster response system requires capacity building, technological interventions, and community-based disaster risk management strategies to enhance resilience against future hazards.

6.9 Inference

Haripad town exhibits high multi-hazard vulnerability, with floods, droughts, heat stress, and lightning emerging as the most significant risks. Flooding remains the dominant hazard, driven by the town's proximity to the Achankovil River, extensive low-lying paddy fields, and a dense network of canals and water bodies, particularly affecting the north-eastern wards. Hazard mapping indicates that nearly half of the municipal area falls within flood-prone zones, with wards such as Pilappuzha South (11), PHC (9), and Kilikkakulangara (3) facing consistently high exposure. These risks are compounded by irregular rainfall patterns, groundwater stress, rapid land-use change, and pressure on transport and basic service networks.

Climate change has intensified these vulnerabilities over the past three decades. Rising temperatures, increased humidity, altered rainfall distribution, and stronger wind patterns have amplified flood frequency, prolonged dry spells, and heightened public health risks. Urban heat stress has emerged as a critical concern, with satellite and ground-based observations confirming a strengthening Urban Heat Island (UHI) effect due to increased built-up density, declining vegetation cover, and loss of wetlands and water bodies. The expansion of heat hotspots in dense built-up areas and transport corridors indicates growing thermal discomfort and energy stress, particularly for vulnerable populations.

While Haripad benefits from an institutional disaster management framework under the District Disaster Management Plan, gaps remain in preparedness, evacuation planning, infrastructure resilience, and inter-agency coordination. The hazard profile clearly demonstrates that the town's natural systems—water networks, wetlands, agricultural lands, and green cover—are central to its resilience, yet are under increasing stress from unplanned urbanisation and climate pressures. Addressing these challenges requires an integrated, risk-informed planning approach that combines flood mitigation, heat reduction, ecosystem restoration, climate-resilient infrastructure, and community-level preparedness to support safe, adaptive, and sustainable urban development



PART I: STUDY & ANALYSIS

SECTORS OF ECONOMY

1. INDUSTRY
2. TRADE AND COMMERCE
3. TOURISM
4. AGRICULTURE
5. ANIMAL HUSBANDRY
6. FISHERIES

CHAPTER
07

INDUSTRY



The industrial sector plays a vital role in Haripad's economic growth, contributing to employment generation, poverty reduction and overall improvement in living standards. Kerala's skilled workforce and strong consumption base create favourable conditions for industrial development, offering a ready market for diverse activities. Within the Master Plan, the industrial sector framework identifies suitable zones for future growth, promotes efficient resource use and ensures environmentally sustainable and disaster-resilient industrial expansion aligned with the town's broader development objectives.

- Introduction
- Existing Scenario
- MSME and Large-scale industries
- Industrial estates
- IT Parks
- Effect of hazard risk in this sector
- Problems and potentials
- Inference

7. INDUSTRY

7.1 Introduction

A strong industrial sector is essential for a city to have a stable economic foundation. With a strategic location along NH-66 and a well-connected transport network, Haripad offers a conducive environment for industrial growth. Additionally, since a large part of the Municipality is agricultural, the city also has the potential to develop the industrial sector in connection with this. However, there are challenges such as infrastructure limitations, environmental concerns, and hazard risks, which need to be addressed for sustainable industrial development.

7.2 Existing Scenario

As per the existing land use survey, only 0.03 sq.km, which is only 0.18% of the total area of the town is under industrial use now. There is no large scale and medium scale industries in Haripad Municipality. The city is dominated by small-scale industries. Most of them are small household units. Coir production units, small food processing units, brick industries, flour mills, furniture manufacturing centers, etc. are operating in the city. According to the Industries Department, there are 434 small industrial units and 20 household industrial units in the city. Out of which 251 are registered units. The majority of household industries are those that manufacture coir-based products and food processing units. It includes manufacturing industry units such as Furniture, Brick, Soap, etc. and service industry units including shops and commercial establishments. Figure 7.1 shows the spatial distribution of industrial land use within the town.

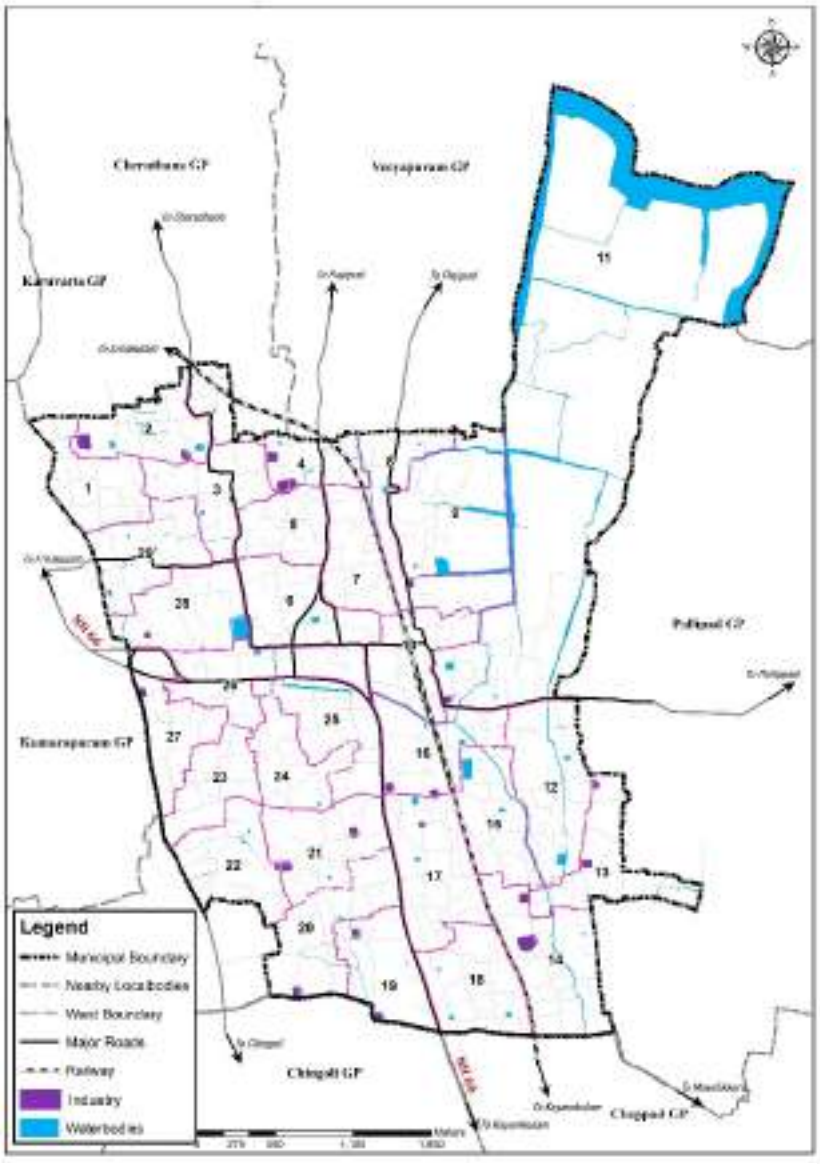

Figure 7.1: Spatial Distribution of Industrial Landuse in Haripad Town

Table 7.1 shows the industrial units in Haripad Municipality.

Table 7.1: Table showing major industries

No.	Name of Industry	Type of Industry	Ward	No. of Employees
1.	New Land	Agro-food	6	45
2.	K Four Extrusions India Private Limited	PVC Pipe	14	31
				Source: Secondary data, Industries Department 2024

Although there are no large industrial establishments in Haripad city, there are MSME (Micro, Small and Medium Enterprises) units registered under the government's Udyog Aadhaar scheme in the city. As per the data received from Industries Department, there are 95 MSME's out of which 12 are manufacturing industries which mostly include spices packaging, food processing etc., 24 are service industries such as phone repairing establishments, bicycle repiar shops, EV charging stations etc. and 59 are trade industries. The various major MSMEs registered include activities such as agro based, automobile related, garments related, stationary, wood products, handloom etc. Town doesn't have designated Industrial Estate or IT park

7.3 Effect of hazard risk in this sector

The most significant disaster experienced by Haripad Municipality in recent years was the 2018 flood. However, the industrial sector of the town was only marginally affected by this and other recent

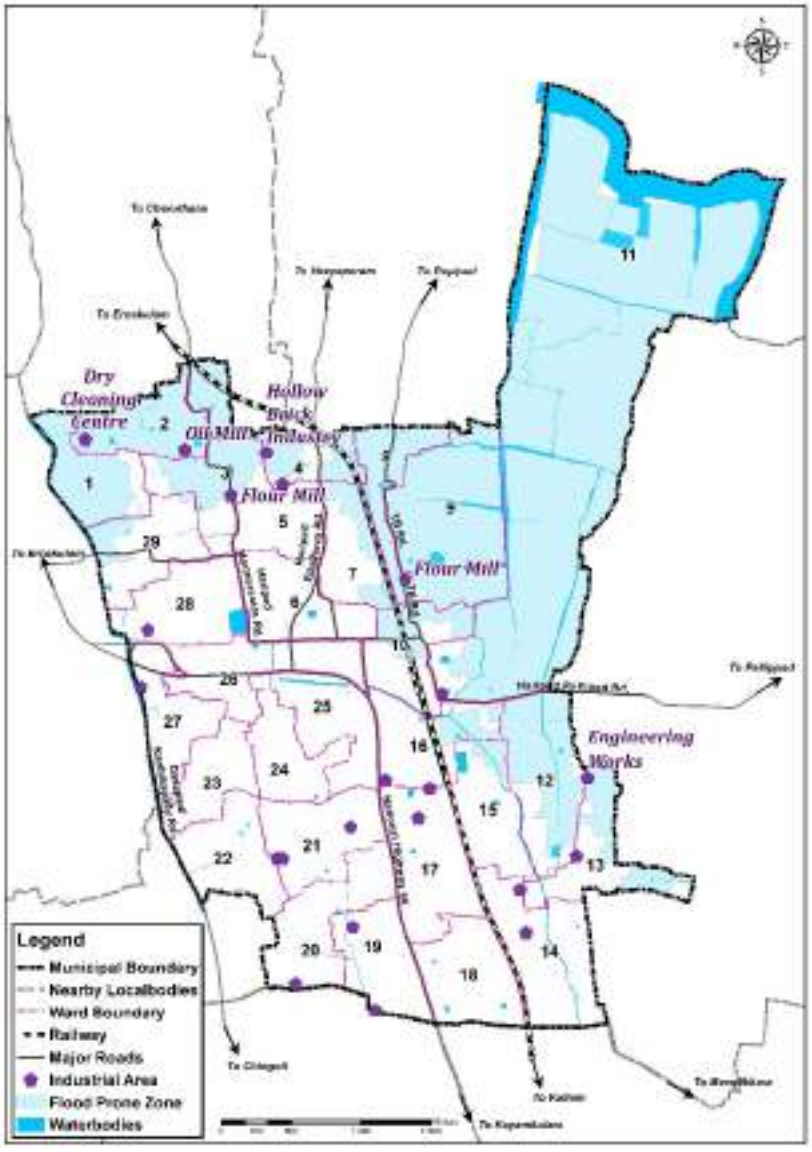

Figure 7.2: Industries in hazard prone areas

disaster events. The limited impact is primarily due to the absence of major industrial establishments within the municipal area and the spatial distribution of existing units outside high-risk zones.

Only a small number of industrial establishments fall within the identified flood-prone areas, and these are largely limited to small-scale and household-level units such as laundries, PVC extrusion units, and vehicle workshops. While minor operational disruptions and temporary production losses were reported during flood events, no substantial or long-term damage to the industrial sector was observed. Most industrial activities in Haripad are dispersed along major accessible corridors and are located in relatively safer, non-flood-prone areas. Figure 7.2 illustrates the spatial distribution of industrial establishments within the town and highlights the limited overlap between industrial land use and flood-prone zones. Overall, given the low concentration of industries and their predominantly safe locations, the impact of hazard risk on the industrial sector in Haripad is minimal and does not pose a critical concern within the broader risk profile of the Municipality.

7.4 Problems and potentials

The absence of major industrial clusters or large-scale establishments in Haripad presents a structural challenge to the town's economic development, particularly in terms of generating adequate local employment opportunities. This limitation has contributed to outward migration, as highlighted in Chapter 3 (Demography) of this Master Plan, with a significant section of the working population—especially youth and women—seeking better economic prospects outside the municipal limits. While the scope for IT parks and knowledge-based industries in Haripad is relatively limited, the town possesses strong inherent advantages that can be leveraged for sector-specific industrial development.

Haripad's extensive agricultural base, widespread paddy fields, and abundant water bodies offer substantial potential for agro-based and food-related industries. These include food processing, packaging, agro-based value addition, fish processing, inland aquaculture-linked activities, and allied enterprises. The presence of large tracts of agricultural land and numerous ponds and canals provides a natural foundation for such industries, enabling closer integration between the primary sector and secondary economic activities. This synergy can significantly improve local self-reliance, reduce dependence on external supply chains, and enhance value capture within the town.

However, the availability of large, contiguous industrial land parcels is limited, posing a constraint to conventional industrial development. This challenge can be addressed through the promotion of small-scale, medium-scale, and household-level industries, particularly MSMEs, which are better suited to Haripad's spatial and socio-economic context. Targeted policy support, financial incentives, institutional facilitation, and infrastructure provisioning will be critical to nurturing such enterprises. Importantly, Haripad does not face a shortage of skilled or semi-skilled labour, rather, the lack of local industrial establishments compels the workforce to seek employment elsewhere.

Local industries currently face additional challenges, including limited access to raw materials, higher input costs due to dependence on external suppliers, competition from larger industrial hubs, outdated technologies, and constrained market reach. These constraints can be mitigated through improved local sourcing, modernization of production processes, enhanced market

linkages, and collective branding and marketing strategies—especially for agro-based and eco-friendly products. Strengthening self-reliance by effectively utilizing Haripad's agricultural and fisheries potential will be central to improving industrial competitiveness.

At the same time, Haripad's vulnerability to flooding and climate-related hazards necessitates a risk-informed approach to industrial development. Future industrial activities must be carefully located and designed with due consideration to flood-prone areas and climate resilience, ensuring long-term stability and reduced economic disruption.

Despite these challenges, the town holds significant growth potential. Expansion of coir-based industries, supported by government schemes and technological innovation, can generate employment and reinforce traditional livelihoods. Similarly, the growth of MSMEs in food processing, agro-products, fisheries, and environmentally sustainable products offers promising avenues for inclusive economic development. Haripad's rail, road, and water connectivity further strengthens its potential as a node for agro-linked industrial activities.

Overall, by strategically aligning its industrial development with agriculture, animal husbandry, fisheries, and value-added processing—while adopting hazard-sensitive planning—Haripad can build a resilient, locally rooted, and employment-generating industrial ecosystem that supports long-term economic growth and social inclusion.

7.5 Inference

Haripad's industrial sector is limited in scale and lacks major industrial clusters, resulting in constrained local employment opportunities and outward migration of the workforce, particularly youth and women. However, the town possesses strong latent potential rooted in its extensive agricultural base, water resources, and skilled labour force, which can be effectively leveraged for agro-based, food processing, fisheries-related, and value-addition industries. Constraints such as limited industrial land, market access, and vulnerability to climate hazards necessitate a shift towards small-scale, MSME, and household industries supported by policy incentives, infrastructure, and risk-informed planning. Strategic integration of agriculture, fisheries, and allied industries can enable Haripad to develop a resilient, locally anchored, and employment-generating industrial economy.

CHAPTER
08

TRADE AND COMMERCE



Trade and commerce form the backbone of Haripad's urban economy, driving employment, revenue generation and overall economic vitality. The town's location along NH 66 and its connectivity through road, rail and waterways have fostered the growth of vibrant commercial hubs and local markets. This chapter examines Haripad's existing trade centres, commercial clusters and informal sectors, analysing their spatial distribution, economic linkages and development potential. The insights derived support strategies for strengthening Haripad's commercial infrastructure, promoting balanced growth and enhancing the town's role as a regional centre for trade and services.

- Introduction
- Present scenario
- Important centres, commercial nodes, hierarchy of nodes
- Street vendors/Informal sector
- Whole sale, Retail Trade, Markets
- Financial institutions
- Effect of hazard risk in this sector
- Problems and potentials
- Inference

8. TRADE AND COMMERCE

8.1 Introduction

Trade and commerce form the backbone of economic activity in Haripad Municipality, driving local employment and contributing to urban growth. The sector is primarily concentrated in the town centre and along major road corridors, where commercial establishments range from retail shops and markets to street vendors and service providers. The commercial landscape is shaped by factors such as accessibility, population density, and connectivity, with key nodes emerging around busy areas like Danappadi Market, Ezhikkakathu Junction, Townhall Junction and the KSRTC Bus Stand. However, challenges such as congestion, inadequate infrastructure, and vulnerability to hazards like flooding and waterlogging affect business operations and economic stability. This chapter provides an analysis of the Trade and Commerce sector in Haripad Municipality, highlighting its spatial distribution, existing challenges, and potentials for developing strategies for sustainable economic growth of the town.

8.2 Present scenario

Commercial facilities in Haripad Municipality are predominantly concentrated in the town centre and along major roads as ribbon development. However, only a limited area has been allocated for commercial land use, which constitutes just 1.86% of the total municipal area. Figure 8.3 illustrates the ward-wise concentration index of commercial areas in Haripad town. It shows that Ward 26 exhibits the highest level of commercial activity compared to other wards in the Municipality. Figure 8.2 shows the spatial distribution of commercial land use in Haripad. The primary commercial centre, Danappady Market, along with the stretch from the Town Hall to Ezhikkakathu Junction and further extending to the KSRTC Bus Stand, forms the key commercial zone of the Municipality. These high-footfall areas face challenges due to inadequate space, leading to traffic congestions and inefficient pedestrian movement.



Figure 8.1 : Commercial Areas in Haripad Town

According to the commercial survey conducted in Haripad Municipality, several challenges were identified in the functioning of commercial establishments. A significant 78.4% of establishments reported the absence of dedicated parking spaces, while only 22% had any form of parking provision, leading to congestion and inconvenience for customers. Traffic congestion emerged as a major concern, with 62.8% of respondents identifying it as a critical issue in busy commercial areas, and 57.4% reporting frequent congestion. Inadequate infrastructure was highlighted by 24.6% of respondents, citing damaged roads, insufficient signage, and lack of regular maintenance around commercial zones. Although municipal waste collection services are available, many establishments lack proper systems for the disposal of biodegradable and liquid waste. The survey also revealed that accessibility for persons with

disabilities is severely limited, as most shops lack basic features such as ramps and handrails. Additionally, sanitation facilities, including toilets and proper drainage systems, are not uniformly available across commercial establishments, affecting both hygiene standards and customer comfort.

8.3 Important commercial centres & hierarchy of nodes

In Haripad Municipality, commercial nodes are predominantly situated along major road corridors (such as NH 66, Town hall junction to Ezhikkakathu junction), exhibiting a linear pattern of development. These nodes are characterized by a high concentration of commercial establishments, particularly at key road intersections where commercial activities are prominent. The city's commercial area is concentrated on the sides of NH 66, and Town Hall Junction - Ezhikkakathu Junction - Taluk Hospital roads, in the central part of the city. The primary commercial hubs include Danappadi Market, the stretch from Town Hall Junction to Ezhikkakathu Junction, and the area extending to the KSRTC Bus Stand. The major commercial hubs on NH 66 are Madhava Junction, Taluk Hospital Junction (KSRTC stand area), RK Junction, and Nangyarkulangara Junction. Apart from these, there are commercial establishments on both sides of NH 66 from Danapady to Nangyarkulangara. In instances of linear commercial development, commercial establishments extend up to approximately 800 meters along major roads, contributing to the economic vitality of the Municipality. According to the District Urbanization Report (DUR) for Alappuzha 2011, Haripad falls under the third order of commercial nodes. Important commercial nodes and their hierarchy in Haripad Town are shown in Table 8.1. The commercial nodes of Haripad Town function at different hierarchical levels. The 1st Order nodes

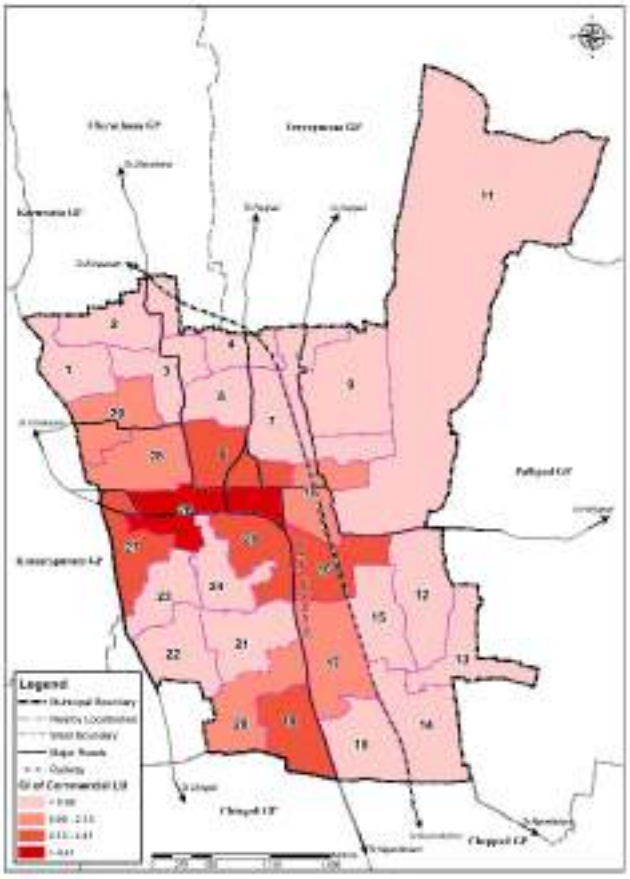

Figure 8.3 : Ward-wise Concentration Index of Commercial Area

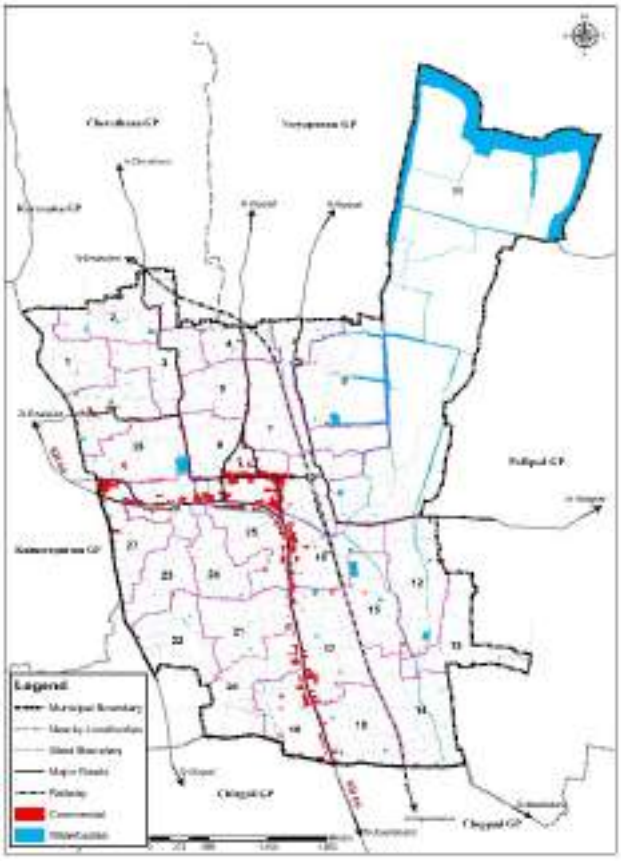

Figure 8.2 : Spatial distribution of commercial land use

Haripad Junction and Madhava Junction serve as major centres with key retail, food outlets, and transport-related activities. The 2nd Order nodes, including Town Hall Junction, Ezhikkakathu Junction, and RK Junction, support medium-scale commercial and institutional functions, with the stretch between Town Hall and Ezhikkakathu Junction accommodating government offices, court and police station. The 3rd Order nodes Danapady Junction, Nangyarkulangara Junction, and TPN Junction cater to neighbourhood-level needs through small retail and daily convenience services.

Table 8.1 Hierarchy of nodes

Sl.No	Name of nodes	Hierarchy
1	Haripad Junction	1st Order
2	Madhava Junction	1st Order
3	Town hall junction	2nd Order
4	Ezhikkakathu Junction	2nd Order
5	Danapady Junction	2nd Order
6	RK Junctiom	3rd Order
7	Nangiarakulangara Junction	3rd Order
8	TPN junction	3rd Order

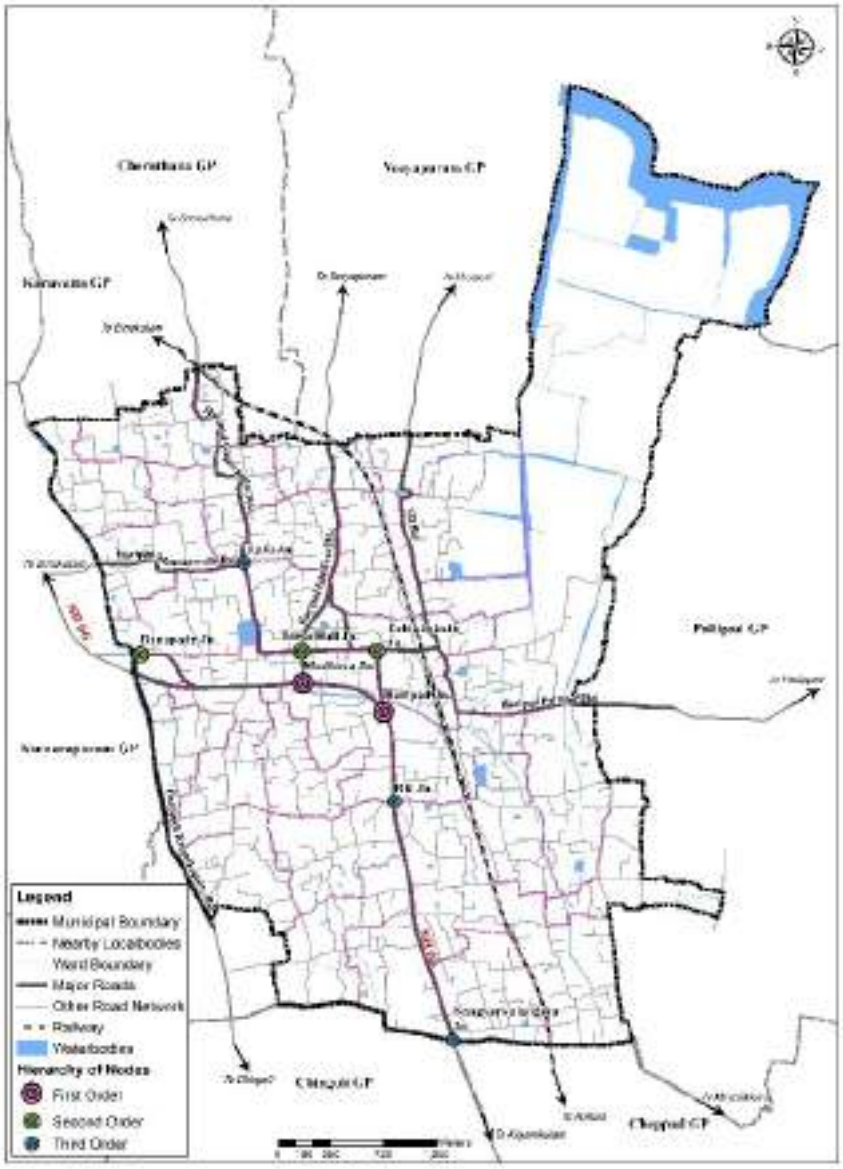

Figure 8.4: Existing hierarchy of nodes

8.4 Street vendors/Informal sector

Street vendors form an essential part of the urban retail trade in the town, offering a range of goods and services that cater to the daily needs of the local population. The National Policy on Urban Street Vendors, 2009, acknowledges street vending as a legitimate source of self-employment that ensures affordability and accessibility for urban residents. In Haripad Municipality, a considerable number of street vendors operate across various locations, primarily selling vegetables, fruits, fish, tea, snacks, and other daily necessities.



Figure 8.6 : Street Vending along Temple Road, Haripad



Figure 8.7 : Street vending near Town Hall Junction

As per the survey conducted by the Municipality (NULM) in year 2021, there are 191 street vendors in the town, of whom only 43 have been issued ID cards, while the remaining operate without official identification. According to the survey the highest concentration of street vendors (refer Figure 8.5) is observed in:

- Temple Road
- Town Hall Junction
- Ezhikkakathu Junction
- Haripad KSRTC Bus Stand area
- Taluk Hospital Area

As per the Commercial Survey conducted in 2025, 82.4% of street vendors reside within the Municipality. Most of them sell vegetables, fruits, food, toys and clothes. According to the Pilgrim Survey conducted in 2025, the vending zone in front of Haripad Subrahmanya Swamy temple was

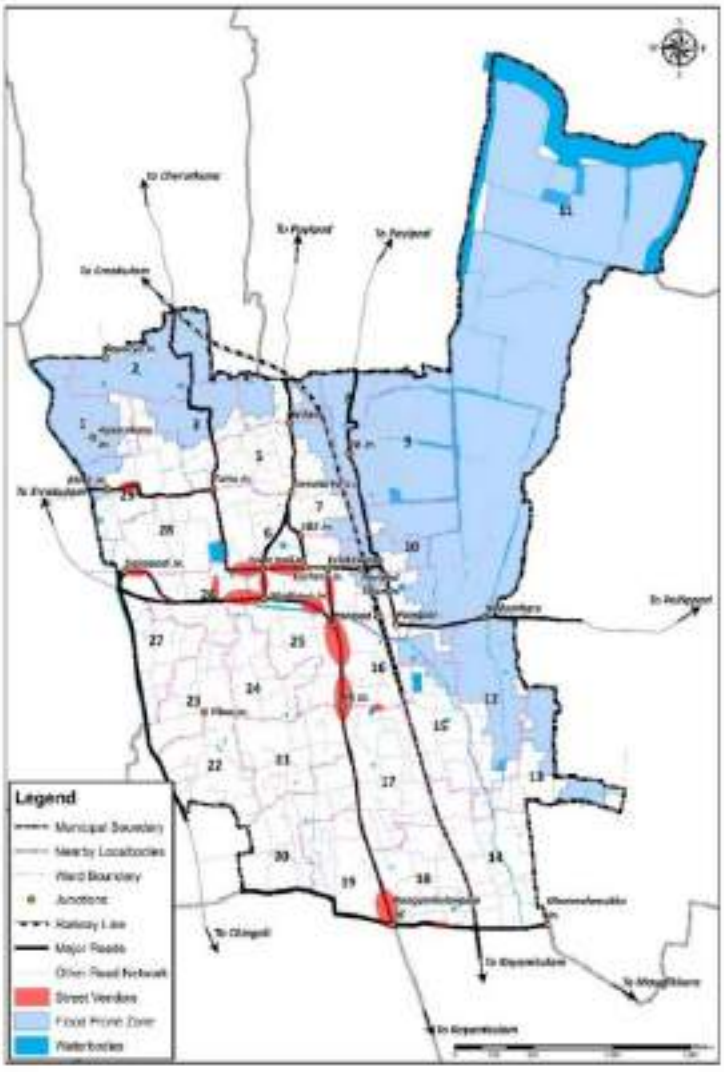

Figure 8.5: Map showing location of Street Vending Activity

found to be a major cause of concern for pilgrims due to overcrowding, lack of parking spaces etc. The presence of seasonal street vendors in this stretch also causes difficulties to school children of the Government Boys and Girls High schools in this area. Currently the lack of any town level designated vending zones is a major cause of concern.

8.5 Wholesale, Retail Trade, Markets

The retail and wholesale trade in Haripad Municipality is primarily concentrated in the Danapady Market area and along the stretch from Town Hall to Ezhikkakathu Junction, where commercial activities are most prominent. A significant number of establishments in these areas operate as both retail and wholesale outlets, catering to a wide range of consumer needs. Wholesale trade is particularly prominent in the vegetable and grocery sectors. According to the commercial survey, 16.9% of shops operate as both wholesale suppliers and direct retail sellers, while only 1.1% function solely as wholesale outlets. This dual nature of operations enhances market accessibility for both bulk buyers and individual consumers, contributing to the commercial vibrancy of the town.

Danapady Market functions as the principal commercial and trading hub of Haripad; however, its current form reflects an unplanned and fragmented pattern of development. Market activities such as fish vending, vegetable and fruit sales, grocery trade, and allied services are scattered across the premises, resulting in operational inefficiencies and poor spatial organisation. The absence of a clearly defined market layout has led to significant challenges, including inadequate waste management, congestion, and severe parking constraints for customers, shopkeepers, and goods vehicles.

Public amenities within the market area are grossly insufficient. Sanitation facilities are in a highly dilapidated condition, negatively affecting public health, hygiene, and the overall market experience. The scattered nature of stalls and activities further exacerbates inefficiency during the monsoon season, when access, circulation, and waste disposal become particularly problematic. Despite these shortcomings, Danapady Market holds considerable potential to evolve into a well-structured commercial activity hub that can support the town's growing economic needs.

The market area offers adequate land resources; however, portions of this land are currently underutilised or used for non-compatible activities such as driving tests and driving classes. A comprehensive redevelopment and reorganisation of the Danapady Market precinct is therefore essential. This should include a space-optimised architectural and urban design approach that integrates organised vending zones, improved circulation, adequate parking, clear signage, and dedicated loading and unloading areas. Provision of modern public conveniences, scientific waste management systems, common storage facilities, cold storage units for fish and meat, and hygienic slaughterhouse facilities are critical components of this upgrade.

An integrated redevelopment of Danapady Market will not only improve operational efficiency and public convenience but also enhance hygiene, safety, and resilience to seasonal disruptions. Such an intervention can significantly strengthen Haripad's commercial structure, support local livelihoods, and position the market as a vibrant and well-managed economic node within the municipality



Figure 8.8: Wholesale and Retail shops near Danapady Market

8.6 Financial Institutions

As per Commercial Survey 2025, the city has nationalized banks like SBI, Canara Bank, Union Bank of India, Punjab National Bank and Bank of Baroda, private sector banks like HDFC Bank, ICICI Bank, Federal Bank, South Indian Bank and IndusInd Bank, public sector banks like Kerala Bank and Kerala Gramin Bank, other private financial institutions like Muthoot finance, Ujjivan Small Finance Bank and Muthoot Fincorp. There is no specific institution that provides financial assistance or schemes exclusively for commercial activities. For commercial purposes, individuals can avail loans from various financial institutions. Although specific financial support is not available, loans can be accessed through regular banking channels.

8.7 Effect of Hazard Risk

Although most of the town's prominent commercial areas do not fall directly within designated flood-prone zones, the trade and commerce sector in Haripad Municipality is partially affected by hazard events due to its strong functional dependence on surrounding areas for labour, goods, and supply chains. Disruptions in adjacent flood-affected regions therefore have indirect but significant impacts on commercial activity within the town. The 2018 floods, in particular, led to economic losses by reducing customer footfall, damaging goods and infrastructure, and interrupting supply and distribution networks.



Figure 8.9: Traffic congestion at commercial area along Town Hall Jucntion- Exhikakath Junction Road

The primary commercial corridor extending from Town Hall Junction to the KSRTC Bus Stand via Ezhikkakathu Junction and the Danapady Market area is especially vulnerable owing to its high commercial density, limited right-of-way, and recurring congestion. Occasional waterlogging in these areas—largely resulting from poorly maintained stormwater drains—restricts pedestrian and vehicular movement, thereby reducing operational efficiency and business continuity. Inadequate drainage infrastructure and maintenance further exacerbate these challenges.

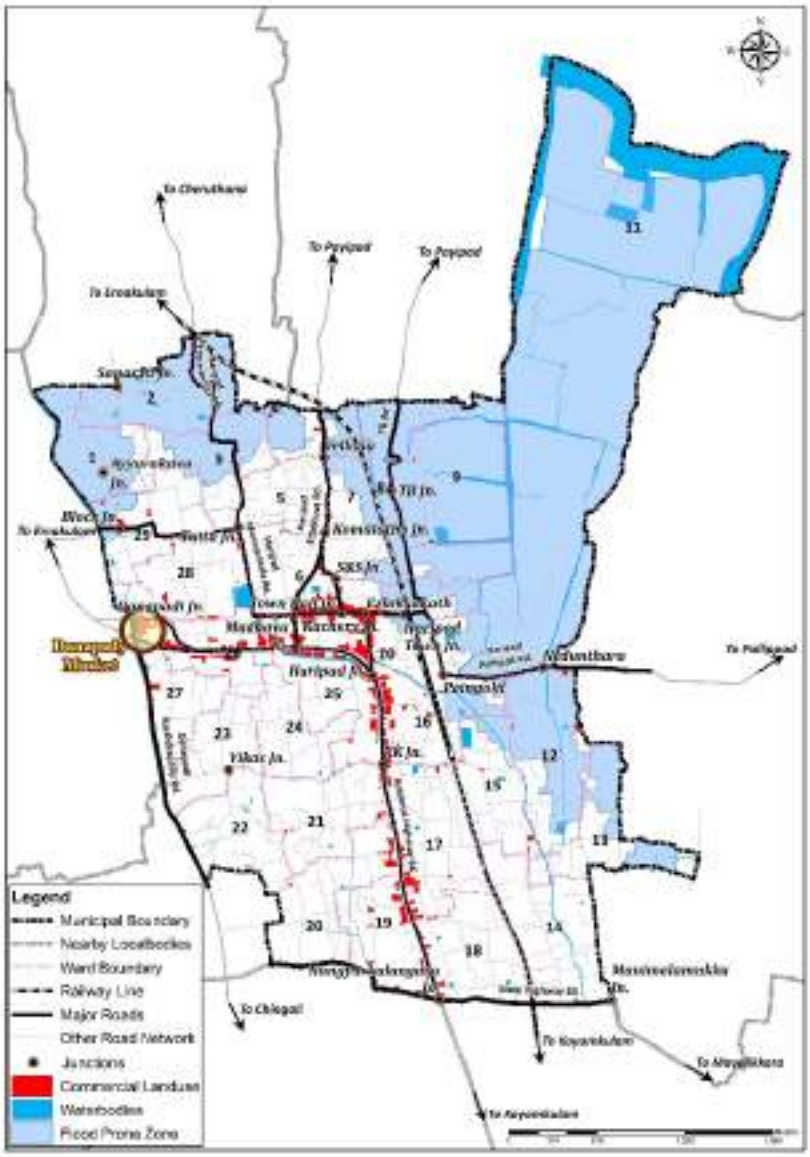

Figure 8.10: Map showing distribution of commercial land use, major junctions and markets in Haripad overlaid with Flood Prone Area

Addressing these issues through improved drainage systems, regular maintenance, and targeted infrastructure upgrades would enable commercial areas to function more efficiently under normal and adverse conditions. To ensure long-term stability and growth of the sector, the adoption of risk-informed planning and climate-resilient infrastructure is essential, with particular emphasis on drainage improvement and hazard mitigation measures. Figure 8.10 illustrates the spatial distribution of commercial land use, major markets, and junctions in relation to flood-prone areas within the town.

8.8 Problems and Potentials

The trade and commerce sector are a key driver of Haripad Municipality's local economy; however, its growth is constrained by spatial, infrastructural, and management challenges. Commercial activity is largely concentrated in the Danapady Market area, along NH 66, and along the Town Hall Junction–Ezhikkakathu Junction–Taluk Hospital Road corridor, forming ribbon development in the central parts of the town. Commercial land use accounts for only 1.83% of the municipal area, with limited development in inland and peripheral wards, resulting in spatial imbalance and pressure on core areas. Major issues include severe traffic

congestion, inadequate parking facilities, poor pedestrian infrastructure, lack of universal accessibility, insufficient sanitation amenities, and inadequate waste management systems.

The principal commercial corridor—Town Hall Junction–Ezhikkat Junction–Taluk Hospital Road—experiences acute congestion due to an unscientific one-way system, on-street parking, and weak traffic management. Raised footpaths have restricted access to parking within commercial plots, forcing vehicles to occupy the carriageway. The presence of major public institutions such as the Court Complex and Mini Civil Station further intensifies congestion due to roadside parking by visitors. Inadequate drainage infrastructure leads to frequent waterlogging even during light rainfall, severely disrupting commercial activities. The deteriorated condition of Danapady Market remains a critical concern, despite multiple unimplemented redevelopment proposals.

The informal sector, particularly street vending, plays an important economic role but functions without regulation. The absence of designated vending zones has resulted in encroachment on footpaths and roadways, aggravating congestion. Wholesale and retail activities are concentrated in limited pockets, with many establishments performing dual functions, which enhances economic activity but further intensifies spatial and traffic pressures.

Despite these challenges, the commercial sector holds significant potential for improvement through strategic spatial planning and infrastructure upgrades. Key interventions include rationalization of the one-way traffic system, development of parallel roads, decentralization of commercial activities, rehabilitation of street vendors into designated vending zones, provision of centralized parking facilities, and elimination of on-street parking along major corridors. Redevelopment of Danapady Market and the Subramanya Temple premises, establishment of a modern fish and meat market, and implementation of a comprehensive waste management system for commercial establishments are essential to support sustainable and efficient commercial growth in Haripad.

8.9 Inference

The trade and commerce sector are a vital component of Haripad Municipality's local economy, with major activities concentrated around Danappadi Market, Ezhikkakathu Junction, Town Hall Junction, and the KSRTC Bus Stand. However, the sector faces several challenges, including limited commercial land availability (1.83% of the municipal area), traffic congestion, inadequate parking, poor waste management, insufficient pedestrian and sanitation facilities, and limited accessibility for persons with disabilities. Informal trade, particularly street vending, plays a significant role but operates largely without regulation or designated spaces. Frequent flooding and waterlogging further disrupt commercial activities. Despite these constraints, the sector holds strong potential for sustainable growth through improved planning, infrastructure upgrades, and formal support for informal trade

CHAPTER
09

TOURISM



Tourism is a key driver of Haripad's economy, reflecting the town's unique blend of cultural heritage, religious significance and natural beauty. Known for iconic landmarks and festivals such as the Sree Subrahmanya Swamy Temple, Mannarasala Temple, Mannarashala Ayilyam and the Payippad Jalotsavam, Haripad also offers vast tourism potential through its scenic paddy fields, natural drains and the Achankovil River. These natural assets, along with its cultural vibrancy, contribute to the town's distinct identity and visitor appeal. This chapter focuses on enhancing tourism infrastructure, conserving heritage and leveraging Haripad's cultural and ecological landscapes to promote sustainable and inclusive tourism development.

- Introduction
- Places of Tourist interest
- Present scenario – existing tourist circuits, number of tourists
- Tourism infrastructure
- Effect of hazard risk in this sector
- Problems and potentials
- Inference

9. TOURISM

9.1 Introduction

Tourism has become a rapidly growing global economic activity with significant potential. When well-planned and managed, it benefits both the environment and local communities. Globalization and technological progress have further boosted the industry, making it a key source of revenue, foreign exchange, employment, and entrepreneurship - especially for developing countries.

Haripad is a town of distinct religious, historical, and ecological significance, characterised by a unique cultural identity and rich heritage. Often referred to as the "town of temples," Haripad is home to renowned pilgrimage centres such as the Subrahmanya Swamy Temple and the Mannarasala Sree Nagaraja Temple, along with numerous other temples that are deeply interwoven with the town's history and cultural evolution. These religious institutions form the spiritual backbone of the town and attract devotees throughout the year.

In addition to its religious importance, Haripad is endowed with an extensive network of water bodies, canals, temple ponds, and agricultural landscapes that contribute to its ecological character. Ecologically significant areas such as Nelpurakkadavu are closely linked to the town's cultural and historical narratives. The presence of heritage structures, including Ananthapuram Palace and Karimpalil Palace, further enriches the town's historical landscape and reinforces its cultural value.

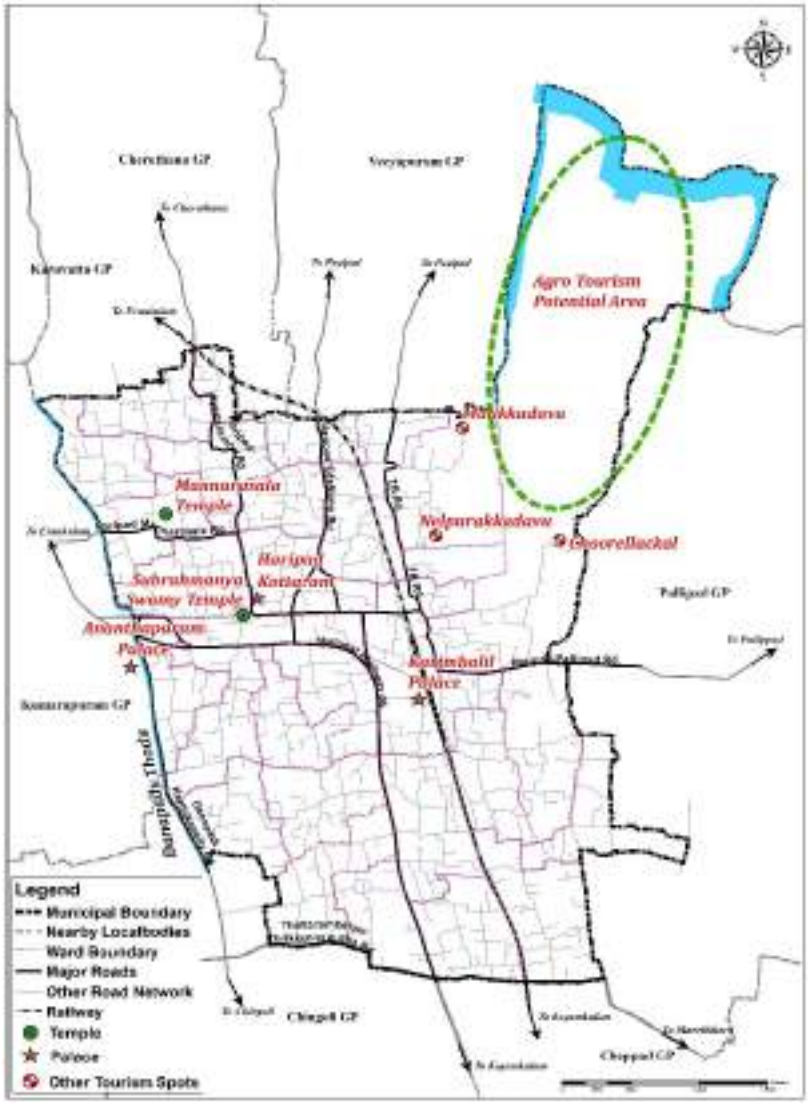

Figure 9.1: Tourism potential areas in Haripad Town

Together, these assets provide Haripad with considerable tourism potential that integrates pilgrimage, heritage, culture, and ecology into a cohesive experience. Its location within Alappuzha district—one of Kerala's most prominent tourism destinations—further enhances this potential, offering opportunities to link Haripad with established tourism circuits across the district.

This chapter presents an overview of the existing tourism resources in Haripad town, reviews the current status of tourism-related infrastructure and services, and identifies key opportunities and challenges for sectoral development. It emphasises the need to protect and conserve heritage assets, improve accessibility and visitor facilities, promote eco-tourism, and guide tourism growth in alignment with principles of sustainable urban development, thereby strengthening Haripad's role within the regional tourism network.

9.2 Places of Tourist Interest

Haripad's tourism sector can be divided into three: Pilgrim Tourism, Heritage Tourism, and Farm Tourism. The uniqueness of the city's tourism sector is that all three are interconnected and can be developed in conjunction with each other.

Haripad town has many cultural, historical, and natural attractions. The Subrahmanya Swamy Temple, one of the oldest temples in Kerala, is well known for its golden flag mast and annual festivals like Avani Festival, Margazhi Festival, Chithira Festival and Thaipooyam. Payippad Jalotsavam, which is held every year in the nearby panchayat is also connected to the history of this temple. The Mannarasala Sree Nagaraja Temple is a famous serpent temple set in a Sacred Grove, attracting many devotees. Nelpurakadavu, located as gateway to paddy fields of the Municipality is a beautiful place, where the idol of Lord Subrahmanya was brought ashore and is closely linked to the Payippad Jalotsavam. Apart from these several other prominent temples within the town include the famous Vathukulangara Devi Temple, Manimangalam Balamuruga Temple, Thalathotta Temple, Kanjoor Sree Durga Devi temple etc. Apart from these the town has two prominent canals running through it- the Pilla Thodu and Danapady Thodu. The town has vast expanse of agricultural fields with intertwined water channels, which proves a major tourist attraction. Further the location of Haripad in Alappuzha district

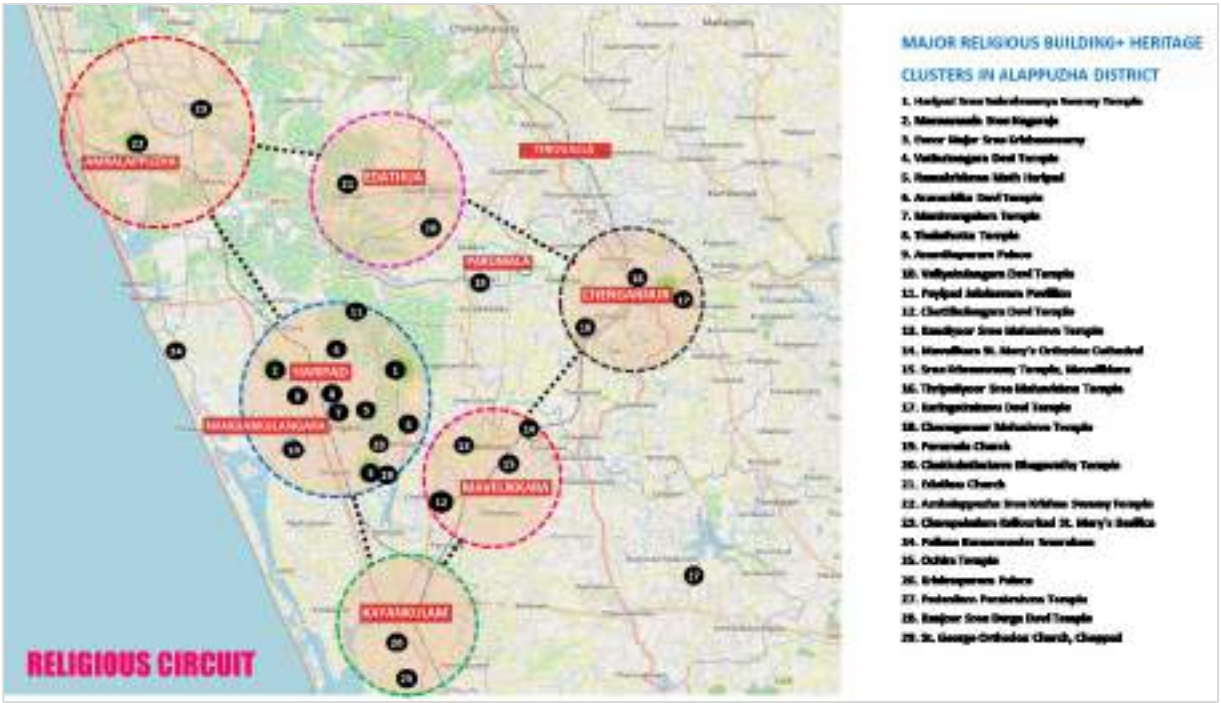

Figure 9.2 : Prominent tourism clusters in Alappuzha District

is such that it is centrally located to prominent religious tourism locations. The figure 9.2 below shows the prominent tourism clusters in the region.

Haripad due to its central location can act a prominent anchoring point from where tourists can choose to diverge to prominent tourism clusters in the district. Chakkulath Kavu, Ambalappuzha Temple, Chettikulangara Temple, Edathwa Church, Parumala Church, Kumaranasan Memorial, Valiyazheekkal Beach, etc. are places that attract people and are located not far from the town, outside the Municipality.

9.2.1 Temples

There are places of worship such as temples, churches, etc. located in and around the city. Temples in town and their associated festivals are currently one of the major factors that attract people to the city. There is potential to develop pilgrim tourism circuits by connecting the worship places in and around the city. Main pilgrim locations within the town are Mannarasala Nagaraja Temple and Subrahmanya Swamy Temple.

A. <u>Mannarasala Temple</u>

Mannarasala Nagaraja Temple (Figure 9.4) is a very ancient temple which is located within the town. It is an internationally renowned temple dedicated to Nagaraja, the serpent god. It's beautiful setting amidst dense green forest grove creates a tranquil and eco-friendly ambience all around. This divine shrine is under the support of a Brahmin family. And unlike other temples in the country, Mannarasala Temple is headed by a priestess whom the devotees fondly call as *"Mannarasala Amma"*. It is said that the deity of this shrine is blessed with the spirit of Lord Shiva and has the form of Lord Vishnu.



Figure 9.3: Subrahmanya Swamy Temple

B. <u>Subrahmanya Swamy Temple</u>

Haripad Sree Subrahmanya Swamy Temple, (Figure 9.3) one of the most revered and ancient temples in Kerala, is dedicated to Lord Subrahmanya (Murugan). Believed to have been consecrated by Lord Parashurama, the temple is often referred to as the *"Palani of the South"* due to its spiritual significance. It houses the largest four-armed idol of Lord Subrahmanya and exemplifies traditional Kerala temple architecture, featuring intricate woodwork, murals, and a majestic



Figure 9.4: Mannarasala Temple

Gopuram. The temple is renowned for its grand festivals, including Avani Festival, Margazhi Festival, Chithira Festival and Thaipooyam, which are marked by a spectacular procession with a "golden peacock vahana". Devotees believe that worshiping here removes obstacles, grants prosperity, and fulfil1s wishes, particularly in family and career matters. As a major religious site in Kerala, Haripad Sree Subrahmanya Swamy Temple serves as a significant center for pilgrimage tourism, attracting thousands of devotees and tourists seeking spiritual blessings and cultural enrichment.

C. Kanjoor Sree Durga Devi Temple



Figure 9.5 : Kanjoor Kolam Varavu procession

Kanjoor Sree Durga Devi Temple is an important local shrine in Haripad, dedicated to Goddess Durga and closely associated with the spiritual and cultural life of the surrounding communities. The temple follows traditional Kerala temple rituals and is especially significant during Navaratri and other major festive occasions, when devotees gather in large numbers for special poojas and offerings. A distinctive cultural feature of the temple is Kanjoor Kolam, a ritualistic folk-art form performed as part of temple festivals. Kolam involves elaborate face painting, vibrant costumes, rhythmic movements, and devotional music, symbolising the presence and power of the deity. This ritual performance is deeply rooted in local tradition and represents an important element of Haripad's intangible cultural heritage. Together, the temple and its associated practices function not only as a place of worship but also as a cultural anchor, reinforcing community identity and contributing to the town's religious and cultural tourism potential.

9.2.2 Heritage Sites and Historically Important Places



Figure 9.6 : Karimpalil Palace, Haripad

Places of historical and heritage importance are located both inside and outside the city. Haripad was a place closely associated with the dynasty when it was part of Travancore. This area was known as the paddy field of Travancore. The Subrahmanya Swamy Temple is deeply connected to the history and heritage of the city and is of great heritage importance. The Karimpalil palace, the palace that houses the office of the Deputy Commissioner of the Devaswom Board are places of historical importance.



Figure 9.7 : Ananthapuram Palace near Haripad Town

History says that Kerala Varma Valiyakoyithampuran wrote the Mayura Sandesham while staying at the Ananthapuram Palace located in the present-day nearby Kumarapuram Panchayat. It remains partly intact but shows signs of deterioration, with weathered walls, damaged timber elements, and sections requiring conservation. Architecturally, it represents the traditional Kerala *nalukettu*/Travancore style, characterised by sloping tiled roofs, wooden structural members, and courtyard-based spatial organisation, with some later vernacular–colonial additions. The palace is still in use, with descendants residing on the premises and parts of the complex occasionally opened for cultural or heritage-related visits. In addition, Kumarakodi, where the memorial of the great poet Kumaranasan is located, is also located in the nearby panchayat of Kumarapuram.

Nelpurakadavu (Figure 9.9) is a historically significant location that played an important role in the supply of paddy to the Travancore Palace. It is said that this place, which is considered the gateway to the paddy fields in the North-Eastern part of the Municipality, was where paddy was collected in the past. It is said that there was a large storage, offices, a mill, etc. for it. To guide the *"kevu vallams"* (large cargo boats) carrying paddy from the paddy fields, a tall teak lamp post was installed at Nelpurakadavu. A part of this original teak structure still remains at the site (Figure 9.8). The location is also culturally significant due to its connection with the Haripad Subrahmanya Temple. It is believed that the idol brought from the Kayamkulam backwaters by the *"karakkar"* (local people) was first brought ashore at Nelpurakadavu. History has it that during the Payippad water festival, the snake boats (Chundan Vallam) used to come here to go to the temple. However, at present, the boats are unable to come here due to the shallowness and the garbage and Water Hyacinth (Pola) filling the water.



Figure 9.8: Remains of original teak lamp post at Nelpurakadavu

9.2.3 Potential Areas for Farm Tourism at Nelpurakadavu and surrounding

A. <u>Nelpurakadavu</u>



Figure 9.9: Nelpurakadavu

Nelpurakadavu has strong potential to be developed as a heritage tourism site. Once a key centre for storing and transporting paddy to the Travancore Palace and closely linked to the religious traditions, region's traditional trade routes, and boat culture with focused conservation measures such as preservation of the teak lamp post and clearing water hyacinth to improve boat access, the site can be revitalized as a heritage tourism destination. There have been attempts to renovate the Nelpurakadavu, but none have been effective. At present, Nelpurakadavu does not host any organised tourism activities. However, the area possesses strong potential for the development of farm tourism due to its rich agricultural heritage and historic role in paddy cultivation and trade. As a former centre for paddy storage and inland transportation to the Travancore region, Nelpurakadavu offers a unique opportunity to showcase traditional agrarian practices and canal-based movement systems. The area can be developed to provide immersive experiences such as guided walks through paddy fields, interpretation of traditional farming methods, and opportunities for visitors to engage in seasonal agricultural activities. Boat rides along the historic canal routes, combined with interactions with local farmers and storytelling on the region's agrarian past, can further enhance the visitor experience. Promoting farm tourism in Nelpurakadavu would help preserve its cultural identity, generate supplementary income for local communities, and support sustainable rural and tourism-led development in Haripad.

B. <u>Malikadavu</u>



Figure 9.10 : Water lillies at Malikadavu

Malikadavu is an area adjacent to Nelpurakadavu. It is a agricultural field which at present is used for single cycle paddy cultivation. During non-paddy season (around 6-7 months in a year), the agricultural field has water lillies growing naturally. This is a unique and scenic location that is visited by localities to witness the vast expanse of water lillies

intertwined with water channels. This area has very less residences and is well connected by road. The area is located closely to Nelpurakadavu. Generally, it is observed to hold a tourism potential which at present is left untapped. Farm based and water-based tourism without causing any damages to the ecology of the area is a viable option that can be explored. Figure 9.10 shows water lillies at Malikadavu during monsoon season. Moving around the water lillies on row boat would be a unique experience to tourists visiting the place.

C. Chooralackal

Chooralackal is rural area within the Municipality limits. It is blessed with vast agricultural fields, water channels, duck rearing etc. The Chooralackal Temple is a famous temple in the area frequented by localities. The area because of its rural scenic setting has a great opportunity to become a rural tourism destination. Kayaking, farm tourism activities, farm experience etc can be explored with the cooperation of the local residents.



Figure 9.11: Navigable water channel at Chooralackal

9.3 Present Scenario of Tourism Potential Areas

Although the tourism sector of Haripad has potential for growth, there are no specific places in the city that can attract or retain tourists. The city's tourism sector mainly consists of pilgrims who come to Mannarasala Nagaraja Temple and Haripad Subrahmanya Swamy Temple. These religious sites attract a steady flow of pilgrims especially during festival times. Most of the visitors of the town are local people and do not stay overnight.

The city's heritage sites, such as Karimpalil palace (Figure 9.12), the palace that houses the office of the Deputy Commissioner of the Devaswom Board (Figure 9.14), are in a dilapidated state due to lack of necessary maintenance. The heritage buildings associated with the Subrahmanya Swamy temple are also on the verge of destruction. Nelpurakadavu and the canals leading to the paddy fields are polluted with waste including plastic (Figure 9.13). They are also shallow and filled with Water Hyacinth (Pola) and mud.



Figure 9.12: Karimpalil Palace

To effectively utilize the tourism potential of the town, it is essential to improve infrastructure, enhance visitor services, and promote better connectivity with surrounding tourist

destinations. At present, there is no established tourism circuit to connect these sites, indicating the need for a more integrated tourism development strategy.



Figure 9.13 : Nelpurakadavu filled with waste and water hyacinth



Figure 9.14: Palace that houses the office of the DC of the Devaswom Board

9.4 Arrival of Tourists

As per Kerala Tourism Statistics 2019 published by the Department of Tourism, Government of Kerala, Alappuzha district remains one of the most visited tourism destinations in the state, recording over 0.50 crore (5 million+) domestic tourists and around 0.05 crore (5 lakh+) foreign tourists annually. With a total annual tourist footfall exceeding 0.55 crore visitors, Alappuzha consistently ranks among the top three tourism districts in Kerala, alongside Ernakulam and Thiruvananthapuram. This sustained annual tourist inflow of over 0.55 crore visitors to Alappuzha district presents a significant opportunity for Haripad. Located within the district and endowed with major pilgrimage destinations such as Mannarasala Nagaraja Temple and Subramanya Swamy Temple, along with heritage structures, canal systems, paddy landscapes, and rich cultural traditions, Haripad has the potential to emerge as a strong inland tourism node. By strategically integrating pilgrimage, heritage, farm, and eco-tourism offerings with Alappuzha's established tourism circuits, Haripad can tap into this large visitor base, encourage longer tourist stays, and generate sustained local employment and economic benefits.

Based on crowd assessments by the Kerala Police, inputs from the Mannarasala Temple Trust, local administrative records, disaster management documents, and regional media reports, Mannarasala Ayilyam attracts an estimated 1.5–2.5 lakh pilgrims annually during the festival period. On the main Ayilyam day, approximately 40,000–60,000 devotees visit the temple, while daily footfall during the extended 3–5-day festival period typically ranges between 25,000 and 45,000 visitors. About 50–55% of pilgrims arrive from other districts of Kerala, 30–35% from within Alappuzha district, and 10–15% from other Indian states and abroad. In terms of access, 65–70% arrive by road, 25–30% by rail via Haripad Railway Station, with the remainder using local or informal modes of transport.

These figures, routinely used for police deployment, traffic management, and disaster preparedness, establish Mannarasala Ayilyam as one of the region's largest recurring pilgrimage events. The scale and seasonal concentration of visitors place considerable pressure on Haripad's infrastructure, particularly public toilets, drinking water, parking, pedestrian circulation, waste management, accommodation, and emergency services. The coincidence of the festival with the monsoon season further intensifies challenges related to flooding,

congestion, and safety. Collectively, these trends highlight the need to plan Haripad as a regional pilgrimage and tourism hub, supported by permanent, climate-resilient infrastructure, improved access and circulation systems, and coordinated tourism services capable of managing peak demand while enhancing visitor experience and long-term tourism potential.

9.5 Tourism Infrastructure

Figure 9.15 illustrates the spatial distribution of public toilets, government- and temple-run guest houses, tourist accommodation facilities, and municipality-approved pay-and-park areas within Haripad town. At present, the town has seven public toilet facilities; however, the overall condition and maintenance of these facilities are poor, indicating an urgent need for improved operation, regular supervision, and upgrading. Haripad has two major guest houses—one PWD Guest House located near Nelpurakadavu and another operated by the Mannarasala Temple Trust—along with approximately 13 tourist homes and lodges catering to visitors. In addition, four designated pay-and-park facilities, approved by the Municipality, are located near the Haripad Municipal Office. During peak festival periods, particularly at the Mannarasala Nagaraja Temple, local residents also temporarily use their private premises as paid parking spaces to manage the surge in pilgrim vehicles.

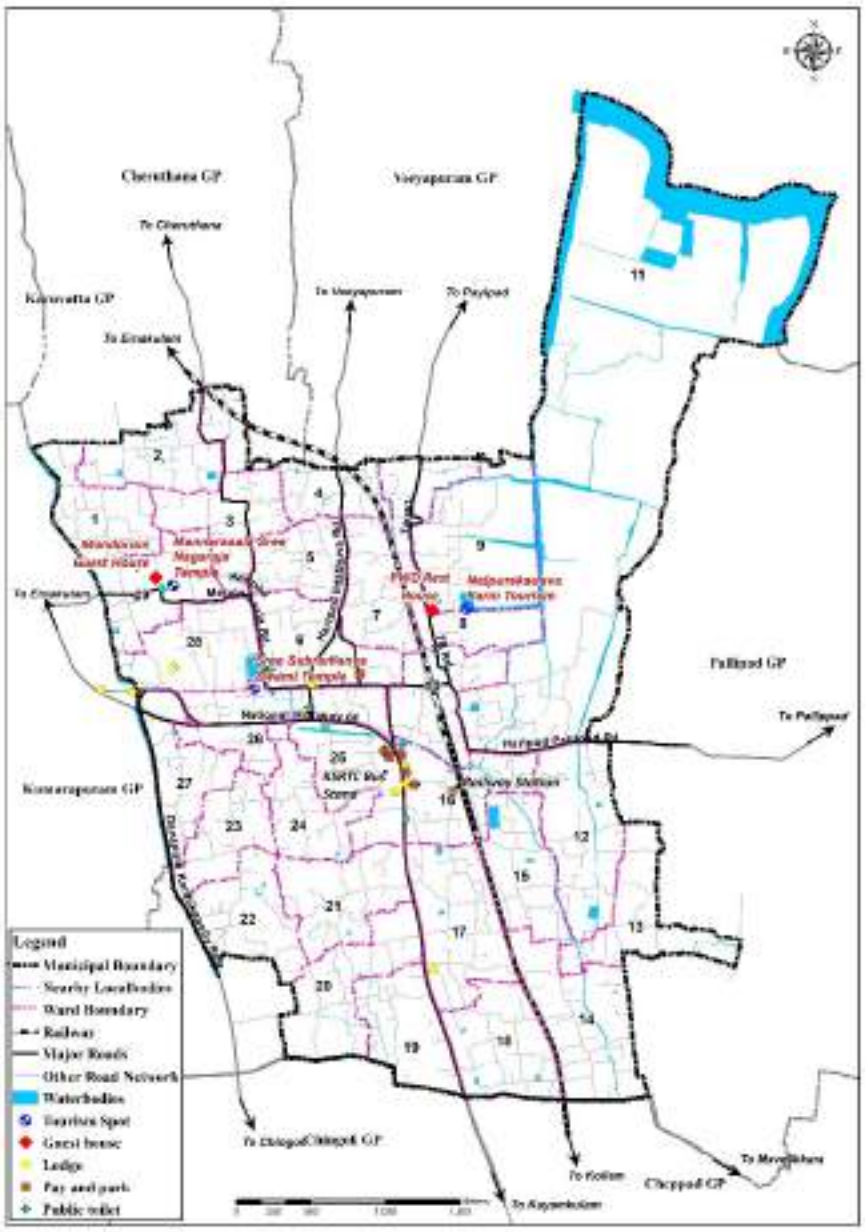

Figure 9.15 : Location of Tourism related infrastructure in Haripad

Despite these facilities, there exists a clear gap between the available tourism infrastructure and the scale of religious and cultural tourism that Haripad accommodates. A key concern is that many existing amenities are not located in close proximity to major pilgrimage

destinations such as the Haripad Subrahmanya Swamy Temple and the Mannarasala Nagaraja Temple, thereby reducing convenience and comfort for visitors.

This shortfall is further substantiated by the Pilgrim Survey conducted by the LSGD Planning Team during Mannarasala Ayilyam 2024. The survey revealed that 75% of respondents identified the need for additional public toilet facilities, while 60% highlighted the lack of adequate seating areas within the temple premises. Only 50% of pilgrims reported using designated parking facilities, indicating issues related to availability, accessibility, or management. Visitors also expressed strong demand for improved infrastructure, including expanded parking areas, better public transport connectivity, enhanced traffic management, improved accommodation options, and reliable drinking water facilities within and around the Mannarasala Temple precinct.

Overall, the tourism sector in Haripad faces multiple infrastructure challenges, including inadequate public toilets and drinking water facilities, insufficient parking, poor waste management, traffic congestion during festival periods, limited public transport options, substandard condition of approach and an inadequate drainage network. These issues are compounded by the limited availability of public land for development, poorly managed and dispersed facilities, inadequate signage, and severe traffic disruptions linked to delayed National Highway widening and flyover projects. Addressing these gaps through integrated, risk-informed, and visitor-oriented infrastructure planning is critical to enhancing Haripad's capacity as a religious and cultural tourism destination and to improving overall visitor experience and urban liveability.

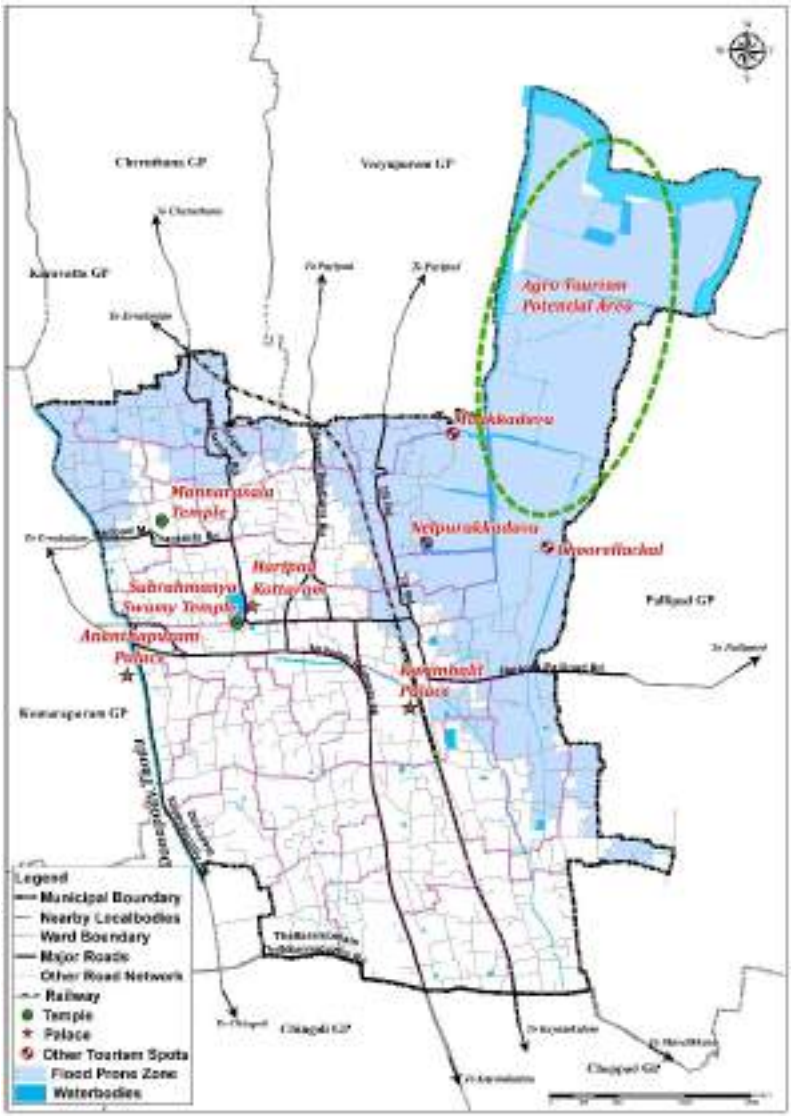

Figure 9.16: Identified potential tourism areas overlaid with flood prone area

9.6 Effect of Hazard Risk

Haripad's tourism assets are intrinsically linked to its natural landscape, cultural heritage, and water-based ecology. Many of the town's most significant tourism destinations—including Mannarasala Sree Nagaraja Temple, Sree Subrahmanya Swamy Temple, Nelpurakadavu, canal stretches, temple ponds, and

adjoining agricultural landscapes—are located either within or in close proximity to identified flood-prone areas. These areas form part of Haripad's interconnected network of rivers, canals, wetlands, and paddy fields, which function both as the town's ecological lifeline and as the foundation of its tourism appeal.

However, this close relationship between water systems and tourism also exposes the sector to heightened hazard risk. Recurrent flooding and waterlogging, particularly during the monsoon season, disrupt access to key pilgrimage and leisure destinations, damage approach roads and public infrastructure, and raise concerns related to visitor safety, hygiene, and service reliability. Flood events in recent years have demonstrated how disruptions to drainage channels, canal edges, and low-lying agricultural lands can cascade into wider impacts—affecting mobility, parking, pedestrian movement, waste management, and emergency access at major tourist nodes.

Poorly maintained drainage systems and solid waste accumulation further aggravate flood impacts, increasing health risks and diminishing the quality of visitor experience, especially during peak pilgrimage seasons. Given that many tourism activities in Haripad are seasonal and event-based, even short-term disruptions can result in disproportionate economic and reputational impacts for the town.

At the same time, the very landscapes that are vulnerable to flooding—canals, wetlands, paddy fields, and temple water bodies—also represent Haripad's strongest tourism differentiators. This makes it essential that hazard risk is not viewed merely as a constraint, but as a key parameter shaping tourism planning and infrastructure investment. Strengthening drainage networks, safeguarding water bodies, restoring canals, and adopting flood-resilient design for tourism facilities will help maintain the functional continuity of these systems while preserving their cultural and ecological value.

9.7 Problems and potentials

Key Issues and Challenges

Despite its strong religious, cultural, and ecological assets, tourism development in Haripad is constrained by a set of structural, infrastructural, and environmental challenges. These issues limit visitor stay duration, reduce economic spill over, and affect the town's ability to function as a well-integrated tourism hub.

1. **Inadequate Tourism Infrastructure and Amenities**

   Haripad experiences a large influx of pilgrims and visitors, particularly during festivals such as Mannarasala Ayilyam. However, the town lacks adequate supporting infrastructure to accommodate this demand.

   - Insufficient and poorly maintained public toilets, drinking water facilities, seating areas, and comfort stations
   - Limited availability of organised parking, leading to congestion and informal parking practices during peak periods
   - Shortage of quality accommodation options, resulting in predominantly short-duration visits
   - Inadequate waste management systems in and around major tourism nodes
   - These gaps significantly affect visitor comfort and discourage longer stays.

2. Limited Overnight Stay and Low Economic Retention

Tourism in Haripad is largely event-based and short-term, with most visitors returning the same day due to:

- Lack of integrated tourism products and packaged experiences
- Absence of well-developed heritage, farm, and village tourism facilities
- Poor linkage between religious tourism and leisure or cultural activities

As a result, tourism-related spending remains limited, reducing local employment and business opportunities.

3. Traffic Congestion and Mobility Constraints

During festivals and peak pilgrimage periods, the town experiences severe mobility challenges:

- Traffic congestion along the Town Hall Junction–KSRTC–Danapady Market corridor
- Inadequate public transport integration and last-mile connectivity to temples and tourism sites
- Narrow roads, delayed national highway widening, and limited pedestrian infrastructure

These factors reduce accessibility to key attractions and negatively affect visitor experience.

4. Hazard Risk and Climate Vulnerability

Many of Haripad's major tourism assets—including Mannarasala Sree Nagaraja Temple, Subrahmanya Swamy Temple, Nelpurakadavu, canal fronts, and surrounding agricultural landscapes—are located within or near flood-prone areas.

- Recurrent flooding and waterlogging disrupt access routes and tourism activities
- Poorly maintained drainage systems aggravate sanitation and safety concerns
- Flood events in recent years have damaged roads and public infrastructure, leading to cancellations and economic losses

Since Haripad's tourism is closely tied to its water networks, temple ponds, canals, and paddy fields, disruptions to these systems have cascading impacts on the sector.

5. Under-utilisation of Heritage and Cultural Assets

Although Haripad and its surrounding region host several heritage structures and cultural landmarks:

- Many sites remain under-conserved or lack adaptive reuse
- Poor signage, interpretation, and visitor information limit engagement
- Weak integration between town-level attractions and nearby regional destinations such as Krishnapuram Palace, Ananthapuram Palace, and Kumaran Asan Smarakom

This limits Haripad's ability to position itself as part of a broader heritage and pilgrimage circuit.

6. Fragmented Tourism Planning and Lack of Integrated Circuits

Tourism development initiatives in Haripad remain largely fragmented:

- Absence of clearly defined pilgrimage, heritage, farm, and village tourism circuits
- Limited coordination between departments, temple trusts, transport agencies, and local communities
- Inadequate promotion of eco-tourism and experiential tourism despite high potential

This fragmentation prevents the town from leveraging its full tourism potential.

While Haripad possesses a rich mix of religious significance, cultural heritage, and ecological landscapes, tourism growth is constrained by infrastructure gaps, hazard exposure, mobility issues, and fragmented planning. Addressing these challenges through risk-informed, integrated, and visitor-centric planning—while strengthening links between religious, heritage, and nature-based tourism—will be essential to enhancing the town's tourism performance and local economic benefits.

Key Potentials and Opportunities

1. Pilgrimage & Religious Tourism

- Presence of regionally and nationally significant temples such as Subrahmanya Swamy Temple and Mannarasala Sree Nagaraja Temple, attracting large annual pilgrim inflows.
- Strong scope for developing structured temple circuits linking Haripad with nearby pilgrimage centres such as Chakkulath Kavu, Ambalappuzha Temple, Chettikulangara Temple, and other shrines in Alappuzha and neighbouring districts.
- Opportunity to position Haripad as a pilgrimage base town offering accommodation, amenities, interpretation, and transport connectivity for religious tourists.

2. Heritage & Cultural Tourism

- Existence of heritage assets such as Karimpalil Palace, ancestral houses, temple tanks, and historic trade corridors that reflect Haripad's cultural evolution.
- Potential for adaptive reuse of heritage structures as museums, visitor centres, cultural hubs, or interpretation spaces.
- Scope for curated heritage walks, festivals, and storytelling initiatives highlighting Haripad's history, temple traditions, and river–canal networks.

3. Eco-Tourism & Nature-Based Tourism

- Extensive network of canals, rivers, temple ponds, wetlands, paddy fields, and low-lying landscapes offering high potential for eco-tourism.
- Areas such as Nelpurakkadavu and canal corridors can be developed for low-impact recreational, educational, and experiential tourism.
- Opportunity to integrate biodiversity conservation, wetland protection, and climate resilience with tourism development.

4. Farm Tourism & Experiential Rural Tourism

- Large stretches of paddy fields, especially in the north and north-eastern parts of the municipality, provide an ideal setting for farm-based tourism.
- Potential to showcase traditional farming practices, padasekharams, irrigation systems, and seasonal agricultural activities.

- Scope for experiential offerings such as farm stays, guided farm walks, local cuisine experiences, and hands-on activities for visitors.

5. Tourism Circuits & Regional Integration

- Strategic location within Alappuzha district enables Haripad to act as a gateway linking backwaters, Kuttanad, Kayamkulam, and inland heritage destinations.
- Strong potential for integrated tourism circuits combining pilgrimage, heritage, ecology, and farm tourism across municipal and inter-panchayat boundaries.
- Rail, road, and water connectivity offer opportunities to strengthen regional tourism flows through Haripad.

6. Festival & Event-Based Tourism

- Major religious events such as Mannarasala Ayilyam attract large crowds and can be expanded into multi-day cultural and experiential tourism offerings.
- Scope for annual heritage, river, and cultural festivals celebrating local traditions, cuisine, crafts, and performing arts.
- Opportunities to extend visitor stay duration through event-linked tourism programming.

7. Local Economy & Livelihood Generation

- Tourism growth can generate employment in hospitality, guiding, transport, handicrafts, food services, and cultural industries.
- Strong potential for participation of women, youth, Kudumbasree units, and local entrepreneurs in tourism-related services.
- Development of local value chains linking agriculture, fisheries, cuisine, and tourism.

8. Sustainable & Climate-Responsive Tourism

- Opportunity to position Haripad as a model for climate-sensitive tourism by integrating flood-resilient infrastructure, green mobility, and low-impact development.
- Potential to align tourism projects with conservation of water systems, agricultural landscapes, and open spaces.
- Scope to promote eco-friendly practices, waste management, and resource-efficient tourism facilities.

Based on the analysis, issues and potentials identified, Table 9.1 discusses the problems, its impacts and implications for the town.

Table 9.1 : Problem–Impact–Planning Implication Matrix in Tourism Sector of Haripad

Key Issues / Problems	Impacts on Tourism Sector	Planning Implications for Master Plan
▪ Concentration of major tourism assets (temples, canal fronts, ecological areas) within or near flood-prone zones	Disruption of access during monsoons; safety concerns; damage to approach roads and public spaces; seasonal decline in tourist footfall	Integrate risk-informed planning for tourism zones; develop flood-resilient access roads, elevated walkways, drainage upgrades, and emergency response infrastructure

Key Issues / Problems	Impacts on Tourism Sector	Planning Implications for Master Plan
▪ Inadequate basic tourist amenities (public toilets, drinking water, seating, rest areas) near key attractions	Poor visitor experience; reduced duration of stay; hygiene and public health concerns, especially during festivals	Develop decentralised, well-maintained tourist amenity nodes near major attractions; adopt universal design and climate-resilient facility standards
▪ Limited accommodation options and absence of overnight tourism facilities	Predominance of short-duration visits; loss of potential tourism revenue	Promote homestays, pilgrim accommodation, eco-lodges, and heritage stays through policy support and zoning incentives
▪ Poor parking management and traffic congestion during peak festival periods	Accessibility challenges; safety risks; negative perception among visitors	Introduce structured parking zones, park-and-ride facilities, pedestrian priority areas, and festival traffic management plans
▪ Fragmented and asset-based tourism development approach	Lack of coherent tourism identity; underutilisation of cultural and ecological assets	Shift towards corridor- and circuit-based tourism planning linking pilgrimage, heritage, farm, and eco-tourism assets
▪ Weak wayfinding, signage, and tourist information systems	Difficulty in navigation; limited awareness of nearby attractions	Establish a unified signage and interpretation system; develop visitor centres and digital tourism platforms
▪ Inadequate waste management in tourist areas and along canals	Environmental degradation; decline in aesthetic and ecological value	Integrate solid waste management, sanitation, and canal protection into tourism planning and public space design
▪ Poor integration between tourism and local livelihoods	Limited economic benefits for local communities; low stakeholder ownership	Promote community-based tourism models involving women, youth, Kudumbasree units, and local entrepreneurs
▪ Dependence on seasonal pilgrimage tourism	Economic vulnerability during off-season periods	Diversify tourism offerings through heritage walks, farm tourism, eco-tourism, and cultural events
▪ Exposure of tourism infrastructure to climate risks (flooding, waterlogging)	Repeated damage, service interruptions, and increased maintenance costs	Mainstream climate resilience into tourism infrastructure design and land-use zoning

9.8 Inference

Haripad possesses a distinctive tourism profile shaped by the close integration of pilgrimage, heritage, ecology, and agrarian landscapes. The presence of nationally significant religious institutions such as the Subrahmanya Swamy Temple and Mannarasala Nagaraja Temple,

combined with historically rooted locations like Nelpurakkadavu and traditional water networks, gives the town a strong cultural identity and a clear basis for integrated tourism development. Its strategic location as a gateway to the Alappuzha backwaters and the wider Kuttanad region further strengthens its potential to function as a nodal tourism hub connecting inland pilgrimage centres with coastal and backwater destinations.

The analysis indicates that tourism in Haripad is largely event-driven and short-duration, dominated by pilgrimage-related visits, with limited conversion into longer stays or diversified tourism experiences. This is primarily due to gaps in supporting infrastructure, including inadequate accommodation facilities, poor sanitation and waste management, insufficient parking, and weak public realm quality. In addition, congestion along key corridors, incomplete road infrastructure, and lack of organised visitor services reduce accessibility and visitor comfort, particularly during peak festival periods.

A critical constraint influencing tourism performance is the town's exposure to flood and waterlogging risks. Many of Haripad's most valuable tourism assets—temples, canal edges, paddy landscapes, and heritage zones—are located within or adjacent to flood-prone areas. The same interconnected water systems and low-lying agricultural fields that define the town's ecological and cultural character also increase vulnerability to climate-related disruptions. Recurrent flooding affects access, damages infrastructure, and disrupts tourism-related economic activity, highlighting the need for risk-informed and climate-resilient tourism planning.

Despite these challenges, the assessment reveals significant opportunities. Haripad's dispersed yet complementary tourism assets provide a strong foundation for developing integrated pilgrimage circuits, heritage trails, farm and village tourism, and eco-cultural experiences. Improved physical connectivity, coordinated planning across sectors, and enhancement of basic infrastructure—particularly drainage, mobility, sanitation, and public amenities—can substantially improve tourism functionality. Aligning tourism development with ecological conservation and climate resilience measures will be essential to safeguard assets while enhancing visitor experience.

The tourism sector in Haripad calls for a transition from isolated, asset-specific interventions to a coordinated, corridor- and circuit-based development approach that acknowledges the town's environmental sensitivities and rich cultural fabric. Through focused infrastructure improvements, stronger institutional coordination, and the promotion of sustainable and experiential tourism models, Haripad can enhance its role within the regional tourism network while fostering inclusive and long-term economic development.

CHAPTER
10

AGRICULTURE



Agriculture forms a vital part of Haripad's economy and landscape, with extensive paddy fields, coconut and banana cultivation shaping its agrarian identity. Located within the fertile Upper Kuttanad region, Haripad benefits from favourable agro-climatic conditions and the nutrient-rich floodplains of the Achankovil River. The sector not only supports livelihoods but also sustains the town's ecological balance. In the context of increasing climate variability and flood risks, the Master Plan emphasizes conserving agricultural land, promoting climate-resilient and sustainable farming practices and strengthening the town's agricultural base to ensure long-term food security and rural well-being.

- Introduction
- Area Under Agriculture
- Important Crops and Production
- Irrigation Facilities
- Agricultural Inputs
- Marketing of Agricultural Produces
- Consumption of Agricultural Produces
- Effect of Hazard Risk in this Sector
- Problems and Potentials
- Inference

10. AGRICULTURE

10.1 Introduction

Haripad Municipality is classified as a low-lying area with a predominantly coastal plain geography. The soil is black and clayey in certain areas. Haripad is a place of great importance for the agricultural sector. According to the Land Use Survey, about 30% of the total area of the Municipality is paddy fields. The paddy fields in the Municipality area are located in the Onattukara region, which is part of Upper Kuttanad. The Kuttanad region is spread over three districts, Alappuzha, Kottayam and Pathanamthitta and is known as 'the rice bowl of Kerala'. The paddy in Kuttanad region is cultivated in three seasons, autumn, winter and summer. Rice cultivation in these seasons is called 'Viruppu', 'Mundakan' and 'Puncha'. The 'Viruppu' is the first crop and in general the season will start from April to August. The 'Mundakan' season starts from August – September and ends in December–January. The season of 'Puncha', the third crop starts from December –January and ends in March-April of the year. However, currently, only 'Puncha' cultivation is carried out in the paddy fields of the Municipality. In the intermediate seasons, sesame, vegetables, etc. are cultivated in some parts.

10.2 Area Under Agriculture

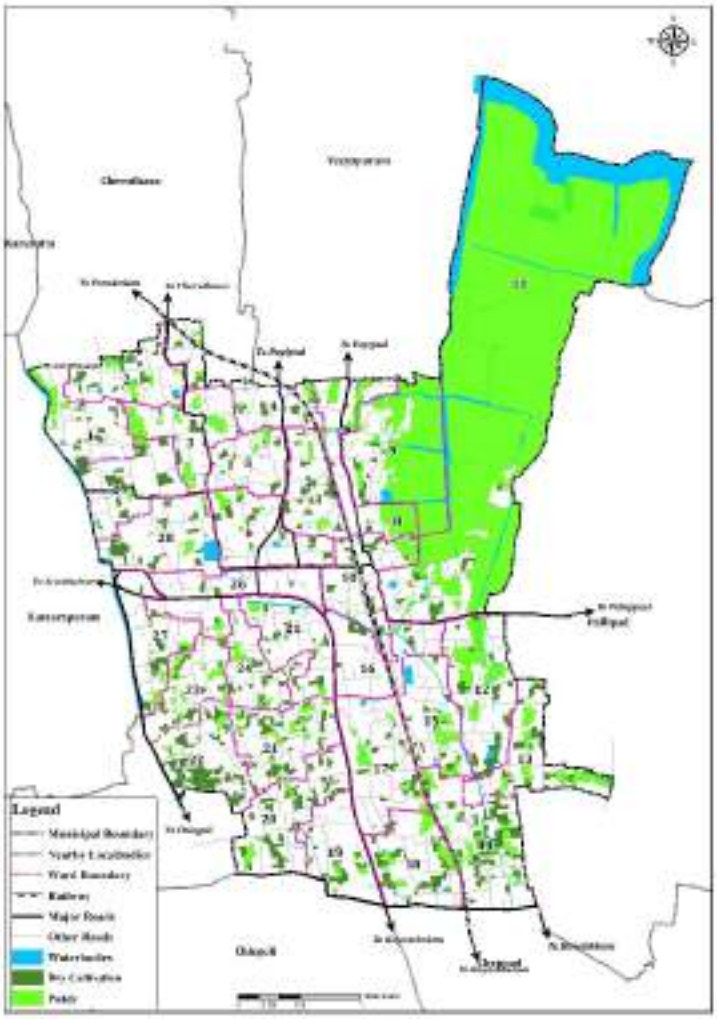

Figure 10.1 : Spatial distribution of Agriculture Land

According to the Land Use Survey, there are about 590 hectares (5.9sq.km.) of agricultural land in the Municipality. This is about 36% of the total area of the Municipality. About 30% of the total area (about 490 hectares) is paddy fields and about 100 hectares is dry cultivation. The paddy fields are spread over wards 8, 9 and 11. Spatial distribution of agricultural land use and the percentage split up of the agriculture land is shown in Figure 10.1. and Figure 10.2.

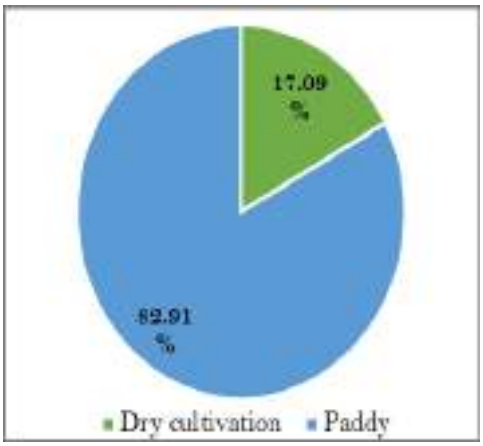

Figure 10.2 : Percentage of Total Agriculture Area

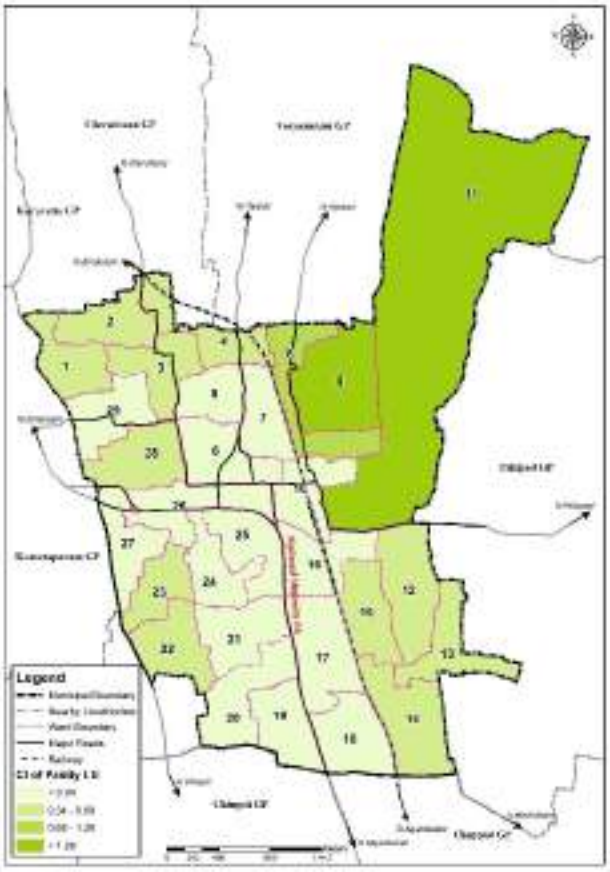

Figure 10.3 : Concentration Index of Dry Agriculture in Haripad

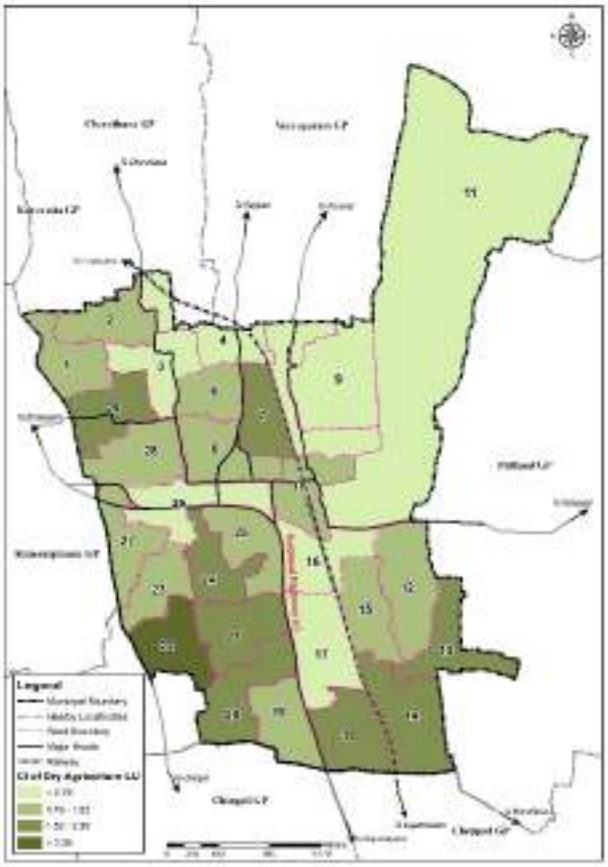

Figure 10.4 : Concentration Index of Paddy cultivation in Haripad

The Municipality comprises eight Padashekarams: Vazhuthanam Padinjarae Thekk, Vazhuthanam Padinjarae Vadakk, Kizhakae Parambakeri A Block, Kizhakae Parambakeri B Block, Sakhethathil Padav, Nakrakkathayankari, Padinjarae Parambakeri, and Kochupappad. According to the data available from the Agriculture Department for the year 2024, the total area of paddy fields is approximately 380 hectares. The area of each Padashekaram and information on rice production for the last 5 years are shown in Table 10.1.

Table 10.1: Details Regarding Padashekaram

Sl. No	Name of Padashekaram	Area in Hectares	Last Five-year production data (2019-2024)
1	Vazhuthanam Padinjarae Thekk	113.6	222 MT
2	Vazhuthanam Padinjarae Vadakk	127.2	254 MT
3	Kizhakae Parambakeri A Block	60	120 MT
4	Kizhakae Parambakeri B Block	28.50	57 MT
5	Padinjarae Parambakeri	16	32 MT
6	Kochupappad	7.20	14.4 MT
7	Nakrakkathayankari	14.84	29.68 MT
8	Sakhethathil Padav	16.47	32.94 MT

Source: Secondary Data, Agriculture Department, 2024

10.3 Important Crops and Productivity

The important crops and their respective areas of cultivation in Haripad Municipal Area are presented in Table 10.2, while their production and productivity are detailed in Figure 10.5 and Table 10.3.

Table 10.2: Area of cultivation of major crops

Sl. No	Year/Type of Crops	Area of Cultivation in Hectares				
		2019-20	2020-21	2021-22	2022-23	2023-24
1	Paddy	383.81	383	383	367.34	367.34
2	Coconut	300	285	285	280	265
3	Banana	32	28	20	20	25
4	Vegetables	30	26	20	20	15
5	Tuber crops	30	30	20	15	20
6	Sesame	5	5	6	7	7

Source: Secondary Data, Agriculture Department, 2024

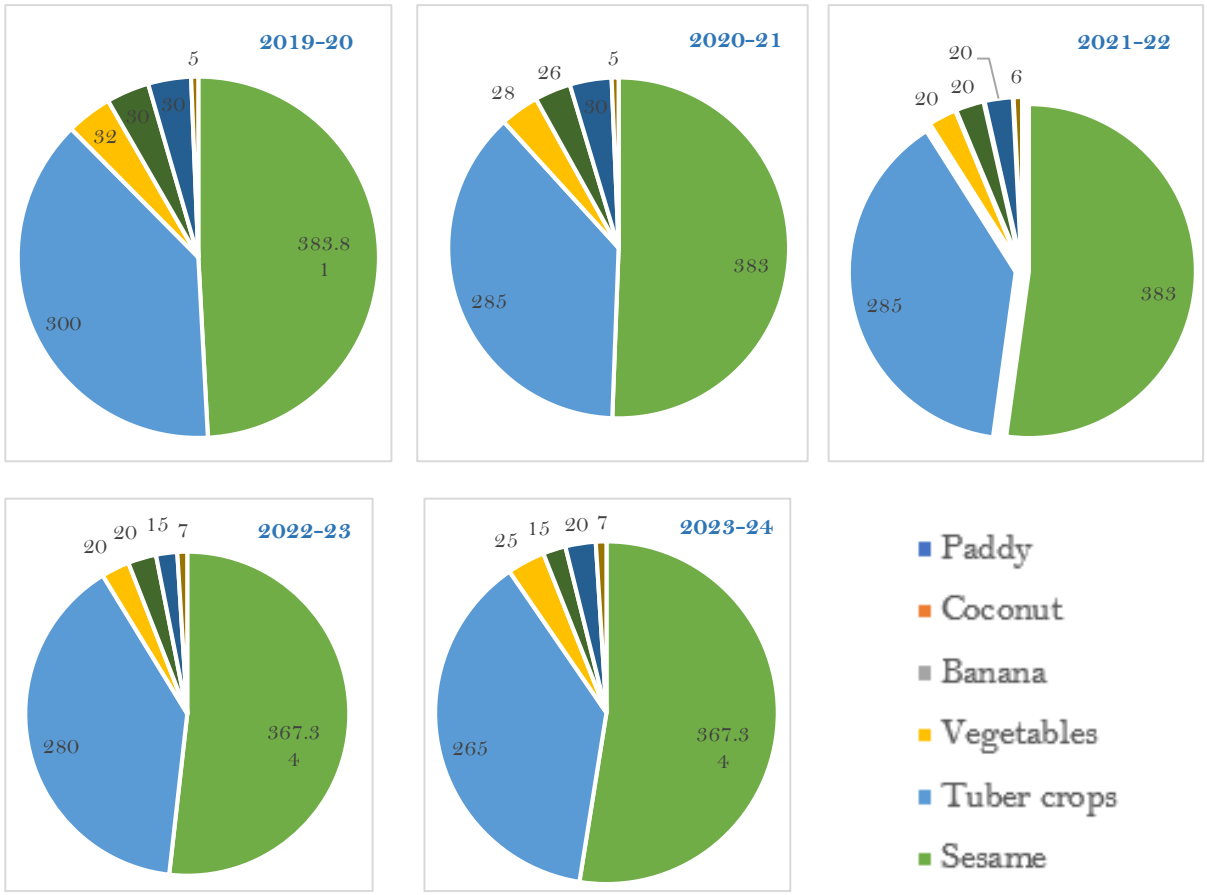

Figure 10.5: Area of cultivation of major crops (2019 to 2014)

Table 10.3: Production and Productivity of major crops

Sl. No	Type of Crops	Production (MT)					Productivity (MT/Ha)				
		2019-20	2020-21	2021-22	2022-23	2023-24	2019-20	2020-21	2021-22	2022-23	2023-24
1	Paddy	2000	2000	2000	2000	2000	5	5	5	5	5
2	Coconut	10	10	10	10	10	30	30	30	30	30
3	Banana	100	100	100	100	100	20	20	20	20	20
4	Vegetables	90	90	90	90	90	10	10	10	10	10
5	Tuber	200	200	200	200	200	20	20	20	20	20
6	Sesame	0.5	0.5	0.5	0.5	0.5	0.1	0.1	0.1	0.1	0.1

Source: Secondary Data, Agriculture Department, 2024

10.4 Irrigation Facilities

Irrigation facilities in Haripad Municipality are managed by various wings of the Irrigation Department, including the Major Irrigation, Minor Irrigation, Inland Navigation & Kuttanad Package, and Pampa Irrigation Sections. The Major Irrigation Section oversees irrigation projects related to the Achankovil and Pampa rivers, while small streams and canals fall under the jurisdiction of the Minor Irrigation Section. Within the municipal limits, the Minor Irrigation Section is responsible for maintaining Danapady Stream, Pillathodu, and canals serving paddy fields. It also undertakes the construction of embankments, canal deepening, bank protection works, and coordination of agriculture-related activities, including the construction of temporary bunds to prevent saltwater intrusion during high tides. The Major Irrigation Section does not construct such temporary bunds within Haripad Municipality. Although the Inland Navigation & Kuttanad Package Section has no projects directly within the municipal limits, its activities elsewhere influence local irrigation

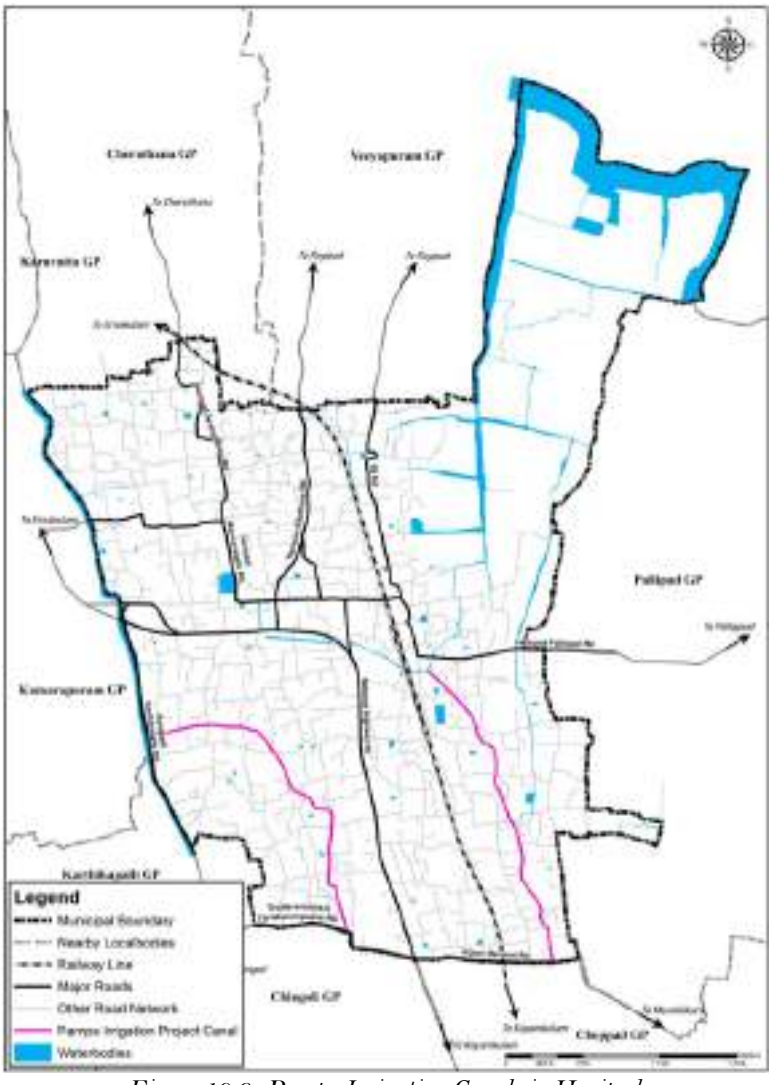

Figure 10.6 : Pampa Irrigation Canals in Haripad

conditions. Additionally, the main canal and branch canals constructed under the Pampa Irrigation Project in the 1970s (shown in Figure 10.6) pass through parts of the Municipality but are currently largely unused due to forest overgrowth, erosion, and waste dumping.



Figure 10.7: Irrigation canals within the town

10.5 Agricultural inputs

Agricultural inputs refer to the essential resources used in farming to enhance productivity and efficiency. These include seeds, fertilizers, pesticides, irrigation water, farm machinery, and labour. Details regarding agricultural infrastructure is given in Table 10.4.

Table 10.4: Details regarding Infrastructure facilities

Sl. No	Agriculture Infrastructure	Location	Total Number	Govt / Private
1	Krishibhavans	Near Haripad Municipality	1	Govt.
2	Fertilizer Depot	Haripad	2	Private
3	Insecticide Depot	Haripad	2	Private

Source: Secondary Data, Agriculture Department, 2024

The agricultural sector faces significant constraints due to labour shortages, inadequate irrigation infrastructure, and saltwater intrusion. Limited availability of skilled labour affects farming operations, while insufficient irrigation restricts reliable water access, especially during dry periods. Saltwater intrusion further reduces crop yields, collectively impacting agricultural productivity and long-term sustainability.

10.6 Marketing of agricultural produces

Private rice mills in Haripad procure paddy mainly through the Padasekharasamithis, ensuring an organized procurement system that supports farmers and the local paddy economy. Marketing of other agricultural produce is facilitated through two daily markets and one weekly market within the Municipality, which serve as key platforms for trading vegetables, fruits, fish, meat, and other local produce. These markets play an important role in connecting farmers, traders, and consumers, while sustaining small-scale vendors and informal livelihoods. Details are provided in Table 10.5, and their spatial distribution is shown in Figure 10.8.

Table 10.5: Details Regarding Daily/Weekly Markets

Sl. No	Name of the market	Daily/ Weekly	Ownership of land	Govt./Private/ Municipality/ Community market
1	Prakritijaivakalavara	Daily	Private	Govt
2	Kathir Ecoshop	Daily	Private	Govt
3	Weekly Market	Weekly	Private	Govt

Source: Secondary Data, Agriculture Department, 2024

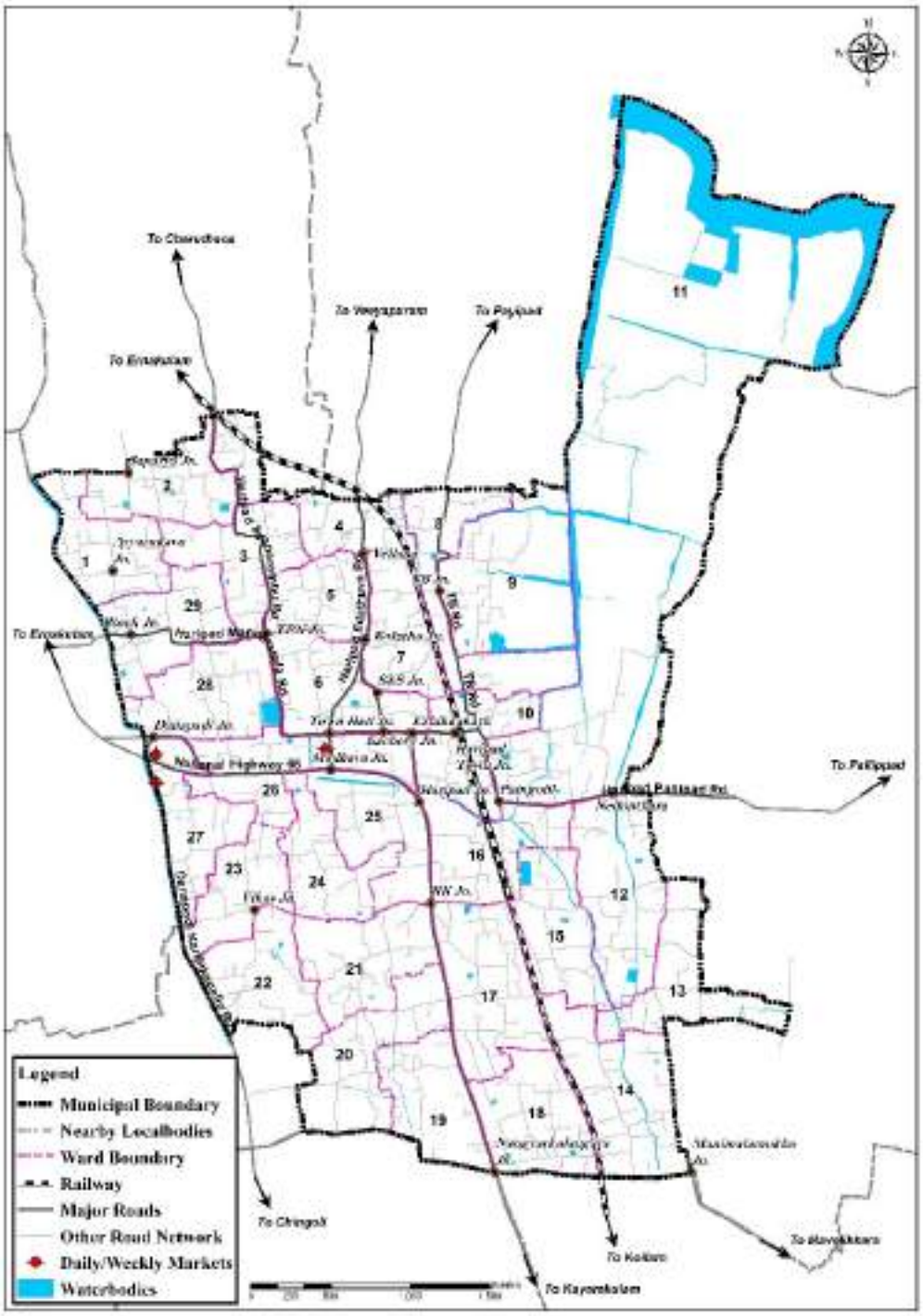

Figure 10.8 : Location of Daily/Weekly Markets in Haripad

10.7 Consumption of agricultural produces

Agricultural production in Haripad Municipality primarily supports local consumption, with a significant dependence on external supply chains to meet food demands. Major agricultural produce includes rice, coconut, banana, vegetables. While coconut is widely used for oil extraction, bananas and vegetables are cultivated but insufficient for local needs. Due to urbanization and limited cultivable land, the Municipality heavily relies on external sources for vegetables, pulses, and dairy products.

Table 10.6: Details of marketed products

Sl. No	Name of the Market	Goods sold in the market.
1	Eco- shop	Vegetables, seeds, Saplings
2	Weekly market	Coconut, Value added products, tuber crops

Source: Secondary Data, Agriculture Department, 2024

10.8 Effect of hazard risk

According to data from the State Climate Change Cell of the Directorate of Environment and Climate Change (DoECC), nearly 66.94% of Alappuzha district is prone to multiple hazards, including floods, landslides, and coastal risks (State Action Plan on Climate Change 2023–2030, Government of Kerala, 2022). This high exposure to climate-induced hazards has direct and serious implications for Haripad Municipality, particularly for its agriculture-dependent economy.

Agriculture has historically been the lifeline of Haripad and continues to hold strong potential as a driver of local livelihoods and economic growth. However, increasing hazard risks—especially flooding and drought—pose a grave threat to the sector. Out of the total 5.9 sq. km of agricultural land in Haripad, approximately 4.3 sq. km (nearly

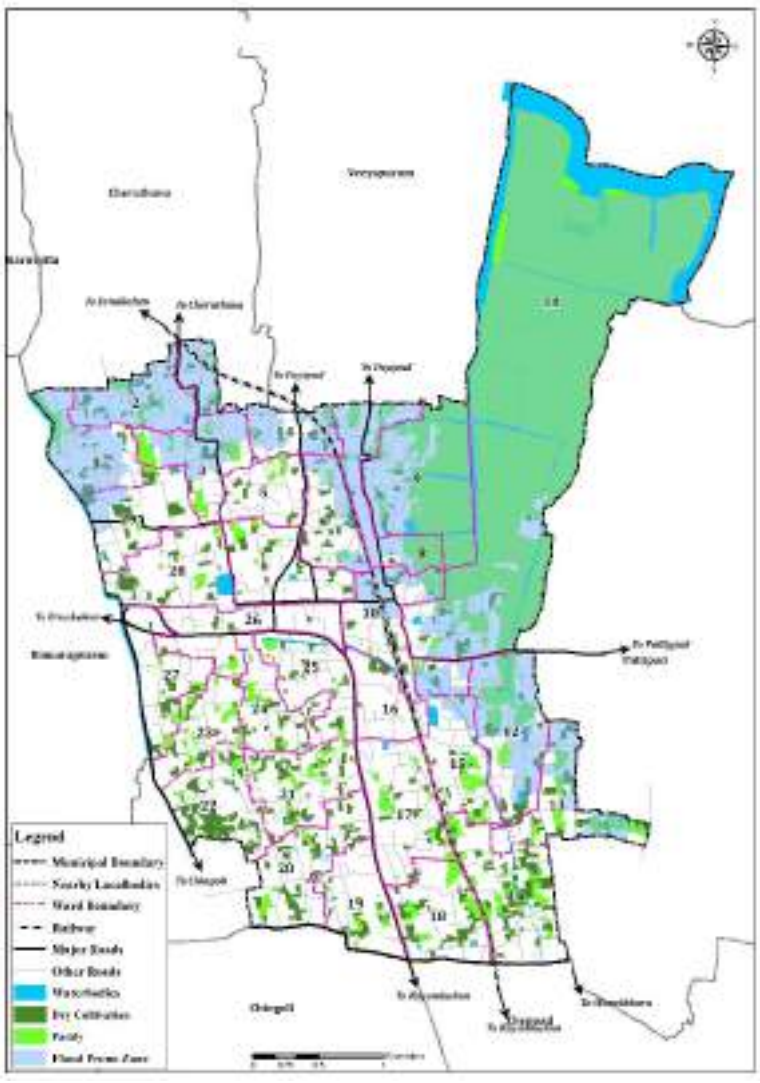

Figure 10.9 : Spatial Distribution of Agricultural land use in Flood Prone Area

73%) lies within flood-prone areas, making farming activities highly vulnerable to climate extremes. Flooding, particularly in the north-eastern parts of the town along the Achankovil river stretch, disrupts crop cycles, damages standing crops, and affects soil stability, with paddy cultivation being the most severely impacted. In contrast, drought conditions during summer months—reported in Wards 9 to 29 as per Kerala Water Authority (2024)—lead to water scarcity, reduced irrigation availability, crop stress, and lower productivity.

These dual stresses of flooding and drought have also adversely affected livestock farming. Reduced grazing lands, scarcity of fodder, and prolonged dry spells have constrained animal husbandry activities, leading to declining milk production and increased vulnerability of small-scale farmers. Additionally, soil degradation caused by erosion during floods and compaction during prolonged dry periods has reduced soil fertility and moisture retention capacity, further weakening agricultural productivity.

The Local Action Plan on Climate Change (LAPCC) for Haripad Municipality provides a detailed assessment of long-term agricultural changes and identifies a substantial decline in overall crop production over the past 30 years. Rising temperatures have led to the breakdown of soil organic matter, increased acidity, and reduced microbial activity, thereby diminishing soil health. The accumulation of elements such as iron and aluminium has further aggravated crop failure. These changes have resulted in reduced yields, rising input costs, and significant economic losses for farmers. Climatic variability has also altered cropping patterns, with traditional crops such as sesame and tender coconut showing a decline, while tuber crops have become more prevalent due to their relative tolerance to fluctuating moisture conditions.

Spatial analysis of agricultural land use further reveals that dry agriculture, comprising coconut, banana, vegetables, and tuber crops, is largely concentrated in the southern and south-eastern parts of the municipality, where relatively higher elevations and better drainage reduce flood risk. These areas depend mainly on wells and canal irrigation systems. Conversely, wet agriculture (paddy fields) is distributed across the municipality, particularly within low-lying flood-prone zones. These paddy tracts benefit from the naturally waterlogged terrain and the canal systems linked to the Achankovil River, which serves as the principal irrigation source. While this hydrological setting supports high productivity, it also exposes cultivation to extreme flood events, placing both livelihoods and food security at risk.

Given that agriculture remains central to Haripad's economic and social fabric, the escalating hazard risks to this sector are a matter of serious concern. The high exposure of farmlands to flooding and drought highlights the urgent need for risk-informed agricultural planning, improved drainage and irrigation management, soil restoration measures, crop diversification strategies, and climate-resilient farming practices. Addressing these challenges is essential not only to safeguard farmers' livelihoods but also to ensure the long-term sustainability, food security, and economic resilience of Haripad.

10.9 Problems and Potentials

Key Issues and Challenges

1. Land Use and Structural Constraints

- Continuous decline in agricultural land due to urbanisation, land conversion, and rising residential development pressures.

- Fragmentation of agricultural land parcels, especially in central and southern parts of the municipality, resulting in non-contiguous plots interspersed with residential uses.
- Filling and raising of residential plots obstruct natural drainage paths, causing water stagnation in adjoining agricultural lands.
- Limited availability of large, contiguous agricultural tracts outside the northern and north-eastern zones of the town.

2. Flooding, Waterlogging, and Salinity

- Approximately 4.3 sq. km out of 5.9 sq. km of agricultural land falls within flood-prone areas, making agriculture highly vulnerable to seasonal flooding.
- Poor bund management, lack of temporary bunds, and absence of permanent shutters lead to saline intrusion and prolonged inundation.
- Recurrent flooding has reduced multi-cropping systems to single-cycle cultivation, significantly impacting farm incomes.
- Inadequate drainage and canal maintenance exacerbate waterlogging and soil degradation.

3. Irrigation and Infrastructure Deficiencies

- Dependence on poorly maintained canals, drains, and wells for irrigation.
- Absence of farm access roads limits mechanisation, timely harvesting, and transport of produce.
- Growth of water hyacinth and sediment accumulation reduces canal carrying capacity.

4. Soil Degradation and Climate Stress

- Rising temperatures and irregular rainfall patterns have led to deterioration of soil organic matter.
- Increased soil acidity and accumulation of iron and aluminium have reduced crop productivity.
- Recurrent climate stresses have increased production costs and discouraged continued farming.

5. Livelihood and Workforce Challenges

- Declining interest in agriculture among youth and women due to low profitability and high risk.
- Shift of workforce away from primary sector livelihoods due to hazard-induced uncertainty.
- Migration in search of stable employment opportunities outside the municipality.

6. Market and Economic Constraints

- Limited market infrastructure, with only one weekly market and two daily markets.
- Lack of cold storage, processing, packaging, and value-addition facilities.
- Dependence on external sources for vegetables, pulses, and dairy products.
- Urban waste inflow into agricultural lands affecting soil quality and crop health.

Key Potentials and Opportunities

1. Strong Agricultural Base

- Agriculture remains a historic and functional lifeline of Haripad, with large paddy fields and a dense network of canals and water bodies.
- Northern and north-eastern parts of the municipality possess contiguous paddy lands suitable for large-scale, organised cultivation.

2. Diversification Beyond Paddy Cultivation

- Fragmented and smaller land parcels are well suited for high-value, low-water crops such as organic vegetables, floriculture, herbs, fodder crops, and medicinal plants.
- Shift from mono-cropping to diversified farming can improve resilience and income stability.

3. Potential for Organic and Climate-Resilient Farming

- Haripad has the potential to emerge as a front-runner in organic vegetable farming in the state.
- Growing consumer demand for organic and locally sourced food supports this transition.
- Adoption of climate-resilient practices can improve long-term sustainability.

4. Collective and Cluster-Based Farming Models

- Opportunities for collective farming through Kudumbasree units, self-help groups, youth groups, and residents' associations.
- Cluster-based agriculture can improve economies of scale, mechanisation, and market access.

5. Agro-Based Value Addition and Processing

- Strong potential for agro-processing, food packaging, dairy processing, fish processing, and herbal product manufacturing.
- Linkages with local markets and emerging tourism activities can strengthen farm-based livelihoods.

6. Integration with Tourism and Local Economy

- Scope to link agriculture with farm tourism, experiential farming, and local food systems.
- Agricultural landscapes, canals, and paddy fields can support eco-tourism and cultural tourism initiatives.

7. Institutional and Policy Support Opportunities

- Alignment with state and central schemes related to organic farming, horticulture, irrigation, and agri-entrepreneurship.
- Scope for targeted incentives, technical guidance, and capacity-building programmes.

8. Youth and Women Engagement Potential

- Agriculture can be repositioned as an entrepreneurial and technology-enabled sector.
- Skill development, start-up support, and assured market linkages can attract youth and women back into farming

Addressing structural vulnerabilities while leveraging Haripad's strong agricultural base and ecological assets can transform the sector into a resilient, diversified, and livelihood-generating system. A risk-informed, cluster-based, and value-driven agricultural strategy will be critical to sustaining agriculture as a core pillar of Haripad's economy and identity.

Based on the analysis, issues and potentials identified, Table 10.7 discusses the problems, its impacts and implications for the town.

Table 10.7 : Problem–Impact–Planning Implication Matrix in Agriculture Sector of Haripad

Problem Identified	Impact on Agriculture & Livelihoods	Planning Implications for the Master Plan
▪ Decline in agricultural land due to urbanisation and land conversion	Reduction in cultivated area, loss of farming livelihoods, increasing dependence on external food supply	Protect remaining agricultural lands through zoning regulations and discourage indiscriminate land conversion
▪ Recurrent flooding in agricultural areas	Crop loss, delayed sowing, reduced yields, and abandonment of farming activities	Integrate flood-resilient agricultural planning, including flood-compatible land use and seasonal cropping strategies
▪ Poor bund management and absence of shutters	Saline intrusion and prolonged inundation of fields, rendering land unusable for long periods	Strengthen bunds, provide temporary bunds and permanent shutters, and improve irrigation control structures
▪ Reduction from multi-cropping to single-cropping systems	Lower farm income, reduced agricultural resilience, and increased economic vulnerability of farmers	Promote multi-cropping through improved drainage, irrigation scheduling, and crop diversification support
▪ Inadequate drainage and canal maintenance	Waterlogging, soil degradation, and reduced productivity	Implement systematic desilting, canal deepening, and routine maintenance programmes
▪ Fragmented and discontinuous agricultural land parcels	Difficulty in mechanisation, higher cultivation costs, and inefficient farming	Encourage cluster-based farming models and collective land management approaches
▪ Disruption of natural drainage due to raised residential plots	Increased water stagnation in adjoining farmlands, discouraging paddy cultivation	Enforce drainage-sensitive building regulations and protect natural flow paths in land use planning
▪ Low participation of women and youth in agriculture	Ageing farmer population and long-term decline of the agricultural sector	Introduce youth- and women-centric schemes, skill development, and agri-entrepreneurship programmes

▪ Limited market infrastructure and value addition facilities	Low profitability, post-harvest losses, and weak farmer bargaining power	Develop local markets, storage facilities, and agro-based value addition and processing units
▪ Dependence on external sources for vegetables, pulses, and dairy	Reduced food security and missed local economic opportunities	Promote local production systems for vegetables, fodder, and dairy through targeted incentives
▪ Waste inflow from urban areas into agricultural fields	Soil contamination, crop damage, and increased cultivation costs	Strengthen waste management systems and protect agricultural areas from urban runoff
▪ Underutilisation of non-paddy agricultural lands	Loss of potential income and productive use of land	Promote alternative crops such as organic vegetables, floriculture, fodder, and medicinal plants
▪ Limited climate-resilient farming practices	Increased vulnerability to climate variability and extreme events	Integrate climate-resilient agriculture, water-efficient practices, and advisory support into planning
▪ Lack of institutional and policy support for diversification	Slow adoption of innovative farming practices	Align municipal, state, and central schemes to support organic farming, collective agriculture, and agri-tourism

10.10 Inference

Haripad's agricultural sector continues to be shaped by its low-lying coastal geography, fertile black and clayey soils, and extensive network of padasekharams, which together sustain paddy as the dominant and most resilient crop. While consultations with the Agriculture Department indicate that paddy productivity has stabilised—and in some cases improved—after the 2018 floods, the overall area under cultivation has steadily declined due to urbanisation, land fragmentation, and conversion of agricultural land. This contraction has particularly affected coconut, vegetable, sesame, and tender coconut cultivation, increasing the town's dependence on external food supply chains.

The sector remains highly vulnerable to climate-related risks, including recurrent flooding, saltwater intrusion, drought, and soil degradation. Inadequate bund management, absence of temporary bunds and permanent shutters, poor drainage, and insufficient irrigation infrastructure continue to expose agricultural lands to prolonged waterlogging and salinity, reducing cropping intensity from multiple cycles to a single cycle in many areas. Post-flood

geomorphological changes have further altered soil structure and hydrology, intensifying long-term risks to productivity. At the same time, fragmented and non-contiguous agricultural plots in central and southern parts of the municipality face additional pressures from surrounding residential development, which disrupts natural drainage patterns.

Despite these challenges, agriculture remains a critical economic and ecological asset for Haripad, with strong potential for diversification and revitalisation. Shifts towards millets, legumes, organic vegetables, floriculture, fodder crops, and climate-resilient farming practices present viable opportunities, particularly in smaller and scattered land parcels. Strengthening irrigation and drainage systems, improving bund management, promoting collective and cluster-based farming, enhancing market linkages, and encouraging participation of youth and women are essential to restoring confidence in agriculture. A risk-informed, diversified, and value-added agricultural strategy is therefore central to sustaining livelihoods, improving food security, and reinforcing Haripad's long-term economic and environmental resilience.

CHAPTER
11

ANIMAL HUSBANDRY



Animal husbandry forms a vital component of Haripad's agrarian economy, contributing to livelihood security, nutrition and rural income. The sector includes cattle, goat, poultry and duck rearing, along with dairy and meat production, supporting a large share of households in the Municipality. Despite its potential, challenges such as limited grazing land, inadequate infrastructure and recurring floods affect productivity and livestock health. The Master Plan emphasizes sustainable livestock management by identifying suitable zones for animal rearing, improving veterinary and fodder infrastructure and integrating climate-resilient and disaster-preparedness measures to strengthen this key allied sector.

- Introduction
- Number of Domestic Animals
- Production
- Physical Infrastructure
- Dairy Farms, Poultry Farms etc.
- Marketing of Products
- Slaughterhouse
- Effect of Hazard Risk in this Sector
- Problems and Potentials
- Inference

11. ANIMAL HUSBANDRY

11.1 Introduction

Animal husbandry and dairying are pivotal to India's national economy and socio-economic development. They significantly enhance rural economies by increasing family income and generating employment, particularly among landless labourers, small and marginal farmers, vulnerable sections, and women. In Kerala, the livestock sector is prominent and among the fastest-growing segments of the rural economy. Advancements in animal husbandry and dairy development are crucial for creating additional employment opportunities and supplementing family income. Predominantly, peasants and agricultural labourers engage in cattle rearing and related activities; thus, progress in this sector will strengthen the local economy. The primary products of animal husbandry in Kerala include milk, eggs, and meat. Additionally, this sector contributes to the state's industrial development by supplying raw materials.

11.2 Number of domestic animals

As per the secondary data received from the Animal Husbandry Department, the main livestock in Haripad Town includes cows, buffaloes, goat, etc. Table 11.1 shows the number of local and exotic breeds of livestock in the town. It is seen that exotic breeds are more in number than local breeds in the case of cow, chicken, duck and dog. Exotic breeds of livestock have higher yield and faster growth.

Table 11.1: Details of number of livestock in Haripad town

Sl. No.	Livestock	Total No	
		Local Breeds	Exotic Breeds
1	Cow	62	943
2	Buffalo	29	21
3	Chicken	218	11558
4	Duck	225	780
5	Goat	472	62
6	Domestic dog	450	500

Source: Secondary data, Animal Husbandry Department, 2024

The number of cows and buffalos in town area over the last 5 years is shown in the following Table 11.2. As per the secondary data in 2024 it is seen that there has been decrease in livestock population over the last 4 years. Unprofitable dairy production, increase in price of cattle feed, disease prone cattle are the reasons for this decreasing trend.

Table 11.2: Details of cows and buffalos

Sl. No	Livestock	2020	2021	2022	2023	2024
1	Cow	1005	1012	1008	998	976
2	Buffalo	50	53	51	47	42

Source: Secondary data, Animal Husbandry Department, 2024

11.3 Production

Meat : The decline in livestock population, coupled with shifting dietary preferences and increasing demand for meat products, highlights the need for improved infrastructure. There is no authorized slaughter house in Haripad Town. There are unauthorized slaughterhouses and unsanitary sales centers. Cattle are mainly brought from other places and other states for the need of meat.

Milk : The details of milk production as per the data from the Dairy Development Department is shown in Table 11.3. The data shows that the cow's milk production is decreasing over the last four years. Increase in price of cattle feed and disease prone cattle may be the reasons for this decreasing trend.

Table 11.3: Details of Milk production

Livestock	Milk production (lakhs litre/annum)				
	2020	2021	2022	2023	2024
Cow	76	90.5	76.06	72.8	51.2
Buffalo	1.08	1.08	1.08	1.08	1.08

Source: Secondary data, Dairy Development Department, 2024

11.4 Physical Infrastructure

11.4.1 Veterinary Hospitals and Clinics:

Haripad Town has a veterinary polyclinic run by the Municipality, which is located in Mannarasala Ward (Ward no. 29). There is a government veterinary hospital located in Ward 20, but it is run by the nearby Karthikappally Grama panchayat.



Figure 11.1 : Government Veterinary Polyclinic, Haripad

11.4.2 Dairy society:

There are three dairy societies in the town. The milk produced in the municipal area is collected through these three societies. The details of the dairy societies and the quantity of milk collected are given Table 11.4. The secondary data shows that total milk collected per month through these societies is 14329 litres.

Table 11.4: Details of dairy society

Sl. No.	Dairy Society	Ward No.	Quantity of milk collected per month
1	Nangiarkulangara KUCS A100 (D) APCOS	12,13,14,15,16	5261 L
2	Pilappuzha KUCS A 238(D) APCOS	7,8,9,10,11	3662 L
3	Haripad KVCS A 198 (D)	1,2,3.4,5,6,26,28,29	5406 L

Source:Secondary data, Dairy Development Department, 2025

11.5 Dairy farms, poultry farms etc.

As per the secondary data received from Animal Husbandry Department, there are two dairy farms present in Haripad town, with a total number of 43 cattle. Around 6000 litres of milk is collected from these two farms. The details of the farms are given in Table 11.5.

Table 11.5: Details of dairy society

Ward No	Name of the dairy farm	No. of cattle	Quantity of milk collected per month
14	Kiran Erickal Bunglaw, Nangiarkulangara	8	4500 lit/month
13	Mannarasala	35	1500lit/month

Source: Secondary data, Dairy Development Department, 2024

Secondary data shows that there are two poultry farms operating in the private sector in the town. One farm with 500 chickens is located in Nangiarkulangara. Another farm with 1000 ducks is also present in town.

11.6 Marketing of Products

The marketing of animal husbandry products in Haripad town happens both within and outside the town area. Milk is marketed through Cooperative Societies. There are three Cooperative societies present in the town and are located in Nangiarkulangara, Pilappuzha and Haripad.

11.7 Slaughterhouse

There are no authorised slaughter houses in Haripad town area. As the demand for meat is increasing day by day, it is seen that the town needs a slaughterhouse with modern facilities and clean marketing centers.

11.8 Effect of hazard risk in this sector

The animal husbandry sector in Haripad Municipality is highly vulnerable to climate-related hazards, particularly flooding and extreme heat conditions. The 2018 floods had a severe and lasting impact on the sector across the State and significantly affected Haripad as well. Intense rainfall and prolonged inundation resulted in the loss of livestock, including cattle, buffaloes,

goats, and poultry, directly undermining rural livelihoods and the local dairy and meat supply systems.

As part of the post-flood relief measures, compensation was provided to affected farmers, with records indicating the loss of approximately 20 cattle during the 2018 event. The floods also caused extensive damage to cattle sheds, leaving many animals without adequate shelter. Disruption of fodder supply chains led to acute shortages of cattle feed, while outbreaks of diseases among surviving livestock further reduced milk and meat production. The scarcity of veterinary medicines and delayed access to veterinary services compounded recovery challenges.

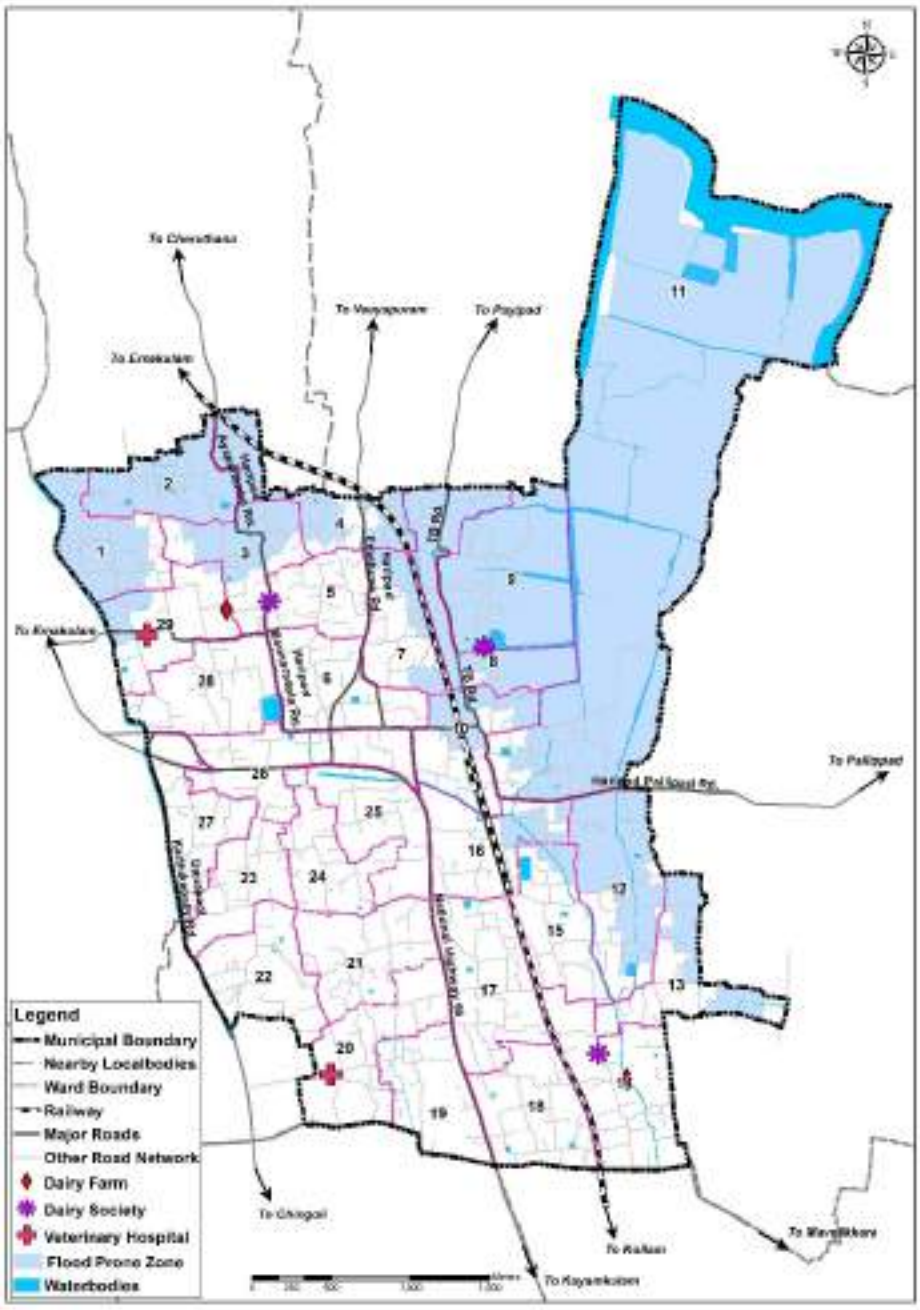

Figure 11.2: Map showing location of various Livestock Institutions overlaid with Flood Prone area of Haripad

Overall, the floods directly impacted approximately 6.6% of the livestock population in the Municipality, underscoring the sector's high sensitivity to disaster events.

In addition to flood-related risks, rising temperatures and heat stress pose growing challenges to animal health and productivity. Prolonged heat conditions reduce feed intake, milk yield, and fertility, while increasing susceptibility to disease, particularly in poorly ventilated or flood-damaged cattle sheds. These combined flood and heat stresses highlight the need for integrated climate-resilient strategies for animal husbandry.

Figure 11.2 illustrates the spatial distribution of livestock-related institutions within Haripad Municipality overlaid with flood-prone areas. Key facilities such as the Gosala at Mannarasala and the Kiran Erickal Bungalow are located in close proximity to flood-prone zones, placing them at heightened risk during monsoon seasons. Given their importance as centres for cattle

rearing and dairy production, these institutions require targeted flood protection, improved shelter design, and emergency preparedness measures.

The Nammal Namukkai Disaster Management framework emphasises the importance of identifying risks to livestock, strengthening early warning and emergency response systems, and implementing mitigation measures to safeguard animal resources. In this context, protecting and strengthening the animal husbandry sector is critical not only for livelihood security but also for food resilience and economic stability in Haripad. Integrating disaster risk reduction, climate-responsive shelter design, fodder security planning, and veterinary preparedness into the Master Plan is essential to ensure the long-term sustainability of the sector.

11.9 Problems and Potentials.

Key Issues and Challenges

1. **Structural and Economic Constraints**

   - Declining livestock population and sharp reduction in milk production, from 90.5 lakh litres (2021) to 51.2 lakh litres (2024), indicating reduced viability of dairy farming.
   - Rising costs of cattle feed and fodder, significantly increasing operational expenses and lowering profit margins for small and marginal farmers.
   - Limited scale of operations, with only two dairy farms and three functional dairy societies, restricting aggregation, processing, and market competitiveness.

2. **Infrastructure and Service Gaps**

   - Inadequate veterinary infrastructure, despite availability of land; the Haripad Veterinary Polyclinic lacks modern buildings, equipment, and specialised facilities.
   - Insufficient livestock waste collection, treatment, and disposal systems, posing environmental and public health concerns.
   - Limited access to high-yielding and disease-resistant cattle breeds, constraining productivity and resilience.

3. **Climate and Hazard Vulnerability**

   - High exposure to flood and heat-related hazards, leading to livestock mortality, fodder shortages, damage to cattle sheds, and disease outbreaks.
   - Delays in compensation and inadequate disaster preparedness further increase financial risks for livestock owners.

4. **Social and Demographic Challenges**

   - Low participation of youth and new generations in animal husbandry due to perceived unprofitability, high risks, and labour intensity.
   - Only a small proportion of the town's population currently depends on animal husbandry, limiting its role as a major livelihood sector.

Key Potentials and Opportunities

1. Land and Resource Base

- Approximately one-third of the municipal area is agricultural land, offering strong potential for integrated animal husbandry development.
- Availability of vacant and underutilised lands that can be developed for fodder cultivation, grazing, and cattle feed farming.

2. Integrated and Complementary Development

- Strong scope for linking animal husbandry with agriculture and agro-based industries, including
  - Fodder production and cattle feed farming
  - Organic manure and bio-fertiliser units using cow dung
  - Small-scale value-added products such as milk products, compost, and bio-inputs
- Potential to develop circular economy models, reducing waste and input costs while enhancing farm sustainability.

3. Institutional and Programmatic Support

- Existing government initiatives such as "Kidari Valarthal", which provide financial assistance for cattle rearing, milk production enhancement, and livelihood improvement.
- Opportunity to strengthen dairy cooperatives and producer groups to improve aggregation, pricing, and market access.

4. Infrastructure Upgradation Potential

- Scope to upgrade the Veterinary Polyclinic into a modern livestock support centre, with facilities for diagnostics, artificial insemination, disease control, training, and emergency care.
- Potential to introduce decentralised livestock waste management systems aligned with environmental and climate goals.

5. Livelihood and Employment Generation

- Animal husbandry can be revitalised as a supplementary and primary livelihood, especially for women, self-help groups, and small farmers.
- Opportunities for skill development, entrepreneurship, and MSMEs in dairy processing, feed production, and allied services

11.10 Inference

The animal husbandry sector in Haripad possesses significant latent potential, supported by the town's extensive agricultural base—covering nearly 36% of the municipal area—and the presence of institutional support systems such as the Veterinary Polyclinic under the Kerala Directorate of Animal Husbandry. However, the sector remains highly vulnerable to climate- and hazard-related risks, particularly flooding, waterlogging, heat stress, and periodic drought conditions. Recurrent flood events, most notably in 2018, have exposed livestock and

associated infrastructure to severe damage, resulting in animal losses, disease outbreaks, fodder scarcity, destruction of cattle sheds, and disruptions to veterinary and supply services. These risks, coupled with rising input costs and limited modern infrastructure, have contributed to a declining livestock population and a sharp fall in milk production in recent years.

Despite these challenges, the sector presents clear opportunities for strengthening resilience and livelihoods through risk-informed planning. Integration of animal husbandry with agriculture, promotion of flood- and heat-resilient livestock practices, improved fodder and feed systems, and better-designed, disaster-resilient cattle shelters can significantly reduce vulnerability. Enhancing veterinary infrastructure, strengthening early warning and emergency response mechanisms, and encouraging value-added activities such as dairy processing, organic manure production, and fodder cultivation can further improve economic viability. With targeted interventions that explicitly address hazard exposure and climate risks, animal husbandry can be repositioned as a resilient and complementary pillar of Haripad's local economy, supporting farmer incomes, food security, and sustainable development in a risk-prone environment.

CHAPTER
12

FISHERIES



The fisheries sector can play a crucial role in Haripad's economy and food security, supporting livelihoods and contributing to the town's socio-economic and nutritional well-being. With its proximity to the Kayamkulam backwaters and the Achankovil River, Haripad possesses significant potential for inland and aquaculture-based fisheries. The sector provides income opportunities for local communities while maintaining ecological balance through sustainable resource use. The Master Plan emphasizes the conservation of aquatic ecosystems, promotion of sustainable fishing practices and enhancement of related infrastructure to strengthen fisheries as a key component of the town's resilient and inclusive development.

- Introduction
- Production, Physical Infrastructure, Fishermen
- Marketing of Products
- Effect of Hazard Risk in this Sector
- Problems and Potentials
- Inference

12. FISHERIES

12.1 Introduction

The fisheries sector plays a vital role in national and state economies, contributing significantly to GDP, employment, and the growth of various industries. It serves as a key source of affordable and nutritious food while also generating foreign exchange. Fisheries are a very important economic sector for Kerala, which is blessed with a 590-kilometer coastline, 44 rivers, and numerous water bodies. As far as the city is concerned, Haripad is a Municipality without a coastline. There are no workers directly involved in sea fishing. The fishing sector in the city is related to inland fishing. Those involved in inland fishing are located along the inland stretches of the Achankovil River. Apart from this, there are farmers in the Municipality who cultivate fish in ponds and other places. The Achankovil River**,** Pamba River are the primary waterways contributing to the inland fisheries sector in Haripad**.** These rivers provide essential ecosystems for a wide variety of freshwater fish and aquatic life**,** supporting both traditional capture fisheries and modern aquaculture practices.

12.2 Production, Physical Infrastructure, Fishermen

As per the data received from the Fisheries Department, the total number of fishermen in the town is only 10 and there are 121 fish farmers in the Municipality. There is no participation of women in the fishing sector. Nearby fishing village in Haripad town is Kayamkulam. Most of fish for consumption in the town comes from this fishing village. Prayikkara, near Mavelikkara is nearby fish landing center. Fishermen bring their daily catch to landing center for initial processing and distribution. Here, the fish are often auctioned to wholesalers and retailers. The purchased fish are then transported to various local and regional markets, ensuring a steady supply to consumers. The fishing season extends for approximately 300 days annually, ensuring a continuous supply of fish. The Achankovil River, a vital water body in the

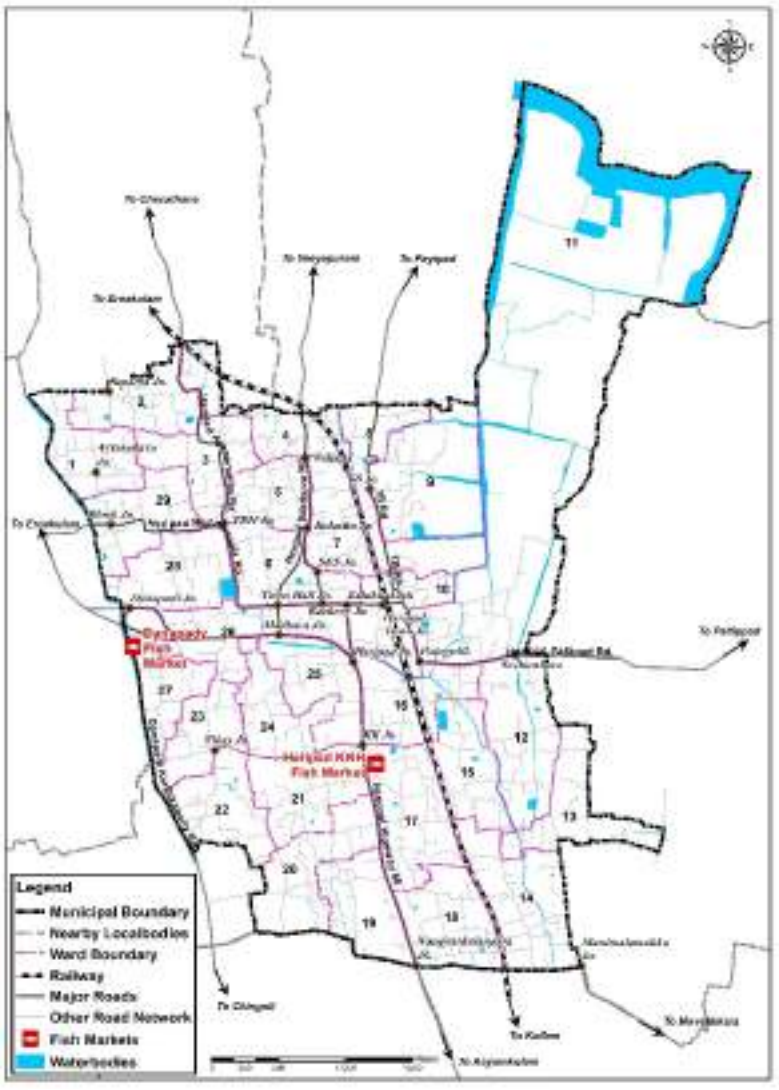

Figure 12.1: Location of Fish Markets in Haripad town

region, supports a diverse range of native fish species, including Catfish, which are available daily. Currently, fish farmers in Haripad town are engaged in the cultivation of high-value species such as Catfish, Anabas, and Tilapia, with the total annual fish production estimated at around 10 tons. The assistance required by fishermen and farmers is provided through the Malsyabhavan. Haripad falls under the jurisdiction of the Matsyabhavan in Thrikunnapuzha.



Figure 12.3 : Fish Market at Danapady



Figure 12.2 : KNH Fish Market near RK Jucntion, Haripad

To support fish farmers and enhance inland fisheries, the Janakeeya Matsya Krishi (JMK) scheme 2023-2025, a state government initiative focused on promoting aquaculture and fish farming introduced which provides Carp, Murrel, Etroplus, and Anabas fingerlings to local farmers, while a feed subsidy program is also in place to reduce input costs. Additionally, the Pradhan Mantri Matsya Sampada Yojana (PMMSY) is being implemented to promote sustainable fisheries, improve infrastructure, and support the livelihoods of fish farmers. Strengthening and modernizing these initiatives can further boost fish production, enhance employment opportunities, and contribute to the overall economic development of the town. Training classes for farmers and disease monitoring and assistance to farmers are also rendered by FFDA (Fish farmers Development Agency). There are two prominent fish markets within the Municipality, as shown in Figure 12.1. No fish landing centers are located within the municipal limits; the nearest landing facility is at Thottapalli. The local demand for fish is primarily met through supplies transported from Thottapalli as well as other major sources such as Kayamkulam, Kozhikode, Malpe, and Goa. The ice requirements are met from the ice plants near Thottapalli.

12.3 Marketing of Products

The fisheries sector in Haripad continues to face significant marketing challenges, which hinder the economic growth and profitability of the fishing community. Despite efforts to revive production post-2018 floods and the support from schemes like PMMSY, the fish marketing segment remains largely informal and inefficient. This limits the benefits fishermen can derive from their hard work. The marketing of fish caught by fishermen remains underdeveloped, resulting in limited market access and reduced profitability for the fishing community.

12.4 Effects of Hazard Risk in this Sector

The 2018 floods were one of the most severe disasters to impact the fishing industry within the municipal limits in recent times. The event caused extensive damage to the fish farming sector, resulting in significant economic losses for farmers. A large number of fishes, including those nearing the harvest stage, were lost due to inundation. The accumulation of soil and silt in ponds further degraded water quality, adversely affecting aquaculture operations. Additionally, the floodwaters disrupted the ecological balance of nearby streams, canals, and rivers, leading to a decline in fish populations and biodiversity as a result of shallowing and sediment deposition.

During flood events, fish farmers are instructed to construct reinforced bunds and utilize green shade nets and bird nets to protect fish stocks from flooding. Periodic advisories are also issued to ensure that fishing boats, nets, and other equipment are relocated to safer locations prior to the onset of the monsoon season.

12.5 Problems and Potentials.

The Haripad town is not having coastal area and hence the fisheries sector comprises of inland fishing and fish farming. The fisheries sector in Haripad Municipality has faced significant challenges, particularly following the 2018 Kerala floods, which caused widespread damage to agriculture and fisheries. Fish farming activities were severely disrupted, necessitating extensive cleaning and restoration of water bodies before pisciculture could resume, leading to production delays and economic losses for fish farmers. Additionally, the sector grapples with limited participation of women in fishing activities, restricting their economic opportunities, and a lack of alternative livelihoods during the offseason, leaving many fishermen financially vulnerable. Another problem facing this sector is the depletion of fish stocks and ineffective fishing due to the accumulation of waste in streams and rivers.

In response, several initiatives have been implemented to bolster the sector's resilience and sustainability. Programs such as JMK (Janakeeya Matsya Krishi) 2023–2025 and the Pradhan Mantri Matsya Sampada Yojana (PMMSY) are the current ongoing schemes in Haripad Municipality. PMMSY aims to improve fishing by building better infrastructure, like harbours and cold storage. JMK is a flagship initiative by the Kerala Department of Fisheries aimed at promoting community-based aquaculture. The scheme emphasizes sustainable inland fish farming by providing support such as fish seed distribution, feed subsidies, and technical training to local farmers. It also focuses on utilizing underused water bodies like public ponds for aquaculture, thereby enhancing local employment and food security. It also helps fishermen with modern technology and better practices to increase their catch and income.

Public and unused ponds represent valuable natural resources that are currently underutilized. By undertaking proper cleaning and rehabilitation efforts, these water bodies can be transformed into productive sites for fish farming. Reviving such ponds not only promotes sustainable aquaculture but also contributes to local employment, food security, and the efficient use of available water resources.

12.6 Inference

The fisheries sector in Haripad is directly dependent on inland fishing and fish farming since the town does not have coastline. The town has not been able to turn the fishing sector into a good source of income. Problems in fish marketing, low participation of women, and seasonal employment shortages negatively affect the growth of the fishing sector. Pollution in streams and canals, and the 2018 floods have adversely affected inland fisheries. Fish stocks can be increased by deepening canals and streams, removing waste, and distributing good quality fish fingerlings through schemes like JSK. The possibilities of developing the fisheries sector should be considered by utilizing innovative technologies like Biofloc, pen culture etc., and implementing various schemes such as training, protection measures against natural disasters. In addition, developing a better marketing system and waste management systems is also essential for the development of the sector.



PART I : STUDY & ANALYSIS

PHYSICAL INFRASTRUCTURE

1. TRAFFIC AND TRANSPORTATION
2. OTHER PHYSICAL INFRASTRUCTURE
   - *Water Supply*
   - *Sewerage System*
   - *Solid Waste Management*
   - *Energy*

CHAPTER 13

TRAFFIC AND TRANSPORTATION



Transportation forms the backbone of Haripad's urban structure and economic growth. The town's location along NH 66, supported by road, rail and inland waterway connectivity, makes it a vital mobility hub in the region. An efficient and well-integrated transport network is essential to support Haripad's residential, commercial and tourism activities. This chapter analyses the existing road hierarchy, public transport systems, pedestrian and parking infrastructure and identifies key issues, potentials and hazard-related vulnerabilities. The goal is to develop a safe, accessible and sustainable transport framework that supports Haripad's balanced and resilient urban growth.

- Introduction
- Roads
- Vehicle Population
- Characteristic Studies of Transportation Network
- Rail Transport
- Water Transport
- Air Transport
- Characteristics of Goods Traffic
- Other Infrastructure Facilities
- Accident Data
- Identification of Gaps in Network
- Effect of Hazard Risk in the Sector
- Inference

13. TRAFFIC AND TRANSPORTATION

13.1 Introduction - an Overview of Transportation facilities

Efficient traffic and transportation systems are crucial to the economic vitality of urban settlements. Enhancing connectivity with neighbouring towns and regional communities can significantly contribute to urban development. Haripad is strategically well-connected by road and rail, located between Alappuzha and Kollam along National Highway 66. The town is bordered with Pallippad Grama Panchayat to the East, Kumarapuram Grama Panchayat to the West, Veeyapuram and Cheruthana Grama Panchayats to the North, Cheppad, Chingoli and Karthikappally Grama Panchayats to the South. Haripad also serves as a vital link between Mavelikkara and Thrikkunnappuzha. Haripad has a good road network that connects the town to adjacent areas. Railway station is located in the heart of the town. Haripad Railway Station, situated on the Southern Railway line, ensures connectivity to major destinations within Kerala and across India. The Railway Station Junction, located 240 meters from the Taluk Hospital, is the primary access point to the station, which is 600 meters away from the junction. The nearest airports are Thiruvananthapuram International Airport and Cochin International Airport, situated at approximately 116 km and 114 km from Haripad, respectively. As part of the preparation of Haripad RIMP, the study on Traffic and Transportation was entrusted with National Transportation Planning and Research Centre (NATPAC).

13.2 Roads

13.2.1 Existing Road Network

Haripad is strategically situated between Alappuzha and Kollam along National Highway 66, bordered to the east by Pallippad Gramapanchayat; to the north by Cheruthana and Veeyapuram Gramapanchayats; Kumarapuram and Karthikapalli Gramapanchayats to the west; and to the south by Chingoli and Cheppad Gramapanchayats. Haripad has a good road network within the town connectivity to the adjacent areas. Additionally, several link roads connect Haripad to various places such as Veeyapuram, Pallippadu, Kollam, Karthikappally, Alappuzha, and Mannarasala Temple. Haripad – Veeyapuram Road which starts at Madhava Jn and connect Ambalappuzha – Thiruvalla road (SH 12). Currently, the total road network in Haripad Municipality is 145.54 km. Considering the area of the Municipality, there are 7.56 km of roads per sq.km. The four major junctions in the central area of Haripad town are:

1. Taluk Hospital Junction on NH 66
2. Madhava Junction on NH 66
3. Town Hall Junction on the Mannarasala–Pallippadu road
4. Ezhikkakathu Junction on the Mannarasala–Pallippadu road

These junctions facilitate efficient connectivity within the town and to surrounding regions. The town's road network is organized in a grid pattern, with streets running perpendicular to each other, forming a structured layout. National Highway 66 serves as the central backbone of this grid, while the intersecting roads function as its supporting elements.

The Town Road serves as a major thoroughfare, significantly contributing to traffic attraction and flow. Commencing at NH 66 near the Taluk Hospital, it passes through Ezhikakathu and Kacheri Junction before ending at Town Hall Junction. This road acts as a vital connector

between NH 66 and Pallipadu Road, with commercial activities predominantly concentrated along its stretch. It facilitates seamless access to the central area for traffic originating from both Pallipadu and TB sides.

13.2.2 Road Inventory Study

Understanding the extent and quality of the road network is crucial for effective future planning. A comprehensive inventory of the existing road infrastructure was conducted to gather key information such as total road length, cross-sectional details, road hierarchy, surface conditions, intersections, street furniture, parking spaces, bus bays, and related features. The road sections selected for the inventory study are given in Table 13.1 and their locations are shown in Figure 13.2.

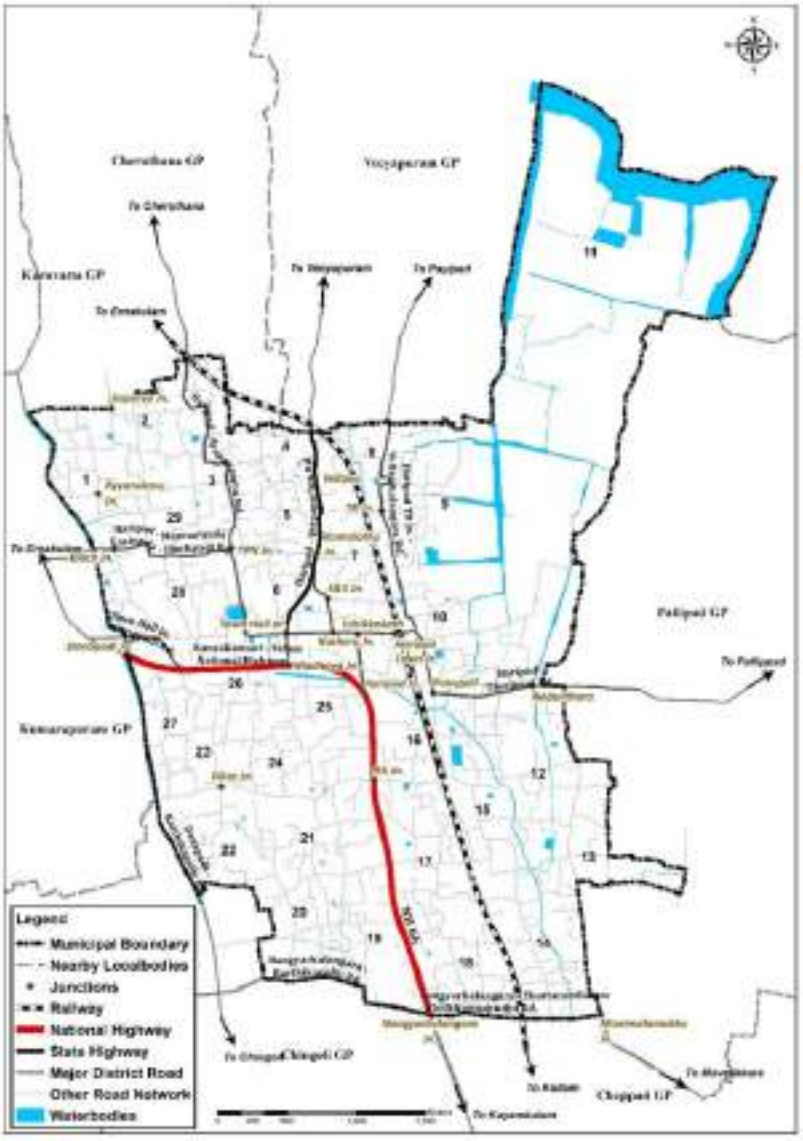

Figure 13.1: Road network of Haripad Municipality

Table 13.1: Road sections selected for inventory survey

Sl. No.	Name of Road Sections
1	NH 66
2	Karthikapally-Nangiarkulangara –Mavelikkara Rd
3	Danapady – Karthikapally on Danapady – Kayamkulam Road
4	Madhava Jn to Veeyapuram road
5	Mannarasala to Town Hall to Pallippadu
6	Ezhikkakathu Jn - Taluk Hospital Jn
7	Kachery Jn road
8	RK Junction to Karthikapalli – Danapady road
9	Railway Station Jn on NH 66 – Haripad Railway Station
10	Narakathara Jn - Danapady–Danapady Jn on NH 66
11	Danapady - Mannarasala Temple

12	Danapady – Subrahmanya Swami temple
13	Townhall Junction to Subrahmanya Swami temple
14	Subramanya Swami temple to Mannarasala temple
15	Manimala to Pallippadu
16	TB road

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

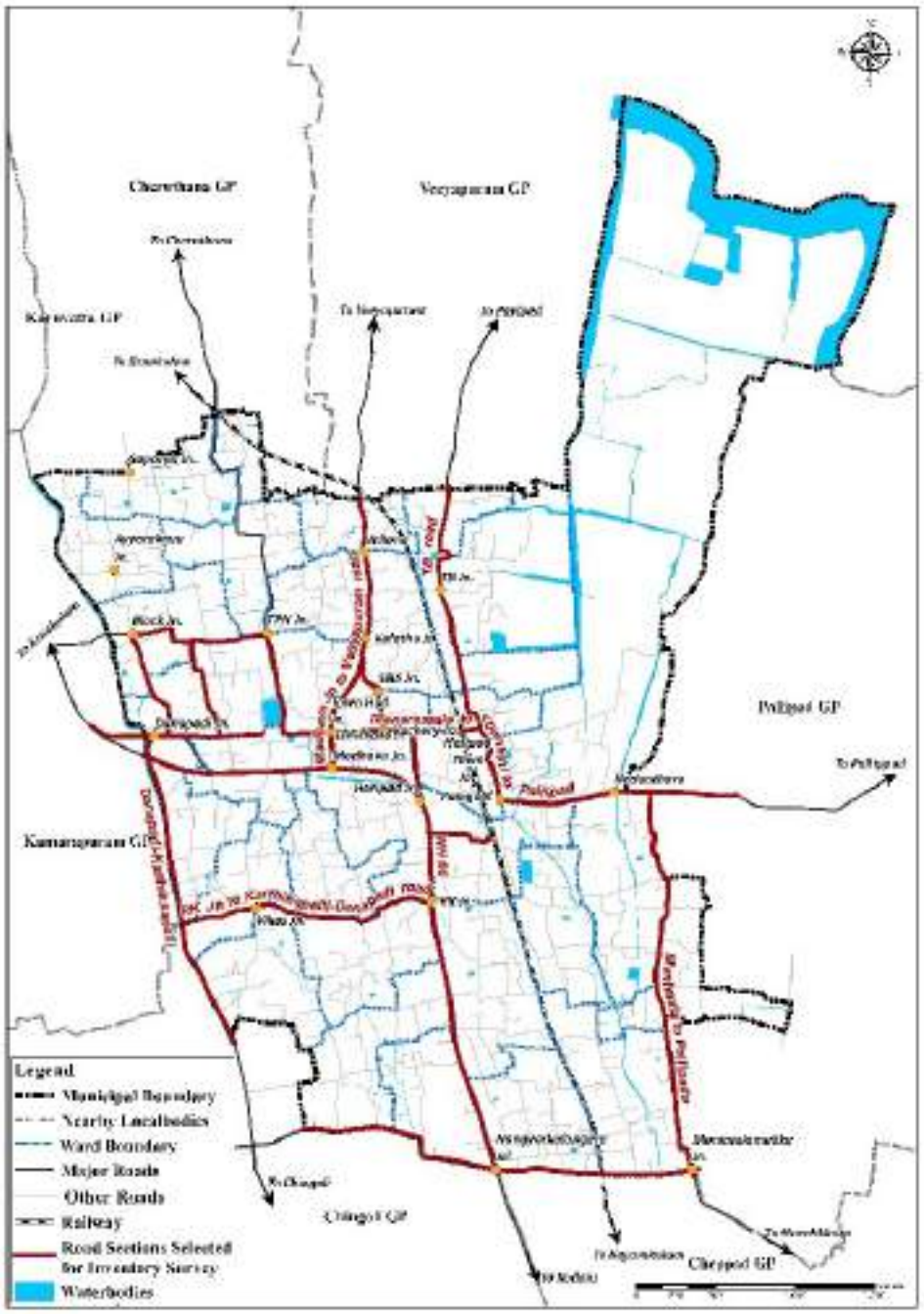

Figure 13.2 : Location of road sections selected for inventory survey

13.2.3 Road Intersections

A road intersection is a point where two or more roads converge or cross, facilitating the movement of vehicles and pedestrians between different routes and serving as a critical element in the transportation network. In the following sections, the Traffic Volume Survey

of some of the major intersections of Haripad town will be discussed in detail. The major intersections under study are:

A. Madhava Junction
B. Townhall Junction
C. Ezhikkakathu Junction
D. Prathimukham Junction
E. Nangiarkulangara Junction



Figure 13.3 : Major intersections in Haripad

13.3 Vehicle Population

Vehicle Population refers to the total number of vehicles in a specific region (like a city, state, or country) that are registered with a government agency and licensed for public use. The vehicle growth trend of the State and the district of Alappuzha has risen phenomenally high. It can be observed that the vehicle population in Alappuzha alone has multiplied more than

two times over the last decade. The growth of motor vehicles in Alappuzha district during the period from 2014 to 2024 is given in Table 13.2.

Table 13.2: Growth of motor vehicles in Alappuzha District during 2014 – 2024

Year	No. of vehicles	Growth index
2014	5,61,495	100
2015	6,18,697	110.19
2016	6,97,203	124.17
2017	7,62,880	135.87
2018	8,30,790	147.96
2019	9,20,817	163.99
2020	9,79,188	174.39
2021	10,24,963	182.54
2022	10,78,234	192.03
2023	11,36,048	202.33
2024	11,53,406	205.42

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

The number of motor vehicles having valid registration in Alappuzha district in 2024 is given in Table 13.3. An analysis of the existing vehicle population reveals that two-wheelers make up the largest share in the district, accounting for approximately 73% (834,867) of the total registered vehicles, followed by cars at around 18% (204,697). At the state level, Kerala also shows a similar trend, with two-wheelers comprising 63% of the total vehicle registrations, followed by cars at 23%. Additionally, Alappuzha district contributes about 7% of the total vehicles with valid registration in Kerala.

Table 13.3: No. of vehicles having valid registration in Alappuzha District and Kerala State in 2024

Sl. No.	Type of vehicle	Alappuzha District		Kerala State	
		No of Vehicles	% share of vehicle	No of Vehicles	% share of vehicle
1	Four wheelers & above	25,488	4.12	4,11,349	4.37
1	Four wheelers & above	34,796	3.03	5,83,334	3.38
2	Three wheelers including Tempos	11573	1.01	1,87,273	1.08
3	Stages carriages	5213	0.45	99,837	0.58
4	Edu. Institution Bus	1754	0.15	39,278	0.23
5	Cars	204697	17.84	38,94,631	22.55
6	Taxis	10419	0.91	1,40,715	0.81
7	Ambulance	484	0.04	9,721	0.06
8	Auto rickshaws	40366	3.52	8,85,211	5.13
9	Scooter/ Motor cycles	834869	72.74	1,13,64,785	65.82
10	Tractors	1029	0.09	20,146	**0.12**

11	Tillers	153	0.01	2,208	0.01
12	Trailers	84	0.01	1,506	**0.01**
13	Others	2260	0.20	38,963	0.23
	Total	**11,47,697**	**100**	**1,72,67,608**	**100**

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

13.4 Characteristic Studies of Transportation Network

13.4.1 Traffic Volume Study

A classified traffic volume count survey was conducted in Haripad town to develop a comprehensive database of vehicle movement on the existing road network. This data played a crucial role in assessing the operational efficiency of the road system and the overall quality of service experienced by road users. Traffic volume counts were carried out at three key locations: (i) outer cordon points, (ii) mid-blocks along major corridors, and (iii) significant intersections within the town.

Traffic Volume Survey at Outer Cordon Points: Link volume counts at outer cordon points were conducted to assess inter-city goods and passenger movements, capturing external-internal, internal-external, and external-external trip patterns. These cordon points were located along Major District Roads (MDR), State Highways (SH), and National Highways (NH) within Haripad town. Depending on the road's significance and traffic intensity, the surveys were carried out continuously for durations ranging from 8 to 24 hours on a typical working day. The outer cordon survey points considered were NH 66 (near Narakathara), Karthikapalli – Thrikkunnapuzha road (near Karthikapalli Jn.), Haripad – Manimala road (near railway cross) and Haripad – Veeyapuram road (near railway cross).

Traffic Volume Survey at Midpoint of Homogeneous Section : The link volume survey was conducted at strategically selected locations along both major and minor arterial roads of the urban road network in the town area. The classification of traffic for the volume count was determined based on findings from a preliminary reconnaissance survey. Depending on the significance of each road and the observed traffic intensity, the survey was carried out continuously for durations ranging from 8 to 12 hours on a regular working day.

The homogeneous section of the study roads where the studies were conducted are shown in Table 13.4 and shown in Figure 13.4

Table 13.4: Homogeneous section selected for Haripad Study Area

Sl. No.	Name of road	Homogeneous section	Volume (PCU/Hour)
1	NH 66 (NH 47)	1. Nangiarkulangara - RK Jn	2149
		2. RK Jn - Railway station Jn	
		3. Railway Station Jn – Taluk Hospital Jn	
		4. Taluk Hospital Jn – Madhava Jn	

		5. Madhava Jn – Narakathara Jn	
2	Danapady – Karthikapally - Nangyarkulangara - Mavelikkara Rd	6. Danapady - Karthikapally	948
		7. Karthikapally - Nangiarkulangara	570
		8. Nangiarkulangara – Manimala Jn	1355
3	Madhava Jn to Veeyapuram road	9. Madhava Jn - Town Hall Jn	1230
		10. Town Hall Jn – Thrippakkudam	1101
4	Mannarasala to Town Hall to Nedumthara	11. Mannarasala Temple - Town hall Jn	459
		12. Town Hall Jn – Kachery Jn	781
		13. Kachery Jn – Ezhikkakathu Jn	740
		14. Ezhikkakathu Jn – Prathimukham Jn	798
		15. Prathimukham Jn - Nedumthara	875
5	Other roads	16. Ezhikkakathu Jn - Taluk Hospital Jn	583
		17. Kachery Jn road	
		18. RK Junction to Karthikapalli – Danapady road	719
		19. Railway Station Jn on NH 66 - Haripad Railway	
		20. Danapady - Mannarasala Temple	
		21. Narakathara - Danapady	719
		22. Danapady – Subramanya Swami temple	
		23.Townhall Junction to Subrahmanya Swami temple	892
		24. Subrahmanya Swami temple to Mannarasala temple	459
		25. Manimala to Nedumthara	
		26. TB road	
		27. Prathimukham Jn - Vathukulangara	

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

(a) Traffic Volume Survey at Important Intersections

The capacity of urban roads is significantly influenced by the operational efficiency of intersections, which serve as critical nodes governing traffic distribution and overall network performance. Well-designed and efficiently managed junctions ensure smoother vehicular movement, reduce delays, and minimize congestion, particularly during peak travel periods. In Haripad town, traffic volume counts were undertaken at selected key intersections to assess peak hour demand and identify potential bottlenecks within the road network.

The surveys were conducted in two sessions to capture representative traffic conditions—four hours in the morning (8:00 AM to 12:00 PM) and four hours in the evening (3:00 PM to 7:00 PM)—covering school, office, market, and commuter peak periods. Classified traffic counts were recorded for different vehicle categories, including two-wheelers, cars, auto-rickshaws, buses, goods vehicles, and non-motorized transport. The observed traffic volumes were subsequently converted into Passenger Car Units (PCU) using the standard equivalency factors prescribed by the Indian Roads Congress (IRC), enabling a uniform basis for capacity assessment and intersection performance analysis. Details of the locations selected for intersection turning volume count are given in Table 13.5 and shown in Figure 13.5.

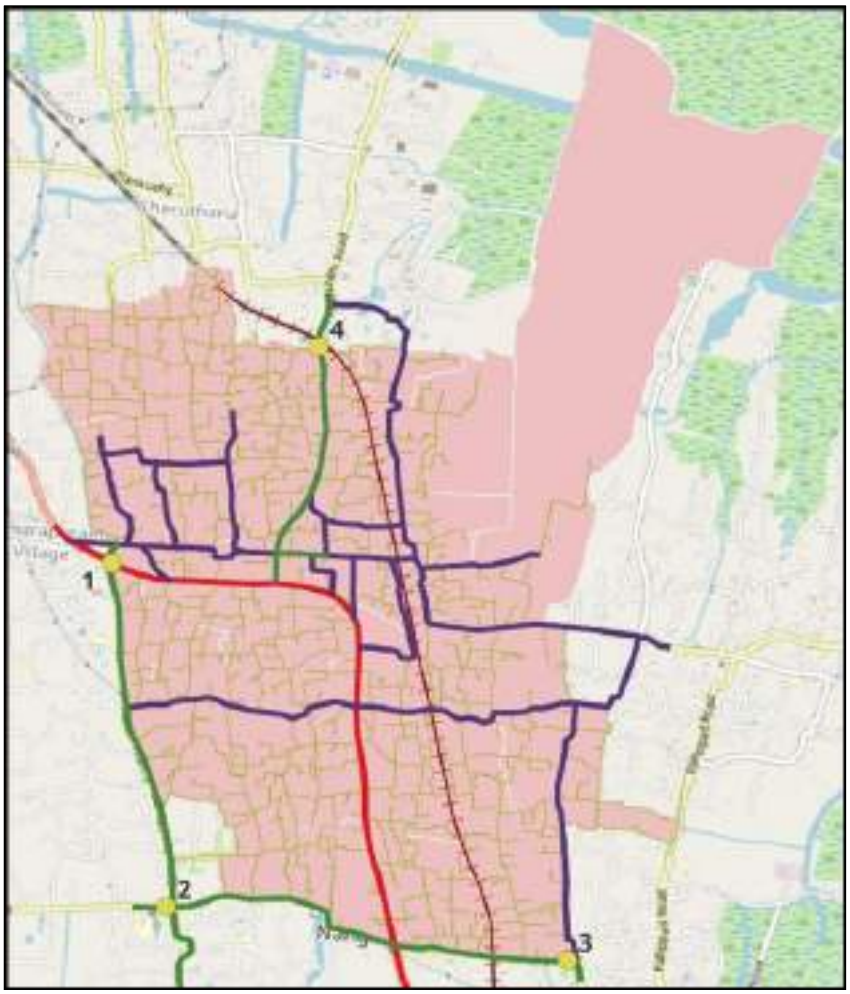

Figure 13.4 : Map showing homogenous sections and locations for OD survey

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

Table 13.5: List of Major Junctions in Haripad Town

Sl. No.	Name of intersection	No. of arms	Peak time	Peak hour PCU
1	Nangiarkulangara Jn	4	17.45 - 18.45	2768
2	Madhava Jn	3	09:45 - 10:45	2860
3	Townhall Jn	4	09.30 - 10.30	1809
4	Ezhikkakathu Jn	3	17.30 - 18.30	898
5	Prathimukham Jn	3	08.30 - 09.30	963

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

(b) Origin - Destination study

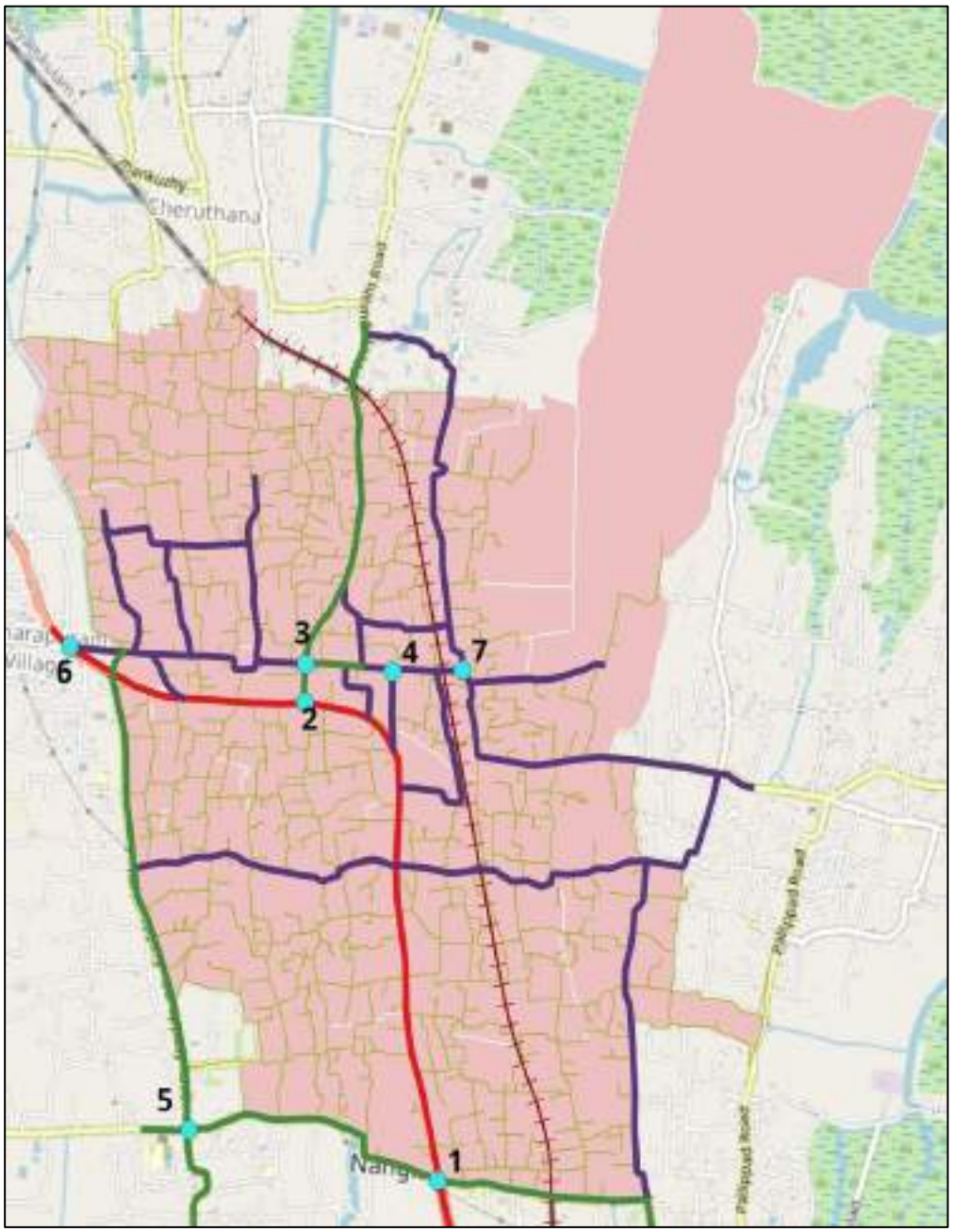

Figure 13.5 : Map showing locations selected for turning movement survey
Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

The pattern of inter-city vehicular movement through Haripad Town was analysed using origin–destination data collected at outer cordon survey locations. The movement trends of inter-city vehicles through these cordon points are presented in Table 13.6 . The analysis reveals that around 24,516 PCU - accounting for nearly 50% of the total traffic with origins and destinations outside Haripad - pass through the town without a specific stop within it. A significant share of this traffic is between Alappuzha and Kayamkulam (8,966 PCU). Other major through-movements include Alappuzha–Haripad (6,833 PCU), Thrikkunnapuzha–Haripad (5,806 PCU), and Mavelikkara–Haripad (3,580 PCU). This indicates that nearly half of the traffic is bypassable.

The modal split of inter-city trips further shows that two-wheelers dominate with 38% of trips, followed by cars at 27% and LCVs at 10%. Trucks and auto-rickshaws contribute almost equally, each with about 9% share.

Table 13.6: Pattern of inter-city vehicular movements in Haripad Town (PCU)

O/D		1	2	3	4	5	6	7	8	9	Total
		Haripad Town	Kayamkulam side	Alappuzha side	Veeyapuram side	Thiruvalla side	Thrikunnapuzha side	Pallipad side	Mavelikkara side	Chingoli side	
1	Haripad Town	1865	189	3288	1481	667	2729	259	1759	288	**12,524**
2	Kayamkulam side	423	-	4072	258	181	372	52	356	36	**5,751**
3	Alappuzha side	3545	4894	-	147	464	548	210	1630	516	**11,955**
4	Veeyapuram side	1515	250	48	-	102	134	32	70	93	**2,245**
5	Thiruvalla side	779	239	336	26	-	238	7	23	130	**1,778**
6	Thrikunnapuzha side	3077	518	509	180	26	-	141	980	453	**6,120**
7	Pallipad side	360	45	439	68	9	320	-	35	124	**1,402**
8	Mavelikkara side	1822	213	1746	132	112	824	11	-	251	**5,111**
9	Chingoli side	518	22	583	118	112	456	103	281	-	**2,195**
		13905	**6,370**	**11021**	**2,410**	**1,910**	**5,622**	**815**	**5,135**	**1892**	**49,079**

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

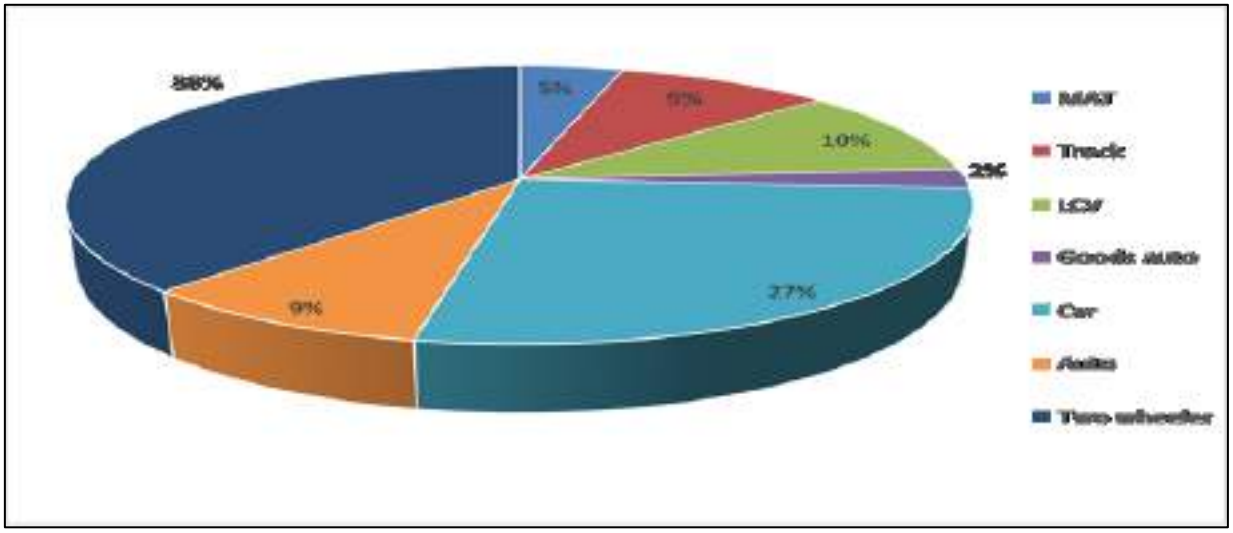

Figure 13.6 : Modal split of inter-city vehicular movement in Haripad
Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

13.4.2 Traffic Volume/Capacity Study

The capacity utilization of road stretches in Haripad town was assessed using the Volume-to-Capacity (V/C) ratio, which represents the ratio of peak-hour traffic volume on a road section to its designed capacity. Road capacities, listed inTable 13.7, were determined on a rational basis, considering factors such as the rural/urban setting and the width of the carriageway/ROW. Data from the road inventory survey was compared with IRC 106-1990 (Guidelines for Capacity of Urban Roads) and IRC 64-1990 (Guidelines for Capacity of Rural Roads) to establish standard capacities. Traffic volumes recorded at various road stretches were then compared with these capacities to compute the V/C ratios within the study area. The results, presented in Table 13.7, indicate that NH 66 has the highest V/C ratio (1.43) (which is expected to relieve after the completion of the ongoing road widening work), followed by Townhall Junction to Kachery Junction (1.30). Several other stretches, including Nangiarkulangara to Manimala, Madhava Junction to Townhall Junction, Kachery

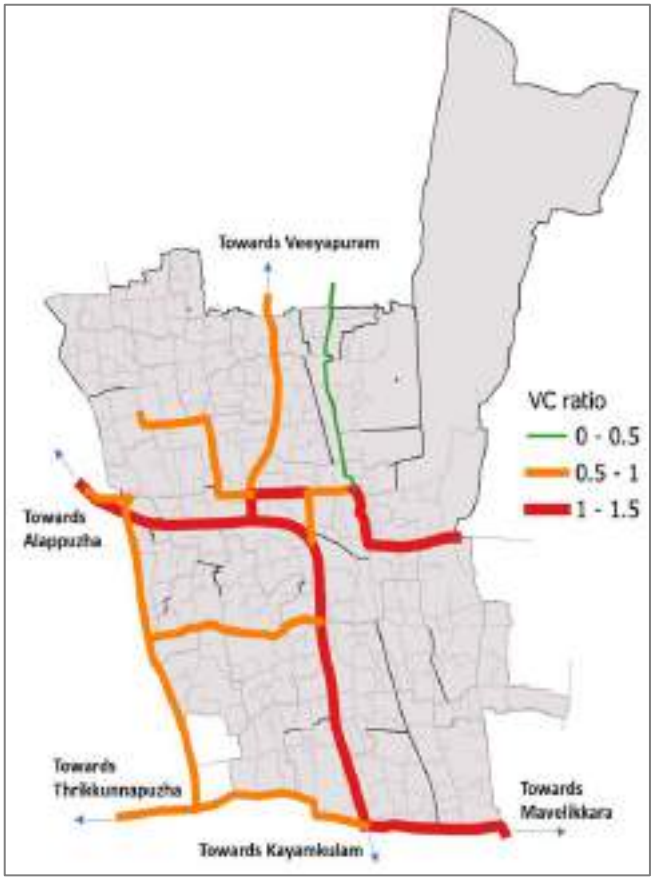

Figure 13.7 : Volume/Capacity utilization of major roads
Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

Junction to Ezhikkakathu Junction, and Prathimukham Junction to Nedumthara, also exhibit V/C ratios greater than 1, highlighting significant congestion in the town's road network.

Table 13.7: Peak hour volume capacity ratio of major roads in Haripad Town

Sl. No	Homogeneous section	Volume (PCU/Hour)	Capacity (PCU/Hour)	V/C Ratio
1	NH 66 (Narakathara – Nangiarkulangara)	2149	1500	1.43
2	Danapady – Karthikapalli	948	1000	0.95
3	Karthikapalli – Nangiarkulangara	570	800	0.71
4	Nangiarkulangara to Manimala	1355	1200	1.13
5	Madhava Junction to Townhall Junction	1230	1200	1.03
6	Townhall Junction to Thrippakkudam	1101	1200	0.92
7	Mannarasala temple to Townhall Junction	459	900	0.51
8	Townhall Junction to Kachery Junction	781	600	1.30
9	Kachery Junction to Ezhikkakathu Junction	740	600	1.23
10	Ezhikkakathu Junction to Prathimukham	798	800	0.99
11	Ezhikkakathu Junction to Taluk hospital Junction	583	600	0.97
12	RK Junction to Karthikapalli – Danapady road	719	750	0.96
13	Narakathara - Danapady	719	900	0.80
14	Townhall Junction to Subramanya Swami temple	892	900	0.99
15	Subramanya Swami temple to Mannarasala temple	459	750	0.61
16	Karthikapalli to Thrikkunnappuzha	987	1200	0.82
17	Prathimukham Jn to Nedumthara	875	800	1.09
18	Prathimukham Jn to Vellamkulangara	253	750	0.34

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

13.4.3 Speed and Delay Study

A speed and delay survey were conducted to assess congestion levels, roadway capacity, level of service, and the need for improvements within the road network. This survey served as a foundation for identifying key issues and estimating the potential benefits of proposed enhancements. The 'moving-car observer' method was employed to measure journey speeds and delays across all radial roads of the town, covering a total road length of 19 km. For this purpose, the road network was divided into homogeneous sections, and test runs were conducted at an average speed representative of the overall traffic flow to determine travel speeds. Separate runs were carried out for each direction. Corridors for speed and delay survey were identified after a detailed reconnaissance survey.

The overall peak-hour average speed across all surveyed roads was 29.54 km/h, with journey speeds ranging from 13 to 38 km/h. The highest average journey speed (38 km/h) was recorded on RK Road, while the lowest speeds were observed on the Danapady–Market Road stretch (around 14 km/h) and the Townhall Junction–Ezhikkakathu (via Kachery) section, where speeds dropped to about 15 km/h due to congestion.

Traffic delays in Haripad Municipality are primarily caused by railway crossings, congestion, and unorganized on-street parking. The Danapady–Karthikapally Road experiences low journey speeds due to the Danapady Market, while delays along the Townhall Junction–Taluk Hospital Road arise from unregulated parking that narrows the one-way carriageway. Additionally, the Nangiarkulangara–Manimala and Townhall Junction–Thrippakkudam stretches face intermittent delays due to frequent railway gate closures along the Alappuzha–Haripad line.

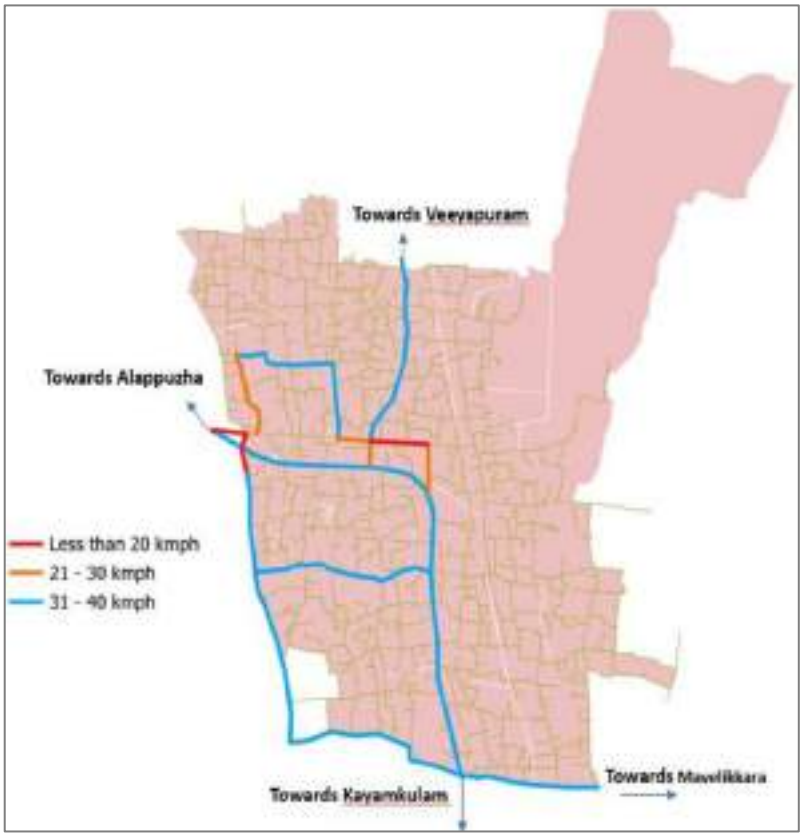

Figure 13.8 : Speed variations in major road stretches in Haripad Town

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report,

13.4.4 Parking Survey

Parking studies in Haripad town were undertaken to understand the existing parking supply and demand patterns and to identify key constraints and issues. The surveys provided insights into on-street and off-street parking characteristics, hourly utilization patterns, and average parking durations. These findings served as the foundation for formulating suitable policies to address parking needs in the town. Surveys were focused on locations with high parking demand. The Registration Number Plate method was used to gather data on parking duration and accumulation across all vehicle types. This data helped calculate parking turnover rates and peak-hour parking requirements. The parking study for Haripad involved the following steps:



Figure 13.9: Map showing locations selected for parking
Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

- Conducting detailed parking surveys
- Estimating existing parking supply and demand
- Forecasting future parking demand
- Preparing conceptual layouts for parking facilities

On-street parking surveys were conducted to assess demand along roadsides. Roads were divided into walkable-length segments, and vehicles parked in each segment were counted at regular intervals throughout the day. Informal interactions with local residents and users were also held to gather feedback on current parking facilities and to uncover suppressed demand in the area. Major road stretches/locations selected for parking survey is given in Table 13.8 and Figure 13.9: Map showing locations selected for parking shows the locations selected for parking survey.

Table 13.8: Road sections selected for parking survey

Sl. No.	Road section	Road name
1	Near Haripad Taluk Hospital	Service road in front of Taluk hospital
2	Townhall Jn – Taluk hospital Jn	Townhall Jn – Ezhikkakath – Taluk hospital road
3	Near Subrahmanya Swamy temple	Townhall Jn – Subrahmanya Swamy temple road

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)



Figure 13.10 : On street parking in the town

13.4.5 Parking Accumulation

Peak parking accumulation in Haripad Municipality, as shown in Table 13.9 and Figure 13.11 : Peak parking accumulation in various road sections , indicates significant on-street parking along key corridors. The highest parking load was recorded on the Townhall Junction–Taluk Hospital stretch with 114 ECS, followed by the Subramanya Temple (LHS) area with 25 ECS. Overall, two-wheelers dominate parking demand with 417 ECS, while cars account for 80 ECS.

Table 13.9: Peak parking accumulation at different road sections in Haripad town

Sl. No.	Location	Peak Time	Car	Two heelers	Pass auto	Mini bus	Mini truck	Goods auto	Tempo	Cycle	Total	ECS Value
1	Townhall Jn - Taluk Hospital (LHS)	10.00-10.30	42	279	9	2	3	1	0	0	336	114
2	Parking area near Subramanya temple (LHS)	8.30-9.00	6	4	1	0	0	0	7	0	18	25
3	Parking area near Subramanya temple (RHS)	18.00-18.30	1	41	0	0	0	0	0	0	42	9
4	Town hall Jn - Temple (LHS)	10.30-11.00	9	41	6	0	0	0	0	0	56	20
5	Town hall Jn - Temple (RHS)	8.00-8.30	3	14	1	0	0	0	1	1	20	9
6	Service road in front of Taluk hospital (LHS)	10.00-10.30	17	2	5	0	0	0	0	0	24	20
7	Service road in front of Taluk hospital (RHS)	18.30-19.00	2	36	4	0	0	0	0	0	42	11

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

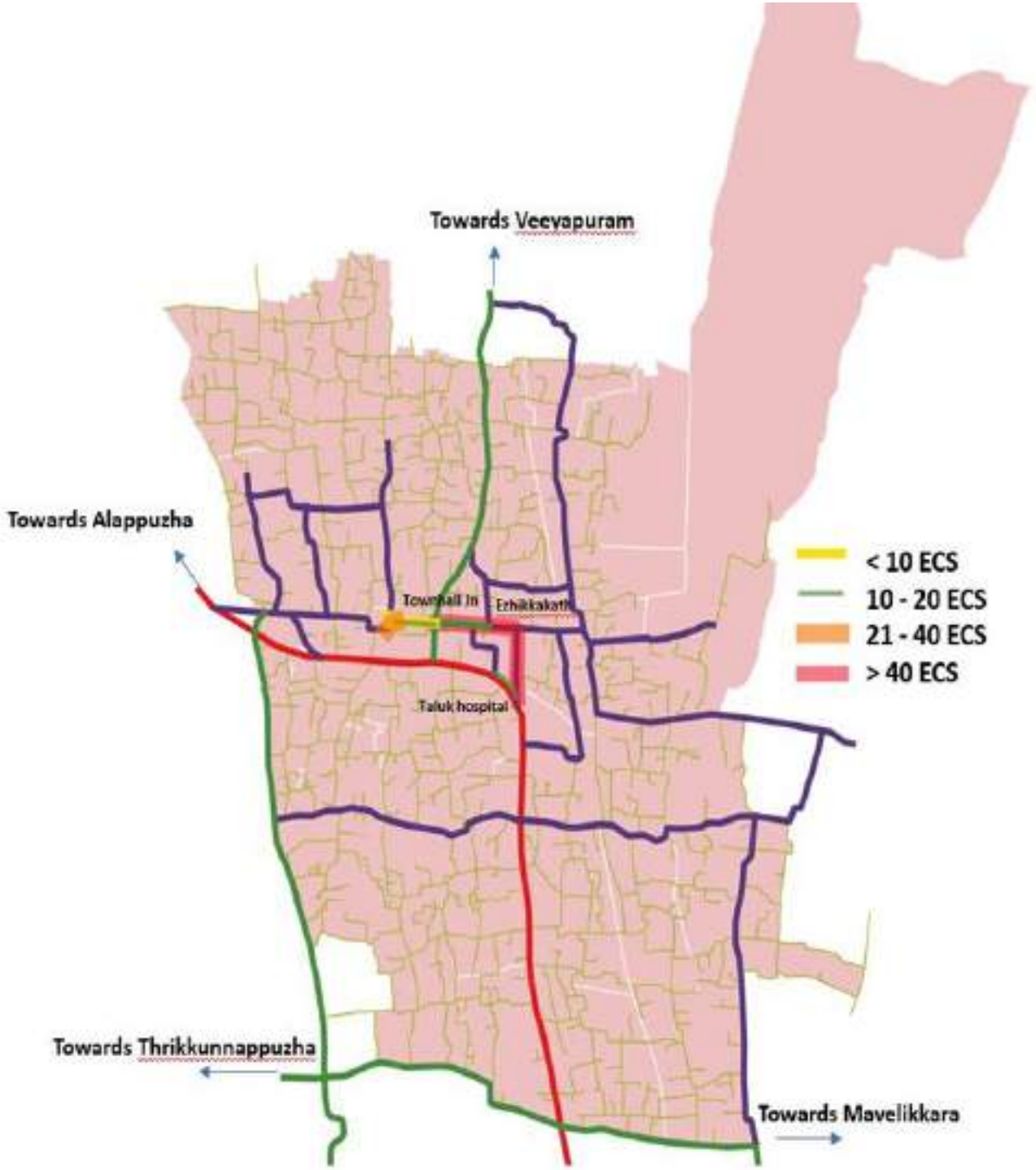

Figure 13.11 : Peak parking accumulation in various road sections

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

13.4.6 Parking Duration

Detailed analysis of the parking data has indicated that maximum number of vehicles are parked in the study area are less than 30 mins (67%). Highest parking duration of vehicles is present at left hand sides of Townhall Jn - Taluk Hospital and Townhall Jn – Temple arms. Table 13.10 and Figure 13.12 shows the duration of vehicles parked at all the survey locations.

Table 13.10: Parking Duration in Haripad town

Sl.No.	Road sections	Time (min)							Total
		<30	30-60	60-90	90-120	120-150	150-180	>180	
1	Townhall Jn - Taluk Hospital (LHS)	723	238	68	37	32	18	11	**1127**
2	Parking area near Subramanya temple (LHS)	120	24	9	9	4	3	2	**171**
3	Parking area near Subramanya temple (RHS)	97	16	5	3	2	0	1	**124**
4	Town hall Jn - Temple (LHS)	176	38	30	9	6	4	12	**275**
5	Town hall Jn - Temple (RHS)	61	9	9	3	1	2	4	**89**
6	Service road infront of Taluk hospital (LHS)	88	17	3	3	1	3	8	**123**
7	Service road infront of Taluk hospital (RHS)	141	26	10	4	2	4	15	**202**
	Total	**1406**	**368**	**134**	**68**	**48**	**34**	**53**	**2111**
	Percentage	**66.60**	**17.43**	**6.35**	**3.22**	**2.27**	**1.61**	**2.51**	**100.00**

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

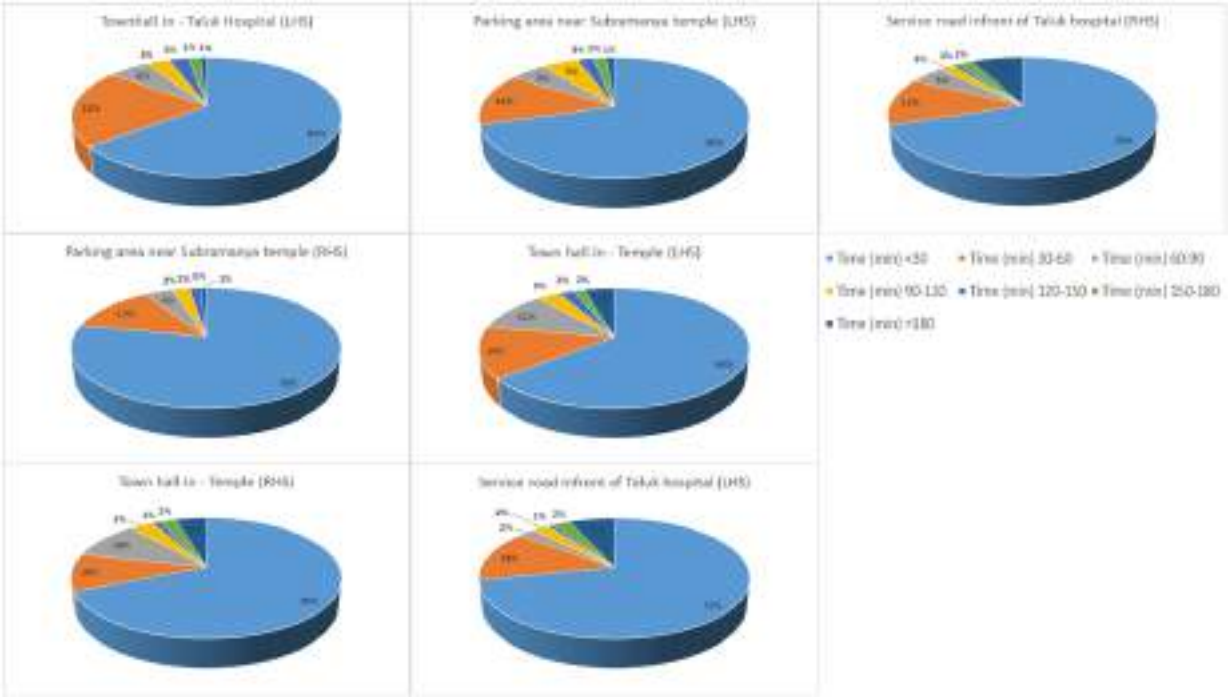

Figure 13.12 : Duration of Vehicles Parked at Various Stretches in Haripad

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

13.4.7 Pedestrian Survey

Pedestrians form a crucial segment of road users, and planning for pedestrian facilities requires a thorough understanding of demand, design standards, functional requirements, and spatial considerations. In Haripad town, a pedestrian traffic survey was conducted at key locations where frequent pedestrian crossing movements occur. These included major intersections and mid-blocks with high foot traffic. The survey captured pedestrian flow patterns across intersecting road arms and mid-sections, providing valuable data to recommend suitable improvements for enhancing pedestrian safety and ensuring smoother, safer movement throughout the town. The pedestrian volume count data was utilized to evaluate the intensity of pedestrian movement and the level of pedestrian-vehicular conflict, thereby helping to identify the appropriate pedestrian infrastructure and safety measures required. Table 13.11 and Figure 13.13 present the locations selected for Pedestrian survey.

Table 13.11: Locations selected for Pedestrian survey

Sl. No.	Area
1	Madhava junction
2	Townhall Jn
3	Subrahmanya Swamy temple

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

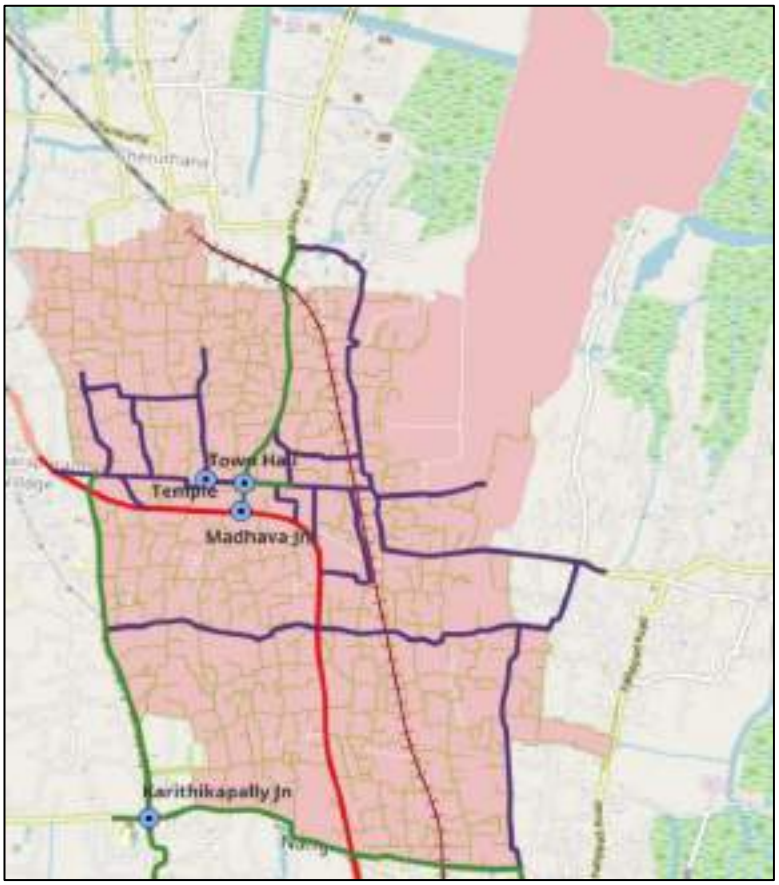

Figure 13.13 : Map showing locations selected for pedestrian

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

13.5 Rail Transport

Haripad town is connected by a broad-gauge railway line to Shornur, Mangalore, and Panvel via the Konkan Railway. Within the study area, Haripad Railway Station serve as the primary stations, while Karuvatta Halt is also located nearby. The major rail hub for the region is Alleppey Railway Station, situated about 29 kilometers away. Haripad Railway Station handles both express and passenger train services. It is located approximately 400 meters from the KSRTC bus station and is accessible via a short road from NH 66 that passes through residential areas. Additionally, the station is connected by Pallippadu Road.



Figure 13.15 : Haripad Railway Station

Haripad town has four major railway crossings and two railway underpasses, both situated at Vathukulangara. However, these underpasses are located in low-lying areas, making them prone to flooding during the rainy season, which renders them unusable for travel during that time.

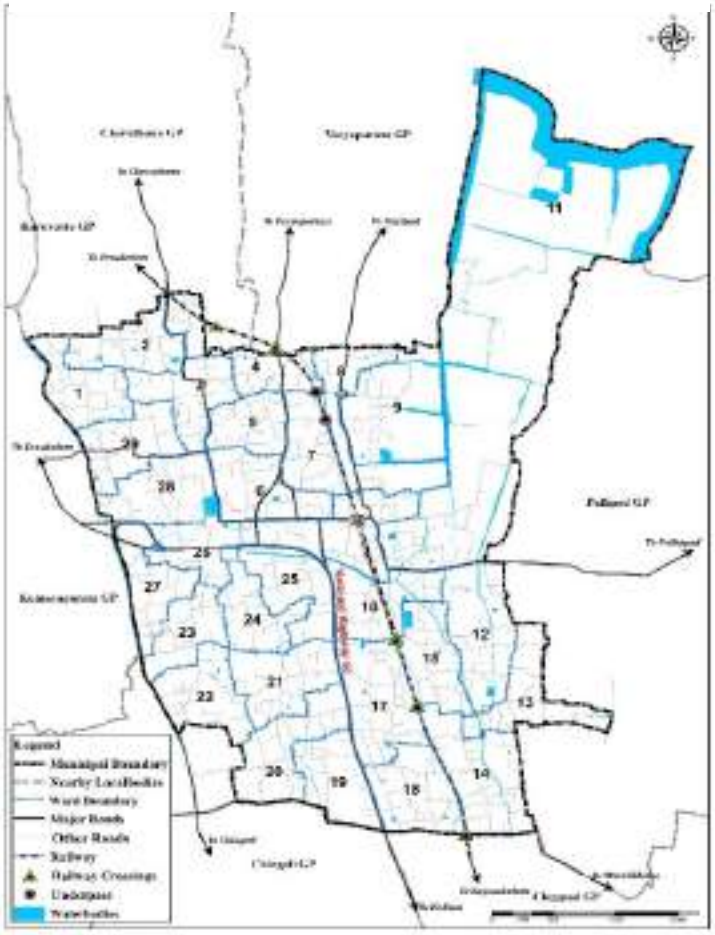

Figure 13.14 : Location of underpasses and railway crossings

TVU (Train Vehicle Unit) is a measurement used to assess traffic density at railway level crossings. It is calculated by multiplying the number of trains and the number of road vehicles passing through a crossing over a 24-hour period. Table 13.12 presents the TVU values for the four major railway crossings in Haripad. These values serve as a key criterion in determining the feasibility of constructing railway overbridges or underpasses to eliminate level crossings. The Table 13.12 highlights the Train Vehicle Units (TVU) for four major railway crossings in Haripad, reflecting the level of conflict between rail and road traffic. The location of railway crossings and underpasses are shown in Figure 13.14. Manimala Road and Veeyapuram Road show significantly high TVU values - 226,496 and 193,248 respectively - indicating severe delays, congestion, and heightened safety risks at these locations. The

crossings at RK Junction–Pallipad Road (90,112) and Prathimukham (74,912) exhibit comparatively lower but still considerable interaction levels.

Table 13.12: TVU values of major railway crossing in Haripad town

Sl. No.	Railway crossing	Train unit	Road unit	TVU
1	Veeyapuram road	32	6039	193248
2	Manimala road	32	7078	226496
3	Prathimukham	32	2341	74912
4	RK Jn – Pallipad road	32	2816	90112

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

13.6 Water Transport

Haripad enjoys the merits of its proximity to a well-connected canal system which was the part of Inland Water Transport (IWT) system. Haripad lies close to National Waterway 3 (NW-3), also known as the West Coast Canal, which spans 205 km from Kottappuram to Kollam. This strategic location along the Kayamkulam–Alappuzha stretch offers Haripad access to an alternative mode of transport for both cargo and passengers. Additionally, the nearby Kayamkulam backwaters link to other inland routes, enhancing regional connectivity and promoting water-based transport and tourism. Figure 13.16 illustrates the major channel linkages between the Achankovil River and the NW3. The map indicates that the Danapady Thodu extends southward from its origin and connects to the NW3 beyond the Karthikappalli Taluk boundary, ultimately draining into Pillakkadavu.

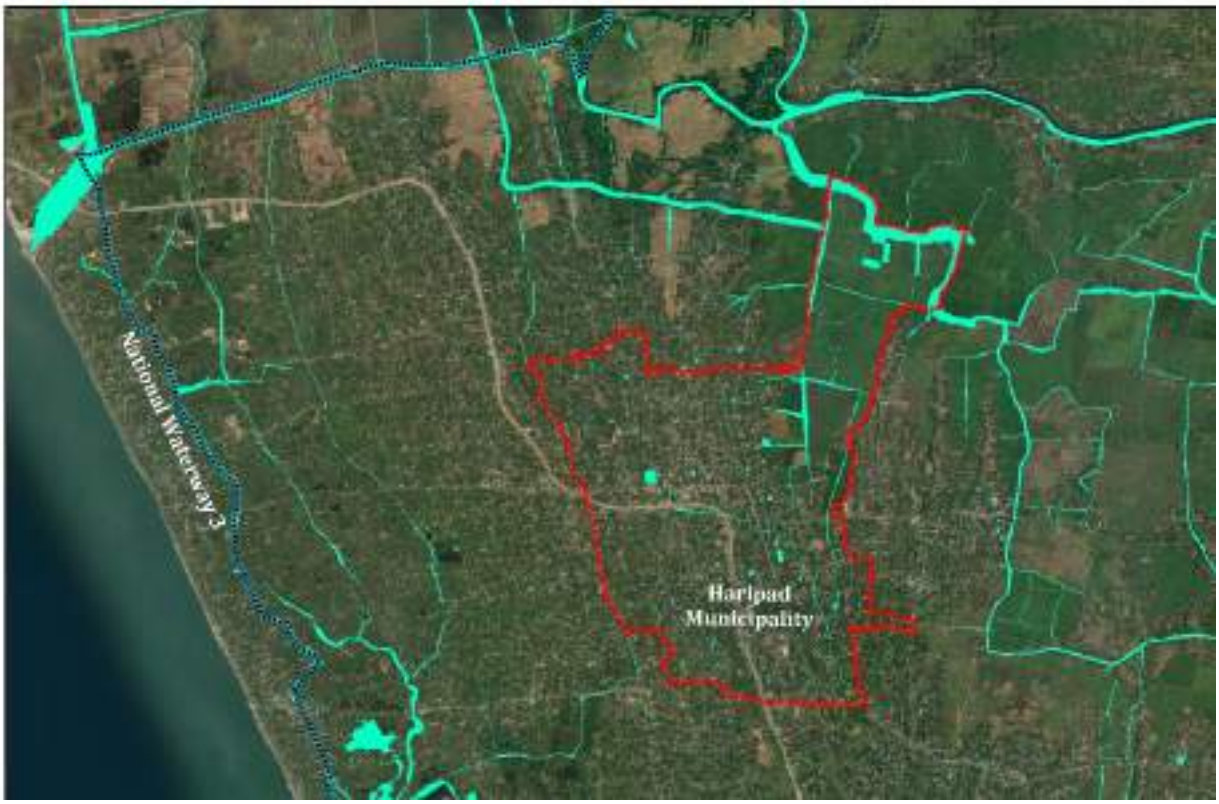

Figure 13.16 : Map showing the proximity of NW3 to Haripad town

13.7 Air Transport

The Cochin International Airport, which is the nearest to the town, is located 75 kilometres away from Haripad. The Thiruvananthapuram International Airport is 117 kilometres away along the NH 66.

13.8 Characteristics of Goods Traffic

13.8.1 Volume of Goods Vehicles

The Origin-Destination survey of the inter-city goods vehicles shows that 22,925 tonnes of goods are transported through the town on the day of survey. Trucks carried the maximum goods (52%), followed by MAT carrying 33% of goods traffic and Mini Truck carrying 14%.

Table 13.13: Inter-city goods transportation (in tons) pattern in Haripad town

Sl. No.	Mode of travel	Internal to Internal	Internal to External	External to Internal	External to External	Total	Total Vehicle Trips in %
1	MAT	36	609	443	6,450	7,538	33%
2	Truck	-	598	1,543	9,867	12,007	52%
3	Mini Truck	14	475	476	2,192	3,158	14%
4	Goods Auto	5	33	45	139	222	1%
Total						**22,925**	**100%**

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

13.8.2 Modal Split

In the case of goods traffic, the modal split refers to the type of vehicle used for its transportation. In Haripad town, most of the intercity goods and passenger transport were made by Light Commercial Vehicles (LCVs) (51%) followed by truck (35%) and MAT (17%). Modal split of goods vehicles has been shown in Figure 13.17

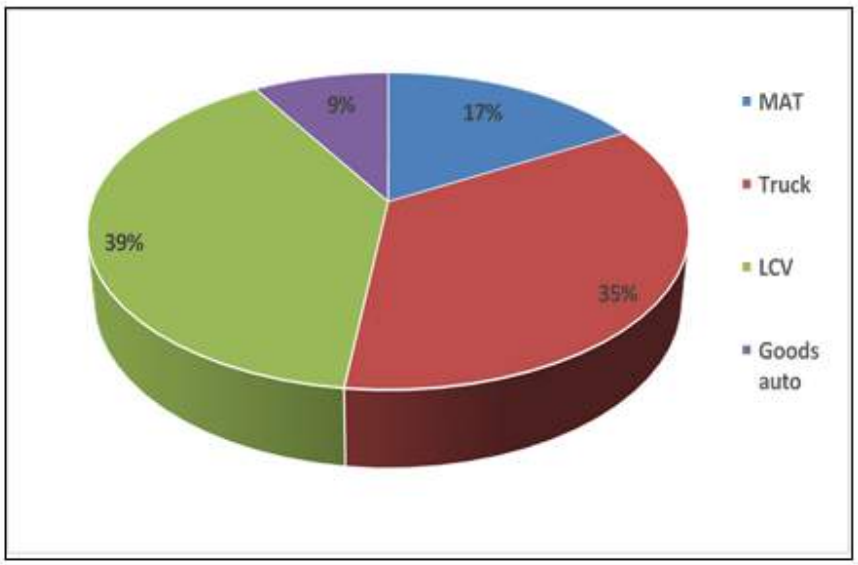

Figure 13.17 : Modal split of inter-city goods vehicles in Haripad town

13.8.3 Composition of Goods Carried

Among the different categories of goods transported by goods vehicles in Haripad Municipality, construction materials account for the largest share at 66%, followed by industrial goods at 19% and miscellaneous goods at 6%. Petroleum products represent the smallest share, comprising only 2%. The distribution of inter-city goods traffic by commodity is presented in Table 13.14.

Table 13.14: Distribution of inter-city goods traffic according to commodity carried in Haripad Municipality

Sl.No	Commodity	Percentage of goods carried	Sl.No	Commodity	Percentage of goods carried
Foods grains		5%	30	Firewood	0%
1	Wheat	43%	31	Bamboo & wood	1%
2	Rice & paddy	57%	32	Furniture	0%
3	Grains & pulses	0%	Industrial goods		19%
4	Other food grains	0%	33	Steel machinery	2%
Agricultural products		3%	34	Iron & steel	78%
5	Fruits & vegetables	19%	35	Aluminium	0%
6	Milk & milk products	7%	36	Electrical goods	2%
7	Coconut & copra	5%	37	Tyres& tubes	0%
8	Meat	0%	38	Spare parts	0%
9	Fish	14%	39	Chemicals & Drugs	0%
10	Eggs	2%	40	Medicines	0%
11	Spices including rubber	0%	41	Fertilizers	0%
12	Tea & coffee	0%	42	Soap	0%
13	Sugar	0%	43	Rubber & plastic goods	13%
14	Bakery items	6%	44	Glass	0%
15	Beverages& toddy	2%	45	Leather goods	0%
16	Soda & drinks	3%	46	Ready-made garments	2%
17	Provisions	32%	47	Stationery & paper	1%
18	Hay	0%	48	Coir & coir products	0%
19	Cattle feed	10%	Petroleum products		1.9%
Construction materials		66%	49	Motor spirit (Petrol)	28%
20	Cement	5%	50	Kerosene	0%
21	Quick lime (Kakka)	0%	51	LPG	69%
22	Earth & gravel	35%	52	Other POL products	3%
23	Sand & clay	46%	Miscellaneous		6%
24	Brick & tiles	5%	53	Empty bags, tins & battles	0%
25	Granite & rubbles	8%	54	Parcel	21%
26	Sanitary wares	0%	55	Ice	0%
27	Asbestos sheets	0%	56	Miscellaneous	75%
28	Paints & varnish	0%			
29	Timber	0%			

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

13.8.4 OD of goods transportation

The OD matrix reveals that maximum goods transported is from zone 36 (i.e. Ernakulam district) and maximum transported to zone 35 (Within the district, towards Ernakulam side). There is also enormous goods traffic originating from zone 35 and 44 (from Within the district, towards Ernakulam side and Pathanamthitta district). The second most travelled destination of goods traffic is Kollam followed by Haripad town.

13.8.5 Pattern of Goods Traffic

Pattern of goods traffic refers to the intercity and intracity locations to which these goods are either sent to or brought from. Pattern of goods traffic is directly proportional to the economic and commercial significance of such locations and the amount (in tonnes) of goods transported. The OD matrix shows these locations in the form of zones. In the case of Haripad, the maximum amount of goods is transported from zone 36 (Ernakulam to Alappuzha) and the maximum goods transported to zone 35 (within Alappuzha, towards Ernakulam side). Goods traffic also originates from zone 34 and 44 (from within Alappuzha, towards Ernakulam side and Pathanamthitta district). The desire lines for the intercity goods traffic pattern are shown Figure 13.18.

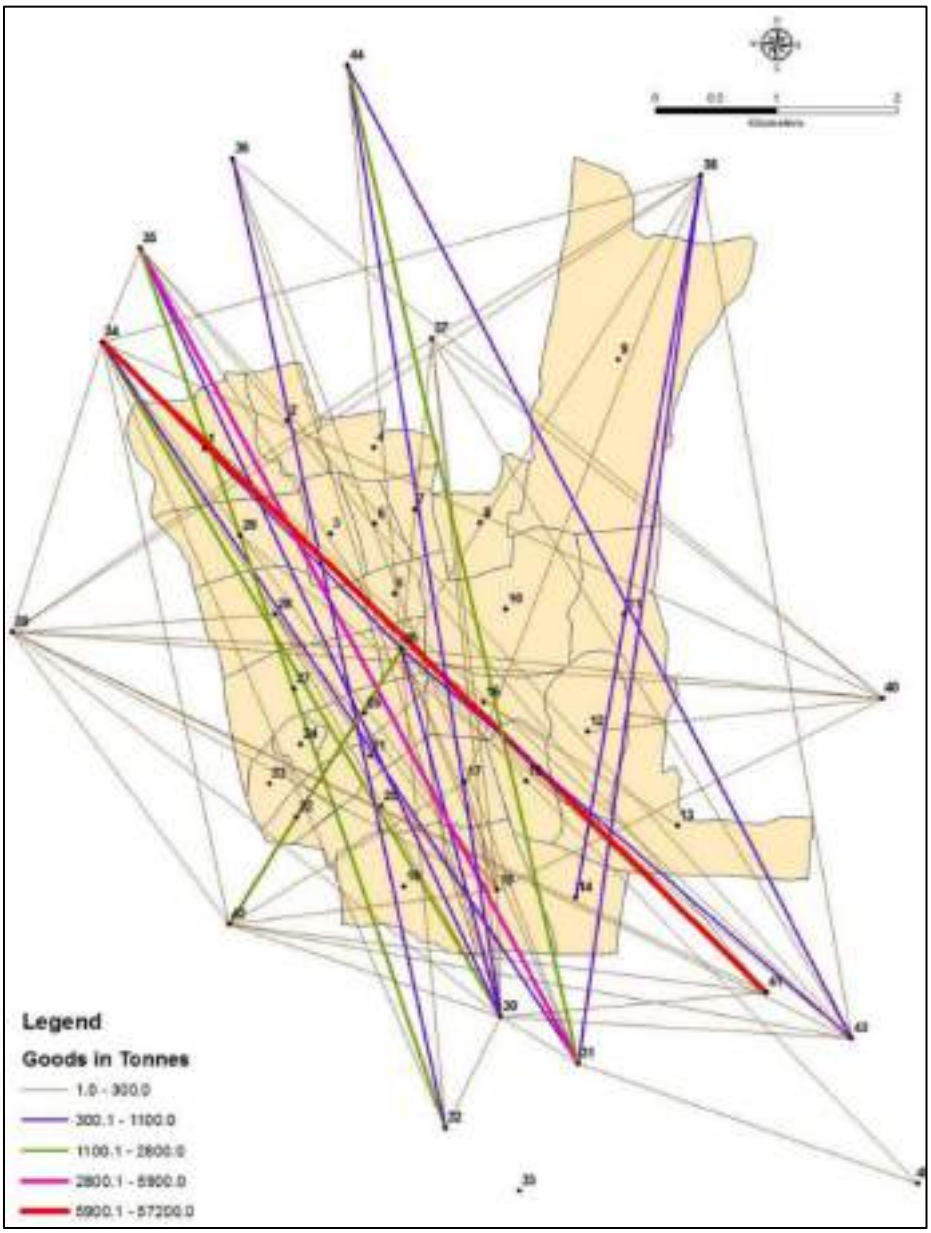

Figure 13.18 : Desire lines showing the intercity goods pattern (in tonnes)

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

13.9 Other Infrastructure Facilities

13.9.1 Bus stand

Public transport in Haripad town is served by both KSRTC and private buses. KSRTC services operate from the KSRTC bus stand located along NH 66 near Taluk Hospital Junction, while private buses pick up and drop passengers along NH 66 near the KSRTC stand, as there is no designated private bus terminal or parking facility in the town. According to KSRTC data, a total of 225 trips are operated from or through the Haripad KSRTC bus station daily. Among these, the highest number of services is on the Haripad–Karunagapally route with 68 trips, followed by 50 trips to Alappuzha town, 24 trips to Kottayam, and 17 trips to Thiruvalla. Table 13.15 provides the detailed schedule and routes of these services.

Table 13.15: KSRTC bus route details in Haripad Town

Sl. No.	Origin	Destination	Trip
1	Haripad	Alappuzha	50
2	Haripad	Karunagappally	68
3	Haripad	Thiruvalla	17
4	Haripad	Kottayam	24
5	Haripad	Pathanamthitta	12
6	Haripad	Cherthala	5
10	Haripad	Thrikkunnappuzha	15
11	Haripad	Thottappally	9
12	Haripad	Oachira	7
13	Haripad	KV jetty	6
14	Haripad	Vizhinjam	7
15	Haripad	Nooranad	5
Total			**225**

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)



Figure 13.19 : KSRTC Bus Station, Haripad

Around 80 private buses operate within Haripad and to nearby destinations across Alappuzha district. These services connect Haripad with places such as Mavelikkara, Chengannur, Pathanamthitta, Thiruvalla, Pallippad, Mannarasala, Bharanikavu, and Arattupuzha, running between 6:00 a.m. and 8:30 p.m. The buses halt along both sides of NH 66 near the Taluk Hospital, with one side serving routes towards Mannarasala and the other towards Mavelikkara and Kayamkulam. To assess the extent of passenger movement using KSRTC buses, ridership patterns to different destinations were studied. The peak-hour ridership of KSRTC services towards various locations is presented in Table 13.16.

Table 13.16: Peak hour KSRTC bus ridership at Haripad KSRTC stand

Direction	Passenger count (No.)		Total	Peak Hour
	Male	Female		
Trivandrum - Kollam	194	151	345	10:00 - 11:00
Mavelikkara	45	32	77	17.30 – 18.30
Kottayam	30	25	55	17.30 – 18.30
Cherthala/Alappuzha	185	150	335	11.00 – 12.00

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

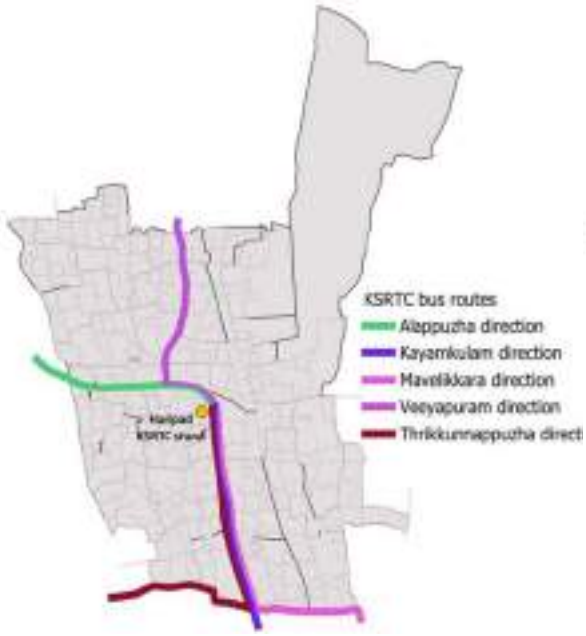

Figure 13.20 : Map showing KSRTC bus routes



Figure 13.21 : Map showing Private bus routes

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

13.9.2 Railway station

A 12-hour survey of passenger entry and exit at Haripad railway station was conducted to evaluate the volume of ridership managed by the station. This assessment helps in understanding trip attraction patterns to and from the station. The peak-hour pedestrian count is presented in Table 13.17, while hourly passenger movements in both directions are illustrated in Figure 13.22

Table 13.17: Peak hour pedestrian count at Haripad railway station

Peak pedestrian count (No.)				Total	Peak Hour
In		Out			
Male	Female	Male	Female		
74	40	187	115	416	18:00 - 19:00

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

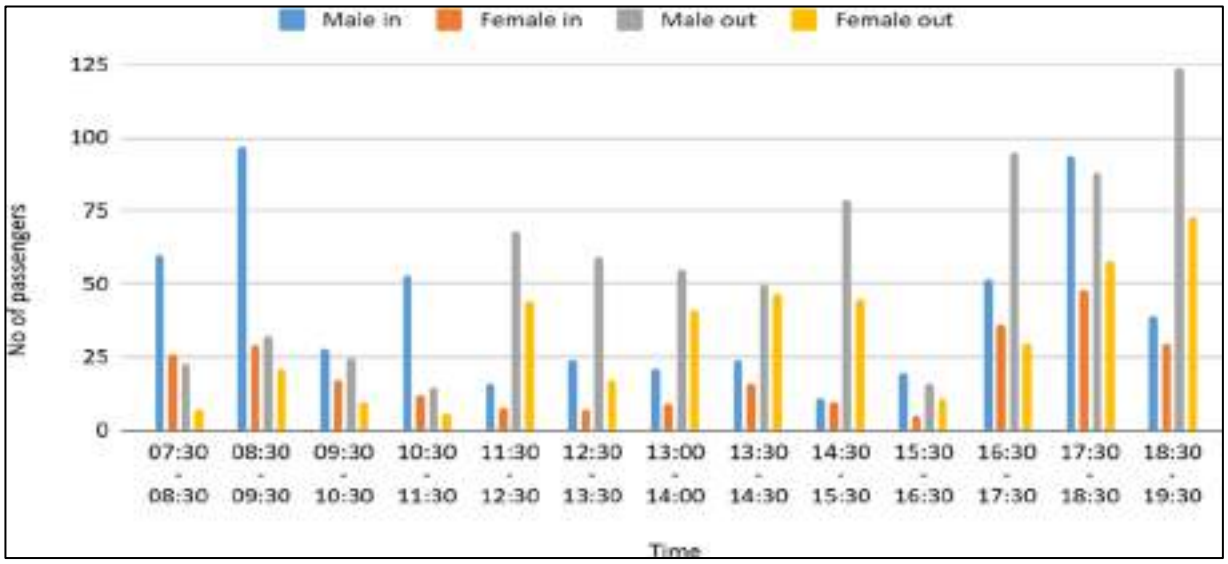

Figure 13.22 : Hourly passenger movement towards and away from the station

13.9.3 Auto Parking

Similar to other medium-sized towns in Kerala, Haripad has a considerable number of auto rickshaws catering to intra-city travel as well as trips to nearby panchayats. Location-wise distribution of passenger auto rickshaws operating within the town is provided in Table 13.18 and their locations are shown in Figure 13.23. Due to limited public transport accessibility in several remote areas, residents are often compelled to rely on intermediate public transport (IPT) modes.

Table 13.18: Details of auto stands in the town

Sl. No	Location of auto stand
1	Haripad Taluk hospital
2	Townhall Jn
3	Madhava Jn
4	Danapady Jn
5	Karthikapally Jn
6	Nangiarkulangara Jn
7	Mannarasala temple
8	Ezhikkakath Jn
9	Kachery Jn
10	Haripad KSRTC stand
11	Haripad Railway Station

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)



Figure 13.23 : Location of Auto stands in Haripad town



Figure 13.24 : Auto stand at Town Hall Junction



Figure 13.25 : Auto stand in front of the KSRTC bus station

13.9.4 Pedestrian Facilities

Ensuring smooth pedestrian movement is essential for improving overall traffic flow in Haripad town. Similar to many medium-sized towns, Haripad faces several pedestrian-related challenges. The major issues identified during the survey at key junctions include:

- Discontinuous footpaths at major intersections
- Absence of railing barriers on existing footpaths
- Lack of pedestrian connectivity between NH 66 and the town centre
- Uncovered roadside drains
- Inadequate pedestrian crossings, traffic lane markings, and signage
- Unsupervised vehicle parking encroaching into pedestrian zones
- Bus bays obstructing pedestrian movement and disrupting other road users

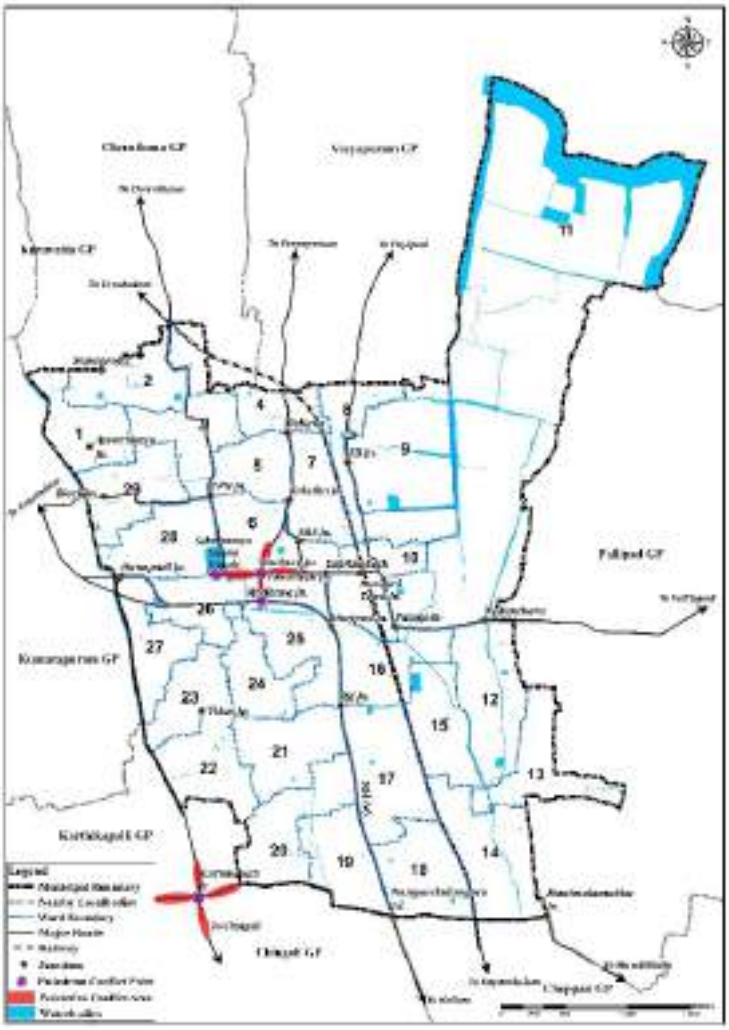

Figure 13.26 : Location of critical pedestrian-traffic conflict points

In addition to these observations, a detailed pedestrian cross-movement survey was conducted at nine major locations within Haripad Municipality to identify potential conflict zones. The PV^2 method (where P represents pedestrian crossings during the peak hour and V represents the corresponding vehicular

volume) was applied to evaluate conflicts. The survey highlighted critical pedestrian–traffic conflict points, particularly at:

- Veeyapuram arm at Town Hall Junction ($PV^2 = 1.71\times10^8$)
- Chingoli arm at Karthikapally Junction ($PV^2 = 1.54\times10^8$)
- Town Hall–Madhava Junction Road ($PV^2 = 1.23\times10^8$)

These locations experience high pedestrian volumes coinciding with dense vehicular traffic during peak hours, creating significant safety concerns. The Traffic and Transportation Study for Haripad Town in Alappuzha District, prepared by the National Transportation Planning and Research Centre (NATPAC), has already addressed most of these pedestrian issues through proposed short-term traffic improvement measures aimed at ensuring pedestrian safety and facilitating uninterrupted pedestrian movement even during peak periods. Figure 13.26 illustrates the locations of the critical pedestrian-traffic conflict points in the town.

13.10 Accident data, Accident Prone Areas

Accident data for the years 2021, 2022, and 2023 were collected from the State Crime Records Bureau, Thiruvananthapuram, to analyse the accident scenario in Haripad town, including accident locations and severity. Table 13.19 presents the details of accidents categorized by severity over the three-year period. The data shows that 75 accidents were reported in 2021, which rose to 102 in 2022 and further to 126 in 2023. Correspondingly, the number of accident victims increased from 101 in 2021 to 144 in 2022 and 189 in 2023. In 2023, more than half of the total accidents were classified as grievous, while minor accidents accounted for 14%. Fatal accidents were reported in about 8% of the cases.

Table 13.19: Growth in accidents in Haripad Town

Year	No. of accidents				No. of causalities			
	Fatal	Grievous	Minor	Total	Fatal	Grievous	Minor	Total
2021	8	58	9	75	8	62	31	**101**
2022	12	78	12	102	12	86	46	**144**
2023	10	99	17	126	11	108	70	**189**

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

The major accident-prone locations in Haripad town are listed in Table 13.20 and the locations are shown in Figure 13.27. These locations have been ranked based on the Crash Severity Index (CSI), which is derived from the severity factors of reported crashes. The analysis shows that Nangiarkulangara records the highest CSI (173), followed by Narakathara (130) and Taluk Hospital Junction (120). Notably, all these critical accident-prone spots are located on or near NH 66, which passes through the town.

Table 13.20: Major accident-prone locations in Haripad

Sl. No.	Accident Prone Locations	Crash Severity index
1	Nagiarkulangara	173
2	Narakathara	130
3	Taluk hospital Jn	120
4	RK Jn	106

5	Madhava Jn	101
6	Maruthamukku	85
7	Thekkenada	43
8	Townhall Jn	40
9	TKM College Jn	36
10	Danapady market	26
11	Karthikapalli Jn	24
12	Nedumthara bridge	23
13	Manimala Jn	18

Source: Traffic and Transportation Study for Haripad Town in Alappuzha District (NATPAC Report, 2025)

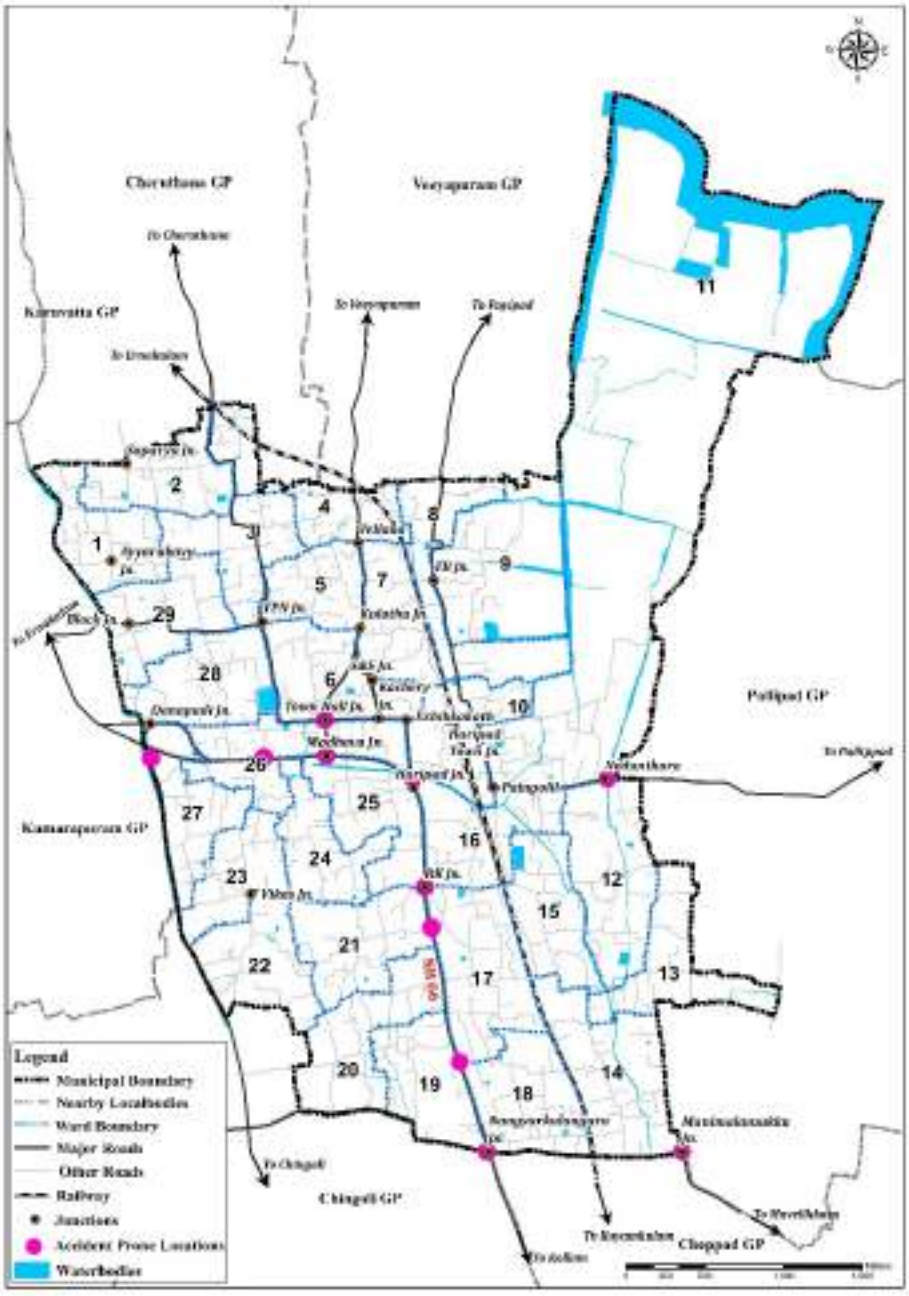

Figure 13.27 : Major accident-prone locations in Haripad

13.11 Identification of gaps in network

The traffic and transportation assessment of Haripad town reveals a network constrained by capacity limitations, poor pedestrian infrastructure, and inadequate integration of public transport services. Some of the major issues identified are listed below:

- Overloaded road capacity, particularly on NH 66 and at major junctions like Karthikapally junction, Townhall junction, Ezhikkakathu junction and Nangiarkulangara junction.
- Railway underpasses at Vathukualangara being flooded during rainy season and unfit for travel.
- Lack of integrated and planned bus infrastructure (no private bus stand, KSRTC congestion).
- Poor connectivity between railway station and town core.
- High dependence on auto rickshaws due to inadequate last-mile public transport.
- Significant proportion of through-traffic burdening the town due to absence of a bypass.
- Rising accident severity at NH junctions, highlighting urgent need for safety measures.
- Inadequate pedestrian facilities, with unsafe crossings and limited footpath continuity.
- Lack of proper parking spaces resulting in on-street parking at the major junctions like Town Hall junction, Kachery Junction etc.

13.12 Effect of hazard risk in this sector

Based on the traffic and transportation analysis for Haripad, the sector is exposed to significant multi-dimensional hazard risks arising from high accident rates, flood vulnerability, and infrastructure deficiencies. The sharp increase in road accidents over the past three years—coupled with a high proportion of grievous and fatal cases—indicates growing safety concerns and heightened vulnerability of road users. Major accident blackspots are concentrated along NH 66, where heavy through-traffic, junction conflicts, roadside commercial activity, and inadequate pedestrian infrastructure compound risks. Unsafe pedestrian–vehicle interactions, discontinuous footpaths, absence of controlled crossings, poor parking management, and weak enforcement further aggravate exposure,

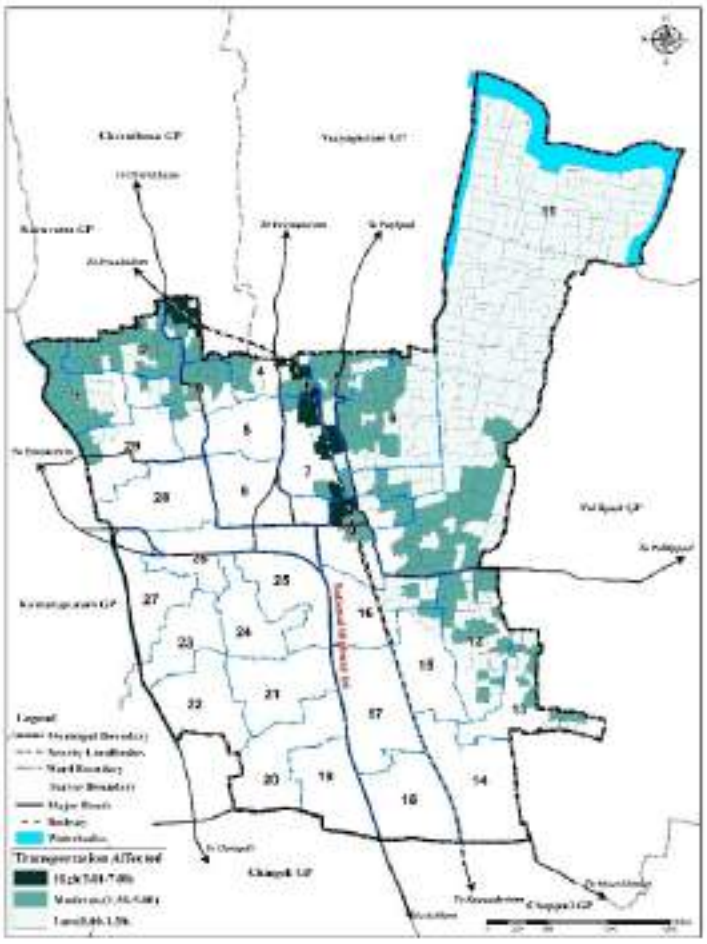

Figure 13.28 : Cadastral level transportation vulnerability in flood prone area

particularly for pedestrians and two-wheeler riders who constitute a dominant modal share in the town.

In addition to road safety concerns, flood vulnerability significantly impacts the transportation network. Figure 13.28 highlights that major roads located north of NH 66 are highly susceptible to inundation during intense rainfall events. Approximately 11.8% of the LSGD roads within the municipality fall under flood-prone areas, posing a serious concern from both mobility and disaster management perspectives. During past flood events, waterlogging has disrupted traffic movement, weakened pavement structures, damaged road shoulders, affected culverts and drainage systems, and reduced the functional efficiency of critical links. The railway line, which traverses several severely flood-prone zones, further underscores the exposure of essential transport infrastructure to climate-related risks. Flooded road segments also compromise emergency response and evacuation operations, limiting safe access to relief centres, hospitals, and critical facilities.

Unless addressed through targeted infrastructure upgrades, flood-proofing of vulnerable stretches, junction improvements, traffic management reforms, and pedestrian safety enhancements, the transportation sector in Haripad will continue to face recurring safety hazards, operational inefficiencies, and climate-induced disruptions, ultimately affecting the town's resilience and overall mobility performance

13.13 Inference

The traffic and transportation assessment of Haripad reveals that while the town enjoys strategic regional connectivity through NH 66, the railway network, and established KSRTC and private bus services, its internal mobility structure is increasingly under pressure. Rising vehicular ownership, concentration of commercial and institutional activities within a compact town centre, and limited carriageway widths in key corridors have collectively reduced the operational efficiency of the road network. Critical junctions such as Ezhikkath Junction, Town Hall Junction, and stretches adjoining major government offices, schools, and markets experience recurring congestion, unmanaged parking, and pedestrian–vehicle conflicts, particularly during peak hours.

The current one-way system, though introduced as a traffic management measure, is not functioning optimally due to on-street parking, encroachments onto footpaths, informal vending, and inadequate enforcement. Pedestrian infrastructure remains discontinuous in several stretches, with insufficient crossings, lack of tactile paving, and minimal safety measures for school children and elderly users. Accident blackspots, especially along NH 66 and major connecting roads, highlight deficiencies in geometric design, speed regulation, visibility, and intersection control.

The analysis also underscores gaps in organized parking infrastructure, integrated bus stand planning, loading–unloading management, and scientific traffic signalling systems. Public transport nodes lack proper multimodal integration, contributing to congestion and unsafe circulation patterns. Additionally, flood-prone road segments and drainage deficiencies reduce network reliability during monsoon periods, affecting emergency mobility and evacuation preparedness.

Overall, the findings indicate that Haripad's transportation system is at a critical transition point. Without integrated planning interventions—such as junction redesign, pedestrian prioritization, structured parking solutions, traffic calming, public transport strengthening, and climate-resilient road infrastructure—the system will continue to face declining safety standards and reduced mobility efficiency. A coordinated, risk-informed mobility strategy aligned with the Master Plan vision is therefore essential to ensure safe, efficient, and sustainable transportation for residents, commuters, and visitors, while supporting the town's economic growth and tourism potential.

CHAPTER
14

OTHER PHYSICAL INFRASTRUCTURE



Physical infrastructure forms the foundation of Haripad's urban functionality and quality of life. This chapter evaluates the town's essential systems - water supply, drainage, sewerage, solid waste management and energy - assessing their current capacity, service gaps and resilience to future demands. Reliable and efficient infrastructure is critical for public health, environmental sustainability and balanced urban growth. The analysis presented here supports strategies for strengthening service delivery, upgrading aging drainge networks and ensuring that Haripad's infrastructure systems evolve to meet the needs of a growing and resilient town.

- Introduction
- Water Supply
- Drainage
- Sewerage System
- Solid Waste Management
- Energy

14. OTHER PHYSICAL INFRASTRUCTURE

14.1 Introduction

Physical infrastructure is a critical component of urban development, influencing livability, economic growth, and environmental sustainability. Beyond transportation, key infrastructure elements are water supply, drainage, sewerage, solid waste management and energy. This chapter assesses the existing infrastructure in the planning area, examining its adequacy, spatial distribution, and operational efficiency while identifying gaps and challenges. The analysis provides a foundation for strategic interventions aimed at enhancing infrastructure resilience, optimizing resource utilization, and ensuring equitable access to essential services.

1.2 Water Supply

14.1.1 Existing water supply system

The Haripad Municipality does not have a comprehensive drinking water distribution network; the existing system supplies water only to select areas of the town. Drinking water sources of the town are domestic wells, public bore wells, and the Pampa / Achankovil rivers. The Detailed Project Report (DPR) on the AMRUT 2.0 – UWSS for Haripad Municipality, 2022 states that water supply in some areas of the Municipality are provided through the Urban Water Supply Scheme (UWSS) which depends on a single tube well located at Thrippakkudam. According to the data received from Kerala Water Authority (KWA), water is pumping to the Over Head Storage Reservoir tank with a capacity of 0.68 Lakh Litres located in Municipal Office compound and supply untreated water directly into distribution lines, serving only 849 water connections which is insufficient for the entire town area.

14.1.2 Water Source

According to the data received from Kerala Water Authority (KWA), the primary drinking water source in the town is groundwater. The surface water source is the Pampa River, as noted in the DPR on the Comprehensive Sewerage Scheme for Haripad Municipality, Alappuzha District – Phase 1 (2022). As per the socio-economic survey 2024, 70.5% of the municipal population depends on domestic wells, while 10.7% relies on public bore wells. The survey result shows that majority of households have access to source of water within their premises. According to socio-economic survey, 87.9% of households has not reported any water shortages.

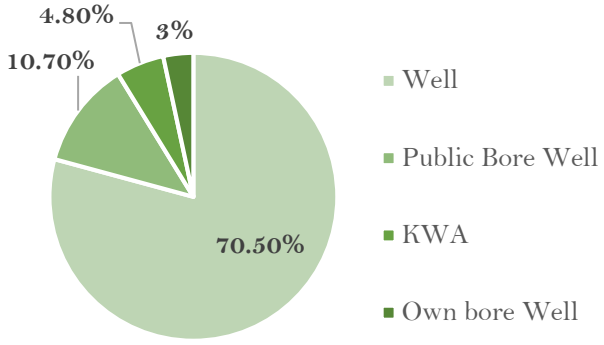

Figure 14.1: Source of Water

Source: Socio-Economic Survey, 2024

As per the data received from Kerala Water Authority (KWA), the Municipality has 151 public taps, providing water to areas with limited or no household connections. Water Authority connections are not available in Wards 14, 15, 16, 17, 18, 19, and 20.

14.1.3 Ground Water

The groundwater scenario in Haripad Municipality is characterized by significant reliance on domestic wells and bore wells for drinking water and irrigation needs. The ground water table is relatively high. However, certain areas experience seasonal ground water depletion, particularly during summer months. Over-extraction and the absence of effective recharge mechanisms have contributed to declining groundwater levels in some localities. Additionally, saltwater intrusion in low-lying areas especially in paddy fields (padasekharam) poses a concern, affecting groundwater quality.

14.1.4 Scarcity of Water

As per data received from the Kerala Water Authority (KWA), water supply shortages are reported predominantly in Wards 9 to 29 of Haripad town, with the problem becoming more acute during the summer months when groundwater levels decline and demand increases. These shortages are largely attributed to reduced source availability, limited storage capacity, and distribution constraints during peak demand periods.

However, findings from the socio-economic survey indicate that a significant majority of households - about 87.9% - do not experience regular water shortages, suggesting that water stress is localized and seasonal rather than uniform across the Municipality. The remaining households reported varying degrees of scarcity, ranging from occasional interruptions to prolonged shortages during dry periods. The spatial pattern, nature, and severity of water scarcity across different wards are illustrated in Figure 14.2, highlighting areas that require targeted interventions such as source augmentation, improved storage, demand management, and strengthened distribution networks.

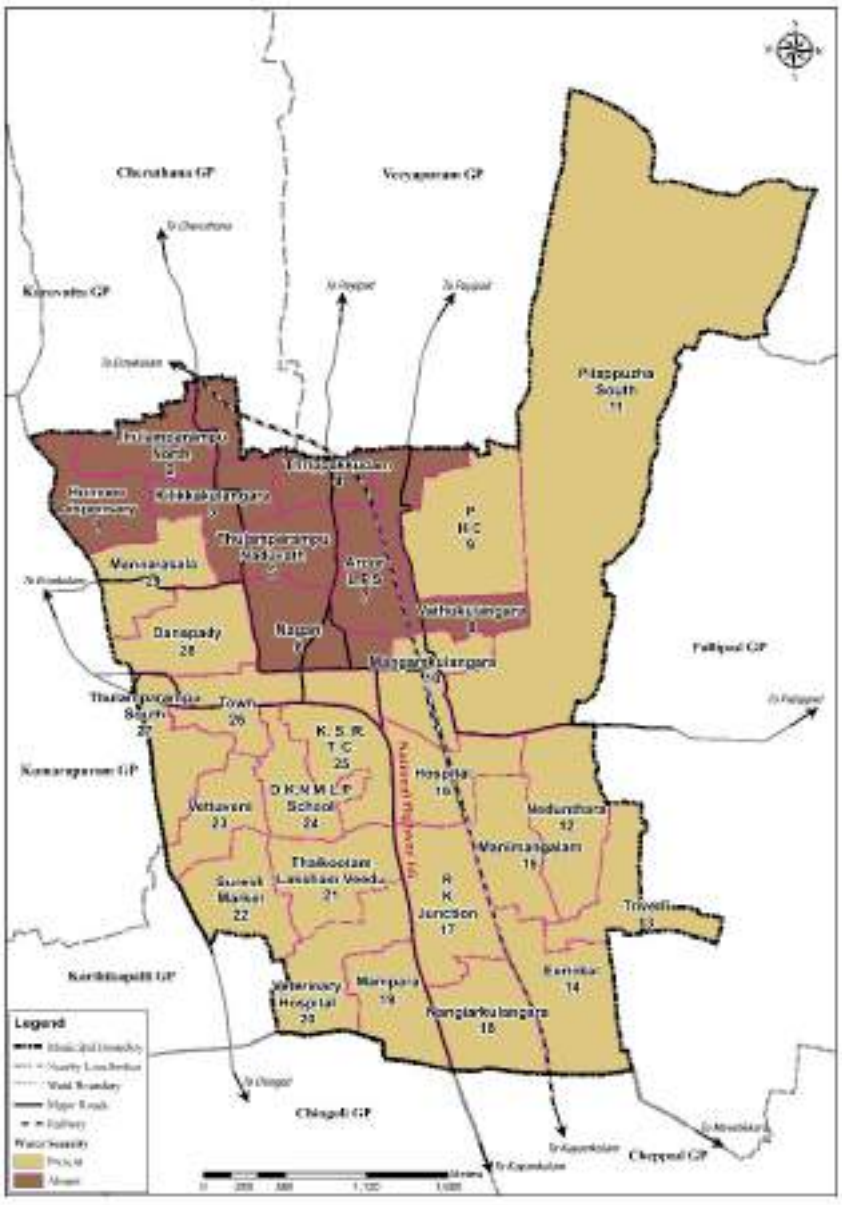

Figure 14.2 : Water Scarcity Map of Haripad

Source: Socio-Economic Survey, 2024



Figure 14.3 : Nature of Water scarcity
Source: Socio-Economic Survey

14.1.5 Effect of hazard risk

Hazard risks - particularly flooding, drought, and contamination - have significantly affected the water supply system in Haripad. Flooding poses the most critical threat, as it contaminates domestic dug wells and public bore wells, which are the primary sources of water for the majority of households. Flood-prone surveys indicate that about 65.1% of water supply sources are affected during flood events, highlighting the high level of vulnerability. The 2018 floods severely disrupted the municipality's water system, leading to widespread contamination and shortages of safe drinking water for several days. While piped water supply systems are relatively less affected, the town's heavy dependence on groundwater sources and a single tube well under the Urban Water Supply Scheme increases overall risk, especially during drought and summer months. Wards such as PHC (9) and Mannarasala (29) are moderately affected, while other flood-prone wards experience high levels of disruption, underscoring the urgent need for resilient and sustainable water management measures.

14.1.6 Problems and Potentials

The majority of the municipal population in Haripad Municipality relies on domestic wells and public bore wells for drinking water. The lack of a sewerage system and the high reliance on groundwater can lead to groundwater contamination, causing health problems. Deposition of waste in public ponds and other surface water sources may also lead to groundwater contamination. Water shortages are prevalent in wards (ward 9 to 29), particularly during summer and the current water supply scheme in the town, Urban Water Supply Scheme (UWSS) which depends on a single tube well at Thrippakkudam with limited production capacity of less than 0.50 MLD, covers only few areas within the town, which is inadequate for the entire population. The absence of a Water Treatment Plant (WTP)-based water supply system raises serious concerns regarding water quality, sustainability, and equitable distribution, particularly in areas experiencing seasonal water scarcity.

Groundwater utilization remains a viable option if sustainable management strategies like rainwater harvesting and recharge programs are effectively implemented. The town also has the potential to raise the groundwater level in the summer and recharge wells in nearby areas by renovating and restoring the flow of water to the damaged PIP (Pampa Irrigation Project) canals that have been lying idle for years.

14.1.7 Inference

Haripad Municipality primarily relies on domestic dug wells, public borewells, and the Pampa and Achankovil rivers as its principal sources of drinking water. In addition, the Urban Water Supply Scheme (UWSS) operates through a single tube well at Thrippakkudam. As per the 2024 socio-economic survey conducted by LSGD Planning, 87.9% of households do not experience regular water shortages; however, certain wards face seasonal scarcity, particularly during summer months. The existing infrastructure, which lacks adequate treatment facilities, remains insufficient to meet the long-term needs of the growing municipal population and raises concerns regarding water quality and sustainability. Flood events further aggravate the situation by contaminating groundwater sources, especially domestic wells, thereby disrupting access to safe drinking water. The 2018 floods highlighted the vulnerability of the current system, with widespread contamination and temporary shortages across several wards. In this context, sustainable groundwater management measures such as rainwater harvesting and recharge initiatives are essential to strengthen resilience. To ensure reliable access to safe and treated water in the future, the establishment of a comprehensive Water Treatment Plant (WTP)-based water supply system covering the entire municipal area is considered imperative.

14.2 Drainage

14.2.1 Introduction

Effective drainage management is a fundamental component of sustainable urban development, particularly in rapidly urbanising regions where declining per capita land availability and extensive surface paving significantly limit natural rainwater percolation. In many urban areas, including Haripad, the majority of residential plots measure less than 400 square metres and are largely covered by buildings or hard surfaces, leaving minimal open space for groundwater recharge. Consequently, stormwater from individual plots is discharged directly into street drains, increasing runoff volumes.

Urban densification driven by population growth has further accelerated the conversion of vacant lands, open spaces, low-lying areas, and paddy fields into built-up zones, thereby reducing the natural capacity for stormwater storage, infiltration, and gradual discharge into natural and manmade drainage channels. As a result, high-intensity rainfall events frequently lead to flash floods, overwhelming inadequately designed roadside drains and resulting in waterlogging and urban flooding. These challenges are compounded by encroachments, solid waste dumping (including plastics), mixing of sewage with stormwater drains, and poor maintenance practices.

Haripad, located on the low-lying coastal plains near Kuttanad with elevations averaging below 3 metres above Mean Sea Level (MSL), is particularly vulnerable to inundation during the monsoon. The 2018 floods in the Greater Pamba river basin, especially along the Achankovil River, highlighted the town's exposure to extreme climate events. Triggered by

unprecedented rainfall and aggravated by poor drainage performance and unplanned urban development, the floods caused extensive damage to lives, infrastructure, agriculture, and local ecosystems.



Figure 14.4 : Waste dumping in drains

14.2.2 Need for a Drainage Plan for the town

Given Haripad's low-lying terrain, extensive paddy landscapes, intense monsoonal rainfall, and increasing urbanisation, the need for a scientifically structured and risk-informed drainage framework has become critical. Recurring waterlogging, flash flooding, and reduced natural percolation - aggravated by land use changes, encroachments, and inadequate stormwater infrastructure - have underscored the urgency for a comprehensive and technically robust intervention. Recognising these vulnerabilities, a detailed study was undertaken under the Rebuild Kerala Development Program (RKDP) to prepare a Drainage Plan to inform the Haripad Risk-Informed Master Plan. The plan was developed using reliable hydrometeorological data, LiDAR-based surface modelling, detailed mapping of existing drains and nalas[1], and supported by topographical, hydraulic, hydrological, and bathymetric surveys. Advanced hydraulic and flood modelling were carried out to assess system performance under extreme rainfall scenarios and identify capacity gaps. The detailed proposals, technical assessments, and redevelopment strategies forming the Drainage Plan are presented in Chapter 33 of this Master Plan.

14.2.3 Existing Drainage Network – Natural and Man-made, Waterlogged Areas

Haripad town comprises a combination of natural and man-made drainage systems that together form its primary stormwater management framework. The natural drainage network is influenced by the Pamba River basin and its tributaries, particularly the Achankovil and Manimala rivers, which play a crucial role in conveying monsoon runoff and regulating regional hydrology. Within the town, a well-connected system of streams, canals, and thodu -

[1] A nala is a natural or man-made drainage channel used to carry stormwater, wastewater, or excess runoff from surrounding areas. In the Indian context, the term commonly refers to small streams, rivulets, or open drains that form part of a town or region's local drainage network.
Nalās play a crucial role in collecting and conveying rainwater, preventing waterlogging and flooding, and connecting local catchments to larger water bodies such as rivers, canals, lakes, or wetlands. In urban areas, they may be modified with lining, culverts, or embankments, while in rural and semi-urban areas they often remain natural channels integrated with agricultural landscapes

including Pillathodu and Danapady Thodu - collects runoff from the central and peripheral areas. These channels ultimately discharge into the Achankovil River through Pillathodu and its sub-streams, or into Kayamkulam Lake via Danapady Thodu. In several locations, stormwater is directed into adjoining paddy fields, which function as natural retention basins; hence, the conservation of these low-lying agricultural lands is integral to flood management.

Complementing the natural waterways, the town has developed man-made drainage infrastructure comprising concrete stormwater drains and roadside channels intended to divert runoff from residential areas, commercial zones, and major road corridors. However, despite the presence of this combined system, its effectiveness remains constrained. Many roads lack proper drains, and several constructed drains are discontinuous or inadequately connected to primary canals, resulting in incomplete conveyance of surface runoff. During periods of intense rainfall, water frequently flows into low-lying areas, leading to waterlogging. Additional challenges include inadequate drainage capacity in certain stretches, siltation, weed growth, encroachments on natural channels, disposal of waste into drains, and disruption of natural flow paths due to construction activities.

To address these systemic deficiencies, a comprehensive Drainage Master Plan was prepared, supported by a LiDAR-based terrain survey and detailed hydraulic and flood modelling. The objective is to restore blocked streams, strengthen and interlink existing drains, and establish missing connections to re-establish natural flow regimes and enhance the overall efficiency and resilience of Haripad's drainage system

Complementing the existing natural and man-made drainage systems, Haripad's hydraulic network is further influenced by tidal canals, protective bunds, and freshwater inflows from the Achankovil River. While bunds play a critical role in preventing tidal ingress and protecting low-lying areas, they can also impede natural drainage if not properly regulated. Tidal canals function as primary drainage conduits; however,

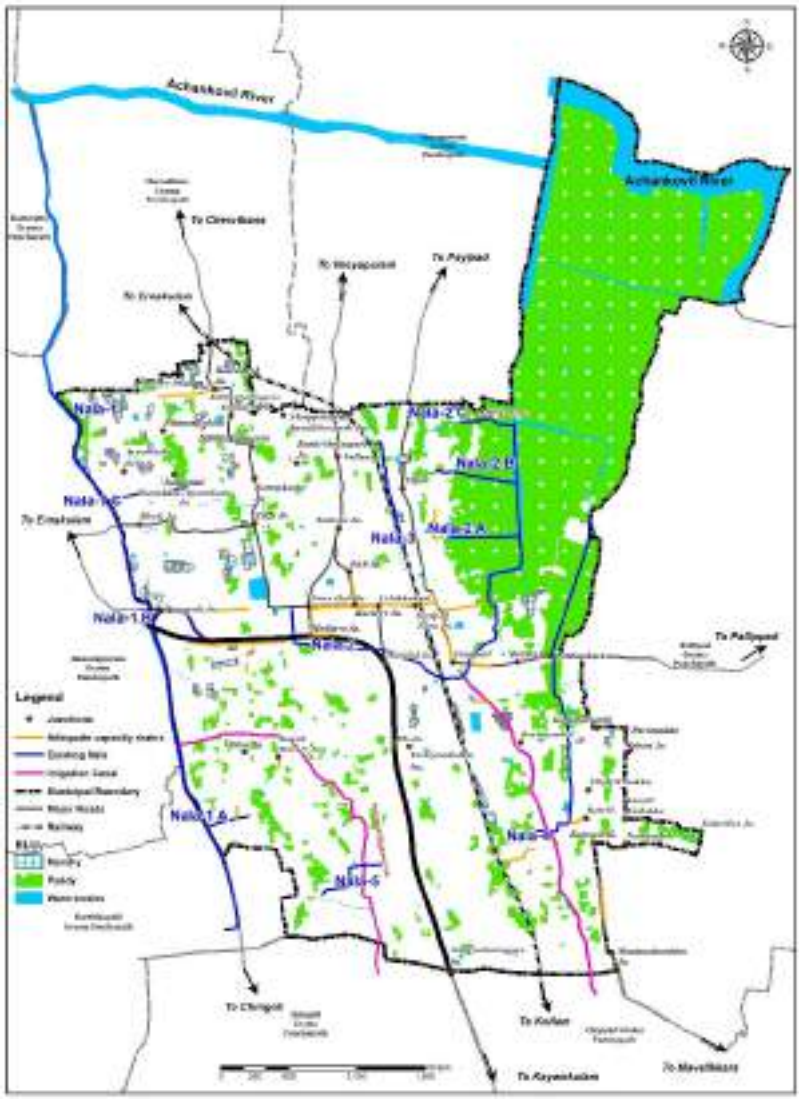

Figure 14.5 : Existing Drainage Network Map Showing Nalas, Drains and Irrigation Canals

Source: Data Source Based on Drainage Management Study conducted in 2025

during high tide conditions, they are susceptible to saline intrusion, which affects both drainage efficiency and adjoining agricultural lands. Figure 14.5 illustrates the existing drainage network of the town, including primary nalas (natural streams) and their sub-nalas, adequately functioning drains, and irrigation canals that collectively shape the hydrological framework of Haripad.

As per the study conducted, there are five natural streams within the town, complemented by roadside drains along most of the roadways. Historically, the town maintained a well-connected drainage system, with roadside drains effectively connected to the natural streams. Over time, however, several of these connections have deteriorated due to indiscriminate dumping of solid waste, uncontrolled vegetation growth, ongoing construction activities, and encroachments. Collectively, these factors have disrupted the continuity of the drainage network, thereby reducing its overall efficiency and capacity and increasing the risks of urban flooding and waterlogging.



Figure 14.6: Pillathodu



Figure 14.7: Weed growth in Pillathodu



Figure 14.8: Channel Blockage Due to Bridge Construction



Figure 14.9: Canals of Pamba Irrigation Project

The five natural streams (referred to as Nala in this document) flowing through the town are: Nala 1 – Danapady Thodu originates from the Achankovil River and drains into the Kayamkulam Lake, Nala 2 – Pillathodu begins near the Subrahmanya Swamy Temple road and flows into the Achankovil River, Nala 3 runs parallel to the railway line in Ward 8 and ultimately joins the Achankovil River through Veeyapuram Grama Panchayat, Nala 4 begins from the south eastern part of the municipal boundary and continues towards Achankovil River and Nala 5, a small stream which originates near the Puthumana Devi Temple area and discharges into a paddy land in the south western part of the town.

- **Nala 1 – Danapady Thodu :**

Nala–1 defines the western boundary of the Municipality, extending approximately 4472 meters within the municipal area, primarily serving agricultural and water management purposes in the Kuttanad region. Nala–1 has three sub branches at different intervals. Nala–1A, with a length of 300 meters, Nala–1B, extending 500 meters, and Nala–1C, measuring 600 meters. However, many stretches of Danapady Thodu have become stagnant due to indiscriminate waste dumping, uncontrolled vegetation growth, and remnants of old bunds



Figure 14.10 : Existing condition of Danapady Thodu

- **Nala 2 - Pillathodu**

Nala–2 is one of the major drainage channels in Haripad Town, extending for approximately 3750 meters. Nala–2 also has three sub-branches: Nala–2A, extending 500 meters, Nala–2B, covering 575 meters, and Nala–2C with a length of 400 meters. Due to indiscriminate waste dumping, unchecked vegetation growth, and the construction of culverts and bridges, many stretches of Pillathodu have become stagnant.



Figure 14.11 : Existing condition of Pillathodu

- **Nala 3 :** Nala–3 has a total length of 875 meters, extending from Pattasseri Devi Temple towards the northern boundary of the Municipality.
- **Nala 4 :** Nala–4 extends for approximately 2675 meters in the south eastern portion of the Municipality, and discharges into a waterbody connected to the Achankovil River.
- **Nala–5 :** Nala–5 extends for 587 meters in the south-western portion of the Municipality and discharges into a paddy land located in the southwestern part of the town.

14.2.4 Existing Roadside Drains

Most roads in the town are equipped with roadside drains, and while some stretches have adequate capacity (Figure 14.5), several others remain discontinuous due to construction activities and various interruptions. A significant portion of these drains are undersized and therefore incapable of accommodating stormwater flows. Many sections are obstructed by weed growth, solid waste accumulation, or have been converted into roadways. The rapid expansion of impervious surfaces has further intensified runoff, resulting in higher peak discharges.



Figure 14.12 : Existing condition of roadside drains

14.2.5 Analysis of Existing System

Across the town, drainage inadequacies significantly amplify natural flood hazards. Hydraulic capacity analysis revealed deficiencies within the stormwater drainage system. In Haripad, drainage outfalls remain ineffective during high tide and tidal surges, forcing backflow into inland settlements. The interaction of natural hydrological processes with man-made drainage limitations converts seasonal rainfall events into severe flooding episodes. Poor drainage gradients and inadequate pumping of accumulated water intensify backwater flooding, and when tidal surges coincide with monsoon discharge, stormwater cannot drain into the sea, resulting in prolonged waterlogging in residential colonies and paddy fields.



Figure 14.13 : Eastern side of Vathukulangara Temple (Ward 8) - Flooding occurs by an overflowed water body on the side of the road and improper drainage



Figure 14.15 : Neriyam Pallath colony road (Ward 11) - Flood due to the presence of nearby water body and paddy field

- **Nala 1 – Danapady Thodu:** Despite its importance in stormwater management, Nala–1 is insufficient across most of its length, limiting its ability to convey stormwater effectively. According to the study, only about 24% of the total length has adequate carrying capacity (indicated in blue lines on Map 2), but inadequate across most portions (indicated in yellow lines on Figure 14.15). The inadequate stretches require redesign and improvement to achieve the necessary hydraulic capacity. Adequate stretches can function efficiently and require no modification beyond routine cleaning and maintenance. While Nala–1A and Nala–1B are fully adequate, structurally sound and need no immediate intervention, Nala-1C is inadequate along most of its length. Nala–1C and the majority of the main channel (Nala 1) demand urgent attention. Without improvements, the system faces a high risk of waterlogging and flooding during peak flows.

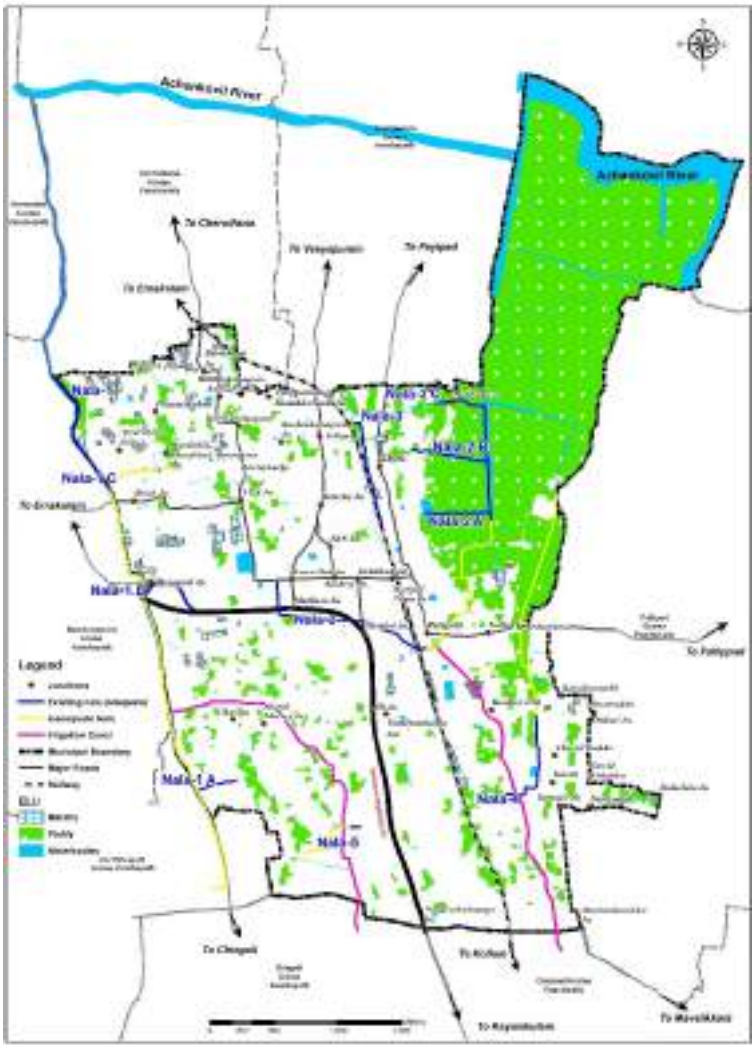

Figure 14.14 : Existing Nala Network Showing Inadequacy

Source: Data Source Based on Drainage Management Study conducted in 2025

- **Nala 2 – Pillathodu:** The existing nala's carrying capacity is adequate at the portions shown in blue lines in Figure 14.15. However, the sections shown in yellow lines (representing around 60% of the total length) are inadequate in most portions. As a result, their efficiency in stormwater conveyance is reduced, creating a high risk of overflow during storm events. While the sub-branches (Nala–2A, 2B, and 2C) are fully adequate, structurally sound and require no intervention beyond routine cleaning and maintenance, the main channel's inadequate stretches demand redesign to improve hydraulic capacity.
- **Nala–3:** The entire stretch of this nala is completely adequate, with no observed bottlenecks or capacity limitations. The adequacy of Nala–3 across its entire length indicates that it is capable of functioning efficiently in stormwater conveyance. Only routine cleaning and maintenance are required to sustain its performance. Unlike other major channels, there are no sections requiring redesign or structural improvement.
- **Nala–4:** The study indicates that about 49% of the total length of Nala-4 is inadequate in terms of carrying capacity, while the remaining portions are adequate. The inadequacy of nearly half of Nala–4's length reduces its overall hydraulic efficiency and limits its ability to manage stormwater discharge effectively. Adequate portions perform well under clean conditions, but the deficient stretches act as bottlenecks, raising the likelihood of overflow and localised flooding during peak flows.
- **Nala–5:** As per the study, approximately 68% of its total length is inadequate in terms of carrying capacity, while only 32% functions adequately under clean condition. This inadequacy highlights the nala's limited ability to convey stormwater effectively under design flow conditions, reduces its hydraulic efficiency and increases the risk of flooding in adjacent areas. While adequate stretches can manage stormwater under clean conditions, most of the nala requires redesign and structural improvements for uniform performance. Its discharge into the paddy land is critical, as this natural retention basin helps absorb excess water and supports flood management.
- **Roadside Drains**: Only a few roadside drains have adequate capacity to convey stormwater,

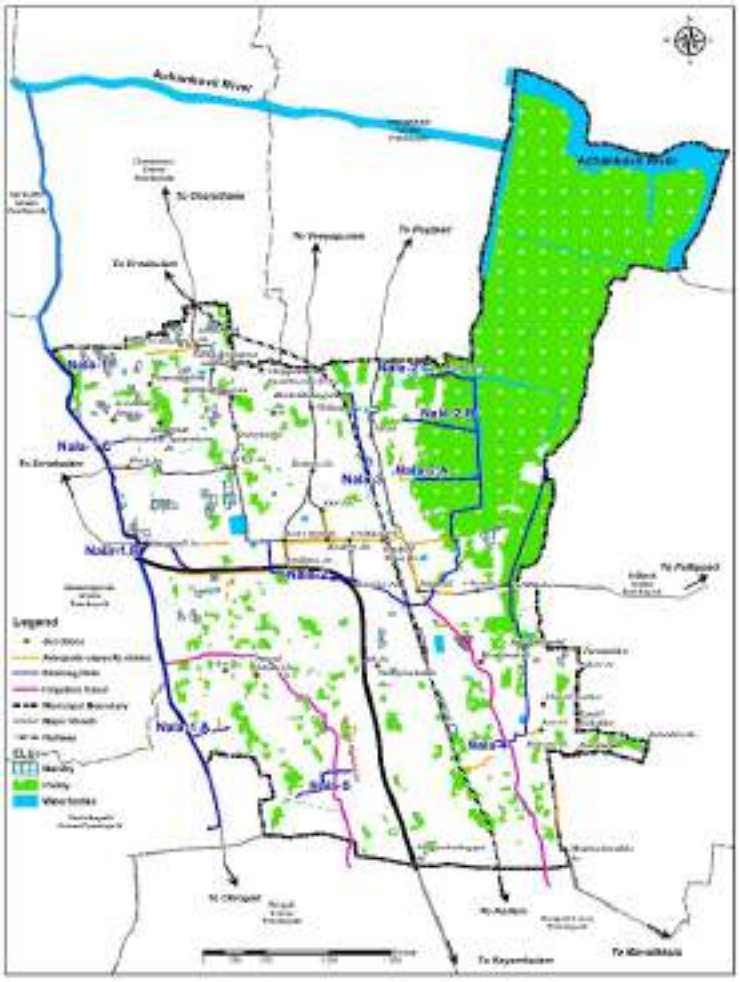

Figure 14.16 : Existing Roadside Drains having adequate capacity

Source: Data Source Based on Drainage Management Study conducted in 2025

as indicated in Figure 14.16. The inadequacy of the drainage system is due to both structural and environmental factors. Discontinuous and undersized roadside drains, compounded by weed growth, waste dumping, and the conversion of drains into roadways have reduced the hydraulic efficiency of the drainage system, limiting stormwater conveyance and aggravating local flooding. Increased paved surfaces have intensified runoff, creating higher peak discharges that the system cannot handle. The presence of culverts, low elevation bridges, and dense cross drainage structures further influences local flood behaviour, and exacerbate vulnerabilities during extreme rainfall events.

14.2.6 Identification of gaps in the network-Analysis of capacity of existing drains, encroachment of natural drains, missing links.

A comprehensive hydraulic assessment of Haripad's drainage system reveals significant structural and systemic gaps that amplify flood risk across the town. Capacity analysis indicates that several major nalas operate below required hydraulic standards. Nala–1 (Danapady Thodu) is adequate along only about 24% of its length, while the remaining stretches - including Nala–1C - are inadequate and require redesign. Nala–2 (Pillathodu) exhibits inadequacy along nearly 60% of its length, though its sub-branches (2A, 2B, 2C) are adequate. Nala–4 is deficient along approximately 49% of its alignment, and Nala–5 is inadequate across nearly 68% of its length, reducing overall stormwater conveyance efficiency. In contrast, Nala–3 is fully adequate and requires only routine maintenance. These deficiencies result in bottlenecks that increase waterlogging and overflow during peak rainfall events.

Beyond hydraulic limitations, widespread encroachments and physical obstructions have severely compromised natural drainage paths. Pillathodu and Danapady Thodu have reduced in width and depth due to soil deposition, plastic waste accumulation, and unauthorized constructions. Approximately 180 meters of the upper stretch of Pillathodu has been covered or constricted near national highway crossings and the Taluk Hospital, disrupting natural flow. Several minor streams and cross-drainage channels, including those passing through railway land, have been blocked or eliminated. The obstruction of tidal outfalls during high tide further aggravates backflow and prolongs flooding in low-lying residential areas and paddy fields.

Additionally, the absence of a continuous and well-integrated roadside drainage network constitutes a major gap. Many roads lack drains, existing drains are discontinuous or undersized, and several are not properly connected to primary canals. Increased paved surfaces have intensified runoff, while culverts and low-elevation bridges further restrict discharge. Collectively, these missing links, inadequate capacities, and encroachments undermine the town's stormwater management efficiency, necessitating a coordinated drainage network redevelopment strategy to restore flow continuity, augment capacity, and enhance flood resilience.

14.2.7 Effect of hazard risk in this sector - Impact of the 2018 Floods

The 2018 floods exposed critical vulnerabilities in Haripad's drainage network and underscored the urgent need for systemic strengthening of stormwater infrastructure. Triggered by unprecedented rainfall across Kerala, the event severely disrupted both natural and man-made drainage systems in the town. The key impacts on the drainage sector are summarised below:

- **River and Canal Overtopping:** The Pampa and Achankovil rivers breached their banks, inundating adjoining low-lying areas of Haripad and overwhelming secondary drainage channels such as Pillathodu and Danapady Thodu.
- **Failure of Stormwater Conveyance:** Existing nalas and roadside drains were unable to accommodate the sudden surge of runoff. Limited hydraulic capacity, discontinuities in the network, and inadequate outfall conditions resulted in widespread flooding of drains and backflow into inland settlements.
- **Prolonged Waterlogging in Low-Lying Areas:** Due to the town's low elevation and restricted natural gradients, excess stormwater could not drain efficiently, leading to prolonged inundation in residential neighbourhoods and paddy fields.
- **Public Health and Environmental Impacts:** Stagnant floodwaters, compounded by malfunctioning drainage systems, contributed to the spread of waterborne diseases such as malaria, dengue, and cholera. Floodwaters also mixed with sewage due to cross-connections and drain overflows, contaminating local water sources and creating severe sanitation hazards.
- **Siltation and Capacity Reduction:** Intense runoff caused extensive soil erosion in upstream catchments, depositing large quantities of silt and debris into drains, canals, and rivers. This further reduced hydraulic capacity and increased vulnerability to subsequent rainfall events.
- **Structural and Systemic Weaknesses Revealed:** The floods highlighted deficiencies such as undersized drains, encroachments on natural waterways, blocked cross-drainage structures, and the absence of an integrated drainage management strategy.



Figure 14.17: Stagnant water mixed with waste



Figure 14.18 : Waste dumped in Pillathodu

14.2.8 Inference

The assessment of Haripad's drainage network highlights significant structural and functional gaps that increase the town's vulnerability to flooding and waterlogging. The 2018 floods clearly demonstrated deficiencies such as inadequate hydraulic capacity in major nalas (including Nala–1, Nala–1C, Nala–2, Nala–4, and Nala–5), siltation, encroachments, discontinuous roadside drains, and the degradation of natural retention areas. Targeted redesign of deficient stretches through widening, deepening, and improved hydraulic configurations, combined with systematic maintenance and restoration of natural waterways, is essential to ensure uniform stormwater conveyance. Equally important is the protection of

paddy lands and wetlands, which function as critical flood buffers and ecological support systems. An integrated approach that combines structural upgrades, ecological conservation, and effective regulatory enforcement is necessary to enhance drainage efficiency and long-term resilience. Haripad town, which is facing the threat of flooding due to the lack of an effective drainage system, needs to prepare a comprehensive drainage management plan to address the problems in this area.

14.3 Sewerage System

There is no centralized sewerage system in Haripad Municipality. Toilet waste (black water) is disposed at source using septic tank and soak pit. Other wastewater (grey water) is disposing within the respective plot or into public drains. However, these on-site systems are often inadequately designed and poorly maintained, resulting in frequent overflows and leaks of untreated effluent. Haripad town is not highly dense in terms of population or built-up development. Still septic tanks and soak pits are not an effective or sustainable solution for managing toilet waste. Soak pits can contaminate groundwater and cause health problems by leaching waste into nearby wells and water sources. In low-lying areas, septic tanks and soak pits are more likely to overflow during the rainy season and cause waste to overflow. Sewage flowing into public drains causes pollution of water sources.

14.3.1 Generation and Sources

Haripad Municipality, has been experiencing rapid urbanization, leading to increased wastewater generation. The primary sources of sewage in Haripad include domestic households, commercial establishments, and institutional facilities.

- **Residential Areas**: Households generate wastewater from daily activities such as bathing, cooking, cleaning, and sanitation.
- **Commercial Establishments**: Businesses, including shops, offices, hotels, and restaurants produce wastewater through their operations, particularly from kitchens and restrooms.
- **Institutional Facilities**: Schools, hospitals, and government buildings contribute to sewage generation through their regular activities.

14.3.2 Existing Scenario

Haripad Municipality lies in the coastal lowland belt, where the groundwater table rises close to ground level during the monsoon season, significantly increasing the risk of groundwater contamination. Septic tanks and soak pits become ineffective under such conditions, allowing untreated effluents to percolate into subsoil and spread to drains, canals, streams, and rivers. In some households lacking proper septic tanks or leach pits, human excreta is directly discharged into nearby water bodies, further aggravating water pollution. Inadequate solid waste management also contributes to groundwater degradation

Socio-economic survey results indicate that 95.8% of households use septic tanks, while 3.3% depend on pit latrines. The widespread use of soak pits and pit latrines for sewage disposal poses a serious risk to subsoil and groundwater quality. The absence of a centralized sewerage system, especially in central wards such as Wards 25 and 26, further worsens the situation, with many households, commercial establishments, institutions, and hospitals discharging untreated wastewater into plots or public drains. This treated wastewater ultimately enters

canals and groundwater sources, posing significant public health risks, including the potential for disease outbreaks.

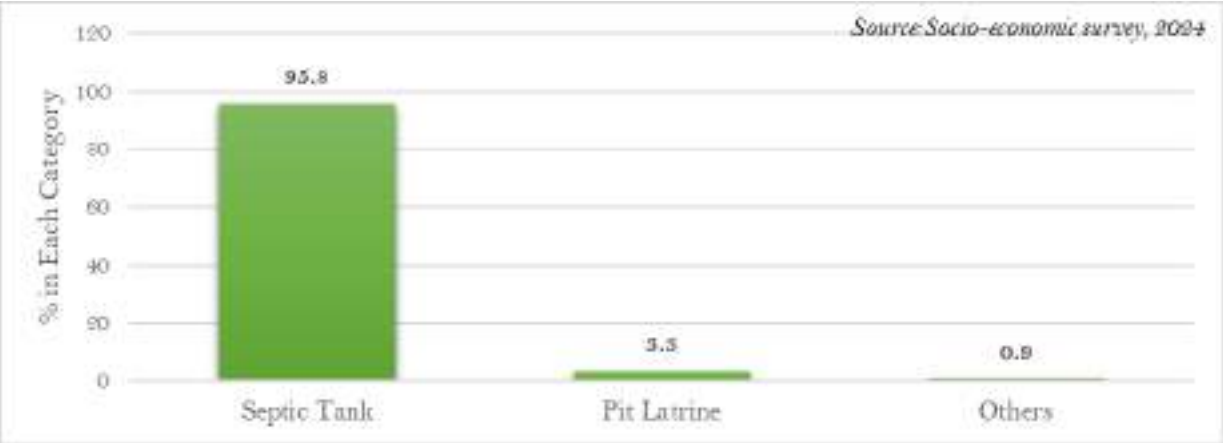

Figure 14.19 : Methods of Sanitary waste disposal

As per the Socio – economic survey, 92.3% of people agreed that there are proper latrine facilities while 7.7% agreed that there are no such facilities. The data indicates that while basic sanitation coverage in Haripad Municipality is relatively high - with 92.3% of residents reporting access to proper latrine facilities - there remains a concerning gap, as 7.7% still lack such access. This reflects a need to ensure inclusive sanitation coverage for all, particularly in underserved areas.

Additionally, 77.2% of respondents dispose of liquid waste within their plot, likely through soak pits or direct ground discharge. Meanwhile, 16.1% use leach pits, suggesting limited adoption of regulated or scientifically managed disposal systems. These on-site methods, if not properly constructed or maintained, can lead to groundwater contamination and environmental degradation.

14.3.3 Management Facilities - Collection, Processing, Disposal

The Municipality does not have the facility to effectively handle and treat sewage. As mentioned above Toilet waste (black water) is disposed at source using septic tank and soak pit. Other wastewater (grey water) is disposed within the respective plot or into public drains. The major issues related to the septic tanks and waste management are:

Septic Tank and Waste Management Issues:

- **Improper Septic Tank Systems**: A majority of households (HHs) have septic tanks or pits, but these are often unscientific in design. The improper outflow of septic tanks is a major concern, which may be attributed to factors such as terrain conditions, water tables, and soil structures. These challenges make it difficult to implement a suitable solution for waste management.
- **Absence of Treatment Facilities**: The Municipality lacks proper facilities for the treatment and management of septage waste. There are no public facilities for liquid waste management which leads to public health and environmental concerns.

- **Lack of Licensed Scavengers or Collection Teams**: The Municipality does not have a licensed or authorized scavenger, nor any formal team or association dedicated to fecal sludge collection and management, further exacerbating the waste disposal issues.

Sewage disposal through soak pits or pit latrines contributes to subsoil water contamination. The lack of scientific treatment and disposal mechanisms poses a significant public health risk, especially in densely populated wards. It is seen that a system needs to be devised to separately handle and dispose of sullage and septage. Additionally, sanitation facilities in the city also need to be improved.

14.3.4 Effect of Hazard Risk in this Sector

Hazard risks, particularly flooding, have significantly impacted the sewerage system in Haripad Municipality. During flood events, the existing sanitation infrastructure becomes overwhelmed, leading to the overflow and mixing of untreated sewage with floodwaters. This not only disrupts sanitation services but also results in the widespread contamination of surface and groundwater sources, posing serious public health risks. Figure 14.20 illustrates the proportion of households affected during flood events, with the analysis focusing on flood-prone areas of the town, especially the northern and north-eastern regions. Field assessments indicate that in the northern and north-eastern flood-prone areas, more than 75% of households are affected during such events, reflecting the high vulnerability of the system.

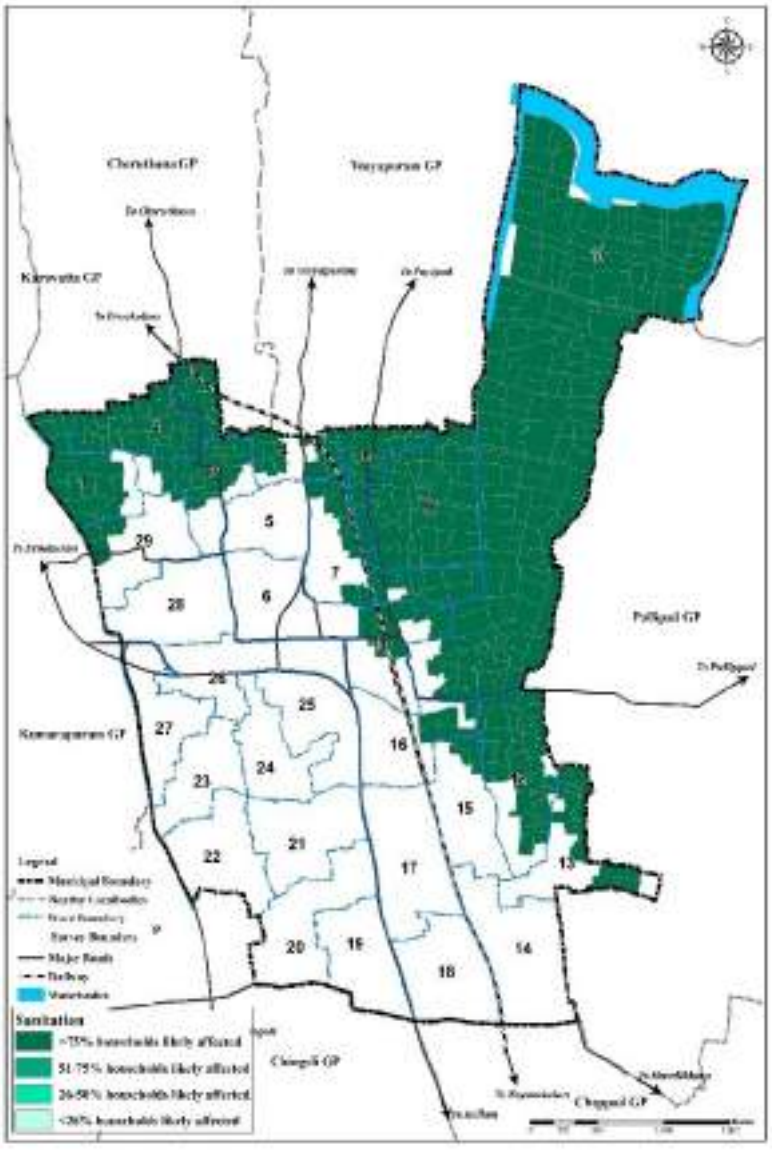

Figure 14.20 : Cadastral level sanitation vulnerability in flood prone areas

Groundwater-dependent sanitation environments, especially those relying on onsite systems and dug wells, are particularly susceptible to contamination during floods. While piped water supply networks remain relatively less affected, the failure of sewerage and sanitation systems significantly increases exposure to waterborne diseases and environmental pollution. Wards such as PHC (9) and Mannarasala (29) experience moderate impacts, whereas other flood-prone wards face

severe disruption. These conditions highlight the urgent need for resilient and flood-responsive sewerage infrastructure to safeguard public health and environmental quality.

14.3.5 Inference

The absence of a centralized sewerage system in Haripad Municipality has led to widespread reliance on poorly maintained on-site sanitation systems like septic tanks, soak pits, and pit latrines. These systems frequently overflow or leak due to inadequate design and lack of maintenance, causing contamination of soil and water sources. Rapid urbanization, limited space, and high population density have worsened the situation, with many households and establishments discharging untreated wastewater into open drains and canals. Flooding further exacerbates the issue by mixing sewage with floodwaters, increasing the risk of waterborne diseases. A centralized sewerage system is needed to solve these problems. Congested areas of the city should be connected to the sewerage system. A sewage treatment plant should be constructed to treat toilet waste in a scientific manner. Other wastewater can be treated and discharged into the drain, and the treated water can be used for agricultural purposes. Facilities such as FSTP (Faecal Sludge Treatment Plant), Mobile Septage Treatment Unit, etc. can also be considered to treat toilet waste only. A proper collection, emptying and disposal mechanism should be adopted for good public health and environmental quality.

14.4 Solid Waste Management

Urban areas are defined by high population density and a focus on non-agricultural activities. These activities generate significant quantities of solid waste as part of daily operations. The management of solid waste, including its collection and disposal, is a key responsibility of local self-governments. However, most towns and cities in Kerala lack well-designed, sustainable, and sanitary solid waste management systems tailored to their specific requirements. Haripad Municipality faces similar challenges, reflecting the broader inadequacies in waste management infrastructure across the state.

14.4.1 Generation and Sources

The solid waste management system in Haripad Municipality is currently inadequately designed. The Municipality does not collect biodegradable waste, resulting in residents disposing of garbage in backyards, open spaces, or roadside drains. Street sweeping activities are primarily limited to the commercial centre of the town. Furthermore, the Municipality's waste collection fleet is both insufficient and poorly maintained, which further impedes effective waste management. The quantity of different solid waste produced are given in Table 14.1.

Table 14.1: Quantity of different solid waste produced

Sl. No.	Parameter	Weighted in TPD
Biodegradable		
1	Bio waste	7.49
Non- Biodegradable Waste		
2	Hard plastic/ bottle	0.504

3	Paper	0.703
4	Polythene/ plastic	0.968
5	Glass/Bottle	0.273
6	Metal	0.036
7	Rags/Textile/Cloth	0.338
8	Inert (sweeping)	1.038
9	Construction & Demolition waste	0.036
10	Sanitary Pad	0.0076

Source :KSWMP, 2025

According to the socio-economic survey, 41.6% of residents dispose of waste within their premises, 2.5% use garbage bins, and 55% rely on municipal waste collection services.

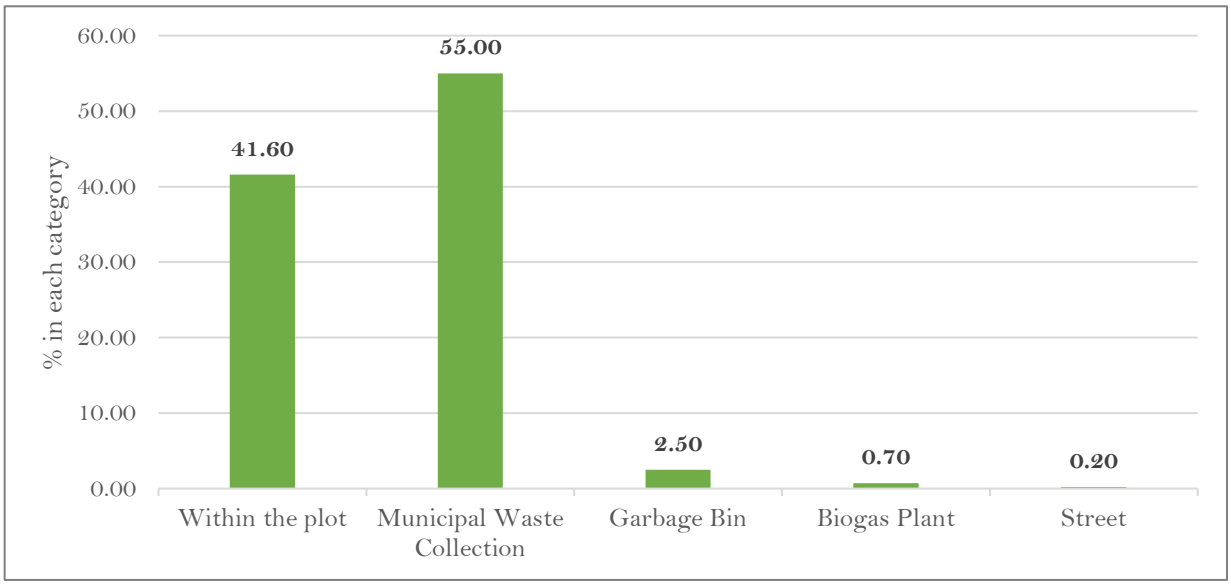

Figure 14.21 : Solid Waste Disposal

Source: Socio economic survey, 2024

14.4.2 Existing Scenario

The solid waste management system in Haripad Municipality continues to face several operational and systemic challenges. While door-to-door waste collection services are in place, coverage remains uneven, particularly in densely populated and interior areas. This has resulted in improper disposal of waste in open spaces, drains, canals, and water bodies, leading to environmental degradation and public health concerns. Source-level segregation of waste is limited, with a majority of households and commercial establishments disposing of mixed waste. This significantly reduces the efficiency of recycling and processing, as biodegradable waste is often diverted to landfills, while non-biodegradable materials - especially plastics - contribute to persistent pollution. Limited public awareness and inadequate segregation infrastructure further constrain the transition toward sustainable waste management practices.

As per secondary data from the Kerala Solid Waste Management Project (KSWMP), Haripad Municipality generates approximately 11.39 tonnes of solid waste per day (TPD). To manage non-biodegradable waste (excluding plastic), Mini Material Collection Facilities (Mini MCFs)

have been established in all wards. Plastic waste is collected directly from households by Harithakarmasena, while a centralized Material Collection Facility (MCF) operates in Ward 27 to support segregation and onward processing. Despite these measures, the system requires strengthening through improved coverage, enhanced segregation at source, infrastructure augmentation, and sustained awareness initiatives. Ward-wise waste generation details are provided in Table 14.2.

Table 14.2: Ward wise waste generation

Ward No.	Waste generation	Ward No.	Waste generation (TPD)
1	0.438	**16**	0.393
2	0.369	**17**	0.378
3	0.397	**18**	0.408
4	0.375	**19**	0.4545
5	0.425	**20**	0.369
6	0.318	**21**	0.448
7	0.361	**22**	0.3975
8	0.393	**23**	0.369
9	0.453	**24**	0.378
10	0.371	**25**	0.369
11	0.500	**26**	0.337
12	0.486	**27**	0.453
13	0.442	**28**	0.371
14	0.450	**29**	0.407
15	0.294		

Source:KSWMP , 2025

14.4.3 Existing management and treatment facilities

Solid waste in Haripad Municipality consists of both biodegradable and non-biodegradable components. The Municipality has initiated several waste management measures through funded projects, including the distribution of Bio Bins and biogas units for household-level treatment of biodegradable waste. Non-biodegradable waste, particularly plastics, is collected and segregated by Harithakarmasena and transferred to authorized agencies for shredding and recycling. Facilities such as aerobic composting units, plastic segregation centres, and Material Collection Facilities (MCFs) are being introduced to strengthen the system. However, these initiatives are still in the early stages and do not yet cover the entire municipal area. Additionally, the absence of a structured mechanism for the disposal of sanitary waste, diapers, and certain biodegradable wastes has resulted in ad hoc and improper disposal practices.

The Municipality has five Thumboormuzhi composting units with a total of 27 bins. Among these, the units in Wards 25 and 26 are operational, while those in Wards 16 and 27 are under maintenance. Additionally, Ward 26 has a second unit, which is non-functional. E-waste is collected and transported to Clean Kerala Company Ltd. in accordance with the

Harithakarmasena calendar. The amount of e -waste produced in the Municipality is 300kg/month

Table 14.3: Existing facilities for waste management in the town

Sl. No	Existing processing facilities	Number
1	Mini MCF points	29
2	MCF facilities	1
3	RRF	1
4	Thumboormuzhi	5 (27 bins)
5	Biogas plants	92 (Institutional level)

Source: KSWMP , 2025

14.4.4 Problems and Potentials

The Municipality currently has 31 Harithakarmasena workers for 29 wards, whereas the required workforce is 58, leading to operational challenges in waste management. They also complain that they are not getting adequate security and wages. The MCF in Ward 27 has no adequate facilities for sorting, collecting and storing waste without getting wet, and there are no basic facilities (toilets, drinking water, and rest areas) for the workers. Although there is a calendar for collecting inorganic waste, it is not followed. Only plastic is collected. In addition, the collected waste is not removed in a timely manner, and there is a situation where the MCF is piled up. Thumboormuzhi composting units are not functioning efficiently in certain areas, affecting the proper processing of biodegradable waste. There is



Figure 14.22: Waste dumping at Water bodies



Figure 14.23 : Waste dumping in MCF (Ward 27, Danapady)

no structured system for the collection and disposal of sanitary waste, including sanitary pads and diapers, resulting in on-site disposal within residential plots. This improper disposal practice poses environmental and public health concerns. Additionally, the indiscriminate dumping of waste into water bodies remains a significant issue, contributing to pollution, water contamination, and ecological degradation. Addressing these challenges requires enhanced waste management infrastructure and workforce allocation. The city has the potential to address existing deficiencies and implement a better solid waste management system.

14.4.5 Effect of Hazard Risk

The inefficiencies in Haripad Municipality's solid waste management system contribute to significant hazard risks, including environmental degradation, public health concerns, and disaster vulnerability. Indiscriminate dumping and open disposal lead to water contamination, soil degradation, and air pollution, while clogged drainage systems exacerbate urban flooding. Public health risks arise from vector-borne diseases, unsanitary conditions, and occupational hazards faced by waste workers due to inadequate protective measures. The shortage of Harithakarmasena workers and non-functional composting units further hinder effective waste management. Additionally, unmanaged dry waste increases fire hazards. Addressing these risks requires improved waste collection, source-level segregation, infrastructure upgrades, workforce expansion, and public awareness to ensure a resilient and sustainable waste management system.

14.4.6 Inference

Haripad Municipality faces significant challenges in solid waste management, characterized by inadequate waste collection, insufficient workforce, and lack of proper segregation at the source. The absence of biodegradable waste collection leads to improper disposal methods, contributing to environmental and public health hazards. Although initiatives such as Mini MCFs, biogas plants, and Thumboormuzhi composting units have been introduced, their limited coverage and operational inefficiencies hinder effective waste processing. Additionally, the unregulated disposal of sanitary waste and the dumping of solid waste into water bodies exacerbate pollution and ecological degradation. Addressing these issues requires comprehensive improvements, including expanding waste collection coverage, increasing workforce capacity, promoting source-level segregation, and strengthening waste treatment infrastructure.

14.5 Energy

Energy is a key resource that drives the growth of human civilization, with electrical energy being the most widely used form. Electricity has become essential for societal progress, and the extent of its consumption is often viewed as a measure of a society's development.

14.5.1 Energy Consumption: Source wise break up

The primary form of energy utilizing is Electrical energy and the source of energy consumption is mainly hydroelectric projects, with no integration of non-conventional energy sources into the main grid. Additionally, petroleum products such as diesel and petrol, along with biomass are also utilized as energy source. Solar energy, a non-conventional energy source, is increasingly being used for electricity generation. The number of solar installations within the municipal limits is increasing.

14.5.2 Energy Consumption: Sector wise break up

As energy consumption is primarily dependent on electrical energy, the electricity usage across various categories is taken into consideration.

Table 14.4: Details of energy consumers in the Municipality

Sl. No	Category	Power Consumption (in kWh)				
		2019-2020	2020-2021	2021-2022	2022-2023	2023-2024
1	Domestic	6740382	7086428	7450818	7754041	7831844
2	Agriculture	6370	6817	7240	7658	8128
3	Industrial	94418	98021	103177	170793	189587
4	Commercial	543209	5391409	602895	5971140	6033647

Source:KSEB, 2025

From the secondary data received from KSEB, it is seen that the energy consumption is highest in the domestic category, exhibiting a consistent increase from 2019-20 to 2023-24. Additionally, the number of commercial, agricultural, and industrial consumers has also increased. From the available data, it is seen that electricity consumption is increasing every year.

14.5.3 Electricity – distribution network, low voltage areas, frequent power disruption areas

Electrical energy is the most extensively consumed form of energy in the Municipality. The Kerala State Electricity Board (KSEB) manages power distribution in Haripad Municipality. From the secondary data received from KSEB, it is seen that electricity consumption is increasing every year. Details of new electricity connections provided by KSEB for 2019 to 2024 is given below. The distribution of transformers in the town is shown in Figure 14.24.

Table 14.5: Details regarding new electricity connection from 2019 to 2024

Sl. No	Category	Nature of connection	Number				
			2019-2020	2020-2021	2021-2022	2022-2023	2023-2024
1	Domestic	LT Single Phase	106	106	112	116	44
		LT 3 Phase	12	19	10	11	24
2	Agriculture	LT Single Phase	9	19	6	10	13
		LT 3 Phase	1	6	4	0	0
		HT	0	0	0	0	0
3	Industrial	LT Single Phase	3	7	4	6	1
		LT 3 Phase	4	4	6	3	4
		HT	0	0	0	0	0

4	Commercial	LT Single Phase	99	92	118	143	135
		LT 3 Phase	11	4	9	7	5
		HT	0	0	0	0	0

Source:KSEB, 2025

Haripad Municipality has 49 transformers, with power distribution exclusively through overhead lines, as underground lines are not utilized. This has resulted in various inconveniences in the town centre. According to the KSEB, electricity has been provided to everyone in the municipal limits under the Complete Electrification project and there are no houses that have not received electricity. There have been no reports of low voltage areas and frequent power disruption areas. Also, there is no situation of power supply interruption in the city except as part of scheduled maintenance.

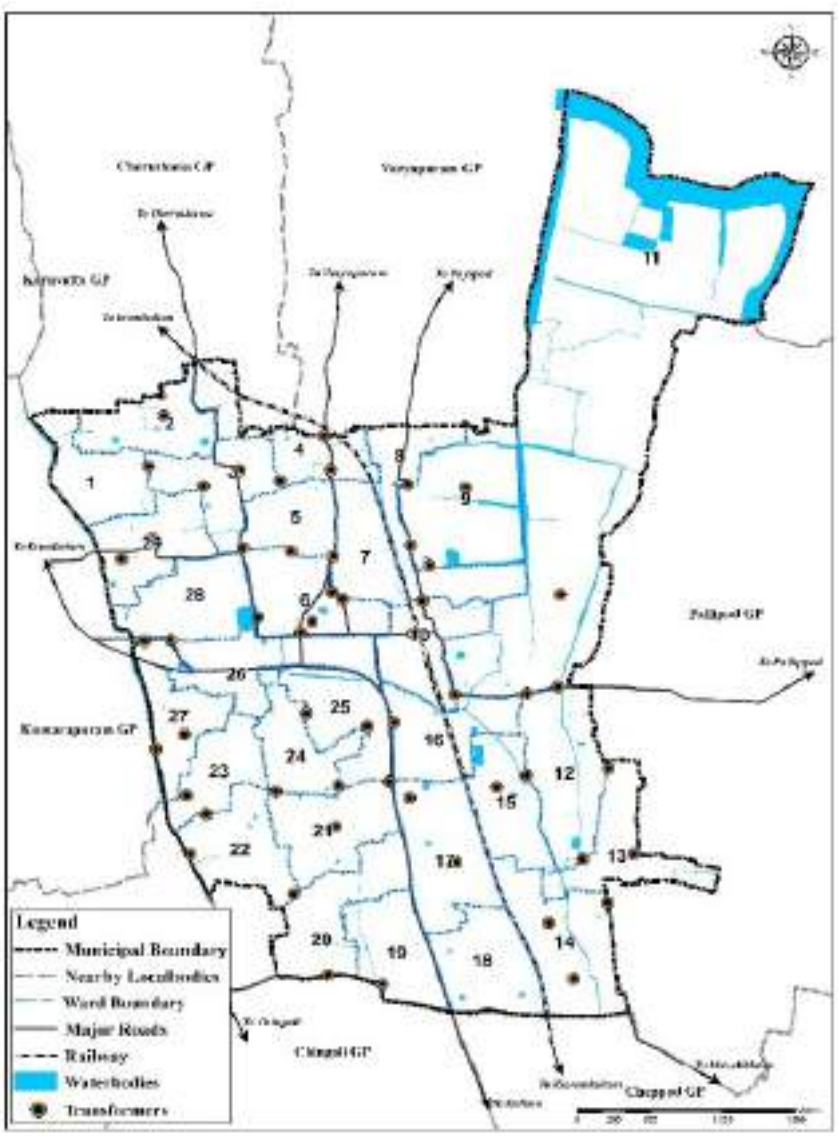

Figure 14.24: Location of Transformers in Haripad

14.5.4 Petroleum - petrol pumps, LPG

When considering energy consumption from petroleum products, the main ones used are petrol, diesel, LPG and CNG. There are petrol pumps and CNG filling station on the side of the national highway within the municipal limits. Approximately 94.6% of households rely on LPG for their energy needs, as per socio-economic survey.

14.5.5 Bio-mass & Energy from Non-conventional Sources

Biomass fuel, primarily sourced from homestead gardens, is also utilized in the town. The adoption of non-conventional energy sources is minimal, with approximately 241 solar roof top installations. As per socio-economic data, around 3.7% of households rely on solar energy for their energy needs.

Table 14.6: Power consumption from solar panels within the town

Sl. No	Category	Power Consumption (in kWh)				
		2019-2020	2020-2021	2021-2022	2022-2023	2023-2024
1	Domestic	45596	65031	72860	159792	231995

Source:KSEB, 2025

14.5.6 Energy Efficiency

Improving energy efficiency is essential for reducing energy consumption and enhancing sustainability in Haripad Municipality. The high reliance on hydroelectric power, petroleum products, and biomass indicates the need for adopting energy-efficient practices and integrating renewable energy sources. The absence of underground power distribution results in transmission losses and inefficiencies, particularly in the town centre. The limited use of non-conventional energy, with only 3.7% of households utilizing solar energy, highlights the potential for expanding renewable energy adoption. Encouraging energy-efficient appliances, promoting rooftop solar panel installations, upgrading transformers to minimize transmission losses, and modernizing the distribution network can significantly enhance energy efficiency. Additionally, implementing energy conservation measures across domestic, commercial, industrial, and agricultural sectors will contribute to long-term energy sustainability in the Municipality.

14.5.7 Effect of Hazard Risk in this Sector

The energy sector in Haripad Municipality is particularly exposed to hazard risks, with flooding and waterlogging posing the most significant threats to uninterrupted power supply. During extreme rainfall events, electrical infrastructure such as substations, transformers, distribution panels, and overhead transmission lines are vulnerable to damage or shutdown, often resulting in prolonged power outages that affect households, commercial establishments, healthcare facilities, and emergency services. Several Kerala State Electricity Board (KSEB) installations are located in flood-prone areas, increasing the likelihood of service disruption during monsoon seasons. In addition, Haripad's dependence on hydroelectric power makes the overall energy supply sensitive to variations in rainfall and reservoir levels, leading to fluctuations in availability. Flood-related road blockages can also disrupt petroleum supply chains, affecting fuel availability for transportation and backup generators. The relatively limited adoption of decentralized and non-conventional energy sources, such as solar power, further heightens the Municipality's vulnerability by reducing resilience during grid failures. Figure 14.25 highlights the spatial distribution of transformers situated within flood-prone areas, underlining the need for targeted risk mitigation and energy resilience measures.

14.5.8 Problems and Potentials

The energy sector in Haripad Municipality faces multiple structural and operational challenges that affect its reliability and resilience. The town remains heavily dependent on hydroelectric power, with minimal integration of non-conventional energy sources into the local energy mix. Solar energy adoption is particularly limited, with only about 3.7% of households utilizing solar systems, indicating significant untapped potential for renewable energy expansion. The power distribution network relies entirely on overhead lines, making

it highly vulnerable to disruptions caused by heavy rainfall, flooding, falling trees, and strong winds - especially in the densely built-up town centre.

Power supply to industrial and agricultural consumers shows periodic fluctuations, reflecting instability in sector-specific energy demand and distribution. In addition, Haripad's high dependence on petroleum-based fuels such as diesel, petrol, and LPG for transportation, cooking, and backup power increases vulnerability to price volatility and supply disruptions. Despite these challenges, the Municipality has considerable scope to improve energy security and sustainability. Integrating rooftop solar systems into the grid, transitioning critical stretches to underground cabling, upgrading substations and transformer capacity, and promoting energy-efficient practices can significantly enhance system reliability. Leveraging government incentives and policies to accelerate renewable energy adoption will further strengthen the town's long-term energy resilience.

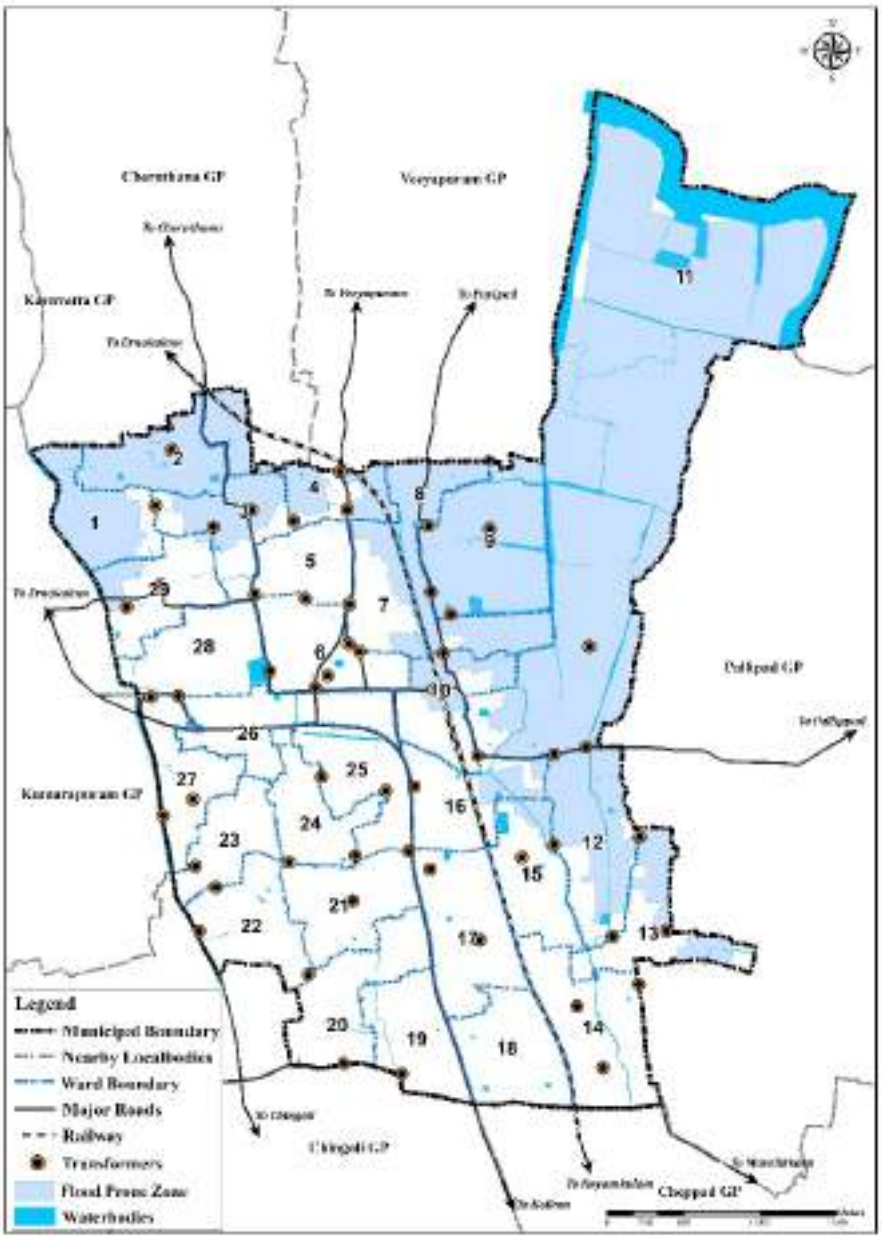

Figure 14.25: Location of Transformers overlaid with flood prone areas

14.5.9 Inference

Electrical energy is the most extensively consumed form of energy in the Municipality. The Kerala State Electricity Board (KSEB) manages power distribution in Haripad Municipality. Electricity generation in the region has predominantly relied on hydroelectric projects. Petroleum products such as petrol, diesel, and LPG are also utilized.

Electricity consumption is increasing every year. Failure to increase production in proportion to this may create a crisis in the future. The use of non-conventional sources such as solar

systems should be increased and for this, solar systems should be implemented in public institutions and offices. Solar systems can be implemented in industrial/commercial institutions and homes by implementing awareness and assistance programs. To increase energy efficiency, wastage of electricity should be avoided and transmission losses should be reduced. For this, the current network should be improved and the electricity network through cables and distribution through underground lines in the city center can be considered. Special attention and consideration are required to prevent the failure of the electricity distribution network due to natural disasters and floods.



PART I : STUDY & ANALYSIS

SOCIAL INFRASTRUCTURE

1. EDUCATION
2. HEALTH
3. HOUSING
4. RECREATIONAL FACILITIES
5. OTHER CIVIC AMENITIES
6. SPECIAL CONCERN AREAS
7. ENVIRONMENT
8. CULTURE AND HERITAGE
9. DEVELOPMENT ADMINISTRATION & FINANCE

CHAPTER
15

EDUCATION



Haripad has long upheld Kerala's legacy of educational excellence, supported by a strong network of schools and higher education institutions. As a town with high literacy and a tradition of academic engagement, ensuring equitable access to quality education remains a key planning priority. Strategically locating educational institutions enhances accessibility, reduces travel time and supports inclusive growth. This chapter examines the existing educational infrastructure of Haripad, identifies spatial and institutional gaps and outlines strategies to strengthen the sector - promoting a well-educated, skilled and future-ready community that underpins the town's sustainable development.

- Introduction
- Existing facilities
- General education - Status
- Higher & Professional Education
- Effect of hazard risk in this sector
- Problems and potentials
- Inference

15. EDUCATION

15.1 Introduction

The educational profile of Haripad town reflects a highly literate and education-oriented population. With an overall literacy rate of 96.88%, the town surpasses the state average of 94.00%, indicating the effectiveness of its educational infrastructure and public awareness regarding the value of education. In Haripad, male literacy rate is 98.10 % while female literacy rate is 95.84 %. The town offers educational options through government, aided, and private institutions from primary to higher education levels, ensuring diverse academic opportunities. Over the years, town has witnessed significant strides in literacy and enrolment rates, reflecting the community's growing awareness and prioritization of education. The presence of long-established schools, newer institutions and digital learning initiatives has helped people's access to quality education. Expanding vocational training could enhance practical skills and contribute to local economic growth.

15.2 Existing Facilities

As per the data received from Education Department, there are a total number of 70 educational institutions in the town area. The details are shown in Table 15.1. There are 30 institutions offering primary education, 18 offering upper primary education, 12 offering high school education and 10 offering higher secondary education. The existing educational facilities are sufficient to cater the present population as per planning standards. But infrastructure facilities need improvements.

Table 15.1: Total number of schools under each category

Sl. No.	Type	Govt.	Aided	Unaided	Total
1	Primary	14	14	2	30
2	U.P	7	11	0	18
3	High Schools	4	8	0	12
4	Higher Secondary	4	6	0	10

Source: Secondary data, Education Department, 2024

The category of schools under Government, Aided and Unaided sector are shown in Figure 15.1.

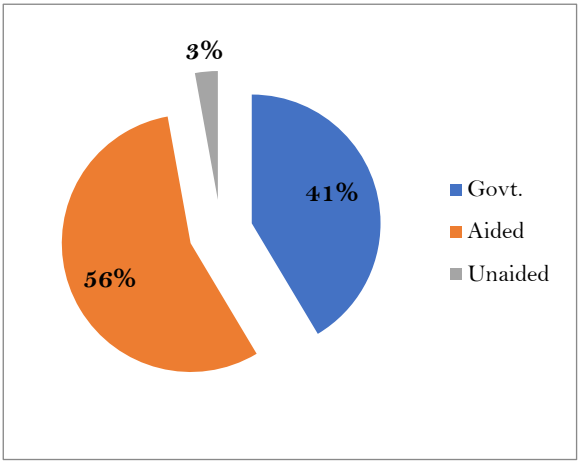

Figure 15.1 : Schools under each category

There is one special school in the town - Sabarmati Special School - which operates under private ownership. The Municipality does not have a government-run special school; however, a Government Autism Centre is located adjacent to the Sub-District Education Office, Haripad. This centre functions under the Haripad Block Resource Centre as part of the Samagra Shiksha Kerala (SSK) Project and is designed to provide skill development and

training for children with autism. The centre operates from 10:00 a.m. to 4:00 p.m. and caters to children aged 3 to 18 years who are enrolled in government schools. Currently, there are 20 students in this institution. The facility is attached to the Government U.P. School, Haripad, and currently functions with inadequate infrastructure, indicating the need for further improvement to ensure effective service delivery.



Figure 15.2: Autism Centre in town

All schools within Haripad town area are equipped with accessible toilet facilities, reflecting progress in meeting essential hygiene and sanitation standards. However, there remains a significant shortfall in basic academic infrastructure. Many schools lack adequate furniture, well-equipped laboratories, functional computer facilities, and properly resourced libraries. Addressing these deficiencies is critical to enhancing the overall quality of education and ensuring a conducive learning environment for all students.

15.3 General Education - status

Out of the total of 27,629 literates in the Municipality, 47% are male and 53% are female. The student-teacher ratio across various educational levels - Primary, Upper Primary, High School, Higher Secondary, and College - satisfies the required standards. This indicates a balanced distribution of teaching staff and supports the delivery of effective and individualized instruction in educational institutions. Primary and secondary education is widely accessible, with an increasing number of students completing their schooling. Haripad also has institutions offering higher secondary education, which ensures that students have the opportunity to pursue further studies. Table 15.2 shows comparison of available schools in town with planning standards (URDPFI Guidelines).

Table 15.2: Comparison of General Educational facilities with Planning Standards

Sl. No.	Category	Population served per unit	No. of schools required.	No. of existing schools	Whether it meets planning standards (URDPFI Guidelines)
1	Primary School (class 1 to 5)	5000	7	30	yes
2	Senior secondary school (class 6 to 12)	7500	5	40	yes

Source:URDPFI guidelines

Table 15.3 shows student enrolment details in primary and secondary schools in town for the last five years.

Table 15.3: Enrolment details in last 5 years

Sl. No.	Educational Institutions	Enrolment									
		2020		2021		2022		2023		2024	
		Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
1	Primary	99	93	92	90	100	98	80	90	81	80
2	Middle	814	715	837	709	943	740	965	754	949	739
Total		**913**	**808**	**929**	**799**	**1043**	**838**	**1045**	**844**	**1030**	**819**

Source: Secondary data, Education Department, 2024

A slight overall decline from 2023 to 2024 in middle levels may point to factors such as demographic changes, migration, or emerging educational alternatives.

With a high literacy rate compared to state average, the present education system focuses on improving the quality of education by integrating modern teaching methods, enhancing facilities, and increasing the availability of digital resources. Local authorities and educational planners are working towards ensuring that every child in town has access to a holistic and inclusive education, thus supporting the state's vision of literacy and social development.

Figure 15.3 shows the spatial distribution of educational institutions.

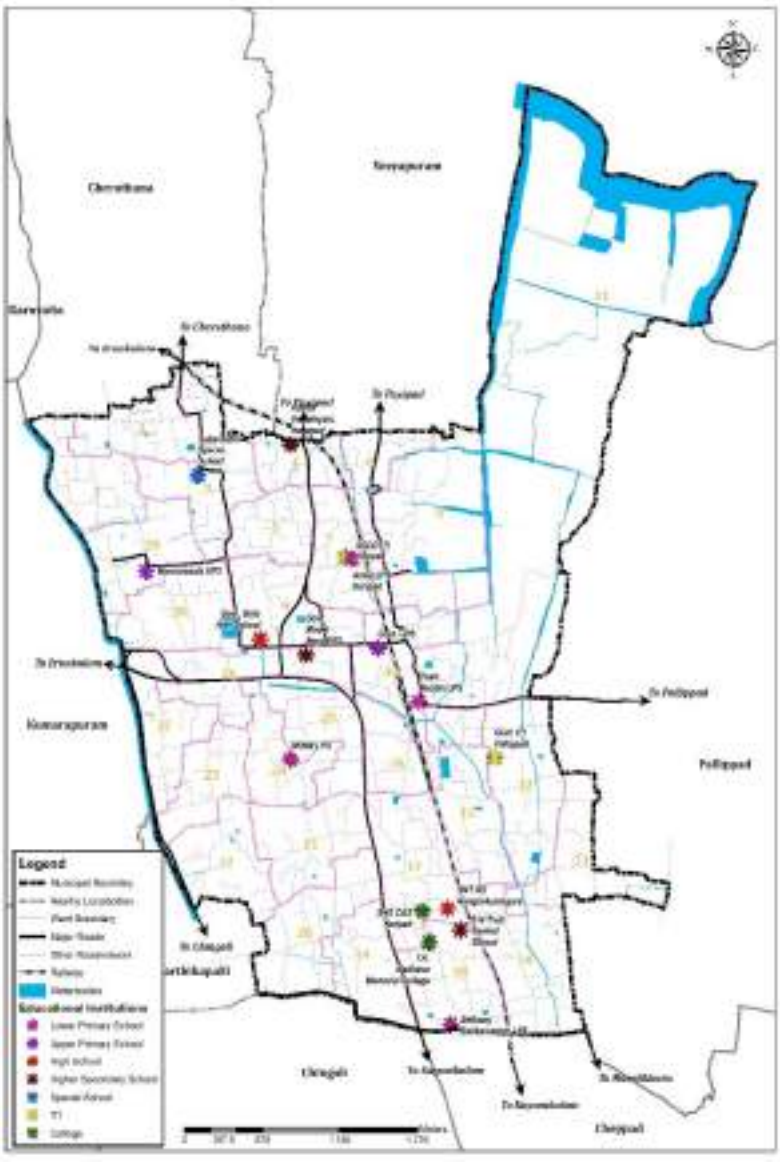

Figure 15.3: Spatial distribution of educational institutions in the town

15.4 Higher and Professional Education

Haripad is home to a few higher education institutions, including colleges that provide undergraduate and postgraduate courses in disciplines such as arts, science, commerce. The town's higher and professional education sector is marked by a blend of traditional colleges and modern institutions offering a variety of courses. TK Madhava Memorial College (TKMM) and Sree Narayana Guru College of Advanced Studies (SNGCAS) are the arts and science colleges located in the town. TKMM College is an aided college offering UG and PG courses in Arts, Science and Commerce while SNGCAS is a private self-financing college. Govt. ITI (SCDD) and Govt. ITI, Pallippad are two government ITI's in Haripad. There are no B. Ed college or Engineering / Health Science colleges in Haripad Municipality. Although, within a 30km radius of Haripad, there are three Engineering colleges and one polytechnic college. In addition, the Government Medical College, Alappuzha, located 24km from Haripad, serves the town's medical education needs.

15.5 Effect of hazard risk in this sector.

From a risk assessment perspective, the education sector in Haripad remains highly vulnerable to flooding and climate-related stresses. The 2018 floods had significant impacts on educational infrastructure across the town, causing structural damages to school buildings, inundation of classrooms, and loss of critical assets such as textbooks, laboratory equipment, furniture, and institutional records. Several schools and colleges located within identified flood-prone areas were directly affected, leading to unsafe learning environments and prolonged academic disruptions. Institutions such as Govt. LP School, Aroor and Govt. UP School, Haripad were also converted into relief camps during the floods, further delaying the resumption of normal academic activities and placing additional stress on infrastructure.

These recurring risks underscore the need to strengthen educational facilities through flood-resilient construction practices, improved drainage systems, plinth elevation strategies, and protective site planning to ensure uninterrupted functioning during and after extreme events. In addition to flood vulnerability, educational campuses in Haripad are increasingly exposed to urban heat island effects due to extensive paved areas and limited tree cover. Enhancing green infrastructure within school premises - through afforestation drives, Miyawaki mini-forests, shaded play areas, and eco-restoration initiatives - can significantly reduce heat stress, improve microclimatic conditions, and create healthier learning environments. Strengthening educational infrastructure from both flood resilience and climate adaptation perspectives is therefore essential to safeguard continuity of learning and institutional stability in Haripad.

Figure 15.3 and Figure 15.4 show the locations of educational institutions overlaid with the flood-prone areas. Institutions situated along the northern and north-eastern boundaries of the Municipality are particularly vulnerable to flooding.

15.6 Problems and Potentials

The education sector in Haripad, while quantitatively adequate, faces several qualitative and resilience-related challenges that require focused intervention.

1. **Quality Deficiencies in Infrastructure:** Many schools and colleges lack essential facilities such as well-equipped laboratories, updated libraries, adequate ICT infrastructure, furniture, study materials, and safe playgrounds. These shortcomings affect the overall learning environment and academic outcomes.
2. **Limited Higher Education Diversification:** The town has only one aided college and one self-financing college, along with two ITIs. Most institutions offer conventional courses, resulting in limited access to emerging, skill-oriented, and industry-linked programmes. This has led to increasing student outmigration to institutions outside the district.

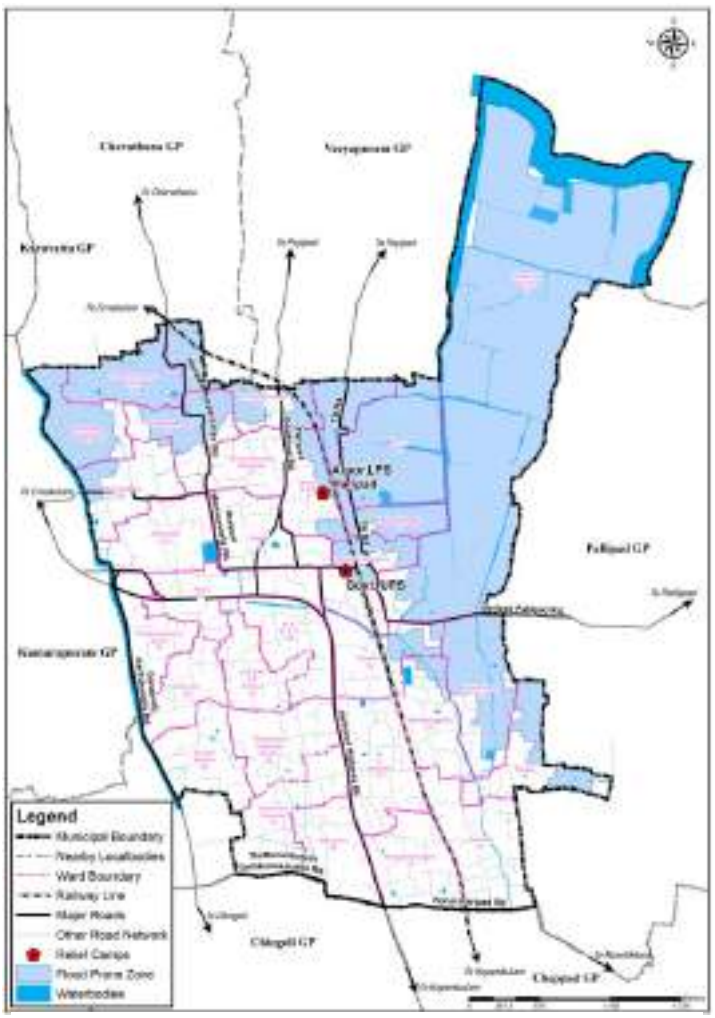

Figure 15.4: Schools in Haripad that function as relief camps

3. **Disaster Vulnerability and Dual Use as Relief Camps:** Several schools, including those identified in Figure 15.4, function as relief camps during flood events. However, many of these institutions lack the infrastructure required to safely and efficiently serve dual purposes (education + disaster relief), such as adequate sanitation, kitchen facilities, storage areas, and resilient building design. The 2018 floods demonstrated the vulnerability of educational infrastructure to inundation, structural damage, and prolonged academic disruption.
4. **Climate and Heat Stress Concerns:** Large paved areas and insufficient tree cover in school campuses contribute to urban heat island effects, affecting student comfort and health.
5. **Special Education Gaps:** Although an autism centre operates under the government sector, it lacks a dedicated building and adequate facilities, limiting its effectiveness in delivering inclusive and specialised educational support.
6. **Resilience and Preparedness Gaps:** Educational institutions located in flood-prone areas require structural strengthening, improved drainage, plinth elevation, and climate-responsive campus planning to ensure continuity of learning during extreme events.

Despite these challenges, Haripad's education sector presents significant opportunities for strategic improvement and long-term transformation.

1. **Quantitative Sufficiency as a Foundation:** The existing network of schools and institutions provides a strong base upon which qualitative improvements and capacity enhancement measures can be built.
2. **Scope for Academic Diversification:** Introduction of skill-based, technology-oriented, agro-based, climate resilience, tourism, and heritage-linked courses can align education with Haripad's economic and sectoral strengths, reducing student migration and enhancing local employment potential.
3. **Upgradation to Climate-Resilient Campuses:** Schools can be retrofitted as flood-resilient and climate-responsive campuses with improved drainage, elevated plinths, green infrastructure, rainwater harvesting, and renewable energy integration.
4. **Green Campus Initiatives:** Afforestation drives, Miyawaki forests, school agro-forestry initiatives (Vidyavanam), and shaded outdoor learning spaces can mitigate heat stress, enhance biodiversity, and promote environmental education.
5. **Strengthening Inclusive Education:** Development of dedicated infrastructure for special education centres, including the autism centre, can enhance inclusivity and ensure equitable access to quality education.
6. **Integration with Disaster Risk Reduction Framework:** Upgrading selected schools as well-equipped, resilient community shelters with adequate sanitation, water supply, and emergency facilities can strengthen Haripad's disaster preparedness strategy while maintaining academic continuity.

15.7 Inference

Although Haripad possesses a network of educational institutions broadly commensurate with its population as per planning standards, the sector faces significant qualitative and structural gaps. The absence of professional and advanced academic programmes, inadequate infrastructure in several institutions, limited government-supported special education facilities, and vulnerability to flood and heat-related risks constrain the overall effectiveness of the education system. Strengthening institutional capacity, upgrading infrastructure, enhancing resilience, and diversifying course offerings are essential to transform Haripad's education sector into a robust, inclusive, and future-ready system aligned with the town's long-term development vision.

CHAPTER
16

HEALTH



Kerala's strong primary, secondary and tertiary healthcare systems, supported by excellent health indicators, provide a solid foundation for accessible and equitable medical services. In Haripad, effective urban planning plays a critical role in safeguarding public health by enhancing air quality, mobility, open spaces, water access and overall living conditions. This chapter reviews the town's existing healthcare infrastructure, identifies service gaps and highlights the importance of integrating health considerations into planning decisions to create a safe, resilient and healthy environment for all residents.

- Introduction
- Existing Facilities - Type & Number of Health care institutions, Health indicators
- Epidemics
- Effect of hazard risk in this sector
- Problems and Potentials
- Inference

16. HEALTH

16.1 Introduction

The State has achieved remarkable progress in health standards for past several years which are almost comparable to that of developed countries in the world. The rapid decline in population growth rate, highest mean age at marriage, a very high level of acceptance and awareness of family planning methods and fertility control, a moderate decline in the mortality rate etc. are the commendable achievements. Low birth rate and death rate along with high female life expectancy, low infant mortality with negligible gap between rural and urban areas and low levels of disability are the special characteristics of Kerala's Health status.

The health sector in Haripad Municipality is a critical component of its social infrastructure, directly influencing the well-being and productivity of its population. The town is served by a network of government and private healthcare institutions. Government institutions include primary health centre, Taluk hospital and wellness centres in allopathic sector and Homeo and Ayurvedic dispensaries. There are no Multi specialty hospitals in the town. Clinics are operating under private sector. These institutions play a vital role in providing preventive, promotive, and curative health services to residents across urban and peri-urban areas.

16.2 Existing Facilities

The existing health facilities in Haripad Municipality encompasses Taluk Headquarters Hospital located near the KSRTC Bus Stand, Government Ayurveda dispensary situated adjacent to the Taluk Hospital, the Primary Health Centre located in Pilappuzha, and the Government Homeo dispensary near Mannarasala. Despite these, there is a Homeocare Homeo Clinic near Mannarasala, KMM Homeo Clinic and Sreehari Ayurveda Hospital located in close proximity to the National Highway. There are two veterinary hospitals in the Municipality. The Municipality comprises several Allopathic, Homeopathic and Ayurvedic health clinics in private sector. Six health and wellness Centres are also functioning in Haripad town as part of the National Urban Health Mission. It is pertinent to note that no super specialty hospital is presently available within the town. The people of Haripad Municipality rely on the Medical College Hospital at Alappuzha, located 22 kilometres away, for higher order facilities.



Figure 16.1: Taluk Head Quarters Hospital & PHC Pilappuzha

The Taluk Hospital in Haripad, with a capacity of 150 beds, provides more than the standard requirement of 62 beds as per URDPFI guidelines for its population of 31,151, indicating more than adequate inpatient capacity. It is fully equipped and operational, handling the majority of medical needs. As per data received from DMO, the hospital has a diversified medical staff, including specialists in gynaecology, paediatrics, orthopaedics, ophthalmology, ENT, dental care, and others. However, there is no cardiology department here.

Table 16.1: Allopathic Hospitals in Government Sector

Sl. No.	Name of the institution	Nurses	No. of doctors	No. of outpatients	No. of inpatients
1	Primary Health Centre	1	3	22317	0
2	Taluk Headquarters Hospital	38	17	370765	3035

Source: Secondary data 2024, DMO, Alappuzha

Table 16.2: Facilities available in the Allopathic Hospitals in Government Sector

Name of Hospital	No.of Beds		Operation Theatre	ECG	X-ray	Clinical Lab	Pharmacy	Ambulance	Mortuary
	Sanctioned	Functional							
PHC Haripad	24	0	0	0	0	0	1	0	0
Taluk HQ Hospital Haripad	150	150	1	1	1	1	1	1	1

Source: Secondary data 2024, DMO, Alappuzha

The Indian Systems of Medicine Department, Kerala coming under the Ministry of AYUSH, Govt. of India undertakes the traditional systems of medicines like Ayurveda, Yoga & Naturopathy, Unani & Siddha. The town has only one Government Ayurveda dispensary under this Department. This institution, which operates exclusively under the OP category, also implements schemes like Jeevani and Snehadhara implemented by the department.



Figure 16.2: Wellness centre under NHM

Haripad Municipality has a Government Homeopathy Dispensary functioning under the Homeopathy Department, located in Ward 1, which provides outpatient healthcare services to residents. In addition to this permanent facility, a floating homeopathy dispensary is also in operation to ensure healthcare access for residents in waterlogged, remote, and socially disadvantaged areas of the Municipality. This mobile service plays a crucial role in reaching populations that face difficulties in accessing regular healthcare facilities, particularly during monsoon seasons and periods of flooding. Through these institutions, the Homeopathy Department implements various health-related programmes and projects aimed at improving preventive care, accessibility, and overall community wellbeing. The details of the projects undertaken under the department are outlined below.

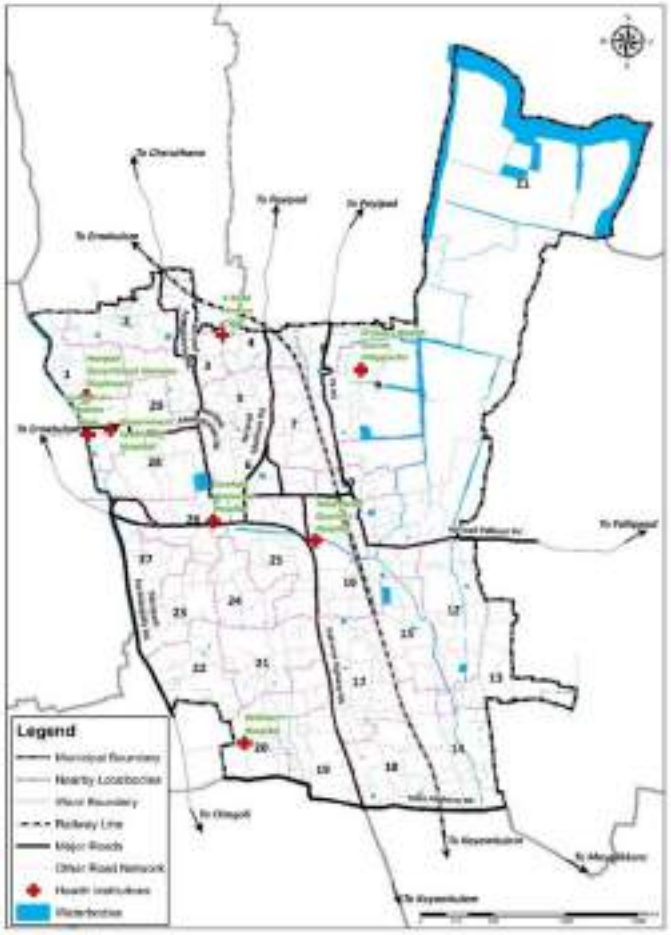

Figure 16.3: Spatial distribution of health institutions in Haripad Town

Table 16.3: Programmes under Homeopathic Department

Programs	Details
Vayojana Clinic (Geriatric Clinic)	Designed to address the health issues of elderly individuals with special care. The clinic offers geriatric specialist services, a fully equipped physiotherapy unit, medical camps, awareness classes, and visits to old-age homes
Seethalayam	Seethalayam is Kerala's first gender-based program focused on women's safety and empowerment through Homoeopathy. It provides medical treatment, counselling, awareness programs, and legal assistance for women.
Punarjani	A de-addiction clinic designed to help individuals overcome substance abuse issues.
Janani	A specialized department exclusively for infertility treatment.
Sadgamaya	A special initiative aimed at addressing behavioural disorders and learning disabilities among children

Source: Secondary data 2024, DMO Homeo, Alappuzha




Figure 16.4: Homeo dispensary in Ward 1 and Floating homeo dispensary

16.3 Epidemics

The COVID-19 pandemic had a significant impact on the health sector of Haripad Municipality. During the period from 2020 to 2023, a total of 40 fatalities were reported due to COVID-19, comprising 19 males and 21 females. Despite the challenges posed by the pandemic, timely interventions by health authorities, strong community participation, and proactive containment measures played a crucial role in managing the crisis and limiting wider impacts on public health.

In addition to COVID-19, Haripad Municipality faced a potential public health threat from avian influenza. In October 2022, an outbreak of avian influenza was confirmed among ducks within the municipal area. As an immediate preventive response, local authorities imposed a ban on the sale and consumption of domestic bird products, including eggs and meat, across the Municipality to prevent possible transmission to humans. These swift containment measures helped averts further escalation.

It is noteworthy that following the COVID-19 pandemic, Haripad Municipality has not experienced any major outbreaks of human epidemics. This reflects improved disease surveillance, enhanced public awareness, and strengthened coordination between health departments and local administration.

16.4 Effect of hazard in health sector

The healthcare sector in Haripad Municipality is vulnerable to multiple hazard risks arising from its geographic setting, environmental conditions, and existing infrastructure. A significant concern is the location of several key healthcare facilities in flood-prone areas, particularly in the northern part of the Municipality. Institutions such as the Primary Health Centre at Pillapuzha, KMM Homeo Clinic, Haripad Government Homeo Dispensary, and Homeocare Homeo Clinic are exposed to recurring flooding during the monsoon season. Flooding in these areas can disrupt access to healthcare services, damage medical equipment and records, and limit emergency response during critical periods. These risks underline the need for targeted flood mitigation measures, improved access routes, and resilient infrastructure planning to ensure uninterrupted healthcare delivery, especially during disaster events.

- **Flooding and Waterlogging Risks**

Haripad's recurrent monsoon flooding has had significant and multi-dimensional impacts on healthcare infrastructure, particularly in facilities located within identified flood-prone areas of the municipality. During major flood events, including the 2018 floods, several health institutions experienced direct inundation, restricted access due to waterlogged approach roads, and damage to critical infrastructure. The Ayurvedic Dispensary suffered loss of medicines and equipment, while the Government Homeo Dispensary in Ward 1 and the Primary Health Centre in Ward 9 were affected by floodwaters in and around their premises. Such incidents highlight the exposure of essential health facilities to hydrological risks.

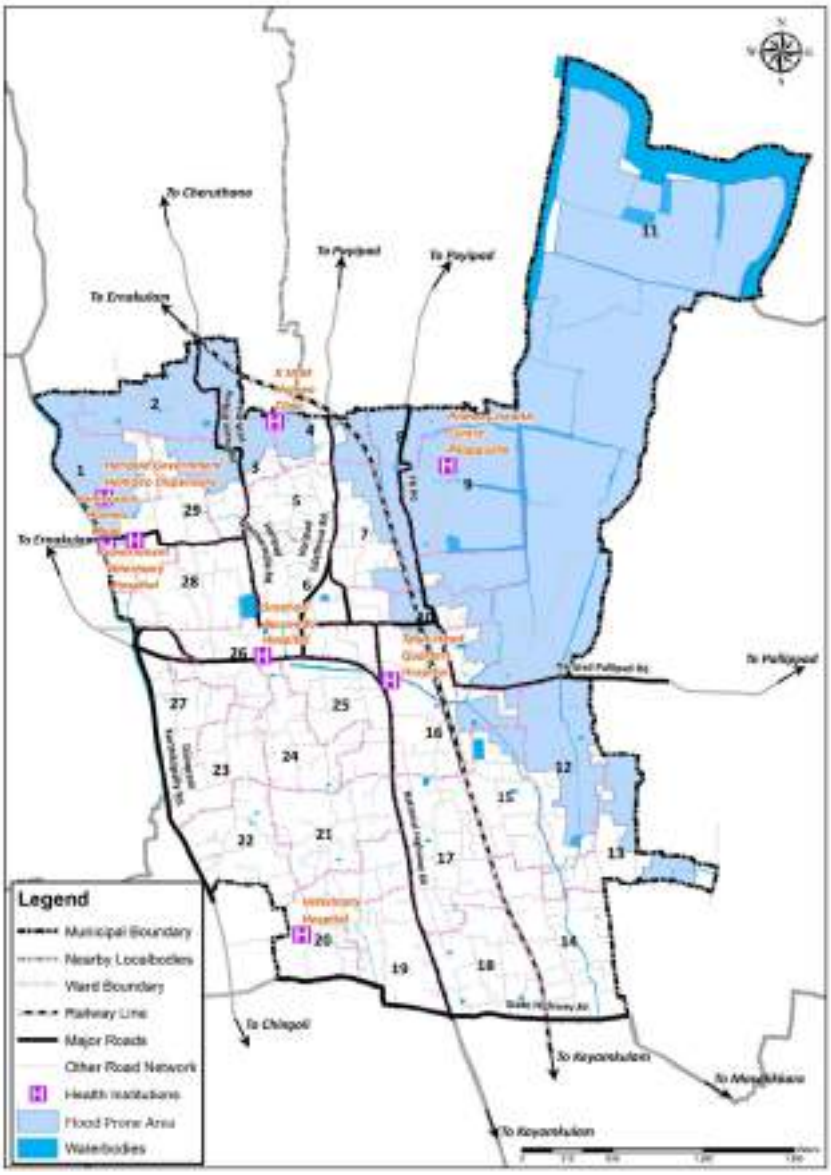

Figure 16.5 Map showing the location of Healthcare facilities in Flood Prone Area

Beyond structural damage, flooding disrupts service continuity at a time when medical demand typically increases. Impeded mobility restricts patient access, delays emergency response, and affects the movement of medical staff and supplies. Damage to drug storage areas, diagnostic equipment, and power systems further weakens operational capacity. In the post-flood phase, stagnant water, compromised sanitation, and overcrowded relief shelters create favourable conditions for vector-borne and water-borne diseases, placing additional strain on local health systems.

These experiences underscore the urgent need to strengthen flood resilience in the healthcare sector through site-level drainage improvements, elevation of critical equipment and storage areas, flood-proofing of buildings, backup power systems, and integration of health facilities into the town's broader disaster risk reduction framework. Ensuring uninterrupted and

resilient healthcare services is essential not only for emergency response but also for safeguarding public health in a climate-vulnerable town like Haripad.

- **Epidemics and Infectious Diseases**

Haripad Municipality is particularly vulnerable to outbreaks of infectious diseases, especially during and after the monsoon season when flooding and waterlogging are widespread. Prolonged stagnation of water in canals, drains, and low-lying areas creates favourable breeding conditions for mosquitoes, leading to increased incidence of vector-borne diseases such as dengue, chikungunya, and other febrile illnesses. Simultaneously, contamination of drinking water sources and compromised sanitation during heavy rainfall contribute to a rise in water-borne diseases, including diarrhoea, leptospirosis, and other gastrointestinal infections.

Flood-related displacement and the use of relief camps further elevate public health risks, as overcrowded conditions, limited sanitation facilities, and reduced access to safe water can accelerate disease transmission. Seasonal influenza outbreaks and the potential resurgence of pandemics such as COVID-19 highlight the importance of maintaining surge capacity, isolation facilities, adequate medical supplies, and effective surveillance systems within the local health infrastructure.

These recurring risks underscore the need for strengthened disease surveillance, improved drainage and waste management systems, regular vector control measures, climate-responsive health planning, and enhanced emergency preparedness within healthcare facilities. A proactive and integrated public health strategy is essential to safeguard Haripad's population against climate-sensitive disease outbreaks.

16.5 Problems and Potentials

The health sector in Haripad faces multiple structural, service delivery, and resilience-related challenges that affect both routine healthcare provision and emergency response capacity. The key problems faced by the health sector in Haripad are elaborated below:

1. **Lack of Super-Specialty Hospital**: The absence of a super-specialty hospital in Haripad Municipality compels patients to seek advanced medical care outside the region, often resulting in delays in diagnosis and treatment. Establishing a super-specialty facility, complemented by mobile health clinics, can significantly enhance access to healthcare, especially for vulnerable populations.
2. **Mental Healthcare Deficit**: Currently, there are no mental health clinics in Haripad. Introducing such facilities would strengthen the healthcare infrastructure and provide much-needed support for psychological well-being in the community.
3. **Disaster Impact on Healthcare**: Recurrent flooding, notably during the 2018 Kerala floods, caused extensive damage to healthcare infrastructure and equipment and led to service disruptions and heightened disease risks. Investing in disaster-resilient healthcare infrastructure is essential to maintain continuous care during emergencies.
4. **Disease Preparedness**: There is a noticeable lack of preparedness for waterborne and vector-borne diseases during the monsoon season. Strengthening surveillance and response systems is vital to mitigating outbreaks.

5. **Infrastructure and Emergency Preparedness Gaps**: Town faces notable challenges in emergency response capacity, particularly during disasters. There is a shortage of essential resources such as ambulances and trained medical personnel *(refer Table 16.2)*, which hampers timely and effective response during crisis situations. Strengthening the Municipality's emergency infrastructure and enhancing the availability of critical healthcare services are imperative to improving disaster resilience and safeguarding public health.
6. **Waste Management and Environmental Hazards**: Poor biomedical waste management, including improper disposal of syringes and contaminated materials, poses serious health and environmental risks. Stagnant water near health centers further increases the risk of disease transmission.

Despite the shortcomings identified, the overall health sector in Haripad remains relatively stable and functional, particularly at the primary and secondary care levels. The town's strong regional connectivity through NH 66, railway access, and proximity to higher-order urban centers enables residents to access advanced and super-specialty medical services outside the municipality when required, thereby partially offsetting local limitations. During disaster events - especially the 2018 floods - temporary medical camps played a critical role in ensuring continuity of care by distributing essential medicines, conducting health check-ups, and disseminating awareness on hygiene, vector control, and disease prevention. Adaptive service delivery models such as the Floating Dispensary have further strengthened outreach in waterlogged and flood-affected areas, ensuring that vulnerable populations continue to receive medical attention even when conventional access routes are disrupted. Collectively, these factors demonstrate a responsive and adaptive healthcare ecosystem, while also highlighting the need for further strengthening of local capacity and resilience.

16.6 Inference

The assessment of the health sector in Haripad indicates that while the town benefits from a reasonably well-distributed network of government and private healthcare institutions, structural and systemic gaps limit its overall resilience and service depth. The absence of a super-specialty hospital necessitates out-of-town referrals for advanced care, potentially delaying critical treatment. Recurrent flooding, particularly during the 2018 event, exposed vulnerabilities in health infrastructure, disrupted service delivery, and heightened risks of waterborne and vector-borne diseases. Inadequate emergency preparedness, limited ambulance and trained personnel capacity, gaps in biomedical waste management, and the absence of dedicated mental health facilities further underscore the need for targeted interventions.

At the same time, Haripad's high literacy rate and favourable social indicators provide a strong foundation for preventive healthcare, awareness-driven interventions, and community-based resilience measures. Adaptive initiatives such as medical camps during disasters and the Floating Dispensary model demonstrate the town's capacity for responsive service delivery in challenging conditions. Moving forward, the Master Plan underscores the importance of strengthening flood-resilient healthcare infrastructure, enhancing emergency response systems, improving disease surveillance and outbreak preparedness, expanding mental health

services, and upgrading sanitation and waste management systems. A resilient, accessible, and preventive-oriented healthcare framework will be essential to safeguard public health and support Haripad's long-term sustainable development.

CHAPTER
17

HOUSING



Housing is a fundamental human need and a key driver of urban development. In Haripad, rising population, urbanization and evolving household structures continue to shape the demand for adequate, affordable and well-serviced homes. Quality housing - supported by secure tenure, access to basic services and safe living conditions - plays a vital role in improving social well-being and reducing poverty. This chapter presents an overview of Haripad's existing housing stock, infrastructure conditions and service levels, while identifying key challenges and opportunities to guide future residential development in a sustainable and inclusive manner.

- Introduction
- Housing Status
- Slums and other Sub-standard Housing
- Housing Schemes
- Spatial distribution
- Effect of Hazard Risk in this Sector
- Problems and potentials
- Inference

17. HOUSING

17.1 Introduction

Housing is a fundamental human necessity that must be prioritized. The housing sector is highly employment-intensive, creating job opportunities during both the construction phase and throughout the lifecycle of the housing for ongoing maintenance. The demand for housing is driven by population growth, rapid industrialization, and urbanisation. Haripad Town comprises 29 wards, with approximately 44 % of the total land area allocated for residential use. This section outlines the current housing conditions in the town.

17.2 Housing Status

The housing shortage is calculated by adding the number of kutcha houses to the difference between the total number of households and the total number of houses. As per the socio-economic survey, kutcha houses constitute 6.7% of the total houses in the town. Some of these kutcha houses require replacement. The total number of houses in the town is 9129 *(as per the Annual Plan 2024–2025 of Haripad Municipality)*. As per census 2011, the total number of households is 8265. Currently, there is no housing shortage in the municipal area. However, there is a significant need to replace kutcha houses with pucca houses to enhance housing quality.

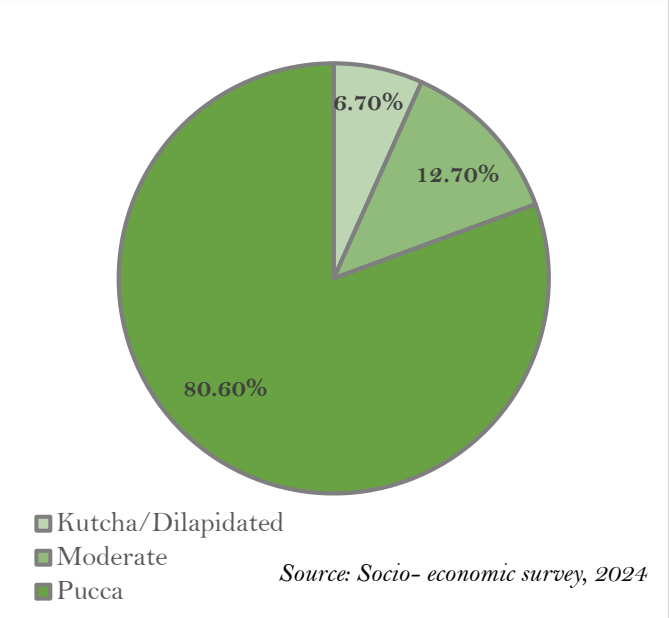

Figure 17.1: Type of buildings

The socio-economic survey indicates that the majority of houses are classified as either pucca (80.60%) and moderate quality (12.7%). The kutcha houses constitute 6.70%. The percentage distribution of different building types is presented in Figure 17.1.

As per socio-economic survey 2024, about 80.6% of houses in the town is good in condition for living only 6.7% of houses is not liveable or in dilapidated condition.

Most of the houses in the town is owned by the residents. Figure 17.2 shows the ownership status of houses in town.

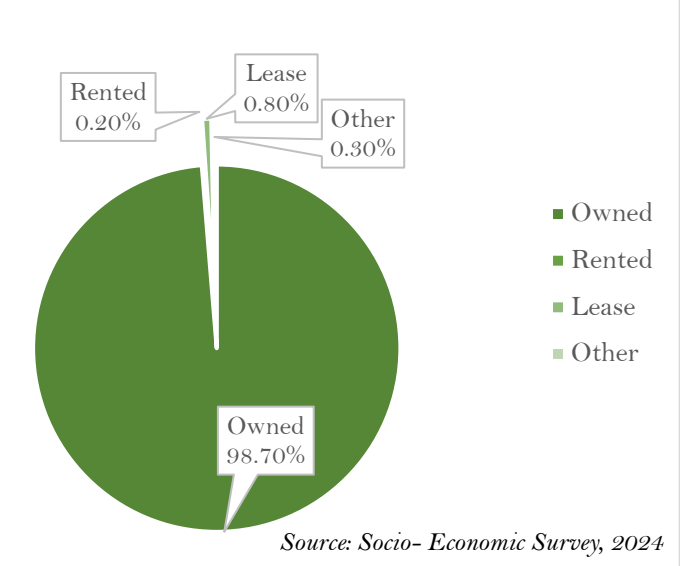

Figure 17.2 : Ownership Status

17.3 Slums and other sub-standard housing

Although Haripad Municipality does not contain officially notified slums, the presence of 19 Nagars predominantly inhabited by socially and economically backward communities highlights the need for targeted and inclusive urban interventions. A detailed Nagar-level survey indicates that 78.9% of houses are of moderate structural quality, 15.8% are pucca structures, and 5.3% remain kutcha, pointing to pockets of physical vulnerability that require housing upgradation and resilience measures. While sanitation access is commendable - with 100% toilet coverage and septic tanks installed - solid waste management remains a major challenge. Approximately 63.2% of households dispose waste within their premises and 15.8% in public spaces, reflecting the absence of structured waste collection and segregation systems in these areas. Further, only 15.8% of houses have access to proper drainage facilities, making these settlements highly susceptible to waterlogging, particularly during the monsoon season.

Physical accessibility and service infrastructure also presents significant constraints. Over 52.6% of houses are accessed by roads less than 3 metres wide, restricting emergency access, service delivery, and overall mobility. Nearly one-third of these roads are in poor condition, while only 31% are in good condition, underscoring the need for systematic road improvement and surface upgrading. Drinking water security is another pressing concern. Although 84.2% of households have water sources within their compounds - primarily wells and borewells - dependence on groundwater raises concerns regarding sustainability and quality. About 21% lack public water supply connections, and among connected households, supply is largely irregular, with only 5.3% receiving continuous supply. More than 21% experience severe water scarcity for nearly three months annually. Despite universal access to electricity and LPG, persistent issues such as waterlogging, erratic water supply, inadequate drainage, poor waste management, substandard access roads, and disturbances from adjacent railway lines indicate infrastructural inequities. These findings underline the need for integrated, ward-level infrastructure strengthening and inclusive service delivery strategies to enhance living conditions and long-term resilience in the Nagar settlements.



Figure 17.3 : Nagar areas in Haripad

17.4 Housing Schemes

Affordable housing remains a critical component of inclusive urban development, particularly for Economically Weaker Sections (EWS), Low-Income Groups (LIG), and other vulnerable populations. Housing schemes play a vital role in improving living conditions, strengthening socio-economic stability, and reducing vulnerability to disasters and environmental risks. By ensuring access to safe and secure housing, such initiatives contribute significantly to social equity and long-term urban resilience.

In Haripad Municipality, the primary centrally sponsored housing initiative currently being implemented is the Pradhan Mantri Awas Yojana (PMAY), which aims to provide affordable housing to eligible beneficiaries. Under this scheme, the Municipality has been assigned the construction of 456 housing units, of which 286 units have been completed, while the remaining units are at various stages of construction. In addition, housing projects are being implemented under the State Government's LIFE (Livelihood, Inclusion and Financial Empowerment) Mission, which focuses on rehabilitating landless and homeless families and providing safe, dignified housing for marginalized groups. Together, these schemes form the backbone of the Municipality's efforts to address housing shortages and improve the quality of life for economically vulnerable households in Haripad.

17.5 Spatial Distribution

According to the Land Use survey, Residential Land Use is most extensive in Ward 17, reflecting a higher concentration of housing units, established neighbourhoods, and relatively stable settlement patterns. This suggests that Ward 17 has evolved as a predominantly residential zone, supported by access to basic infrastructure, internal road connectivity, and proximity to essential services. In contrast, Ward 9 records the lowest share of residential land use, indicating comparatively limited residential development and a greater dominance of other land use categories such as agriculture, wetlands, institutional areas, or transportation infrastructure.

This spatial variation underscores the uneven pattern of residential growth across Haripad Municipality. The distribution of housing is influenced by multiple factors, including availability of developable land, flood-prone areas and low-lying paddy fields, infrastructure provision, accessibility to major roads and transport corridors, and proximity to commercial and activity nodes. Environmental constraints, particularly in flood-vulnerable zones, have also shaped settlement expansion in certain wards. These differences highlight the need for a more balanced and risk-informed approach to future residential planning, ensuring that housing growth is aligned with infrastructure capacity, environmental sustainability, and disaster resilience objectives of the Master Plan. The overall spatial distribution of residential areas across the Municipality is shown in Figure 17.4.

17.6 Effect of hazard risk

As part of the risk assessment for Haripad Municipality, a detailed building vulnerability analysis was undertaken at the cadastral level to understand the exposure and sensitivity of the housing stock to prevailing hazards. The assessment considered key parameters including access to the building (30%), building type (40%), age of structure (15%), and number of floors (15%). Buildings with poor road access, kutcha construction, single-storey configuration, and

older structural conditions were assigned higher vulnerability ratings, while multi-storey pucca buildings with access roads of at least 7 metres width were categorized as having lower vulnerability. Vulnerability Analysis indicates that Ward 3 (Kilikkakulangara) exhibits relatively high building vulnerability, reflecting concentrations of structurally weaker and less accessible housing.

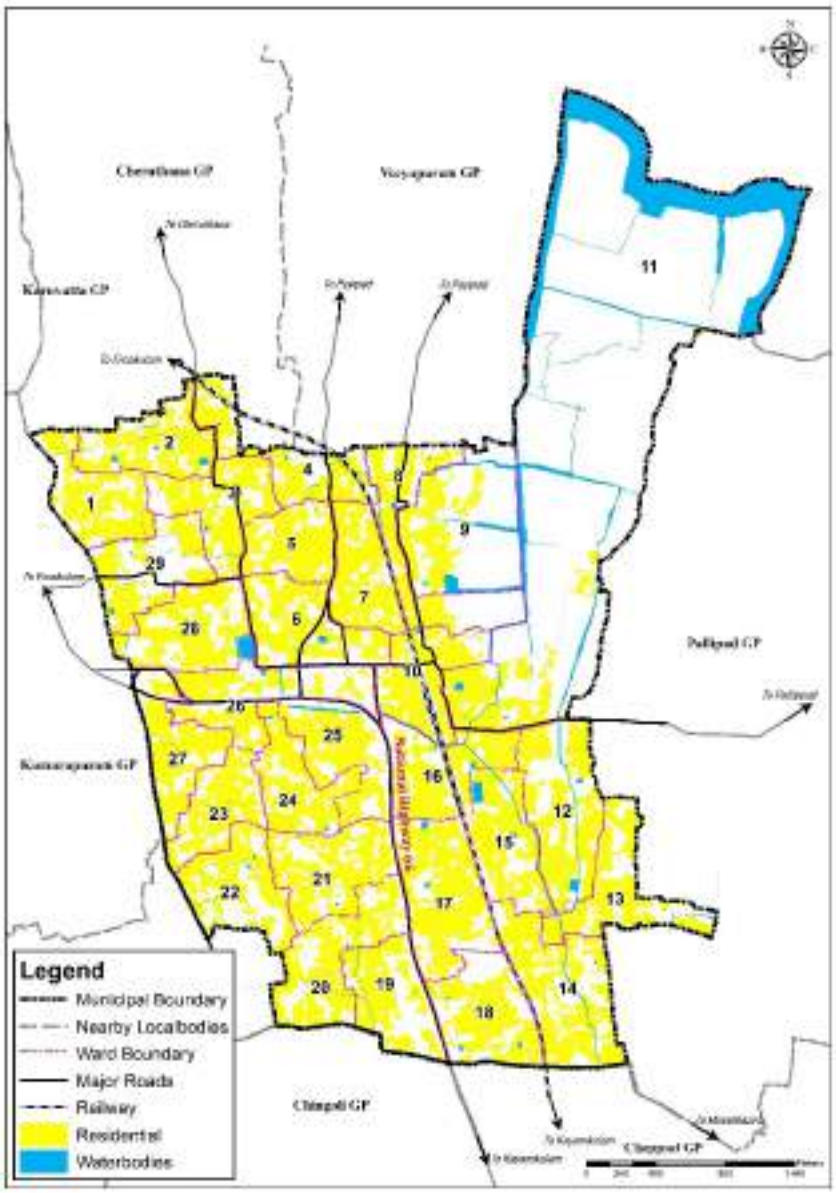

Figure 17.4: Spatial Distribution of Residential Land Use

In the context of Haripad's low-lying terrain, proximity to canals and paddy fields, and recurring monsoon flooding, the housing sector remains highly susceptible to hazard risks. Seasonal inundation and prolonged waterlogging lead to seepage, dampness, and gradual deterioration of foundations, walls, and flooring systems, particularly in kutcha and semi-pucca structures. In several flood-prone wards, repeated exposure to water not only increases maintenance costs but also reduces the structural lifespan of buildings. Limited access widths in certain residential pockets further constrain emergency response and evacuation during flood events, compounding vulnerability. Flood impacts extend beyond physical damage. Recurrent waterlogging disrupts daily routines, affects home-based livelihoods, and temporarily displaces families in severely affected areas. Damp indoor environments contribute to heightened risks of respiratory ailments and waterborne diseases, particularly among children, the elderly, and economically weaker sections. Over time, persistent hazard exposure can depress property values and discourage private investment in housing improvements.

Given these conditions, strengthening flood-resilient construction practices, improving drainage connectivity, enhancing access infrastructure, and prioritizing interventions in high-vulnerability wards such as Kilikkakulangara are critical to safeguarding Haripad's housing sector. A risk-informed approach to residential development and upgradation is essential to

ensure safer, healthier, and more resilient living environments across the Municipality. Figure 17.5 illustrates the cadastral-level vulnerability of buildings located within flood-prone areas of the town, highlighting the extent and spatial distribution of housing at risk.

17.7 Problems and potentials

Haripad Municipality demonstrates a relatively stable housing profile, with the absence of notified slums and a majority of houses classified as pucca or of moderate structural quality. However, certain structural and environmental challenges persist. Approximately 6.7% of the housing stock comprises kutcha structures, which are inherently vulnerable to flooding, moisture ingress, and structural deterioration. Recurrent waterlogging in low-lying wards weakens foundations, accelerates material decay, and increases long-term maintenance costs. In areas with narrow access roads and limited drainage infrastructure - particularly within some Nagar settlements - housing vulnerability is compounded by poor accessibility for emergency response and inadequate stormwater management. Erratic water supply, localized waste disposal practices, and insufficient drainage facilities further affect living conditions and public health. These risks are intensified during monsoon seasons, when flooding disrupts habitation and raises the incidence of waterborne and vector-borne diseases.

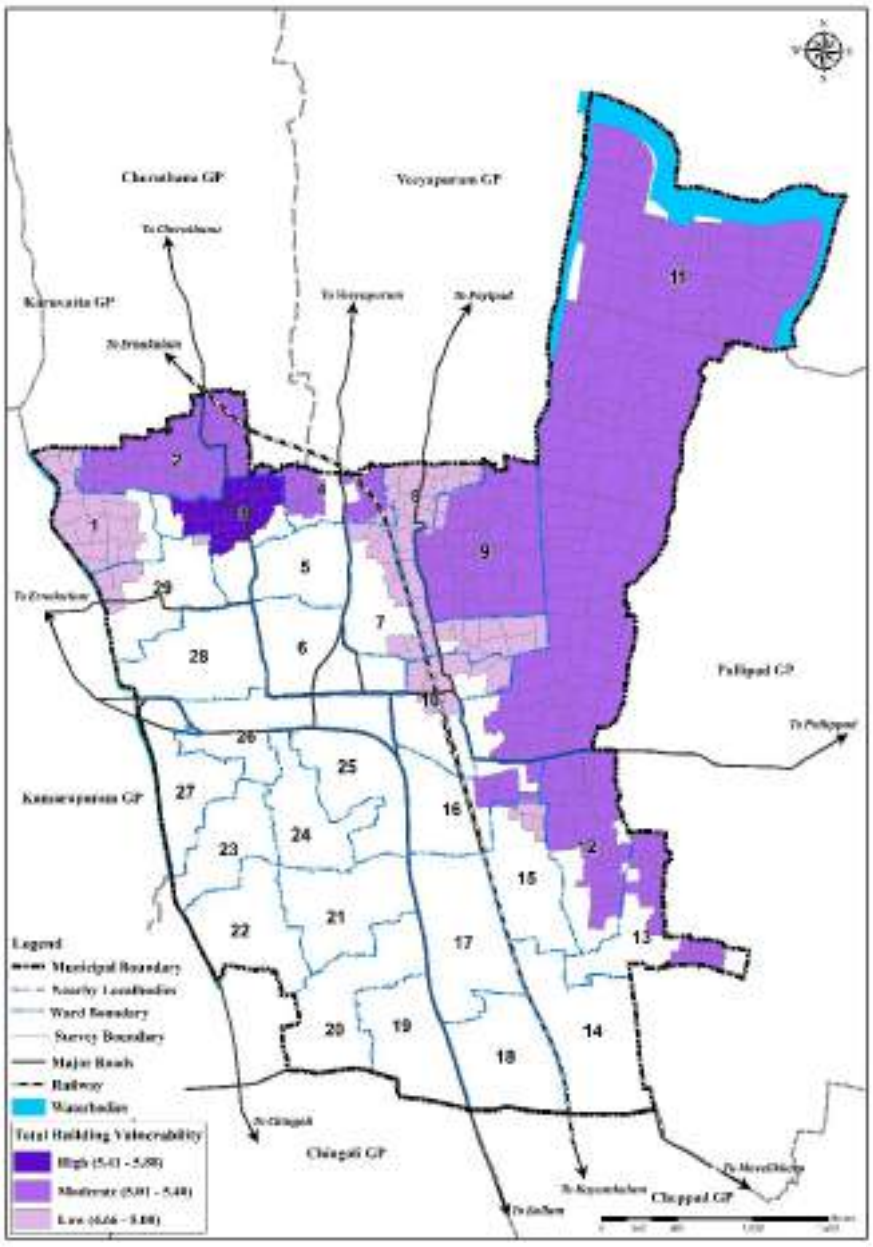

Figure 17.5: Total building vulnerability in the flood prone areas of Haripad town

Despite these challenges, the housing sector holds significant potential for improvement and resilience building. The ongoing implementation of the Pradhan Mantri Awas Yojana (PMAY), with 286 houses completed out of 456 sanctioned units, has strengthened affordable

housing provision. Projects under the LIFE Mission further support vulnerable households in securing safe and dignified housing. The overall predominance of pucca and semi-pucca houses provides a strong base for upgrading rather than large-scale redevelopment. There is substantial scope for in-situ improvement of structurally weak units, integration of disaster-resilient construction techniques, elevation of plinth levels in flood-prone areas, and promotion of eco-friendly, climate-responsive housing designs. Strengthening drainage connectivity, improving access infrastructure, and incorporating green building practices can significantly enhance housing safety and sustainability.

With targeted interventions focused on vulnerable wards and environmentally sensitive areas, Haripad can transition towards a more resilient, inclusive, and climate-adaptive housing framework while maintaining its relatively strong baseline housing conditions.

17.8 Inference

The housing scenario in Haripad Municipality is relatively stable, with the majority of dwelling units being pucca or of moderate structural quality and no presence of notified slums. Housing shortage is minimal, and ongoing schemes such as PMAY and LIFE Mission have contributed to strengthening affordable housing provision. However, the presence of kutcha houses (6.7%), coupled with recurrent flooding and waterlogging in low-lying wards, highlights the need for targeted interventions. Building vulnerability in certain pockets, inadequate drainage connectivity, and narrow access roads further increase exposure to hazard risks. Moving forward, the housing sector must prioritize replacement of weak structures, promotion of disaster-resilient and climate-responsive construction practices, and integration of improved drainage and infrastructure support to ensure safe, sustainable, and inclusive residential development in Haripad.

CHAPTER
18

RECREATIONAL FACILITIES



Recreational spaces are essential to enhancing quality of life and promoting social well-being in Haripad. Parks, playgrounds, sports facilities and green corridors support physical activity, mental health and community interaction. Green spaces also provide vital environmental benefits by reducing heat island effects, improving air quality, aiding stormwater management and strengthening climate resilience. This chapter examines the current recreational infrastructure in Haripad and outlines strategies to integrate accessible, well-distributed and sustainable open spaces within the town's urban fabric to create a healthier and more vibrant living environment.

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- Existing Facilities
- Effect of Hazard Risk in this Sector
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18. RECREATIONAL FACILITIES

18.1 Introduction

Recreational facilities are essential components of a town's infrastructure, contributing to the physical, mental, and social well-being of its residents. A well-planned town should include a variety of recreational spaces to cater to people of all ages and interests. Key recreational facilities include Parks and Green Spaces, Playgrounds, Sports Facilities including stadiums, gyms, courts etc., Community Centres, Swimming Pools and Water Parks, Walking and Cycling Trails, Libraries and Reading Rooms, Theatres and Cultural Halls. These facilities not only promote a healthier lifestyle but also foster a sense of community, inclusion, and improved quality of life in a town.

18.2 Existing Facilities

As per the URDPFI Guidelines, 2014, a small town is required to have 12–14% of its total area under recreational use to ensure adequate open spaces for leisure, physical activity, and community interaction. In contrast, Haripad Municipality has only about 0.06% of its total area designated as recreational space, indicating a severe shortfall in recreational infrastructure. This significant gap highlights limited access to parks, playgrounds, and organized open spaces for residents, adversely affecting quality of life, public health, and social wellbeing. The scarcity of recreational areas is particularly concerning given Haripad's growing population, increasing urbanization, and its emerging role as a cultural and tourism-oriented town. Existing recreational facilities in the Municipality are shown in Figure 18.1, which further illustrates their sparse distribution and limited coverage across wards.

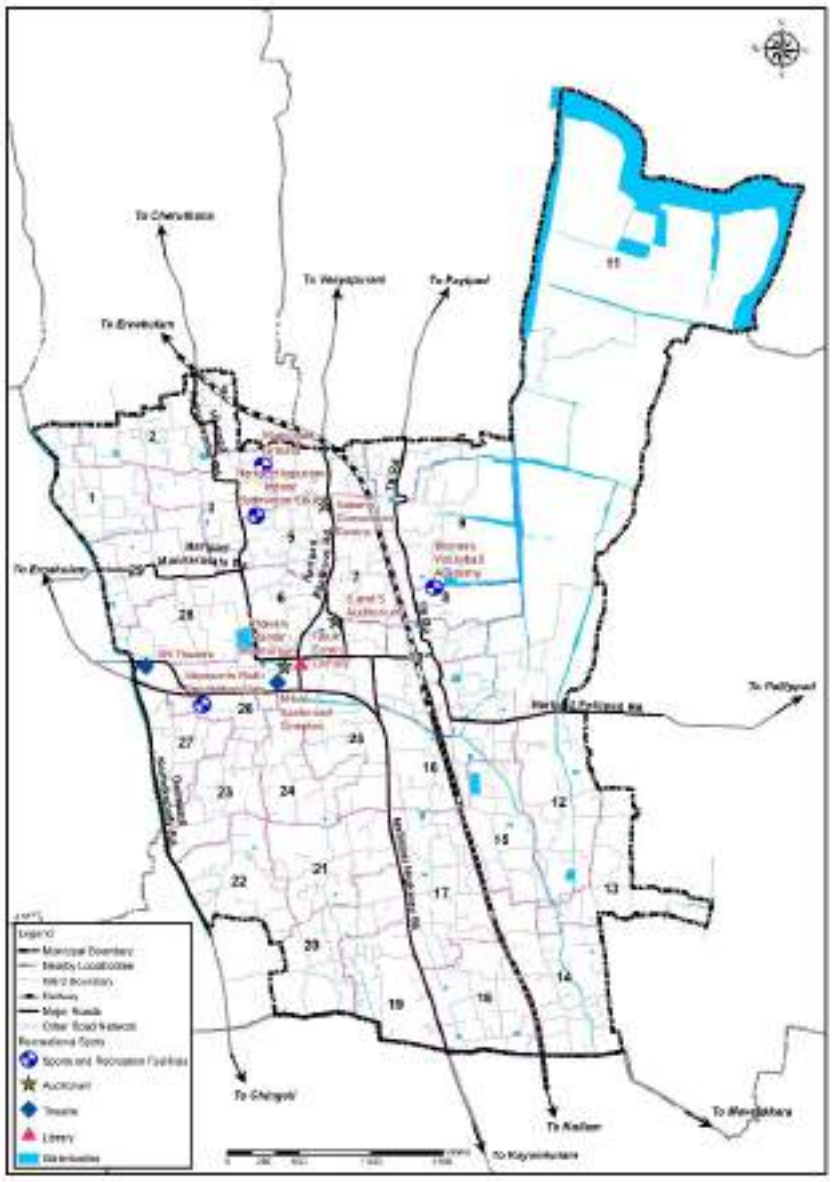

Figure 18.1: Location of Existing Recreation Facilities

- **Parks and Play Grounds**

According to the land use classification, only about 0.043% of the total land area in Haripad is designated for open spaces and parks, which is below the standards recommended by the URDPFI Guidelines. The town does not have public playgrounds or stadiums; the available play areas are mainly within educational institutions and private premises. Despite having any sort of play equipment or such facilities, almost all of the schools and colleges have open grounds within their premises. These areas are limited to open grounds without proper recreational facilities. To address this deficiency, the potential of waterbodies in Haripad can be effectively utilized to enhance open space availability.

- **Theatres and Auditorium**

The town does not have an open-air theatre or art galleries. However, there are two cinema theatres in the town. Haripad town is equipped with 6 auditoriums, of which 3 have an average capacity of 1,000 or more. They are Bhavani Mandhir Auditorium, S&S Auditorium, Sabari Convention Centre.



Figure 18.2: SN Cinema Theatre



Figure 18.3: S&S Auditorium

- **Reading Room and Library**

There are no public reading rooms available in the town. However, the Taluk Central Library is functioning at the Town Hall Junction.



Figure 18.4: Taluk Central Library

- **Town Hall**

The Town Hall in Haripad town has remained non-functional for the past 20 years. It is now in a dilapidated condition.

18.3 Effect of Hazard Risk

The inadequate recreational infrastructure in Haripad town increases its vulnerability to hazard risks. The shortage of public parks and playgrounds forces residents, especially children, to use unsafe spaces, heightening the risk of accidents. The Figure 18. shows that the Municipal ground and the Winners Volleyball Academy lies within the flood prone areas. The absence of open-air theatres and art galleries limits community engagement, reducing cultural resilience and psychological recovery after disasters. Auditoriums, though available, may lack structural resilience to withstand hazards, and their limited capacity restricts their

use as emergency shelters. The lack of public reading rooms and a non-functional Town Hall further weakens the town's ability to provide safe assembly points during emergencies. Additionally, the absence of well-maintained open spaces can exacerbate urban heat island effects and reduce natural flood absorption, increasing climate-related risks. Strengthening these facilities with hazard-resistant designs and multi-functional uses can enhance disaster preparedness and community resilience.

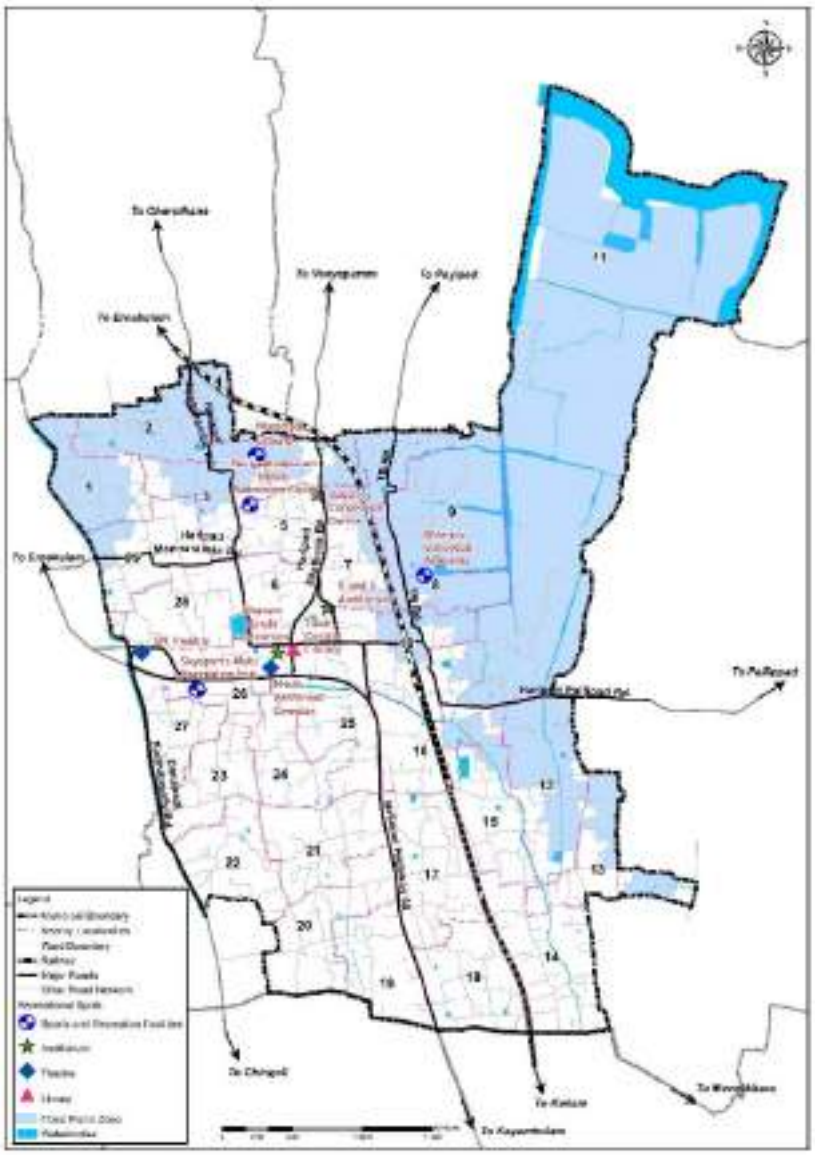

Figure 18.5: Map showing locations of Existing Recreational Facilities in Flood Prone Area

18.4 Problems and Potentials

The recreational infrastructure in Haripad town remains inadequate both in quantitative and qualitative terms. The proportion of land allocated for parks, playgrounds, and open spaces is significantly below the standards prescribed under URDPFI guidelines, resulting in limited access to structured recreational facilities for residents. The absence of a public stadium, dedicated playgrounds, and well-developed neighbourhood parks restricts opportunities for sports, physical activity, and community interaction. Existing play areas are largely confined to schools and private institutions, which are not universally accessible and lack supporting amenities such as seating, landscaping, lighting, and sanitation facilities.

Cultural and intellectual recreation facilities are also insufficient. The town lacks functional public reading rooms, art galleries, exhibition spaces, and an open-air theatre to support cultural expression and community events. The prolonged non-functioning of the Town Hall for nearly two decades represents a significant underutilization of civic infrastructure, limiting the town's capacity to host public gatherings, cultural programmes, and civic engagement activities.

Despite these gaps, Haripad possesses strong potential to enhance its recreational profile. Revitalization and adaptive reuse of the Town Hall, development of waterfront-based

recreation along canals and water bodies, and creation of neighbourhood-level green spaces can help address the current shortfall. Integrating multipurpose community halls, libraries, and cultural centres into existing public buildings can further promote social cohesion and cultural vibrancy. With strategic planning, recreational infrastructure can be expanded in a manner that supports public health, youth engagement, tourism, and overall urban liveability in Haripad.

18.5 Inference

The assessment of recreational infrastructure in Haripad indicates a substantial gap between existing provisions and the needs of the community. The shortage of parks, playgrounds, cultural venues, and accessible public gathering spaces limits opportunities for leisure, physical activity, and social interaction, while also reducing the town's capacity to function as a resilient public realm during emergencies. The current recreational infrastructure falls short of established urban planning norms, contributing to safety concerns, diminished community engagement, and constrained disaster preparedness.

Nevertheless, the sector presents strong potential for transformation. Through the development of new open spaces, adaptive reuse of underutilised facilities, and targeted public investments, Haripad can significantly enhance its recreational profile. Integrating hazard-resistant design principles and promoting multifunctional use of recreational spaces will not only improve urban liveability but also strengthen social cohesion and build long-term community resilience.

CHAPTER
19

OTHER CIVIC AMENITIES



Civic amenities are essential public services that ensure safety, convenience and a high quality of life for Haripad's residents. Facilities such as police and fire stations, crematoriums, burial grounds, public toilets, comfort stations, fuel stations and "take a break" centers play a vital role in supporting daily functioning and emergency response. Understanding population distribution and service gaps is crucial for planning these amenities effectively. This chapter evaluates the existing civic infrastructure in Haripad and identifies priority areas for improvement, ensuring that future development remains safe, accessible and responsive to community needs.

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19. OTHER CIVIC AMENITIES

19.1 Introduction

Civic amenities such as police stations, fuel stations, crematoria, communication facilities, public toilets, comfort stations, and fire stations are essential for ensuring public safety, convenience, and overall urban functionality. These facilities support law enforcement, emergency response, fuel accessibility, sanitation, and communication, contributing to the efficient operation of the town. The availability and distribution of these amenities play a crucial role in maintaining public order, enhancing mobility, and improving the quality of life for residents. This chapter provides an assessment of the existing civic amenities, highlighting their spatial distribution, challenges, and potential areas for improvement to enhance urban service delivery.

19.2 Existing Facilities

Figure 19.1 shows the spatial distribution of existing civic amenities with the town.

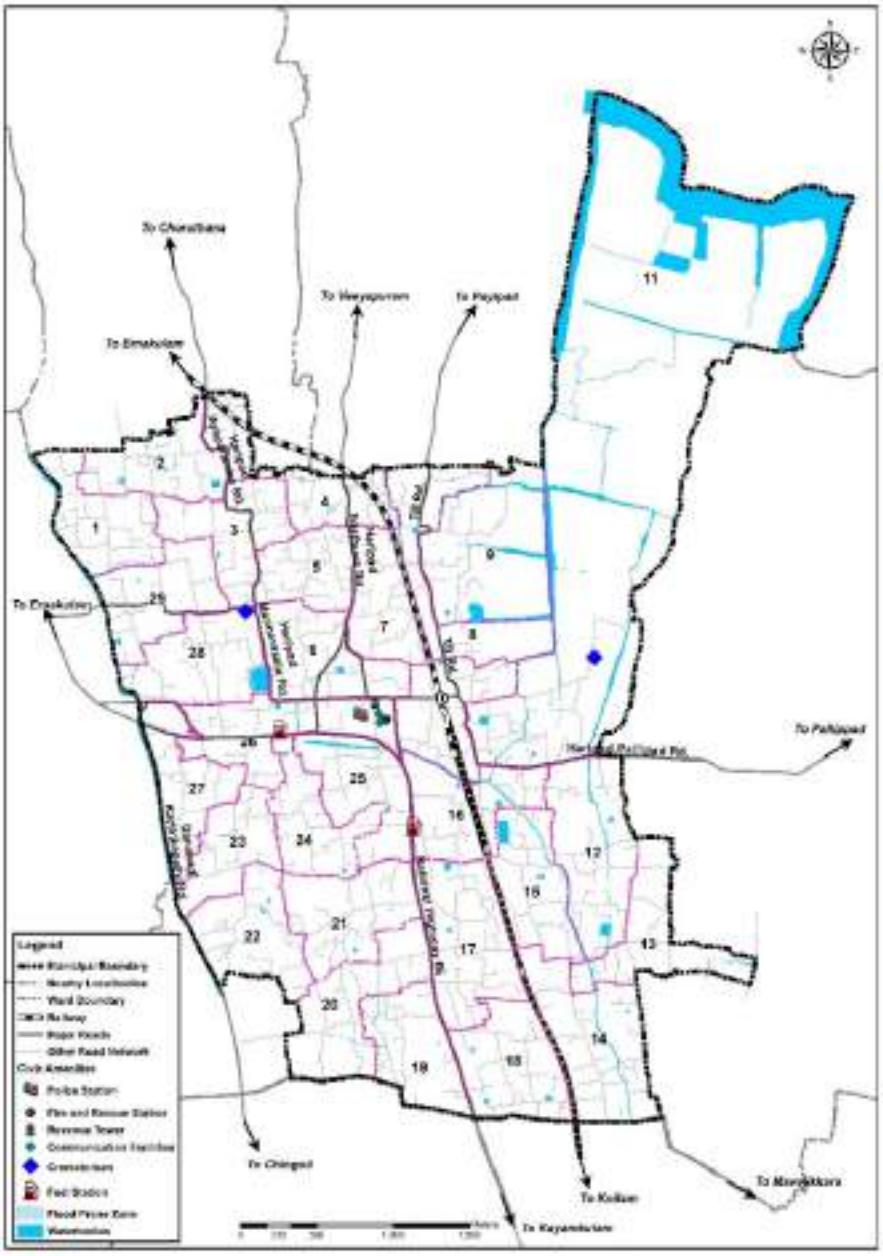


Figure 19.1: Location of Other Civic Amenities in town

19.2.1 Police Station

Haripad Police Station is situated on the southern side of Town Hall Jn - Ezhikkakathu Jn Road. The Police station is about 750 meters North - West from the KSRTC Bus Station, and about 100-meter North from the National Highway 66. As per the website of Kerala Police, the Haripad Police Station has a sanctioned strength of 49 officers including one inspector and two sub inspectors.



Figure 19.2: Haripad Police Station

19.2.2 Fuel Station

There are currently only two vehicle fuel filling stations within the Haripad municipal limits. Both of them are located on the side of the national highway, ensuring accessibility for both private and commercial vehicles.

1. Indian Oil Fuel Station – Near Madhava Junction
2. Hindustan Petroleum Fuel Station – Near KSRTC Bus Station

19.2.3 Crematorium and Burial Grounds

A public crematorium under the ownership of Municipality exist in Ward 11. However, it remains partially completed and non-operational. In addition, there is a crematorium of Brahmana Samooham in Ward 28.



Figure 19.3: Public Crematorium in Ward 11

19.2.4 Communication Facilities

Haripad town has a well-established communication network, including postal services, telecommunications, and internet connectivity. The town is served by the Haripad Post Office, which provides essential mail services, including speed post, parcel services. Additionally, courier services from major private operators ensure efficient logistics and delivery within the region. Telecommunication infrastructure in Haripad is robust, with multiple service providers offering mobile and landline connectivity. High-speed internet services, including fiber-optic

broadband, are available through various providers, ensuring digital accessibility for residents and businesses. Customer service centers further enhance communication facilities in the town. The presence of local cable TV networks adds to providing information and entertainment to the community. Overall, town has a comprehensive communication infrastructure that supports both personal and business connectivity.

19.2.5 Public Toilets and Comfort Stations

A total of six public toilet facilities have been identified within the municipal limits of Haripad. These are strategically located at high-footfall areas such as the KSRTC Bus Station, Mannarasala Temple, Haripad Subrahmanya Swami Temple, and the Ashoka Fuels petrol pump (privately owned), catering to commuters, pilgrims, and visitors. In addition, an e-toilet facility has been installed in front of the Municipal Office complex to serve the general public and staff. The operation and maintenance of toilet facilities located within temple premises are managed by the Devaswom Board.

Further strengthening public convenience infrastructure, a roadside rest centre has been established at Madhava Junction under the 'Take a Break' project launched by the State Government in 2021 as part of the New Kerala Action Plan. This facility includes a public toilet and a designated resting area for travellers and motorists, with maintenance and supervision carried out by the District Tourism Promotion Council (DTPC). Together, these facilities contribute to improving sanitation, traveller comfort, and public health within the town).



Figure 19.4 : Public toilets near (A) Haripad Subramanya Swamy Temple (B) Town Hall Junciton

19.2.6 Fire Station

Haripad town is served by a Fire and Rescue Station under the Kerala Fire and Rescue Services Department, located near the Taluk Hospital Junction. The station operates 24/7 and provides a range of essential services, including fire and rescue operations, issuance of No Objection



Figure 19.5 : Haripad Fire Station

Certificates (NOCs), ambulance assistance, standby duties, recovery vehicle support, pumping operations, pressure testing of fire extinguishers, explosive licensing, awareness programs, training sessions, and incident reporting. The fire station is situated in a congested area with limited access width, which poses certain operational constraints. Nevertheless, the facility serves the entire population of the town in accordance with the URDPFI guidelines.

19.3 Effect of Hazard Risk in this Sector

Civic amenities in Haripad Municipality are exposed to multiple hazard risks, particularly flooding and infrastructure-related failures, which significantly affect service delivery and public safety. Flood events can disrupt essential civic functions by damaging physical infrastructure and restricting access to critical facilities. Interruptions to communication networks, blockage of roads leading to emergency services, and damage to fuel supply and water distribution systems can delay emergency response and hinder disaster management operations, especially during extreme weather events.

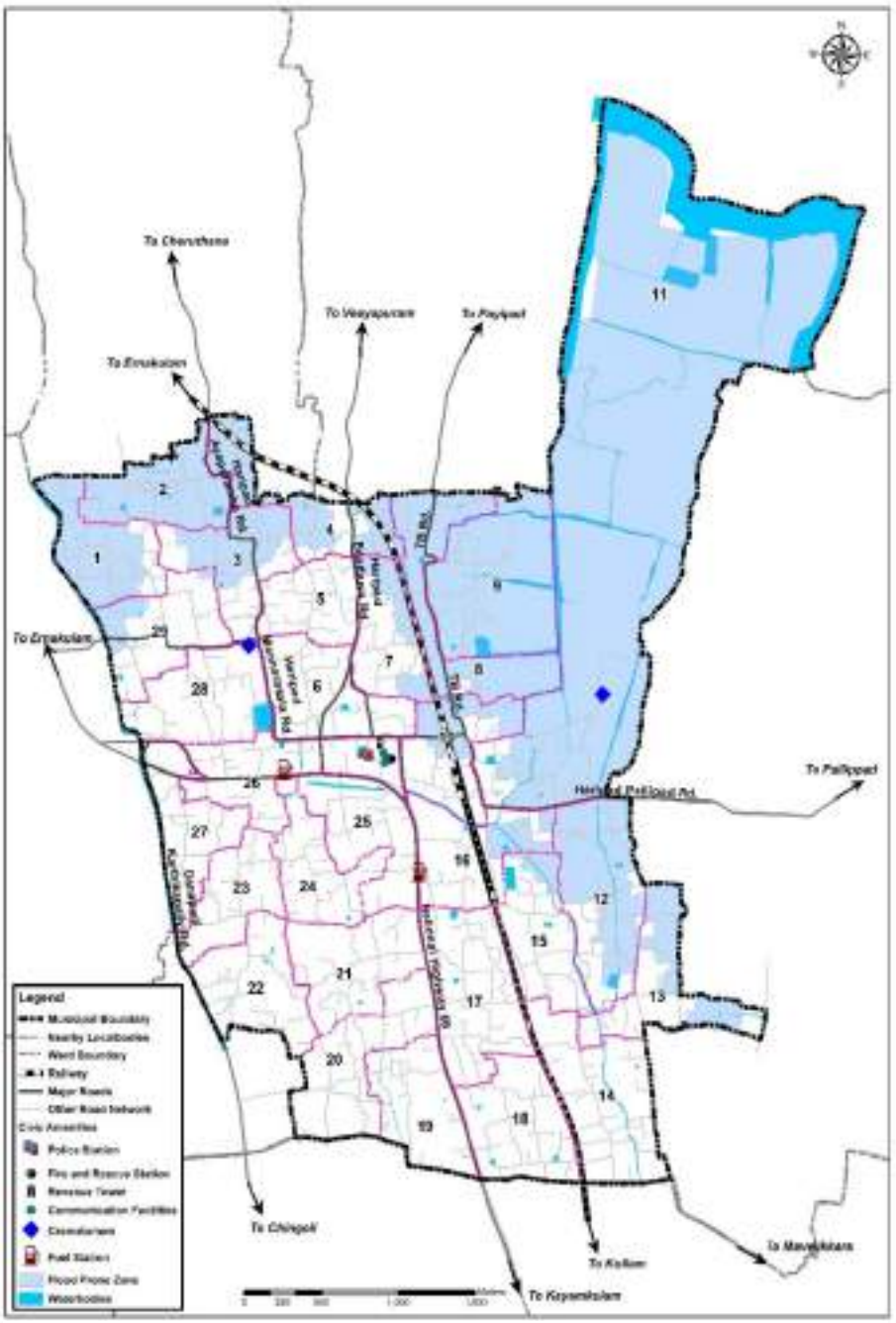


Figure 19.6: Map showing location of Existing Civic Amenities in Flood Prone Area

Figure 19.6 highlights that one of the major civic amenities vulnerable to flooding is the crematorium located in the eastern part of the Municipality. Field surveys indicate that this crematorium is currently non-functional, further increasing the town's vulnerability during emergencies. The situation is compounded by inadequate drainage infrastructure and poorly maintained

supporting amenities in the area. These deficiencies not only limit the functionality of the crematorium but also pose serious challenges to public health, dignity, and safety during disaster situations, underscoring the need for targeted infrastructure upgrades and risk mitigation measures.

19.4 Problems and Potentials

The assessment of civic amenities in Haripad reveals critical gaps in functionality, accessibility, and resilience that require urgent attention under the Master Plan framework. Several essential public facilities are either underutilised, inadequately maintained, or vulnerable to flooding and traffic constraints, thereby affecting service delivery and public convenience.

The Municipality-owned crematorium, for instance, has remained non-functional for years and is presently overgrown and poorly maintained. Its location in a low-lying area, coupled with waterlogging of the access road and surrounding premises during heavy rainfall, renders it inaccessible and unsuitable for use. Key emergency service facilities also face locational and operational challenges. The police station, situated along a congested one-way corridor, is frequently affected by traffic bottlenecks, hindering rapid response during emergencies. Similarly, the fire station is located on a narrow road with restricted access, potentially compromising emergency mobilization. Fuel infrastructure is also inadequately distributed, with both fuel stations located along the National Highway, compelling residents from interior wards to traverse congested stretches for refuelling, thereby increasing traffic pressure.

Public sanitation infrastructure remains insufficient and unevenly distributed. The public toilets in the Danapady market area are in poor condition and lack proper maintenance, while several other high-footfall zones - including commercial areas and transport nodes - lack adequate comfort stations altogether. These deficiencies disproportionately affect women, elderly persons, persons with disabilities, traders, and daily commuters, and undermine public health and urban dignity.

Despite these shortcomings, the civic amenities sector presents strong potential for structured improvement. Upgrading and relocating the crematorium to a flood-resilient and accessible site, modernising public sanitation facilities under inclusive design principles, and improving the accessibility and disaster resilience of emergency infrastructure can significantly enhance service efficiency. Strategic siting of additional fuel stations, development of inclusive public comfort stations, and integration of flood-proofing measures in civic infrastructure will strengthen urban functionality. Collectively, these interventions can elevate service standards, enhance public safety, and contribute meaningfully to improving the overall quality of life and resilience of Haripad town.

19.5 Inference

The review of civic amenities in Haripad indicates that while the town possesses essential urban service infrastructure - such as police and fire stations, fuel stations, communication facilities, and basic public sanitation - there are notable functional and spatial deficiencies that limit service efficiency and resilience. Key facilities, including the municipal crematorium, remain incomplete or non-operational, and several public toilets are either inadequately maintained or insufficiently distributed across high-footfall areas. Critical service institutions

are also affected by locational constraints, traffic congestion, and flood vulnerability, which can impede emergency response during peak monsoon periods.

These gaps highlight the need for systematic upgradation, improved siting, flood-proofing, and inclusive design interventions within the civic amenities sector. Strengthening operational readiness, enhancing accessibility for vulnerable user groups, modernising sanitation infrastructure, and ensuring climate-resilient infrastructure planning will be essential to improving service delivery standards. Addressing these concerns in a coordinated manner will significantly enhance urban functionality, public safety, and overall resilience in Haripad.

CHAPTER
20

SPECIAL CONCERN AREAS



Addressing the needs of people with special concerns is essential for creating an inclusive and equitable Haripad. This chapter examines social backwardness, poverty levels, SC/ST welfare, living standards, BPL distribution and the effectiveness of social security and poverty alleviation programmes. It also reviews services supporting women, children and the urban poor, including anganwadis and related welfare initiatives. By integrating these considerations into spatial planning, the Master Plan aims to enhance access to opportunities, strengthen social resilience and ensure that Haripad evolves as a supportive and inclusive community for all.

- Introduction
- Social Backwardness & Poverty
- Poverty Alleviation Programmes
- Social Security & Welfare, Women and Child Development
- Effect of hazard risk in this sector
- Problems and potentials
- Inference

20. SPECIAL CONCERN AREAS

20.1 Introduction

All human beings are inherently born free and equal in dignity and rights, underscoring the duty of individuals to act with respect and fraternity towards one another. In consonance with this principle, the Indian Constitution mandates the government to safeguard the social and economic interests of marginalized and excluded groups through well-defined policies and strategies, with particular emphasis on gender equality, education, health, and livelihood. Each planning area is characterized by its unique features and challenges, necessitating focused attention across physical, economic, and social dimensions. This chapter delineates the critical issues and priority areas essential for promoting the socio-economic development of the town.

20.2 Social Backwardness and Poverty

Poverty, defined as the inability of certain sections of society to meet basic necessities, continues to affect marginalized and underprivileged groups, often concentrated in specific regions, age groups, or social strata. Over the years, socio-economic inequalities between regions and communities have intensified, underscoring the global challenge of poverty amidst abundance. Similarly, backwardness, characterized by a lack of progress relative to cultural norms, exacerbates these disparities. It reflects the divide between traditional and modern, technologically advanced societies, with social backwardness perpetuating educational and economic inequalities. These interconnected factors, rooted in systemic inequities and low-status occupations, contribute to a cycle that impedes overall societal development.

20.2.1 Details of Backward Settlements in Haripad

Socially and economically marginalized groups often reside in clusters, frequently lacking access to basic amenities. Low-income households often live in 'Nagar', which may be authorized or unauthorized settlements or housing colonies. Haripad municipal area comprises 19 Nagars, accommodating approximately 561 households. Their details are shown in Table 20.1.

Table 20.1 : Details of Backward settlements - Nagars- in Haripad

Sl. No	Name of Nagar	Ward	Number of Households	Members in Household
1	Thongel Thekkathil	1	40	150
2	Nakrath	2	50	220
3	Madathil Paramb	2	20	83
4	Plakkot	4	8	30
5	Pattukaran Parampil	4	11	45
6	Chakkurmadam	4	10	40
7	Mallassery	4	3	10
8	Ottathengil	9	97	388
9	Kuttikkad Laksham Veed	9	34	136
10	Arannazhika AC	10	15	73
11	Chooralaackal	11	27	115
12	Neriyampallathu	11	15	80
13	Ullannur	12	48	192
14	Kotheri	12	56	224

15	ThaikkoottamVeed	21	17	70
16	Kizhakkidampalli	23	21	85
17	Moodayil Laksham Veed	25	4	16
18	Puthanpurayil	27	70	300
19	Valethu Laksham Veedu	27	15	60
				Source: Duranthanivarana Asoothranarekha, 2023-24

A survey was conducted in these settlements in June 2025 to understand the infrastructure problems in these Nagars. Categories like BPL, SC, ST etc. live here. The ownership of the land is with the residents. There are good quality houses in some Nagars. But mostly they are of moderate condition. Poor houses were found in Mathathiparambil. The houses in these Nagars have toilet, septic tank facility, electricity connection and LPG connection. Only a few Nagars have public water supply system. Most of them depend on open well / bore well. Only three Nagars have drainage lines. Liquid waste and biodegradable waste are disposed of on the respective plots and non-degradable waste is collected by the Municipality. Good access roads are available only to some Nagars. The survey found that the problems faced by the residents of these areas include scarcity of clean drinking water, lack of wide and good roads, problems with waste management, threat of floods, threat of reptiles, and the poor condition of the houses.



Figure 20.1 : Nagar areas in Haripad

20.2.2 BPL Household

The Below Poverty Line (BPL) framework, implemented by the Government of India, serves to identify economically underprivileged individuals and households in need of government assistance. Kerala has established its own set of criteria, assessing families across nine parameters, with those failing to meet four or more classified as BPL. The criteria are as follows:

1. No land or less than five cents of land
2. No house or dilapidated house

3. No sanitation latrine
4. Family with an illiterate family member
5. No regular employed person in the family
6. No access to safe drinking water
7. Women-headed household or presence of widows or divorcee
8. Scheduled castes and scheduled tribes (SC/ST)
9. Mentally retarded or disabled member in the family

20.2.3 SC/ST Population and General Condition

As per ward level census conducted by Municipality and data published in Duranthanivarana Asoothranarekha, total SC population in Municipality is 2257 and that of ST population is 20. The SC population constitutes approximately 7.28% of the total population in Haripad Municipality, whereas the ST population is minimal, accounting for only about 0.064%. The highest concentration of the SC population is observed in the Pilappuzha South Ward, while the ST population is predominantly located in the Eerikkal Ward. In Haripad, vulnerable groups, including a portion of the SC/ST population, continue to face challenges in accessing quality education, employment, and healthcare due to economic constraints and inadequate service delivery. Their socio-economic status remains lower compared to the general population, necessitating focused developmental programs. Detailed representations of the SC and ST populations within the Municipality is shown in Figure 20.2.

Some of SC/ST settlements in Haripad are often characterized by poor housing conditions, lack of proper sanitation, and limited access to potable water. Infrastructure improvements and livelihood enhancement programs are crucial to improving their living conditions.

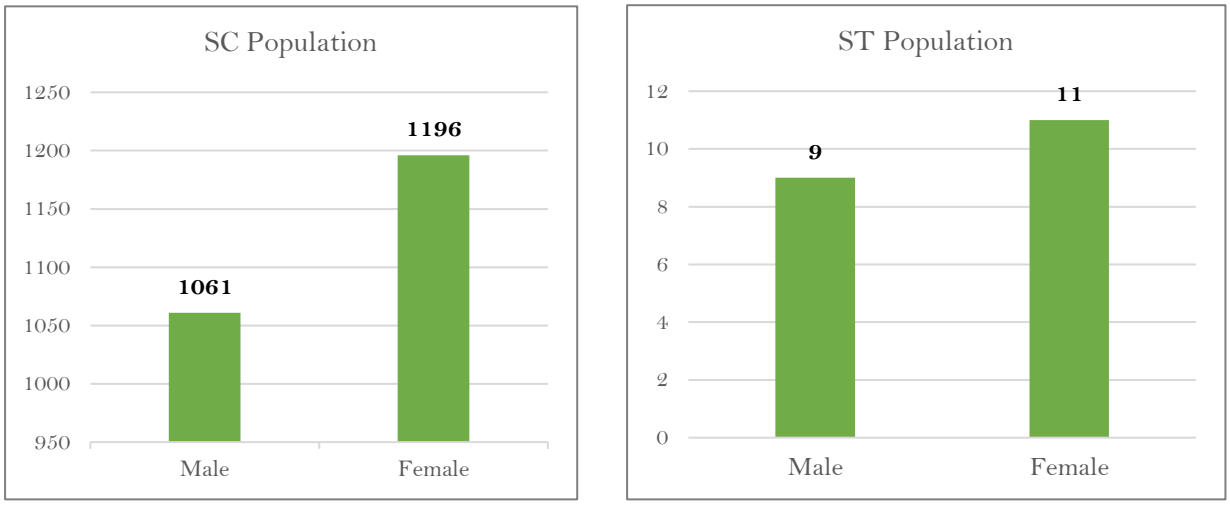


Figure 20.2: Details of SC and ST population

20.3 Poverty Alleviation Programmes

Several government initiatives, including Kudumbasree, Pradhan Mantri Awas Yojana (PMAY) etc. have been implemented to improve economic conditions. However, challenges in outreach and execution persist. Urban poverty alleviation programs such as NULM (National Urban Livelihoods Mission) and community development schemes have been introduced to

enhance the socio-economic status of Haripad's urban poor. Strengthening these initiatives through community participation and financial inclusion is essential.

20.4 Social Security & Welfare, Women and Child Development

Social security serves as a social insurance program aimed at providing protection against various vulnerabilities, including poverty, old age, disability, unemployment, and other socially recognized challenges. Women, children, individuals with disabilities, and the elderly are particularly vulnerable due to historical and societal factors. To support these vulnerable groups, numerous schemes are implemented with assistance from central and state governments. These initiatives offer significant benefits, such as pensions, insurance coverage, and other forms of support, for the elderly, differently-abled, and orphaned individuals. Currently, seven categories of social security pensions are distributed through local self-governments, including agricultural labour pensions, destitute pensions, widow pensions, old-age pensions, disability pensions, and others.

Crime data in Haripad municipal are is given in Table 20.2. As per the crime statistics records of Haripad police station there are a total of 30 crimes in 2024.The highest crime rate is 38 in 2022.

Table 20.2: Crime data in Haripad Municipality in past 5 years

Type	2020	2021	2022	2023	2024
Theft	2	2	8	3	2
Burglary	0	1	2	0	0
Kidnapping	1	0	0	0	0
Robbery	0	0	0	0	1
Riots	5	5	11	8	3
Murder	0	0	0	0	1
Crimes against women	2	4	5	3	5
Fatal accidents	1	7	8	6	10
Cyber crime	5	3	4	7	8

Source: Police Department, 2025

The development and empowerment of women and children are integral to fostering equitable and sustainable societal progress. This sector focuses on addressing the specific needs and challenges faced by women and children, ensuring their access to health, education, and economic opportunities while safeguarding their rights and well-being.

In the modern developed world, the development of women and children always receives special attention. In Kerala, women make up more than half of the total population, and the state's literacy rate for women is higher than average. The government has implemented numerous initiatives to integrate women into the mainstream of society. To promote the welfare and advancement of women, labour enterprises and specialized training programs should be encouraged. The "Kudumbasree" initiative plays a crucial role in establishing labour

enterprises. Additionally, it is essential to ensure that women in the unorganized sector receive minimum wages for their work.

According to the socio-economic survey conducted in 2024, out of the total households that responded, 17.2% of households were identified as female-headed families. This data highlights the role and prevalence of women as heads of families in the community, shedding light in their social and economic responsibilities.

20.4.1 Social Welfare Programmes and Infrastructure

A. Kudumbasree Mission

A significant contributor to women's empowerment in Haripad is the Kudumbasree Mission, a state-wide initiative launched by the Government of Kerala. This program has facilitated the formation of Neighborhood Groups (NHGs), Area Development Societies (ADSs), and Community Development Societies (CDSs) within the Municipality. These community networks provide women with opportunities for self-employment, skill development, and active participation in local governance, contributing to poverty alleviation and women's empowerment.

The Municipality has a total of 242 registered Kudumbasree units. In addition, there are 21 Balasabhas for children, 11 Vayojana Ayalkoottams for the elderly, one Ayalkoottam for persons with disabilities, and one Ayalkoottam for the transgender community. Kudumbasree units in the Municipality undertake a range of activities, including the establishment of food processing units, facilitation of linkage loans for members, operation of support mechanisms such as the Snehitha community counselling centre, and the management of catering units. A notable enterprise under Kudumbasree is the Karthika Flour Mill located near Prathimukham junction, which functions as a successful micro-enterprise initiative.



Figure 20.3: Karthika Flour Mill near Prathimukham Junction operated by Kudumbasree unit

B. Integrated Child Development Service (ICDS)

While various programs have been implemented, such as collaborations between different departments to reduce infant mortality rates, prevent diseases in children, and provide classes for mothers on proper child care, there is still a need to enhance basic amenities. The Integrated Child Development Services (ICDS) program, which was launched on October 2nd, 1975, has now evolved into one of the largest child development programs in the world. However, to maximize its impact, further improvements in infrastructure and essential services are crucial. ICDS program is a comprehensive approach aimed at the development of women and children

from disadvantaged communities throughout their lifecycle. Launched in Kerala in 1975, the program provides an integrated package of early childhood services designed to leverage their synergistic benefits. The scheme primarily targets the most vulnerable groups, including children up to six years of age, pregnant women, and nursing mothers from the poorest families living in disadvantaged areas, such as rural, tribal, and urban slum regions. Beneficiaries are identified through community surveys that pinpoint families living below the poverty line.

The ICDS scheme aims for the holistic development of women and children, providing a comprehensive range of services through ICDS projects. These services are delivered at the grassroots level through Anganwadi centers, where an Anganwadi Worker and Helper oversee the activities. The ICDS projects offer supplementary nutrition, health education (National Health Education and Development NHED), immunization, and awareness on various topics for women. For children, the projects include non-formal preschool education, supplementary nutrition, immunization, health check-ups, referral services, and health and nutrition education to promote their overall development. Additionally, ICDS runs welfare programs for children, including the SABALA scheme for adolescent girls (ages 11-18), focusing on their empowerment, particularly in tribal areas. This scheme provides training for adolescent girls in education, personal hygiene, and skill development programs.

20.4.2 Status of Anganwadis

Anganwadi centres function as the primary grassroots service delivery units for social welfare programs, each managed by an Anganwadi Worker and supported by a helper, both selected from the local community. As per norms, one Anganwadi is required for every 1,000 population.



Figure 20.4: Anganwadi

Haripad Municipality has a total of 27 Anganwadi centres, catering to 278 children by providing nutritious food along with interactive and activity-based learning.

According to ICDS data, all centres are equipped with adequate indoor and outdoor spaces, separate kitchens, storage facilities, electricity, fans, safe drinking water, and toilet facilities. While nine centres require minor maintenance, the remaining Anganwadis are in good condition with proper ventilation and functional infrastructure.

Table 20.3: Ownership type of the Anganwadis

Public owned	Private owned	Community owned	Others
15	10	1	1

Source: Secondary Data provided by Integrated Child Development Services

Table 20.4: Enrolment details of students in the Anganwadis

Enrolment	Total	Boys	150
		Girls	128
	Other	Boys	141
		Girls	117
	SC/ST	Boys	9
		Girls	14
Infants (0-3 yrs)	Girls	SC/ST	9
		Other	143
		Total	152
	Boys	SC/ST	16
		Other	127
		Total	143
Toddlers (3-6 yrs)	Girls	SC/ST	14
		Other	119
		Total	132
	Boys	SC/ST	10
		Other	123
		Total	133
Mothers (Nursing and Pregnant)		SC/ST	11
		Other	167
		Total	175

20.5 Effect of Hazard Risk in this Sector

The 2018 floods had a profound and wide-ranging impact on Haripad, clearly exposing vulnerabilities in the town's physical infrastructure, housing systems, and overall disaster preparedness. Large sections of roads, public buildings, and residential areas suffered extensive damage, necessitating immediate relief and long-term rehabilitation measures. The floods disproportionately affected low-income and economically vulnerable households, many of whom experienced displacement, loss of shelter, and damage to livelihoods. These impacts intensified existing socio-economic inequalities and made recovery particularly difficult for already marginalized communities.

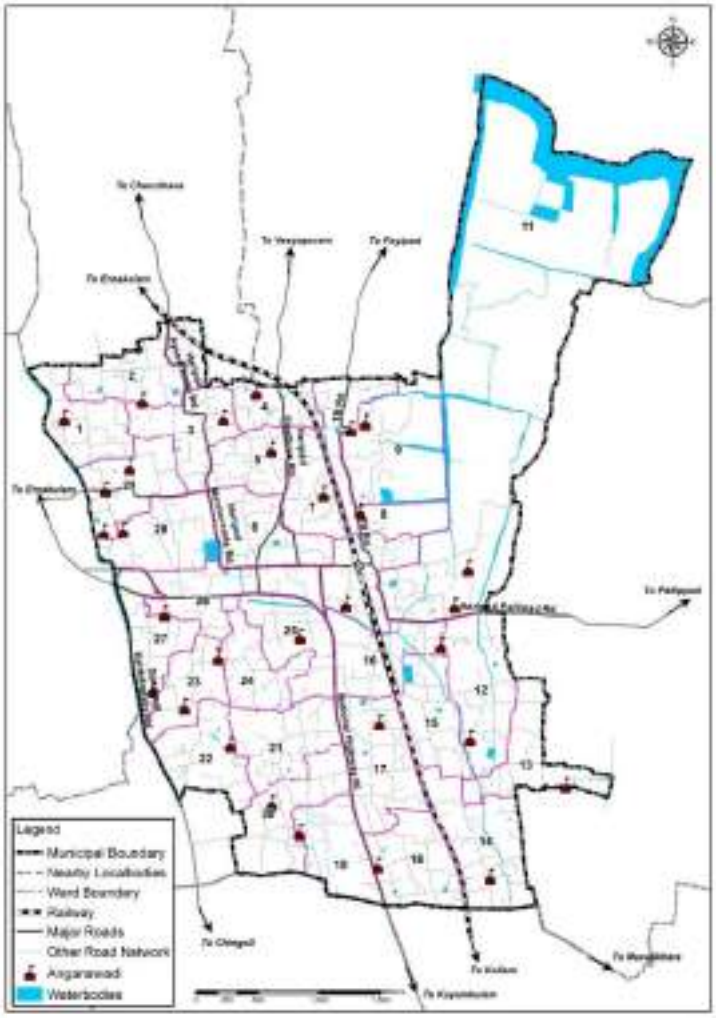


Figure 20.5: Spatial Distribution of Anganwadis in Haripad town

The disaster also placed significant strain on essential social services. Flooding disrupted healthcare delivery systems, affecting routine medical services as well as maternal and child health programmes. Anganwadi centres, which play a critical role in early childhood care and nutritional support, faced operational challenges due to inundation and access issues. Interruptions in supplementary nutrition services posed health risks to pregnant women, lactating mothers, and young children. Educational infrastructure was also affected, leading to the temporary closure of schools and learning centres, thereby disrupting the education of many children across the town.

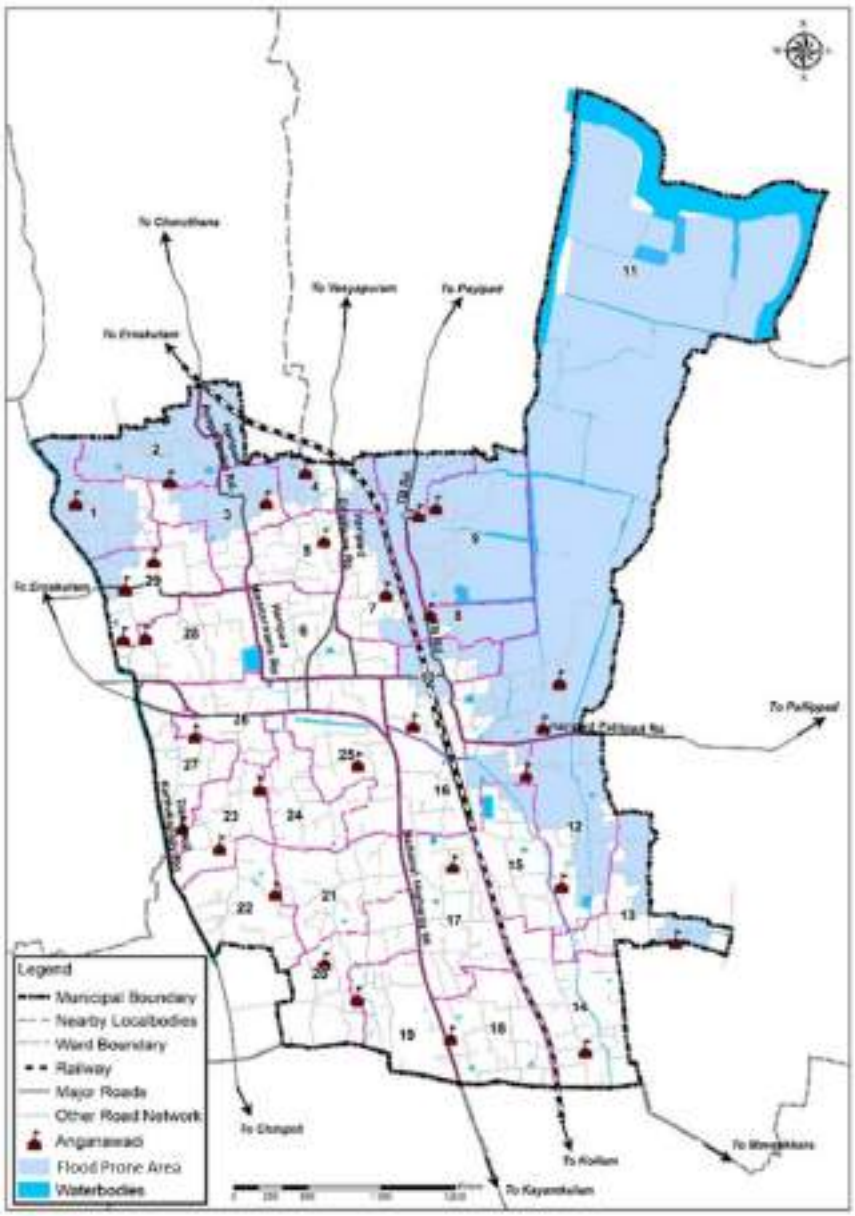


Figure 20.6: Spatial distribution of Anganwadi overlaid with 1 in 50 years hazard probability map of Haripad town

Spatial analysis further highlights the vulnerability of social infrastructure, with Figure 20.6 indicating that Anganwadi centres located in the northern and eastern parts of Haripad are particularly prone to flooding. These centres experienced service disruptions during the floods, affecting the timely delivery of nutrition, healthcare, and early childhood services. Although efforts were undertaken to restore functionality at the earliest, the initial interruptions had adverse consequences for the intended beneficiaries. Overall, the 2018 floods underscored the urgent need for flood-resilient infrastructure, improved disaster preparedness, and targeted support mechanisms to protect vulnerable populations in Haripad.

20.6 Problems and Potentials

High poverty levels and widening economic disparities continue to affect marginalized communities in Haripad, particularly Scheduled Castes (SC) and Scheduled Tribes (ST), constraining their access to essential services and opportunities for socio-economic

advancement. Limited income security and asset ownership restrict their ability to invest in housing improvements, education, healthcare, and livelihood diversification, thereby reinforcing intergenerational cycles of deprivation.

Infrastructure deficits within SC/ST settlements further exacerbate vulnerability. Inadequate housing quality, insufficient drainage, unreliable drinking water supply, poor sanitation coverage, and weak road connectivity significantly affect living standards and public health outcomes. These deficiencies not only increase exposure to environmental hazards but also limit access to schools, healthcare facilities, and employment centers, thereby constraining upward mobility.

Employment challenges remain a critical concern. Many individuals from marginalized communities face barriers to quality education, skill development, and formal job markets. The absence of structured vocational training, limited access to credit, and weak market linkages often push them into informal, low-paying, and insecure occupations. This underemployment perpetuates income instability and reduces their capacity to cope with economic shocks.

Social protection mechanisms, though present, do not always achieve full coverage. Gaps in awareness, documentation, and access to welfare schemes - such as health insurance, pensions, housing assistance, and livelihood subsidies - leave sections of vulnerable households inadequately supported. This increases their susceptibility to financial distress during health emergencies, crop failures, or natural disasters.

Climate and disaster vulnerability further compound these challenges. Marginalized settlements are often located in low-lying or hazard-prone areas with weak structural resilience. Floods, droughts, and extreme weather events disproportionately impact these communities due to fragile housing, inadequate drainage, and limited preparedness. Such events frequently result in asset loss, displacement, interruption of livelihoods, and long-term economic setbacks.

Addressing these multidimensional vulnerabilities requires an integrated approach combining infrastructure upgradation, livelihood enhancement, improved social protection delivery, disaster-resilient housing, and targeted capacity-building initiatives to ensure inclusive and equitable urban development in Haripad.

20.7 Inference

Haripad Municipality faces significant socio-economic challenges, particularly in poverty and social backwardness, with marginalized groups residing in colonies and nagars that lack access to basic amenities. The concentration of Below Poverty Line (BPL) households in specific wards highlights inequalities, while the high SC population indicates the need for targeted interventions addressing caste-based discrimination. Vulnerable groups, including the elderly and differently-abled individuals, benefit from social security schemes, but gaps in coverage and support remain. Improving infrastructure and services for these groups is crucial for ensuring sustainable development.

Women and children in Haripad Municipality are particularly vulnerable, with many female-headed households facing economic challenges. Programs like Kudumbasree and ICDS have been effective in empowering women and improving child welfare, but further investments in infrastructure, such as Anganwadi centers, are necessary to enhance service delivery. Ensuring

better food distribution, improving Anganwadi worker salaries, and expanding social security schemes will be essential in addressing gender and age-based disparities. A strategic focus on improving living conditions, education, and healthcare for marginalized communities is vital for promoting inclusive growth.



CHAPTER
21

ENVIRONMENT



Environmental planning is essential for guiding Haripad's sustainable and climate-resilient development. Understanding the town's ecosystems, natural resources, landforms and environmental sensitivities helps mitigate risks such as pollution, habitat loss and resource depletion. This chapter examines the town's environmental profile, including its wetlands, paddy fields, backwaters and climate-related vulnerabilities, to ensure that future development aligns with ecological balance and long-term resilience. The goal is to support a healthier, more sustainable urban environment that protects natural assets while enhancing the well-being of residents.

- Introduction
- Existing Scenario
- Ecologically Sensitive & Fragile Areas
- Effect of Hazard Risk in this Sector
- Problems and Potentials
- Inference

21. ENVIRONMENT

21.1 Introduction

Creating a livable and healthy town requires urban planners to prioritize environmental concerns, as these have a profound and lasting impact on both people and the land. Across the globe, poor environmental management - driven by reckless development and biodiversity loss - leads to what is known as environmental fatigue. Haripad is no exception. Unplanned development and ecologically insensitive policies have pushed the town toward becoming an environmentally endangered area. To reverse this trend, a truly integrated urban planning approach must focus on environmental protection, conservation, and the adoption of sustainable practices.

21.2 Existing Scenario

As per the existing land use of Haripad town, areas classified as Paddy/Wetland, Marshy land, Sacred Groves, and Water Bodies are considered as Ecologically Sensitive Areas due to their critical environmental functions. Together, these categories cover 7.06 sq. km, accounting for approximately 43% of the total planning area. This indicates that more than one-third of Haripad's land area is environmentally sensitive, underscoring the town's strong ecological character. The significant extent of Economically Sensitive Areas highlights the need for a cautious, conservation-oriented planning approach that safeguards natural drainage systems, biodiversity, and flood-buffering landscapes while guiding development away from vulnerable areas. The spatial distribution of these Ecologically Sensitive Areas is shown in Figure 21.1.

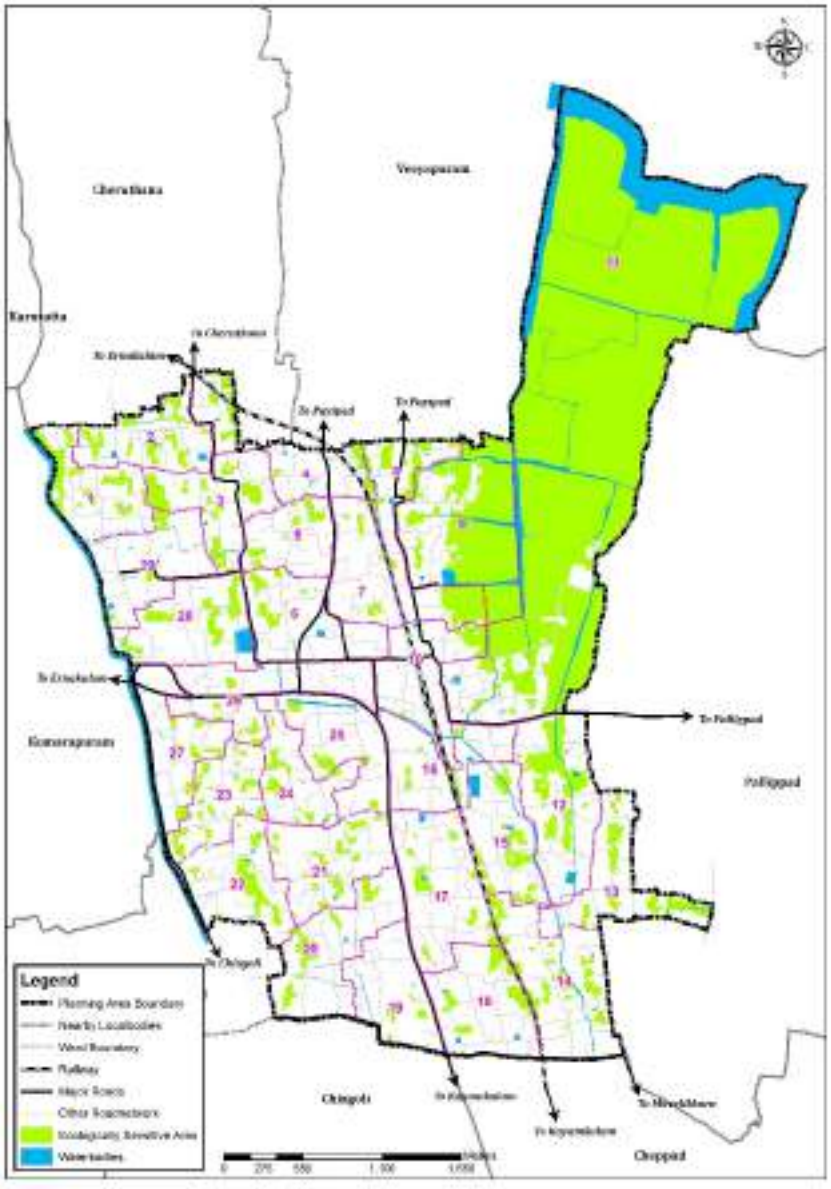


Figure 21.1: Spatial distribution of Ecologically Sensitive Areas

21.2.1 Water Pollution

Water pollution is a major problem facing the city. The chief contributor to water pollution is the uncontrolled dumping of solid waste. Due to lack of proper sewerage system and absence of an efficient solid waste management system, water bodies are facing high levels of contamination. Waste from the major commercial areas of the city reaches Pillathodu and Danapady Thodu, polluting their water. The waste water from Pillathodu reaches the paddy fields in the North-East. This causes pollution in these areas. Moreover, the discharge of wastewater into nearby water bodies poses a risk of groundwater contamination, which in turn leads to the deterioration of well water quality available for domestic use.

Details of water quality standards in various locations of the town as per the study of Pollution Control Board (PCB) is given in Table 21.1.

Table 21.1: Water quality standards

Sl. No.	Location (Source)	BOD	TC	FC	PH	Turbidity	TDS	Chloride	Sulphate
1	Aroor LPS, Haripad (Tap)		0	0	8.2			80	BDL
2	Public tap near SN centre, Haripad		0	0	8.1			80	BDL
3	Sree Anchanaya Navagraha Dampti temple, Haripad (Well)		0	0	8.2	1.82	322	100	BDL
4	Sree Subrahmanya Swami Temple, Haripad (Well)		0	0	8.2	1.18	206	60	BDL
5	Aroor LPS, Harippad (Well)		0	0	7.7	1.7	96	60	BDL
6	Sree Subramanya Swami Temple, Haripad (Pond)	9.13	0	0	7.4	17.29			BDL
7	Sree Subrahmaniya Swamy Temple, Kizakenada (Pond)	3.06	800	600	8.1	4.88			BDL

Source: Pollution Control Board, 2025

From the data received from PCB, it is noted that tap water samples from Aroor LPS and near SN Centre in Haripad are safe for consumption, showing no bacterial contamination, acceptable pH levels, and undetectable sulphate. Well water from various locations in Haripad is microbiologically safe, with low turbidity, moderate TDS, and chemical parameters within permissible limits. Pond water from Sree Subrahmanya Swami Temple and Kizakenada is highly polluted, with elevated BOD, turbidity, and severe fecal contamination, making it unfit for domestic use.

21.2.2 Land Pollution

Land pollution in Haripad is caused by solid waste disposal including plastic waste, agricultural residue, construction and demolition wastes, and industrial by-products. There are no authorized landfill areas within the municipal limits. In agricultural zones, the misuse of chemical fertilizers and pesticides also contributes to soil contamination.

21.2.3 Noise Pollution

The rising levels of ambient noise in public places, caused by industrial and construction activities, firecrackers, loudspeakers, generator sets, music systems, vehicular horns, and other mechanical devices are having harmful effects on human health and psychological well-being. The city's main commercial area - Town Hall Junction – Ezhikkakath Junction - Taluk Hospital Junction Road- is the area where traffic congestion and vehicular traffic are most prevalent, and this area experiences the most noise pollution. Since schools, hospitals, and public offices are concentrated here, it is essential to reduce noise pollution. The noise level of Haripad town is given in Table 21.2.

Table 21.2: Noise level of Haripad town (in dB)

	Residential	Commercial	Industrial	Silence Zone
Day	55	65	75	50
Night	45	55	70	40

Source: Pollution Control Board, 2025

21.2.4 Air Pollution

Air pollution is the presence of harmful substances in the air that can damage human health, wildlife, and the environment. It is mainly caused by vehicle emissions, industrial activities, burning of fossil fuels, construction dust, and waste burning. Common pollutants include particulate matter (PM2.5 and PM10), carbon monoxide, nitrogen oxides, sulphur dioxide, and ground-level ozone. Reducing air pollution requires cleaner energy sources, better waste management, fewer emissions, and stronger environmental regulations.

There is no air quality monitoring station in Haripad Municipality. The Pollution Control Board has not conducted any studies to assess the extent to which air pollution affects people of Haripad town.

21.3 Ecologically sensitive and Fragile areas – Paddy fields / Wetlands, Water bodies, Sacred Groves and Marshy land

As stated in Section 21.2 above, total area of Ecologically Sensitive Areas in town is 7.06 sq.km and is about 43% of the total area (planning area) of the town. The Land use categories Paddy/Wetland, Water bodies Sacred Groves along with Marshy land have been considered as Ecologically Sensitive Areas. Since about 30 % of total municipal area is paddy fields and is mainly located in the North-East part of the town, Ecologically Sensitive Areas mainly concentrated in this area. Apart from this, there are small farm lands and Marshy areas scattered in various parts of the town. The Sacred Grove is mainly located in the vicinity of the Mannarasala temple. Apart from this, there are small Sacred Groves in various parts. The North-Eastern boundary of the town is the Achankovil River and its tributaries. In addition, many canals and streams flow through the paddy fields. The main water bodies within the town are the Pillathodu and the Danapady Thodu. Multiple ponds are located across different parts of the town. Collectively, these water bodies form part of the Ecologically Sensitive Areas, which accounts for more than one-third of the Municipality's total area. There are 56 ponds in Haripad town, of which 18 are privately owned and 38 are public.

Wetlands are a type of ecosystem that remains submerged in water, either permanently or temporarily. The soil in wetlands facilitates the growth of aquatic plants. Both freshwater, saltwater, and brackish water are found in these areas. Wetlands function as natural sponge areas, regulating the urban water cycle by absorbing and retaining rainwater, mitigating flood risks, and facilitating groundwater recharge. They gradually release the stored water, which then contributes to groundwater or surface water systems, helping to recharge natural water sources. Increasing temperatures lead to a drop-in water levels in wetlands, raising the possibility of the death of aquatic life within them. The extent of wetlands in Haripad Municipality has significantly reduced over the past year. There have also been changes in both the quality and quantity of water in the wetlands. Excessive use of chemicals in agricultural lands has severely impacted water quality. Changes in the water levels of wetlands have contributed to droughts, affecting agriculture, livelihoods, and biodiversity. Additionally, water levels in drinking water sources such as wells and ponds have decreased. There have been both direct and indirect land use and encroachment activities related to wetlands. As the population grows, the number of family increases, and due to limited space for expansion, settlements have spread into areas with lower land prices. This has led to an increase in the number of roads in these areas. Land conversion and the construction of new roads have negatively impacted wetlands and other water sources. Protecting wetlands can help mitigate natural disasters such as droughts and floods to a certain extent.



Figure 21.2: Mannarasala temple and North-East paddy fields

21.4 Effect of Hazard Risk in this Sector

The 2018 floods in Haripad had severe environmental impacts, including the deterioration of water quality due to contamination from agricultural runoff, untreated sewage, and waste. Soil erosion and sedimentation affected agricultural productivity, with paddy fields and crops being submerged or washed away. The floods also caused damage to ecosystems, disrupting biodiversity and fish habitats. The Mannarasala sacred grove suffered ecological stress, leading to the loss of native flora and fish habitats. Additionally, wetlands, wildlife habitats faced erosion and habitat loss. . Wetlands and the Pillathodu area experienced sedimentation and pollution, further affecting biodiversity. In low-lying zones, saltwater intrusion rendered agricultural lands infertile, forcing some farmers to abandon cultivation. These events underscored the vulnerability of Haripad's environmental systems and the need for resilient planning, ecological restoration, and stronger disaster preparedness.

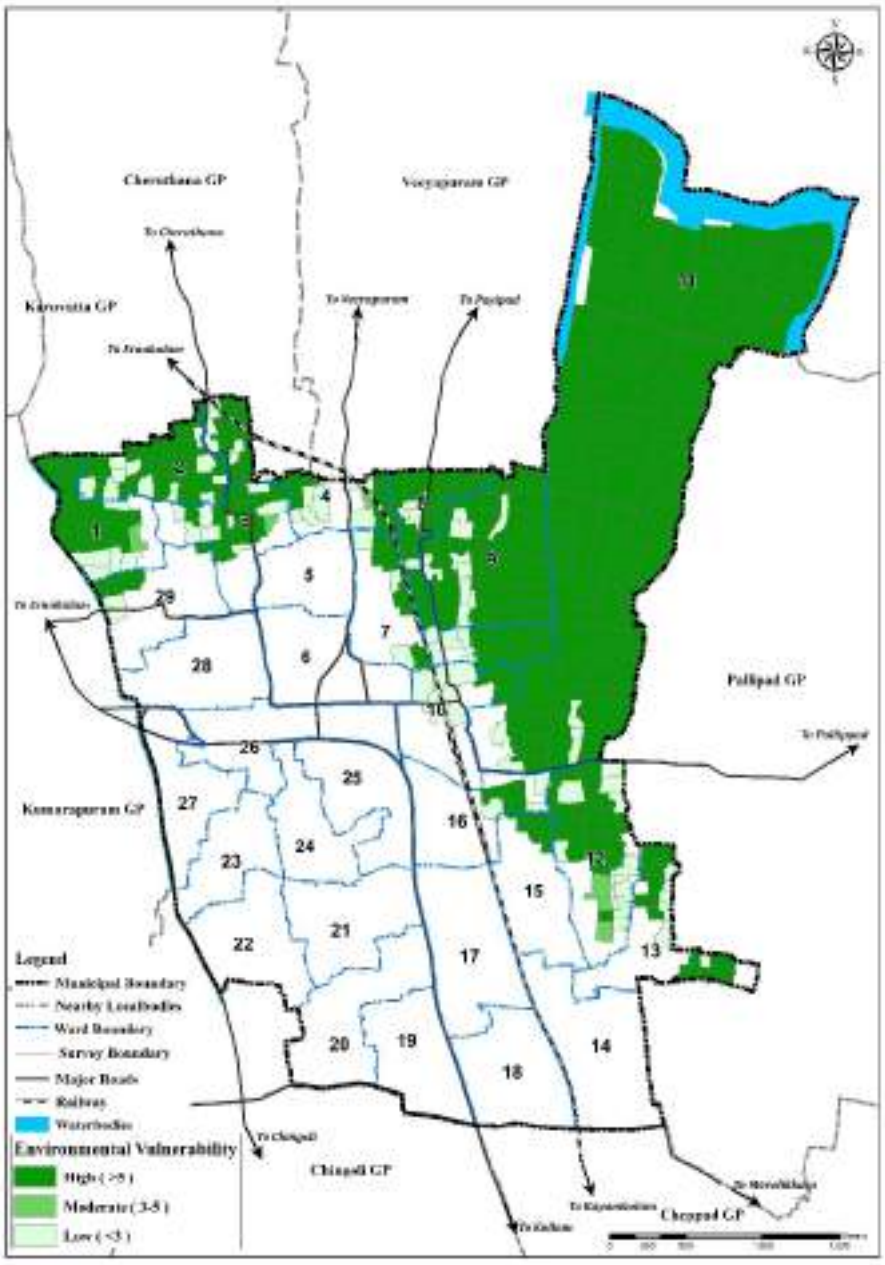


Figure 21.3: Map showing the environmental vulnerability in flood prone area

The risk assessment for Haripad indicates that Environment and Heritage Vulnerability contributes 10% to the overall vulnerability index, comprising two sub-parameters: Areas of Ecological Importance (60% weightage) and Heritage Areas (40% weightage). Ecologically sensitive zones—identified from the existing land use map—include paddy fields, wetlands, marshy lands, sacred groves, and water bodies. Notably, 4.93% of the flood-prone area overlaps with ecologically sensitive land, underscoring the exposure of critical natural systems to hazard risks. Haripad is characterized by extensive eco-sensitive landscapes, particularly the

vast paddy fields concentrated in the north-eastern part of the town, where active cultivation remains predominant. However, several other wards also contain significant ecological assets. Recurrent flooding, unregulated development, encroachments, and alterations to natural drainage patterns pose direct threats to these environmentally fragile areas. Flooding can lead to prolonged water stagnation, silt deposition, salinity intrusion, and degradation of wetland ecology, thereby affecting agricultural productivity, biodiversity, and groundwater recharge functions.

Given the ecological and hydrological importance of these landscapes, hazard impacts in Haripad extend beyond infrastructure damage to include long-term environmental degradation. Protecting paddy fields, wetlands, sacred groves, and natural water bodies is therefore essential not only for biodiversity conservation but also for sustaining natural flood buffering capacity and enhancing the town's overall climate resilience

Table 21.3: Percentage of Environmental Vulnerability

Environmental Vulnerability	Area (in sq.km.)	Percentage
Low	1.05	6.44
Moderate	0.07	0.43
High	6.00	36.74

Figure 21.3 illustrates that the northern and north-eastern parts of Haripad town exhibit high environmental vulnerability, primarily due to recurring flood events during the monsoon season. This condition arises from the area's location along the floodplains of the Achankovil River. The north-eastern region, which comprises the town's predominant agricultural lands, is also identified as an ecologically sensitive area. As shown in Table 21.3, approximately 44% of the total land area of the town is susceptible to environmental vulnerability



Figure 21.4 : (A) Danapady Thodu (B) Pillathodu (C) Malikadavu (D) Nelpurakadavu

21.5 Problems and Potentials

Haripad's environmental landscape is both a major asset and a significant planning constraint. With more than one-third of the town falling within ecologically sensitive zones—comprising paddy fields, wetlands, marshy lands, canals, sacred groves, and water bodies—the Municipality faces inherent development limitations. These areas perform critical ecological functions such as flood buffering, groundwater recharge, biodiversity support, and micro-climate regulation. However, protecting and managing these sensitive landscapes requires sustained regulatory oversight, financial investment, and carefully aligned land-use planning interventions.

The principal environmental challenge confronting Haripad is pollution and ecological degradation. Indiscriminate dumping of solid waste into canals, particularly Pillathodu and other interconnected waterways, results in the downstream accumulation of waste in paddy fields, leading to soil contamination and crop damage. Rapid urban expansion has reduced green cover, intensifying urban heat effects and disturbing ecological balance. Excessive use of chemical fertilizers and improper waste disposal practices have further contributed to declining soil fertility. Vehicular emissions are gradually affecting air quality and urban livability. Additionally, monsoon rainfall and recurrent flooding cause erosion of canal and field bunds, destabilizing embankments, damaging crops, and degrading natural habitats.

Despite these challenges, Haripad possesses significant environmental potential. Restoration and rejuvenation of unused ponds, marshlands, canals, and streams can simultaneously enhance ecological resilience and expand public open space. Introducing low-impact recreational facilities, eco-walkways, and landscaped buffers along restored water bodies can strengthen environmental protection while improving urban quality of life. Further, an integrated eco-tourism circuit connecting Nelpurakadavu, canal networks, and surrounding paddy fields presents an opportunity to generate sustainable economic benefits while incentivizing conservation. By aligning environmental restoration with tourism development, green infrastructure planning, and sustainable land management practices, Haripad can transform its ecological assets into a foundation for climate resilience, biodiversity conservation, and environmentally responsible growth.

21.6 Inference

The environmental assessment of Haripad highlights a town at a critical juncture—rich in ecological assets yet increasingly vulnerable to environmental degradation and climate-related risks. Extensive paddy fields, wetlands, canals, marshlands, and sacred groves form the ecological backbone of the Municipality, providing flood buffering, groundwater recharge, biodiversity support, and micro-climate regulation. However, rapid urbanization, unregulated land-use changes, pollution from untreated sewage and solid waste, excessive agrochemical use, and rising vehicular emissions have placed mounting stress on these natural systems. The 2018 floods and subsequent seasonal inundations further exposed the fragility of the town's environmental infrastructure, resulting in soil erosion, habitat degradation, and increased public health risks.

At the same time, Haripad's ecological landscape presents significant opportunities for sustainable and climate-responsive development. The protection and restoration of wetlands and canals, rejuvenation of ponds and marshlands, strengthening of green buffers, and

integration of nature-based solutions can enhance resilience while supporting eco-tourism, agriculture, and public recreation. The Master Plan therefore underscores the need for a balanced approach that safeguards environmentally sensitive zones, strengthens environmental governance, promotes pollution control and sustainable land management, and integrates green infrastructure into urban development. By aligning conservation with livelihood generation and disaster risk reduction, Haripad can transition towards an ecologically secure, climate-resilient, and environmentally sustainable urban future.

CHAPTER
22

CULTURE AND HERITAGE



Haripad's identity is deeply rooted in its rich cultural traditions, historic temples, vibrant festivals and long-standing artistic heritage. Known as Kshetranagari, the town is home to landmark institutions such as the Sree Subrahmanya Swamy Temple and Mannarasala Temple, along with celebrated events like the Payippad Jalotsavam. Its performing arts, temple rituals, craftsmanship and community traditions contribute to a unique cultural landscape that shapes both daily life and regional significance. This chapter explores Haripad's cultural and heritage assets, identifies areas requiring protection and enhancement and outlines strategies to preserve these enduring values as an integral part of the town's future development.

- Introduction
- Culture
- Heritage
- Effect of Hazard Risk in this Sector
- Problems and Potentials
- Inference

22. CULTURE AND HERITAGE

22.1 Introduction

This chapter highlights the rich historical, architectural, and cultural legacy of Haripad town, reflecting its deep-rooted traditions and vibrant community life. The town is home to significant heritage structures, temples, and religious institutions that play a pivotal role in shaping its identity. Traditional art forms, festivals, and local crafts contribute to the cultural fabric, fostering social cohesion and economic opportunities. Despite its cultural wealth, challenges such as urbanization, inadequate conservation efforts, and changing societal dynamics threaten the preservation of heritage assets. This chapter aims to assess the existing cultural and heritage resources, identify key issues, and propose strategies for their conservation and sustainable promotion.

22.2 Culture

The culture of Haripad town is deeply rooted in tradition, spirituality, and artistic heritage. The town is renowned for its vibrant festivals, classical art forms, and religious practices, which reflect the cultural identity of the region. Haripad is home to the famous Sree Subrahmanya Swamy Temple, a significant pilgrimage site where grand festivals attract devotees from across Kerala. Traditional performing arts such as Kathakali, Ottamthullal, and Theyyam are integral to local festivities, preserving the rich artistic heritage. Folk music, temple percussion ensembles like Chenda Melam, and local crafts further enhance the cultural landscape. The town also has a strong literary and educational tradition, with a history of nurturing scholars and writers. Despite modernization, Haripad continues to uphold its cultural essence, blending heritage with contemporary influences.

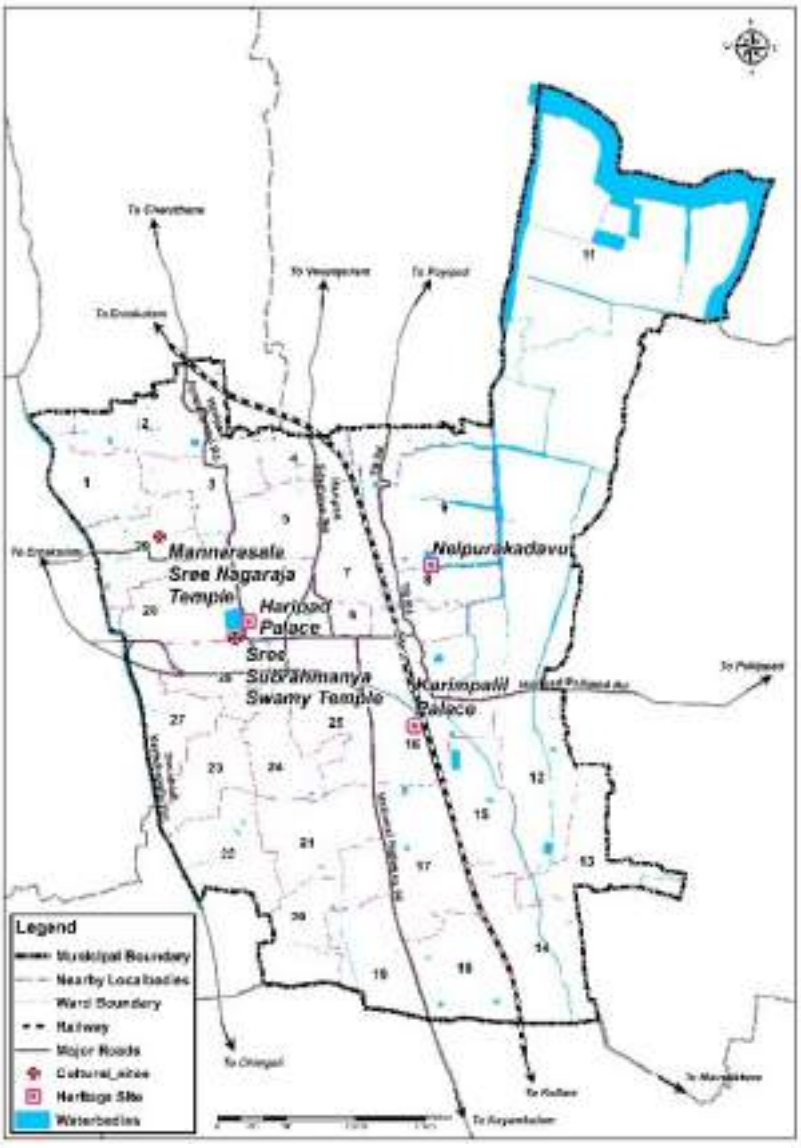


Figure 22.1: Cultural and Heritage site in Haripad town

22.2.1 Religious institutions and Festivals, Custom, Ethnic groups

A. Mannarasala Temple



Figure 22.2: Mannarasala Temple

The legend of the Mannarasala Nagaraja Temple is associated with the story of how Lord Parasurama cleaved out the land known as Kerala. As he found the land infertile and infested with snakes, he is said to have invoked Nagaraja. The Snake God agreed to move and settle at a place that came to be known as Mannarasala. Lord Parasurama installed an idol of the Serpent King along with Sarpayakshi and assigned a scholarly Brahmin to carry out daily rituals for Nagaraja. Once when hundreds of snakes perished in a forest fire, others who got hurt are said to have crawled into pits near the place which are part of the temple premises now. The childless wife of the Brahmin anointed them with turmeric powder, milk, honey and tender coconut water. Pleased with her selfless service, Nagaraja is said to have appeared in her dream promising to be soon born as her son. The Brahmin lady gave birth to a five- hooded serpent child and a male child. When the two brothers grew up, the five hooded elder brothers disappeared into the underground cellar of the Illom (the Brahmin ancestral home) for meditation after assigning the family responsibilities to his brother. He also requested his mother to do certain rituals without fail. He is said to have conveyed that the 'poojas' have to be performed by the female members of his mother's family. This custom is followed to this day. Ever since, "*Mannarasala Amma"* has been venerated as the mother of Lord Nagaraja and devotees from all over the world come to the place for her blessings.



Figure 22.3: Mannarasala Ayilyam

Mannarasala Ayilyam is the principal festival of the Mannarasala Sree Nagaraja Temple, celebrated annually on the Ayilyam asterism in the Malayalam month of Thulam (October-November).

Dedicated to Nagaraja, the serpent king, the festival attracts thousands of devotees seeking blessings and protection from snake-related fears and ailments. The main ritual involves a grand procession where all serpent

idols from the temple and sacred grove are carried to the Illam, the ancestral home of the temple's priestess, who carries the idol of Nagaraja. Devotees offer Nurum Palum (a mixture of rice flour and milk) and Kuruthi (a red turmeric-lime liquid) as part of the rituals. Traditional music and dance performances like Kathakali and Mohiniyattam add to the vibrant atmosphere, making it both a significant religious event and a celebration of Kerala's cultural heritage.

According to the Pilgrim Survey 2024 conducted during Mannarasala Ayilyam day in 2024, over 75% of the respondents belong to the age group of 31 years and above. Nearly 65% of the visitors are from within the district, resulting in over 90% of pilgrims not staying in or around the temple premises. Additionally, approximately 75% of the visitors spend between 2 to 6 hours within and near the temple premises. The Subrahmanya Temple and Hanuman Temple hold cultural significance in relation to Mannarasala, particularly during Ayilyam days, making it an inseparable part of Haripad's cultural fabric and a potential node for heritage tourism in the wider region.



Figure 22.4 : Pilgrim Survey conducted in 2024

B. Sree Subrahmanya Swamy Temple



Figure 22.5: Sree Subrahmanya Swamy Temple

Haripad Sree Subrahmanya Swamy Temple, one of the most revered and ancient temples in Kerala, is dedicated to Lord Subrahmanya (Murugan). Believed to have been consecrated by

Lord Parashurama, the temple is often referred to as the "Palani of the South" due to its spiritual significance. It houses the largest four-armed idol of Lord Subrahmanya and exemplifies traditional Kerala temple architecture, featuring intricate woodworks and murals. The temple, known for its traditional architecture, has four gopurams, a golden flag mast, a unique round sanctum sanctorum, a Koothambalam (performance hall), and the expansive Perumkulam, the temple pond. The temple is renowned for its grand festivals, including Chithira Thiruvulsavam, Avani Ulsavam, Margazhi Ulsavam and Thaipooyam, which are marked by a spectacular procession with a golden peacock vahana. Devotees believe that worshiping here removes obstacles, grants prosperity, and fulfils wishes, particularly in family and career matters.

The temple is renowned for its grand festivals, including Avani Festival, Margazhi Festival, Chithira Festival and Thaipooyam. Chithira Ulsavam is celebrated during the Malayalam month of Medom (April-May). It is dedicated to Lord Subrahmanya. Avani Ulsavam celebrated during the Malayalam month of Chingom (August–September) and is dedicated to Lord Vishnu. Markazhi Ulsavam is celebrated during the Malayalam month of Dhanu (November – December) and is dedicated to Lord Shiva. This temple is also unique in that it holds three different festivals for three deities. These three are known as the Utsava Tryam. Another festival held here is Thaipooyam and is dedicated to Lord Subrahmanya. Observed annually on the Pooyam star in the Malayalam month of Makaram (January-February), this vibrant festival symbolizes faith, endurance, and penance. Devotees participate in various rituals, including the Kavadiyattam, a ritualistic dance carrying a decorated arch on their shoulders, showcasing a rich vibrancy of colors.



Figure 22.6 : Haripad Kavadiyattam

22.3 Heritage

Haripad town has a rich cultural and historical legacy, reflected in its heritage structures, traditional architecture, and socio-religious institutions. Notable heritage buildings such as Karimpalil Palace and the Devaswom Office near Sree Subrahmanya Swamy Temple stand as significant landmarks, showcasing the historical and cultural evolution of the region. Preserving these heritage assets is essential for maintaining historical continuity while supporting sustainable urban development.

22.3.1 Important Heritage Sites and Buildings



Figure 22.7: Karimpalil Palace



Figure 22.8: Haripad Palace that houses the office of the Deputy Commissioner of the Devaswom Board

Karimpalil palace, known as the capital of Vettimana near the present-day Haripad Railway Station and Haripad Palace, the palace that houses the office of the Deputy Commissioner of the Devaswom Board, located near Subrahmanya Swami temple are heritage buildings located in the town. Built during the Travancore period, these are buildings of historical importance. Many heritage structures can be seen in their vicinity. Also, Subrahmanya Swamy Temple is one of the oldest temples in Kerala. This too, along with the associated structures are heritage constructions.

Ananthapuram Palace, situated in Kumarapuram Grama Panchayat, 4 km away from Haripad town, is an 18th-century Travancore-style architectural marvel featuring a "pathinaru kettu" structure with four courtyards, built using surki (lime-clay mixture) and wooden roofing. It is historically significant as the residence of Kerala Varma Valiya Koyithampuran, known as "Kerala Kalidasa," who was placed under house arrest (1875–1880) by Travancore King Ayilyam Thirunal and composed notable works like *Kshamapana Sahasram*, *Yamapranama Sathakam*, and *Visakha Vijayam*.



Figure 22.9 : Ananthapuram Palace

Nelpurakadavu holds historical significance as a key hub for the collection and supply of paddy to the Travancore Palace. Once considered the gateway to the paddy fields in the north-eastern part of the Municipality, it served as a central point where paddy was gathered. Supporting this function were various facilities such as a large storage area, offices, and a mill. To assist the kevu vallams - large cargo boats transporting paddy from the fields - a tall teak lamp post was erected to guide their way. Remarkably, a part of this original teak structure still stands at the site today. Nelpurakadavu is also culturally important because of its association with the Haripad Subrahmanya Temple. According to local belief, the idol destined for the temple was first brought ashore here by the *karakkar* (local people) from the Kayamkulam backwaters.



Figure 22.10: Teak lamp post at Nelpurakadavu





Figure 22.11 : Nelpurakadavu

22.3.2 Present Condition

Despite the heritage and cultural importance, the Ananthapuram Palace is deteriorating due to termite infestations, roof tile damage, and plaster loss, with minimal government intervention since it remains private property, while its fifth-generation descendants struggle to preserve it. Karimpalil palace and the palace that houses the office of the Deputy Commissioner of the Devaswom Board, is currently owned by the Travancore Devaswom Board. Both are in a dilapidated state due to lack of necessary maintenance. Nelpurakadavu and the canals connecting it to the nearby paddy fields are now heavily polluted, with waste - especially plastic - accumulating in the water. The canals have become shallow and are choked with mud and overgrown Water Hyacinth (locally known as *Pola*). The once-significant teak lamp post, once a guiding beacon for cargo boats, now stands unused, poorly maintained, and in a state of disrepair.

22.3.3 Conservation Efforts – Adaptive Reuse

Adaptive reuse presents one of the most practical and sustainable strategies for safeguarding Haripad's heritage assets while aligning them with contemporary urban needs. Rather than treating historic structures as static relics, adaptive reuse enables them to function as active components of the urban fabric. Converting palaces, traditional residences, canal-side trade buildings, and heritage precincts into cultural centres, interpretation museums, performance venues, research institutes, boutique heritage stays, or community art spaces can generate steady revenue streams for long-term maintenance and upkeep. Such functional transformation not only reduces the financial burden of conservation but also enhances public access, awareness, and appreciation of local history, architecture, and cultural traditions.

Strategically designed heritage tourism hubs can anchor temple-based tourism circuits, canal revitalisation projects, and cultural festivals, thereby creating multiplier economic effects for local artisans, guides, hospitality providers, and small businesses. Linking adaptive reuse initiatives with curated heritage walks, digital interpretation tools, and experiential tourism programmes can further strengthen the town's positioning as a culturally significant destination.

Institutional and financial mechanisms will be critical to operationalising this approach. Public–private partnerships (PPPs), Corporate Social Responsibility (CSR) contributions, heritage conservation grants, and targeted government incentives—such as tax rebates, transferable development rights, or conservation subsidies—can mobilise resources for restoration. Collaboration with the Tourism Department, Devaswom Board, local cultural organisations, and academic institutions can ensure professional conservation standards and sustained programming.

At the design level, sensitive retrofitting is essential. Structural strengthening, termite treatment, climate-responsive repairs, and service upgrades (electrical, plumbing, fire safety, accessibility) must be undertaken without compromising architectural integrity or traditional material character. Use of compatible materials, reversible interventions, and adherence to conservation guidelines will help maintain authenticity. Sustainable reuse strategies—including energy-efficient lighting, rainwater harvesting, and low-impact landscaping—can further enhance environmental performance while respecting heritage value.

Equally important is community engagement. Awareness campaigns, volunteer-driven heritage documentation, school outreach programmes, and local cultural events can foster a sense of ownership among residents. When communities actively participate in preservation efforts, heritage assets are more likely to be protected, maintained, and meaningfully integrated into everyday life.

Through a balanced approach that combines conservation ethics, economic viability, institutional support, and community participation, adaptive reuse can transform Haripad's heritage structures into resilient, functional, and culturally vibrant spaces—ensuring that they remain relevant, accessible, and valued for generations to come.

22.4 Effect of Hazard Risk in this Sector

Flooding, a recurrent issue in the region, poses a significant risk to heritage buildings, leading to structural deterioration, water seepage, and erosion. Among the cultural and heritage sites,

Figure 22.12 shows that Nelpurakadavu is the one prone to flooding since it is already part of the wetlands and is an ecologically sensitive area. The Nelpurakadavu is also considered as an entrance point to the paddy fields of Haripad, which comprises the majority area of the flood prone zone. High humidity and termite infestations further accelerate the degradation of wooden and lime-clay structures. Additionally, unregulated urbanization and infrastructure development may encroach upon heritage sites, increasing their vulnerability to demolition or alteration. Fire hazards, especially in temples and traditional performance spaces, also threaten cultural heritage due to the extensive use of wooden structures and oil lamps. Without adequate conservation measures and disaster risk management strategies, these risks could lead to irreversible damage, resulting in the loss of architectural, historical, and cultural assets. Integrating heritage conservation with climate resilience planning and emergency preparedness is crucial to safeguarding Haripad's cultural legacy.

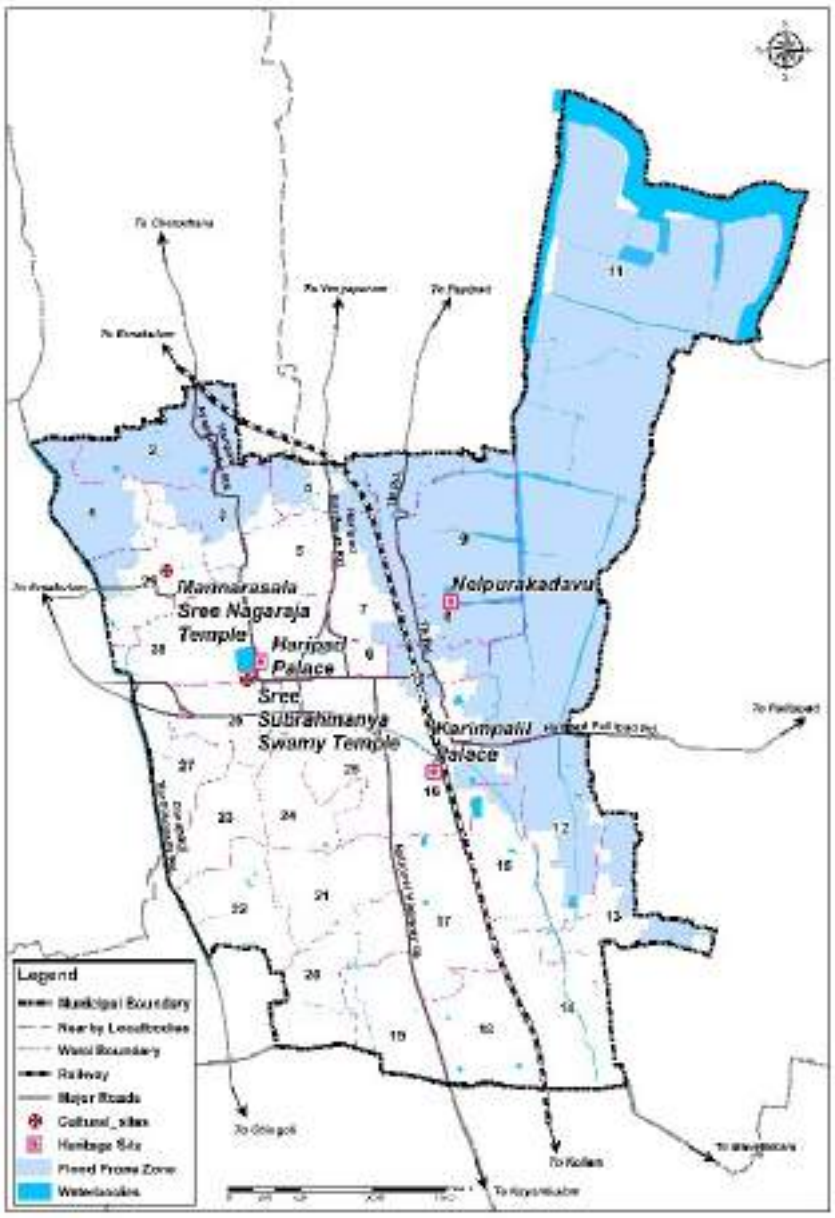


Figure 22.12: Hazard zonation map of Haripad town overlaid with spatial distribution of cultural and heritage sites

22.5 Problems and Potentials

Haripad's heritage and cultural sector embodies a deep historical continuum shaped by its temple traditions, agrarian economy, inland water trade networks, and royal associations. The town's palaces, temple precincts, sacred groves, traditional residences, canal-linked trade nodes such as Nelpurakadavu, and ritual landmarks collectively form an interconnected cultural landscape rather than isolated monuments. However, this legacy is under increasing stress from structural, environmental, and institutional challenges. Many heritage buildings are in advanced stages of physical deterioration due to termite infestation, roofing decay, structural

weakening, and prolonged neglect. Inadequate conservation mechanisms, limited access to restoration finance, fragmented ownership patterns (private, Devaswom, and public bodies), and the absence of a comprehensive heritage management framework have constrained systematic preservation efforts. Publicly owned structures often suffer from deferred maintenance due to competing fiscal priorities, while privately owned heritage properties lack technical guidance and incentives for conservation.

Environmental degradation further compounds vulnerability. Pollution, siltation, and invasive vegetation in historic canals weaken the ecological setting that historically supported trade and ritual connectivity. Encroachments and insensitive urban development around temple corridors and heritage structures dilute their visual and spatial integrity. At the same time, intangible cultural assets—including traditional performing arts, ritual practices, and craft traditions—face declining patronage due to changing socio-economic patterns, migration, and generational shifts. Limited documentation, insufficient cultural programming, and lack of structured platforms for revival further restrict cultural continuity.

Despite these constraints, Haripad holds strong potential for heritage-led urban regeneration. Its identity as a prominent temple town, proximity to culturally significant pilgrimage routes, and historic canal networks provide a strategic base for integrated cultural tourism development. Adaptive reuse of palaces and traditional structures as museums, cultural interpretation centres, art galleries, performance venues, or heritage stays can ensure functional sustainability while retaining architectural character. Revitalisation of canal corridors through ecological restoration and heritage-sensitive design can reconnect historical trade routes with contemporary tourism circuits. Curated heritage walks, temple festivals, craft bazaars, cultural museums (including themes such as boat-building heritage), and interpretive signage can enhance visitor engagement while generating local employment.

Institutional strengthening will be critical. Establishing a heritage conservation framework within the Master Plan, leveraging heritage grants, CSR funding, and public–private partnerships, and coordinating with the Tourism Department, Devaswom Board, and cultural organisations can mobilise technical and financial resources. Community-led awareness programmes and documentation initiatives can foster local stewardship, ensuring that conservation efforts are inclusive and sustainable.

The Master Plan therefore positions heritage and culture not merely as assets requiring protection, but as dynamic catalysts for economic revitalisation, place-making, and identity reinforcement. By integrating conservation with tourism planning, environmental restoration, and urban design interventions, Haripad can transform its cultural legacy into a resilient and productive foundation for long-term sustainable development while safeguarding both its tangible and intangible heritage for future generations.

22.6 Inference

Haripad's heritage and cultural landscape represents one of its most defining urban strengths, deeply rooted in its identity as a historic temple town and an important node within Kerala's socio-religious and agrarian history. The presence of significant religious institutions, historic palaces, canal-linked trade corridors, sacred groves, ritual landscapes, and traditional performing arts collectively contribute to a layered cultural fabric that extends beyond built

structures into living traditions and community practices. These assets not only reflect architectural and artistic value but also embody collective memory, local identity, and socio-economic history.

However, the sector faces mounting pressures. Rapid urbanisation, infrastructure expansion, environmental degradation, fragmented property ownership, and limited conservation funding have led to the physical deterioration of key heritage structures and associated cultural landscapes. Pollution and siltation of historic canals, neglect of palace complexes, encroachments, lack of systematic documentation, and the gradual decline in patronage for traditional art forms threaten both tangible and intangible heritage. Institutional gaps in conservation planning, absence of structured heritage management frameworks, and limited public awareness further compound the vulnerability of these assets. Without timely intervention, Haripad risks incremental loss of irreplaceable cultural capital.

At the same time, the town possesses significant potential to leverage its heritage as a driver of sustainable urban development. Temple-based tourism circuits, canal-front revitalisation, adaptive reuse of historic buildings as museums and cultural centres, promotion of traditional art festivals, and heritage walks can create a strong cultural economy while ensuring conservation. Strategic public–private partnerships, heritage grants, CSR funding, and coordinated action between the Municipality, Devaswom Board, Tourism Department, and local stakeholders can mobilise resources for restoration and adaptive reuse. Integrating heritage conservation with urban design, tourism planning, and environmental restoration initiatives can strengthen place-making and reinforce Haripad's positioning as a culturally vibrant and historically significant town.

The Master Plan therefore recognises heritage and culture not merely as sectors requiring protection, but as catalytic elements for inclusive growth, identity building, and long-term resilience. By aligning conservation efforts with economic revitalisation, community engagement, and policy support, Haripad can safeguard its cultural wealth while transforming it into a sustainable asset for future generations.

CHAPTER 23

DEVELOPMENT ADMINISTRATION & FINANCE



Effective municipal administration is essential for delivering services, managing resources and guiding Haripad's planned growth. This chapter examines key governance components - elected bodies, financial management, departmental functions, public services, infrastructure development and regulatory responsibilities. Strong coordination between administration and spatial planning ensures that land use decisions, budgeting and infrastructure investments align with community needs. By integrating governance and planning priorities, Haripad can promote transparent, efficient and financially sustainable development that supports a well-managed, inclusive and future-ready urban environment.

- Introduction
- Development Administration
- Municipal Finance
- Existing Sources of Funds
- Asset Management Plan
- Problems and Potentials
- Inference

23. DEVELOPMENT ADMINISTRATION AND FINANCE

23.1 Introduction

Development administration and finance play a crucial role in facilitating effective governance, ensuring the implementation of development initiatives, and sustaining municipal operations. Efficient administration, supported by well-structured financial management, enables the town to plan, execute, and monitor various development projects and public services. Revenue generation, budget allocation, and expenditure management are key components that influence the financial sustainability of urban development. This chapter examines the administrative framework, financial resources, revenue streams, and expenditure patterns of town, highlighting existing challenges and potential strategies for enhancing governance efficiency and financial stability.

23.2 Development Administration

23.2.1 The Elected Council

The elected council of Haripad town comprises 30 members, with one representative elected from each ward by the respective residents. The Chairperson, elected from within the council, serves as the head of the municipal body, while the Vice-Chairperson, also elected by the council members, assists the Chairperson and fulfils their duties in their absence. To facilitate governance and sectoral decision-making, the municipal council operates through six standing committees: Finance, Development, Welfare, Health, Education-Art & Sports, and Public Works. The Finance, Development, Welfare, and Health Standing Committees each comprise five members, the Public Works Standing Committee and the Education, Art & Sports Standing Committee comprises of four members each. The Vice-Chairperson serves as the Chairperson of the Finance Standing Committee, while the Chairpersons of the remaining standing committees are elected by the council members. The structure of the elected council of Haripad Municipality is shown in the Figure 23.1.

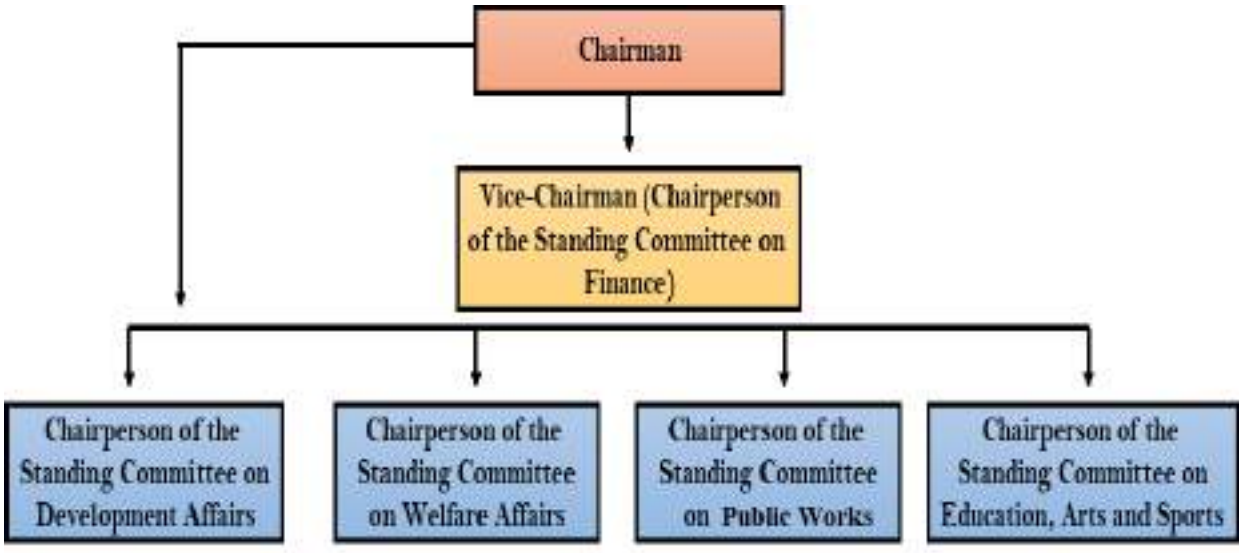


Figure 23.1 Structure of the Elected Council of Haripad Municipality

23.2.2 Administrative Structure of the Municipality

The Municipal Secretary is the executive head of the Municipality and he is supported by the following six sections of staff:

i. General Administration section
ii. Revenue section
iii. Engineering section
iv. Public health section
v. Peoples planning section and
vi. Accounts and Auditing

Figure 23.2 shows the administrative structure of Haripad Municipality.

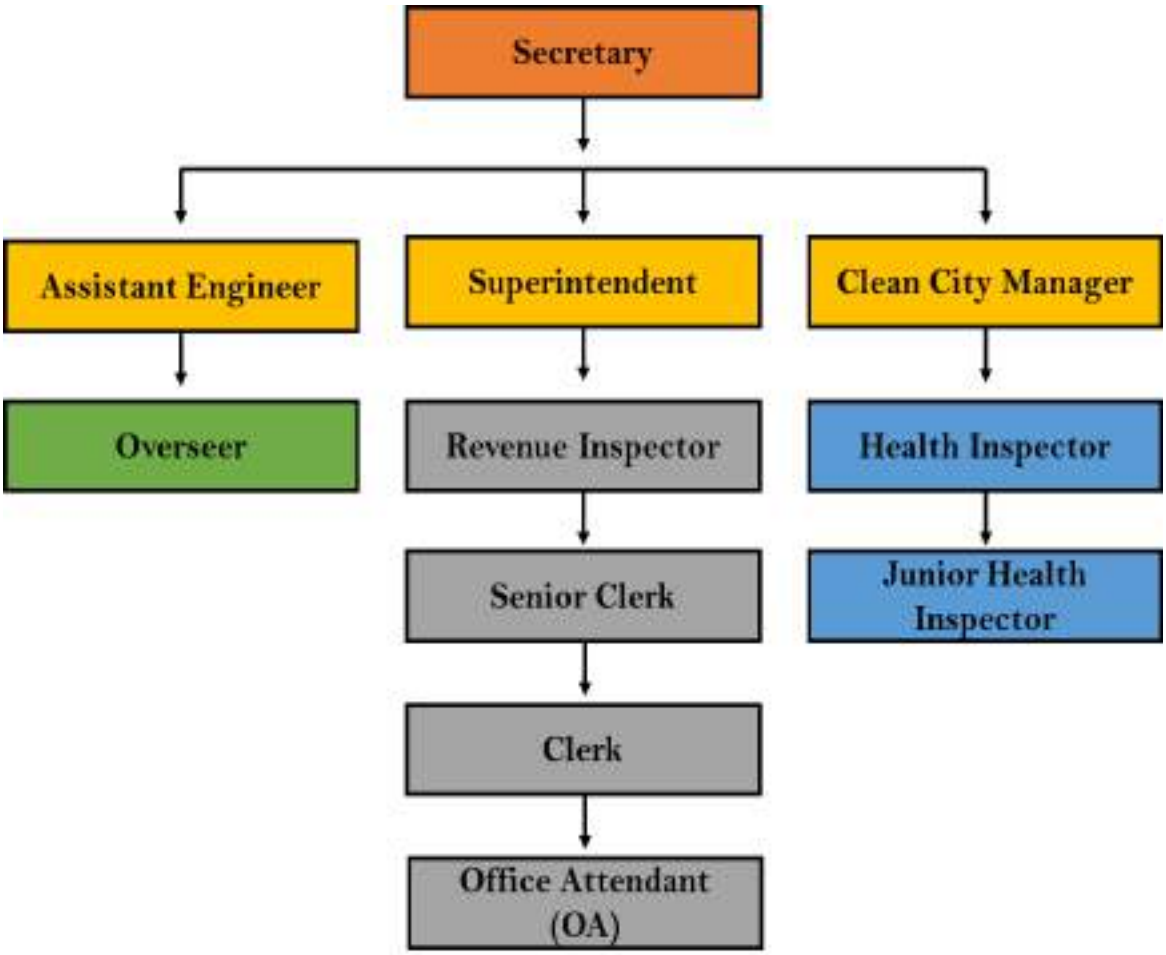


Figure 23.2: Administrative Structure of Haripad Municipality

23.2.3 General Administration Section

The General Administration section, under the leadership of the Junior Superintendent, comprises three sub-divisions: Establishment, Accounts, and General Matters.

23.2.4 Revenue Section

The Revenue Section, headed by the Revenue Officer, is responsible for the administration and management of the Municipality's revenue.

23.2.5 Engineering Section

The Engineering Section, headed by the Municipal Engineer in the cadre of Assistant Engineer and Public Works Overseers. This section is responsible for project planning, execution, and maintenance of essential services and infrastructure within the town. It oversees the implementation of development plans and town planning schemes, grants approval for building and layout plans, identifies unauthorized constructions, and facilitates the eviction of encroachments.

23.2.6 Public Health Section

This section is headed by the Public Health Officer Grade I and is responsible for tasks such as solid waste collection and disposal, drain cleaning, and matters related to public health, maternal and child care, as well as Community Development Scheme (CDS) activities.

23.2.7 People's Planning Section

This section coordinates plan formulation under the decentralized planning process, facilitating the preparation of annual and five-year plans for the Municipality.

23.3 Municipal Finance

To review the status of municipal finances, actual income and expenditure data for the financial years 2022–23 to 2024–25 has been collected, regrouped, and recast. Based on this, an analysis was carried out to assess the status of the revenue and capital accounts, as well as the overall closing balance for the review period. The key highlights of the financial assessment are given in Table 23.1.

Table 23.1: Income and Expenditure Statement (in Rupees)

Sl. No	Particulars	2022-2023	2023-2024	2024-2025
1	Total Income	175287257	363814118	540179985
2	Total Expenditure	151851260	344225076	526645690
3	Closing Balance	23435997	19589042	13534295

Source: Budget 2024-2025, Haripad Municpality

23.3.1 Current Status of Municipal Finance

1. Revenue Account- Revenue Income

Revenue income of Haripad Municipality comprises own sources of revenue and revenue grants and contributions. The own revenue sources are further categorized into tax and non-tax revenues. The following figure illustrates the trends in revenue income over the years, highlighting the contribution of each source tax revenue, non-tax revenue, and revenue grants. The Figure 23.3 reveals a significant dependence on revenue grants, with comparatively low contributions from tax and non-tax revenues in most years, except in 2024–2025.

Table 23.2: Revenue Income (in Rupees)

Sl. No	Particulars	2022-2023	2023-2024	2024-2025
1	Tax	25700332	27796602	68300000
2	Non-Tax	6969303	7518536	15823573
3	Plan Grants	30732024	81059960	90139000
4	Non Plan Grants	40736580	86573940	95187370
5	Total Revenue	81007939	202949038	269449943

Source: Budget 2024-2025, Haripad Municpality

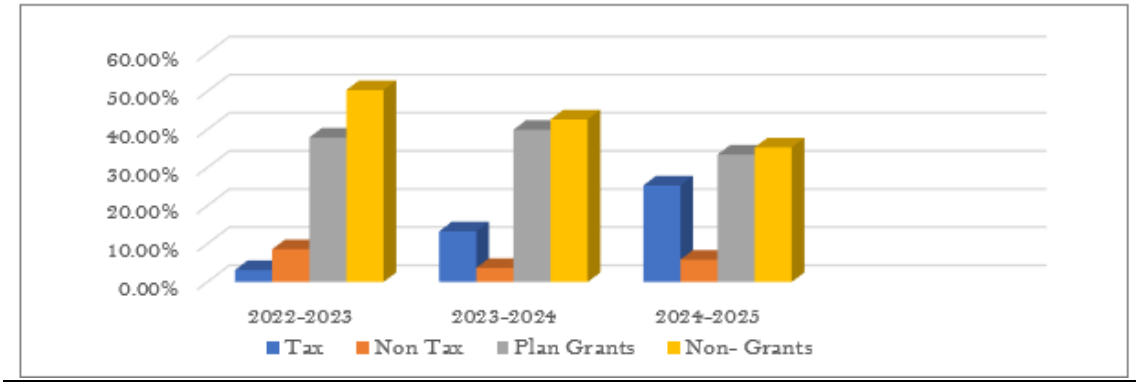


Figure 23.3: Revenue Income Composition

2. Revenue Expenditure

The expenditure of the Municipality, like its receipts, is classified into three accounts: Revenue Account, Capital Account, and Debt Account. The Revenue Account covers expenses for administration and tax collection, public works, town planning, education, water supply and drainage, public health, street lighting, maintenance of municipal properties, and grants for maintaining transferred assets. The Capital Account includes expenses for management, public works, water supply and drainage, public health, street lighting, endowments, deposits, poverty eradication programmes, schemes implemented through transferred departments, and programmes under decentralized planning. Property tax and profession tax are the main sources of own revenue for the Municipality. The following figures show the trends in expenditure at Haripad Municipality.

Table 23.3: Revenue Expenditure (in Rupees)

Sl. No	Particulars	2022-2023	2023-2024	2024-2025
1	Establishment	28589061	29067440	38153063
2	Administration	6557846	9543274	12552000
3	Operation and Maintenance	4532265	8535338	17385000
4	Capital Account	16579098	53049554	117443334
5	Total Expenditure	56258270	100195606	185533397

Source: Budget 2024-2025, Haripad Municpality

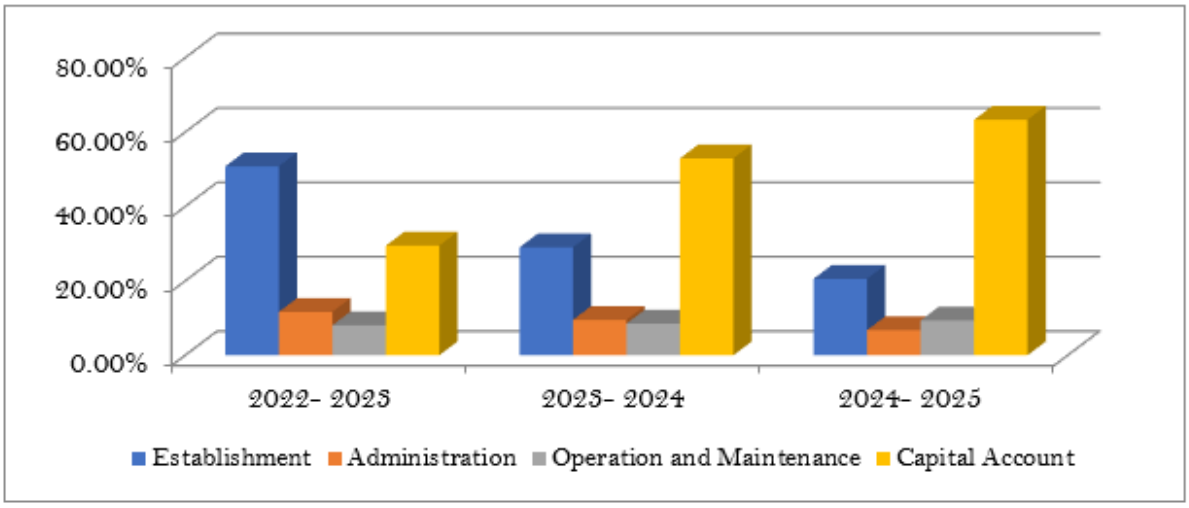


Figure 23.4:: Revenue Expenditure Composition

Revenue expenditure towards each head i.e. Establishment & Administration, Operation & Maintenance, Capital Account and Interest has been depicted the Figure 23.4.

23.4 Existing Sources of Funds

The Municipality generates revenue from various sources that support its financial stability. The main sources include property tax and professional tax collected from institutions, professional traders, and employees. Additional income is received from advertisement tax, entertainment tax, and tax on timber, as well as rental income from municipal properties. The Municipality also collects fees and user charges, sales and hire service charges, and earns income through interest and other miscellaneous sources. Together, these funds provide the financial base for municipal administration.

23.5 Asset Management Plan

23.5.1 Municipal Assets

The Municipality has a range of social and physical infrastructure that supports the needs of its residents. These include 27 Anganwadis, 9 schools, one Pakal Veedu, one Homeopathy hospital, one Ayurveda hospital, one Taluk hospital, one Primary Health Centre (PHC), one Krishi Bhavan, and one Veterinary Hospital, which together strengthen the educational, healthcare, and primary sector support systems of the town. In addition, there is one crematorium and a parcel of land proposed for a Material Collection Facility (MCF) to improve solid waste management. These assets collectively play an important role in social welfare, education, healthcare, agriculture, and environmental management within the Municipality.

23.5.2 Key issues in Asset Management

Despite the presence of a wide range of municipal assets - including educational facilities such as Anganwadis and schools, healthcare institutions, primary sector support facilities, and critical environmental management infrastructure - Haripad Municipality faces several challenges in ensuring their effective management, maintenance, and long-term sustainability.

1. **Inadequate Asset Maintenance and Upkeep**

Many municipal assets require periodic maintenance to ensure continued functionality. Insufficient budgeting, lack of preventive maintenance schedules, and delayed repairs can reduce the operational efficiency and service quality of facilities such as Anganwadis, healthcare centres, and public utilities.

2. **Ageing Infrastructure**

   Several public buildings and service facilities are ageing and may no longer meet current safety, accessibility, or service-delivery standards. This can lead to increasing maintenance costs, structural vulnerabilities, and reduced user satisfaction.

3. **Inadequate Integration of Risk and Climate Considerations**

   Given Haripad's vulnerability to flooding and climate-related hazards, many municipal assets face increased risk of damage or service disruption.

4. **Financial Constraints and Funding Gaps**

   Limited municipal revenue and dependence on external funding (state or centrally sponsored schemes) restrict the Municipality's ability to invest in infrastructure upgrades, modernisation, and asset lifecycle management.

23.6 Problems and Potentials

The Municipality has a wide range of social and physical infrastructure, but several challenges persist. Many Anganwadis, schools, and healthcare facilities face issues of inadequate infrastructure, limited capacity, and insufficient maintenance. Solid waste management facilities are also inadequate and land identified for a Material Collection Facility (MCF), which is yet to be developed. At the same time, there are notable opportunities to improve services by upgrading schools and healthcare institutions, modernizing Anganwadis, and strengthening the Krishi Bhavan and Veterinary Hospital to better support agriculture and allied activities. The proposed MCF also provides scope for improving waste management.

23.7 Inference

The analysis of development administration, municipal finance, sources of funds, and municipal assets reveals that Haripad Municipality has a well-defined institutional structure and a range of community-supporting facilities. While the Municipality benefits from a structured administrative framework, elected council, and various social and physical assets, its financial base continues to rely heavily on grants, with limited contribution from own sources of revenue. However, the presence of established institutions such as Anganwadis, schools, hospitals, the Krishi Bhavan, and the Veterinary Hospital, along with planned facilities like the Material Collection Facility, provide a strong foundation for future improvements. Strengthening own revenue sources, modernizing infrastructure, and ensuring efficient utilization of funds will be essential for enhancing governance, service delivery, and overall urban development.



PART I : STUDY & ANALYSIS

DISCUSSION AND ANALYSIS

1. COMMUNITY INVOLVEMENT
2. SUMMARY AND FINDINGS
3. SECTORAL AND OTHER LINKAGES
4. SPATIAL STRUCTURE

CHAPTER
24

COMMUNITY INVOLVEMENT



Community participation is a cornerstone of effective and inclusive planning in Haripad. Engaging residents, stakeholders and local organizations ensures that the Master Plan reflects the town's real needs, aspirations and priorities. Local knowledge provides valuable insights into environmental challenges, infrastructure gaps and social concerns, leading to more responsive and people-centric planning outcomes. Community involvement is especially critical in risk-informed planning, helping in identifying vulnerabilities, strengthening preparedness and developing practical mitigation strategies. This chapter highlights the role of participatory processes - such as workshops, consultations and focus group discussions - in building transparency, fostering ownership and creating resilient, sustainable and widely supported development strategies for Haripad.

- Introduction
- Development Seminars
- Stakeholder Consultations
- Focus Group Discussions

24. COMMUNITY INVOLVEMENT

24.1 Introduction

The master plan seeks to optimize the use of land and resources for the benefit of the people living in the planning area. Engaging local communities is essential in the plan preparation process for creating spaces that reflect the needs and desires of those who live there, especially to address the social, environmental, and economic factors of sustainability. Such engagement strengthens the relationship between Local Self Governments (LSGs) and the community, facilitating informed and inclusive decision-making. It enables individuals and groups affected by, or interested in, development initiatives to voice their perspectives prior to finalization of the plan.

As per Section 34(1) of the Kerala Town and Country Planning Act 2016, the Master Plan shall be prepared through a participatory process. Further, as per Section 16(6) of the Kerala Town and Country Planning (Formulation and Sanctioning of Master Plan) Rules 2021, the Local Self-Government shall ensure the public participation in the process of preparation of the Master Plan by conducting discussions and consultations with stakeholders or experts whenever necessary and by organizing seminars to identify the development problems and opportunities of the town.

In accordance with these acts and rules, and with the technical support of LSGD Planning, the Municipality has facilitated consultations with stakeholders and line departments, carried out discussions with focus groups from various development sectors; consulted experts, resource persons and the general public; and conducted development seminars to ensure the involvement of citizens in various stages of the plan preparation process. The Figure 24.1Figure 24.1: Key Components involved in Community Participation illustrates the various activities that has been carried out to ensure the involvement of community in the process of preparation of master plan for Haripad Town. Those activities include various primary and secondary surveys conducted at the community level; capacity building programs for the students engaged in various surveys, officers of the Municipality and LSGD Planning; focus group discussions, consultations with various stakeholders, experts and resource persons, political representatives and various seminars organized by the Municipality.

Focus group discussions were conducted with representatives from Harithakarmasena, Kudumbasree units, Residents Associations, Vyapari Vyavasayi Association, Padasekhara Samithi members, Asoothrana Samithi members and with representatives from various Temple Authorities within the Municipality. Stakeholder consultations include public interactions, discussions with various line departments and working groups of the Municipality. Working group discussions primarily involved experts from key sectors such as public works, social justice and women's development, animal husbandry and dairy development, agriculture, health, poverty alleviation, and housing. The above-mentioned activities and the suggestions received from those discussions and consultations are detailed in the following sections.

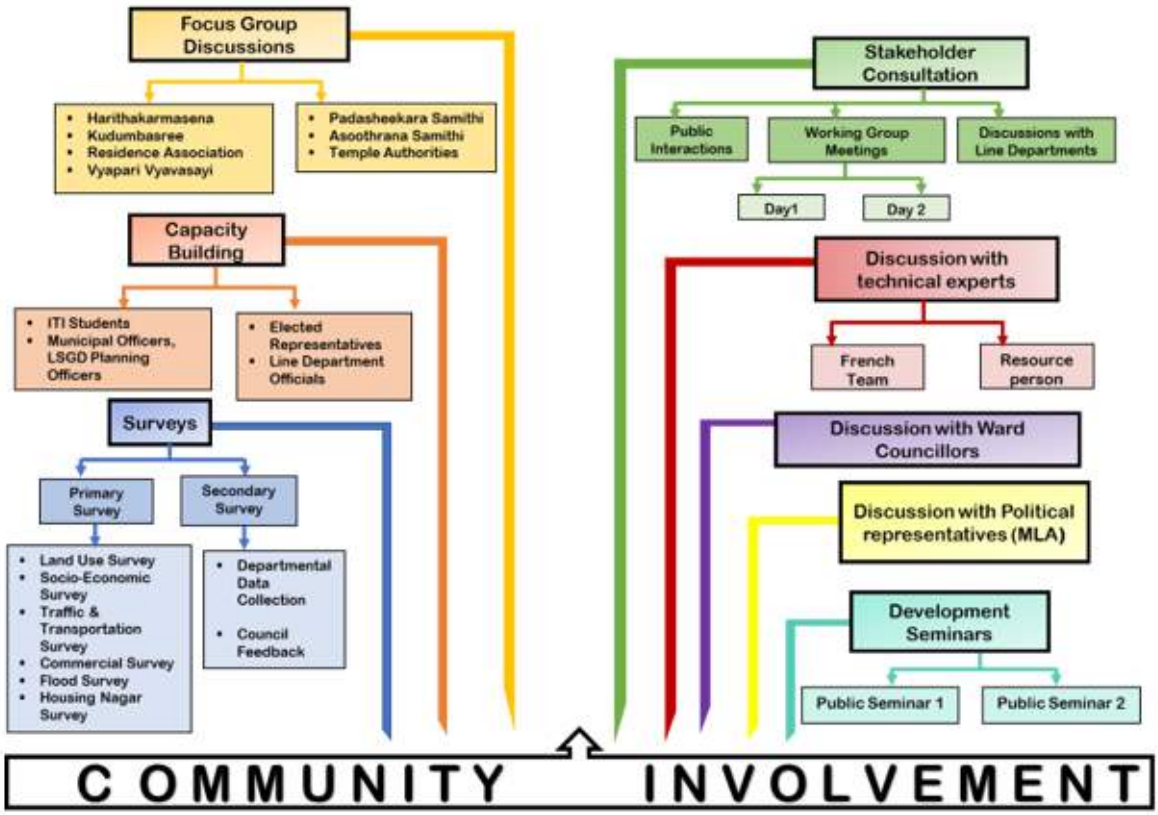


Figure 24.1: Key Components involved in Community Participation

24.2 Surveys

A survey is a systematic process of collecting primary field-level data to understand the physical, social, economic, and environmental conditions of an area. In Haripad, surveys were carried out through field inspections, household interactions, stakeholder consultations, and questionnaires to capture ground realities such as land use, infrastructure, traffic, drainage, housing, public amenities, and disaster vulnerability. These surveys are crucial for the preparation of the Master Plan as they provide accurate, location-specific, and up-to-date information, help identify local needs and development potentials, validate secondary data, and support evidence-based planning. Overall, survey findings form the foundation for framing realistic and context-sensitive development strategies, zoning regulations, infrastructure proposals, and disaster risk mitigation measures. The primary data required for the preparation of Master Plan was collected by various surveys such as:

- Land Use Survey
- Socio-Economic Survey
- Flood Prone Area Survey
- Traffic & Transportation Survey
- Commercial Area Survey
- Housing Nagar Survey
- Pilgrim Survey
- LiDAR Survey



24.2.1 Land Use Survey

The land use survey was carried out during November – December 2024, by the students of Govt.ITI, Pallipad and Govt.ITI SCDD, Haripad, under On-Job-Training programme supervised by the officials of LSGD planning. Capacity building program were conducted for the students regarding the conduct of land use survey. The photos taken during the training program and surveys are shown in Figure 24.2 and Figure 24.3 respectively. This survey was conducted by using the base map of Haripad town and verifying the land uses by field checks throughout the Municipality. It also involved verifying the cadastral level data for checking the accuracy of the prepared base map.



Figure 24.2: Training given to ITI Students



Figure 24.3: Photos taken during Land Use Survey

24.2.2 Socio-Economic Survey

The Socio-Economic Survey was conducted in 10% of the households in all the wards of the Municipality. The survey was conducted by the ITI students under the supervision of officials of LSGD Planning, using pre-prepared questionnaire in "Google Forms". The questionnaire survey was conducted by one-to-one conservation with the residents from the selected

residential building. The photos taken during the socio-economic survey is shown in Figure 24.4.



Figure 24.4: Photos taken during Socio-Economic Survey

24.2.3 Flood Prone Area Survey

The major hazard identified for the town is flood, and in the identified flood prone area within the town as per the 1 in 50-year return probability maps published by KSDMA, 10% of the buildings were surveyed to assess the severity and frequency of the flood hazard happening in those areas. The survey was conducted using a questionnaire in google forms, by one-to-one conservation with the residents from the identified buildings in the Flood prone area of each ward. Photos taken during the Survey are shown Figure 24.5.



Figure 24.5: Photos taken during Flood Prone Area Survey

24.2.4 Traffic& Transportation Survey

The Traffic and Transportation surveys and studies of Haripad town were carried out by National Transportation Planning and Research Centre (NATPAC) in October 2025. Study involved various surveys related to the assessment of traffic volume, parking requirements, pedestrian facilities and other infrastructure related to the transport sector within the town. It also includes discussions and consultations with the Municipality, KILA, PIU-DLI4 and Chief Town Planner (Planning). Photos taken during those surveys are shown in Figure 24.6.



Figure 24.6: Photos taken during Traffic Studies and Site Visit

24.2.5 Commercial Area Survey

Survey of the existing commercial areas within the town was carried out in May 2025 using questionnaires in Google Forms to study the problems faced in commercial sector. The survey was conducted at market, wholesale/retail shops, commercial establishments and street vendors in the town through one-to-one conversation. Photos taken during the Survey are shown Figure 24.7.



Figure 24.7: Photos taken during Commercial Survey

24.2.6 Housing Nagar Survey

A survey was conducted in housing nagars of backward classes in the town during June 2025 to understand the problems faced by them. A total of 19 nagars across 11 wards in the Municipality were surveyed. Lack of adequate drainage is the most commonly reported issue across all nagars. All nagars have electricity and LPG connections. Most of the houses in Madathilparambu nagar are in an unsafe condition, with leaking roofs, cracked walls and poor sanitation. Photos taken during the survey is shown in Figure 24.8.



Figure 24.8 : Photos taken during Housing Nagar Survey

Findings from Survey	▪ Waterlogging/Flood Risk- nagars 8, 10–13, and 11 (Choorallackal) are severely waterlogged; access frequently cut off. ▪ Lack of Drainage- All nagars, except Chakkoormadam nagar, have improper drainage facilities. ▪ Access Constraints- nagars 5, 6, 13, 16 and 18 lack proper road connectivity. Narrow footpaths hinder service delivery and emergency response. ▪ Water Quality & Scarcity- Poor sources in nagars 2, 9, 14, and 18. Residents resort to bottled water or wells. ▪ Housing Conditions-Poor housing notable in nagars 2 and 3; most others are average. Housing conditions are good in nagars 17 and 19. ▪ Waste & Health Risks- Dumping in nagar 2, lack of waste systems in 7 & 15. Snakes hazards due to proximity to railway line in Pattukaran Parambil nagar (Ward 4). ▪ Only one nagar (Chakkoormadom – Ward 4) has proper drainage. Several nagars face multiple challenges such as flooding, poor housing, and water scarcity. Infrastructure improvement, waste management, and safe drinking water supply are urgent needs across most nagars.

24.2.7 LIDAR Survey

A LIDAR Survey using drone was conducted as a consultancy programme to prepare a drainage management plan as part of the Master Plan for Haripad town. The LiDAR survey has been outsourced, following a competitive tendering process, to a technically qualified and experienced firm with proven expertise in LiDAR data acquisition and processing.



Figure 24.9 : Municipal Chairman Inaugurating LIDAR Survey

24.2.8 Pilgrim Survey

Pilgrim Survey was conducted at Mannarasala Sree Nagaraja Temple during 25th and 26 th of October 2024. The survey was conducted by one-to-one conversation with the devotees of the temple during that time.

24.3 Councillors' Feedback Forms

Feedback forms (a set of questionnaires) were provided to all the ward councillors to understand and identify the development issues and potentials at the ward and Municipality level. A sample feedback form obtained is shown in the Figure 24.10.

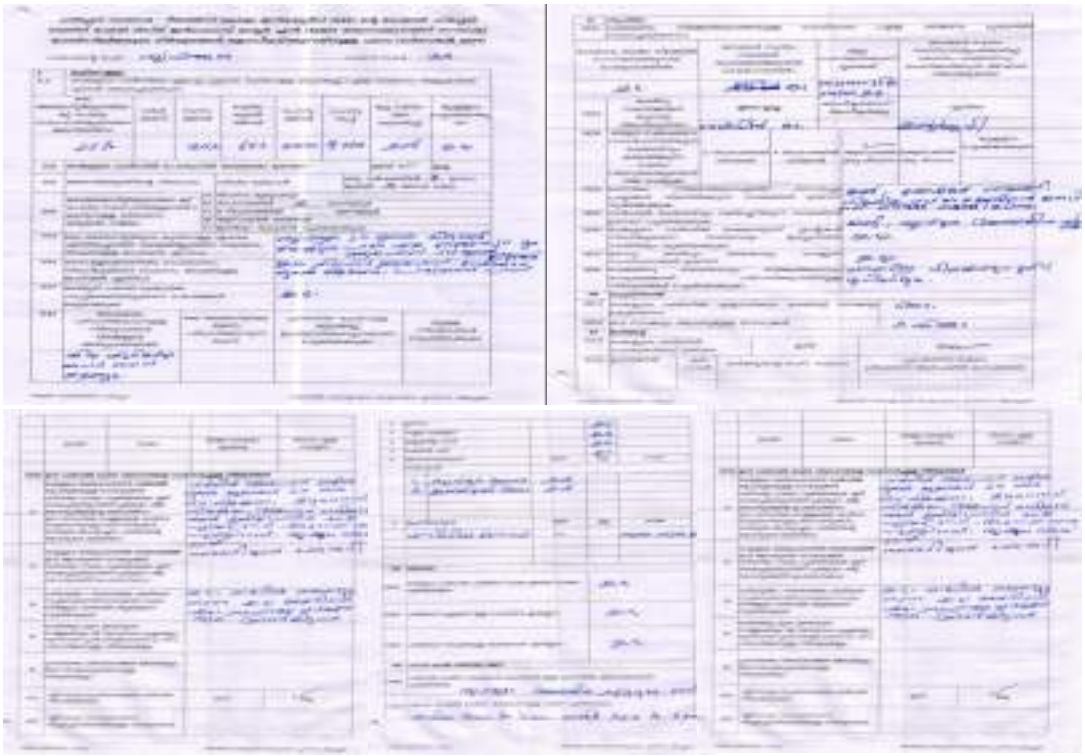


Figure 24.10: Sample Feedback form - Ward No: 4

24.4 Field Visits/ Site Visits

Field visits were conducted during the various stages of the plan preparation process by the LSGD Planning Team along with officials from the project implementation unit - DLI4, in coordination with municipal councillors, to identify areas with future development potentials, hazard-prone zones, and locations such as nagars that require basic infrastructure facilities. Photos taken during the site visits are shown in Figure 24.11.



Figure 24.11 : Photos taken during Field Visit

24.5 Development Seminar 1

As part of the preparation of the Risk-Informed Master Plan for Haripad Municipality, a Development Seminar was held on 21st June 2025 at the Municipality Conference Hall as per Rule 16(6) of Kerala Town and Country Planning (Formulation and Sanctioning of Master Plan) Rules,2021. The seminar was inaugurated by Mr. K. K. Ramakrishnan, Municipal Chairman, and presided over by Mrs. Subi Prajith, Vice Chairperson. The event witnessed active participation from around 140 individuals, including Standing Committee Chairperson, Planning Committee Members, Ward Councillors, Subject Experts, and General Public. Presentations were delivered by officials from the LSGD Planning Wing, followed by an open discussion wherein many participants shared their views, and also written suggestions were received. The major issues that have been addressed during the Seminar are: frequent flooding and waterlogging issues within the town area, Insufficient waste management facilities, traffic congestion, Limited public spaces and recreational amenities, poor drainage facility etc.



Figure 24.12: Development Seminar





ഭാവിയിലേക്കുള്ള 20 വർഷത്തേക്കുള്ള വികസനം

ഹരിപ്പാട് നഗരവികസനം മുന്നിൽക്കണ്ട് കർമപദ്ധതി തയ്യാറാക്കും

നിയോജക വികസന സെമിനാർ നടത്തും













ഹരിപ്പാട് നഗരസഭ വികസന സെമിനാർ നഗരസഭാ അധ്യക്ഷൻ കെ. കെ.രാമകൃഷ്ണൻ ഉദ്ഘാടനം ചെയ്യുന്നു

നഗരസഭ വികസന സെമിനാർ

ഹരിപ്പാട് ● 20 വർഷത്തെ വികസനം മുന്നിൽ കണ്ട് നഗരസഭ വികസന സെമിനാർ നടത്തി. വികസന സെമിനാറിൽ ലഭിച്ച നിർദേശങ്ങൾ കൂടി പരിഗണിച്ചു, ലഭ്യമായ വിവിധ ഡേറ്റ വിശകലനം ചെയ്തും വികസന രൂപരേഖ പൂർത്തീകരിക്കും.

വികസന സെമിനാറിൽ ലഭ്യമായ നിർദേശങ്ങൾ കൂടി കണക്കിൽ എടുത്ത് മാസ്റ്റർ പ്ലാൻ തയാറാക്കുന്നതിന്റെ അടുത്ത ഘട്ട നടപടികൾ കൈക്കൊള്ളും. നഗരസഭാധ്യക്ഷൻ കെ.കെ.രാമകൃഷ്ണൻ ഉദ്ഘാടനം ചെയ്തു.

ഉപാധ്യക്ഷ സുജി പ്രജിത് അധ്യക്ഷത വഹിച്ചു. ജില്ലാ ടൗൺ പ്ലാനർ കെ.എഫ്. ജോസഫ്, സ്ഥിരം സമിതി അധ്യക്ഷരായ വിനു ആർ.നാഥ്, എസ്.കുഞ്ഞുമോൾ, എസ്.നാഗദാസ്, മിനി സാവിത്രി, നിർമല കുമാരി സുബ്രഹ്മണ്യൻ പ്രസംഗിച്ചു.


20 വർഷത്തിനുശേഷം ഹരിപ്പാട് എങ്ങനെയാകണം

കർമപദ്ധതിയുടെ കരട് വികസനസെമിനാറിൽ ചർച്ചയായി


സുപ്രഭാതം

വികസന സെമിനാർ നടത്തി



















Suggestions from Development Seminar

Drainage



- Haripad once had an efficient drainage system, but it has deteriorated over time and now needs to be revived.
- Renovation of Danapady Thodu is essential for improving local drainage and preventing waterlogging.
- Wards 3 and 29 are flood-prone areas requiring proper drainage systems along roads, which should also be covered.
- There is a need to preserve the environment, increase the depth and width of Danapady Thodu, restore damaged streams like Pillathodu and other natural drains, implement rainwater harvesting systems, and include a financial plan for these initiatives.
- Pillathodu needs to be preserved by constructing proper pitching to ensure its stability.
- As NH 66 is elevated compared to the surrounding land, water flows along the highway, leading to waterlogging on both sides, affecting houses and properties. A proper solution needs to be identified to address this issue.
- The width of the streams from Wards 20, 21, and 22 flowing into Danapady Thodu should be increased to improve water flow.
- Construction and renovation of drainages.

Agriculture



- To restore both dry and wet agriculture, a proper drainage system should be developed at the ward level.
- Currently, farmers do not have a facility to sell their agricultural produce; therefore, a market facility is required.

Disaster Management



- The side of the Pillathodu canal, starting in front of Haripad Temple, should be strengthened with pitching, covered with a slab, and developed as an access road to the highway.
- To address waterlogging in the 29 wards of Haripad town, a comprehensive master plan should be prepared, focusing on directing water to the Danapady canal. Water from the area east of Madhava Junction can be drained along the side of the highway, passing in front of Murali Hotel and beneath Gandhi Square, into the Pillathodu canal.
- Ward 4 is located at the boundary of Cheruthana and Veeyapuram panchayats, is one of the lowest-lying areas in the Municipality. Waterlogging is a major concern, and the two streams in the area should be renovated to resolve this issue.
- To mitigate waterlogging, measures should be taken to connect all small streams from all area to main canal. Resolve the waterlogging issues near Kolath temple and Nagari temple. Street vendors should be relocated, and an alternative space should be identified for them. Auto-rickshaw and taxi stands should be provided on the same side of the road. Police attention is also required to monitor parking effectively.
- Proper waste management in the Municipality can be achieved through central government schemes, which would help reduce dumping in water bodies and improper waste disposal.

Traffic & Transportation



- The road from Ezhikkakathu to Haripad Taluk Hospital requires widening to improve accessibility and traffic flow.
- The one-way system from Town Hall to Haripad Taluk Hospital is not properly maintained, and its effective implementation is necessary to reduce traffic congestion. When the one-way system is implemented in Haripad town, proper parking facilities must be ensured.

Other Infrastructure

- Renovation of Danapady Market and the establishment of a private bus stand are essential.
- The shops in front of Haripad Government Girls' High School should be removed, as some of them sell weapons, posing a threat to student safety.
- There is a need to establish day-care centres for children of working parents, an old age home, and a park for differently abled persons.
- As tourism is growing, there is a need to construct safe roads and establish centres for the care and control of stray dogs. Public toilets with advanced facilities should be provided, and road networks must be properly connected to link various tourist destinations.
- Streetlights in the town are not functioning properly. Proper lighting should be installed to ensure illumination. Ornamental plants should be planted to improve the town's appearance.
- A project aimed at promoting sports and educational development for the youth within the municipality.



- An IT industrial estate should also be established in this area.
- There is a need to establish a super speciality hospital.
- House maintenance and toilet maintenance should be ensured for the General and categories.
- The crematorium should be renovated and made functional.
- Wards 8, 9, and 11 of Haripad Municipality are flood prone. Therefore, it is necessary to establish a Disaster Management Office in this area. The poramboke land near Vathukulangara Temple can be utilized for constructing the office. It would also be beneficial to build a shelter home and a PWD rest house at this location, as they can serve as relief camps during emergencies.

Waste Management



- The waste on the poramboke land in front of Karthika Vidyanikethan should be cleared, and the area should be utilized for beneficial projects.
- The waste accumulated in the stream flowing eastward from in front of the S & S Auditorium at Kachery Junction should be removed to ensure smooth water flow. Also clean the drains in Town Hall junction.

Tourism



- Haripad is a land rich in artistic, cultural, and intellectual heritage. Like temple towns, Haripad is also known for its palaces. Although these are under the ownership of Devaswom Boards, a heritage circuit should be established by recognizing their historical and cultural value as a subject of research, and measures should be taken for their preservation.
- A temple-based help desk for tourists should be established, along with proper auto and taxi facilities.

24.6 Development Seminar 2

The draft Master Plan is presented before the General Public on 17/02/2026 as part of the development seminar organized by the Municipality. The seminar was inaugurated by the Hon'ble MLA Shri. Ramesh Chennithala, and the project proposals in the draft master plan has been discussed among around 500 people from various parts of the Municipality.



24.7 Stakeholder Consultations

Stakeholder consultation is considered as an integral part of the Master Plan preparation process. It includes meetings with various working groups, detailed discussions with line departments, and consultations with other relevant stakeholders to gather sector-specific inputs and technical insights. In addition, public interactions were conducted to understand local issues, needs, and aspirations. These consultations ensured that the Master Plan was participatory, inclusive, and responsive to on-ground realities, while also aligning with statutory requirements and departmental priorities.

24.7.1 Working Group Meetings

Working Group discussion were held at Haripad Municipality on 12th and 13th March 2025, wherein the sessions on 12th March focused on Social Justice and Women's Development, Animal Husbandry and Dairy Development, Agriculture, Public Works, Health, Poverty Alleviation, and Housing, while the discussions on 13th March addressed issues related to Drinking Water, Waste Management, and Drainage.

The session on Social Justice and Women's Development was attended by 25 participants, including 15 women, wherein six key members highlighted major challenges and development priorities. The Animal Husbandry and Dairy Development session focused on identifying sectoral issues and potential development measures, while the Agriculture Working Group

addressed concerns such as delays in implementing timely interventions to prevent saltwater intrusion due to the involvement of multiple departments. The Public Works Working Group emphasized critical issues including flooding, inadequate road width, lack of parking facilities, and the absence of a private bus stand. Discussions were held on Drinking Water, Waste Management, and Drainage, during which the major issues identified included poor drainage, frequent waterlogging, damaged canals, stray dog menace, and limited access to piped drinking water.



Suggestions from Working Group Meetings

Social Justice and Women's Development

Key Highlights

Anganwadi Centres

- There are 27 Anganwadi centres operating within the municipality, with 15 functioning in their own buildings, 10 in rented spaces, and 2 in government-owned buildings. None of these centers are classified as "smart Anganwadis" as they lack necessary facilities.
- Water scarcity is a significant issue impacting most of the Anganwadis.
- Anganwadis No. 17 and 24, located in Ward 11, are severely affected by flooding during the rainy season due to inadequate drainage systems.

Vayomithram Scheme - The Vayomithram scheme, managed by Kerala Social Security Mission (KSSM), offers free medical camps for residents over 65 years of age.

Support for Differently Abled Individuals

- Various schemes are available for differently abled individuals, including the distribution of assistive devices and scholarships, under KSSM.

Transgender Group Initiatives

- A group of 15-20 transgender individuals is actively involved in Kudumbasree, participating in various programs and activities within the organization.

Needs Raised

New Anganwadi Buildings:

- ✓ Proposals for new Anganwadi buildings that include classrooms, kitchen facilities, creches, and meeting halls are needed.

Mental Health Facilities:

- ✓ There is a pressing need for facilities that provide mental health support for children and women.

Gender Park:

- ✓ A Gender Park, complete with a comfort station, gymnasium for women, and healthcare services, is needed to promote gender equity and well-being.

Recreational Park:

- ✓ The municipality lacks recreational parks. It was suggested to utilize unused land under the Danapady Bridge for the creation of a park.

Sanitary Napkin Disposal:

- ✓ The installation of incinerators in public spaces within the municipality is necessary for the safe disposal of sanitary napkins.

Public Library Facility:

- ✓ The establishment of a public library within the municipality has been identified as an essential community resource.

Addressing Drug Use:

- ✓ Measures should be taken to address the gathering of men and children (aged 35 and below) in different parts of the town during the evening, as they are suspected to be involved in drug use. Initiative to curb this issue are urgently needed.

Animal Husbandry and Dairy Development

Key Highlights	▪ There is a shortage of medicines in the veterinary hospital. ▪ Value-added production is not taking place within the municipality. ▪ The veterinary hospital is currently operating in an old building and lacks adequate facilities. ▪ The price of fodder is significantly high and needs to be reduced. ▪ The subsidies are not reaching all eligible beneficiaries. ▪ Vaccinations for diseases such as Foot and Mouth Disease (Kulamburogam) are given every six months.
Needs Raised	✓ Proposals such as a mobile veterinary unit have been suggested. ✓ Insurance coverage for cows is necessary. ✓ Proposal for establishing small-scale industries for value-added products. ✓ Farmers will be encouraged if more subsidies are provided
	Agriculture
Key Highlights	▪ Due to the involvement of multiple departments, implementing timely ▪ measures to prevent the entry of saltwater into the fields is challenging. ▪ Vegetable farming is carried out in all seasons, with red spinach cultivated specifically during the summer season. ▪ Kera Samithi is provided with seeds at a 50% subsidy. ▪ Most of the seeds provided are of poor quality and fail to germinate. ▪ Encroachment and blockage of water-flowing drainage systems result in waterlogging in the fields. ▪ Youngsters are primarily interested in precision farming and mushroom cultivation.
Needs Raised	✓ Water hyacinth (പോളള) must be effectively removed or properly managed. ✓ Beautification of the Danapady Canal. ✓ The depth of the canal must be increased, and the width of the bund should be expanded to provide farmers with space for vegetable and coconut cultivation.
	Public Works
Key Highlights	▪ The main challenges include flooding, parking issues, and inadequate road width. ▪ There is no private bus stand at present. Previously, one existed in Danapady, but it has since been converted into a marketplace and a space for driving classes. ▪ Crematorium Road is frequently affected by flooding and becomes unusable during the rainy season.
Needs Raised	✓ To alleviate traffic congestion from Town Hall Junction to Ezhikath Junction, implementing a one-way traffic system is necessary. ✓ An elevated highway is proposed from Prathimukham Junction, running parallel to the road opposite Subrahmanya Swami Temple.

	Health
Key Highlights	▪ At present, mobile palliative clinics function only one day per week as part of the Snehadhara project at the Ayurveda Dispensary under the health sector, however this level of service is insufficient to address community needs ▪ Palliative unit is available in allopathic sector. But super specialty is not available. ▪ Laboratory facilities need to be expanded to be able to conduct more medical tests.
Needs Raised	✓ Training is needed to deal with a future disaster. ✓ Medical camps need to be conducted to connect more people with Ayurvedic treatment. ✓ At present, the Ayurveda hospital operates in a rented premise, highlighting the need for the construction of its own permanent building.
	Poverty Alleviation
Key Highlights	▪ Various employment opportunities are being made available through Kudumbasree units, such as umbrella making, pickles and chips making. They are also running Janakeeya hotel. This creates employment opportunities to some extent. ▪ Awareness classes are being provided for women between the ages of eighteen and forty to start small businesses (small scale industries). ▪ Financial assistance is being provided through the Department of Industries and Kudumbasree Loans.
	Housing
	▪ The landless homelessness project has not been implemented in the municipality. ▪ The project to build flats for the landless has not been implemented. ▪ The landless homelessness project has not been implemented in the municipality. ▪ The project to build flats for the landless has not been implemented
	Drinking water, Waste Management, drainage
	▪ Drainage problems. ▪ Water logging around railway track. ▪ Pathetic condition of Pillathodu. ▪ Street light issues. ▪ Programmes to be implemented to control stray dogs. ▪ Drinking water supply through pipeline is absent in many wards, especially in ward 22. ▪ Wards 10,15,20,21,22 are facing issues related to PIP canals. These canals are not functioning and hence it became waste dumping areas.



Figure 24.13: Day 1 Working Group Discussions



Figure 24.14: Day 2 Working Group Discussions

24.8 Focus Group Discussions

Focus Group Discussions (FGDs) were conducted as an integral part of the master plan preparation for Haripad to ensure a participatory and inclusive planning approach. These discussions brought together representatives from key stakeholder groups including residents, elected representatives, sectoral experts, traders, women's groups, youth, and vulnerable communities. The FGDs provided a platform to understand local issues, sector-specific challenges and development aspirations related to land use, mobility, drainage, housing, environment, and social infrastructure. Insights gathered from these interactions helped validate secondary data, identify ground-level priorities, and incorporate community perspectives into planning proposals, thereby strengthening the relevance, feasibility and local acceptance of the Haripad Master Plan.



24.8.1 Discussion with Harithakarmasena and Kudumbasree Members

A meeting with members of the Harithakarmasena and Kudumbasree, along with the representatives from LSGD Planning, Alappuzha, was held on 31st January 2025 at Haripad Municipality as part of the preparation of the Risk-Informed Master Plan. All 31 Harithakarmasena members and 14 Kudumbasree members attended the meeting. Both groups consist entirely of women, with Harithakarmasena members selected from among Kudumbasree. Following a brief overview of the Master Plan process, a detailed discussion was held to understand the challenges they face in their respective areas of work.



Figure 24.15 : Meeting with Harithakarmasena & Kudumbasree

Harithakarmasena	▪ They should also be facilitated to start related initiatives like inoculum production. It will help them increase their income and make waste management activities more efficient. ▪ Daily wages are low compared to other municipalities. There are only 31 people, out of a total of 58 people required, including two people for one ward. ▪ They need to be provided with safety equipment like gloves, masks and toilet facilities, adequate drinking water, seating facilities etc. ▪ There are no facilities for disposing of sanitary pads, diapers, etc. ▪ The Harithakarmasena members segregate waste at the MCF, where the waste gets piled up in the open without any other facilities
Kudumbasree	They receive revolving funds to launch various projects. They should be enabled to undertake more innovative ventures through awareness raising and providing necessary training. This will ensure economic security and empower women. The initiatives under Kudumbasree are as follows: ▪ Stitching units ▪ Mill (coconut oil, curry powders etc.) ▪ Pickles ▪ Snacks ▪ Tea shop

24.8.2 Discussion with Residents' Associations and Vyapari Vyavasayi Ekopana Samithi

A meeting was convened on 05/03/2025 with representatives of Residents' Associations and Vyapari Vyavasayi organizations of Haripad Municipality.

Key highlights of the Discussion

- Haripad, which has a lot of tourist potential, does not yet have any kind of tourist center. The existing canal at Nelpurakkadavu can be widened and deepened, side pitching can be constructed, the area up to Payippad river can be beautified, and facilities like fountains and boating can be provided.
- There are currently no parks or community halls in the Haripad area. Planning a community hall and park centered on five wards would be beneficial for the city residents.
- There are no suitable facilities for senior citizens to gather or socialize. For this purpose, a "Pakalveedu" can be set up by combining at least four wards.
- The upper part of the Pillathodu starting from the front of the Haripad Govt. Girls Higher Secondary school up to the Aashirvad theatre can be covered with strong concrete and made beautiful, strengthened by providing pillars at the bottom, and bunkers can be built on one side for street vendors on top of it, and the opposite side can be made suitable for t wo-wheeler/cycle parking and transportation.
- When the stream near the pilappuzha cheriyalethu railway line is constructed with pitching and thereby rainwater is allowed to flow away, the waterlogging in that area will be resolved. Also, the road east of Aroor School will be connected to Cheriyalethu Road, which will be very beneficial for the residents and children.
- Construction of road and drains from naga junction towards eastern side of S&S auditorium to Aroor school and from prathibha junction to railway line towards east will be a solution to the water logging in that area.
- The existing crematorium in Haripad Municipality needs to be modernized and made operational.
- Need Stadium and industrial estate.
- Sanitation facilities are inadequate in certain wards.
- In certain areas with PIP canals, residents lack proper access to their homes.
- Wards 18, 17, and 15 have water sources with high iron content, while certain other wards are experiencing water scarcity, requiring residents to purchase water.
- A road is required near Aroor ITI. Drainage infrastructure is required on the west side of the railway.
- Encroachment of street vendors on main roads affect traffic in many places. Rehabilitation of street vendors to convenient positions by earmarking vending zones.
- Unauthorised parking in front of shops and scattered street vendors is largely affecting their business.
- Traffic congestion at Ezhikkath Junction is a significant concern.
- The shops in front of Haripad Temple require renovation, and there is a need for a marketplace and an efficient waste management system.



Figure 24.16: Meeting with Residents' Association & Vyapari Vyavasayi

24.8.3 Discussion with representatives from various Padasekhara Samithis

A meeting was convened on 11/03/25 with representatives of Padasekhara Samithi of Haripad Municipality to discuss key issues related to agricultural development and infrastructure in paddy cultivation areas.



Figure 24.17 : Meeting with representatives from various Padasekhara Samithi

Key Highlights of the Discussions

- The representatives emphasized the need for municipal support to sustain paddy cultivation.
- The municipality should provide support for paddy cultivation.
- Water scarcity is prevalent in five Padasekharams.
- Insufficient electricity supply.
- Permanent shutters need to be constructed on bridges to regulate the proper flow of water instead of "Orumuttu".
- The pending road construction needs to be completed.
- The tax on fields within the municipality is high and needs to be reduced.
- The "Kalvilakku" that was traditionally installed in the field since ancient times is no longer there and should be restored.
- Although the road construction from Prathimugham to Kuruvithara Kunnu has been completed, the road work that continues to it needs to be completed and made suitable for traffic. Street lights also need to be installed.
- Ramps and pitching should be constructed on the sides of the streams adjacent to the paddy fields, and small bridges should be constructed where necessary to allow machines to be unloaded and used for farming.
- There is a situation where garbage is being dumped in many parts of Puncha. A permanent solution needs to be found for this.

24.8.4 Discussion with Planning Committee Members

A meeting was convened on 19/03/2025 with the Asoothrana Samithi members of Haripad Municipality to gather inputs on various development needs and priorities within the municipal area. Participants highlighted the urgent requirement for comprehensive infrastructure improvements to address traffic congestion, waterlogging, and urban crowding.

Key Highlights of the Discussions	**Infrastructure**
	▪ Public spaces and public market, Children's Park. ▪ Slaughterhouse with modern facility, Modern fish and meat market. ▪ Facilities for senior citizens, Playground and Reading room/library in each ward. ▪ Modern facilities in Taluk hospital. ▪ Need a swimming training center.
	Traffic and Transportation
	▪ Ring road to avoid traffic congestion and Parking facilities should be provided away from the town centre. ▪ Private bus stand, Flyovers and Mobility hub. ▪ Promote farm tourism. ▪ Steps should be taken to reduce road accidents.
	Tourism/ Culture/Heritage
	▪ Develop as a temple town with facilities for halt and entertainment. ▪ Tourist home. ▪ Encourage water transportation. ▪ Toilet facilities in public places. ▪ Haripad should be developed as a cultural center that serves as a gateway to Kuttanad and preserves its heritage. Peacock (Mayooram) should be promoted as a heritage symbol. ▪ Facilities should be provided as a temple city from Haripad Temple to Mannarasala Temple. ▪ A cultural museum related to boat building and a historical museum that preserves the heritage should be established. ▪ There should be systems in place to encourage people coming to the city to spend more time. There should also be systems to reach out to others through a communication strategy. ▪ The eastern part of the railway remains underdeveloped and the necessary railway over-bridges should be constructed.
	Disaster Reduction/ Environment
	▪ Deepening, widening and beautification of Danapady thodu and Pillathodu. ▪ Removal of encroachments on the Pillathodu, which joins the Achankovil River, and by deepening it and building a protective wall. ▪ The tributaries of Pillathodu should be cleared of moss. ▪ Scientifically designed drainage systems should be put in place. ▪ The canal near the Sree Krishna Swamy Temple should be cleaned and used. ▪ To avoid waterlogging in the city, a drainage system is needed so that water from all wards flows into nearby canals

	Agriculture & Allied Sectors
	▪ Increase the production of Padasekharams, self-sufficiency in paddy and vegetable. ▪ Self-sufficiency in milk, meat and egg production. ▪ Fallen lands should be cultivated with the involvement of Kudumbasree. ▪ Parts of the paddy fields should be turned into lakes, and the water should be treated and used for drinking. The areas on the sides of the lake should be turned into resting places. ▪ Fields should be developed into diversified production areas. ▪ Wastewater can be converted into artificial wetlands for paddy cultivation and fodder cultivation



Figure 24.18: Meeting with Asoothranasamithi members

24.8.5 Discussion with representatives from various temples in the town

A meeting was held on 08/05/2025 with representatives from six major temples within Haripad Municipality. Shri K. K Ramakrishnan, Municipal Chairman along with the officials from LSGD Planning, Alappuzha attended the meeting. The session aimed to understand the key infrastructural and environmental concerns faced by temple authorities.

	Subrahmanya Swamy Temple
Suggestions from Focus Group Discussions	▪ Koothambalam is in a degraded condition. It is to be reconstructed. ▪ Perumkulam, should be protected by doing pitching constructions. ▪ Kuthiramalika, Palace – should be protected. ▪ The traffic around the temple should be controlled. Private buses should not enter to the temple road. ▪ Parking problems prevails. Devaswom board have areas, but due to court orders, using their land is not possible. Alternative solutions outside the devaswom property should be considered. ▪ No Guest houses near the temple. Only Mannarasala temple have one Guest house. Tourism Department is willing to construct Guest House if Devaswom board allows. ▪ There is a toilet to the back side of the temple. A proposal for Take a Break under AMRUT project is under consideration from the Municipality. ▪ Drainages should be maintained properly. The drain from temple is directly connected to the Pillathodu.

- Rejuvenation of the Pillathodu starting from the temple to be considered. The funding may be got from CWRDM. There are schemes in CWRDM for rejuvenation of water resources.

Pilappuzha Temple

- The Road which is passing in front of the temple from TB Junction is having narrow width. There is no place for Parking the vehicles of the devotees. The present width of the road is 3m. Widening and Beautification of this road is to be done. There are no foot paths on the road. It should be properly beautified, parking and pedestrian facilities may be provided.
- There is a sacred groove in the temple. This should be protected. A proposal for Afforestation of the grooves has been submitted by the temple Trust to the Forest Department. The proposal was approved by the Department. But, due to insufficient funds, no further development has been carried out.

Sreekrishna Swamy Temple

- There is 2 Acre area in the temple ownership, which is not used for any other purposes. It may be used for developing any farming practices.
- 3 to 5 marriages are being taking place in the temple every month. But there is no sadyalayam to cater the needs of the people.
- The existing waste management system is not sufficient.
- Parking facilities are insufficient.
- There are 3 sacred groves associated with the temple. That should be protected.
- Drainage facilities should be improved.

Thalathottam Temple

- The existing waste management system is not sufficient.
- There is no sadyalayam to cater the needs of the people.
- A large pond is associated with temple. Recently, pitching works completed.

Thrippakkulam Shiva Temple

- Recently in this temple, pond maintenance has done.
- Pond (Theerthakkulam) is towards the western side of the temple. Beautification to be done to this. Drain passing through the Brahmodayam school is to be maintained.
- Parking facilities and road widening may be considered.
- Road from the front to back side of the temple is not connected.

Nagari Temple

- Parking facilities and road widening may be considered.
- Temple pond should be protected by pitching construction.
- No comfort stations. There is a land under the ownership of Devaswom, a proposal for constructing toilet may be considered.
- Unscientific construction of road causes flooding during rainy season. (road from Nagari to Town hall).
- Sacred groves need to be protected.



Figure 24.19: Meeting with Temple Authorities

24.8.6 Discussion with Resource Person from District Planning Committee

A discussion was held with Mr. Sreekanth, Member of the District Planning Committee (DPC), to gather insights and reference materials relevant to the development of Haripad Municipality. Key development issues and sectoral gaps were identified during the interaction.

Suggestions received from Discussions

- Traffic congestion in roads and Parking is an important issue. Proposals in NATPAC Report like ring road proposal may be explored.
- During Sabarimala pilgrim season, heavy footfall is at Subrahmanya temple. Presently, there is no facility for such pilgrims. Chakkulatthukavu temple and Edathua church pilgrim season also experiences heavy traffic congestion in the town area. This town may be developed as a pilgrim hub.
- No public amenities (comfort stations) in Bus Stand, Hospitals etc. Comfort stations are at some locations, but it is not functional.
- No integration between Railway, Private and KSRTC transportation facilities. There was a proposal to construct a private bus stand near Danapady. But it was dropped due to the distance from KSRTC and Railway station to this place. A mobility hub proposal is under consideration by the Municipality and KITCO is the consulting agency.
- Trauma care centre to be proposed. At the Taluk hospital no facilities for trauma care. At present, they depend on medical college at Vandanam.
- No Guest houses or hotel facilities for visitors. Govt/Private institutions may be proposed. No municipal guest houses. BOT mode may be adopted for this proposal. One such project including shopping complex and accommodation facilities was proposed at Govt.BHSS. But it was dropped. Recently, one such project is planning by the SAI center.
- Land Availability is a major problem. But PPP is an option. Special purpose Vehicle may be formed for such kind of projects. And the project may be implemented with the help of any national financing agency.

24.8.7 Meeting with Organization of Licensees

A meeting with representatives of the Organization of Licensees was held on 10.04.2025 as part of the municipal focus group discussions for the preparation of the Risk-Informed Master Plan for Haripad Municipality. A total of nine participants attended the meeting, including six women, reflecting approximately 67% female participation.











Suggestions received from Discussions

- Master plans should be designed in a way that encourages mixed use.
- Traffic reforms are not being implemented effectively in our country. The signaling system is outdated. The signaling system cannot effectively manage the traffic in our country. Flyover/interchange systems should be implemented.
- When constructing in a flood zone by raising the plinth height, local bodies tend to include the area of the cellar floor in the built-up area and collect taxes. This should be addressed.
- Steps should be taken to implement development proposals by coordinating various departments. (e.g. deepening the banks of canals and streams in collaboration with the Irrigation Department, removing plastic waste in collaboration with the Clean Kerala Company, etc.)
- Alappuzha is famous in the name "Venice of the East". This can be justified by reviving the waterways and utilizing them for transportation and tourism.
- Our cities lack parks and public recreation facilities. These should be developed and protected in the public realm.
- There is a situation where roadside vendors have encroached on roads in busy areas of the city. A special place should be found and they should be resettled.
- Stray dog infestation is rampant in our cities. To control them, ABC centers and shelters should be constructed.
- Danapady market in Haripad is not being used effectively. There was a proposal to build a private bus stand here. This too has not been taken forward. Accidents are

common on the one-way road from the highway to the market. Steps should be taken to develop this road, bus stand and market.

- A slaughterhouse should be developed in the city. Also, the existing cemetery is useless. This should be resolved. Pillathodu has been closed and the road has been diverted as part of the highway development. Due to this, waterlogging occurs in various parts of the city during the rainy season.
- The current one-way system is not being used effectively. Revenue Tower, court, etc. are on this road. People coming to these places park their vehicles on this side of the road. Due to this, this road faces a lot of traffic congestion.
- The footpaths on the sides of the one-way road are being encroached upon, and businesses are being carried out. This should be resolved.
- The work of the Harithakarmasena is not effective. Plastic waste is piled up in Danapady market and is spread all over the area. This can cause serious health problems during the rainy season.
- The drainage channels in wards 3, 4 and 5 are blocked. Due to this, even during light rains, waterlogging occurs in the Mannarasala area.

24.9 Meetings and Discussions



Figure 24.20 : Discussion at LSGD Planning Office

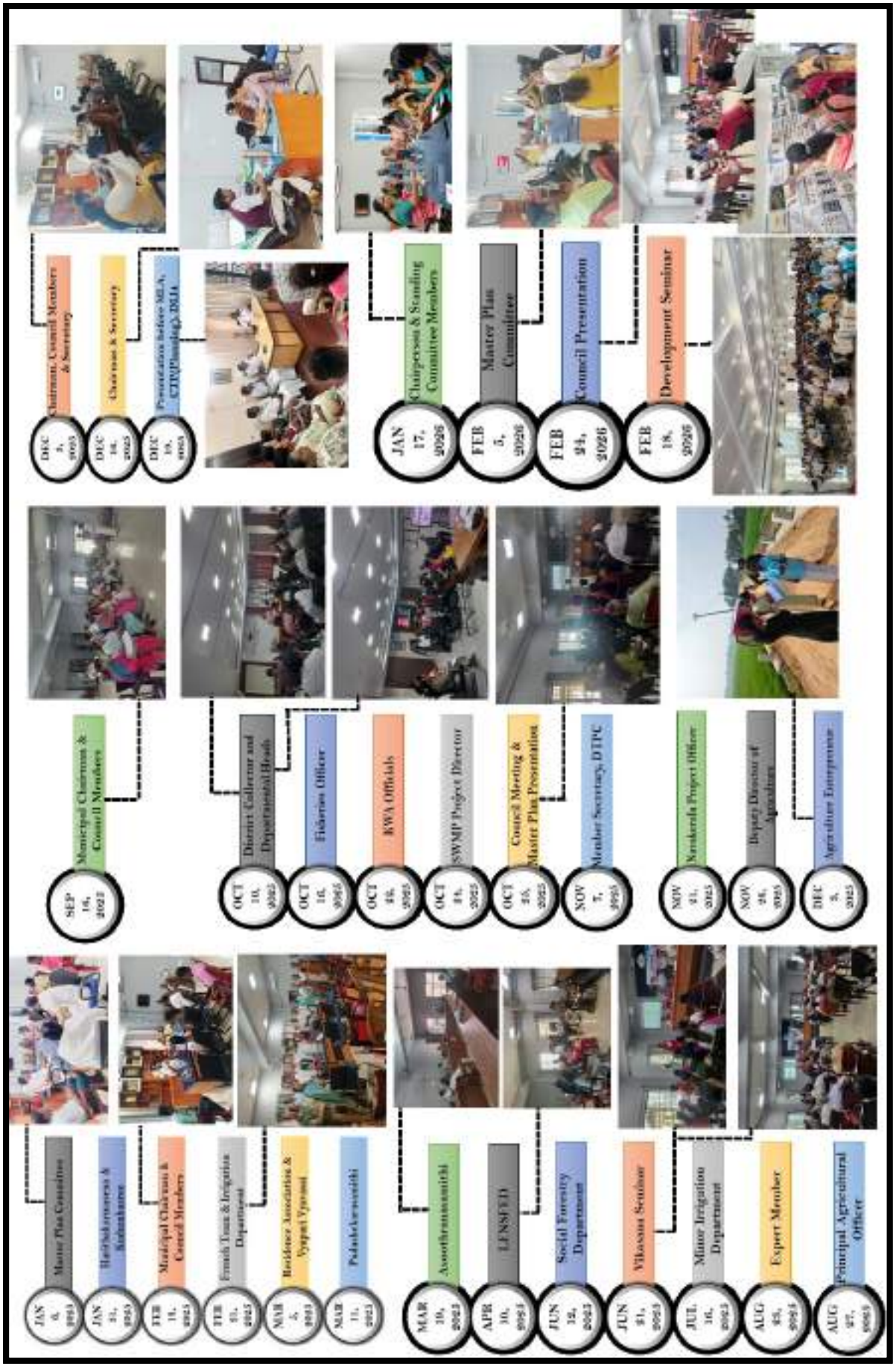


Figure 24.21 : Discussion with Municipal Secretary and Municipal Chairman



Figure 24.22 : Presentation & Discussion with Honorable MLA of Haripad




Chairman, Council Members & Secretary
DEC 3, 2025
Chairman & Secretary
DEC 14, 2025
Presentation before MLA, CDS(Planning), DMA
DEC 19, 2025
Chairperson & Standing Committee Members
JAN 17, 2026
Master Plan Committee
FEB 5, 2026
Council Presentation
FEB 24, 2026
Development Seminar
FEB 18, 2026
Municipal Chairman & Council Members
SEP 18, 2025
District Collector and Departmental Heads
OCT 10, 2025
Fisheries Officer
OCT 16, 2025
KWA Officials
OCT 18, 2025
SWMP Project Director
OCT 11, 2025
Council Meeting & Master Plan Presentation
OCT 25, 2025
Member Secretary, DTPC
NOV 7, 2025
Kudumbashree Project Officer
NOV 21, 2025
Deputy Director of Agriculture
NOV 28, 2025
Agriculture Entrepreneur
DEC 5, 2025
Master Plan Committee
JAN 6, 2026
Harithakarmasena Koordinator
JAN 21, 2026
Municipal Chairman & Council Members
FEB 11, 2026
Fresh Cuts & Irrigation Department
FEB 23, 2026
Residence Association & Vyapari Vyavasai
MAR 2, 2026
Palakkezhuvathi
MAR 11, 2026
Asoothramanimkl
MAR 30, 2026
LENSFED
APR 10, 2026
Social Forestry Department
JUN 12, 2026
Vikasana Seminar
JUN 21, 2026
Minor Irrigation Department
JUL 16, 2026
Expert Member
AUG 25, 2026
Principal Agricultural Officer
AUG 27, 2026

24.10 Expert Level Discussions

24.10.1 Discussion with former Chief Town Planner, Shri. Remanan

On 23/08/2025, discussion with Sri.Remanan, former Chief Town Planner (Retd) and member of the Master Plan Committee was carried out to discuss the findings from the analysis and discussions. The session primarily focused on the cultural and religious significance of Haripad, with special reference to the Mannarasala and Haripad temples. The discussion also highlighted the prevailing challenges in the agricultural sector and the drainage issues within Haripad Municipality. This expert-level interaction enabled the identification of key thrust areas, thereby supporting focused and informed planning interventions for Haripad Municipality.





24.10.2 Discussion with French Team

In connection with the preparation of the Risk-Informed Master Plan (RIMP) for Harippad Municipality, experts from CEREMA, Agence Française de Développement (AFD), and the Association Française pour la Prévention des Catastrophes Naturelles et Technologiques (AFPCNT, France) visited the municipal area on 21 February 2025. They held discussions with the Municipal Chairman and Standing Council Chairpersons to sensitise them on the need to strengthen risk awareness and promote a culture of resilience among the local community. Further interactions were held with members of the Inter Agency Group (IAG) and other NGOs directly involved in training and awareness programmes on risks that the municipality may face in the future. The NGOs highlighted various programmes and activities already undertaken in the fields of disaster risk awareness and climate change adaptation.

The team recommended integrating key measures into the RIMP, including regulation of construction to address flooding, restoration of stream depth and drainage clearance, safeguarding natural drainage in new infrastructure, mock drills and training of Rapid Response Teams (RRTs), pre-monsoon cleaning of canals and water bodies, and preparation of a comprehensive evacuation plan in coordination with IAG. These steps aim to strengthen Haripad Municipality's resilience against future climate and disaster risks.

As part of the mission, the team also visited areas of the municipality that were severely affected during the 2018 floods. This field visit provided first-hand insights into the vulnerabilities of local infrastructure and communities, reinforcing the urgency of integrating flood-risk considerations into planning.



Figure 24.23:Expert level Discussions with the French Team

CHAPTER
25

SUMMARY AND FINDINGS



The Summary & Findings chapter consolidates the key insights derived from the detailed sectoral analyses of Haripad. It highlights the town's strengths, challenges and emerging opportunities, providing a clear understanding of the factors shaping its current and future development. By synthesizing findings across demographics, land use, infrastructure, environment, economy and social sectors, the chapter translates analysis into actionable guidance. It forms the foundation for informed decision-making, ensuring that Haripad's future growth is sustainable, inclusive and well-coordinated. This chapter also sets the direction for subsequent planning interventions essential to achieve the town's long-term development vision.

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25. SUMMARY AND FINDINGS

25.1 Introduction

This chapter presents the key findings derived from the analysis of various development sectors and highlights the major shortcomings observed across different sectors, providing valuable insights for authorities to determine priority areas of intervention. The analysis further serves as a foundation for envisioning the future development of the town, ensuring an integrated and well-planned approach to its growth.

25.2 Summary and Findings

25.2.1 Regional setting

Haripad Municipality often referred to as "Land of Temples" or "Kshetranagari", is one of the six municipalities in Alappuzha district. Spanning 16.34 sq.km with a population of 31,151 the town is renowned for its temples, festivals, and paddy fields, with agriculture forming its economic base alongside emerging local commercial and service sectors. Town is located along NH 66 and has strong regional connectivity through road, rail, waterway (NW-3), and proximity to international airports, positioning it as an important medium sized urban centre in Central Kerala. The town's geographical features include paddy fields, the Achankovil River, and proximity to the Arabian Sea. As per the District Urbanization report 2011, the settlement hierarchy and activity nodes reflect its role as a third-order settlement and it provides a strong foundation for integrated planning and future development of Haripad Town.

25.2.2 Land use

The total area of the Municipality is 16.34 sq.km. As per the existing land use survey conducted in 2024, it is seen that residential use dominates with 43.94%, followed by paddy land (29.93%), while commercial (1.84%), industrial (0.18%), recreational (0.06%), and public/semi-public uses (3.55%) occupy much smaller shares. Transportation accounts for 5.35%, supported by road and rail networks, while water bodies and marshy lands together cover about 6.92%. The analysis of the spatial distribution of different land uses across various wards shows that residential areas are concentrated in most of the wards except wards in North-Eastern parts, commercial activities along major junctions and corridors, and agricultural lands on the peripheries. Over the past decade, urban growth has reduced agricultural land and water bodies, with rising built-up density driven by highway development and settlement expansion. A comparison with URDPFI Guidelines reveals significant deficiencies in commercial, industrial, recreational, and public land use categories, emphasizing the need for balanced allocation to ensure sustainable urban development.

25.2.3 Hazard Profile and Climate Change

The hazard assessment of Haripad Municipality indicates a high level of vulnerability, primarily due to recurrent flooding and increasing climate variability. As per the 50-Year Return Probability Flood Hazard Map (KSDMA), 14 out of 29 wards fall within flood-prone areas, covering 7.13 sq.km (43.63%) of the total municipal area (16.34 sq.km). The north-eastern wards, particularly along the Achankovil River and adjoining low-lying paddy fields,

face very high exposure. Wards such as Pilappuzha South (Ward 11) and PHC (Ward 9) are among the most vulnerable.

Land use analysis shows that 60.48% of the Flood Prone Area (FPA) comprises paddy fields, while 20.75% is residential, directly affecting housing and livelihoods. A significant share of water bodies (77.92%) and paddy lands (87.55%) lie within flood-prone zones, highlighting both ecological vulnerability and the natural flood-buffering role of these landscapes. Critical infrastructure, including transportation networks, is also partly exposed, affecting mobility and emergency response during extreme events.

Climate change has intensified these risks through erratic rainfall, short-duration high-intensity storms, rising temperatures, and groundwater stress. The 2018 floods demonstrated the cascading impacts on infrastructure, agriculture, public health, and economic activity. In addition to flooding, emerging concerns such as Urban Heat Island effects and heat stress are becoming prominent due to declining green cover, increased built-up areas, and loss of wetlands. Higher localized temperatures affect public health, energy demand, and urban comfort.

Haripad's hazard profile underscores the need for integrated disaster risk reduction, protection of ecologically sensitive flood-buffer areas, climate-responsive infrastructure, improved drainage and water management, and enhancement of urban green cover. A coordinated and risk-informed planning approach is essential to strengthen resilience and ensure sustainable urban development.

25.2.4 Population

The demographic profile of Haripad town reveals significant changes following its upgradation from a Gramapanchayat to a Municipality in 2015, expanding to 29 wards with an estimated population based on 2011 Census is 31,151. The town records a population density of 1,619 persons per sq.km, with marked intra-ward variations, and shows a declining population growth trend similar to other urban centres in Alappuzha district. Haripad, however, maintains a higher sex ratio (1145) and literacy rate (96.88%) compared to both state and district averages, reflecting strong social development indicators. The average household size is 3.4, with age structure and social composition indicating a balanced population mix. Migration trends highlight that a significant share of the population moves abroad and outside the state for economic opportunities, while internal migration is also notable within the town and district. Overall, the demographic analysis underscores the town's strengths in literacy and gender balance while also pointing to challenges of declining growth and uneven population distribution across wards.

25.2.5 Employment

The employment profile of Haripad town indicates that out of a population of 31,151 (Census 2011), 10,977 individuals (35.24%) are engaged in work, with 66.5% male and 33.5% female workers, reflecting low female participation. The majority (90.6%) of workers fall under the 'other workers' category, showing a clear shift from the primary sector—cultivators and agricultural labourers—to services and non-primary activities over the decades. While the total workforce has grown despite a decline in population growth, work participation rate remains below that of its neighbouring panchayats, pointing to underutilized economic

potential. Overall, the analysis highlights a declining reliance on agriculture, a growing dominance of service-oriented employment, and the need to enhance female participation and overall workforce engagement for balanced economic development.

25.2.6 Agriculture

Agriculture in Haripad Municipality, concentrated mainly in its eight Padasekharams, remains a vital sector despite pressures from urbanization, declining cultivation area, and climate risks. About 36% of the municipal area (590 ha) is under agriculture, with paddy as the dominant crop cultivated mainly during the Puncha season, while coconut, banana, tuber crops, and vegetables are grown in smaller extents. Productivity (2019-2024) remains stable, but overall cultivation has reduced, particularly for coconut and vegetables. Challenges include inadequate irrigation facilities, saltwater intrusion, flooding, drought, soil degradation, and waste dumping, which limit output and sustainability. Local production meets only a fraction of consumption needs, with heavy reliance on external supply chains. However, the Municipality holds significant potential through better water management, renovation of canals and bunds, diversification into climate-resilient and value-added crops, expansion of market infrastructure, and adoption of modern and urban farming practices, which together can strengthen food security and ensure sustainable agricultural development.

25.2.7 Fisheries

The fisheries sector in Haripad Municipality is entirely dependent on inland fishing and aquaculture, as the town lacks a coastline. With only 10 fishermen and 121 fish farmers, production is modest (around 10 tons annually), focused mainly on species like Catfish, Anabas, and Tilapia cultivated along rivers and ponds. The sector faces major challenges such as the impact of the 2018 floods, declining fish stocks, waste accumulation in water bodies, weak marketing systems, limited female participation, and seasonal employment gaps. Ongoing initiatives like Janakeeya Matsya Krishi (JMK) and the Pradhan Mantri Matsya Sampada Yojana (PMMSY) support fish seed distribution, feed subsidies, training, and infrastructure improvements, offering scope for revival. With better waste management, restoration of ponds and canals, adoption of modern techniques like Biofloc and pen culture, and the creation of stronger marketing systems, the fisheries sector in Haripad holds significant potential for sustainable growth, improved livelihoods, and enhanced food security.

25.2.8 Animal husbandry

The Animal Husbandry sector in Haripad plays a vital role in supporting livelihoods and the local economy, yet faces major challenges. While livestock farming—especially cattle, poultry, and goats—has strong potential due to the town's agricultural land base, secondary data shows a steady decline in livestock population and milk production, mainly due to high feed costs, disease-prone breeds, inadequate veterinary facilities, and recurring natural disasters such as floods. The sector currently relies on a limited number of dairy farms, three cooperative societies, and small-scale private initiatives, with milk and meat often supplemented from outside the town due to insufficient local production and the absence of authorized slaughterhouses. Despite these issues, there is significant scope for growth through better infrastructure, modern veterinary facilities, value-added agro-based industries, and integrated development with agriculture. With strategic interventions, Haripad can transform animal

husbandry into a sustainable and profitable sector that complements both agriculture and industry.

25.2.9 Industry

The industrial sector in Haripad is small but diverse, with only 0.18% of the municipal area under industrial use and activity largely dominated by household and small-scale units such as coir production, food processing, furniture, and brick industries. The town has 434 small industries, 20 household units, and 95 registered MSMEs, but lacks large-scale industries, designated industrial estates, or IT parks. While hazard risks like the 2018 floods caused only minor disruptions, industrial growth is constrained by limited land availability, infrastructure gaps, lack of skilled labour, dependence on external raw materials, and stiff competition from larger hubs. Despite these challenges, town's location along NH-66 with rail, road, and water connectivity, along with strong linkages to agriculture and animal husbandry, provide opportunities for expanding coir-based industries, food processing, eco-friendly manufacturing, and IT-enabled services. With government support and innovation, the sector can evolve into a sustainable driver of local employment and economic growth.

25.2.10 Tourism

Tourism in Haripad holds immense potential due to its rich blend of pilgrimage, heritage, cultural, and ecological attractions, with key sites such as the Subrahmanya Swamy Temple, Mannarasala Nagaraja Temple, Nelpurakadavu, and nearby heritage and cultural landmarks. Despite its strengths, the sector currently depends mainly on daily pilgrim visitors due to limited infrastructure to support longer stays. Challenges include inadequate sanitation, parking, accommodation, waste management, poor road connectivity, and vulnerability to floods, which disrupt access and affect the visitor experience. However, with integrated planning, the development of pilgrim circuits, revitalization of heritage sites, promotion of farm and eco-tourism, and improved facilities, Haripad can evolve into a sustainable tourism hub that boosts the local economy while preserving its cultural and natural heritage.

25.2.11 Trade & Commerce

The Trade and Commerce sector forms the backbone of the town's economy, concentrated mainly in Danappadi Market, Town Hall–Ezhikkakathu Junction, KSRTC Bus Stand, and along NH 66. Despite its importance, the sector is limited to just 1.84% of municipal land and faces major challenges such as traffic congestion, inadequate parking, poor waste management, insufficient pedestrian and sanitation facilities, lack of accessibility for persons with disabilities, and frequent flooding and waterlogging. Street vendors and the informal sector play a vital role but largely operate without regulation or designated vending zones, contributing to congestion. Wholesale and retail trade are concentrated in a few nodes, with many establishments serving dual roles. However, the sector holds strong potential for growth through decentralization of commercial activities, development of parallel roads, establishment of designated vending zones, renovation of Danappadi Market, creation of modern facilities for fish and meat trade, improved drainage, centralized parking systems, and better waste management, paving the way for more sustainable and inclusive commercial development in Haripad.

25.2.12 Traffic & transportation

While Haripad town is well-connected by NH 66 and supported by KSRTC and private bus services, the lack of a designated private bus stand, inadequate pedestrian facilities, and absence of integrated transport nodes contribute to congestion and unsafe conditions. Inter-city traffic surveys reveal that nearly half of the vehicular movements are through-traffic with no functional link to the town, emphasizing the need for bypass strategies. Modal split analysis shows a heavy reliance on two-wheelers, reflecting limited availability and convenience of public transport alternatives. Freight movement is dominated by construction materials, further straining urban roads. Rising accident trends and the identification of accident-prone locations along NH 66 underscore critical safety concerns, while pedestrian surveys reveal unsafe crossings, discontinuous footpaths, and conflicts at key junctions. Overall, the chapter underscores the urgent need for improved traffic management, upgraded pedestrian and public transport facilities, and strategic interventions to ensure safe, efficient, and sustainable transportation for Haripad.

25.2.13 Water supply

Haripad Municipality's water supply primarily depends on domestic wells, public bore wells, and the Pampa/Achankovil rivers, with limited coverage from the Urban Water Supply Scheme (UWSS) that relies on a single tube well at Thrippakkudam, serving only a small share of households without treatment facilities. While 87.9% of households report no major shortages, certain wards experience seasonal scarcity, especially in summer, due to over-extraction, declining groundwater levels, and saltwater intrusion in low-lying areas. Floods, droughts, and contamination risks further threaten water quality and availability, as seen during the 2018 floods. The absence of a comprehensive water distribution network, reliance on untreated groundwater, and lack of a Water Treatment Plant pose serious concerns for sustainability and health. However, the Municipality has strong potential to improve water security through rainwater harvesting, groundwater recharge, restoration of Pampa Irrigation Project canals, and the establishment of a WTP-based system to ensure safe, equitable, and reliable water supply for the entire population.

25.2.14 Drainage

Haripad's drainage system comprises an interconnected network of natural waterways and man-made stormwater infrastructure forming the town's primary flood management framework. The natural system is shaped by the Pamba basin, particularly the Achankovil River and its tributaries, along with five major nalas—Danapady Thodu (Nala–1), Pillathodu (Nala–2), Nala–3, Nala–4, and Nala–5—which ultimately discharge into the Achankovil River, Kayamkulam Lake, or adjoining paddy fields that function as natural retention basins. Complementing these are roadside drains and concrete stormwater channels intended to convey runoff from built-up areas. However, rapid urbanisation, encroachments, siltation, waste deposition, discontinuous roadside drains, undersized sections, and disruption of natural flow paths have significantly reduced the system's hydraulic efficiency. Capacity assessments reveal that major stretches of Nala–1, Nala–2, Nala–4, and Nala–5 are inadequate, with only Nala–3 functioning fully efficiently under clean conditions. Roadside drains remain largely discontinuous and insufficiently integrated with primary canals, creating bottlenecks that intensify waterlogging during peak rainfall. Tidal influences, bunds, and ineffective outfalls

during high tide further aggravate backflow conditions in low-lying residential and agricultural areas.

The 2018 floods exposed critical systemic weaknesses, including river overtopping, failure of stormwater conveyance, prolonged inundation, siltation-induced capacity reduction, and significant public health impacts. Nearly half of the Municipality falls within flood-prone zones, particularly in the north-eastern wards adjoining paddy fields and river corridors, underscoring the town's hydrological vulnerability. In response, a comprehensive Drainage Master Plan supported by LiDAR-based terrain surveys and hydraulic modelling has been formulated to restore blocked streams, augment deficient stretches, interlink missing connections, remove encroachments, and enhance outfall efficiency. The strategy emphasizes protection of paddy lands as natural retention areas, integration of nature-based solutions, strengthening of roadside drainage continuity, and systematic maintenance to re-establish flow regimes. The drainage sector requires coordinated structural upgradation, ecological restoration, and institutional management reforms to ensure resilient stormwater management, reduce flood risks, and safeguard Haripad's long-term urban sustainability.

25.2.15 Waste water

Haripad Municipality lacks a centralized sewerage system, with households and establishments relying mainly on septic tanks, soak pits, and pit latrines, most of which are poorly designed and maintained. This has led to frequent leakages, overflows, and contamination of groundwater and surface water, particularly in low-lying areas and during floods, posing serious public health risks such as waterborne diseases. While sanitation coverage is relatively high, unsafe disposal practices, absence of licensed septage management services, and inadequate treatment facilities worsen the situation. Rapid urbanization and dense settlements demand urgent intervention, including the development of a centralized sewerage system, sewage treatment plant, scientific septage management facilities like FSTP or mobile units, and improved sanitation infrastructure to ensure safe, inclusive, and sustainable wastewater management in Haripad.

25.2.16 Solid waste disposal

Solid waste management in Haripad Municipality remains inadequate, with daily generation of about 11.62 TPD and poor source-level segregation, leading to widespread improper disposal in open spaces, drains, and water bodies. Waste collection covers only part of the town, with just 31 Harithakarmasena workers for 29 wards against the required 58, resulting in operational inefficiencies. While facilities such as Mini MCFs, biogas plants, Thumboormuzhi composting units, and plastic collection systems exist, many remain underutilized, poorly maintained, or lacking adequate infrastructure. Sanitary waste disposal remains unregulated, and irregular waste removal causes piling at collection points. These deficiencies contribute to environmental pollution, public health risks, urban flooding, and fire hazards. Despite these challenges, the presence of decentralized facilities, Harithakarmasena support, and new waste management initiatives provide potential for building an integrated, efficient, and sustainable solid waste management system in Haripad.

25.2.17 Energy

Energy consumption in Haripad Municipality is dominated by electricity, primarily sourced from hydroelectric projects, supplemented by petroleum products such as diesel, petrol, and LPG, along with limited use of biomass and solar energy. Electricity demand has steadily increased across domestic, commercial, industrial, and agricultural sectors, with KSEB ensuring universal household electrification, though power distribution remains dependent on overhead lines, leading to inefficiencies and risks during floods. Renewable energy adoption is minimal, with only 3.7% of households using solar power, despite growing rooftop installations. Key challenges include heavy reliance on hydroelectric and petroleum-based energy, inadequate integration of renewable sources, and vulnerability of infrastructure to natural hazards. However, significant potential exists for expanding solar energy, improving energy efficiency through grid upgrades and promoting conservation measures to ensure sustainable and resilient energy management in Haripad.

25.2.18 Education

The education sector in Haripad is characterized by a high literacy rate of 96.88%, above the state average, supported by 70 institutions providing primary to higher secondary education that meet planning standards in terms of quantity. However, most schools lack adequate infrastructure such as laboratories, libraries, furniture, computer facilities, and playgrounds, limiting the quality of education. While higher education is represented by two arts and science colleges and two ITIs, the town lacks professional colleges, polytechnics, and health education institutions, compelling students to seek advanced courses outside the district. Special education facilities are inadequate, with only one autism centre functioning under poor infrastructure and the absence of government-supported special schools. Flood hazards further expose vulnerabilities, as schools often double as relief camps without proper facilities. Overall, while educational access is sufficient, qualitative improvements, infrastructure upgrades, and diversification into professional and vocational education are crucial for strengthening the sector.

25.2.19 Health

The health sector in Haripad Municipality is supported by a network of government and private institutions, including the Taluk Headquarters Hospital, PHC, Ayurveda and Homeo hospitals, and wellness centres, ensuring adequate inpatient capacity but lacking super-specialty and advanced testing facilities. Innovative initiatives such as Floating Dispensaries, Vayojana Clinics, and gender- and child-focused programs under AYUSH enhance outreach, yet critical gaps remain in disaster preparedness, mental healthcare, biomedical waste management, and infrastructure resilience, particularly against recurrent flooding. The COVID-19 pandemic and avian influenza highlighted the need for stronger epidemic response systems. While Haripad benefits from Kerala's strong health indicators and community awareness, future priorities include establishing super-specialty services, improving disease surveillance, expanding mobile and mental health facilities, and strengthening disaster-resilient infrastructure to ensure equitable, accessible, and comprehensive healthcare for all residents.

25.2.20 Housing

Haripad town's housing sector is largely stable, with nearly 44% of land under residential use and most houses being pucca or of moderate quality, while only 6.7% are kutcha and require replacement. There are no slums, and about 80% of houses are in good condition, with most being owner-occupied. The housing shortage is minimal, though hazard risks such as flooding and waterlogging threaten structural safety and living conditions. The Pradhan Mantri Awas Yojana (PMAY) is the key housing scheme, with 286 out of 456 sanctioned houses completed, helping improve availability for vulnerable groups. Future opportunities lie in replacing weak structures, promoting disaster-resilient and eco-friendly housing, and improving drainage to ensure safe and sustainable living conditions.

25.2.21 Recreation

Haripad town's recreational sector is almost nill, with only 0.043% of land designated for open spaces—well below URDPFI standards—and no public playgrounds or stadiums, as play areas are confined to schools and private premises without proper facilities. Cultural infrastructure is limited, with two cinemas, six auditoriums, and a library, but the absence of public reading rooms, art galleries, and an open-air theatre, along with a non-functional Town Hall, restricts community engagement. This shortage of recreational spaces also heightens hazard risks by limiting safe gathering areas and reducing resilience to disasters. However, opportunities exist to revitalize the Town Hall, repurpose water bodies as recreational open spaces, and promote multipurpose, hazard-resistant recreational infrastructure to enhance livability, cultural vitality, and community resilience.

25.2.22 Other civic amenities

Haripad town is equipped with key civic amenities, including a police station, fuel stations, communication facilities, public toilets, and a fire and rescue station, which collectively support safety, mobility, and service delivery. However, significant gaps remain, such as an incomplete and non-functional crematorium, inadequate sanitation facilities, absence of comfort stations, and the fire station's location in a congested area with limited access. Many amenities are also vulnerable to flooding and lack accessibility for all groups, reducing their reliability during emergencies. Despite these challenges, the town has strong potential to improve urban services by completing and upgrading facilities, expanding sanitation infrastructure, and adopting hazard-resilient designs, thereby enhancing overall quality of life and urban resilience.

25.2.23 Social backwardness

The social backwardness and poverty profile of Haripad highlights persistent socio-economic disparities, particularly among marginalized communities living in 17 identified nagars with over 500 households. Many of these settlements lack adequate housing, sanitation, potable water, and healthcare, while residents are often engaged in low-income or irregular employment, perpetuating poverty cycles. Around 7.3% of the population belongs to Scheduled Castes and 0.3% to Scheduled Tribes, concentrated in specific wards, and facing limited access to quality education, employment, and basic services. The presence of Below Poverty Line (BPL) households, identified through multiple deprivation criteria, further reflects structural inequalities. Addressing these issues through targeted interventions in housing, infrastructure,

healthcare, education, and skill development is essential to uplift the living standards of Haripad's vulnerable groups and promote inclusive growth.

25.2.24 Environment

The environmental profile of Haripad highlights mounting stress from rapid urbanization, inadequate infrastructure, and unsustainable practices. Water pollution from untreated sewage, agricultural runoff, and waste dumping has degraded ponds and canals, while excessive fertilizer use has contributed to soil erosion and declining fertility. Air and noise pollution are rising due to traffic, industries, and festivals, and recurrent floods—such as in 2018—have intensified ecological fragility, causing biodiversity loss, wetland degradation, and saltwater intrusion in paddy fields. Despite conservation efforts like financial support for farmers, wetland restoration initiatives, and crop insurance schemes, challenges persist, including poor waste management, idle irrigation infrastructure, gaps in drinking water coverage, and shrinking green cover. However, Haripad's ecological wealth—its paddy fields, wetlands, sacred groves, and surface water sources—offers strong potential for eco-restoration and nature-based tourism, provided environmental governance is strengthened with a focus on resilience, sustainability, and climate adaptation.

25.2.25 Culture & Heritage

Haripad town has a rich cultural and heritage legacy, deeply rooted in its temples, festivals, traditional art forms, and historic structures, which together shape its identity and community life. Major cultural landmarks include the Mannarasala Nagaraja Temple and the Sree Subrahmanya Swamy Temple, both hosting grand festivals that attract devotees and preserve Kerala's artistic traditions. Heritage assets such as Ananthapuram Palace and Karimpalil Palace highlight the town's historical significance but face deterioration due to neglect, urbanization, and environmental risks like flooding and termite damage. Challenges include inadequate conservation efforts, financial constraints, and declining traditional practices; however, there is strong potential for heritage-led development through adaptive reuse of historic buildings, promotion of temple-based tourism, revival of traditional arts, and community-driven conservation initiatives. With proper government support, public-private partnerships, and integration of heritage into tourism and resilience planning, Haripad can safeguard its cultural wealth while fostering sustainable development and community cohesion.

25.2.26 Development Administration and finance

The elected municipal council, supported by sectoral standing committees and an administrative framework with specialized sections, ensures decentralized planning and execution of development initiatives in Municipality. Financial assessment reveals significant dependence on grants alongside limited contributions from own-source revenues such as property and professional tax, with increasing expenditure on establishment, administration, and infrastructure. Despite challenges like inadequate infrastructure in schools, healthcare, and Anganwadis, as well as gaps in waste management facilities, the Municipality possesses valuable assets and opportunities for strengthening public services, enhancing revenue generation, and improving asset management. Strategic reforms in governance efficiency,

financial sustainability, and infrastructure modernization are vital for ensuring balanced and resilient urban development in Haripad.

25.3 SWOT Analysis

25.3.1 Regional & Demographic Aspects

Strength	Weakness
▪ Haripad town holds administrative significance as it serves as the headquarters of the Karthikapally taluk. ▪ The town has well connectivity ▪ Presence of water bodies and canals ▪ Presence of agriculture land	▪ Population growth rate is declining
Opportunities	**Threat**
▪ Work Participation rate is increasing ▪ Scope for better job opportunities	▪ Unplanned development

25.3.2 Economic Aspects

Strength	Weakness
▪ Presence of temples, heritage buildings, and extensive paddy fields enhances the town's cultural identity ▪ Scope for traditional industries such as coir, handicrafts, etc	▪ The town lacks in tourist infrastructure, such as accommodation facilities, comfort stations, etc ▪ Inadequate industrial infrastructure ▪ Animal husbandry sector is non-profitable due to increasing cost of cattle feed.
Opportunities	**Threat**
▪ Certain locations with historical significance indicate potential for tourism development ▪ Scope for value addition of agriculture and animal husbandry products. ▪ Modernisation of industrial infrastructure ▪ Promotion of handicrafts will leverage tourism	▪ Recurring floods and waterlogging ▪ Underdeveloped market area with improper waste management and drainage ▪ Pollution of water bodies affect tourism and environment

▪ Enough land availability for fodder cultivation ▪ Scope for water front tourism ▪ Scope for inland fisheries	

25.3.3 Transport Infrastructure

Strength	Weakness
▪ Presence of good road and rail connectivity	▪ The road lacks proper drainage and other essential facilities. ▪ Unauthorised parking ▪ Traffic congestion at intersections in the town centre. ▪ Bus connectivity in the town is inadequate.
Opportunities	**Threat**
▪ Good connectivity will benefit the growth of other sectors. ▪ Scope for improvement of public transport, parking and other facilities.	▪ Improper maintenance of roads ▪ Encroachment of road by street vendors

25.3.4 Physical Infrastructure

Strength	Weakness
▪ Presence of natural and man-made water bodies ▪ The electricity supply system is well-maintained and functioning efficiently.	▪ The existing water supply system is insufficient for the Municipality. ▪ Improper management of canal system ▪ Lack of drainage connections ▪ Less utilization of conventional energy sources
Opportunities	**Threat**
▪ Rejuvenation of existing water bodies ▪ Strengthening of existing waste management system.	▪ Waterlogging due to gaps in drainage network ▪ Waste management is not effective. ▪ Water bodies are in poor condition due to waste dumping and encroachment.

25.3.5 Social Infrastructure

Strength	Weakness
▪ Active Kudumbasree units. ▪ Education and health facilities are sufficient	▪ Absence of recreational facilities within the town ▪ Inadequate infrastructure in schools. ▪ Absence of mental health clinics. ▪ Absence of technical/ professional institutions
Opportunities	**Threat**
▪ Scope for digital and smart classrooms. ▪ Scope for improving health facilities ▪ Scope for encouraging urban afforestation.	▪ Limited emergency response capacity.

25.3.6 Environment & Disaster Management

Strength	Weakness
▪ Presence of water bodies ▪ Presence of ecologically sensitive zones like sacred groves ▪ Presence of paddy fields	▪ Missing links and encroachment of canals and drainages ▪ Majority of canal structures are contaminated
Opportunities	**Threat**
▪ Disasters such as floods can be mitigated by connecting the missing links in the drainage network. ▪ Protection of wetlands	▪ Lack of drainage leads to flood

25.3.7 Heritage

▪ Strength	▪ Weakness
▪ Historic significance of town ▪ Presence of heritage structures.	▪ Heritage infrastructure may face challenges due to the development of modern infrastructure ▪ Lack of incentives for conservation
Opportunities	**Threat**

▪ Heritage structures can be reused for new purposes. (eg: museum)	▪ Heritage buildings are in a deteriorated condition due to lack of proper maintenance

25.4 Development Issues

Haripad Municipality, despite its strategic regional connectivity, strong social indicators, rich cultural heritage, and extensive ecological assets, faces a series of interrelated development challenges that require coordinated and forward-looking planning interventions. The town is highly vulnerable to recurrent flooding, with nearly half of its municipal area falling within flood-prone zones, particularly in the north-eastern wards adjoining the Achankovil River and low-lying paddy fields. Inadequate drainage capacity, encroachments on natural waterways, tidal backflow effects, and the loss of wetlands have significantly weakened the town's hydrological resilience. Climate variability, erratic rainfall, groundwater stress, and emerging urban heat island effects further intensify environmental risks.

Land use distribution remains imbalanced, with residential areas dominating while commercial, industrial, recreational, and public/semi-public uses remain substantially below planning norms. Rapid urban expansion has reduced agricultural land and water bodies, undermining ecological balance and long-term sustainability. Critical infrastructure gaps persist in water supply, sewerage, stormwater drainage, and solid waste management, affecting public health, environmental quality, and service reliability.

Traffic congestion along NH 66, absence of integrated transport facilities, increasing accident rates, and inadequate pedestrian infrastructure highlight growing mobility and safety concerns. Economic growth is constrained by the lack of industrial estates, limited tourism infrastructure, underutilization of agro-based potential, and low female workforce participation. While literacy and healthcare indicators are strong, qualitative gaps remain in educational infrastructure, professional institutions, mental healthcare services, and recreational facilities. Civic amenities such as crematoriums and public sanitation infrastructure require urgent upgradation and improved accessibility. Social disparities persist in identified Nagar settlements, where infrastructure deficits and livelihood vulnerabilities require targeted interventions.

Environmental degradation, pollution of canals and wetlands, shrinking green cover, and deteriorating heritage structures reflect weaknesses in environmental governance and conservation mechanisms. Furthermore, limited municipal own-source revenues and dependence on grants constrain the pace and scale of infrastructure modernization.

Collectively, these issues underscore the need for integrated, climate-responsive, infrastructure-driven, and heritage-sensitive urban development strategies to ensure sustainable and resilient growth for Haripad.

The Table 25.1 below discusses the various development issues in Haripad based on the priority.

Table 25.1 : Haripad Development Issues- Priority based development issues

Critical Development Issues *(Immediate / 0–5 Years – Risk & Service Stabilisation)*	
Sector	**Key Development Issues**
Flood & Drainage Management	▪ 43.63% municipal area within flood-prone zone ▪ Inadequate hydraulic capacity of major nalas (Nala 1, 2, 4 & 5) ▪ Tidal backflow and ineffective outfalls ▪ Severe waterlogging in low-lying residential wards ▪ Encroachments and siltation in canals
Water Supply & Sanitation	▪ Absence of centralized sewerage system ▪ Groundwater dependency and erratic public supply ▪ Inadequate septage management ▪ Flood-induced contamination risks
Solid Waste Management	▪ Insufficient manpower and infrastructure ▪ Improper segregation and canal dumping ▪ Waste accumulation in markets and flood-prone areas
Traffic & Road Safety	▪ High accident severity along NH 66 ▪ Congested junctions and ineffective one-way system ▪ Unsafe pedestrian infrastructure ▪ Poor parking regulation
Civic Amenities	▪ Non-functional crematorium ▪ Inadequate public comfort stations ▪ Accessibility constraints to emergency facilities
Vulnerable Settlements	▪ Infrastructure deficits in Nagar areas ▪ Poor drainage and narrow access roads ▪ Seasonal water scarcity
Medium-Term Development Issues *(5–10 Years – Structural Strengthening & Urban Quality Enhancement)*	
Sector	**Key Development Issues**
Land Use & Urban Structure	▪ Imbalanced land use distribution with dominance of residential use ▪ Reduction in paddy fields and wetlands due to urban expansion ▪ Inadequate allocation for commercial, industrial, and recreational uses
Transport Infrastructure	▪ Absence of private bus stand and organized public transport terminal ▪ Lack of integrated mobility hub ▪ Insufficient pedestrian infrastructure and non-motorised transport (NMT) facilities ▪ Need for scientific parking management systems

Economic Development	▪ Lack of industrial estate and formal employment clusters ▪ Underdeveloped agro-processing and fisheries value chains ▪ Limited tourism infrastructure despite temple and canal potential
Education Infrastructure	▪ Lack of professional, technical, and advanced higher education institutions ▪ Inadequate laboratory, library, and digital facilities in schools ▪ Flood vulnerability of certain educational institutions
Healthcare Infrastructure	▪ Absence of super-specialty hospital ▪ Lack of dedicated mental healthcare facilities ▪ Inadequate disaster-resilient upgrades in health institutions
Recreation & Public Spaces	▪ Open space deficit (below URDPFI norms) ▪ No public playgrounds or stadium ▪ Non-functional Town Hall and limited cultural venues
Environmental Management	▪ Pollution of canals and wetlands ▪ Declining green cover and soil quality ▪ Limited structured ecological restoration initiatives
Long-Term Development Issues *(10–20 Years – Strategic Sustainability & Resilience-Oriented Growth)*	
Sector	**Key Development Issues**
Climate Change Adaptation	▪ Urban Heat Island mitigation strategies required ▪ Integration of blue-green infrastructure systems ▪ Groundwater recharge and drought resilience mechanisms
Heritage & Cultural Conservation	▪ Structured conservation framework for palaces and historic assets ▪ Restoration of canal-linked heritage corridors ▪ Heritage-led tourism circuit development
Industrial & Economic Diversification	▪ Development of eco-friendly and knowledge-based industries ▪ Promotion of women's workforce participation ▪ Formalization of economic clusters and value-chain integration
Urban Environmental Sustainability	▪ Long-term wetland and paddy field conservation strategy ▪ Renewable energy integration and carbon footprint reduction ▪ Sustainable land-use control mechanisms
Governance & Financial Sustainability	▪ Strengthening own-source revenue mechanisms ▪ Adoption of land-based financing tools ▪ Institutional capacity building for inter-departmental convergence
Resilient Urban Systems	▪ • Integration of climate-responsive building codes ▪ Disaster-proof infrastructure retrofitting ▪ Institutionalized disaster risk reduction framework

Environmental Management	▪ Pollution of canals and wetlands ▪ Declining green cover and soil quality ▪ Limited structured ecological restoration initiatives

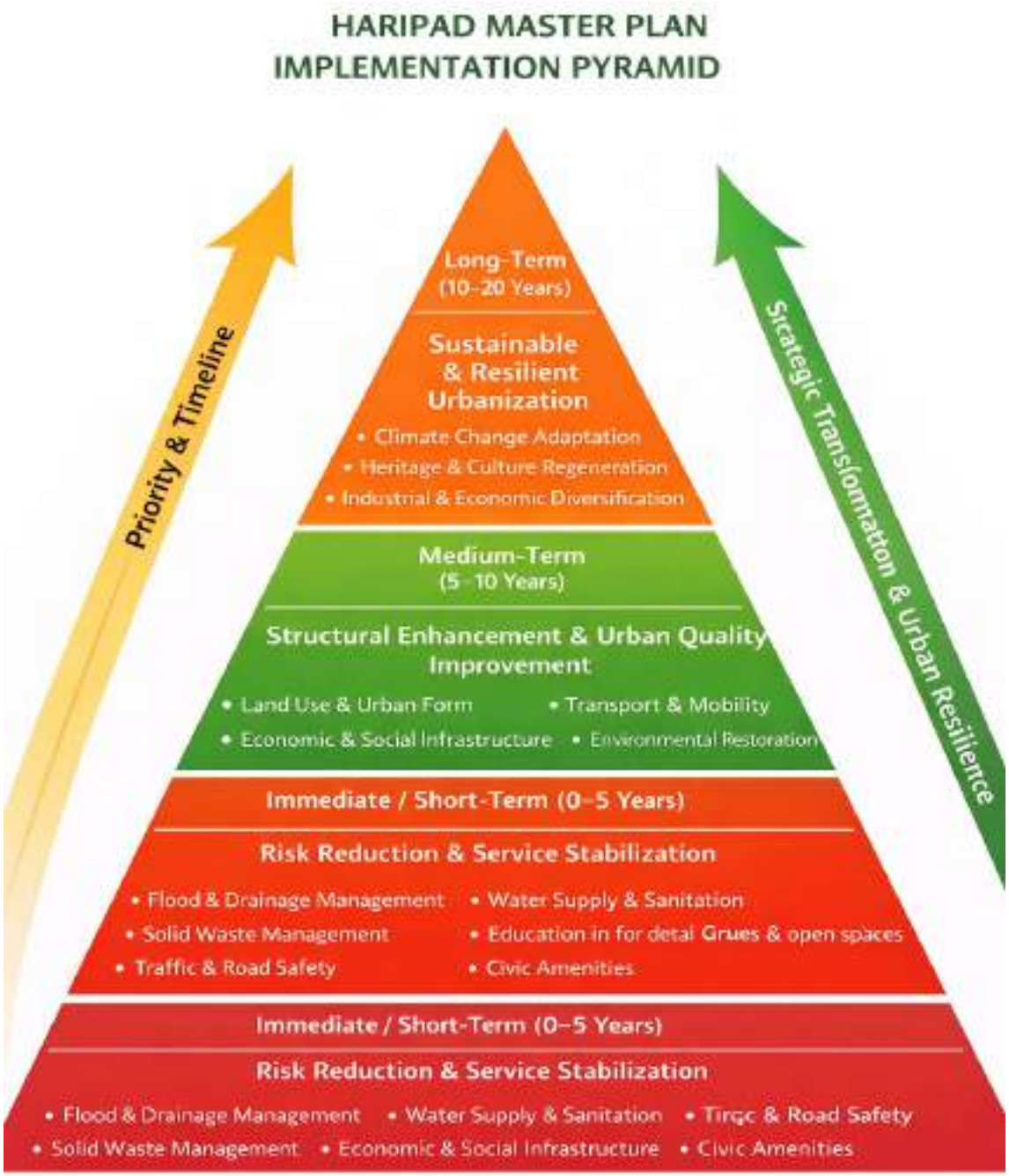


Figure 25.1 : Haripad Master Plan Development Pyramid

CHAPTER
26

SECTORAL AND OTHER LINKAGES



Urban development in Haripad is shaped by the dynamic interactions between its economic sectors, settlement patterns, infrastructure systems and environmental conditions. This chapter examines these interdependencies to understand how changes in one sector influence others – such as the effects of primary activities on commerce and tourism, the influence of industrial growth on land use and employment and the role of transportation in shaping economic and environmental outcomes. It also assesses how population growth, spatial distribution of activities and shifts in land use affect housing, mobility, resource efficiency and social equity. By analysing these linkages, the Master Plan identifies strategies to enhance coordination across sectors, promote inclusive and energy-efficient development and support a resilient and well-balanced future for Haripad.

- Intersectoral Linkages
- Linkage between Settlement Characteristics and Sectoral Developments

26. SECTORAL AND OTHER LINKAGES

26.1 Intersectoral Linkages

26.1.1 Primary Sector - Effect on Industries, Commerce, Transportation, Tourism, Environment and Special Concern Areas

The primary sector, particularly agriculture, animal husbandry, dairies fisheries, and related activities plays a vital role in influencing other sectors. Agricultural and animal husbandry produce support local industries such as rice mills, coir units, and small-scale food processing, while contributing to commerce through daily markets and local trade networks. The movement of these goods creates a strong linkage with the transportation sector, necessitating reliable road connectivity, especially from rural production zones to market areas. The tourism sector is also linked to primary activities, with features such as paddy landscapes and farm tourism adding to the visitor experience. However, intensive land use, excessive fertilizer application, and waste discharge can impact the environment, leading to soil and water degradation. In sensitive areas such as paddy wetlands and backwaters, these pressures can diminish ecological resilience and increase the risk of flooding.

26.1.2 Industries and Commerce - Effect on Transportation, Tourism, Environment and Special Concern Areas

The growth of industries and the trade and commerce sector in Haripad Town is expected to increase both inbound and outbound freight traffic, with inbound traffic likely to be higher. To manage this demand, it is important to develop a truck terminal that is easily accessible from the main road network. This facility is necessary to support industrial growth and the smooth movement of goods. In addition, the increase in trade and commerce will also lead to more traffic within the town. To reduce congestion in the town centre, commercial activities meant for local consumption should be spread out to other parts of the town. This will help ease traffic and improve overall accessibility.

The development of industries and the trade and commerce sector in Haripad town can influence tourism in both positive and negative ways. On the positive side, improved infrastructure, better road connectivity, and the availability of services such as shops, restaurants, and transport facilities can enhance the experience of visitors and support the growth of tourism. However, if industrial and commercial growth is unplanned, it may lead to traffic congestion, pollution, and a loss of the town's cultural and environmental appeal. This could negatively affect tourist attractions. Therefore, it is important to guide industrial and commercial development in a way that supports tourism. Proper zoning, buffer areas, and effective waste management measures should be adopted to protect key tourism sites and maintain the overall character of the town.

26.1.3 Transportation - Effect on Tourism, Environment

Transportation plays a key role in influencing both tourism and the environment. Improved road connectivity and access to destinations such as the Sree Subrahmanya Swamy Temple, Mannarasala Temple and other tourist areas may support the growth of pilgrimage and

heritage tourism. However, increased traffic, especially during festival seasons and tourist inflow, leads to congestion and affects the overall visitor experience. The expansion of roads and transport infrastructure also impacts the environment through increased vehicular emissions, noise pollution, and the conversion of natural areas into paved surfaces. These changes contribute to the loss of green cover, disruption of local ecosystems, and increased flood risk in low-lying areas. The interconnected nature of these effects highlights the need for transport planning that supports tourism while minimizing environmental impacts and preserving the ecological balance.

26.1.4 Tourism - Effect on Environment and Special Concern Areas

Tourism, particularly related to pilgrim sites and heritage structures, has significant linkages with the environment, especially in ecologically sensitive areas such as wetlands and sacred groves. If not properly managed, tourism activities can cause environmental problems such as water pollution, waste accumulation, and disruption of local ecosystems, especially around the Achankovil River and paddy wetlands. The development of tourism infrastructure may also increase pressure on natural resources and raise the risk of flooding. To ensure balanced development, it is essential to promote sustainable tourism practices, assess the carrying capacity of sensitive areas, and involve local communities in planning and management.

26.2 Linkage between Settlement Characteristics and Sectoral Developments

Settlement characteristics such as population distribution, density, accessibility, and availability of basic infrastructure significantly influence the development of various sectors. Areas with better road connectivity and public services have witnessed growth in trade, education, healthcare, and other service-based activities. Densely populated wards support small-scale commercial enterprises and public facilities due to higher demand. Industrial development, especially small and micro enterprises, tends to cluster in locations with access to transport and utilities. Similarly, tourism activities are concentrated around culturally and environmentally significant sites like temples, backwaters, and wetlands. At the same time, sectoral development influences settlement patterns, with economic growth driving urban expansion, increased land demand, and the need for improved infrastructure. These connections between where people live and how sectors develop highlight the need for planning that supports balanced growth while respecting the town's unique character.

26.2.1 Effect of Population Growth on Various Development Sectors

Population growth has significant intersectoral impacts across various development sectors. The increasing population has led to greater demand for housing, resulting in the expansion of residential areas, encroachment into agricultural and wetland regions, and pressure on available land. This affects the environment through loss of natural habitats, increased waste generation, and strain on water resources. In the health sector, population growth contributes to overcrowding in healthcare facilities and challenges in maintaining service quality. The education sector faces difficulties in providing sufficient infrastructure, teachers, and learning materials to accommodate more students. Transport systems experience increased traffic congestion and rising demand for public transport, while water supply and sanitation infrastructure come under pressure, leading to service gaps and environmental health concerns. These issues are interconnected, and the growing population intensifies the need for

integrated planning and coordinated action across sectors to ensure sustainable and balanced development.

26.2.2 Effect of Population Growth on Land use Changes and Environment

Population growth has led to significant land use changes, which are closely linked to environmental impacts across various sectors. The rising demand for housing, infrastructure, and services has resulted in the conversion of agricultural land and wetlands into built-up areas. This urban expansion has caused the fragmentation of natural ecosystems, encroachment on ecologically sensitive areas such as paddy fields and sacred groves, and increased vulnerability to flooding. The growing pressure on land and natural resources has also led to the depletion of water bodies and the loss of green cover. These changes affect not only the environment but also agriculture, water management, and public health. Additionally, increased waste generation and pollution from vehicles and households further strain the local environment. These interconnected challenges underline the importance of integrated land use planning and the implementation of strong environmental safeguards.

26.2.3 Industrial Sector - Effect on Environment, Land Use and Employment

The industrial sector is closely linked with the environment, land use, and employment. As small and micro-industries grow, they create valuable job opportunities and help boost the local economy. This also attracts more people to the area, increasing the need for housing, roads, and other services. As a result, agricultural lands and open spaces often give way to industrial units and related infrastructure. Over time, this expansion may intrude into ecologically sensitive areas like wetlands and paddy fields. If industries are not properly managed, they can cause pollution, generate waste, and overuse natural resources, putting local ecosystems and public health at risk. To strike a balance between development and conservation, it's important for Haripad to focus on well-planned, eco-friendly industrial growth that protects the environment while supporting livelihoods.

26.2.4 Effect of Various Sectors on Employment

Employment opportunities in Haripad are shaped by the combined contributions of various sectors. The primary sector covering agriculture, animal husbandry, dairies and fisheries continues to support many livelihoods but is gradually declining due to shrinking profitability, and the conversion of farmland for other uses. The industrial sector, mainly consisting of Micro, Small, and Medium Enterprises (MSMEs), plays an important role in creating jobs, especially for semi-skilled and unskilled workers. Meanwhile, the service sector which includes trade, education, healthcare, transport, and public services has become a major source of employment, offering a wide range of job opportunities across skill levels. The tourism sector, enriched by Haripad's pilgrim centres, heritage sites, and nature beauty, also creates jobs in areas like hospitality, retail, and local transportation. To improve employment prospects for the community, it is important to ensure balanced development across these sectors, while also investing in skill development and better infrastructure.

26.2.5 Changes in Traffic and Transportation Needs due to Growth in Various Sectors

The growth of various sectors such as commerce, industry, education, healthcare, and tourism has significantly influenced traffic patterns and transportation needs. As commercial areas

expand and industrial units increase, the movement of goods and people increase, leading to higher traffic volumes on key roads. The rise in educational and healthcare institutions generates daily travel demand, particularly during peak hours, contributing to congestion. Tourism-related growth also brings seasonal surges in traffic, especially near heritage sites and religious destinations. These developments place additional pressure on the existing road network, parking facilities, and public transport services. The lack of adequate traffic management systems and infrastructure improvements in Haripad town has further compounded mobility challenges. Addressing these issues requires coordinated planning that includes road widening, development of alternate routes, improved public transport, pedestrian-friendly infrastructure, and traffic regulation measures to ensure safe and efficient movement within the town.

26.2.6 Changes in Traffic and Transportation Needs Due to Changes in Land Use

Changes in land use, such as the conversion of agricultural land or vacant land to residential, commercial, or industrial uses, have a direct impact on traffic patterns and transportation needs. As residential areas expand, there is an increased demand for daily commuting, especially to work, schools, and service centres. The development of commercial zones attracts more vehicular movement, including freight traffic and customer access, often leading to congestion in key locations. Industrial development generates the need for transportation of raw materials and finished goods, placing pressure on existing road networks. Similarly, the emergence of institutional and recreational spaces alters peak travel times and intensifies demand for parking and public transport. In Haripad town, these land use changes have led to uneven traffic distribution, congestion in certain area.

26.2.7 Spatial Distribution of Trade & Commerce - Effect on Real Property Values and Equitable Housing Policies

The Draft Housing Policy, 2011 of the Government of Kerala recognises housing as a basic human right, in line with the International Covenant on Economic, Social and Cultural Rights and Article 21 of the Indian Constitution, which includes the right to shelter and livelihood as part of a dignified life. In Haripad town, rising land prices and speculative real estate activities where individuals hold land purely for investment have made housing less affordable and contributed to outmigration. The concentration of commercial activities in specific areas has also driven up land prices in nearby residential zones. To address this, it is important to allocate sufficient land for commercial uses across the town to avoid commercial encroachment into residential areas. Similarly, adequate zoning for residential use, including provisions for low-density housing for Economically Weaker Sections (EWS) and Low-Income Groups (LIG) in selected dry cultivation areas, can improve housing access. These planning measures, through balanced land use and effective zoning regulations, are necessary to ensure affordable housing and reduce speculative pressure on land in Haripad.

26.2.8 Inclusive growth in various sectors

Inclusive growth in Haripad town refers to ensuring that the benefits of development are equitably shared among all sections of society, particularly the marginalized and economically weaker groups. In the housing sector, policies must promote affordable housing for all, especially for Economically Weaker Sections (EWS) and Low-Income Groups (LIG), through

proper zoning, infrastructure provision, and support for low-density housing options. In the trade and commerce sector, recognizing street vendors as legitimate entrepreneurs and allocating designated vending spaces encourages livelihood opportunities for the urban poor while improving access to affordable goods for residents.

The industrial sector, primarily comprising Micro, Small, and Medium Enterprises (MSMEs), can be made more inclusive by permitting home-based and small-scale units within designated residential and commercial zones, encouraging local entrepreneurship. In the education and healthcare sectors, the equitable spatial distribution of schools and primary health centres ensures accessibility for all, particularly in remote wards. Improving basic services such as sanitation, water supply, and waste management is crucial for enhancing the living conditions of underserved areas.

In transportation, widening interior roads and improving connectivity through public transport services promotes inclusiveness by connecting peripheral settlements to the town center and essential services. The energy sector in Haripad is fully electrified, and continued focus on reliability and supports overall quality of life.

26.2.9 Energy Efficiency and Land Use

Energy efficiency is a critical consideration in the planning and functioning of urban systems. Urban areas typically consume more energy than rural areas of similar size due to concentrated activities and higher infrastructure demands. With growing concerns over fossil fuel depletion, climate change, and environmental degradation, it is imperative to adopt planning strategies that promote energy conservation. Land use planning plays a key role in enhancing energy efficiency. Compact and mixed-use development reduces the need for long commutes, thereby lowering fuel consumption and encouraging walking, cycling, and the use of public transport. Efficient spatial arrangements where residential, commercial, and institutional areas are well-integrated minimize energy use in transportation and service delivery such as water supply and electricity. In Haripad, effective land use planning can help reduce the formation of urban heat islands by preserving green spaces, wetlands, and encouraging eco-friendly construction practices. This leads to lower demand for artificial cooling, resulting in significant energy savings. Promoting pedestrian-friendly layouts and maintaining natural ventilation paths through proper zoning further supports energy efficiency. These measures are important for creating a resilient and energy-conscious urban environment in Haripad.



CHAPTER
27

SPATIAL STRUCTURE



Haripad's spatial structure reflects the arrangement of its built environment, land uses, infrastructure networks and natural features. This chapter synthesizes multiple spatial layers - land use, transportation, environmental assets and socio-economic patterns - to provide a comprehensive understanding of how the town is currently organized. Analysing this structure helps identify Haripad's strengths, constraints, growth dynamics and areas requiring strategic intervention. The insights gained form the foundation for shaping an integrated development vision that supports balanced, efficient and sustainable urban growth.

- Existing Spatial Structure

27. SPATIAL STRUCTURE

27.1 Existing Spatial Structure

The existing spatial structure has been defined based on the functional characteristics of land use, activity distribution, road network, and the hierarchy of nodes and settlements. Although urban development is widespread, several peripheral wards retain a semi-urban and rural characters.

27.1.1 Geography of the area

The topography of Haripad town is predominantly flat and low-lying with extensive paddy fields, wetlands, canals, which play a crucial role in shaping its spatial structure and guiding sustainable, environment-friendly development strategies. The contour profile reveals that the southern, western and central parts of the town are comparatively elevated, while the north-eastern portion lies at a low- lying area, predominantly comprising wetlands and water bodies. The elevated areas are primarily occupied by residential and mixed-use developments, whereas the low-lying regions are characterized by extensive paddy fields, canal networks, and ecologically sensitive wetlands. This diverse landscape presents both opportunities and challenges, necessitating careful consideration in the planning process to ensure resilience and balanced growth.



Figure 27.1 : Slope Profile of Haripad Town

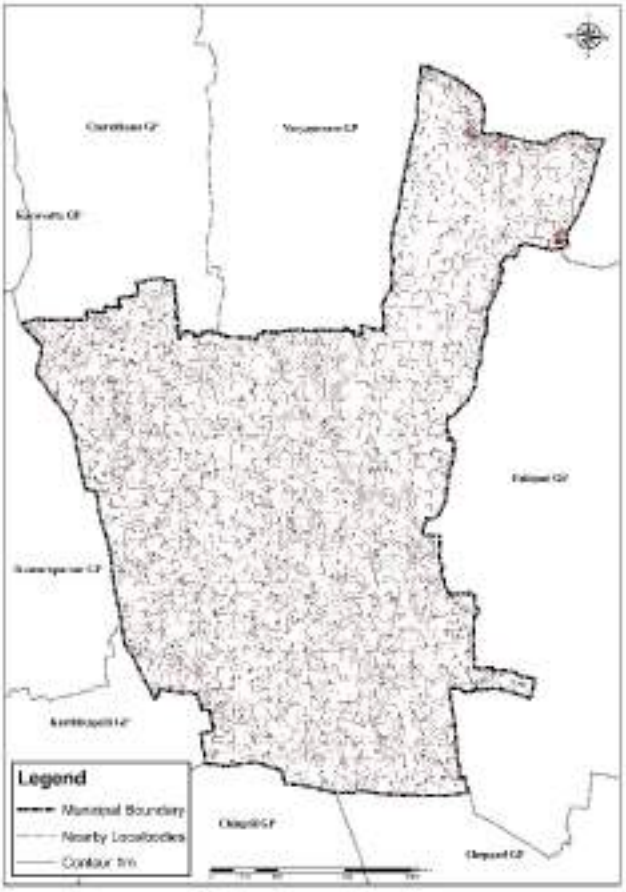


Figure 27.2 : Contour Map of Haripad Town

27.1.2 Functional Character

The functional characteristics of Haripad town are identified based on factors such as population density, urban share, built-up area, and the proportion of urban and rural areas.

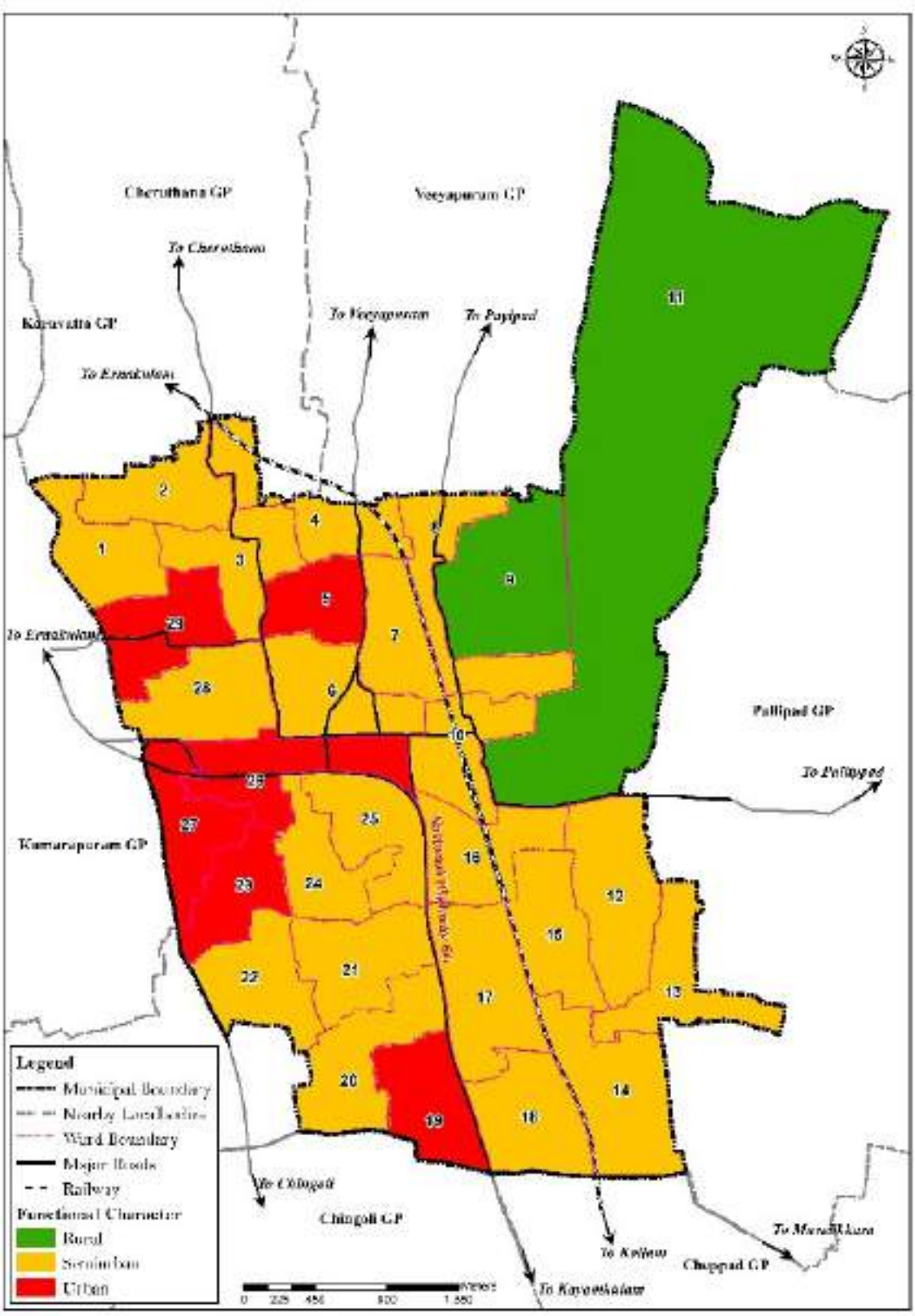


Figure 27.3 : Functional Character of Haripad Town

Rural areas are predominantly located in the north-eastern parts of the town. Semi-urban areas are observed in the inner and peripheral wards, while urban areas are mainly concentrated in the central and southwestern regions.

27.1.3 Activity Pattern

The spatial distribution of activities in Haripad town has been identified through analysis of concentration indices of existing land use patterns. Primary activities, particularly agriculture, are predominant in the outer wards, especially in the north-eastern parts of the town. Secondary activities are observed in inner wards, while tertiary activities are concentrated in the central and southwestern areas, mainly along major road corridors.

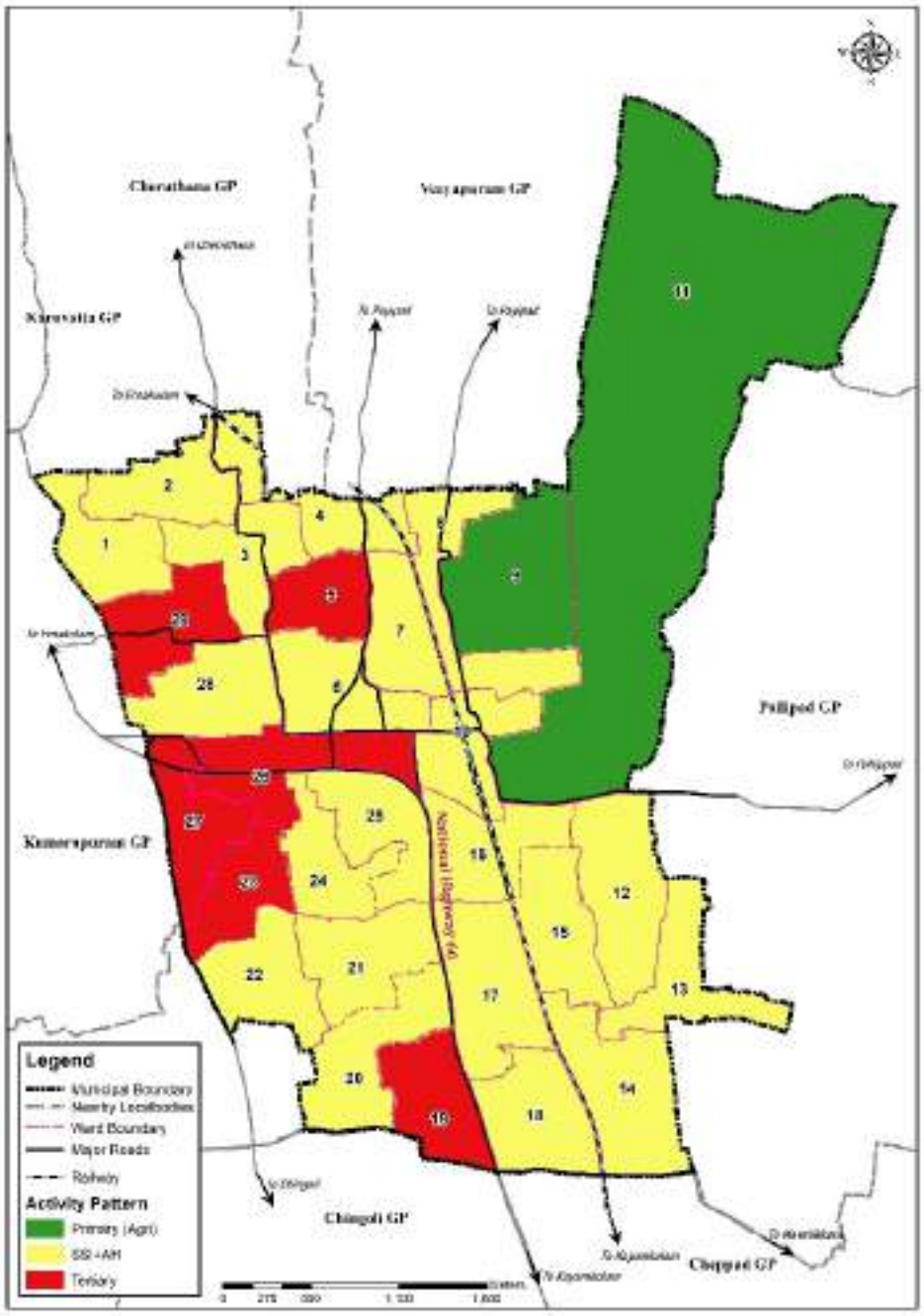


Figure 27.4 : Activity Pattern of Haripad Town

27.1.4 Connectivity Pattern

The planning area has a well-connected transportation network, primarily comprising National Highway 66 (NH 66) and State Highway 80 (Konni - Haripad Road). NH 66 links key junctions such as Nangiarkulangara and Madhava Junction. In addition to road connectivity, Haripad also benefits from good rail access. However, the town experiences traffic congestion due to narrow roads, mixed traffic patterns, and roadside encroachments for parking and other activities. Moreover, reliance on private vehicles is increasing as a result of inefficient and poor-quality public transport, along with lifestyle change. The proposed development concept for the traffic and transportation sector focuses on strengthening the public transport system by upgrading the existing road network through appropriate design and management interventions and establishing organized parking facilities.

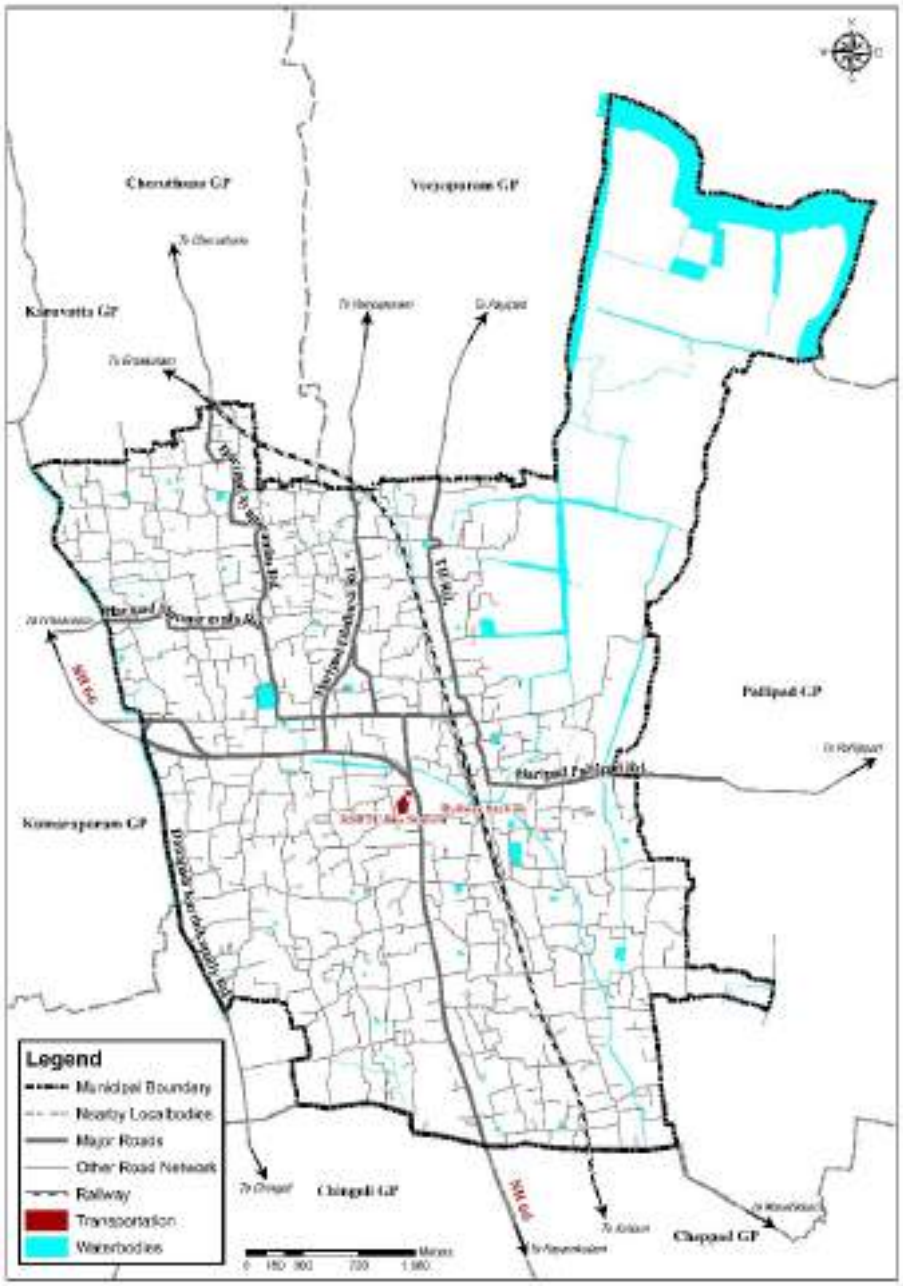


Figure 27.5 : Connectivity map

27.1.5 Existing Hierarchy of Nodes

The existing node structure of Haripad town shows a concentration of urban activities around key transport intersections. The existing node hierarchy has been identified based on road classification and the intensity of commercial activities. The first-order nodes are located near the municipal core (Madhava Junction and Haripad Junction), where NH66 and other arterial roads intersect, supported by the bus stand and major public institutions, making them the primary commercial hubs. Second-order nodes are Danapady Market area, Town Hall Junction, and Ezhikkakath Junction, are situated near NH66 and other major roads, featuring institutional facilities and local markets. Third-order nodes, including RK Junction, TPN Junction, and Nagiarakulangara Junction, are located along NH66 and other roads, with limited commercial activity. This hierarchy of nodes reflects Haripad's function as a service centre for the surrounding rural areas and provides a foundation for future planned urban growth.

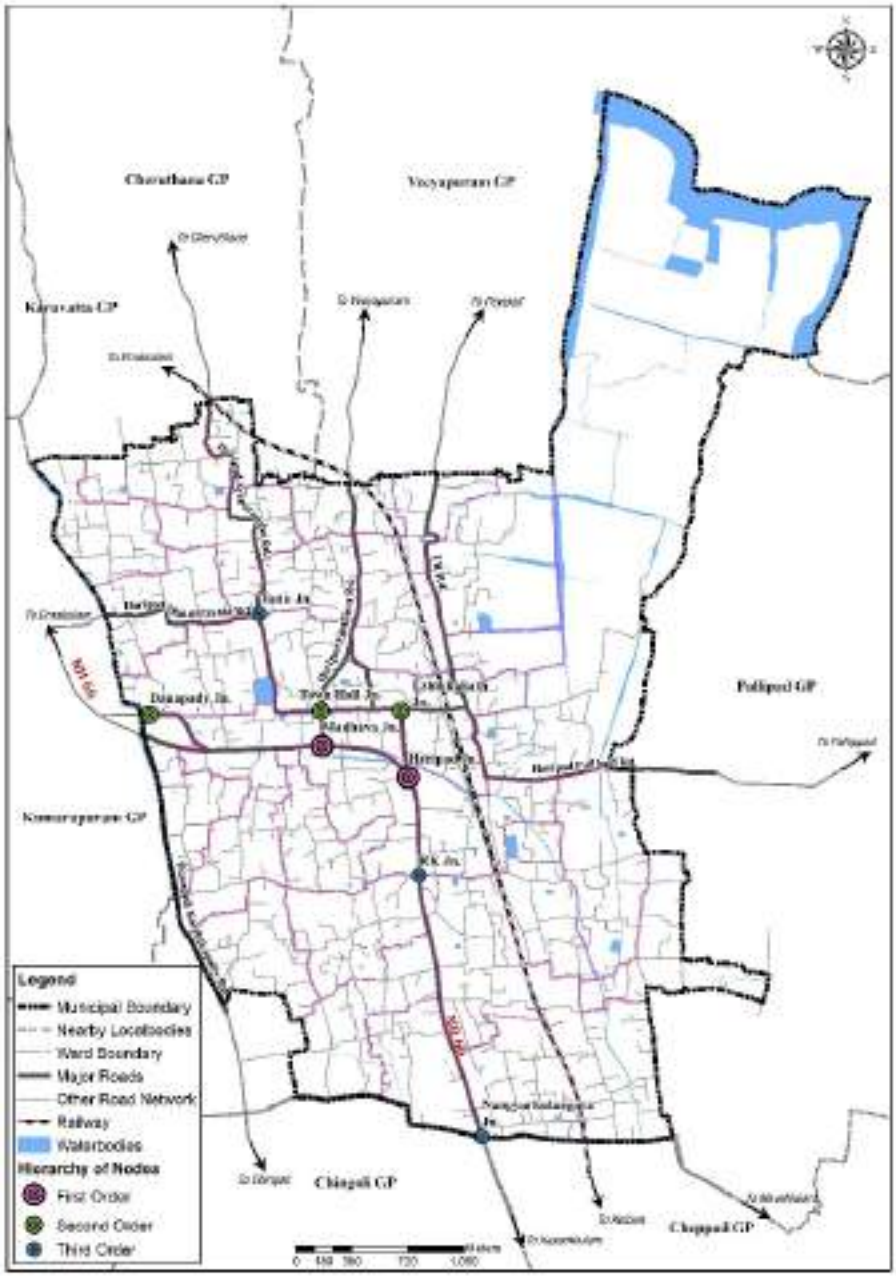


Figure 27.6 : Existing Hierarchy of Nodes

27.1.6 Population Projection (Trend) Based and Its Distributions

Spatial distribution of population is in such a way that high density is seen along the National highways and around the town centre. Agriculture dominated area have less population density. The population projection for Haripad town has been carried out using the Arithmetic Increase Method, Incremental Increase Method and the Ratio Method. The study highlighted a declining decadal population growth rate, falling from 7.62% in 1991 to -0.18% in 2011.

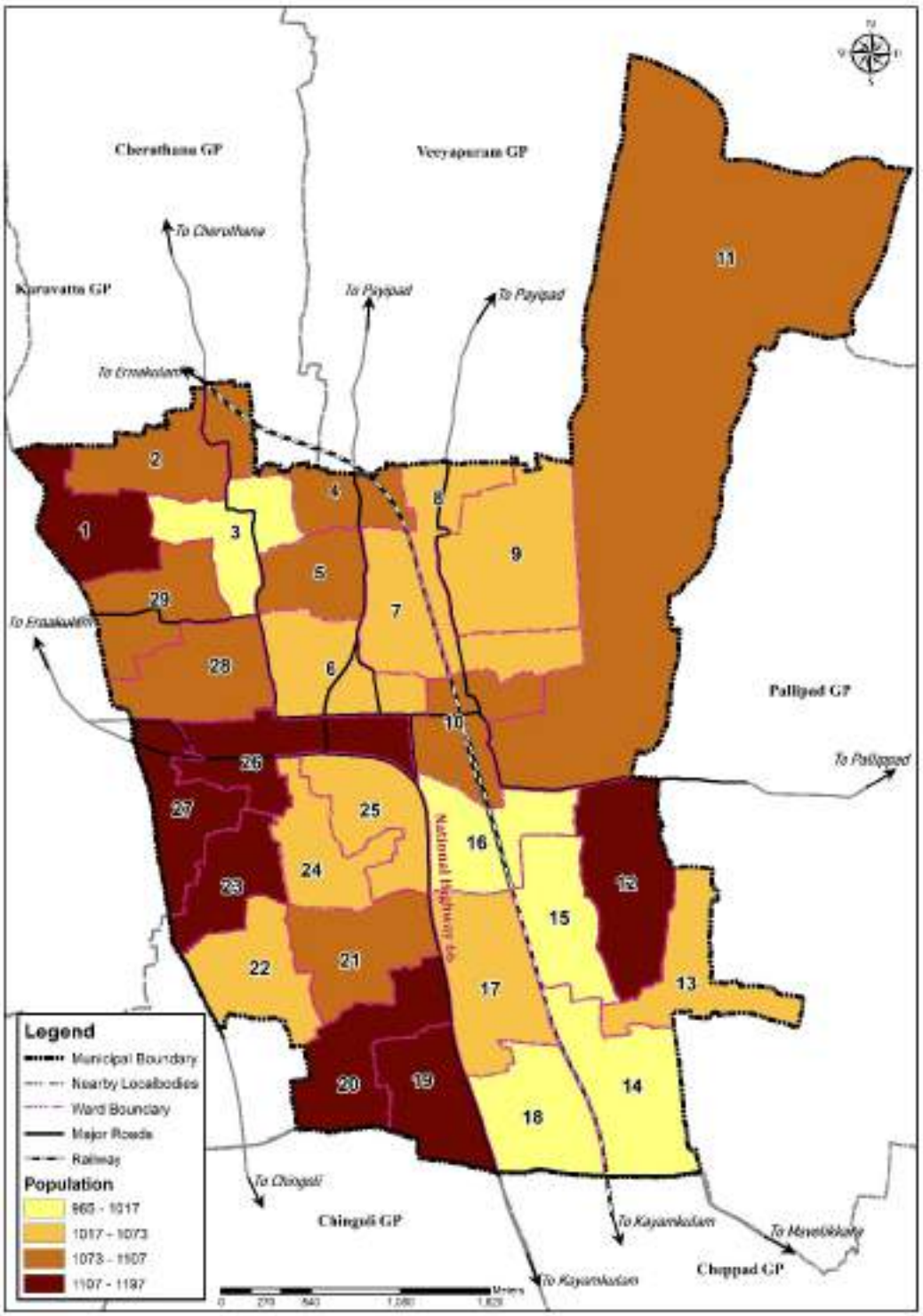


Figure 27.7 : Population

27.1.7 Existing Spatial Structure

The existing spatial structure has been derived by analysing the functional character, activity patterns, existing road network, hierarchy of nodes, hierarchy of settlements, and the concentration of sectoral land uses. A significant portion of the area exhibits a mixed-use character, while the north-eastern parts are predominantly agricultural and classified as eco-sensitive zones. Commercial Intensive Area is primarily concentrated around the major nodes of the town, with Madhava Junction and Haripad Junction functioning as first-order nodes, Danapady Market area, Town Hall Junction, and Ezhikkakath Junction serving as second-order nodes, and RK Junction, TPN Junction, and Nangiarakulangara Junction identified as third-order nodes.

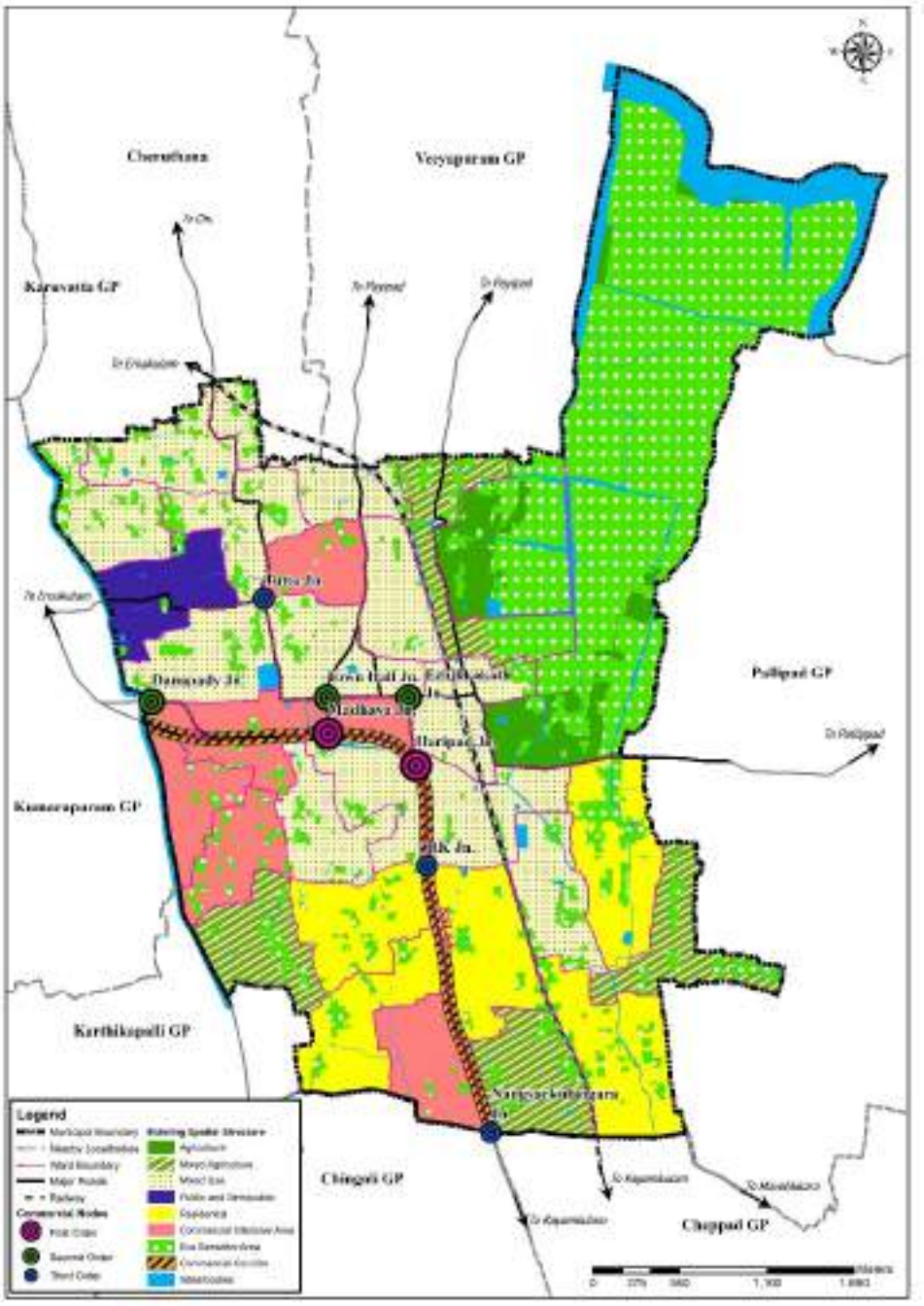
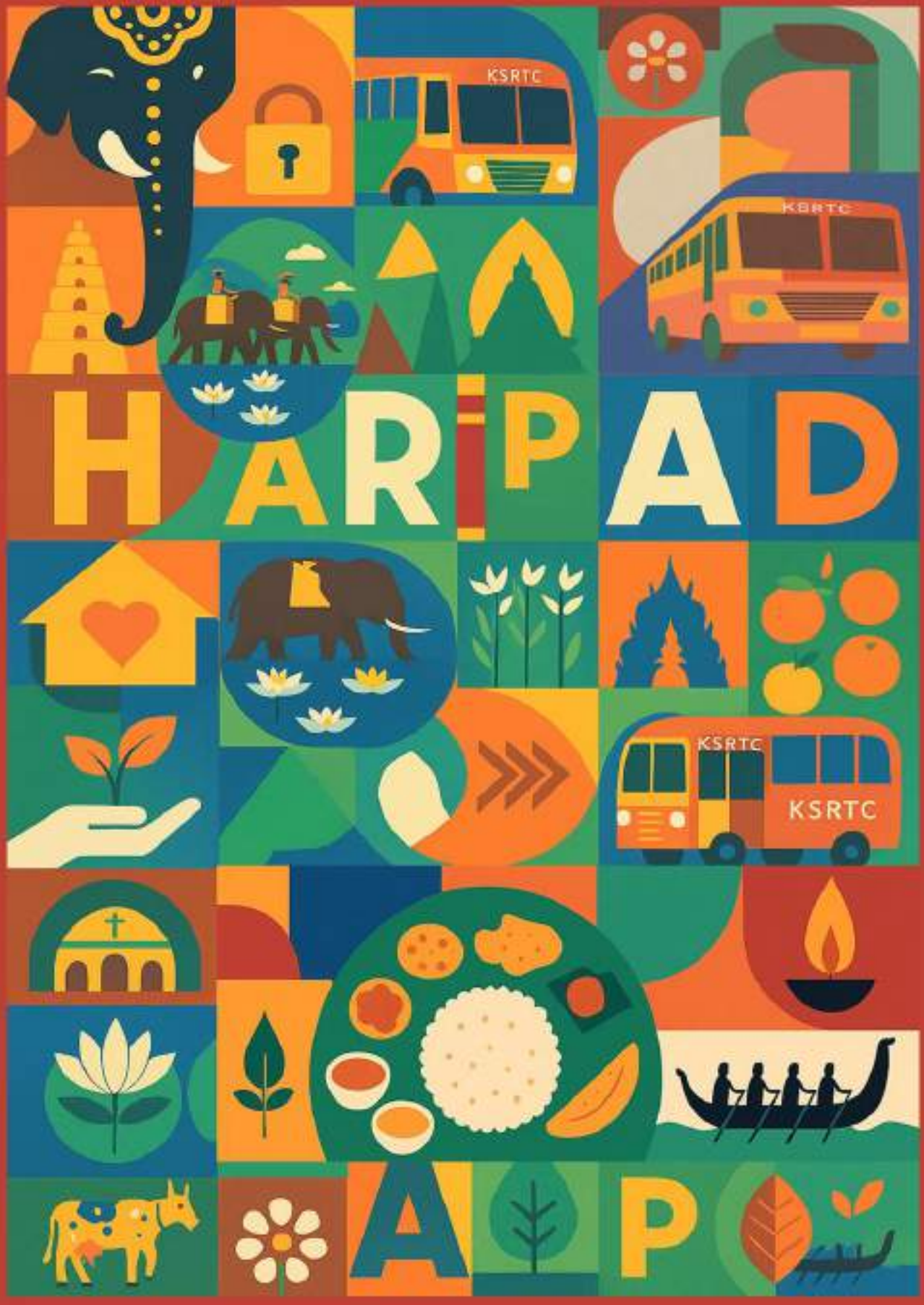


Figure 27.8 : Existing Spatial Structure



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